NOKUKHANYA ENERGY

Proposed Construction of the Nokukhanya 75MW Solar Photovoltaic (PV) Power Plant near Dennilton, Limpopo Province

Draft Environmental Impact Assessment Report

DEA Ref No: 14/12/16/3/3/2/737
Issue Date: 02 July 2015
Revision No.: 1
Project No.: 12847

Date:	02 July 2015
Document Title:	Proposed Construction of the Nokukhanya 75MW Solar Photovoltaic (PV) Power Plant near Dennilton, Limpopo Province: Draft Environmental Impact Assessment Report
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Revision Number:	1
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Signature:	
For:	SiVEST Environmental Division

KEY PROJECT INFORMATION

FARM DESCRIPTION	21 DIGIT SURVEYOR GENERAL CODE
Portion 182 of the farm Kikvorschfontein 57	T0JS00000000005700182
Remainder 183 of farm Kikvorschfontein 57	T0JS00000000005700183
Portion 191 of the farm Kikvorschfontein 57	T0JS00000000005700191
Remainder of Kikvorschfontein 57	T0JS00000000005700000

APPLICATION SITE CORNER POINT CO-ORDINATES		
POINT	**SOUTH**	**EAST**
1 (NW)	S25° 17' 17.020"	E29° 7' 29.931"
2	S25° 17' 8.670"	E29° 7' 37.006"
3	S25° 17' 45.325"	E29° 7' 55.698"
4	S25° 17' 49.115"	E29° 7' 58.498"
5 (E)	S25° 17' 43.325"	E29° 8' 11.240"
6 (SE)	S25° 18' 27.929"	E29° 8' 37.388"
7	S25° 18' 35.341"	E29° 8' 0.704"
8	S25° 18' 27.612"	E29° 7' 57.667"
9 (W)	S25° 18' 22.236"	E29° 7' 34.719"
10	S25° 17' 59.986"	E29° 7' 30.923"
11	S25° 17' 59.972"	E29° 7' 46.808"

PREFERRED PV ARRAY LAYOUT CO-ORDINATES		
CORNER POINT CO-ORDINATES		
POINT	**SOUTH**	**EAST**
1 (NW)	S25° 18' 0.567"	E29° 7' 31.836"
2	S25° 18' 0.547"	E29° 8' 0.194"
3	S25° 17' 56.134"	E29° 8' 0.191"
4 (NE)	S25° 17' 56.114"	E29° 8' 17.845"
5 (SE)	S25° 18' 26.905"	E29° 8' 35.897"
6	S25° 18' 26.924"	E29° 8' 16.520"
7	S25° 18' 31.337"	E29° 8' 16.525"
8	S25° 18' 31.352"	E29° 8' 0.855"
9	S25° 18' 26.941"	E29° 7' 57.800"
10	S25° 18' 22.525"	E29° 7' 57.797"

11	S25° 18' 22.539"	E29° 7' 43.650"
12	S25° 18' 18.127"	E29° 7' 43.646"
13 (SW)	S25° 18' 18.130"	E29° 7' 34.857"

PREFERRED ASSOCIATED INFRASTRUCTURE ALTERNATIVE CENTRE POINT CO-ORDINATES:

ALTERNATIVE	SOUTH	EAST
SUBSTATION	S25° 18' 20.840"	E29° 7' 41.110"
O&M BUILDING	S25° 18' 20.265"	E29° 7' 36.767"
LAYDOWN AREA (WESTERN SECTION)	S25° 18' 24.121"	E29° 7' 51.231"
LAYDOWN AREA (EASTERN SECTION)	S25° 18' 28.885"	E29° 8' 25.184"

LAYOUT ALTERNATIVE CO-ORDINATES: Attached as Appendix 9

PHOTOGRAPH OF SITE:

General Characteristics of the study area

TYPE OF TECHNOLOGY: Photovoltaic (PV) panels

STRUCTURE HEIGHT: The final structure height will be determined based on the latest technology prior to construction. The total height of panels will not exceed 5m above the ground.

SURFACE AREA TO BE COVERED: The total buildable area is approximately 171 hectares. The preferred array layout area is approximately 125 hectares. The site assessed for the proposed substation is approximately 2.3 hectares, however the actual footprint of the substation will likely be smaller than this and will be positioned within the assessed substation site. The assessed O&M building site is approximately 1.2 hectares, however the actual footprint of the O&M building will likely be smaller than this and will be positioned within the assessed O&M building site. All onsite roads will be positioned within the authorised area for the PV array.

STRUCTURE ORIENTATION: Structure will be orientated in a north / north –east / north- west direction.

LAYDOWN AREA DIMENSIONS (DURING CONSTRUCTION AND THEREAFTER): The area of the construction laydown area is approximately 7.9 hectares. The size of the permanent post-construction laydown area has not yet been determined, but will be smaller than the construction laydown area.

GENERATION CAPACITY: Maximum of 75 MW

TECHNICAL DETAILS:

Component	Description / Dimensions
Generation capacity	Maximum of 75MW
Capacity of the on-site substation	Maximum of 75MW (the same as the final layout)
Number of Panels	Approx. 142,857 to 833,333
Area occupied by each panel	Approx. 1.2x0.6m to 1x2m
Panel Height	0 to 5m
Area of the application site	215.15 hectares
Area of the buildable area	171.15 hectares
Area of preferred PV array (layout alternative 1)	124.48 hectares
Area of preferred substation assessment site (substation alternative 1)	2.28 hectares
Footprint of Substation	To be confirmed once the EPC contractor has been selected and the design is finalised.
Area of preferred O&M building assessment site (O&M alternative 1)	1.17 hectares
Footprint of O&M building(s)	To be confirmed once the EPC contractor has been selected and the design is finalised.
Area of preferred construction laydown area (laydown alternative 1)	7.92 hectares
Area of permanent laydown area	Likely to be significantly smaller than the temporary laydown area, however this will be confirmed once the EPC contractor has been selected and the design is finalised.
Width of internal roads	Approx. 4m to 10m wide
Length of internal roads	To be confirmed once the EPC contractor has been selected and the design is finalised.
Number of inverters required	Likely to be 75 or less, however this will be confirmed once the EPC contractor has been selected and the design is finalised.
Area occupied by inverter / transformer stations / substations	To be confirmed once the EPC contractor has been selected and the design is finalised.
Proximity to grid connection	The onsite substation will be connected to the grid by a 132kV power line over a distance of 28km to the existing Kwaggafontein Eskom substation, however the power line is not part of this current project and

	will be applied for at a later stage as a separate application.
Height of fencing	1.75m minimum working height
Type of fencing	Electrified

A3 Maps of all smaller maps included in the report are attached in Appendix 7.

NOKUKHANYA ENERGY

PROPOSED CONSTRUCTION OF THE NOKUKHANYA 75MW SOLAR PHOTOVOLTAIC (PV) POWER PLANT NEAR DENNILTON, LIMPOPO PROVINCE OF SOUTH AFRICA

DRAFT ENVIRONMENTAL IMPACT ASSESSMENT REPORT

Executive Summary

SiVEST SA (Pty) Ltd (hereafter referred to as SiVEST) has been appointed by Nokukhanya Energy Group (hereafter Nokukhanya) as independent Environmental Assessment Practitioner (EAP) to undertake an Environmental Impact Assessment (EIA) for the proposed establishment of the Nokukhanya Solar Photovoltaic (PV) Power Plant near Dennilton, Limpopo Province. The objective of the project is to generate electricity to feed into the national grid by installing a solar plant of 75 MW capacity.

The proposed development requires environmental authorisation from the National Department of Environmental Affairs (DEA), however provincial authorities have also be consulted (i.e. the Limpopo Department of Economic Development, Environment and Tourism - LEDET).

The National Environmental Management Act (No. 107 of 1998) (NEMA) EIA Regulations that were promulgated in December 2014 govern the EIA process. However the EIA for this proposed project was initiated in August 2014 with the submission of the application form, therefore in accordance with Regulation 53(1) of the 2014 EIA Regulations, any applications submitted in terms of the previous NEMA regulations must be undertaken as if the previous NEMA regulations were not repealed. This EIA has therefore been undertaken in accordance with the NEMA 2010 EIA Regulations which are contained in four Government Notices (GN 543, 544, 545 and 546) which were promulgated on 18 June 2010 and came into effect on 02 August 2010. All relevant legislation (including Equator Principles) has been consulted during the EIA process and have been complied with at all times.

The proposed project is required to improve electricity supply to the Eskom Grid and to assist in achieving the Government's mandate for the establishment of renewable energy generation facilities. In addition, the Elias Motsoaledi Local Municipality (EMLM) Integrated Development Plan (IDP) for 2013-2014 estimates that 4.6% of the towns and villages in the local municipality do not have access to electricity supply, and that there is insufficient bulk capacity to extend connections to additional households. The proposed project is thus aligned with serving the objectives of local and national government.

The proposed project involves the construction of one 75MV solar PV power plant and associated infrastructure. Layout alternatives have been investigated which relate to the location of the infrastructure on the site. These are illustrated below:

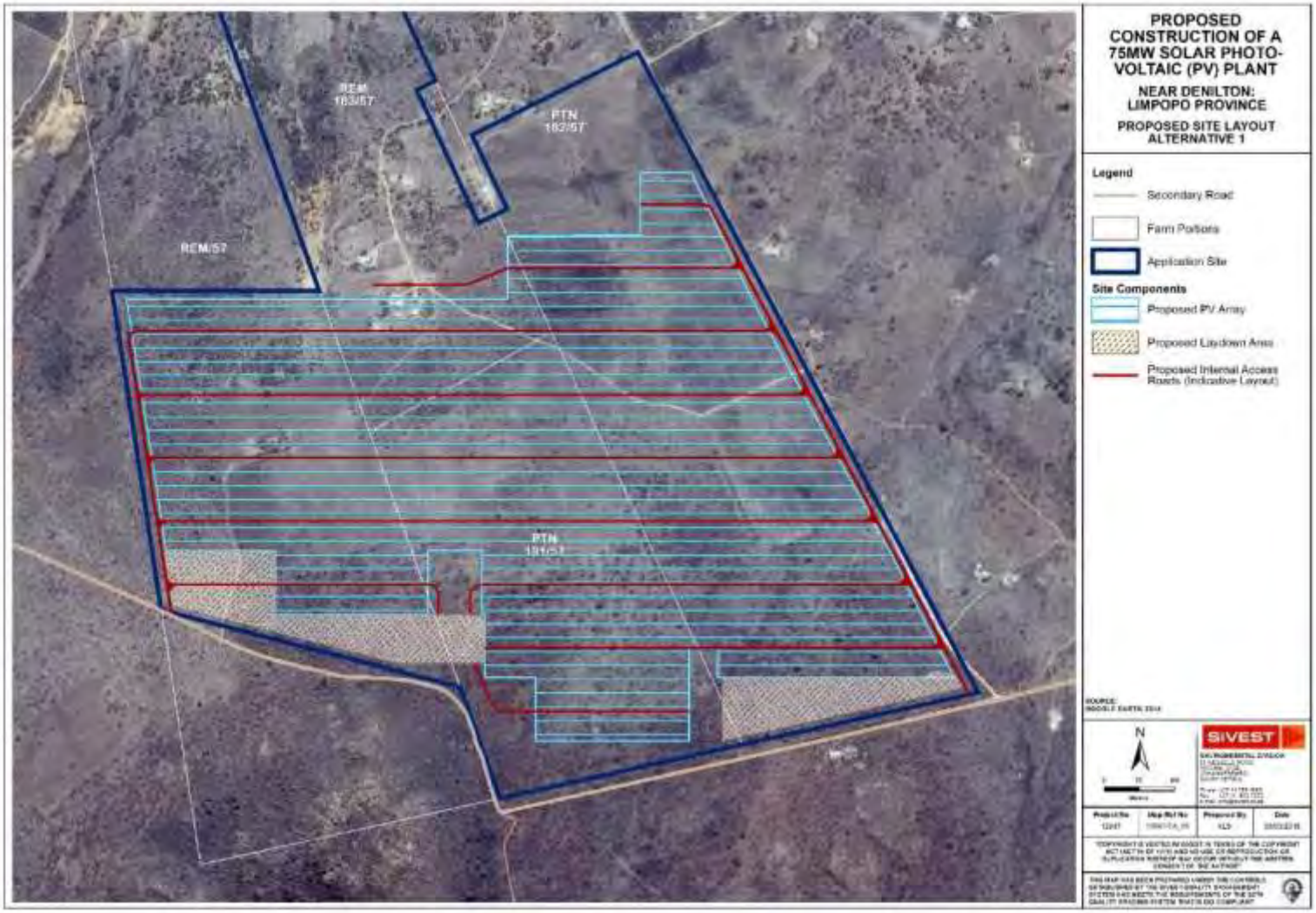

Figure i: PV array layout alternative 1

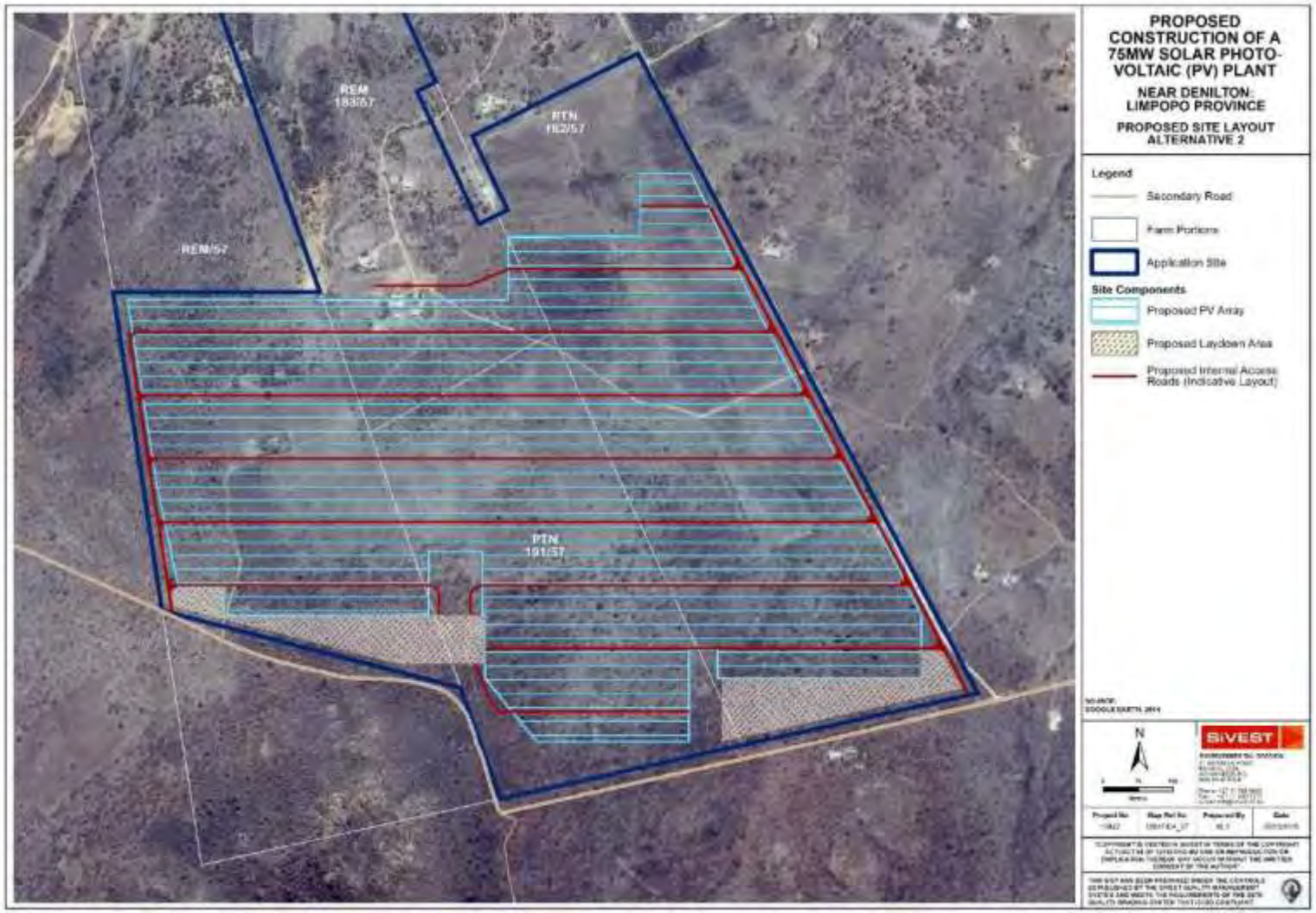

Figure ii: PV array layout alternative 2

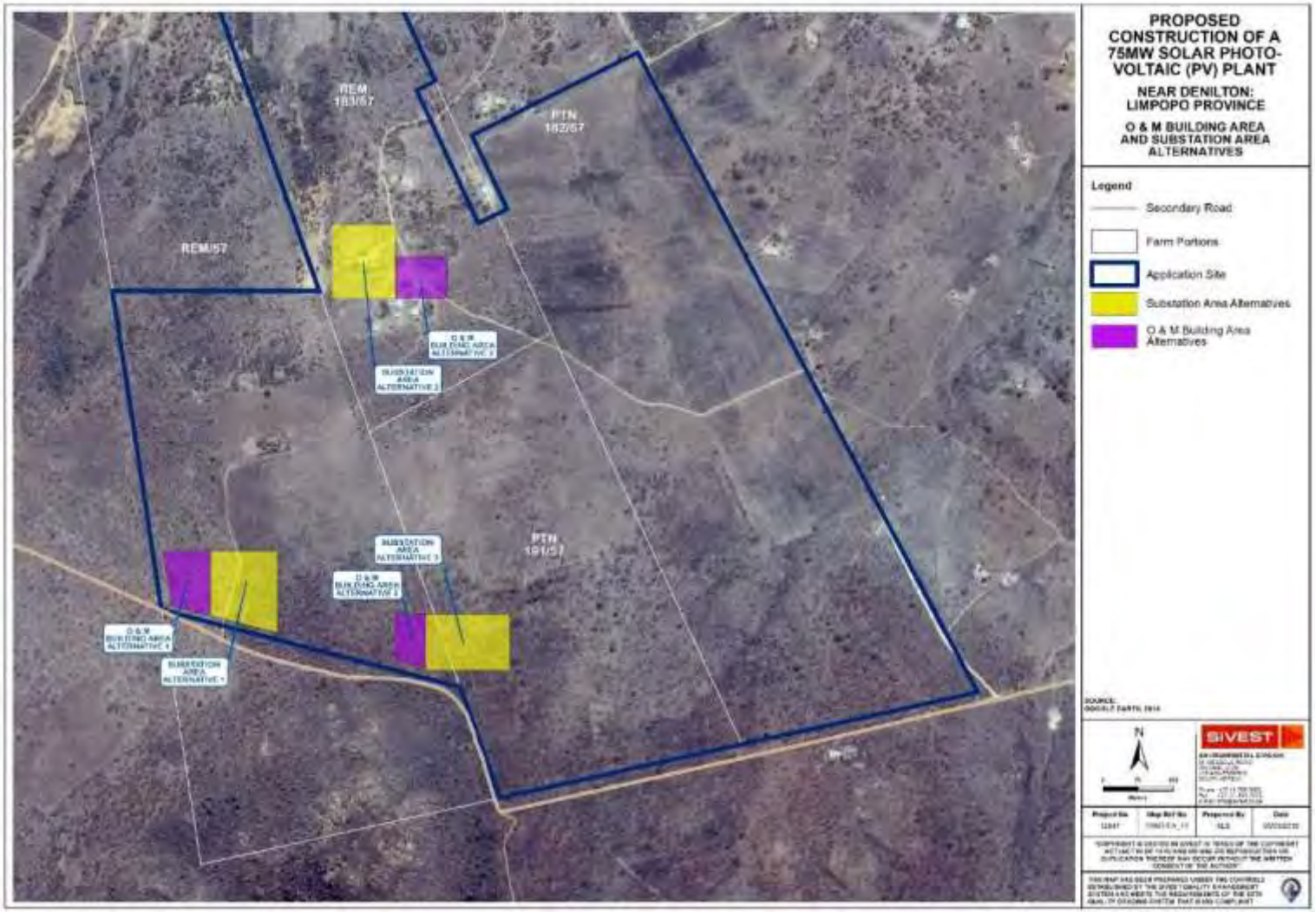

Figure iii: Substation and O&M layout alternatives

The site is characterised by Central Sandy Bushveld and Loskop Mountain Bushveld and much of the study area appears to be vacant, undeveloped land although the presence of a few cattle would suggest some low intensity grazing activity. In addition, there are some patches of small-scale cultivation, typical of that found on peri-urban smallholdings.

Specialist studies were conducted for the following environmental parameters during the EIA Phase, as stipulated in the approved Plan of Study for EIA:

- Biodiversity (including flora, avifauna and fauna)
- Surface Water
- Soils and Agricultural Potential
- Visual
- Heritage
- Socio-economic
- Geotechnical

Table i: Summary of findings

Environmental Parameter	Summary of major findings	Recommendations
Biodiversity	The study area consists of a combination of previously cultivated fields and remaining patches of woodland in various states of degradation. There is also a small section of riparian habitat running through the northern part of the site, but this is not affected by the placement of the proposed infrastructure. Large proportions of the infrastructure are proposed to be located within transformed or degraded areas. However, remaining patches of natural vegetation on site are included in Provincial Critical Biodiversity Areas and therefore potentially have elevated conservation status. There are a number of threatened or protected species that could potentially be affected by the proposed project. This includes one plant species listed as Near Threatened, one as Declining and one as Rare, as well as eleven mammal and ten bird species of conservation concern. There are no threatened reptile or amphibian species that are likely to occur in the study area. There is one protected tree species that occurs on site. Significant parts of the site have been previously cultivated and are therefore not considered to have high sensitivity or biodiversity value. However, remaining natural habitats are within areas designated as having high conservation value in	▪ **Surface Runoff and Stormwater Management Plan** This plan must indicate how all surface runoff generated as a result of the project and associated activities (during both the construction and operational phases) will be managed (e.g. artificial wetlands/stormwater and flood retention ponds) prior to entering any natural drainage system or wetland and how surface water runoff will be retained outside of any demarcated buffer/flood zones and subsequently released to simulate natural hydrological conditions. ▪ **Rehabilitation Programme** Rehabilitation Programme should be established before operation. The programme must address the rehabilitation of the existing habitats as well as rehabilitation after closure. This Rehabilitation Programme must be approved by the relevant government departments. ▪ **Botanical walk-through survey** A preconstruction walk-through survey should be undertaken to list the identity and location of all listed and protected species. The results of the walk-through survey should provide an indication of the number of

	the Provincial Conservation Plan. The areas of affected vegetation are relatively disturbed woodlands and are not considered to have high biodiversity value on site, despite inclusion into CBA2 and ESA areas in the Provincial Conservation plan. The proposed project is assessed as having impacts of mostly low negative significance and one impact of medium negative significance on some relatively small areas of natural vegetation. To conclude, the project will not have highly significant impacts on the ecological receiving environment and impacts that will occur can be controlled and reduced to low significance. Impacts on natural vegetation are assessed as having medium significance, but will only affect relatively small areas of disturbed woodland.	individuals of each listed species that are likely to be impacted by the proposed development ▪ **Obtain permits for protected plants** It is a legal requirement that permits will be required for any species protected according to National or Provincial legislation. The identity of species affected by such permit requirements can only be identified during the walk-through survey (previous mitigation measure). It is common practice for the authorities that issue the permits to require search and rescue of affected plants. There are a number of individuals of the protected tree, *Sclerocarya birrea* subsp. *caffra*, that occur on site. The location and condition of each individual tree must be recorded and a permit obtained for the removal of each of these. ▪ **Alien plant management plan** It is recommended that a monitoring programme be implemented to enforce continual eradication of alien and invasive species, especially within the riparian habitat. An Alien Invasive Programme is an essential component to the successful conservation of habitats and species. Alien species, especially invasive species are a major threat to the ecological functioning of natural systems and to the productive use of land. In terms of the amendments of the regulations under the Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983), landowners are legally responsible for the control of alien species on their

		properties. The protection of our natural systems from invasive species is further strengthened within Sections 70-77 of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004). This programme should include monitoring procedures. ▪ **Undertake regular monitoring** Monitoring should be undertaken to evaluate the success of mitigation measures. Monitoring methods must be in accordance with features that need to be monitored and can form part of a monitoring programme to be compiled.
Surface Water	Ultimately, it was found that there are three (3) wetlands, one (1) watercourse with an associated riparian habitat, and one (1) erosion channel within and/or in close proximity of the proposed development area. More specifically, the wetlands include one (1) hillslope seep wetland, and two (2) unchannelled valley-bottom wetlands. In terms of potentially applicable water related legislature, it is anticipated that no water use license requirements or environmentally listed activities are expected to be triggered, as the proposed development is not located within the delineated surface water resources. Therefore, no water use license or environmental authorisation (from a surface water perspective) is anticipated. This however should be confirmed with the relevant government departments.	▪ As stipulated in the surface water specialist report, the proposed alternative locations for the site layouts and construction lay-down areas are suitably placed from a surface water perspective as no surface water resources are to be directly affected. It is highly recommended that the proposed substation alternative 1 and 3 locations be preferred, as substation alternative 2 is located within close proximity to an identified erosion channel and is vulnerable to further erosion. ▪ In general, all surface water resources must be avoided as far as possible to prevent direct impacts. Where this is not achievable, the relevant water use license and environmental authorisations are to be applied for before construction is allowed to

	Foreseen potential negative impacts in terms of the pre-construction, construction, operation and decommissioning phases of the proposed development were identified and assessed. Mitigation measures have been stipulated and must be implemented as part of the Environmental Management Programme (EMPr) for the proposed development.	commence in any of the identified surface water resources identified in this report. ▪ Importantly, where any structures are within 100m of any surface water resource, adequate run-off mitigation measures need to be accounted for as stipulated in the surface water specialist report to prevent/minimize erosion and sedimentation impacts. These two impacts are the primary concern for the proposed development.
Agricultural Potential and Soils	The establishment of infrastructure, such as the solar panel arrays and associated substation, will have an impact on the soil resource in that the soils will no longer be available for agriculture. There is little or no cultivation being practiced in the surrounding area, but the south-eastern corner of the site has deep, high potential soils.	▪ The main mitigation measures will involve ensuring that the minimum surface disturbance takes place, both in terms of soil excavation and vegetation removal. If normal construction methods are used for foundations and infrastructure, then post-project rehabilitation should be successful once the infrastructure is removed. Where roads or paths are constructed, soil conservation measures (run-off channels, drains etc.) as well as regular maintenance will also be required.
Visual	The visual impact assessment conducted for the proposed PV plant has demonstrated that a large portion of the study area has a pastoral visual character and is not valued for its scenic significance. Potentially sensitive receptor locations were identified in the study area, however the proposed development will have a low or medium impact on most of these receptors. In addition, several of these receptors are likely to associate the proposed development with employment creation and potential economic growth in the	▪ Carefully plan to reduce the construction period. ▪ Where possible, minimise vegetation clearing and rehabilitate cleared areas as soon as possible. ▪ Maintain a neat construction site by removing rubble and waste materials regularly. ▪ Make use of existing gravel access roads where possible. ▪ Ensure that dust suppression techniques are implemented on all access roads.

	area. The assessment revealed that overall the proposed PV plant would have a low visual impact during construction and a medium visual impact during operation, with very few mitigation measures available. Overall it can be concluded that the visual impact of the PV plant would be reduced due to the number and nature of visual receptors present and the degree of transformation of the natural environment. The facility does not however correspond with the typical land use and would visually contrast with the existing character of the landscape, although this contrast would be less significant in areas that have already been highly degraded by human activities.	▪ Light fittings for operations and security at night should reflect the light toward the ground and prevent light spill. ▪ The operations and maintenance buildings should not be illuminated at night. ▪ Bury cables under the ground where possible. ▪ The operation and maintenance building should be painted with natural tones that fit with the surrounding environment. Non-reflective surfaces should be utilised where possible.
Heritage	The historical significance of the region with regards to the Ndebele and the proclamation of the KwaNdebele homeland have been described in the background research. The presence of Late Iron Age (LIA) stone walling, on the south western boundary the study area, as well as the numerous historical ruins of African homesteads necessitate extensive fieldwork to evaluate and recommend the necessary mitigation measures, where required. The development of the PV facility near Dennilton is underlain by Mogolian aged Nebo Granite of the Lebowa Granite Suite, Bushveld Complex. Due to the age and igneous nature of the Nebo Granite, no fossils will be present and Low Palaeontological Sensitivity is allocated. No further Palaeontological mitigation is recommended.	Archaeological Sites ▪ Monitor find spot areas if construction is going to take place through them. ▪ A management plan for the heritage resources needs then to be compiled and approved for implementation during construction and operations. Historical sites ▪ Where the structures are to be impacted directly by the development, a consultation process to determine if any graves or still born burial exist in and around the ruins, must be conducted; ▪ If it is found that there are burials associated with the ruins, a grave relocation process must be initiated.

	A total of 14 heritage sites were identified, of which 13 are located within the development boundary and the 14th a cemetery located on the eastern boundary just of the current access road.	▪ An archaeologist to identify any significant cultural or possible human remains must monitor the demolition of the structures. Cemetery ▪ The cemetery needs to be fenced and a 20m safety buffer needs to be included where this falls inside the development footprint to ensure protection of the cemetery.
Socio-economic	Given the socio-economic challenges experienced by the Elias Motsoaledi LM (i.e. lack of revenue and access to basic services, unemployment, and growth stagnation) and the feedback from the directly affected landowners and residents, the positive impacts associated with the project in the context of the national economy and specifically the Elias Motsoaledi LM and Dennilton in particular, far outweigh the negative effects. On a national level, the project will assist government in achieving its goal of job creation, upliftment of rural communities, and sustainable development. More importantly, it will contribute towards creating energy security, which is vital for the country's economy. From a local perspective, the project will likely lead to a more sustainable local growth, diversified local economy, creation of new employment opportunities, increase in household income, and additional investment into the local community facilities and businesses. It will also be associated with some negative impacts during construction and operation, however these are possible to manage and mitigate. Considering the	▪ Procure construction materials, goods, and products from local suppliers if feasible ▪ Employ local residents and contractors where possible ▪ Employ labour-intensive methods in construction, where feasible. ▪ In order to improve the chances of skills being developed during the construction period it is recommended that contractors are encouraged to provide learnerships and share knowledge with the employees ▪ Set up a recruitment office in the nearby towns and adhere to strict labour recruitment practices that would reduce the desire of potential job seekers to loiter around the properties in hope to find temporary employment. ▪ Ensure that the development site is fenced and the access controlled to limit or completely eliminate the

	above, it is recommended that the project is approved for development, under the condition that the proposed mitigations are implemented.	possibility of livestock theft and burglaries at the residential properties. ▪ It is recommended that if possible, the project developers implement health awareness campaigns to curb the potential of spreading disease, use of drugs, or alcohol abuse for example. ▪ Where feasible, assist the municipality in ensuring that the quality of the local social and economic infrastructure does not deteriorate further (especially the local roads) ▪ It is recommended that the project owner develops practical SED and ED programmes throughout the project's lifespan.
Geotechnical	The geotechnical study did not identify any fatal flaws that, from a purely geotechnical perspective, would prevent the construction of the development. The area under investigation is underlain by one rock type, the Nebo Granite. The bedrock is covered with a soils mantle comprised of colluvial, pedogenic and residual soils. Adequate founding conditions for the proposed infrastructure occur at relatively shallow depths below ground level over the major portion of the proposed development footprint. However, the following geotechnical constraints were identified: ▪ Compressible soils with low bearing capacity ▪ Potentially collapsible soils ▪ Shallow ground water conditions ▪ Corestone boulders	▪ Geotechnical constraints may be mitigated by conventional design and construction methods. ▪ Design and construction of stormwater management system including stormwater outfalls ▪ Use of berms and drainage channels to direct water away from the construction areas where necessary ▪ Minimise earthworks and levelling ▪ Rehabilitate disturbed areas as soon as possible after construction ▪ Correct engineering design of all access roads.

These specialist studies were conducted to address the potential impacts relating to the proposed development that were identified during the scoping phase. An impact assessment was conducted to ascertain the level of each identified impact, as well as mitigation measures which may be required. The potential positive and negative impacts associated within these studies have been evaluated and rated accordingly. The results of the specialist studies have indicated that no fatal flaws exist as a result of the proposed project.

Based on the findings of the specialist studies, **Substation Area Alternative 1 and O&M Building Area 1 with a corresponding preferred PV Area and Laydown Area** were chosen as the preferred layout (Figure iv). It is proposed that all PV arrays and associated infrastructure will be positioned within these preferred areas should they be authorised by the DEA. This is to enable the avoidance of any unidentified features on site or any design constraints when the project reaches construction. All onsite roads will be located within the authorised area for the PV array. The exact position of the roads will be determined by the panel layout which will only be finalised by the Engineering, Procurement and Construction team (EPC).

Figure iv: Preferred site layout

It is the opinion of the EAP that the information and data provided in this EIAr is sufficient to enable the DEA to consider all identified potentially significant impacts and to make an informed decision

on the application. Further, it is the opinion of the EAP that the proposed project be allowed to proceed provided that the following conditions are adhered to:

- The proposed PV arrays should be constructed within the environmentally preferred PV array area.
- The environmentally preferred laydown area should be utilised during construction.
- The substation and O&M building should be constructed within the environmentally preferred **Alternative 1** areas.
- All onsite roads should be located within the authorised area for the PV array.
- All feasible and practical mitigation measures recommended by the various specialists should be implemented, where applicable to the authorised PV array area, authorised substation area, authorised O&M building or authorised laydown area.
- Final EMPr should be approved by DEA prior to construction.

SiVEST as the EAP is therefore of the view that:

- A preferred substation and O&M building site, PV panel array area and construction laydown area have been identified which are less environmentally sensitive compared to the other considered alternatives.
- Through the implementation of mitigation measures, together with adequate compliance monitoring, auditing and enforcement thereof by the appointed ECO as well as competent authority, the potential detrimental impacts associated with the PV Plant can be mitigated to acceptable levels.

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DRAFT ENVIRONMENTAL IMPACT ASSESSMENT REPORT

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Glossary of terms

Archaeological resources: This includes:

- material remains resulting from human activity 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;
- rock art, being any form of painting, engraving or other graphic representation on a fixed rock surface or loose rock or stone, which was executed by human agency and which is older than 100 years, including any area within 10m of such representation;
  wrecks, being any vessel or aircraft, or any part thereof which was wrecked in South Africa, whether on land, in the internal waters, the territorial waters or in the maritime culture zone of the republic as defined in the Maritimes Zones Act, and any cargo, debris or artefacts found or associated therewith, which is older than 60 years or which SAHRA considers to be worthy of conservation;
- Features, structures and artefacts associated with military history which are older than 75 years and the site on which they are found.

Alluvial: Resulting from the action of rivers, whereby sedimentary deposits are laid down in river channels, floodplains, lakes, depressions etc.

Biodiversity: The variety of life in an area, including the number of different species, the genetic wealth within each species, and the natural areas where they are found.

Cultural significance: This means aesthetic, architectural, historical, scientific, social, spiritual, linguistic or technological value or significance

Cumulative Impact: In relation to an activity, cumulative impact means 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.

"Equator Principles": A financial industry benchmark for determining, assessing and managing social & environmental risk in project financing

Environmental Impact Assessment: 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 the application.

Environmental Impact Assessment Report: In-depth assessment of impacts associated with a proposed development. This forms the second phase of an Environmental Impact Assessment and follows on from the Scoping Report.

Environmental Management Programme: A legally binding working document, which stipulates environmental and socio-economic mitigation measures that must be implemented by several responsible parties throughout the duration of the proposed project.

Greenhouse gas: Gases (primarily carbon dioxide, methane, and nitrous oxide) in the earth's lower atmosphere that trap heat, thus causing an increase in the earth's temperature and lead towards the phenomenon of global warming.

Heritage resources: This means any place or object of cultural significance. See also archaeological resources above

Historical Period: Since the arrival of the white settlers - c. AD 1840 - in this part of the country

Iron Age: Period covering the last 1800 years, when new people brought a new way of life to southern Africa. They established settled villages, cultivated domestic crops such as sorghum, millet and beans, and they herded cattle as well as sheep and goats. These people, according to archaeological evidence, spoke early variations of the Bantu Language. Because they produced their own iron tools, archaeologists call this the Iron Age.
Early Iron Age AD 200 - AD 900
Middle Iron Age AD 900 - AD 1300
Late Iron Age AD 1300 - AD 1830

Kilovolt (kV): a unit of electric potential equal to a thousand volts (a volt being the standard unit of electric potential. It is defined as the amount of electrical potential between two points on a conductor carrying a current of one ampere while one watt of power is dissipated between the two points).

Red Data species: All those species included in the categories of endangered, vulnerable or rare, as defined by the International Union for the Conservation of Nature and Natural Resources.

Renewable Energy: Energy which harnesses naturally occurring non-depletable sources of energy, such as solar, wind, hydro, tidal wave, ocean current and geothermal, or a combination of these energy types, to produce electricity.

Riparian: The area of land adjacent to a stream or river that is influenced by stream induced or related processes.

Scoping Report: An "issues-based" report which forms the first phase of an Environmental Impact Assessment process

Social impacts: The consequences to human populations of any public or private actions that alter the ways in which people live, work, play, relate to one another, organise to meet their needs and

generally live and cope as members of society. These impacts are felt at various levels, including individual level, family or household level, community, organisation or society level. Some social impacts are felt by the body as physical reality, while other social impacts are perceptual or emotional (Vanclay, 2002).

Stone Age: The first and longest part of human history is the Stone Age, which began with the appearance of early humans between 3-2 million years ago. Stone Age people were hunters, gatherers and scavengers who did not live in permanently settled communities. Their stone tools preserve well and are found in most places in South Africa and elsewhere.
Early Stone Age 2 000 000 - 150 000 Before Present
Middle Stone Age 150 000 - 30 000 BP
Late Stone Age 30 000 - until c. AD 200

Sustainable Development: Integration of social, economic and environmental factors into planning, implementation and decision-making so as to providing for the needs of the present without impairing the ability of future generations to meet their own needs.

List of Abbreviations

AC	Alternating Current
ATNS	Air Traffic Navigation Services
BEE	Black Economic Empowerment
C&RR	Comments and Response Report
CAGR	Compounded Average Growth Rate
CARA	Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983)
CBA	Critical Biodiversity Area
CCP	Central Cattle Pattern
CHC	Community Health Centres
CR	Critically Endangered
BA	Basic Assessment
BID	Background Information Document
DAFF	Department of Agriculture Forestry and Fisheries
DC	Direct Current
DEA	Department of Environmental Affairs
DEIAr	Draft Environmental Impact Assessment Report
DEA	Department of Environmental Affairs
DME	Department of Minerals and Energy (former)
DoE	Department of Energy
DSR	Draft Scoping Report
DTM	Digital Terrain Model
DWS	Department of Water and Sanitation
EAP	Environmental Assessment Practitioner
ED	Enterprise Development
EHS	Environmental, Health, and Safety
EIA	Environmental Impact Assessment
EIAr	Environmental Impact Assessment Report
EMLM	Elias Motsoaledi Local Municipality
EMPr	Environmental Management Programme
EP	Equator Principles
EPC	Engineering, Procurement and Construction
EPFI	Equator Principles Financial Institutions
ERA	Electricity Regulation Act
ESA	Ecological Support Area
ESMS	Environmental and Social Management System
EWT	Endangered Wildlife Trust
FEIAr	Final Environmental Impact Assessment Report
FGM	Focus Group Meeting
FSR	Final Scoping Report
FTE	Full-time Equivalent

GDP-R	Gross Domestic Product per Region
GHG	Greenhouse gas
GIS	Geographic Information System
GM	Government Notice
HIA	Heritage Impact Assessment
HV	High Voltage
I&APs	Interested and Affected Parties
IDP	Integrated Development Plan
IEP	Integrated Energy Plan
IFC	International Finance Corporation
IPP	Independent Power Producer
IUCN	International Union for the Conservation of Nature and Natural Resources
IRP	Integrated Resource Plan
IUCN	International Union for the Conservation of Nature and Natural Resources
KMIA	Kruger Mpumalanga International Airport
KSW	Key Stakeholder Workshop
kV	Kilo Volt
LED	Local Economic Development
LEDET	Limpopo Department of Economic Development, Environment and Tourism
LIA	Later Iron Age
LSA	Late Stone Age
LM	Local Municipality
MSA	Middle Stone Age
MW	Megawatt
MWp	Megawatt peak
NDP	National Development Plan
NEMA	National Environmental Management Act, 1998 (Act No. 107 of 1998)
NEMBA	National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004)
NFA	National Forest Act, 1998 (Act No. 84 of 1998)
NHRA	National Heritage Resources Act, 1999 (Act No. 25 of 1999)
NRTA	National Road Traffic Act, 1996 (Act No. 93 of 1996, as amended)
NT	Near Threatened
NWA	National Water Act, 1998 (Act No. 36 of 1998)
O&M	Operations and Maintenance
PICC	Presidential Infrastructure Coordinating Commission
PM	Public Meeting
PPA	Power Purchase Agreement
PPP	Public Participation Process
PV	Photovoltaic
RE IPPPP	Renewable Energy Independent Power Producer Procumbent Programme
RFP	Request for Proposals
RFQ	Request for Qualifications

SA CAA	South African Civil Aviation Authority
SAHRA	South African Heritage Resources Agency
SANBI	South African National Biodiversity Institute
SANRAL	South African National Roads Agency Limited
SED	Socio-Economic Development
SMME	Small, Micro, and Medium Enterprises
WESSA	Wildlife and Environment Society of South Africa

NOKUKHANYA ENERGY

PROPOSED CONSTRUCTION OF THE NOKUKHANYA 75MW SOLAR PHOTOVOLTAIC (PV) POWER PLANT NEAR DENNILTON, LIMPOPO PROVINCE OF SOUTH AFRICA

DRAFT ENVIRONMENTAL IMPACT ASSESSMENT REPORT

1 INTRODUCTION

Nokukhanya Energy Group (hereafter referred to as Nokukhanya) has appointed SiVEST as independent Environmental Assessment Practitioner (EAP) to conduct an Environmental Impact Assessment (EIA) for the proposed establishment of a 75MW Solar Photovoltaic (PV) Power Plant near Dennilton in the Limpopo Province, South Africa. The objective of the project is to generate electricity to feed into the national grid by installing a solar panel field. The project is also in line with the government's commitment to provide renewable energy as an alternative energy source to those currently utilised. In addition, the Elias Motsoaledi Local Municipality (EMLM) Integrated Development Plan (IDP) for 2013-2014 estimates that 4.6% of the towns and villages in the local municipality do not have access to electricity supply, and that there is insufficient bulk capacity to extend connections to additional households. The proposed project is thus aligned with serving the objectives of local and national government. According to the National Solar Resource Map the Limpopo Province of South Africa has a solar energy concentration of between 6501 and 8500 MJ/m^2. The project site falls within the range of 8001 – 8500 MJ/m^2 and is thus suitable for the establishment of solar PV power plants.

The National Environmental Management Act (No. 107 of 1998) (NEMA) EIA Regulations that were promulgated in December 2014 govern the EIA process. However the EIA for this proposed project was initiated in August 2014 with the submission of the application form, therefore in accordance with Regulation 53(1) of the 2014 EIA Regulations, any applications submitted in terms of the previous NEMA regulations must be undertaken as if the previous NEMA regulations were not repealed. This EIA has therefore been undertaken in accordance with the NEMA 2010 EIA Regulations which are contained in four Government Notices (GN 543, 544, 545 and 546) which were promulgated on 18 June 2010 and came into effect on 02 August 2010. In terms of the 2010 EIA Regulations, the proposed development is regarded as a listed activity under Government Notice R544 - R546 of. The Scoping Phase of the project has been completed and has been accepted by the National Department of Environmental Affairs (DEA). The EIA phase is currently in progress.

This report has been compiled in accordance with World Bank standards and the Equator Principles. The Equator Principles ("EP") is a financial industry benchmark for determining, assessing and managing social & environmental risk in project financing (Equator Principles, 2013).

This PV project is considered a Category B project. Category B Projects are those with potential limited adverse social or environmental impacts that are few in number, generally site-specific, largely reversible and readily addressed through mitigation measures (Equator Principles, 2013).

1.1 Structure of this Report

This Draft Environmental Impact Assessment Report (DEIAr) is structured as follows:

- Chapter 1 introduces the project and discusses the experience of the Environmental Assessment Practitioners (EAP), including specialists, who have contributed to the report. It expands on the relevant legal ramifications applicable to the project and describes the Equator Principles, IFC Performance Standards and the relevant development strategies and guidelines.
- Chapter 2 details the approach used to undertake the study i.e. the scoping study, authority consultation and the EIAr.
- Chapter 3 elaborates on the assumptions and limitations pertaining to the EIA process for the proposed development.
- Chapter 4 provides explanation to the need and desirability of the proposed project by highlighting issues such as security of power supply; local employment as well as regional and local income profile.
- Chapter 5 gives detailed technical descriptions of the solar PV power plant as well as the alternatives involved.
- Chapter 6 provides a description of the region in which the proposed development is intended to be located. Although the chapter provides a broad overview of the region, it is also specific to the application. It contains descriptions of the site and the specialist studies conducted during scoping phase are also summarised.
- Chapter 7 describes the Public Participation Process (PPP) undertaken during the EIA Phase and tables issues and concerns raised by Interested and Affected Parties (I&APs).
- Chapter 8 documents the findings of the specialist studies and associated potential impacts of the proposed solar PV power plant.
- Chapter 9 presents a rating of each environmental issue before and after mitigation measures.
- Chapter 10 identifies potential cumulative impacts per environmental issue (specialist study) as well as mitigation measures.
- Chapter 11 gives a comparative assessment of all identified alternatives based on the various environmental issues (specialist studies).
- Chapter 12 provides a description of the environmental monitoring and auditing process to be undertaken for the proposed solar PV power plants.
- Chapter 13 presents a checklist that ensures that the report has been compiled according to the requirements of the World Bank Standards and Equator Principles.
- Chapter 14 summarises the findings and recommendations per specialist study and provides the overall conclusion.

- Chapter 15 lists references indicated in the EIAr.

1.2 Expertise of Environmental Assessment Practitioner

SiVEST has considerable experience in the undertaking of EIAs. Staff and specialists who have worked on this project and contributed to the compilation of this report are detailed in Table **1** below.

Table 1: Project Team

Name and Organisation	Role
Rebecca Thomas, SiVEST	Project Director
Andrea Gibb, SiVEST	Project Leader (EAP)
Lynsey Rimbault, SiVEST	Public Participation and Environmental Consultant
Kerry Schwartz, SiVEST	GIS and Mapping
David Hoare, David Hoare Consulting	Biodiversity (Flora, Fauna and Avifauna)
Shaun Taylor, SiVEST	Surface Water and Wetlands
Alistair Fyfe, SiVEST	
Martin Ferreira, Jeffares and Green	External Review: Surface Water and Wetlands
D.G. Paterson, ARC Institute for Soil, Climate and Water	Soils and Agricultural Potential
Andrea Gibb, SiVEST	Visual
Keagan Allan, SRK Consulting	External Review: Visual
Wouter Fourie, Professional Grave Solutions	Heritage
Elena Broughton, Urban-Econ Development Economists	Socio-economic
Cecilia Canahai, Jeffares and Green	Geotechnical

Please refer to Appendix 2 for CV's of each team member. Declarations of independence are included in Appendix 4.

1.3 Key Legal and Administrative Requirements Relating to the Proposed Development

1.3.1 National Environmental Management Act (Act No 107 of 1998) – NEMA EIA Requirements

The National Environmental Management Act (Act No. 107 of 1998) was promulgated in 1998 but has since been amended on several occasions from this date. This Act replaces parts of the Environment Conservation Act (Act No 73 of 1989) with exception to certain parts pertaining to Integrated Environmental Management. The act intends to provide for:

- co-operative environmental governance by establishing principles for decision-making on matters affecting the environment;
- institutions that will promote co-operative governance and procedures for coordinating environmental functions exercised by organs of state;
- to provide for the prohibition, restriction or control of activities which are likely to have a detrimental effect on the environment;
- and to provide for matters connected therewith.

Activities that may significantly affect the environment must be considered, investigated and assessed prior to implementation.

1.3.2 NEMA EIA Requirements

Sections 24 and 44 of NEMA make provision for the promulgation of regulations that identify activities which may not commence without an environmental authorisation, the result being that NEMA now governs the EIA process with the said promulgation of EIA Regulations in December 2014 (Government Gazette No. 38282 of 04 December 2014). However the EIA for this proposed project was initiated in August 2014 with the submission of the application form. Therefore in accordance with Regulation 53 (1) of the 2014 EIA Regulations, any applications submitted in terms of the previous NEMA regulations must be undertaken as if the previous NEMA regulations were not repealed. This EIA has therefore been undertaken in accordance with the NEMA EIA 2010 Regulations which are contained in four Government Notices (GN 543, 544, 545 and 546) which were promulgated on 18 June 2010 and came into effect on 02 August 2010.

Apart from other matters regulating the EIA process and related matters, Government Notice (GN) No. R.543 sets out two distinct authorisation processes. Depending on the nature of listed activity that is proposed to be undertaken, either a so-called “basic assessment” process or a so-called “scoping and EIA” process is required to apply for an environmental authorisation in terms of NEMA. GN No. R.544 lists activities that require a Basic Assessment (BA), GN No. R.545 lists activities that require scoping and an Environmental Impact Assessment (EIA) and GN No. R.546 lists activities that only require an environmental authorisation, through a basic assessment process, if the activity is undertaken in a specific geographical area indicated in the listing notice. A full Environmental Impact Assessment is required for the

proposed development based on triggered activities. However, several activities which trigger a basic assessment were also identified and need also to be specified. Ultimately, these activities will not form a separate assessment, but will fall into the greater EIA.

The following Schedules of the Government Notice No. R. 544 - 545 of 18 June 2010 are of relevance to the project in question. The Listed Activities identified in terms of Sections 24(2) and 24D include;

Table 2: Listed activities in terms of the NEMA Regulations

Number and date of the relevant notice:	**Activity No (s)**	**Description of listed activity**	**Description of the project activity in relation to the listed activity**
Government Notice R544 (18 June 2010)	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 275 kilovolts.*	An onsite substation will be constructed with a capacity of 132kV.
	11	The construction of (xi) infrastructure or structures covering 50 square metres or more, where such infrastructure occurs within a water course or within 32 metres of a watercourse, measured from the edge of the water course…	The surface water specialist study revealed that there are five surface water features within close proximity of the project buildable area. None of these surface water features overlap with any of the proposed alternatives, however the PV array area will be within 32m from at least one of the identified surface water features (refer to Figure 60).
	18	The infilling or deposition of any material of more than 5 cubic metres into, or the dredging, excavation, removal of moving of soil, sand, sand….pebbles or rock from (i) a watercourse	The surface water specialist study revealed that there are five surface water features within close proximity of the project buildable area. None of these surface water features overlap with any of the proposed alternatives, however at least one of these surface water features traverse the secondary road leading to the site. Existing access roads will need to be upgraded to allow access to the site during the construction phase. During these

			construction activities soil may ne removed from a water course.
Government Notice R545 (18 June 2010)	1	The construction of facilities or infrastructure, including associated structures or infrastructure, for the generation of electricity where the electricity output is 20 megawatts or more.	It is proposed that a solar PV plant with a generation capacity of approximately 75MW will be constructed**.**
	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; except where such physical alteration takes place for *i) Linear development activities; or* *ii) Agriculture or afforestation where the activity 16 in this schedule will apply*	The proposed development will transform undeveloped, vacant or derelict land to industrial use (solar PV plant). The entire project site is approximately 215 hectares, and the buildable area (after excluding environmentally sensitive areas) is approximately 170 hectares. The preferred PV array area is approximately 125 hectares, with approximately an additional 11 hectares proposed for associated infrastructure.
Government Notice R546 (18 June 2010)	4	The construction of a road wider than 4 metres with a reserve less than 13,5 metres - (a) In Limpopo province: *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* *ee) Critical biodiversity areas as identified in*	Internal access roads will require a width of typically at least 5m. According to the Limpopo C-Plan, the study area spans across a Critical Biodiversity Area (CBA) 2. In addition, the Mabusa Nature Reserve forms part of the southern border of the proposed development site. As such, the proposed internal access roads will be located within 5km of this protected area. See Figure 1 for the location of the project in relation to CBAs and the protected area.

		systematic biodiversity plans adopted by the competent authority or in bioregional plans; *gg) Areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any other protected area identified in terms of NEMPAA or from the core areas of a biosphere reserve;*	
	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 *a) Within critical biodiversity areas identified in bioregional plans;*	Indigenous vegetation would need to be cleared for the proposed solar PV plant and associated infrastructure. The two broad vegetation types listed in terms of NEMBA are not listed as endangered. However, the study area spans across a CBA 2 as identified by the Limpopo C-Plan V2. Aerial imagery suggests that the vegetation has been impacted to varying degrees, however the dominant vegetation type is Central Sandy Bushveld, which is listed as vulnerable by Driver et al., 2005 and Mucina et al., 2006. See Figure 1 for the location of the project in relation to CBAs.
	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 and ecological support areas as	Indigenous vegetation would need to be cleared for the proposed solar PV plant and associated infrastructure. The study area spans across a CBA 2, an Eological Support Area (ESA) 1 and ESA 2, as identified by the Limpopo C-Plan V2. . In addition, the Mabusa Nature Reserve forms part of the southern border of the proposed

		identified in systematic biodiversity plans adopted by the competent authority. **b) In Limpopo:** ii) *Outside urban areas, the following*: (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 (ff) Areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any other protected area identified in terms of NEMPAA or from the core area of a biosphere reserve;	development site. As such, the proposed development will be located within 5km of this protected area. The size of the project will be larger than 1 hectare. Aerial imagery suggests that the vegetation has been impacted to varying degrees, however the dominant vegetation type is Central Sandy Bushveld, which is listed as vulnerable by Driver et al., 2005 and Mucina et al., 2006. See Figure 1 for the location of the project in relation to CBAs, ESAs and the protected area.
	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 Limpopo** *i) All areas outside of urban areas*	Indigenous vegetation would need to be cleared for the proposed solar PV plant and associated infrastructure. Two regional vegetation types occur in the area but they appear from aerial photography to have been impacted to varying degrees. The dominant vegetation types, Central Sandy Bushveld and Loskop Mountain Bushveld, are not listed as threatened in terms of NE:MBA, however Central Sandy Bushveld is listed as threatened by Driver et al., 2005 and Mucina et al.,

			2006. More than 5 hectares of vegetation clearing would need to take place.
	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, measured from the edge of a watercourse, excluding where such construction will occur behind the development setback line. **a) In Limpopo:** ii) Outside urban areas, in: (dd) Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority; (ff) Critical biodiversity areas or ecosystem service areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans; hh) Areas within 10 kilometres from national parks or world heritage sites	The surface water specialist study revealed that there are five surface water features within close proximity of the project buildable area. None of these surface water features overlap with any of the proposed alternatives, however the PV array area will be within 32m from at least one of the identified surface water features (refer to Figure 60). The study area spans across a CBA 2, as identified by the Limpopo C-Plan V2. In addition, the Mabusa Nature Reserve forms part of the southern border of the proposed development site. As such, the proposed development will be located within 5km of this protected area. See Figure 1 for the location of the project in relation to CBAs and the protected area.

		or 5 kilometres from any other protected area identified in terms of NEMPAA or from the core area of a biosphere reserve.	
	19	The widening of a road by more than 4 metres, or the lengthening of a road by more than 1 kilometre. **a) In Limpopo provinces:** iii) 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; (ee) Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans; (gg) Areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any other protected area identified in terms of NEMPAA or from the core area	Existing access roads will need to be upgraded in order to access to the site. Upgrading the existing roads could involve widening and lengthening of the road. The study area spans across a CBA 2, as identified by the Limpopo C-Plan V2. In addition, the Mabusa Nature Reserve forms part of the southern border of the proposed development site. As such, the proposed access roads to be upgraded could be located within 5km of this protected area. The surface water specialist study revealed that there are five surface water features within close proximity of the project buildable area. See Figure 1 for the location of the project in relation to CBAs and the protected area.

		of a biosphere reserve; (ii) Areas on the watercourse side of the development setback line or within 100 metres from the edge of a watercourse where no such setback line has been determined.	

Figure 1 below shows the location of the project in relation to CBAs, ESAs and the protected area.

Figure 1: Project Proximity to CBAs, ESAs and the Mabusa Nature Reserve

1.3.3 National Heritage Resources Act (Act No 25 of 1999)

The protection and management of South Africa's heritage resources is primarily regulated by the National Heritage Resources Act, 1999 (Act 25 of 1999) (NHRA). The law ensures community participation in the protection of national heritage resources and involves all three levels of government (national, provincial and local) in the management of the country's national heritage. The South African Heritage Resources Agency (SAHRA) is the enforcing authority for the NHRA.

In terms of the Act, various forms of heritage resources (such as graves, certain trees, archaeological artefacts, fossil beds etc.), are afforded protection and a permit may be required to destroy, damage, excavate, alter, etc. protected heritage resources).

Furthermore, in terms of section 38 of the NHRA, the responsible heritage resources authority can call for a Heritage Impact Assessment (HIA) where certain categories of development are proposed. The provisions of section 38 do not apply to a development if an evaluation of the impact of such development on heritage resources is required in terms of (among other legislation), NEMA. This is subject to the proviso that the consenting authority must ensure that the evaluation fulfils the requirements of the relevant heritage resources authority in terms of section 38(3) and that any comments and recommendations of the relevant heritage resources authority with regard to such development have been taken into account prior to the granting of the consent.

A heritage assessment has been conducted to explore how the proposed development may impact on heritage resources as protected by the Act.

1.3.4 National Water Act (Act No 36 of 1998)

The National Water Act, No 36 of 1998 (NWA) was promulgated on the 20th August 1998. This Act is important in that it provides a framework to protect water resources against over exploitation and to ensure that there is water for social and economic development, human needs and to meet the needs of the aquatic environment. The Act also recognises that water belongs to the whole nation for the benefit of all people.

It is important to note that water resources are protected under the Act. Under the act, water resources as defined include a watercourse, surface water, estuary or aquifer. A watercourse is defined as a river or spring, a natural channel in which water flows regularly or intermittently, or a wetland, lake or dam into which, or from which water flows.

One of the main aims of the Act is the protection of water resources. 'Protection' in relation to a water resource entails:

- Maintenance of the quality of the water resource to the extent that the water use may be used in a sustainable way;

- Prevention of degradation of the water resource
- The rehabilitation of the water resource

In the context of the proposed development and any potential impact on water resources, the definition of pollution and pollution prevention contained within the Act is relevant. 'Pollution', as described by the Act is the direct or indirect alteration of the physical, chemical or biological properties of a water resource, so as to make it (inter alia)

- less fit for any beneficial purpose for which it may reasonably be expected to be used; or
- harmful or potentially harmful to the welfare or human beings, to any aquatic or non-aquatic organisms, or to the resource quality.

This definition of pollution is quite wide ranging, and it applies to all types of water resource. Activities which cause alteration of the biological properties of a watercourse (i.e. the fauna and flora contained within that watercourse are also considered pollution).

In terms of section 19 of the Act owners / managers / people occupying land on which any activity or process undertaken which causes, or is likely to cause pollution of a water resource must take all reasonable measures to prevent any such pollution from occurring, continuing or recurring. These measures may include (inter alia):

- measures to cease, modify, or control any act or process causing the pollution
- comply with any prescribed waste standard or management practice
- contain or prevent the movement of pollutants
- remedy the effects of the pollution; and
- remedy the effects of any disturbance to the bed and banks of a watercourse

A surface water assessment has been conducted to explore how the proposed development may impact on water resources as protected by the Act.

1.3.5 National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004)

The overarching aim of the National Environmental Management: Biodiversity Act 10 of 2004 (NEMBA), within the framework of NEMA, is to provide for:

- The management and conservation of biological diversity within South Africa, and of the components of such biological diversity;
- The use of indigenous biological resources in a sustainable manner; and
- The fair and equitable sharing among stakeholders of benefits arising from bio-prospecting involving indigenous biological resources.

The South African National Biodiversity Institute (SANBI) was established by the NEMBA, its purpose being (*inter alia*) to report on the status of the country's biodiversity and the conservation status of all listed threatened or protected species and ecosystems.

NEMBA provides for a range of measures to protect ecosystems and for the protection of species that are threatened or in need of protection to ensure their survival in the wild, including a prohibition on carrying out a "restricted activity" involving a specimen of a listed threatened or protected species without a permit issued in terms of Chapter 7. Lists of critically endangered, endangered, vulnerable and protected species have been published and a permit system for listed species has been established.

It is also appropriate to undertake a Faunal and Botanical Impact Assessment where developments in an area that is considered ecologically sensitive require an environmental authorisation in terms of NEMA, with such Assessment taking place during the basic assessment or EIA. These two studies will be undertaken during the project.

The NEMBA is relevant to the proposed project as the construction of the PV power plant and other components such as substations may impact negatively on biodiversity. The project proponent is therefore required to take appropriate reasonable measures to limit the impacts on biodiversity, to obtain permits if required and to also invite SANBI to provide commentary on any documentation resulting from the proposed development.

A biodiversity assessment has been conducted to explore how the proposed development may impact on biodiversity as protected by the Act.

1.3.6 The National Forest Act, 1998 (Act 84 of 1998) (NFA)

The National Forest Act, 1998 (Act 84 of 1998) (NFA) was enacted to:

- Promote the sustainable management and development of forests for the benefit of all;
- Provide special measures for the promotion of certain forests and trees;
- Promote the sustainable use of forests for environmental, economic, educational, recreational, cultural, health and spiritual purposes;
- Promote greater participation in all aspects of forests and the forest products industry by persons disadvantaged by unfair discrimination.

The NFA enforces the necessity for a license to be obtained prior to destroying any indigenous tree in a natural forest and, subject to certain exemptions, cutting, disturbing, damaging, destroying or removing any protected tree. The list of protected trees is currently contained in GN 908 of 21 November 2014. Licenses are issued by the Minister and are subject to periods and conditions as may be stipulated.

The NFA is relevant to the proposed project as protected tree species may be damaged, disturbed, cured, destroyed or removed. The specialist biodiversity assessment has been conducted to determine the occurrence of protected tree species on the site and if these are affected by the proposed development, a Forest Act License would be required to cut and destroy the protected trees.

1.3.7 Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983) (CARA)

The Conservation of Agricultural Resources Act (CARA) and the Regulations promulgated under that Act are designed to protect natural agricultural resources and to promote inter alia water sources and vegetation in South Africa.

The primary objective of the Act is to conserve natural agricultural resources by:

- maintaining the production potential of land;
- combating and preventing erosion and weakening or destruction of the water resources;
- protecting vegetation; and
- combating weeds and invaders plants.

The ambit of the CARA is however limited, as land situated within the ambit of an "urban area[1]" **does not** fall within the ambit of the CARA, except in so far as the Act relates to weeds and invader plants.

The CARA is relevant to the proposed project as the construction of a solar plant may impact on agricultural resources and vegetation on the site. The CARA prohibits the spreading of weeds and prescribes control measures that need to be complied with in order to achieve this. As such, measures will need to be taken to protect agricultural resources and prevent weeds and exotic plants from invading the site as a result of the proposed development.

An agricultural potential assessment has been conducted to explore how the proposed development may impact on the agricultural production potential of the proposed site.

1.3.8 Subdivision of Agricultural Land Act No. 70 of 1970, as amended

The Subdivision of Agricultural Land Act No. 70 of 1970 controls the subdivision of all agricultural land in South Africa; prohibiting certain actions pertaining to agricultural land. Under the Act the owner of

[1] "**Urban area**" is defined to include any land which is under the control of a local authority (subject to certain exclusions) and land which is subdivided into erven or lots.

agricultural land is required to obtain consent from the Minister of Agriculture in order to subdivide agricultural land.

The purpose of the Act is to prevent uneconomic farming units from being created and degradation of prime agricultural land. To achieve this purpose the act also regulates leasing and selling of agricultural land as well as registration of servitudes.

The Act is of relevance to the proposed development as any land within the study area that is zoned for agricultural purposes will be regulated by this Act.

Although the whole of this Act has been repealed by section 1 of the Subdivision of Agricultural Land Act Repeal Act 64 of 1998, this Repeal Act has not been implemented and no date of coming into operation has been proclaimed.

It is important to note that the implementation of this Act is problematic as the Act defines 'Agricultural Land' as being any land, except land situated in the area of jurisdiction of a municipality or town council, and subsequent to the promulgation of this Act uninterrupted Municipalities have been established throughout South Africa.

1.3.9 National Road Traffic Act No. 93 of 1996, as amended

The National Road Traffic Act (NRTA) No. 93 of 1996 provides for all road traffic matters and is applied uniformly throughout South Africa. The Act enforces the necessity of registering and licensing motor vehicles. It also stipulates requirements regarding fitness of drivers and vehicles as well as making provision for the transportation of dangerous goods.

All the requirements stipulated in the NRTA will need to be complied with during the construction and operational phases of the proposed photovoltaic plant.

1.3.10 Additional Relevant Legislation

- Occupational Health and Safety Act (Act 85 of 1993)
- National Environmental Management: Air Quality Act, 2004
- National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008)
- Development Facilitation Act No. 67 of 1995
- National Protected Areas Act (Act No. 25 of 2003)

1.4 Equator Principles (EPs)

The Equator Principles are a financial industry benchmark for determining, assessing and managing social & environmental risk in project financing. A number of banks, exchanges and organisations worldwide have adopted the Principles as requirements to be undertaken for project funding on application and approval. Furthermore, certain funding institutions have not formally adopted the Principles, but require clients to be compliant with them in order to qualify for loans. The Equator Principles are summarised below:

Principle 1: Review and Categorisation
When a project is proposed for financing, the Equator Principles Funding Institution ("EPFI") will categorise the project based on the magnitude of its potential environmental and social impacts and risks.

Principle 2: Environmental and Social Assessment
For each project assessed as being either Category A or Category B, the client / borrower must conduct a Social and Environmental Assessment ("Assessment") process to address the relevant impacts and risks of the proposed project. The Assessment should also propose mitigation and management measures relevant and appropriate to the nature and scale of the proposed project.

Principle 3: Applicable Environmental and Social Standards
The Assessment will refer to the applicable IFC Performance Standards and applicable Industry Specific Environmental, Health, and Safety (EHS) Guidelines.

Principle 4: Environmental and Social Management System and Equator Principles Action Plan
The client / borrower must prepare an Environmental and Social Management System (ESMS). Further, an Environmental and Social Management Plan (ESMP) must be prepared by the client to address issues raised in the Assessment process and incorporate actions required to comply with the applicable standards. Where applicable standards are not met to the EPFI's satisfaction, the client and the EPFI will agree to an Equator Principles Action Plan to outline gaps and commitments.

Principle 5: Stakeholder Engagement
For all Category A and Category B Projects, the EPFI will require the client to demonstrate effective Stakeholder Engagement as an ongoing process in a structured and culturally appropriate manner with Affected Communities and, where relevant, Other Stakeholders. For Projects with potentially significant adverse impacts on Affected Communities, the client will conduct an Informed Consultation and Participation process. The client will tailor its consultation process to: the risks and impacts of the Project; the Project's phase of development; the language preferences of the Affected Communities; their decision-making processes; and the needs of disadvantaged and vulnerable groups.

Principle 6: Grievance Mechanism
The EPFI will require the client, as part of the ESMS, to establish a grievance mechanism designed to receive and facilitate resolution of concerns and grievances about the Project's environmental and social performance. The grievance mechanism is required to be scaled to the risks and impacts of the Project and

have Affected Communities as its primary user. It will seek to resolve concerns promptly, using an understandable and transparent consultative process that is culturally appropriate, readily accessible, at no cost, and without retribution to the party that originated the issue or concern. The mechanism should not impede access to judicial or administrative remedies.

Principle 7: Independent Review

For all Category A projects and, as appropriate, for Category B projects, an independent social or environmental expert not directly associated with the borrower must review the Assessment, AP and consultation process documentations in order to assist the EPFIs due diligence, and assess Equator Principles compliance.

Principle 8: Covenants

An important strength of the Principles is the incorporation of covenants linked to compliance. For all Projects, the client will covenant in the financing documentation to comply with all relevant host country environmental and social laws, regulations and permits in all material respects. For Category A and B projects, the client / borrower will covenant in financing documentation:

- To comply with the ESMPs and Equator Principles AP (where applicable) during the construction and operation of the Project in all material respects; and

- To provide periodic reports in a format agreed with the EPFI (with the frequency of these reports proportionate to the severity of impacts, or as required by law, but not less than annually), prepared by in-house staff or third party experts, that i) document compliance with the ESMPs and Equator Principles AP (where applicable), and ii) provide representation of compliance with relevant local, state and host country environmental and social laws, regulations and permits; and

- To decommission the facilities, where applicable and appropriate, in accordance with an agreed decommissioning plan.

Principle 9: Independent Monitoring and Reporting

To ensure ongoing monitoring and reporting over the life of the loan, EPFIs will, for all Category A projects, and as appropriate, for Category B projects, require appointment of an independent environmental and/or social expert, or require that the borrower to retain qualified and experienced external experts to verify its monitoring information, which would be shared with EPFIs.

Principle 10: Reporting and Transparency

For all Category A and, as appropriate, Category B Projects:

- The client will ensure that, at a minimum, a summary of the ESIA is accessible and available online.

- The client will publicly report GHG emission levels (combined Scope 1 and Scope 2 Emissions) during the operational phase for Projects emitting over 100,000 tonnes of CO_2 equivalent annually.

Although this report is not written in terms of the Equator Principles (EPs), it fully acknowledges that EPs will need to be complied with should funding for the project be required. In general, the following documentation will need to be considered in that regard:

- The "Equator Principles" 2013
- International Finance Corporations Performance Standards on Social and Environment, IFC, April, 2006 namely:
    - Performance Standard 1: Social and Environmental Assessment and Management Systems
    - Performance Standard 2: Labour and Working Conditions
    - Performance Standard 3: Pollution Prevention and Abatement
    - Performance Standard 4: Community Health, Safety and Security
    - Performance Standard 5: Land Acquisition and Involuntary Resettlement
    - Performance Standard 6: Biodiversity Conservation and Sustainable Natural Resource Management
    - Performance Standard 7: Indigenous Peoples
    - Performance Standard 8: Cultural Heritage

- International Finance Corporation – World Bank Guidelines, General EHS Guidelines 2007.

EHS Guidelines are technical reference documents with general and industry-specific examples of Good International Industry Practice. These EHS Guidelines are applied as required by the World Bank's respective policies and standards. These General EHS Guidelines are designed to be used together with the relevant Industry Sector EHS Guidelines which provide guidance to users on EHS issues in specific industry sectors.

- The EHS Guidelines contain the performance levels and measures that are generally considered to be achievable in new facilities by existing technology at reasonable costs.

1.5 Key Development Strategies and Guidelines

1.5.1 Integrated Development Plans

An Integrated Development Plan (IDP) is defined in the Local Government: Municipal Systems Act, 2000 (Act 32 of 2000), as an inclusive and strategic plan that:

- Links, integrates and co-ordinates plans and takes into account proposals for the development of the municipality;
- Aligns the resources and capacity of the municipality with the implementation of the plan
- Forms the policy framework on which annual budgets must be based; and,

- Is compatible with national and provincial development plans and planning requirements binding on the municipality in terms of legislation.

The main purpose of the IDP is for the enhancement of service delivery and fighting poverty through an integrated and aligned approach between different role-players and stakeholders.

Each municipality is required to produce an IDP which would address pertinent issues relevant to their municipality. However, common concerns include municipal transformation and development, and service delivery and infrastructural development.

Two of the three main goals of the Elias Motsoaledi LM, as per the LM IDP include a) provision of services to communities in a sustainable manner and b) promoting social and economic development. These are envisaged to be achieved, among others, by "supporting sustainable infrastructure development and maintenance, as well as service delivery, through a fair allocation of resources", "promoting a safe and healthy environment", and "facilitating economic development and job creation" (Elias Motsoaledi Local Municipality, 2013).

Thus the proposed development is aligned with the goals of the municipal IDP in the study area.

1.5.2 Limpopo Province Green Economy Plan, 2013

In June 2013, the province also adopted a Green Economy Plan (Limpopo Provincial Government, 2013) that acknowledges the province's perfect geographic position to develop various green industries and achieve economies of scale. The immediate policy decisions and enforcement to start green economy practices include, among others, green procurement and energy efficiency. The Green Economy Plan of 2013 also highlights the favourable solar radiation and abundant land to build even concentrated solar plants, as well as development of off-grid small power plants where Eskom's grid would not reach. The provincial government also wants to encourage the production of solar panels in the province as silicon reserves and the second biggest silicon smelter in the world are located in Limpopo.

1.5.3 Integrated Energy Plan for the Republic of South Africa, 2003

The Integrated Energy Plan (IEP), developed by the former Department of Minerals and Energy (DME), was formulated to address the energy demand of the country balanced with energy supply, transformation, economics and environmental considerations in concourse with available resources. One of the main objectives of the plan is to promote universal access to clean and affordable energy, with emphasis on household energy supply being co-ordinated with provincial and local integrated development programmes. Another objective is to ensure that the environment is considered with regard to energy supply, transformation and end use. This project is thus in line with the goals of the IEP and will assist with implementing the plan.

1.5.4 Integrated Resource Plan for Electricity for the Republic of South Africa, 2011; and Update Report, 2013

The Integrated Resource Plan (IRP) for Electricity (2013) comprehensively examines the current and future demands for electricity, and outlines a plan for meeting these demands. The plan is derived from a cost-optimal scenario for new build options balanced with qualitative factors such as job creation. The IRP encourages the development of renewables in order to foster the development of local industry clusters and assist in fulfilling South Africa's climate change mitigation commitments. The IRP recommends a continuation of the current renewable bid programme with additional annual rounds of 1000 MW PV capacity; 1000 MW wind capacity and 200 MW CSP capacity.

1.5.5 DEA Draft National Renewable Energy Guideline, 2013

The Guideline was produced to provide a review of Renewable Energy technologies, a summary of the impacts of each technology and associated authorisation processes required, an overview of some good industry mitigation practices, a review of National legislation, a schematic of the NEMA approvals process and a list of relevant contact details. Assuming an IPP project triggers the need for Basic Assessment (BA) or an Environmental Impact Assessment (EIA) under the National Environmental Management Act (NEMA), included in the assessment process is the preparation of an environmental management programme (EMPr). Project-specific measures designed to mitigate negative impacts and enhance positive impacts should be informed by good industry practice and are to be included in the EMPr.

1.5.6 Independent Power Producer Process

(The following information was extracted from the Eskom website: Guide to Independent Power Producer (IPP) processes in South Africa and Eskom**,** June 2010
http://www.eskom.co.za/live/content.php?Item_ID=14324)

The objective of this section is to provide an overview of the processes in the country and within Eskom relating to Independent Power Producers (IPPs). It is important that certain enabling policies, rules and regulations are in place to provide certainty and transparency in the introduction of IPPs.

- Country Process

South Africa has two acts that direct the planning and development of the country's electricity sector:

i. The National Energy Act of 2008 (No. 34 of 2008)
ii. The Electricity Regulation Act (ERA) of 2006 (No. 4 of 2006).

In August 2009, the Department of Energy (DoE) gazetted the Electricity Regulations on New Generation Capacity under the ERA. The New Generation Regulations establish rules and guidelines that are applicable to the undertaking of an IPP Bid Programme and the procurement of an IPP for new generation capacity. They also facilitate the fair treatment and non-discrimination between IPPs and the buyer of the energy.

- Formal Programmes

In terms of the New Generation Regulations, the Integrated Resource Plan (IRP) will be developed by the DoE and will set out the new generation capacity requirement per technology, taking energy efficiency and the demand-side management projects into account. This required, new generation capacity to be met through the technologies and projects listed in the IRP and all IPP procurement programmes will be executed in accordance with the specified capacities and technologies listed in the IRP.

The table below highlights the energy plan that has been proposed until 2030.

Table 3: Government Energy Plans up until 2030 in terms of the IRP

New Build Options								
	Coal	**Nuclear**	**Import Hydro**	**Gas - CCGT**	**Peak - OCGT**	**Wind**	**CSP**	**Solar PV**
2010	0	0	0	0	0	0	0	0
2011	0	0	0	0	0	0	0	0
2012	0	0	0	0	0	0	0	300
2013	0	0	0	0	0	0	0	300
2014	500	0	0	0	0	400	0	300
2015	500	0	0	0	0	400	0	300
2016	0	0	0	0	0	400	100	300
2017	0	0	0	0	0	400	100	300
2018	0	0	0	0	0	400	100	300
2019	250	0	0	237	0	400	100	300
2020	250	0	0	237	0	400	100	300
2021	250	0	0	237	0	400	100	300
2022	250	0	1143	0	805	400	100	300
2023	250	1600	1183	0	805	400	100	300
2024	250	1600	283	0	0	800	100	300
2025	250	1600	0	0	805	1600	100	1000
2026	1000	1600	0	0	0	400	0	500
2027	250	0	0	0	0	1600	0	500
2028	1000	1600	0	474	690	0	0	500
2029	250	1600	0	237	805	0	0	1000
2030	1000	0	0	948	0	0	0	1000
	6250	**9600**	**2609**	**2370**	**3910**	**8400**	**1000**	**8400**

A decision that additional capacity be provided by an IPP must be made with the concurrence of the Minister of Finance. Once such a decision is made, a procurement process needs to be embarked upon to procure that capacity in a fair, equitable and transparent process.

The New Generation Regulations set out the procurement process. The stages within a bid programme are prescribed as follows:

i. Request for Qualifications (RFQ)
ii. Request for Proposals (RFP)
iii. Negotiation with the preferred bidder(s).

A successful bidder will be awarded a Power Purchase Agreement (PPA) subject to approval by the Regulator. Once the Regulator has approved the bidder's associated PPA, the bidder may be licensed as a generator and grid connection may be possible.

2 APPROACH TO UNDERTAKING THE STUDY

The Environmental Impact Assessment was undertaken in accordance with the EIA 2010 Regulations listed in Government Gazette No. 33306 of 18 June 2010 (GN 543, 544, 545 and 546 of 18 June 2010, as amended), in terms of Section 24 and 44 of the National Environmental Management Act, (No 107 of 1998) (NEMA) as amended; the World Bank Standards (IFC Guidelines) and the Equator Principles, as well as with the relevant legislation and guidelines mentioned above.

2.1 Environmental Scoping Study

The Scoping Study identified the potential positive and negative impacts associated with the proposed development as well as the studies which were required to be undertaken as part of the EIA-phase of the project. The Draft Scoping Report (DSR) was made available for public review from Thursday the 9th October 2014 to Friday the 7th November 2014. Comments received on the Draft Scoping Report were included in the Final Scoping Report (FSR) which was submitted to the DEA on the 18th of November 2015. The DEA rejected the FSR on the 26th of February 2015 on the grounds that alternatives had not been properly considered. The DEA requested that the FSR be amended to include alternatives and that it be made available to all Interested & Affected Parties (I&APs) for comment. This was duly done and the Amended FSR comment period ran from Wednesday the 11th of March 2015 to Monday the 13th of April 2015. The Amended FSR was submitted to the DEA on Tuesday the 14th of April 2015. The DEA accepted the Amended FSR and EIA Plan of study on the 5th of May 2015.

The following studies were taken through into the EIA Phase:

- Biodiversity (including fauna, avifauna, and flora)
- Surface Water
- Agricultural Potential and Soils
- Visual
- Heritage
- Socio-economic
- Geotechnical

2.2 Authority Consultation

The National Department of Environmental Affairs (DEA) are the determining authority on this application. The following consultation took place with DEA:

- An application was submitted to DEA on the 28th of August 2014 and acknowledged on the 16th of September 2014.
- The following reference number was allocated to the proposed development - DEA reference number: 14/12/16/3/3/2/737
- The Draft Scoping Report (DSR) was submitted to the DEA on the 09th of October 2014 and the Department confirmed receipt of the DSR on the 24th of October 2014.
- The Final Scoping Report was submitted to the DEA on the 18th of November 2014 and the Department confirmed receipt of this on the 3rd of December 2014.
- The DEA rejected the Final Scoping Report on the 26th of February 2015.
- The Amended Final Scoping Report was submitted to the Department on the 16th of March 2015 and the Department confirmed receipt of this on the 30th of March 2015.
- The Department was notified that the Amended FSR comment period had ended and that the Amended FSR was ready for review on the 14th of April 2015.
- Acceptance of the Amended FSR and the plan of study for the EIA was received on the 5th of May 2015.

As part of the letter from the DEA accepting the Amended FSR, it was requested that additional information be included in the DEIAr. The table below provides details as to how this DEIAr fulfils the main information requested by the DEA in the Amended FSR acceptance letter. For a further details, refer to Appendix 3 for FSR Acceptance Letter.

Table 4: Compliance with the DEA requirements detailed in the FSR acceptance letter

Additional Information Required by the DEA	Notes / Comments
Comments and recommendations made by stakeholders, including Organs of State, must be taken into consideration and addressed during the EIA Phase. Proof of all correspondence, and of attempts to obtain comments, should be included.	The comments and response report is included in Appendix 5E. A record of distribution to Organs of States, including attempts made to obtain comments, is included in Appendix 5I.
All mitigation measures and recommendations by specialists must be included in the Final Impact Assessment Report (FEIAr) and EMPr.	Specialist recommendations and mitigation measures are included in Chapters 9 and 10, as well as in Chapter 14.1, the summary of findings. All mitigation measures are detailed in the EMPr, included as Appendix 8.

Comments from all relevant stakeholders, including additional stakeholders identified by the DEA in the FSR acceptance letter, must be submitted to the DEA with the FEIAr.	All comments from stakeholders are included in the comments and response report. See Appendix 5E.
An assessment of impacts of routing the 132kV overhead power line to the 132kV Amandla substation, 132kV Kwaggafontein substation or Groblersdal substation should be included in the FEIAr.	The proposed solar PV facility will connect into the Kwaggafontein substation, however the power line is not part of this application and will be applied from as a separate process. See Chapter 5 for the technical project description.
The EAP must give I&APs the opportunity to comment on the report within 21 days before submitting the FEIAr to the DEA.	The EAP will give I&APs opportunity to comment within 21 days before submitting the FEIAr. See Chapter 7 for a description of the PPP followed.
An A3 regional map must be included in the FEIAr as per the specifications in the FSR acceptance letter (see Appendix 3 for the letter).	All applicable A3 maps are included in Appendix 7.
The EIAr must provide an assessment of the impacts and mitigation measures for each of the listed activities applied for.	The listed activities that are being applied for as part of this project are detailed in Chapter 1. Impacts and mitigation measures identified by the specialists are included in Chapter 9, and mitigation measures are also detailed in Chapter 10.
Technical details of the proposed facility must be provided in a table format, as per the specifications listed in point 2 in the FSR acceptance letter (see Appendix 3).	Technical details of the project are provided in table format on from page ii to page v of the report.
Coordinates for the proposed project must be included.	Coordinates are included on page ii of the report and in Chapter 6, and also included in further detail in Appendix 9.
The EIAr must include a clear indication of the envisioned area for the proposed solar energy facility and a clear description of all associated infrastructure.	Technical details of the project are included in Chapter 5 and from page ii to page v of the report. The receiving environment is discussed in Chapter 6.
As the area is zoned agricultural land, an agricultural potential study must form part of the EIA process, as per point 3 in the FSR acceptance letter (see Appendix 3).	Different sections of the agricultural potential study are included in Chapters 6.7, 8.3, 9.2.3, and 10.2.3. The full agricultural potential report is also included in Appendix 6C.
The EIAr must include detailed breakdown of the Public Participation Process followed, including a comments and response report.	Chapter 7 includes a detailed breakdown of the Public Participation Process followed, and all public participation documents are included in Appendix 5. The comments and response report is in Appendix 5E.

Details of the future plans for the site and infrastructure after decommissioning and the possibility of upgrading the proposed infrastructure to more advanced technologies should be included in the report.	After decommissioning Nokukhanya plan to assess opportunities to upgrade the proposed infrastructure in line with a more advanced solar energy technology available at the time.
An Avifaunal Assessment must be conducted as per the specifications in the FSR acceptance letter.	A full biodiversity assessment, including avifauna, is included in Appendix 6A. Various sections of the biodiversity report are also included in Chapters 6.5, 8.1, 9.2.1, and 10.2.1.
Should a Water Use License be required, proof of application for a license needs to be submitted.	At this stage it is not envisaged that a water use license will be required, however if the need for a water use license arises this will be applied for in due course. The surface water assessment is included in Appendix 6B.
Information on services required on the site should be included including proof of agreements if applicable.	Information on services provision and availability is included in Appendix 10.
The EIAr must provide a detailed description of need and desirability, including indicating 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.	Project need and desirability is provided in Chapter 4, and in the discussion of alternatives in Chapter 5.2.
A final site layout map, indicating features as per the FSR acceptance letter, and an environmental sensitivity map must be included in the final report (See Appendix 3 for the FSR acceptance letter).	The project description (Chapter 5) details all of the project components shown on various maps throughout the report. Specific technical details may not be available at this stage as they will be determined by the EPC during the detailed design phase. All applicable A3 maps are included in Appendix 7.
All shapefiles must be submitted to the DEA. Shapefiles must be created using the methodology detailed in the FSR acceptance letter.	Project shapefiles will be submitted to the DEA with the FEIAr.
An EMPr must be submitted as part of the EIAr, including all maps, specialist mitigation measures, recommendations, management plans, monitoring systems, and measures to protect hydrological features. Detailed specifications for the EMPr, including details of all required management plans, are included in the FSR acceptance letter, shown in Appendix 3.	The EMPr, prepared according to the specifications of the FSR acceptance letter, is included in Appendix 8.

The EIAr must include a cumulative impact assessment of the facility if there are other similar facilities in the region.	There are no other existing or planned renewable projects known in the area. The cumulative impacts are addressed in Chapter 10.1.
All relevant listed activities should be applied for, these should be specific and should be able to be linked to the project description. Should any changes occur, the EIAr and the application form must be amended accordingly.	A description of listed activities applied for is included in Chapter 1.3. If any changes occur, the EIAr and the application form will be amended accordingly.
The applicant must comply with all timeframes specified in the regulations.	All regulated timeframes will be complied with. A description of the public participation process to be followed is included in Chapter 7.
The DEA will not make a decision on the application for environmental authorisation without a letter from the pertinent heritage authority stating that the application fulfils the requirements of the relevant heritage resources authority. Comments from SAHRA and/or the provincial department of heritage must be included in the EIAr.	The relevant officials from the SAHRA have been included on the project database, notified of the project progress and sent copies of the Heritage Reports, DSR and DEIAr for comment via SAHRIS. Comments from SAHRA on the impact phase Heritage Report will be included in the FEIAr.
Two hard copies and 2 electronic copies of the draft and final EIAr must be submitted to the department.	Two hard copies and 2 electronic copies of the report will be submitted to the DEA.
General site information as per point 1 in the EIA information required for solar facilities must be included in the EIAr (See Appendix 3 for the FSR acceptance letter detailing EIA information required for solar facilities).	General site information as per point 1 of the FSR acceptance letter is included on pages ii to v of the report.

A record of all authority consultation is included within Appendix 3.

Consultation with other relevant authorities was and is also being undertaken via meetings and telephonic consultation in order to actively engage them and provide them with information and gain their feedback.

Authorities and key stakeholders consulted include the following:

- National Government
- Limpopo Provincial Government
- Limpopo Department of Economic Development, Environment and Tourism (LEDET)
- Sekhukhune District Municipality
- Elias Motsoaledi Local Municipality
- Nkangala District Municipality
- Thembisile Hani Local Municipality
- Department of Mineral Resources
- Department of Rural Development and Land Reform

- Department of Water and Sanitation (DWS)
- Department of Communications
- SENTECH
- Department of Agriculture Forestry and Fisheries (DAFF)
- Limpopo Department of Agriculture
- Agri Limpopo
- South African National Roads Agency Limited (SANRAL)
- Limpopo Department of Transport
- South African Heritage Resources Agency (SAHRA)
- Eskom Holding SOC Limited
- SA Civil Aviation Authority (SA CAA)
- Air Traffic Navigation Services (ATNS)
- Transnet Freight Rail
- Telkom SA
- Endangered Wildlife Trust (EWT)
- Wildlife and Environment Society of South Africa (WESSA)
- Birdlife South Africa

2.3 Environmental Impact Assessment Report

The EIA Phase of the project has focused on consulting with Interested and / or Affected Parties as well as conducting specialist studies to address the potential impacts identified during the Scoping Phase.

The purpose of the EIAr is to:

- address issues that have been raised during the scoping phase;
- assess alternatives to the proposed activity in a comparative manner;
- assess all identified impacts and determine the significance of each impact; and
- formulate mitigation measures.

3 ASSUMPTIONS AND LIMITATIONS

- It is assumed that all information provided by the Applicant to the Environmental Team was correct and valid at the time it was provided.
- It is not always possible to involve all Interested and / or Affected Parties individually. However, every effort has / is been made to involve as many interested parties as possible. It is also assumed that individuals representing various associations or parties convey the necessary information to these associations / parties.
- It is assumed that the information provided by the various specialists is unbiased and accurate.

- The following assumptions, uncertainties and gaps in knowledge were encountered by the various specialists:

  Biodiversity:
  - Red List species are, by their nature, usually very rare and difficult to locate. Compiling the list of species that could potentially occur in an area is limited by the paucity of collection records that make it difficult to predict whether a species may occur in an area or not. The methodology used in this assessment is designed to reduce the risks of omitting any species, but it is always possible that a species that does not occur on a list may be unexpectedly located in an area.
  - This study excludes invertebrates.

  Heritage:
  - Not detracting in any way from the comprehensiveness of the fieldwork undertaken, it is necessary to realise that the heritage resources located during the fieldwork do not necessarily represent all the possible heritage resources present within the development area. Various factors account for this, including the subterranean nature of some archaeological sites. As such, should any heritage features and/or objects not included in the present inventory be located or observed, a heritage specialist must immediately be contacted.

  Socio-Economic
  - It is envisaged that the construction period of the solar plant with a total generation capacity of approximately 75MW will span over 18 months. Since the client was not in a position of accurate figures, information reported by the Department of Energy (DOE) and Independent Power Producer (IPP) Office for the approved Bid Window 3 projects was used to create assumptions for some of the construction-related expenditure.
  - Based on the average figures for Bid Window 3 data, solar PV projects approved under Bid Window 3 had an average project value of R15.8 million per MW (calculations based on DOE's announcement of Bid Window 3 preferred bidders on 4 November 2013). These projects also estimated to create an average number of 3.9 12-month employment opportunities per MW.
  - Using the above-mentioned information, it was assumed that the proposed project will require a capital investment to the value of R1.184 million in 2014 prices. This excludes expenses on land mobilization, finance charges, costs payable to Eskom for connection and power distribution, etc. although the average local content achieved in Bid Window 3 was 53.8%, the threshold for solar PV projects was set at 45%. Therefore, for the purpose of this study it was assumed that a minimum of 45% or R533 000 of the capital investment will be spent in South Africa during the construction of the proposed 75 MW solar PV plant.
  - It is further estimated that about 365 full-time equivalent (FTE) jobs will be created during the construction phase. The vast majority of the workforce required for the establishment of the PV plant is envisaged to be sourced from the surrounding villages and the greater

area of Dennilton, especially given the opportunities for unskilled and semi-skilled jobs. Eighty percent of the positions (i.e. 292 positions) are expected to be filled by local people.

- It is expected that the proposed Nokukhanya solar plant will operate for 25 years. The average annual electricity generated by the proposed 75 MW plant will amount to about 140 000 MWh per annum. Given the average electricity tariff reported for Bid Window 3 approved solar PV projects, the annual revenue generated by the plant could amount to up to R123.3 million (R0.881/kWh as per Bid Window 3 average fully indexed price0. Furthermore, making use of the information report by the DOE for Bid Window 3 projects, it is expected that 65 jobs will be created at the plant. Of these, about 50 jobs will be filled by people coming from the local communities, of who 80% will be unskilled and semi-skilled workers such as panel cleaners and security guards.

Surface Water:

- This study has only focused on the delineation of surface water resources within the proposed development area. Aquatic studies of fish, invertebrates, amphibians etc. have not been included in this report. Nor has a hydrological or groundwater study been included. Wetland or river health, ecosystem services and the ecological importance have also not been assessed for identified surface water resources.

Visual:

- For the purpose of this visual study, the study area is assumed to encompass a zone of 5km from the buildable area. This area was assigned as distance is a critical factor when assessing visual impacts. Given the nature of the receiving environment and the potential height of the development as proposed, the visual impact associated with the proposed development would be significantly diminished beyond 5km and thus the need to assess the impact on potential receptors beyond this distance would not be warranted.
- The identification of visual receptors has been based on a combination of desktop assessment as well as field-based observation. Initially Google Earth imagery was used to identify potential receptors within the study area. Thereafter a site visit was undertaken to verify the sensitive visual receptors within the study area and assess the visual impact of the development from these receptor locations. Due to the extensive area covered by the study area, a number of broad assumptions have been made in terms of the sensitivity of the receptors to the proposed development. It should be noted that not all receptor locations would necessarily perceive the proposed development in a negative way. This is usually dependent on the use of the facility and the economic dependency on the scenic quality of views from the facility. Sensitive receptor locations typically include sites that are likely to be adversely affected by the visual intrusion of the proposed development. They include; tourism facilities and scenic sites within natural settings.
- Due to the varying scales and sources of information as well as the fact that only 20m contours were available to establish the Digital Terrain Model (DTM); maps and visual models may have minor inaccuracies. As such, only large scale topographical variations

have been taken into account and minor topographical features or small undulations in the landscape may not be depicted on the DTM

- A viewshed analysis was undertaken for the proposed PV plant based on the available layout alternatives at the time of undertaking the visual study. A single viewshed analysis was undertaken from the corners and centre point of the development area. The worst-case scenario, in which the PV panels would have a maximum height of 5m was assumed when undertaking the analysis. The other infrastructure associated with the proposed PV plant was not factored into the viewshed analysis. In addition, screening provided by existing infrastructure and tall wooded vegetation were not factored into the analysis. It should be noted that detailed topographic data was not available for the broader study area and as such the viewshed analysis does not take into account any localised topographic variations which may constrain views. The viewshed analysis should therefore be seen as a conceptual representation or a worst case scenario indication of the geographical area from where the proposed PV plant would be visible from.
- A matrix has been developed to assist in the assessment of the potential visual impact at each receptor location. The limitations of quantitatively assessing a largely subjective or qualitative type of impact should be noted. The matrix is relatively simplistic in considering five main parameters relating to visual impact, but provides a reasonably accurate indicative assessment of the degree of visual impact likely to be exerted on each receptor location by the proposed solar PV power plant. The matrix should therefore be seen as a representation of the likely visual impact at a receptor location.
- The assessment of receptor-based impacts has been based on the layout provided by the proponent. It is recognised however that this layout is a preliminary one, and is subject to changes based on a number of potential factors, including the findings of the EIA studies. The locations of the PV field and associated infrastructure may thus move, which may result in greater or lesser visual impacts on receptor locations.
- Visualisation modelling has not been undertaken for the proposed development due to budget limitations. Should the need for visualisation modelling be proven by stakeholder / I&AP feedback, this will be able to be incorporated into this assessment. To date however, no feedback regarding the visual impact of the PV plant has been received from the public participation process.
- Any additional feedback relevant to the visual environment received during the Impact-phase public comment period will be incorporated into further drafts of this report.
- At the time of undertaking the visual study no information was available regarding the type and intensity of lighting required and therefore the potential impact of lighting at night has not been assessed. General measures to mitigate the impact of additional light sources on the ambiance of the nightscape have been provided.
- It should be noted that the 'experiencing' of visual impacts is subjective and largely based on the perception of the viewer or receptor. The presence of a receptor in an area potentially affected by the proposed development does not thus necessarily mean that a visual impact will be experienced.

4 PROJECT NEED AND DESIRABILITY

4.1 National Renewable Energy Requirement

In 2010 South Africa (SA) had 44,157MW of power generation capacity installed. Current forecasts indicate that by 2025, the expected growth in demand will require the current installed power generation capacity to be almost doubled to approximately 74,000MW (SAWEA: 2010).

South Africa has embarked on a renewable energy infrastructure growth programme supported by various government initiatives. These include; the National Development Plan (NDP), the Presidential Infrastructure Coordinating Commission (PICC), the Department of Energy's Integrated Resource Plan, the National Strategy for Sustainable Development, the National Climate Change Response White Paper, the White Paper on Renewable Energy, the National Treasury's Carbon Tax Policy Paper, and the Presidency of the Republic of South Africa's Medium-Term Framework.

The Department of Energy has set a target of contributing 17,8*GW* of renewable energy to the final energy consumption by 2030. This target is to be produced mainly through, wind and solar; but also through biomass and small scale hydro (DME, 2003; IRP, 2010).

4.2 Solar PV Power Potential in South Africa and Internationally

Internationally, PV is the fastest-growing power generation technology, South Africa has some of the highest levels of solar radiation in the world and as much as 8GW PV could potentially be installed by 2020 (DEA Guideline for Renewable Energy, 2013). Between 2000 and 2009 the installed capacity globally grew on average by 60% per year. Worldwide more than 35GW of PVs are installed and operating, and in South Africa as much as 8GW PV could potentially be installed by 2020.

4.3 Site Specific Suitability

According to the solar map (Figure 2) the Limpopo Province of South Africa has a solar energy concentration of between 6501 and 8500 MJ/m^2. The project site falls within the range of 8001 – 8500 MJ/m^2 and is thus suitable for the establishment of solar PV power plants.

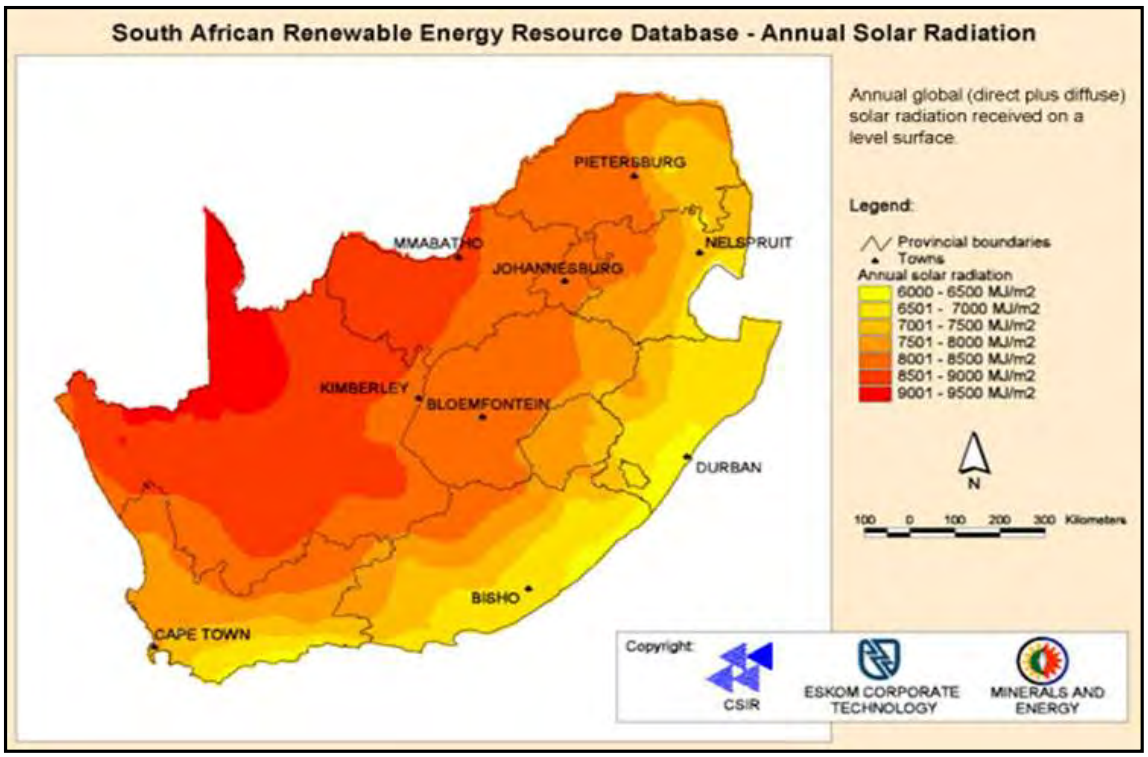


Figure 2: National Solar Resource Map (Source: Solar Vision, 2010)

The site includes portions of four different farms, specifically part of Portion 182 of Kikvorschfontein 57 (70 hectares out of 129.66 hectares), part of Remainder 183 of Kikvorschfontein 57 (50 hectares out of 76 hectares), Portion 191 of Kikvorschfontein 57 (42 hectares), and Kikvorschfontein 57. There are no permanent residents on any of the affected farm sections. Portion 182 of Kikvorschfontein 57 is currently used for livestock production (11 Ngunis cattle) and subsistence farming of one field of maize, however only 70 hectares out of the 130 hectare farm is proposed to be included in the solar PV power plant footprint. Current agricultural activities will therefore likely be reduced, but not stopped completely. This is also the case for the Remainder 183 of Kikvorschfontein 57, which is currently used for livestock farming (20 cows). Of the 76 hectare farm only 50 hectares will be affected by the proposed project and livestock farming can continue on the unaffected areas. The other two farms are not currently used for any farming activities. Very little subsistence impact would be felt by local communities, nor would the proposed project entail any reduction in economic production. The site is therefore considered to be suitable from a land use perspective.

Dennilton and the project site is easily accessed from the major economic centres of South Africa. It is approximately 190km from Johannesburg and 140km from Pretoria. The proximity of the site to Gauteng will enable more efficient construction as well as easy access to semi-skilled and skilled labour. Eskom has visited the site with the project developers and has confirmed that grid access will be facilitated. Additionally, grid access for this project is almost identical to Eskom's existing planned transmission upgrades. Eskom has developed the transmission line route and the project will make use of this optimised route. Grid access

will allow the power generated by the proposed solar PV power plant to supply the national grid, which will improve electricity supply reliability in the country.

4.4 Local Need

The site falls within the Elias Motsoaledi Local Municipality in the Sekhukhune District Municipality, Limpopo Province. The Limpopo Employment Growth and Development Plan 2009 – 2014 (Limpopo Provincial Government, 2009) recognises the absence of sustained growth and job creation as the most pressing problem facing the province. It also points out the vulnerability of the provincial economy to the impact of climate change, biodiversity loss and diminishing water resources. In this regard, green economy is seen by the province as a means for growth and job creation, as well as an objective to achieve sustainable development and a low carbon economy. “Sustainable resource management and use” is set as one of the ten priority areas for the region. The province’s interventions in this regard will include, among others, diversifying the energy mix in pursuit of renewable energy alternatives and promoting energy efficiency.

In 2011, the Elias Motsoaledi LM had a 42.1% unemployment rate, which is significantly higher than that of the country (29.7%) recorded by Stats SA through Census 2011 (Stats SA, 2014). Regarding Dennilton and the small towns and settlements/villages surrounding it, their unemployment rate was slightly better (36.6%) than that of the average for the municipality but still worse than that for the country. Thembisile Hani LM, which borders the project site, also has a high unemployment rate (36.4%).

As part of their localisation plan, Nokukhanya is planning on building a facility near Dennilton to assemble all the required parts of the power plant. During construction there will be 1800 people employed from the local area and they also intend to empower local people to maintain the power plant over its 30-year life-span. The project will contribute to local economic progress by supporting industry development in line with provincial and regional goals and ensuring advanced skills are drawn to the Limpopo Province and reducing the local unemployment rate. The project will likely encounter widespread support from government, civil society and businesses, all of whom see potential opportunities for revenues, employment and business opportunities locally.

The Nokukhanya solar PV plant will benefit the country by tapping into an energy resource that is sustainable, by reducing the overall carbon footprint of the nation’s generating fleet, by implementing a cost effective source of energy, by promoting a renewable energy culture, and by creating local jobs and training opportunities. The local community around the plant will be benefited by profit sharing with a local trust; this could allow for an improvement in the local environment and housing conditions as well as general community upliftment. Nokukhanya and its advisors have evaluated the feasibility of the plant from land, access, environmental, financial, solar resource, and grid capacity perspectives, among others. These studies have shown that a plant installed in this area is competitive on a national scale.

5 TECHNICAL PROJECT DESCRIPTION

5.1 Project Components

The project will consist of two components:

- Solar PV Power Plant
- Associated infrastructure

The solar PV power plant will consist of the following infrastructure

- Solar field
- Buildings

The section below describes the typical technical components that would be involved in the construction of the proposed infrastructure.

5.1.1 Solar Field

Solar PV panels are usually arranged in rows or 'arrays' consisting of a number of PV panels. The area required for the PV panel arrays would not need to be entirely cleared or graded. However, where tall vegetation is present, this vegetation may need to be removed from the PV array area due to shading concerns.

The solar PV panels are variable in size, the actual size will be determined in the final design stages of the project, however panels will range from approximately 0.6m x 1.2m to 1m x 2m. The height of panel arrays will be less than 5m above the ground. The panels may be made using various materials, possibly including silicon, cadmium telluride, and aluminium. The PV panels are mounted into metal frames which are usually aluminium. Concrete or screw pile foundations are commonly used to support the panel arrays and these foundations will be suitable based on the project site geotechnical conditions (Figure **3**). The power from the solar PV panels will be routed to inverter/transformer stations located throughout the solar field. At the inverter/transformer stations, the power will be converted to AC and then the voltage will be stepped up to between 20kV and 40kV. The power will then be routed from the inverter/transformer stations to the substation in preparation for exportation to the grid.

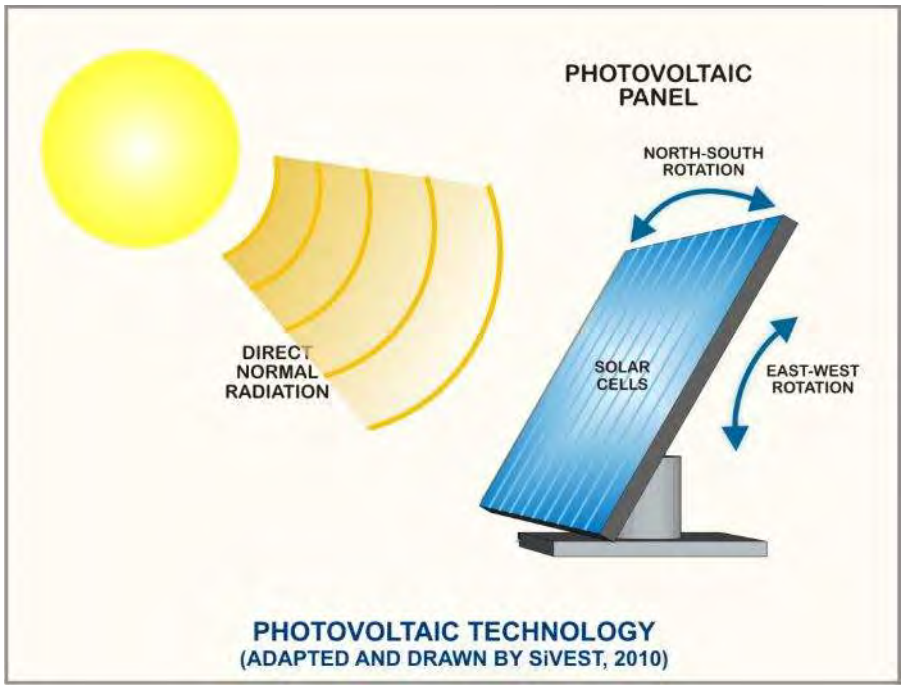


Figure 3: Illustration of how a PV panel operates

5.1.2 Buildings

The solar field will require an onsite building which will be used in the daily operation of the plant and includes an administration building (office). The onsite building is proposed to be located adjacent to the onsite substation (see section 5.1.3). Potential locations for the administration building were determined during the EIA process based on environmental constraints identified and design factors that need to be considered. The buildings will likely be single storey buildings which will be required to accommodate the following:

- Control room
- Workshop
- High Voltage (HV) switchgear
- Mess Room
- Toilets
- Warehouse for storage

5.1.3 Associated Infrastructure

- Electrical Infrastructure

The solar PV panel arrays are connected to each other in strings. In turn, the strings are connected to DC to the AC inverters (Figure **4**). The strings are connected to the inverters by low voltage DC cables. Power

from the inverters is collected in medium voltage transformers through AC cables. Cables may be buried or pole mounted depending on the voltage level and site conditions.

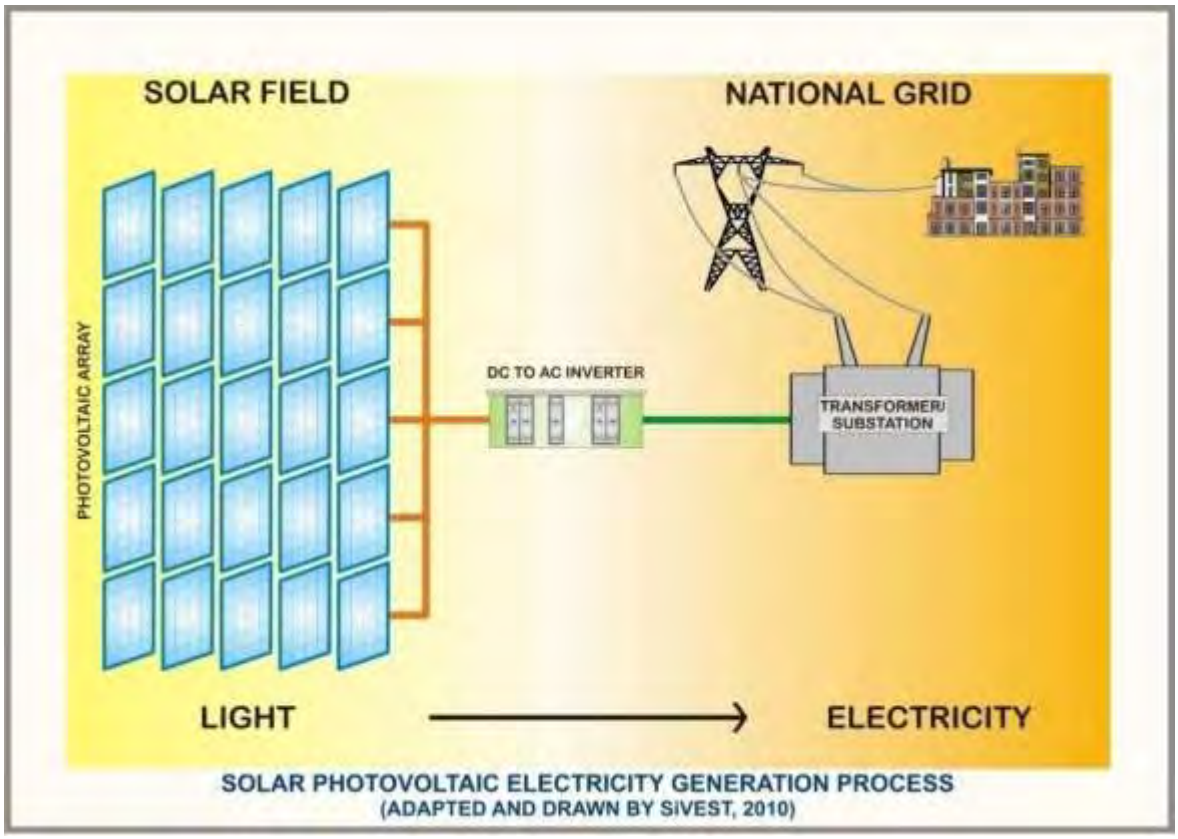


Figure 4: PV process

The medium voltage transformers will be at a central substation. The proposed alternative locations of the substation were determined during the EIA process based on environmental constraints and design factors.

Where possible the distribution substation will ideally be located in close proximity to the proposed power lines in order to limit the environmental impact. This substation will be a transmission substation and will include transformer bays which will contain transformer oils. Bunds will be constructed to ensure that any oil spills are suitably attenuated and not released into the environment. The substation will be securely fenced.

As previously mentioned, the electricity generated by the proposed PV plant is to be fed into the existing Eskom grid. The grid connection is likely to be to the 132kV Kwaggafontein substation, which is directly west of the site, however this will be determined at a later stage and environmental authorisation will be applied for in a separate process, there is no power line being proposed as part of the current project. The indicative proposed power line is shown in relation to the Nokukhanya project site in Figure 5.

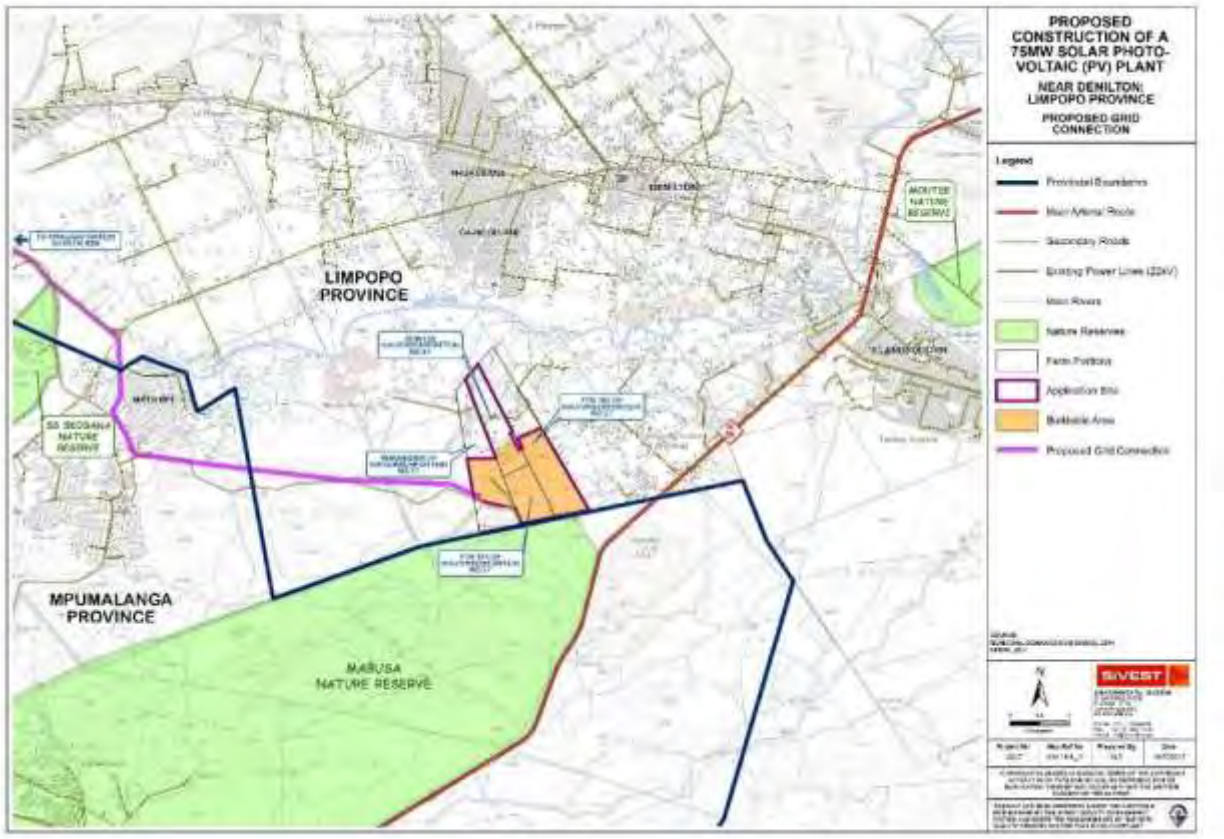


Figure 5: Indicative proposed grid connection

- Construction Lay-down Area

A general construction lay-down area will be required for the construction phase of the proposed solar PV power plant. The size of this area is yet to be determined, but 10 000 m² is typical. The permanent laydown area will be positioned within the construction laydown area. It is likely to be significantly smaller than the temporary laydown area, however this will be confirmed once the EPC contractor has been selected and the design is finalised.

5.2 Alternatives

As per Chapter 1 of the EIA regulations (2010), feasible and reasonable alternatives are required to be considered during the EIA process. Alternatives are defined at "different means of meeting the general purpose and requirements of the activity" These alternatives may include:

(a) The property on which or location where it is proposed to undertake the activity;
(b) The type of activity to be undertaken;
(c) The design or layout of the activity;

(d) The technology to be used in the activity;
(e) The operational aspects of the activity; and
(f) The option of not implementing the activity.

Each of this alternatives is discussed in relation to the proposed project in the sections below.

5.2.1 The property on which or location where it is proposed to undertake the activity;

No site alternatives for this project are being considered because the placement of solar PV installations is dependent on several factors, all of which are favourable at the proposed site location. These include resource, climate, topography, grid connections and access to the site. The project site near Dennilton has been identified through pre-feasibility studies conducted by Nokukhanya based on an estimation of the solar energy resource as well as weather, dust, dirt, and surface albedo. Grid connection and land availability were also important initial considerations. The Limpopo Province has high levels of solar potential, and the project site falls within the range of 8001 – 8500 MJ/m^2 and is thus suitable for the establishment of solar PV power plants. The project site has a relatively flat topography that is suitable for facilities of this kind. Dennilton and the project site are relatively easily accessed from the major economic centres of South Africa. It is approximately 190km from Johannesburg and 140km from Pretoria. The proximity of the site to Gauteng will enable more efficient construction. The site is also easily accessible as the R25 passes close to the farm. Eskom has visited the site with the project developers and have confirmed that grid access will be facilitated. The site is therefore considered highly suitable for the proposed development and no other locations are being considered.

5.2.2 The type of activity to be undertaken;

No other activity alternatives are being considered. Renewable energy development in South Africa is highly desirable from a social, environmental and development point of view. Wind energy installations are not feasible on the site as there is not enough of a wind resource. Concentrated solar power (CSP) installations are also not feasible because they have a high water requirement. Therefore solar PV is the only activity being considered for the proposed site.

5.2.3 The design or layout of the activity;

Design or layout alternatives are being considered in the EIA process. Various environmental specialists assessed the site during the scoping phase. Their assessments encompassed the entire potential buildable area and included the identification of sensitive areas. These sensitive areas were used during the scoping phase to guide layout design for the proposed project. These layouts were extensively investigated in the EIA. The design and layout alternatives included; PV panel array layouts, substation and O&M building alternatives, and alternative locations for the construction lay-down area. The layout alternatives were based on both environmental constraints and design factors. The layout alternatives, including maps, are presented in Chapter 11.

5.2.4 The technology to be used in the activity;

There are very few technological alternatives for PV technology. For the Nokukhanya power plant the mounting structures will be either fixed axis mounting or single axis tracking solutions. Panels will range from approximately 0.6m x 1.2m to 1m x 2m; and the height of panel arrays will be less than 5m above the ground. The panels may be made using various materials, possibly including silicon, cadmium telluride, and aluminium. The impacts on the environment of the different types of PV technology are the same during construction, operation and decommissioning. Therefore no technology alternatives have been considered during the EIA. The choice of technology used will ultimately be determined by technological and economic factors at a later stage.

5.2.5 The operational aspects of the activity; and

No operational alternatives were assessed in the EIA, as none are available for solar PV installations.

5.2.6 The option of not implementing the activity.

The option of not implementing the activity, or **the 'no-go' alternative, is considered in the EIA**. South Africa is under immense pressure to provide electricity generating capacity in order to reduce the current electricity demand in the country. With the global focus on climate change, the government is under severe pressure to explore alternative energy sources in addition to coal-fired power stations. Although solar power is not the only solution to solving the energy crisis in South Africa, not establishing the proposed solar PV energy facility would be detrimental to the mandate that the government has set to promote the implementation of renewable energy. It is a suitable sustainable solution to the energy crisis and this project could contribute to addressing the problem. This project will aid in achieving South Africa's goals in terms of sustainability, energy security, mitigating energy cost risks, local economic development and national job creation.

In addition, not establishing the proposed solar PV power plant may also hinder the economic injection that the project would provide for the town of Dennilton and its surrounding residential communities in the form of short term employment, long term job creation and financial injection. The project is a suitable sustainable solution to the energy crisis and it could contribute to addressing the problem. This project will aid in achieving South Africa's goals in terms of sustainability, energy security, mitigating energy cost risks, local economic development and national job creation. Although the potential environmental issues, such as visual impacts or habitat destruction, would not occur if the project did not go ahead, the socio economic benefit of the proposed project should not be overlooked.

In light of the above, the design and layout alternatives and the no-go alternative have been evaluated in Chapter 11.

6 DESCRIPTION OF THE RECEIVING ENVIRONMENT

The Limpopo Province is considered to be favourable for the establishment of solar energy facilities. Accordingly, land portions located near Dennilton have been identified as a potential site. A general description of the study area is outlined in the sections below.

6.1 Locality

The proposed PV plant will be established on the following land portions:

- Portion 182 of the farm Kikvorschfontein 57;
- Remainder 183 of the farm Kikvorschfontein 57;
- Portion 191 of the farm Kikvorschfontein 57;
- Remainder of Kikvorschfontein 57.

During the scoping phase of the EIA only three of the above mentioned farms were included in the study site. During this phase various surface water features were identified at a desktop level in the northern portion of the site and consequently the northern portion was eliminated from the buildable area. Additionally, a new portion of land was added to the west of the original site to compensate for the area that was removed. The additional farm is Remainder of Kikvorschfontein 57 and was selected after the landowner contacted the project team during initial public participation with a request to have his farm included.

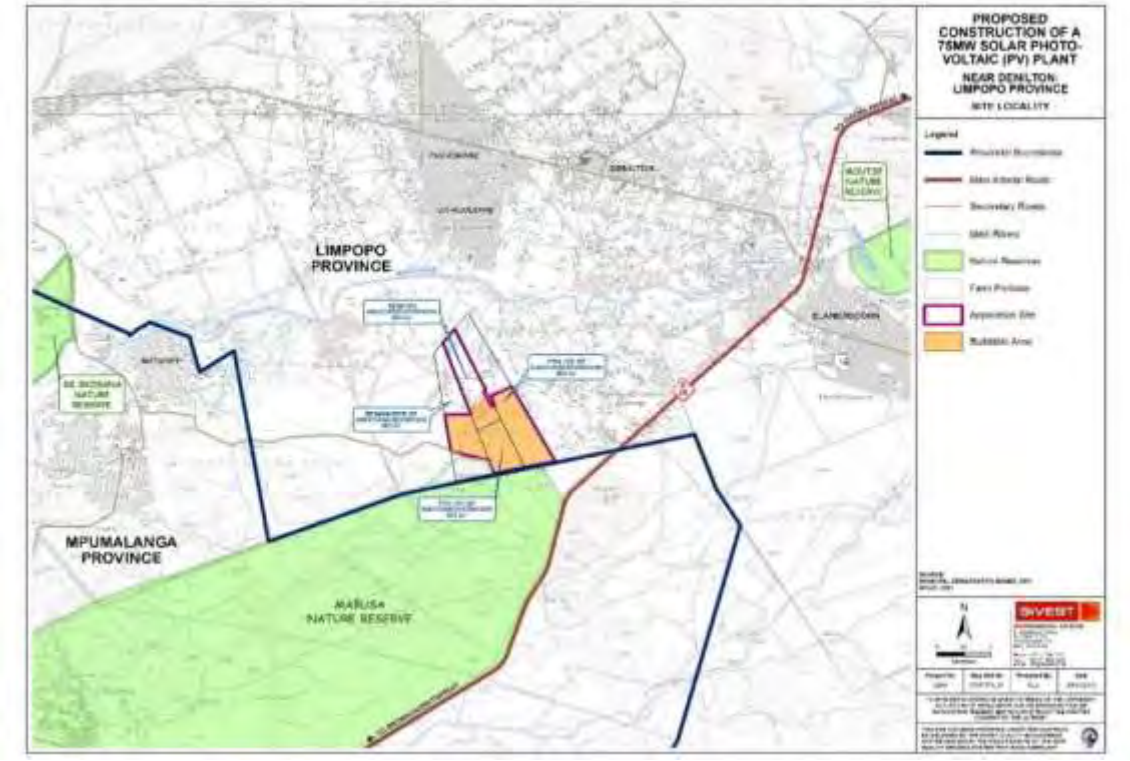


Figure 6: Site locality map

The proposed development site is situated within the Elias Motsoaledi Local Municipality in the greater Sekhukhune District Municipality, Limpopo Province. The Nokukhanya solar PV power plant site is located approximately 6km south-west of the town of Dennilton. Dennilton can be found approximately 30 km to the west-south-west of Groblersdal, approximately 110km north-east of Pretoria and approximately 70km north of Emalahleni. The Nokukhanya solar PV power plant site is situated to the north of the R25. The project site co-ordinates are included in Table 5 and Table 6.

Table 5: Proposed Applications Site Location

APPLICATION SITE CORNER POINT CO-ORDINATES		
POINT	**SOUTH**	**EAST**
1 (NW)	S25° 17' 17.020"	E29° 7' 29.931"
2	S25° 17' 8.670"	E29° 7' 37.006"
3	S25° 17' 45.325"	E29° 7' 55.698"
4	S25° 17' 49.115"	E29° 7' 58.498"
5 (E)	S25° 17' 43.325"	E29° 8' 11.240"
6 (SE)	S25° 18' 27.929"	E29° 8' 37.388"
7	S25° 18' 35.341"	E29° 8' 0.704"
8	S25° 18' 27.612"	E29° 7' 57.667"
9 (W)	S25° 18' 22.236"	E29° 7' 34.719"
10	S25° 17' 59.986"	E29° 7' 30.923"
11	S25° 17' 59.972"	E29° 7' 46.808"

Table 6: Proposed Buildable Area

BUILDABLE AREA CORNER POINT CO-ORDINATES		
POINT	**SOUTH**	**EAST**
1 (NW)	S25° 17' 59.986"	E29° 7' 30.923"
2	S25° 17' 59.972"	E29° 7' 46.808"
3	S25° 17' 55.428"	E29° 7' 45.032"
4 (NE)	S25° 17' 43.325"	E29° 8' 11.240"
5 (SE)	S25° 18' 27.929"	E29° 8' 37.388"
6 (SW)	S25° 18' 35.341"	E29° 8' 0.704"
7	S25° 18' 27.612"	E29° 7' 57.667"
8	S25° 18' 22.236"	E29° 7' 34.719"

6.2 Study Area Description

The total area of the Nokukhanya application is site approximately 215 hectares, however the total buildable area being assessed is approximately 170 hectares.

Much of the surrounding area appears to be vacant, undeveloped land although the presence of a few cattle would suggest some low intensity grazing activity (Figure **9**). In addition, there are some patches of small-scale cultivation, typical of that found on peri-urban smallholdings. A few farmsteads are evident and there are clusters of small dwellings and structures near the development site, many of which are derelict or abandoned (Figure 7). Additional anthropogenic elements include gravel access roads, wire fences and electrical and Telkom infrastructure. Patches of severe erosion are evident in the landscape (Figure 8).

The Mabusa Nature Reserve, which borders the application site to the south, consists of a scenic, natural landscape on the hilly terrain. The closest built up area lies to the north and north-east of the application site and includes the residential townships of Ga-Ngolvane and Phukukane and the town of Dennilton.

Figure 7: Derelict buildings close to the development site and transformed vegetation

Figure 8: Typical anthropogenic elements present within the study area

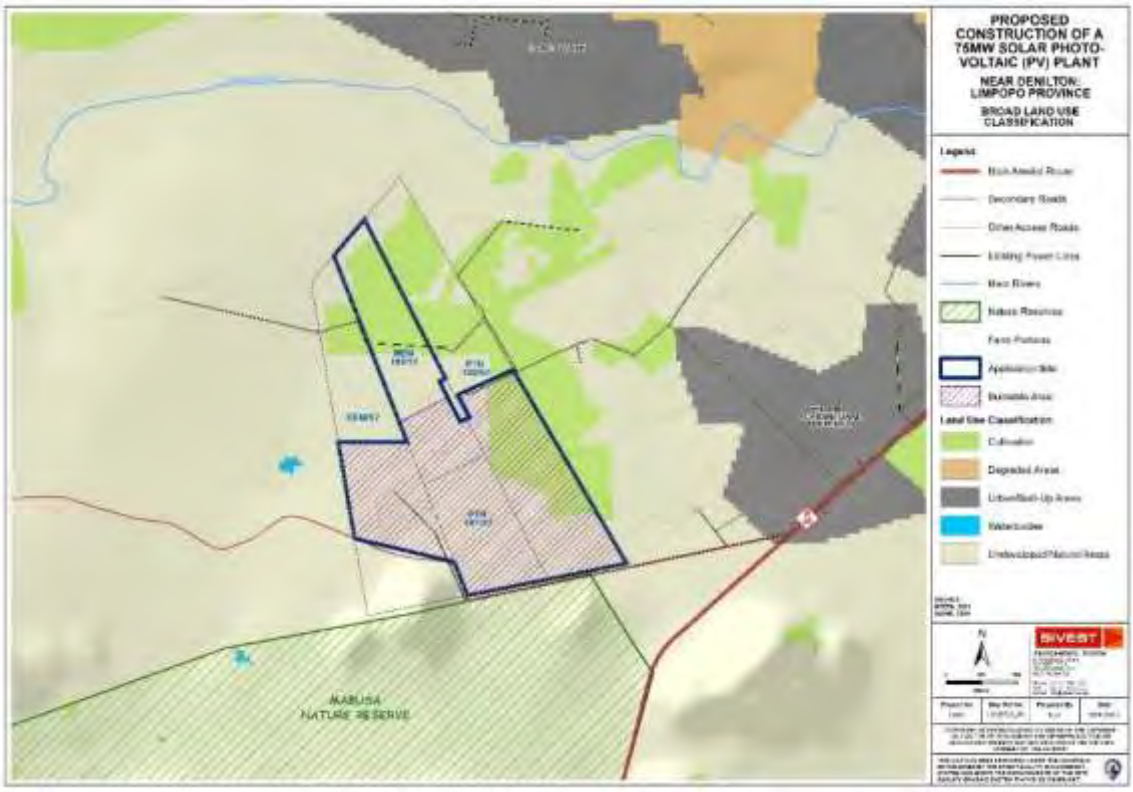


Figure 9: Land use of the study area

Much of the broader study area lies in the Moses River valley and is characterised by relatively flat to gently undulating terrain. The south-western portion of the surrounding area however incorporates part of the Mabusa Nature Reserve which is characterised by hilly terrain with steep slopes (Figure **10**). Overall, the gradient of the surrounding area rises in a north-east to south-west direction, while the application site itself slopes gently from an elevation of 1020m in the north to 1055m in the south.

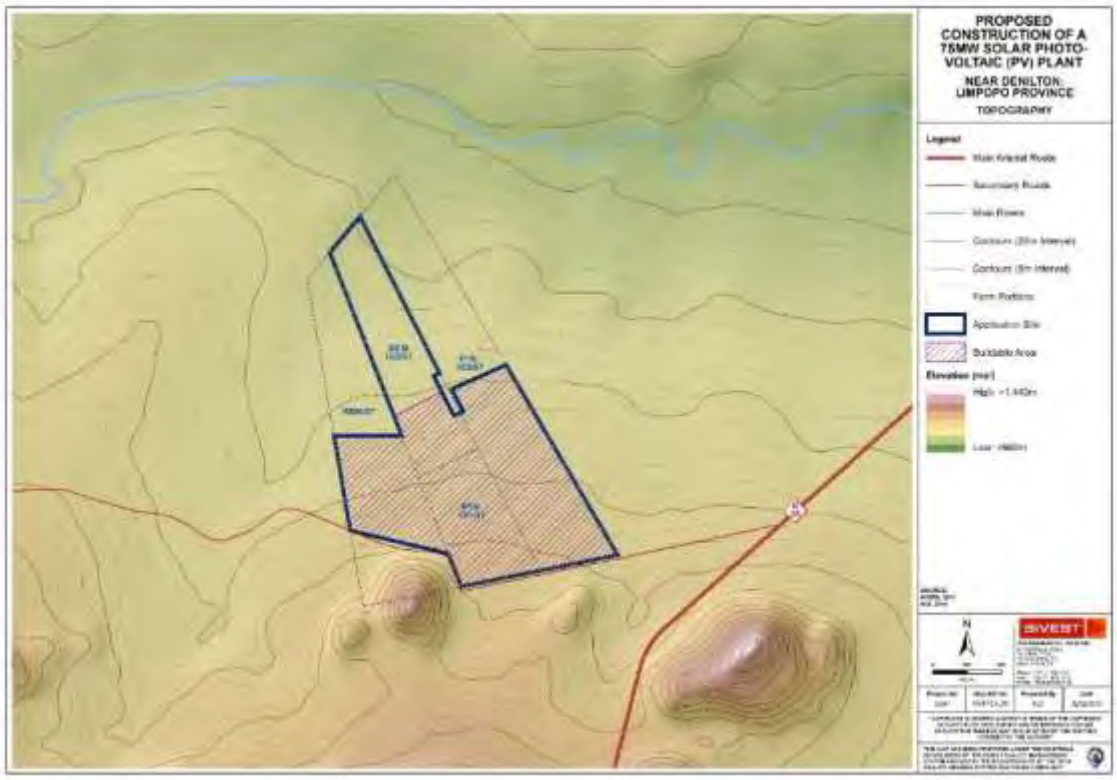


Figure 10: Topography of the study area

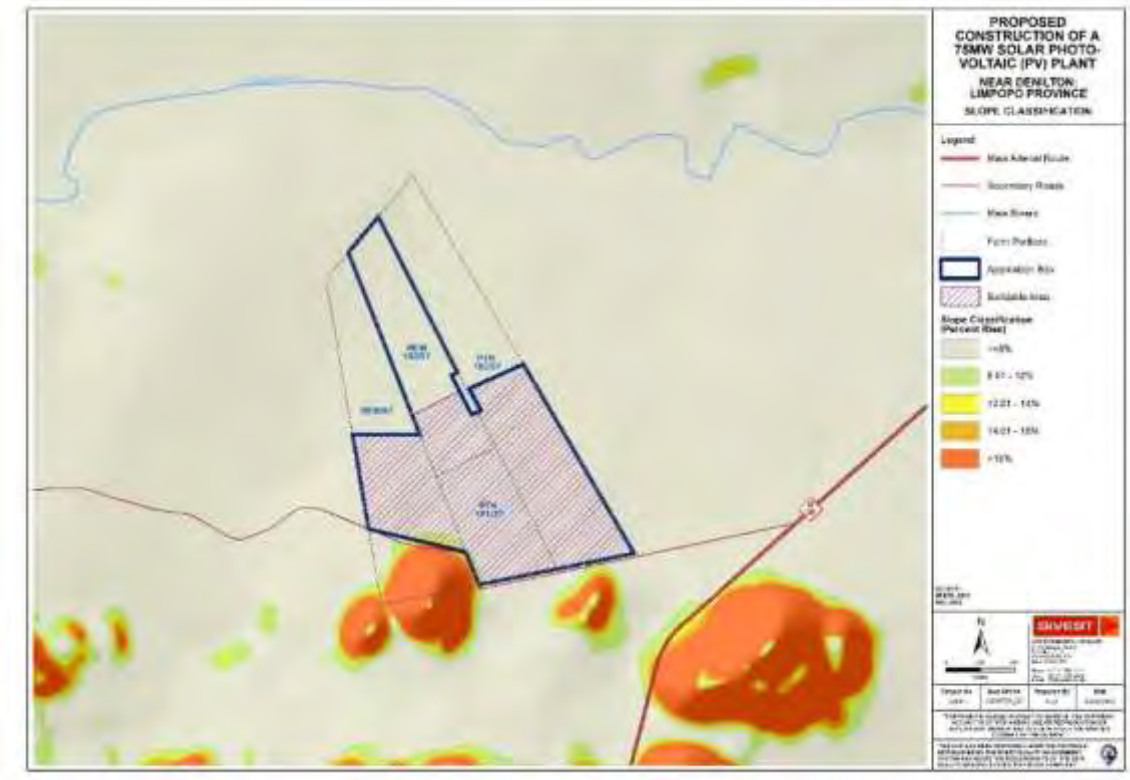


Figure 11: Slope of the study area

6.3 Climate

Climate data was obtained from the Agroclimatology database at ARC-ISCW (ARC-ISCW, 2011). The area has warm to hot, moist summers with cool to cold, dry winters. The climatic data is given in Table 7 below.

Table 7: Climate data for Dennilton area

Month	Average Rainfall (mm)	Average Min. Temp (°C)	Average Max. Temp (°C)	Average frost dates
Jan	97.9	18.0	31.3	Start date: 28/06
Feb	88.1	17.9	30.7	End date: 04/07
Mar	68.8	16.2	29.6	Days with frost: ±7
Apr	45.2	12.7	27.5	
May	14.4	8.1	24.4	
Jun	4.9	4.6	22.0	
Jul	5.0	3.7	29.5	Heat units (hrs > 10°C)
Aug	3.9	6.8	24.8	Summer
Sep	18.4	11.0	28.3	(Oct-Mar): 2554
Oct	51.5	15.0	30.3	

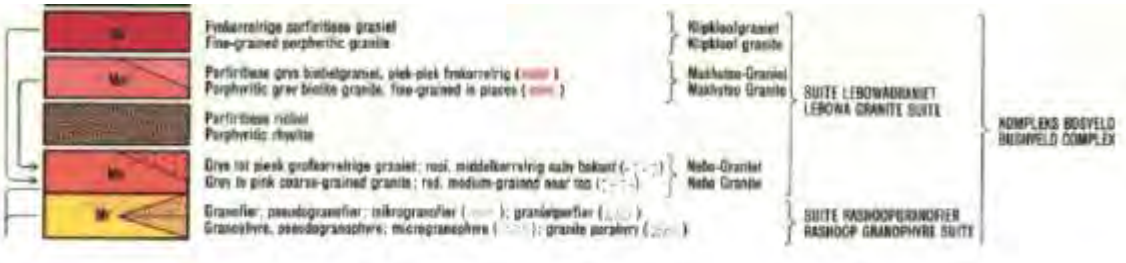
Nov	99.7	16.4	31.2	Winter (Apr-Sept): 1396
Dec	99.6	17.6	31.5	
Year	597.3 mm	20.4 °C (Average)		

The long-term average annual rainfall is 597.3 mm, of which 505.6 mm, or 85%, falls from October to March. Temperatures vary from an average monthly maximum and minimum of 31.3ºC and 18.0ºC for January to 29.5ºC and 3.7ºC for July respectively.

6.4 Geology

According to the 1:250 000 geological map 2528 Pretoria, the study area is underlain entirely by grey to pink, coarse grained granite and red, medium grained granite known as Nebo Granite, of the Lebowa Suite, of the Bushveld Complex. The Geological Map and the stratigraphy are indicated below.

Figure 12: Geology Map



Stratigraphy	Map Symbol	Lithology
Bushveld Complex Lebowa Granite Suite Nebo Granite	Mn	Grey to pink, coarse grained granite: red, medium grained near top.

Scattered outcrops or surface boulders of very coarse grained granite occur in the northern section of the proposed development footprint.

6.5 Biodiversity

The Biodiversity Assessment was conducted by Dr David Hoare, of David Hoare Consulting and is included in Appendix 6A. The environmental baseline from a biodiversity perspective is presented below.

Most of the study area consists of cultivated fields, with some “degraded forest and woodland” in the southern parts (Fairbanks et al., 2000). The 1:50 000 topocadastral maps of the study area confirm this pattern, including small areas of partially degraded natural vegetation in the central and southern parts of the study area. Observations on site also support this view, with all vegetation on site showing some level of impact by humans. In some places the vegetation appears to be natural, but this is due to a well-developed recovery of the vegetation in previously disturbed areas.

Aerial imagery of the site shows the cultivated areas throughout the site as well as the regularly spaced homesteads with associated smaller cultivated fields adjacent to them in the central parts of the site. In the field it was seen that there were a number of relicts of previous homesteads, including ruins and grave sites in the southern parts of the site that indicated that these areas were also settled at some stage.

Previously cultivated areas on site now have a perennial cover of grasses with scattered shrubs or small trees in places, mostly the sickle-bush, *Dichrostachys cinereus*. These old fields are overwhelmingly dominated by a small number of grass species, namely *Hyperthelia dissoluta*, *Eragrostis superba* and *Pogonarthria squarrosa*, as well as the herbaceous species, *Bulbostylis burchellii*, *Felicia mossamadensis*, *Gomphrena celosioides*, *Tephrosia capensis* and *Chamaecrispa comosa*. There are a high number of other grass and herb species that occur in these old fields, but these are relatively common species and/or weeds of disturbed places.

Open woodland areas in the southern part of the site had a diverse woody layer and a well-developed herbaceous layer. Common trees included *Sclerocarya birrea*, *Combretum apiculatum*, *Dichrostachys cinereus*, *Burkea africana*, *Terminalia sericea*, *Peltophorum africanum*, *Ochna pulchra*, *Dombeya rotundifolia*, *Combretum zeyheri*, *Ozoroa paniculosa*, *Grewia monticola*, *Vangueria infausta*, *Searsia leptodictya* and *Euclea undulata*. The grass layer was dominated primarily by the grasses *Digitaria erianthe*, *Eragrostis superba*, *Eragrostis lehmanniana*, *Themeda triandra*, *Panicum maximum*, *Heteropogon*

contortus and *Perotis patens*. A complete list of species found on site is given in the biodiversity specialist report. .

6.5.1 Broad vegetation patterns

The vegetation of the study area indicates that there are two regional vegetation types occurring in the study area, one of which only just enters the site in the southern parts. These are Central Sandy Bushveld across most of the site and Loskop Mountain Bushveld at the southern tip associated with the low hills. The vegetation types that occur on site are briefly described below.

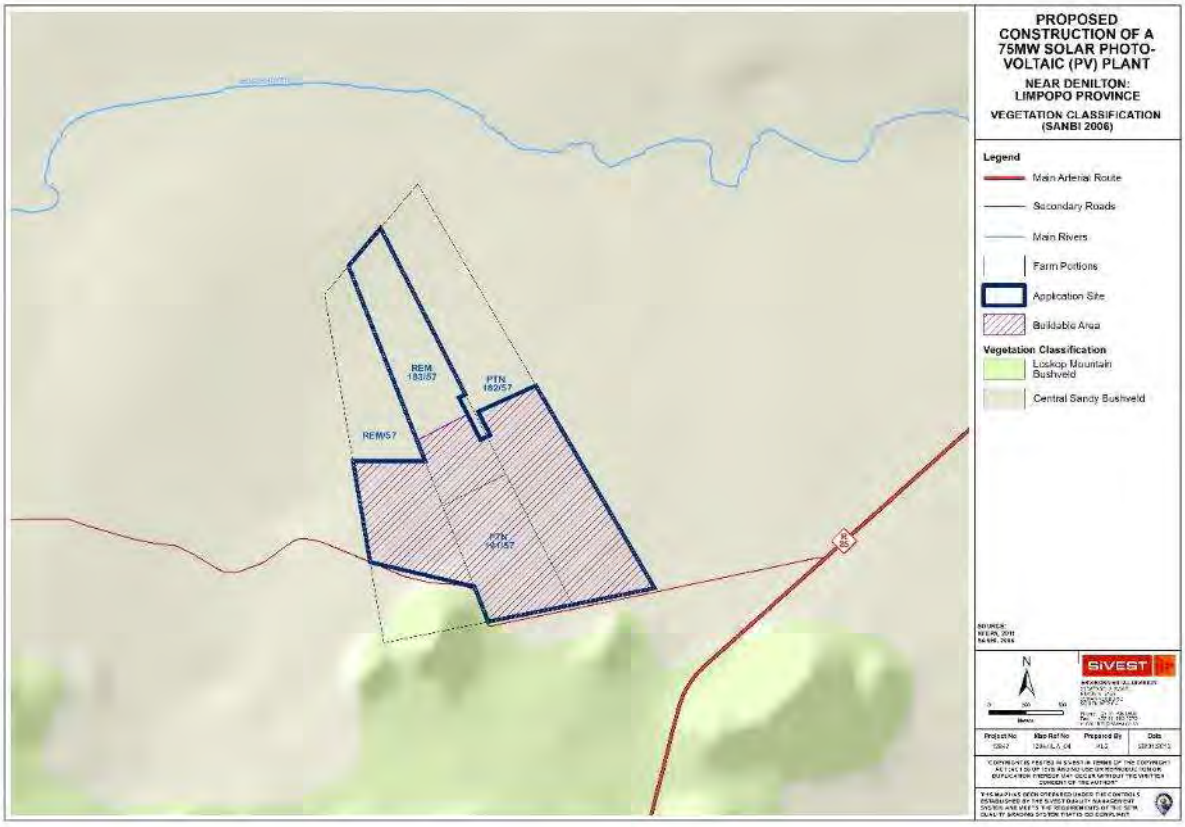


Figure 13: Vegetation prevalent in the study area

Central Sandy Bushveld

Central Sandy Bushveld is found in Limpopo, Mpumalanga, Gauteng and North-West Provinces and occurs mainly in a broad arc south of the Springbokvlakte from the Pilanesberg in the west through Hammanskraal and Groblersdal to GaMasemola in the east. It is found in low undulating areas and sandy plains (Mucina et al. 2006). The vegetation is a tall, deciduous *Terminalia sericea* and *Burkea africana* woodland on deep sandy soils and low, broad-leaved *Combretum* woodland on shallow rocky or gravelly soils (Mucina et al. 2006). Species of *Acacia*, *Ziziphus* and *Euclea* are found on flats and lower slopes on eutrophic sands and some less sandy soils. *Acacia tortilis* may dominate some areas along valleys.

Central Sandy Bushveld occurs on well-drained, deep Hutton or Clovelly soils mostly derived from sandstone, conglomerate and siltstone of the Alma Formation and sandstone, siltstone and shale of the Vaalwater Formation (Mucina et al. 2006).

Loskop Mountain Bushveld

Loskop Mountain Bushveld is found in Limpopo, Mpumalanga and Gauteng Provinces and occurs on mountains in the vicinity of Loskop Dam extending south-westwards towards Bronkhorstspruit on mountains including the Gouwsberge and westwards to Rust de Winter. It is found on low mountains and ridges (Mucina et al. 2006). The vegetation is an open tree savanna on lower-lying areas dominated by *Burkea africana* and denser broad-leaved tree savanna on lower slopes and midslopes characterized by the prominent occurrence of *Diplorhynchus condylocarpon*, *Combretum apiculatum* and *Acacia caffra* (Mucina et al. 2006).

Loskop Mountain Bushveld occurs on rocky areas with miscellaneous soils ranging from sandy to sandy loams, sandy clays and some clays mostly on the Ib land type (Mucina et al. 2006).

6.6 Surface Water

The Surface Water Assessment was conducted by Shaun Taylor and Alistair Fyfe of SiVEST including an external peer review by Dr Martin Ferreira from Jeffares and Green. The report is included in Appendix 6B. The environmental baseline from a surface water perspective is presented below.

6.6.1 Study Area Drainage and Hydrology

According to Dollar *et al*. (2007), regions can be grouped that have similar land areas containing a limited range of recurring landforms that reflect comparable erosion, climatic and tectonic influences, and impose broad constraints on lower levels of organisation, e.g., drainage basins, macro-reaches and channel types. Hence, on this basis, geomorphic provinces (Partridge *et al*. 2010) have been delineated that reflect a relatively common set of climatic, vegetation, geological and topographical characteristics that are akin to one another. Utilising this information, the regional drainage characteristics of the broader study area can be elucidated. Under this context, the study site is located within the Western Transvaal Basin geomorphic province of South Africa.

- Western Transvaal Basin geomorphic province

According to Partridge *et al.* (2010), this province represents the western part of the Transvaal Basin which has been intruded by the rocks of the Bushveld Complex (mainly norite, granite and felsite) and as a consequence, the province is characterised by considerable topographical diversity. The centripetal dip of these rocks was imparted by the emplacement of the igneous rocks that occupy much of the province's

floor. Along parts of the rim, recent faults (Partridge, 1998), some still active today and many associated with thermal springs, show that the basin floor has subsided by as much as 400 m in places (particularly in the northeast) (McCarthy & Rubidge, 2005). Much of the floor has limited relief, the landscape being dominated by a sprinkling of steep hills separated by wide, gentle pediments. The relief is particularly subdued on the Springbok Flats, where the Bushveld rocks are overlain by Karoo basalt. This low-relief area coincides with the Post-African I erosion surface (Partridge & Maud, 1987). Here, both the valley cross-sectional and longitudinal profiles of rivers are very gentle. The flat, marshy valley of the Nyl River, with its underfit character, is partly the result of channel disruption through ongoing subsidence and partly the product of capture by the Mokgalakwena River (Partridge & Maud, 1987). During the Cretaceous, the Mokgalakwena River drained the north-eastern escarpment zone to the west of the then Great Escarpment (around Tzaneen and Phalaborwa). It flowed west approximately along the present-day course of the Olifants River before veering north at the point where the present-day Nyl River flows into the valley of the Mokgalakwena River (Partridge & Maud, 1987). The westward recession of the Great Escarpment in the warm and wet Cretaceous and the Tertiary subsidence of the Western Transvaal Basin disrupted the early drainage pattern, leading to the present day hydrography.

These events also constrained the hydrography of the Olifants River. The concave longitudinal profiles of the five main river systems (Marico, Crocodile, Elands, Mokgalakwena and Olifants) that drain the Western Transvaal Basin reflect the imprint of lithology, structure and neotectonics. There is no clear trend from west to east or north to south, although in the extreme west of the basin, flatter slopes and broader valley cross sectional profiles are evident. However, the rivers are uniform in their longitudinal profile, with flat or medium slopes and wide or broad valley cross-sectional profiles, so that the sediment storage surrogate descriptors are predominantly Wide and Flat (WF) and, Broad and Medium (BM). However, there is significant heterogeneity, with river longitudinal profiles.

6.7 Agricultural Potential and Soils

The Agricultural Potential Assessment was conducted by M.N. Mushia, S.D. Mkula and D.G. Paterson of ARC Institute for Soil, Climate and Water and is included in Appendix 6C. The environmental baseline from an agricultural potential and soil perspective is presented below.

6.7.1 Soil Map Units

Several soil map units were identified. A description of the most important soil characteristics of each unit, such as the dominant soil form and family, soil depth, topsoil texture and underlying material, is given in the soil legend shown in Table 8.

The study site has a mixture of different soil forms, ranging from yellow-brown, structureless sandy clay loams with plinthite underneath to areas of shallow, rocky soils, as well as deep, red and yellow-brown, structureless sandy clay loam soils.

Table 8: Soil map legend

Map Unit	Depth (mm)	Dominant Soil Form(s)	Sub-dominant Soil Form(s)	General description of soils occurring	Area (ha)	Agricultural Potential
Cv	800-1200+	Clovelly	Avalon	Dark brown to grey brown, structureless to weakly structured, sandy clay loam topsoil over freely drained, apedal sandy clay loam yellow-brown subsoil.	16.4	High
Av	500-900	Avalon	Clovelly	Dark brown to grey brown, structureless to weakly structured, loam to sandy clay loam topsoil over well-drained, yellow-brown, sandy clay loam apedal subsoil over imperfectly drained grey material with red, yellow and black iron and manganese oxide mottling.	53.4	Moderate to High
Hu	800-1000	Hutton	Clovelly	Red-brown to brown, structureless to weakly structured, sandy clay loam topsoil overlying freely-drained, structureless to weakly structured, sandy clay loam topsoil red apedal soil material on weathering rock	14.1	High
Gs	0-350	Glenrosa	Dresden	Grey brown, structureless, sandy loam topsoil overlying weathered rock.	49.0	Low
Ms	0-250	Mispah	Dresden	Grey brown, structureless, sandy loam topsoil overlying hard rock or cemented hard plinthite (ferricrete)	73.8	Low
Er	-	Eroded area	-	Area of topsoil removal leading to erosion by water with rock and hard plinthic outcrops	1.4	Low
Bu	-	Buildings	-	Area with built structures	1.3	None
TOTAL AREA					**209.4**	

6.7.2 Soil analysis

A total of six soil samples were collected at four sites within the study area and analysed in the laboratory at ARC-ISCW. The positions of the sampling sites (S1-S4) are shown on the soil map in Figure 29below. Sites S2 and S4 were shallow soils on rock, so there was no subsoil horizon that could be sampled.

The results of the analyses are given in Table 9 below.

Table 9: Soil analyses results

Sample site		S1		S2	S3		S4
Co-ordinates (Lat/Long)		25o18'27.8"S 29o08'09.3"E		25o18'27.8"S 29o08'09.3"E	25o18'27.8"S 29o08'09.3"E		25o18'27.8"S 29o08'09.3"E
Soil Form		Cv		Ms	Hu		Gs
Horizon		A1	B1	A1	A1	B1	A1
Depth (mm)		0-250	250-1000	0-250	0-250	250-1000	0-350
Sa	%	84	72	86	82	78	80
Si	%	4	6	4	4	4	6
Cl	%	12	22	10	14	18	14
Na	cmol kg-1	0.012	0.022	0.870	0.013	0.016	0.040
K	cmol kg-1	0.350	0.238	0.140	0.350	0.141	0.326
Ca	cmol kg-1	0.711	0.317	0.699	1.098	0.912	0.419
Mg	cmol kg-1	0.506	0.563	0.422	0.587	0.767	0.467
CEC	cmol kg-1	2.584	4.579	2.562	2.776	2.623	3.030
P (ppm)		7.81	7.33	7.45	7.49	7.25	7.23
pH (H2O)		5.96	5.10	5.47	5.72	5.18	5.29
Org C (%)		0.74	0.36	0.83	0.69	0.33	0.63

The analysis results show that the soils in the area have a light to moderate texture (sandy loam topsoils overlying sandy clay loam subsoils) and that the soils have been subject to moderate to strong leaching. This is confirmed by the pH values, showing the relatively acidic nature of all the soils. Coupled with the low organic carbon levels and the low P levels, the soils can be considered as relatively infertile, so that some sort of fertilization and liming would be required before any sort of arable production, either commercially or small-scale.

6.8 Visual

The Visual Assessment was conducted by Andrea Gibb of SiVEST and will include an external peer review by Keagan Allan of SRK Consulting. The report included in Appendix 6D. The environmental baseline from a visual perspective is presented below.

6.8.1 Visual Baseline Assessment

The nature of the terrain would suggest that that PV panels with a height of up to 5m could be visible from many surrounding areas as well as from higher ground, particularly from the flatter areas to the north.

In the southern part of the study area, the hilly topography would constrain the viewshed and limit views of the proposed development from areas to the south and south-east of the application site. This is depicted in Figure 14below.

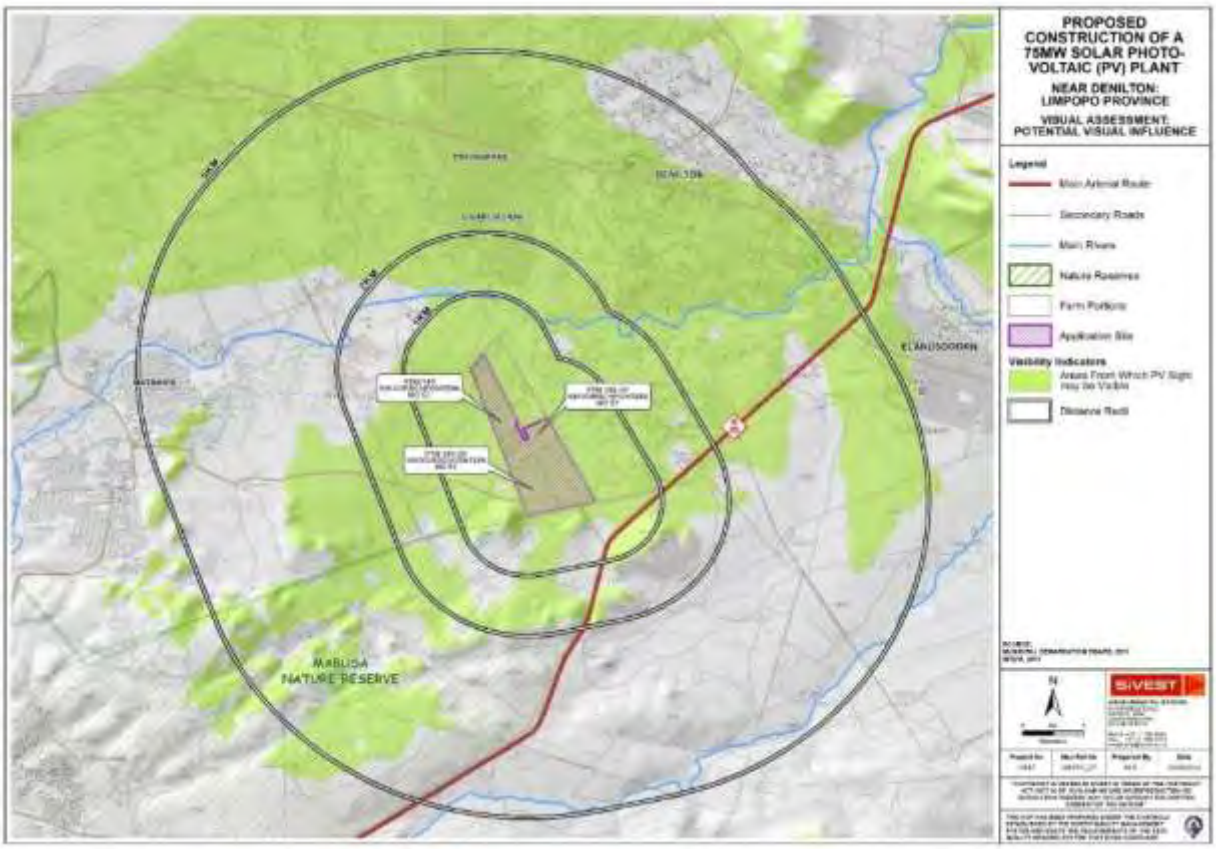


Figure 14: Map showing the potential visual influence of the proposed PV plant

The natural vegetation cover across much of the study area has undergone significant transformation to accommodate human settlement and agricultural activity. Much of the natural woodland has been cleared from the flatter areas leaving grassy plains with scattered trees and some isolated small patches of dense woodland. At the time of the site visit, vegetation cover near the development site was fairly sparse as a result of bush fires.

In contrast, the natural vegetation cover has been largely preserved in the hilly areas located within the Mabusa Nature Reserve (Figure 15 and Figure 16).

Figure 15: Typical flat terrain with natural vegetation cover near Mabusa Nature Reserve

Figure 16: Natural vegetation in Mabusa Nature Reserve

Despite the degree of transformation of the natural vegetation in the study area, the remaining vegetation cover may visually screen the proposed development, although the effectiveness of this screening would depend on the location of the receptor. The land use and associated infrastructure has significantly transformed the surrounding environment and has resulted in a somewhat degraded peri-urban landscape.

Visual character can be defined based on the level of change or transformation from a completely natural setting, which would represent a natural baseline in which there is little evidence of human transformation of the landscape. Varying degrees of human transformation of a landscape would engender differing visual characteristics to that landscape, with a highly modified urban or industrial landscape being at the opposite end of the scale to a largely natural undisturbed landscape. Visual character is also influenced by the presence of built infrastructure such as buildings, roads and other objects such as electrical infrastructure.

The Mabusa Nature reserve in the south-western sector of the study area is the only remaining natural landscape. The primary built infrastructure within the study area includes built-up areas to the north-east and the west, the R25 tar road, a network of gravel access roads, several boundary fences, power lines, telephone lines and a few farm buildings (Figure 17). These localised anthropogenic features are typical of a peri-urban or pastoral environment. As such, the overall study area is considered to have a rural visual character that appears to be transformed in close proximity to the built-up areas. Although the PV plant would not conform to the typical character of the area, the visual contrast would be less significant within this already partially degraded landscape which would reduce the likely visual impacts.

Figure 17: Typical landscape of the project site

6.9 Heritage

The Heritage Assessment was conducted by Wouter Fourie of Professional Grave Solutions and is included in Appendix 6E. The environmental baseline from a heritage perspective is presented below.

The examination of heritage databases, historical data and cartographic resources represents a critical additional tool for locating and identifying heritage resources and in determining the historical and cultural context of the study area. Therefore an internet literature search was conducted and relevant archaeological and historical texts were also consulted. Relevant topographic maps and satellite imagery were studied.

6.9.1 Previous Studies

Researching the SAHRA APM Report Mapping Project records and the SAHRIS online database (http://www.sahra.org.za/sahris), it was determined that a number of other archaeological or historical studies have been performed within the wider vicinity of the study area

- Findings from the studies

A single exemption application done by Roodt in 2006 was identified close to the study area. The study did not include any background research and no heritage resources were identified during the field work.

Roodt, F. 2006. *Phase 1 Heritage Resources Impact Assessment (Scoping & Evaluation), Ntwane/Elandsdoorn, Groblersdal, Mpumalanga. Letter of recommendation for exemption*. Completed for AGES Environmental.

6.9.2 General background to study area

- Stone Age

The Stone Age can be roughly divided into three

Earlier Stone Age (400 000 – 2 million Before Present/BP)
Middle Stone Age (30 000 – 300 000 BP)
Later Stone Age (30 000 BP – recent times)

- Iron Age

The Iron Age as a whole represents the spread of Bantu speaking people and includes both the Pre-Historic and Historic periods. It can be divided into three distinct periods:

- The Early Iron Age: Most of the first millennium AD.

- The Middle Iron Age: 10th to 13th centuries AD
- The Late Iron Age: 14th century to colonial period.

The Iron Age is characterised by the ability of these early people to manipulate and work Iron ore into implements that assisted them in creating a favourable environment to make a better living. Iron is a very hard metal to work with compared to gold and copper that have lower melting temperatures and therefore are easier to forge. A drawback of gold and copper are the occurrence of ore, which is relatively limited compared to iron.

In Africa, we proceeded technologically directly from the Stone Age in to the Iron Age whereas in Eurasia there was a prolonged Copper and Bronze Age preceding the Iron Age. In southern Africa, metallurgical techniques made their first appearance in a rather advanced state that permitted the smelting of Copper and Iron directly after a Stone Age economic way of live.

This scenario provides a strong argument that metallurgical technology was introduced from elsewhere and did not develop locally. To effectively smelt iron oxide, ore by reduction requires a temperature of at least 1100°C that is 400°C below the metals melting point. To obtain a temperature this high was probably unattainable in ancient furnaces. But the prolonged heating of ore in contact with abundant charcoal, needed to obtain a sufficiently high temperature for the reduction of the oxide ores, enable the iron to obtain enough carbon to make it mild steel. If this mild steel was repeatedly heated and hammered during the forge process, it will harden.

- Early Iron Age

Early in the first millennium AD, there seem to be a significant change in the archaeological record of the greater part of eastern and southern Africa lying between the equator and Natal. This change is marked by the appearance of a characteristic ceramic style that belongs to a single stylistic tradition. These Early Iron Age people practised a mixed farming economy and had the technology to work metals like iron and copper.

A meaningful interpretation of the Early Iron Age has been hampered by the uneven distribution of research conducted so far; this can be partly attributed to the poor preservation of these early sites.

Linguistic and archaeological research has developed a model of Bantu distribution from Central Africa down towards Southern Africa from around 1000 BC to 500 AD. This movement has resulted in the current tribal distribution as known today.

- Later Iron Age – early Farming Communities

Later Iron Age (LIA), also referred to as early farming communities, starts around 1500 AD and continues up to 1840 with the start of colonialisation of the South African interior. One of the main features of the LIA is the remnants of stone walled settlements scattered over large area of southern Africa. These stone walled settlements and characterised by a specific type of layout referred to as the Central Cattle Pattern (CCP).

The CCP refer to a settlement pattern where animal enclosures forma circle around a central open space or cattle are kept in a central kraal around which the development of settlements are done (Huffman, 2007).

There are numerous differences in layout of these stone walled settlements which researchers use to assign cultural affinities and/ or associated temporal scales. The main types are Moorpark Cluster (Moore park/Melora/KwaMaza walling; Nguni, 1500-1600AD), Ntsuanatsatsi Cluster (Types N/V/ Klipriviersberg/Molokwane/Badfontein/Type Z/B/ Thukela and Doornspruit type walling), and Zimbabwe Patterns (Khami and great Zimbabwe) (Huffman, 2007).

6.9.3 Anthropology of area

The study area falls within an area proclaimed as a homeland to the Ndebele, by the pre-1994 government as KwaNdebele. The inhabitants of this area are predominantly associated with the Southern Ndebele.

Three main groups of Ndebele people are recognised in southern Africa:

- The Southern Transvaal Ndebele (now Gauteng and Mpumalanga)
- The Northern Transvaal Ndebele (now Limpopo Province) around the towns of Mokopane (Potgietersrus) and Polokwane (Pietersburg).
- The Ndebele people of Zimbabwe, who were called the Matabele by the British (Coetzee, 1980; De Beer, 1986; Fourie, 1921)

The Southern Transvaal Ndebele (Southern Ndebele) is divided into three kin groups, namely the Ndzundza, the Manala and the Hwaduba (Jonas, 1989). The origins of the southern Ndebele starts with Mafana and Mhlanga (1557 AD-1587 AD) ruling at a place called Emhlangeni (close to Randfontein) after which they moved under Mhlanga to KwaMnyamana, near Bon Accord. Mhlanga was then succeeded by Musi (1666 AD). Musi had five or six sons: Manala, Masombuka, Ndzundza, Mathombeni and Dhlomu (Nelson, 2008; Jonas, 1989). Jonas (1989) indicates that a war of succession broke out between Manala and Ndundza and Ndzundza and his followers fled east wards through the Bronkhorstspruit, Witbank and Middelburg areas before settling in the Stoffberg area. Massie (1905) however maintains that the tribe divided in to four groups; Manala (settling in the Pretoria area), Kekaan (settling in the Soutpansberg, Waterberg and Pretoria area), M'Hwaduba (settling the Pretoria area) and Ndzundza (also known as the Mapoch tribe, settling in the eastern Transvaal (Mpumalanga) and Pretoria area).

The dispersal of the Ndzundza Ndebele to the Steelpoort and KwaNdebele in 1883, was preceded by numerous movements and resettlements due to political and socio-economic circumstances during the preceding 150 years (Nelson, 2008). The important settlement sites are Lower Steelpoort, KwaMaza, Eskikhujini, KoNomtjarhelo, KwaNdebele and Weltevreden farm (Loskop Dam reserve).

The most significant of the above mentioned sites, also having the final part in the scattering of the Ndebele, is KoNomtjarhelo. KoNomtjarhelo was the royal kraal of Mabogho of the Ndzundza clan and was laid out as settlement and military fortress around 1830. The Ndzundza maintained a fragile peace with the colonial

forces of the ZAR up until 1882, when Nyabela, the successor of Mabhogo, provided shelter for the Pedi chief, Mampuru and his men. Mampuru murdered his half-brother Sekhukhune in 1882, resulting in the then ZAR sending gen. Piet Joubert and a commando to arrest Mampuru and end the uprising that ensued the murder of Sekhukhune (Saks, 2008)

The ZAR forces laid siege to KoNomtjarhelo for 8 months after which Nyabela and 8000 of his subject surrendered. Mampuru was sentenced to death and hanged on 22 November1883 in Pretoria.

The Ndzundza was dispersed to Boer farms in different districts of the ZAR to work for 5 years as indentured labour. KoNomtjarhelo and surrounds were subdivided and given as reward to Boer commando members that participated in the siege. After the release of Nyabela in 1898 he settled with some of his subjects at KwaMkhina (close to Derdepoort in Pretoria) (Van Jaarsveld, 1986)

6.9.4 Recent history

- KwaNdebele

Since the scattering of the Ndzundza, the Ndebele people work towards the establishment of a self-governing area (Phatlane, 1998). This former Bantustan was given self-governing status on 1 April 1981 by the pre-1994 government under the name KwaNdebele. This former homeland was re-integrated in to South Africa on 27 April 1994.

- Historical structures and history

Four areas of possible historical settlements have been identified in the study area and were assessed during the field work of the HIA.

- Historical Maps

Historical maps of the study area consulted were the First edition 1:50 000 topo cadastral map – 2529AC dated 1966 and surveyed in 1965.

The map provides interesting information on the historic layout of the farm and corroboration of the data on farms sales in the area.

- **First Edition 1:50 000 – 2529AC map (1962)**

  Evaluation of the map (Figure **18**) indicates the presence of on cluster of structures in the central part of the study area and two separate settlement units in the southern sections of the study area (all circled in red).

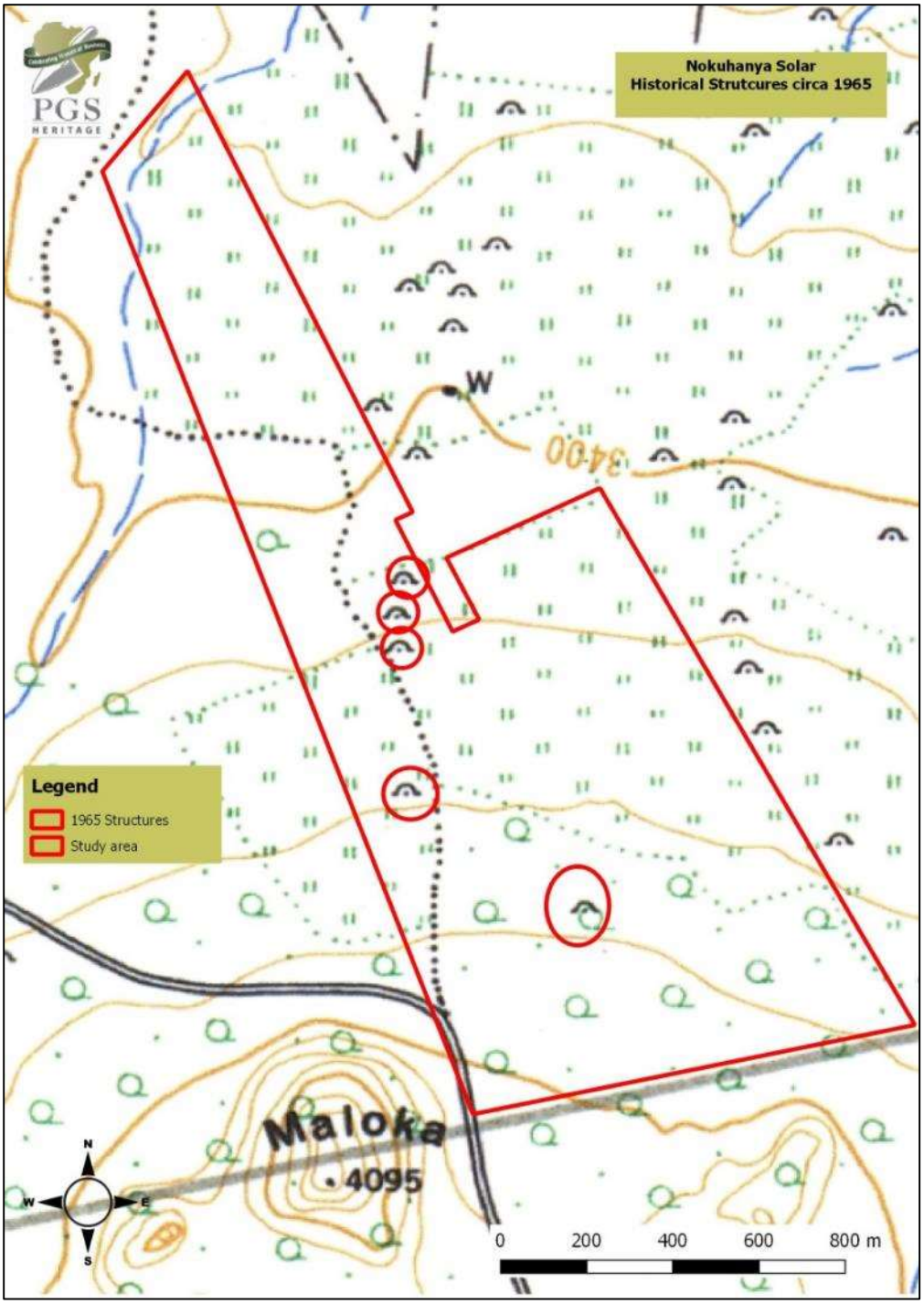


Figure 18: Structures dating to 1965 as demarcated on the 1966 topographical map

6.9.5 Palaeontology

The Study area is underlain by Mogolian aged Nebo Granite of the Lebowa Granite Suite, Bushveld Complex. This unit consists of grey to pink coarse-grained granite becoming red, medium grained near the top (Geological Survey 1978).

Due to the age and igneous nature of the Nebo Granite, no fossils will occur and there is a Low Palaeontological sensitivity

6.9.6 Possible finds

Evaluation of aerial photography has indicated that specific areas that may be sensitive from an archaeological perspective. The analysis of the studies conducted in the area assisted in the development of the following landform type to heritage find matrix in Table 10.

Table 10: Landform to heritage matrix

LAND FROM TYPE	HERITAGE TYPE
River drainages	LSA and MSA scatters
Ridges	Iron Age stone walling
Farmsteads	Historical material/cemeteries
Labourer housing	Historical material/cemeteries/still born burials (Cocks, et al, 2006)

Analysis of the area around the study area has shown a large LIA stone walled site situated on the hill (Phookwane Hill) just southwest of the study are, at this stage no reference to any archaeological sites could be found in literature.

The layout of the stone walling shows resemblance to stone walled layout of other Ndebele sites such as KwMaza.

The study area was delineated in terms of heritage sensitivity of areas within the study area. Notably previously ploughed fields are given low heritage sensitivity, while ruins and African labourer housing is given a high rating due to the possibility of still-born burials. No area has been graded as a no-go.

6.10 Socio-Economic

The Socio-economic Assessment was conducted by Elena Broughton of Urban-Econ Development Economists and is included in Appendix 6F. The environmental baseline from a socio-economic perspective is presented below.

6.10.1 Spatial Context and Regional Linkages

Limpopo is spatially the fifth-largest province within South Africa with a land mass of 125 754 km2 equating to approximately 10.3% of South Africa's spatial composition (Stats SA, 2014). It holds a population of approximately 5.4 million people that represents 10.4% of the total national population (Stats SA, 2014). It is made up of five DMs, namely Capricorn, Mopani, Sekhukhune, Vhembe and Waterberg, as well as 25 local municipalities. Limpopo is in the Savanna Biome, an area of mixed grassland and trees generally known as bushveld. It has borders with three provinces on the southern side, namely Mpumalanga, Gauteng and the North West. It is also a gateway to the rest of Africa as it borders the countries of Botswana to the west, Zimbabwe to the north and Mozambique to the east.

The Sekhukhune DM lies in the south-eastern part of the province with an area of 13 528 km2 (i.e. 10.8% of the Limpopo Province), most of which is rural. It comprises the five municipalities of the Makhuduthamaga, the Greater Tubatse, Elias Motsoaledi, Ephraim Mogale, and Fetakgomo. There are 740 villages in the district; and the main urban centres include Groblersdal, Marble Hall, Burgersfort, Jane Furse, Ohrigsta, Steelpoort, and Driekop (Sekhukhune District Municipality, 2014).

Elias Motsoaledi is Sekhukhune's second largest LM with an area of about 3 713 km2, constituting 27.4 % of the district's area. It is situated about 180 km from Polokwane, 135 km from Pretoria, and 150 km from Nelspruit. The municipality is predominantly rural and is made up of about 151 villages and 30 wards (Sekhukhune District Municipality, 2014). The main business nodes within the municipality are Groblersdal, Dennilton, Monsterlus, and Tafelkop. The main topography and geography of the area is characterised by undulating slopes interrupted by koppies, mountains and valleys (Elias Motsoaledi Local Municipality, 2013). To the south and south-west of the municipality where the proposed project location is, are the following mountains namely Mapule, Boshalala, and Phooko (Elias Motsoaledi Local Municipality, 2013).

The area is traversed by a number of roads, including one national road (the N11), two regional roads (R25 and R33/R555), and one district road (D1547) that the municipality defines as strategic. Sekhukhune recognises that "the growth of the economy of the district is highly dependent on road connectivity and on quality roads"; however, it highlights that connectivity and quality of roads in the district are inadequate (Sekhukhune District Municipality, 2014). In response to this challenge, the LM established the roads construction and storm water management unit (Elias Motsoaledi Local Municipality, 2013). There are also three railway lines in the Sekhukhune District, originally developed to support the mining industry. Since then, these have not been extended or re-routed, placing extreme pressure on the road network. However, a new commuter rail link, known as the "Moloto Rail Corridor", between Pretoria is being envisaged (Thembisile Hani Local Municipality, 2013).

As already mentioned, the proposed project is situated next to the Thembisile Hani LM, which is part of the Nkangala District in the Mpumalanga Province. It is, therefore, important to provide some information about these different administrative areas.

Mpumalanga is the second smallest province within South Africa (after Gauteng) with a land mass of 76 495 km2 equating to 6.3% of South Africa's spatial composition. It holds a population of 4.04 million people which represents 7.8% of the total national population (Stats SA, 2014). It is made up of three DMs, namely

Gert Sibande, Nkangala and Ehlanzeni, and 18 local municipalities. The province borders with Mozambique and Swaziland to the east, the Free State Province to the south, and the Gauteng Province to the west. Mpumalanga has a network of excellent roads and railway connections; it also hosts the Kruger Mpumalanga International Airport (KMIA).

The Nkangala District lies in the north-western part of the Mpumalanga Province with an area of 16 758 km2 (i.e. 22% of the Mpumalanga Province). The DM comprises of six local municipalities, namely Delmas, Dr J.S. Moroka, Emalahleni, Emakhazeni, Steve Tshwete, and Thembisile. Nkangala is “the economic hub of Mpumalanga and is rich in minerals and natural resources” (Nkangala District Municipality, 2014).

Thembisile Hani has an area of approximately 23 84.37km2, constituting 14.2 % of the district’s area. The principal business nodes of the municipality are Mathyzensloop, Kwaggafontein, Verena, Miliva, and KwaMhlanga. Most of the urban, peri-urban and agricultural settlements in the municipality are situated along the R573, also known as the Moloto Road (Thembisile Hani Local Municipality, 2013). As mentioned earlier, a 198 km railway line, the “Moloto Rail Corridor" linking Gauteng to Limpopo, is in the pipeline for development. The project feasibility is currently being assessed. The railway line will serve the Thembisile and Dr. JS (SABC News, 2014). Moroka municipalities within the Nkangala District. It is also envisaged to extend the rail corridor through the Elias Motsoaledi municipal area (Thembisile Hani Local Municipality, 2013).

6.10.2 Towns and settlements

The area where the proposed project is to be located forms part of the western population concentration point of the Elias Motsoaledi LM (refer to Figure 19). The closest major town to the site is Dennilton, while the area includes numerous villages that largely form part of the tribal area. Most of these villages are situated in the Elias Motsoaledi LM, with only a few of the settlements located in close proximity to the project site that are situated in the Thembisile Hani LM.

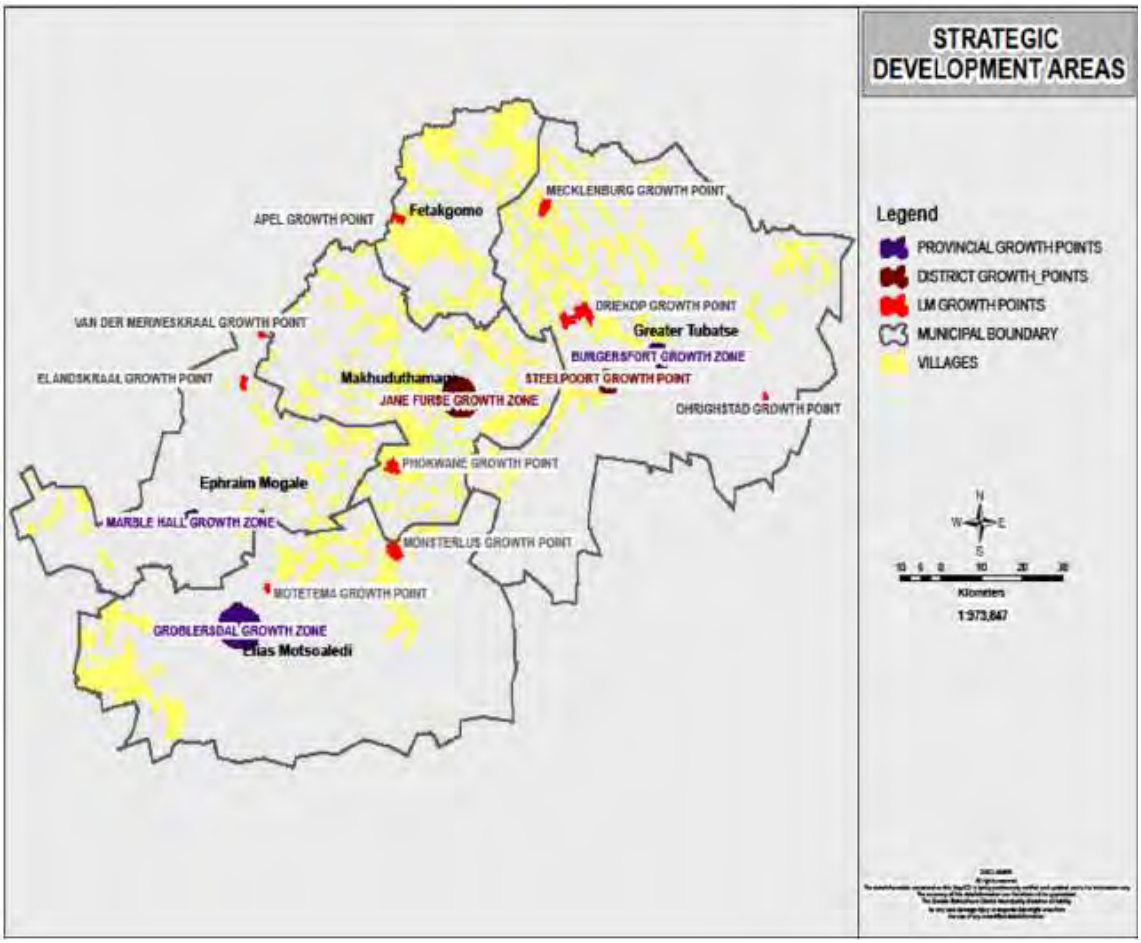


Figure 19: Development areas in Sekhukhune (Sekhukhune District Municipality, 2014)

As indicated on Figure **20**, aside from Dennilton, the villages and other towns located in vicinity of the project site in the Elias Motsoaledi LM include Kolofane, Ten Morgan, Elandsdoorn, Theareng, and others. The area in the Thembisile Hani LM that borders with the Elias Motsoaledi LM is dominated by nature reserves with only the Matshipe and Boekenhouthoek settlements observed in proximity to the proposed project's locality.

Figure 20: Major towns and villages in the vicinity of the project site

Dennilton is regarded as one of the main business nodes within the Elias Motsoaledi LM, together with Groblersdal, Monsterlus and Tafelkop (Elias Motsoaledi Local Municipality, 2013). It is situated in a tribal and traditional area, which is of rural nature. It has a population of 2 408 people representing 632 households. The regional road (R25) runs through the centre of the town and connects it to Groblersdal. The town provides a range of social facilities and amenities, including schools, a post office, sport stadium and a police station.

6.10.3 Land-uses within the affected zone of influence

Land use in Sekhukhune is dominated by commercial and subsistence farming (Sekhukhune District Municipality, 2014). Importantly, about a third of the land area in Elias Motsoaledi is recognised to be potential conservation areas, which may eventually encompass a third of the total land cover of this LM (Sekhukhune District Municipality, 2014). The interviews with the landowners of the farms forming part of the project site and adjacent farm landowners and residents reveal that no commercial agricultural activities exists in the immediate zone of influence. The farms in the immediate zone of influence are used for

subsistence farming or for residential purposes only. Both formal and informal settlements are found to the east and north of the site although none of them are adjacent to the site itself. Nature reserves, i.e. SS Skosana, Moutse and Mabusa Nature Reserves, are found to the west, east and south of the site, respectively; however, the project boundaries are expected to share the border only with the Mabusa Nature Reserve in its north-western corner. With respect to other activities, no mining activities are registered in the vicinity of the project (refer to Figure 21).

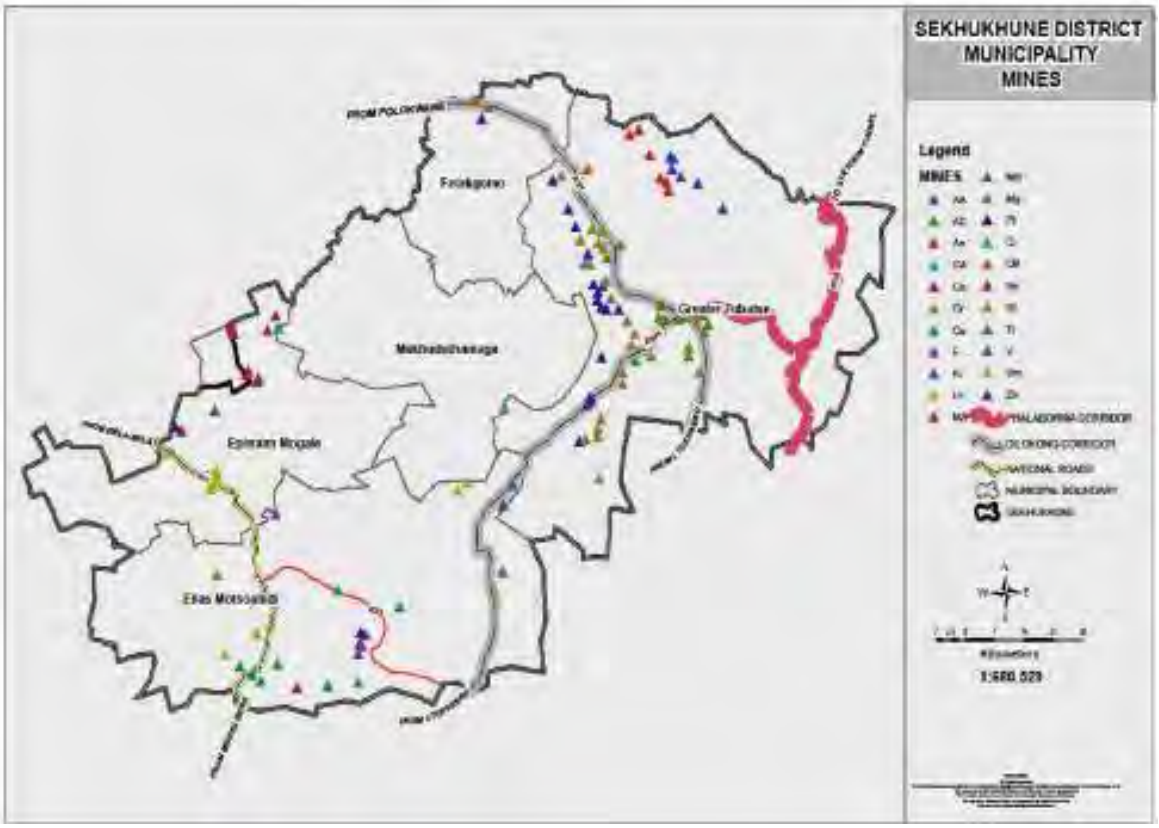


Figure 21: Mines in Sekhukhune District (Sekhukhune District Municipality, 2014)

6.10.4 Demographic Profile and Income Levels

The population of any geographical area is the cornerstone of the development process, as it affects the economic growth through the provision of labour and entrepreneurial skills, and determines the demand for the production output. Examining population dynamics is essential in gaining an accurate perspective of those who are likely to be affected by any prospective development or project.

The Elias Motsoaledi LM encompasses 249 363 people comprising of 60 249 households that accounts for approximately 22.8% of the total households of the Sekhukhune District. The majority (86.6%) of the population in the LM resides in tribal areas, with only 6.1% of the people living in urban areas and 7.3% living on farms. The female population (53.6%) in the municipality exceeds that of male (46.4 %). Practically all people are Black African (97.9%), followed by White (1.6%), Indian Asian (0.2%), other (0.17%) and

Coloured (0.15%). Sepedi is the mother tongue of the majority of people residing in this area is 87.8% (Stats SA, 2014).

As indicated in Figure 22, children (i.e. below the age of 15 years old) are the largest group of people (36.1%) and the youth, i.e. people between 15 – 34 years of age, comprise 34.5% of the total population. People aged between 35-64 amount to 22.4%, and the elderly (over 65 years old) to 7% of the total Municipality population. The population in the area is characterised by a high dependency ratio with more than a third of people falling within the ages of 0 to 14 and over 65 years old (43.10%).

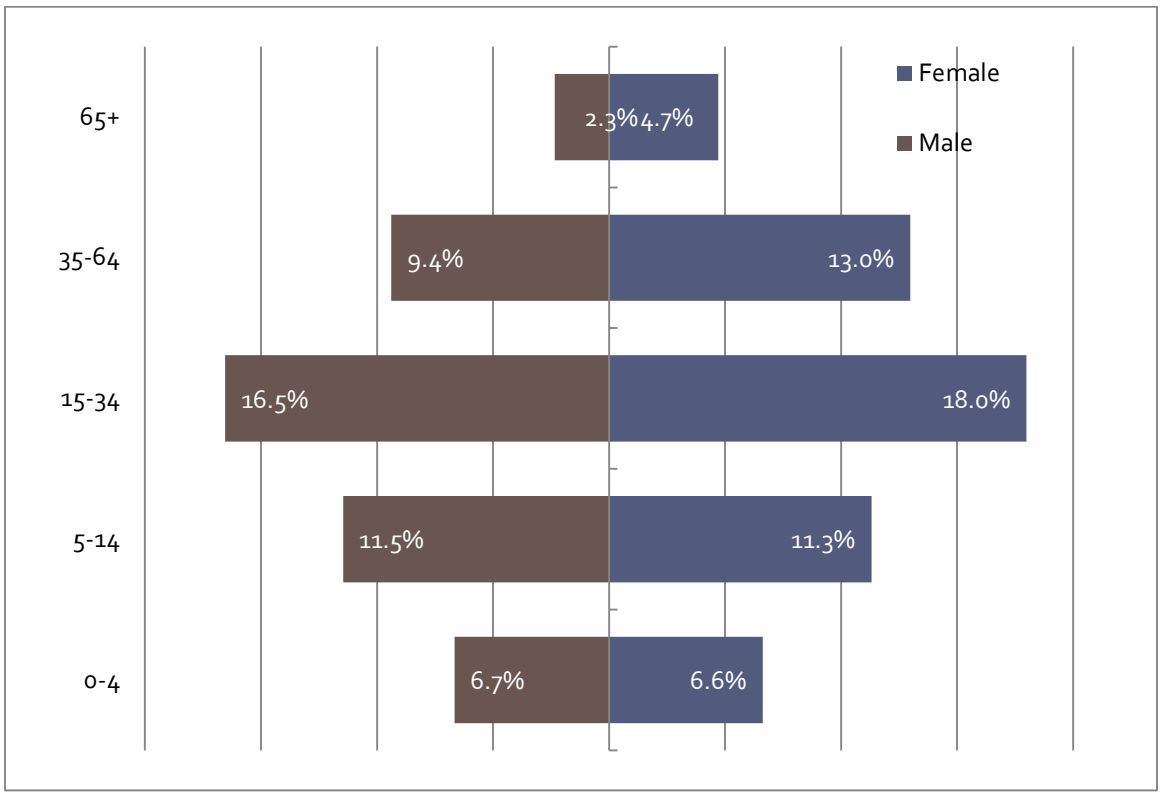


Figure 22: Age and gender profile

The education levels in the municipality are worse than in the district and the province. In 2011, 23.8% of the adult population in the municipality did not have any schooling, while 49.3% had some form of secondary or primary education. Only 19.8% of the adult population completed Grade 12 and 6.3% had some form of higher education. Education levels are slightly better in Dennilton with 14% of the adult population who did not have any schooling and 47% had some form of secondary or primary education. More than a third of the adult population had completed secondary education, including 14% who have a form of higher education (Stats SA, 2014).

On average, households in the Elias Motsoaledi LM earn R4 109 per month in 2014 prices, which is significantly lower than the national average of R9 235 and the district level (R 4 229). The lower than national average income levels in the municipality is an indicator of the limited number of employment opportunities available, which in turn is associated with a small economic base. More than half of the

households (56.1%) earn an income of less than R1 600 per month, including 13.5% who have no income at all. This means that the majority of households are unable to pay for services and afford an adequate standard of living, which in turn impacts negatively on the ability of the municipality to deliver these services.

Regarding the Thembisile Hani LM, it encompasses 310 455 people comprising of 75 635 households, which accounts for approximately 21.2% of the total households of the Nkangala District. The bulk of the population lives in the tribal areas (69.9%) and 28.5% of people live in urban areas. The female population (52.5%) in the municipality exceeds that of male (47.5 %). The main language spoken is IsiNdebele (58.4%), followed by Sepede and IsiZulu (i.e. respectively 12.6% and 12.5%). The youth (i.e. people aged between 15 and 34 years old) are the largest group of people (36.6%) and children, i.e. people below the age of 15 years of age, comprise 32.1% of the total population. People aged between 35-64 years amount to 26.4%, and the elderly (over 65 years old) to 4.9% of the total Municipality population. The municipality has a very high dependency ratio with 37.1% of people falling within the ages of 0 to 15 and over 65 years.

In 2011, 17.7% of the adult population in the municipality did not have any schooling, which was higher than the district and provincial levels (i.e. 11.3% and 13.7%) and a further 50.5% had completed some form of secondary or primary education, which was also higher than the district and provincial levels. Only 26% of the adult population completed Grade 12 and 5.3% had some form of higher education.

On average, households in the Thembisile Hani LM earn R4 254 per month in 2014 prices, which is significantly lower than the district and national averages of R8 106 and R9 235 per month. Half of households (49.8%) earn an income lower than R1600 per month, including 14.2% who do not earn any income.

6.10.5 Economy and labour force

The structure of the economy and the composition of its employment provide valuable insight into the dependency of an area on specific sectors and its sensitivity to fluctuations of global and regional markets. Knowledge of the structure and the size of each sector are also important for the economic impact results' interpretation, as it allows the assessment of the extent to which the proposed activity would change the economy, its structure, and trends of specific sectors.

The Elias Motsoaledi economy was valued at R8 057.8 million in 2013 in current prices. It contributed 20.2% to the Sekhukhune's economy and 3.7% to the provincial economy. Over the ten-year period between 2003 and 2013, the economy of the municipality grew at a Compounded Average Growth Rate (CAGR) of 7.2% in 2005 constant prices, which is significantly greater than that of the province (3%) and South Africa (3%). However, since 2009, the municipal economy has been rather stagnating after experiencing a sharp decrease (Figure 23). This illustrates that it is highly sensitive to the changes in the global and national economic situation. In 2009, the global economy went into a recession following financial crises, which negatively impacted the demand for South Africa's goods and services and resulted in a drastic decrease in export earnings and domestic consumption. Although the economic situation started to improve somewhat from 2010, the prognosis was not realised and it was clear that the recession had a far greater

impact than what was perceived to be originally. As a result, the national economy showed poor performance post the 2009 recession and it is clear that the Elias Motsoaledi economy could not recover in full during that time either.

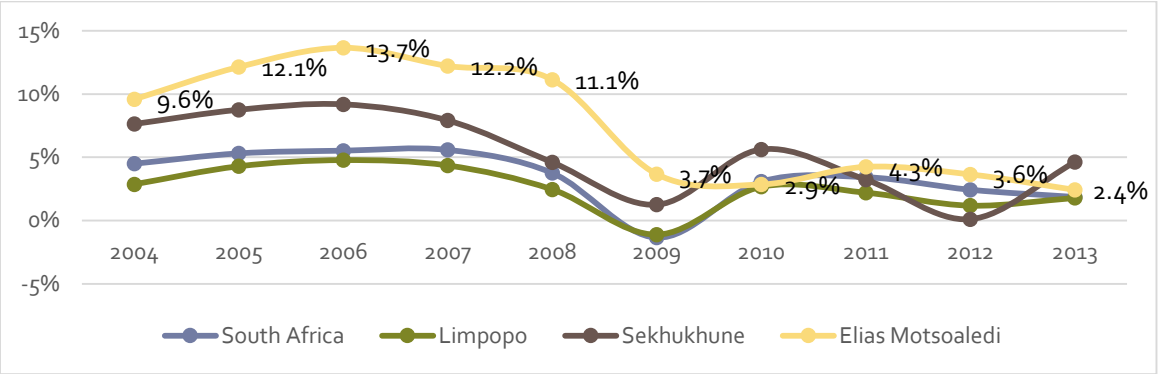


Figure 23: CAGR at municipal, district, provincial and national level (Quantec, 2014)

As shown in Table 11, the Elias Motsoaledi economy is a service economy with more than three quarters of its economy generated by the tertiary industries (i.e. 83.2%), including finance and business services (25.5%), trade (20.5%) and transport and communication (18.2%). Over the years, it was the construction and finance and business services sectors that largely contributed to the development of the local economy. Contrarily to the provincial and district levels, the mining sector only represents a small share of the economy (3.4% of the GDP in 2013 current prices compared to and 47.7% for the district and 28.3% for the province). Mining and quarrying used to be an important sector in the municipality's economy but it experienced a sharp decrease in 2013, while the GDP-R of construction, finance and business services and trade grew by 5%, 4% and 3% in 2013 compared to 2012 respectively. The agricultural sector in the LM is also small (3% of the 2013 GDP), but its contribution to the local economy is greater than that for the district (1.6%) and province (2.4%).

Thembisile Hani LM is also a service economy (72.8% of the total GDP-R in 2013 current prices) with finance and business services (26.8%), government services (13.8%), and transport and communication (12.5%) amounting to more than half of the 2013 municipality's GDP (see Table 11). However, in 2013 the Municipality only contributed 8.22% to the Nkangala District economy (Stats SA, 2014). As in the case with Elias Motsoaledi, the municipality's economy has experienced a recession in 2009, but it managed to recover somewhat and show a positive CAGR growth thereafter of 1.4%.

Table 11: Elias Motsoaledi and Thembisile Hani structure of economies (2013, current prices)

Economic Sector	Elias Motsoaledi			Thembisile Hani LM		
	GDP (R'm)	% of GDP	CAGR (2009-2013)	GDP (R'm)	% of GDP	CAGR (2009 - 2013)
Agriculture	365.0	3.0%	-1.6%	92.2	1.2%	0.1%
Mining and quarrying	273.6	3.4%	-2.3%	309.0	4.2%	-1.3%
Manufacturing	198.2	2.5%	1.6%	771.3	10.4%	0.3%
Electricity, gas and water	389.0	4.8%	1.6%	276	3.7%	1.3%
Construction	253.5	3.1%	3.9%	565.2	7.6%	1.1%
Trade	1 649.4	20.5%	4.3%	892.5	12.1%	-1.0%
Transport and communication	1 470.4	18.2%	2.8%	925.2	12.5%	0.6%
Finance and business services	2053.3	25.5%	5.5%	1 985.8	26.8%	3.7%
Personal services	327.0	4.1%	1.5%	562.7	7.6%	1.2%
General government	1 200.4	14.9%	1.8%	1 020.5	13.8%	2.0%
TOTAL	8 057.8	100.0%	3.3%	7 400.5	100.0%	1.4%

(Quantec, 2014)

6.10.6 Labour Force and Employment Structure

Employment is the primary means by which individuals who are of working age may earn an income that will enable them to provide for their basic needs and improve their standard of living. As such, employment and unemployment rates are important indicators of socio-economic well-being. In 2011, the Elias Motsoaledi LM had 141 951 people within the working age population (i.e. between 15 and 64 years of age), of who 56 803 comprised the labour force (Stats SA, 2014). About 7.9% of the working age population was discouraged job seekers, who are capable of working but who are no longer looking for employment (Stats SA, 2014). The labour force comprised of 32 883 employed and 23 920 unemployed, reflecting a 42.1% unemployment rate, which is significantly higher than that of the country (29.7%) recorded by Stats SA through Census 2011 (Stats SA, 2014). Regarding Dennilton and the small towns and settlements/villages surrounding it, their unemployment rate was slightly better (36.6%) than that of the average for the municipality but still worse than that for the country. About 65.1% of the employed population in the Elias Motsoaledi LM is employed in the formal sector, while one out of five people work in the informal sector (Stats SA, 2014). Private households provide about 12.3% of employment opportunities in the municipality (Stats SA, 2014). In Dennilton and surrounding villages the figures are quite similar to these of the overall municipality with two thirds of the employed population working in the formal sector. The trade, personal services and agriculture sectors in the Elias Motsoaledi LM account for the largest number of jobs created in the area, i.e. 33.3%, 12.8% and 12.3% respectively (refer to Table 12).

In 2011, the unemployment rate in Thembisile Hani LM was also high (36.4%) and 6.8% of the working age population (i.e. 195 495 people) was discouraged job seekers (Stats SA, 2014). More than half of the employed population (54.5%) worked in the formal sector, while 22.5% people worked in the informal sector. Private households provided about 20.4% of employment opportunities in the municipality. The majority of people were employed in the tertiary sector (71%), including personal services (19%) and finance and business services (18.2%). The construction sector also made a significant contribution to employment with 18.9% of the municipality economically active population working in this sector.

Table 12: Employment by economic sectors in Elias Motsoaledi and Thembisile Hani (2013)

Economic Sector	Elias Motsoaledi Employment		Thembisile Hani LM Employment	
	Employment	% of total Employment	Employment	% of total Employment
Agriculture	7 731	12.3%	1 776	2.9%
Mining and quarrying	443	0.7%	635	1.1%
Manufacturing	2 615	4.2%	3281	5.4%
Electricity, gas and water	329	0.5%	371	0.6%
Construction	7 327	11.7%	11 445	18.9%
Trade	20 857	33.3%	10 067	16.7%
Transport and communication	4871	7.8%	3405	5.6%
Finance and business services	4830	7.7%	10 983	18.2%
Personal services	8027	12.8%	11 490	19.0%
General government	5574	8.9%	6989	11.6%
TOTAL	62 604	100.0%	60 442	100.0%

(Quantec, 2014)

6.10.7 Access to Services and State of Local Built Environment

Access to shelter, water, electricity, sanitation, and other services are indicators that assist to determine the standard of living of the people in the area under investigation. Infrastructure and the state of local infrastructure is another indicator to contemplate when considering living standards. The availability of social and economic infrastructure including roads, educational facilities, and health facilities further indicates the nature of the study area, which is valuable in developing a complete profile of the circumstances in which communities are living. These measurements create a baseline against, which the potential impacts of the proposed project can be assessed.

Access to Housing and Basic Services

The two municipalities under analysis are characterised by the following access to services:

- Access to water in the area is a pressing problem. In 2011, 33.3% of households in the municipality did not have any access to piped water and only 47.1% had access to water on site, i.e. either in their dwellings, inside their yards and community stand pipe <200 (Stats SA, 2014). However, when focusing on Dennilton in particular, figures are better; 86% of households have access to piped water, including 58% on site. In comparison, 95.4% of households had access to water in Thembisile Hani, including 88.4% on site.
- Access to sanitation is also a key development challenge in the Municipality. In 2011, only 12.9% of households in Elias Motsoaledi had access to flush toilets and 79.3% used pit latrine (including 71% without ventilation), while 4.3% had no access to sanitation in 2011 (Stats SA, 2014). Regarding Thembisile Municipality, the use of pit latrines is also widespread (85.2% of households) but the Municipality performs better in terms of access (2.6% of households with no access to sanitation).
- In 2011, 88.5% of households in the municipality had access to some form of formal housing, which primarily was a house or a brick structure on a separate stand or yard or on a farm (86.1%). These figures are quite similar in the case of Thembisile Hani municipality with 84.5% of households living in some form of formal housing (Stats SA, 2014).
- Access to electricity examined through a proxy indicator "energy for lighting" was not universal in the municipality in 2011 but 91.4% of households used electricity for lighting (Stats SA, 2014). The rest of the households primarily made use of candles, i.e. 7.5% (Stats SA, 2014). The Sekhukhune Integrated Development Plan 2014/2015 reads that Eskom is the main provider of electricity on the District and that local municipalities implement electrification projects to assist in reducing electricity backlogs. In 2011, the electricity backlog was estimated at 37 124 households, which represented 14% of the households in Sekhukhune. It is further indicated that the majority of the villages that did not have access to electricity were in Greater Tubatse Local Municipality (69); Elias Motsoaledi Local Municipality (32); Fetakgomo Local Municipality (6); Makhuduthamaga Local Municipality (5) and finally Ephraim Mogale Local Municipality (2), (Sekhukhune District Municipality, 2014). As to Thembisile Hani, the figures are quite similar to these of Elias Motsoaledi with 92.3% of households using electricity for lightning and 6.8% using candles.

Social and recreational infrastructure

The following social and recreational infrastructure is available in the Elias Motsoaledi LM:

- In terms of educational facilities, the municipality comprises of one college (i.e. the Sekhukhune Fet College), 85 secondary schools, 115 primary schools and 126 early childhood centres.
- There are two libraries, one is located in Groblersdal and the other at Roossenekal.
- There are six formal sports and recreational facilities including a rugby field in Groblersdal, a cricket and soccer field in Tafelkop, and four soccer stadiums in Elandsdoorn, Groblersdal, Hlogotlou and Tafelkop respectively. There are also 30 informal sports fields in the municipality.
- The cultural historic sites and tourist attractions are limited and these are not actively formalized and promoted.

- Elias Motsoaledi includes seven police stations, including one in Dennilton.
- Fifteen postal offices are located within the municipality.
- There are 19 health facilities, including 17 primary health care clinics and two hospitals.

As to Thembisile Hani, its social and recreational facilities include, inter alia:

- There are four post offices located in Kwaggafontein, Verena, KwaMhlanga and Somarobogo.
- There are two stadiums in KwaMhlanga and Kwaggafontein.
- In terms of access to health services, the Municipality comprises one hospital, six Community Health Centres (CHC), 14 clinics and four mobile CHC for a population of 310 455 people.
- Regarding access to education, the Local Municipality stresses that "facilities are well distributed throughout the area with even the new informal developments being served with schools." However, "the problem in most schools appears not to be the lack of facilities but rather non-performance of schools due to poor management" (Thembisile Hani Local Municipality, 2013).

6.11 Geotechnical

The Geotechnical Assessment was conducted by Steven Bok and Cecilia Canahai of Jeffares and Green and is included in Appendix 6G. The environmental baseline from a geotechnical perspective is presented below.

6.11.1 Topography

The site presents gentle to flat gradients and slopes in a northerly direction. There are no ridges within the site boundary and hence no related sensitivity. However a prominent ridge and large conical hill, both with surface outcrop, occur to the south west and south of the site, respectively.

There are no significant surface drainage features within the proposed site boundary. An erosion donga originates near the northern boundary of the site, east of an existing homestead. Shallow ground water seepage was observed in trial pits excavated near the north eastern corner of the proposed project footprint and marshy conditions were observed in this area.

The nearest surface drainage features are limited to a non-perennial stream, namely a tributary to the Moses River, which runs in a south westerly direction approximately 200 m from the north eastern site boundary.

Surface drainage has been influenced to a limited extent by berms and shallow drainage channels constructed in disused agricultural lands over the central section of the site. These features are indicative of poor drainage conditions over the flatter areas of the site.

6.11.2 Climate

The climatic regime plays a fundamental role in rock weathering and the development of a soil profile. Weinert (1964), through his work on basic igneous rocks in southern Africa, demonstrated that mechanical disintegration is the predominant mode of rock weathering in areas where his climatic "N-value" is greater than 5, while chemical decomposition predominates where the N-value is less than 5. The climatic N-value at the site is between 3 and 4, which implies that chemical decomposition is the dominant mode of rock weathering at the site. However mechanical disintegration is also expected to occur.

6.11.3 Subsurface Conditions

Based on the geological maps and the preliminary results of intrusive investigations, the following near-surface materials are expected to be encountered at the site. Nebo granites will occur beneath the entire site and will comprise the parent bedrock. The site is overlain by a mantle of colluvial, pedogenic and residual soils. Very shallow or surface rock outcrop is expected in limited areas.

- Colluvial Soils

Colluvial soils, which are soils transported and deposited by gravity, were observed to form the upper soil mantle occur over the majority of the site. The deposits typically consist of sandy soils to fine gravely soils with interstitial sand with occasional cobbles and small boulders. The consistency of the materials was typically described as loose becoming medium dense with depth.

- Pedogenic Soils

Pedogenic ferricrete was observed to underlie the colluvial soils over large portions of the central and northern section of the site. Ferricrete is a pedogenic soil formed by the accumulation of iron oxides, which results in cementation of the soil profile. The nature and degree of cementation and the thickness of the pedogenic horizons were found to be variable. The ferricrete horizon was typically encountered at depths of between approximately 0.50 and 1.50 m below ground level.

- Residual Granite Soils

Residual soils, which are soils derived from the chemical and mechanical decomposition of the parent rock, were found to occur over the majority of the site beneath the colluvial soils and pedogenic soils. The granitic parent rock is course grained and the residual granite soils comprise predominantly of very fine gravel particles with interstitial sand, silt and minor clay. The consistency of the residual soils was typically found to be dense, becoming very dense with depth.

Granites are known to weather to residual soils that have an open-voided soil structure. These soils may be prone to collapse settlement. Based on observations of the soil structure in the trial pits, the residual soils are expected to have a low to moderate collapse potential. The collapse potential of the soils will need to be confirmed by further laboratory testing.

- Nebo Granite (Mn)

The Nebo granite is a hypersolvus, coarse-grained, equigranular rock, and is typically grey, pink or pinkish-red in colour. The granite is composed principally of quartz, perthite, interstitial biotite and/or hornblende and some minor oxides, with hornblende occurring more abundantly at the base of the granite sheet and biotite in the more fractionated portions. It is commonly porphyritic with K-feldspar phenocrysts and quartz phenocrysts, which weather prominently.

The colouration of the granites intensifies and reddens towards the top, as the Fe2+/ Fe3+ ratio decreases in the upper, more fractionated portions (Bailie, 1997). Changes in the mineralogy are characterised by an increase in K-feldspar/perthite over plagioclase, and ascendant proportions of biotite, as the principal femic mineral over hornblende. The upper Nebo granites are further characterised by the formation of linked chains and clusters of quartz.

Typically these granites weather to flat plains as noticed on this particular site.

Weathered granite was observed with depth in a limited number of trial pits. However the excavation plant generally refused in dense residual granite or hard ferricrete above the rock level.

None of the formations discussed above are sensitive or protected.

- Groundwater

Given the relatively dry climate, groundwater seepage is not expected to be problematic for the majority of the year. However a shallow, perched water table may be encountered on site during the rainy season. This will be most problematic in the northern-most section of the proposed development footprint, particularly the north eastern corner.

7 PUBLIC PARTICIPATION PROCESS

Public participation is the cornerstone of any EIA. The principles of NEMA as well as the EIA Regulations govern the EIA process, including public participation. The Public Participation Process (PPP) for the proposed development has been conducted according to Guideline 4 of the EIA Regulations. These include provision of sufficient and transparent information on an ongoing basis to stakeholders to allow them to comment, and ensuring the participation of previously disadvantaged people, women and the youth.

The public participation process is primarily based on two factors; firstly, ongoing interaction with the environmental specialists and the technical teams in order to achieve integration of technical assessment and public participation throughout. Secondly, to obtain the bulk of the issues to be addressed early on in the process, with the latter half of the process designed to provide environmental and technical evaluation of these issues. These findings are presented to stakeholders for verification that their issues have been captured and for further comment.

Input into the public participation process by members of the public and stakeholders can be given at various stages of the EIA process. Registration on the project can take place at any time during the EIA process up until the final EIA report is submitted to DEA. There are however set periods in which comments are required from Interested and / or Affected Parties (I&APs) in order to ensure that these are captured in time for the submission of the various reports. The comment periods during the EIA phase will be implemented according to Guideline 4 of the NEMA (107/1998) and Environmental Impact Assessment Regulations in terms of section 24(5).

The EIA regulations emphasise the importance of public participation. In terms of the EIA regulations, registered interested and/or affected parties –

- may participate in the application process;
- may comment on any written communication submitted to the competent authority by the applicant or environmental consultant;
- must comment within the timeframes as stipulated by the EIA Regulations;
- must send a copy of any comments to the applicant or Environmental Assessment Practitioner (EAP) if the comments were submitted directly to the competent authority; and
- Must disclose any direct business, financial, personal or other interests that the person has in the application being granted or refused.

The following actions were taken upon receiving comments/queries/issues:

- The contact details provided were entered into the project database for use in future notifications.
- Confirmation receipts were sent to those submitting comments.
- Comments were addressed in the Comments & Response Report.

7.1 Overview of the Public Participation Process to date

The public participation process for the EIA phase was initiated on the 7th of October 2014 with the issuing of the BID. This was followed by publication of the EIA process advert on the 17th of October 2014.

The Draft Scoping Report (DSR) was released to the public on the 9th of October 2014 and the subsequent public comment period ran until the 7th of November 2014. I&APs were notified at the start of the comment period, and invited to meetings on the 7th of November 2014. The Final Scoping Report (FSR) was submitted to the DEA on the 18th of November 2014, and I&APs were notified on the same day. Following the rejection by the DEA of the FSR, the FSR was Amended and I&APs were notified of a second comment period which ran from the 11th of March to the 13th of April 2015. Following the acceptance of the Amended Scoping Report and Plan of Study for EIA, the public was notified of the DEA's decision through the EIA Newsletter which was sent out on the 29th of May 2015.

The process that was followed during the Scoping Phase of the project will be repeated during the EIA phase. The major difference would be that the public now have an opportunity to comment on the findings of the detailed specialist studies and the final layout of the project.

On-going consultation with key stakeholders (e.g. provincial, district and local authorities, relevant government departments, local business, affected and adjacent landowners etc.) and identified I&APs will ensure that I&APs are kept informed regarding the EIA phase (the full stakeholder database list is included in Appendix 5F).

7.2 Consultation and Public Involvement

As in the scoping phase, telephonic discussions and focus group meetings will be held with key stakeholders and other relevant I&APs in order to identify key issues, needs and priorities for input into the proposed project. Special attention will be paid to the consultation with possibly affected landowners and communities within the study area to try address their main concerns.

I&APs were notified (in English and Northern Sotho) via email, post and fax on the 2nd of July 2015 that the DEIAr was available for public review and comment from the 2nd of July 2015 to the 31st of July 2015. An advertisement was placed in the *Sekhukhune Dispatch* (in English and Northern Sotho) on the 10th of July 2015 to advertise the public meeting and availability of the DEIAr.

7.3 Proof of Notification

Appendix 5 includes all proof of notification to Interested and Affected Parties;

- DEIAr availability notification (Appendix 5B)
- Proof of advertisements in the newspaper (Appendix 5C)
- EIA Newsletter (Appendix 5A)
- Correspondence to registered I&APs and key stakeholders (Appendix 5B)

7.4 Focus Group Meetings

Focus Group Meetings (FGMs) are smaller meetings with specific groups or organisations who have similar interests in or concerns about the project.

The following FGM is scheduled to take place during the review period of the draft report.

Table 13: Focus Group meeting

Venue	Interested Parties	Date	Time
Elias Motsoaledi Traffic Offices, Elandsdoorn, Dennilton	Councillors and Officials – Sekhukhune DM, Elias Motsoaledi LM, Nkangala DM & Thembisile Hani LM	**To be confirmed during the comment period**	**To be confirmed during the comment period**

Minutes of the FGM will be compiled and forwarded to all attendees for their review and comment. The primary aim of the meeting is to:

- Disseminate information regarding the proposed development to I&APs.
- Provide I&APs with an opportunity to interact with the EIA team and the Nokukhanya Energy representatives present.
- Supply more information regarding the EIA process.
- Answer questions regarding the project and the EIA process.
- Receive input regarding the public participation process and the proposed development.

7.5 Public Meeting

A Public Meeting will be held during the review of the DEIAr. The meeting is scheduled to take place as follows:

Table 14: Public Meetings / Open Days

Venue	Date	Time
St Joseph's Comprehensive School, Ten Morgan, Dennilton	**To be confirmed during the comment period**	**To be confirmed during the comment period**

This meeting will be advertised in *Sekhukhune Dispatch* (in English and Northern Sotho) on the 10th of July 2015. Invitation letters will also be sent out via post, fax and e-mail to all registered I&APs on the project's database.

The Public Meeting will be held in order to provide I&APs with information regarding the proposed development, present the impact phase environmental findings and invite I&APs to raise any further comments and/or concerns that they may have.

Draft minutes of this meeting will be compiled and forwarded to all attendees (Appendix 5G).

7.6 Public review of Environmental Impact Assessment Report

The DEIAr will be made available for review at the following venue from the 2nd of July 2015 to the 31st of July 2015:

Table 15: Venues where the DEIAr was publically available

Venue	Street Address	Hours	Contact No.
Groblersdal Library	2 Grobler Street Groblersdal 0470	Monday – Fridays 08h45 – 16h45 Saturdays 08h00 – 13h00	013 262 3056

All comments received on this report will be incorporated into the Comments and Response Report, which will be included in the FEIAr.

7.7 Comments and response report

Issues, comments and concerns raised during the public participation process will be captured in the Comments and Response Report (C&RR) – Appendix 5E. This C&RR provides a summary of the issues raised, as well as responses which were provided to I&APs. This information will be used to feed into the evaluation of social impacts.

8 SPECIALIST STUDIES

The following specialist studies were undertaken as per the Plan of Study for EIA:

- Biodiversity
- Surface Water
- Agricultural Potential and Soils
- Visual
- Heritage
- Socio-economic
- Geotechnical

Each specialist assessed the impact of the solar energy facility that Nokukhanya are proposing to develop near Dennilton and the results for are presented below.

8.1 Biodiversity

The full Biodiversity Assessment was conducted by David Hoare and is included in Appendix 6A.

The vegetation of the study area indicates that there are two regional vegetation types occurring in the study area, one of which only just enters the site in the southern parts. These are Central Sandy Bushveld across most of the site and Loskop Mountain Bushveld at the southern tip associated with the low hills. The vegetation types that occur on site are briefly described below.

8.1.1 Conservation status of broad vegetation types

On the basis of a scientific approach used at national level by SANBI (Driver et al. 2005), vegetation types can be categorised according to their conservation status which is, in turn, assessed according to the degree of transformation relative to the expected extent of each vegetation type. The status of a habitat or vegetation type is based on how much of its original area still remains intact relative to various thresholds. The original extent of a vegetation type is as presented in the most recent national vegetation map (Mucina, Rutherford & Powrie 2005) and is the extent of the vegetation type in the absence of any historical human impact. On a national scale the thresholds are as depicted in Table 16, as determined by best available scientific approaches (Driver et al. 2005). The level at which an ecosystem becomes Critically Endangered differs from one ecosystem to another and varies from 16% to 36% (Driver et al. 2005).

Table 16: Determining ecosystem status (Driver et al. 2005).

*BT = biodiversity target (the minimum conservation requirement).

Habitat remaining (%)			
	80–100	least threatened	LT
	60–80	vulnerable	VU
	*BT–60	endangered	EN
	0–*BT	critically endangered	CR

Table 17: Conservation status of different vegetation types occurring in the study area, according to Driver et al. 2005 and Mucina et al. 2005.

Vegetation Type	Target (%)	Conserved (%)	Transformed (%)	Conservation status	
				Driver et al. 2005; Mucina et al., 2006	National Ecosystem List (NEM:BA)
Central Sandy Bushveld	19	4.6	24	Vulnerable	Not listed
Loskop Mountain Bushveld	24	16.4	3	Least Threatened	Not listed

According to scientific literature (Driver et al. 2005; Mucina et al., 2006), as shown in Table 17, Central Sandy Bushveld is listed as Vulnerable and Loskop Mountain Bushveld as Least threatened.

The National List of Ecosystems that are Threatened and need of protection (GN1002 of 2011), published under the National Environmental Management: Biodiversity Act (Act No. 10, 2004), lists national vegetation types that are afforded protection on the basis of rates of transformation. The thresholds for listing in this legislation are higher than in the scientific literature, which means there are fewer ecosystems listed in the National Ecosystem List versus in the scientific literature.

Neither vegetation type is listed in the National List of Ecosystems that are Threatened and need of protection (GN1002 of 2011).

There is a fine-scale Biodiversity Conservation Plans for Limpopo Province, called the Limpopo Conservation Plan version 2 (http://bgis.sanbi.org). This divides the Province CBAs into various conservation levels, as follows (in decreasing conservation importance):

- Protected Area;
- Critical Biodiversity Area 1;
- Critical Biodiversity Area 2;
- Ecological Support Area 1;
- Ecological Support Area 2;
- Other Natural;
- No natural remaining.

Based on the Limpopo Conservation Plan, 40% of the province is designated as CBAs. These CBAs have been split into CBA 1 and CBA 2 on the basis of selection frequency and the underlying characteristics of the biodiversity features which are being protected (i.e. location fixed features such as sites for Critically Endangered (CR) species and flexible ones such as Least Cost Corridors). The majority of the CBAs in the province are CBA 1 (22 %), which can be considered "irreplaceable" in that there is little choice in terms of areas available to meet targets. If CBA 1 areas are not maintained in a natural state then targets cannot be achieved. CBA 2's are considered "optimal" as there is significant design involved in their identification, make up 18 % of the province.

An additional 23% of the province is designated as Ecological Support Area (ESA). This category has also been split on the basis of land-cover into ESA 1 (16%) and ESA 2 (7%), with ESA 1 being in a largely natural state while ESA 2 areas are no longer intact but potentially retain significant importance from a process perspective (e.g. maintaining landscape connectivity). Other Natural Areas make up 20% of the province and just over 11% is designated as formal Protected Area.

Most of the study area falls within either Critical Biodiversity Area 2 (CBA2) or Ecological Support Area 1 (ESA1) (see Figure 24). The remainder is mapped as "No Natural Remaining".

The proposed infrastructure falls within the southern parts of the site mapped as CBA2 and EAS1. The importance of this categorization is, however, affected by whether the infrastructure affects natural areas or disturbed areas, which is not encapsulated in the conservation plan, but is discussed further in a section below where site sensitivity is summarised.

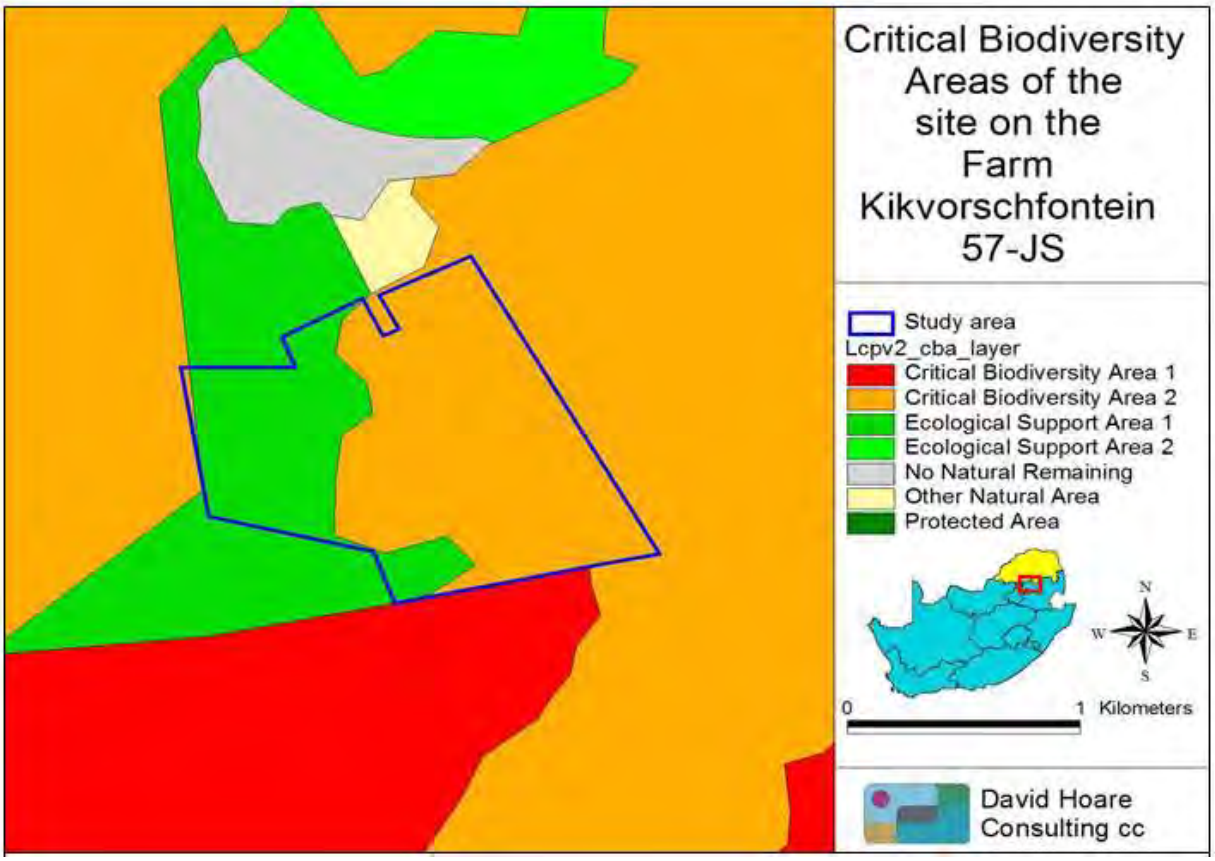


Figure 24: Critical Biodiversity Areas in the Study Area

8.1.2 Red List plant species of the study area

Lists of plant species previously recorded in the quarter degree grids in which the study area is situated were obtained from the South African National Biodiversity Institute. These are listed in the biodiversity specialist report. Additional species that could occur in similar habitats, as determined from database searches and literature sources, but have not been recorded in these grids are also listed.

The species on this list were evaluated to determine the likelihood of any of them occurring on site on the basis of habitat suitability. Of the five species that are considered to occur within the geographical area under consideration, there is one Declining plant species that has a high probability of occurring in habitats that are available in the study area (see biodiversity specialist report). This species is *Ilex mitis* var. *mitis*. This is a tree that is found along rivers and streams in forest and thickets, sometimes in the open. The species was not found on site and it is considered unlikely to occur there.

There are also two species that have a moderate probability of occurring on site, namely *Argyrolobium megarrhizum* (listed as Near threatened) and *Gladiolus pole-evansii* (listed as Rare). Neither species was seen on site, but there is still a small probability that they could occur there.

Table 18: Explanation of IUCN Ver. 3.1 categories (IUCN, 2001), and Orange List categories (Victor & Keith, 2004).

IUCN / Orange List category	**Definition**	**Class**
EX	Extinct	Extinct
CR	Critically Endangered	Red List
EN	Endangered	Red List
VU	Vulnerable	Red List
NT	Near Threatened	Orange List
Declining	Declining taxa	Orange List
Rare	Rare	Orange List
Critically Rare	Rare: only one subpopulation	Orange List
Rare-Sparse	Rare: widely distributed but rare	Orange List
DDD	Data Deficient: well-known but not enough information for assessment	Orange List
DDT	Data Deficient: taxonomic problems	Data Deficient
DDX	Data Deficient: unknown species	Data Deficient

8.1.3 Protected plants (National Environmental Management: Biodiversity Act)

Plant species protected under the National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004) are listed in the biodiversity specialist report. Two plant species that appear on this list that could potentially occur in the general region, although they have not previously been recorded in the grids of the study area, are *Encephalartus middelbergensis* and *Encephalartus lanatus*.

Encephalartus middelbergensis is confined to the Witbank and Middelburg districts in the upper catchment areas of the Olifants River, which include the Wilge and Klein Olifants Rivers. It occurs in open grassland and sheltered valleys. It has not been previously recorded in this grid, but has been recorded in the grid to the south-east and east. It is considered unlikely that this species could occur on site due to habitat conditions found there relative to the species requirements. No cycads were seen on site or nearby.

Encephalartus lanatus occurs in the upper catchment area of the Olifants River in the Middelburg, Witbank and Bronkhorstspruit areas. It also occurs along the Little Olifants and Wilge rivers in this area, from 1,200 to 1,500 m. It is found on the slopes of sheltered wooded kloofs and sandstone ridges where it occurs as an element of open to sometimes rather closed woodland communities. Sites are usually gentle to steep sloping, associated with scattered sandstone boulders and well drained soils. The species shows a definite preference for semi-exposed, steep sloping sites with a southern aspect. It has not been previously recorded in this grid, but has been recorded in the grid to the south, south-east and east. It is considered unlikely that this species could occur on site due to habitat conditions found there relative to the species

requirements. No cycads were found on site or nearby and it is considered highly unlikely that this species occurs there.

8.1.4 Protected trees

Tree species protected under the National Forest Act are listed in the surface water report. There are a number of species that are known to have a geographical distribution that includes the grids in which the proposed infrastructure is to be located, namely *Boscia albitrunca, Combretum imberbe, Curtisia dentata, Elaedendron transvaalensis, Pittosporum viridiflorum, Prunus africana* and *Sclerocarya birrea* subsp. *caffra*.

- *Boscia albitrunca* occurs in semi-desert areas and bushveld, often on termitaria, but is common on sandy to loamy soils and calcrete soils. No individuals were found on site and it is considered unlikely that this species occurs there or that it will be affected by the proposed project.
- *Combretum imberbe* occurs in bushveld, often on alluvial soils along rivers or dry watercourses. No individuals were seen on site, although the entire watercourse was not examined in detail and it is possible that individuals of this species could occur there. However, the proposed infrastructure does not directly impact any of these areas and it is considered unlikely that this species will be affected by the proposed project.
- *Curtisia dentata* occurs in coastal and montane forest. No individuals were seen on site and no suitable habitat is considered to occur there. It is considered unlikely that this species occurs there or that it will be affected by the proposed project.
- *Elaedendron transvaalensis* occurs in bushveld, occasionally on termitaria. No individuals were found on site and it is considered unlikely that this species occurs there or that it will be affected by the proposed project.
- *Pittosporum viridiflorum* occurs along forest margins, in bush-clumps and in bushveld, often in rocky outcrops. No individuals were found on site and it is considered unlikely that this species occurs there or that it will be affected by the proposed project.
- *Prunus africana* occurs in montane forest, usually in mistbelt areas. It is unlikely to occur on site and has not previously been recorded there. No individuals were found on site and it is considered unlikely that this species occurs there or that it will be affected by the proposed project.
- *Sclerocarya birrea* subsp. *caffra* occurs in bushveld and woodland. It also typically occurs quite often within homestead yards and on the side of the road within rural settlements, where it is highly regarded for the fruit that it produces in copious amounts. A number of individuals of this species were recorded on site and in surrounding areas. A typical example growing within a cultivated land is shown in Figure 25.

Figure 25: Maroela tree (*Sclerocarya birrea*) growing in cultivated land.

In summary, a number of protected trees could occur in the geographical area that includes the site or in habitats that may be found on site. However, only one species was found on site and this is the only protected tree species that is likely to be affected by the proposed project.

8.1.5 Red List animal species of the study area

All threatened (Critically Endangered, Endangered or Vulnerable) or near threatened vertebrate animals (mammals, reptiles, amphibians) that could occur in the study area are listed in the biodiversity specialist report. Those vertebrate species with a geographical distribution that includes the study area, and habitat preference that includes habitats available in the study area are discussed further.

There is a high diversity of mammal species that have a geographical distribution that includes the study area. This includes various species that are listed in a threat category, including the following that are considered to have a probability of potentially occurring on site:

1. Brown Hyaena (NT)
2. Serval (NT)
3. Honey Badger (NT)
4. Percival's Short-eared Trident Bat (NT)
5. Natal Long-fingered Bat (NT)
6. Temminck's Hairy Bat (NT)

7. Welwitsch's Hairy Bat (NT)
8. Rusty Bat (NT)
9. Geoffroy's Horseshoe Bat (NT)
10. Darling's Horseshoe Bat (NT)
11. South African Hedgehog (NT)

This list includes a high number of bat species that are likely to only traverse the site during feeding or travelling and will not use the site for roosting. Of the remaining species, all, except the South African Hedgehog, are highly mobile species and are unlikely to be resident on site.

There are no threatened reptile species that have a geographical distribution that includes the study area.

There is one listed amphibian species that has a geographical distribution that includes the study area. This is the Giant Bullfrog, listed as Near Threatened. Based on habitat requirements, this species is not considered likely to occur on site.

There are ten bird species of conservation concern that could potentially use the site, mostly for foraging, but in one case, possibly also for breeding. The Red-billed Oxpecker is the only bird species that may possibly breed on site. The remainder of the species, if they occurred there, would only use the site for occasional foraging. These are the following species:

1. Blue Crane
2. Grey-crowned crane
3. Martial Eagle
4. Lanner Falcon
5. Lesser Kestrel
6. Melodious Lark
7. Red-billed Oxpecker
8. Secretarybird
9. Cape vulture
10. Lappet-faced Vulture

In all cases, the site does not constitute important habitat for any of these species, but there is still a possibility that they may occur there. Development of the site is unlikely to cause a significant loss of habitat for any of these species.

8.1.6 Protected animals

There are a number of animal species protected according to the National Environmental Management: Biodiversity Act (Act No. 10 of 2004).According to this Act, "*a person may not carry out a restricted activity involving a specimen of a listed threatened or protected species without a permit issued in terms of Chapter 7*". Such activities include any that are "*of a nature that may negatively impact on the survival of a listed*

threatened or protected species". This implies that any negative impacts on habitats in which populations of protected species occur or are dependent upon would be restricted according to this Act.

Those species protected according to the National Environmental Management: Biodiversity Act (Act No. 10 of 2004) that have a geographical distribution that includes the site are listed in the biodiversity specialist report, marked with the letter "N". This includes the following species: White Rhinoceros, Black Wildebeest, Oribi, Cheetah, Cape Clawless Otter, Black-footed Cat, Brown Hyaena, Serval, Spotted-necked Otter, Honey Badger, Leopard, Cape Fox, Southern African Hedgehog, Southern African Python, Giant Bullfrog, Blue Crane, Grey-crowned Crane, Martial Eagle, Cape Vulture, and Lappet-faced Vulture.

Due to habitat and forage requirements and the fact that some species are restricted to game farms and/or conservation areas, only the Black-footed Cat, Brown Hyaena, Serval, Honey Badger, Leopard, Cape Fox, Southern African Hedgehog, Southern African Python and some of the birds (Blue Crane, Grey-crowned Crane, Martial Eagle, Cape Vulture and Lappet-faced Vulture) have a likelihood of occurring on site. All of these species are mobile animals that are likely to move away in the event of any activities on site disturbing them. They are therefore unlikely to be affected by the proposed development of the solar power facility and associated infrastructure.

In summary, the following animal species protected by National legislation (National Environmental Management: Biodiversity Act) could potentially occur on site and may be negatively affected by development of the study area:

1. Southern African Hedgehog,
2. Southern African Python,
3. Blue Crane,
4. Grey-crowned Crane,
5. Martial Eagle,
6. Cape Vulture,
7. Lappet-faced Vulture.

8.1.7 Important Bird Areas

The study area is not within an Important Bird Area, but is near to the Loskop Dam Nature Reserve IBA (approximately 14 km from the site to the south-east).

8.1.8 Habitat sensitivity on site

A map of habitats on site is provided in Figure 26. This shows three main habitat units on site, namely riparian habitats, previously cultivated areas and other natural areas. The other natural areas include various densities of woodland, but these areas are also degraded to varying degrees and do not appear from aerial imagery or from the field investigation to be in a pristine state. The cover and species composition was relatively good in places, but mostly there were signs of historical disturbance and the overall composition was relatively uniform within these woodlands.

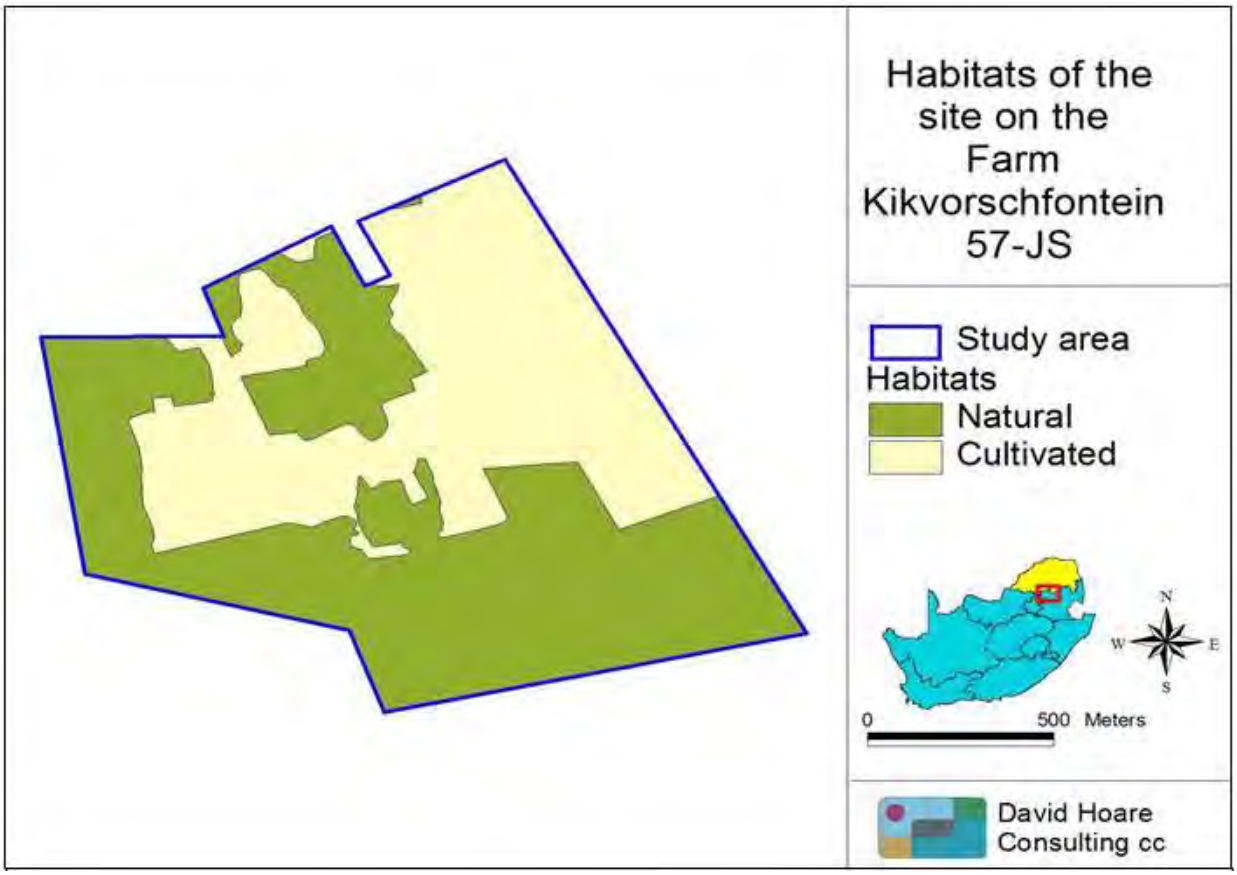


Figure 26: Main habitats of the study area

This information, in combination with the map of Critical Biodiversity Areas (Figure 24), was used to produce a preliminary sensitivity map of the study area (Figure 27). This shows the river area and the natural area in the southern part of the site to have HIGH sensitivity, other natural areas to have MEDIUM-HIGH sensitivity and all remaining areas to have LOW sensitivity.

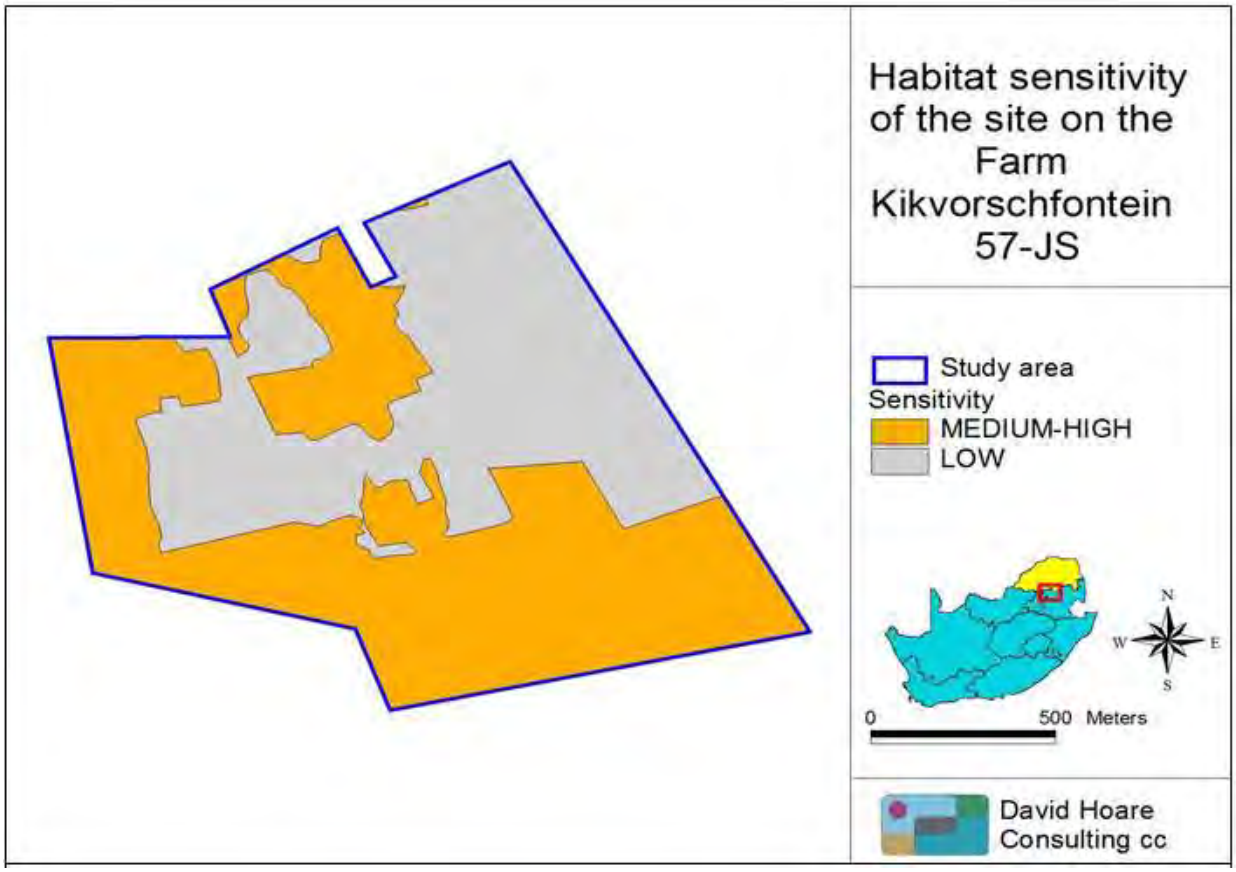


Figure 27: Preliminary habitat sensitivity of the study area

8.2 Surface Water

The full Surface Water Assessment conducted by Shaun Taylor and Alistair Fyfe is included in Appendix 6B. Also included is an external peer review by Dr Martin Ferreira from Jeffares and Green.

The in-field wetland delineation assessment took place on the 27th of January 2015, within the proposed development area. The fieldwork verification and ground-truthing assessment was undertaken to scrutinize the results of the database and desktop study conducted during the scoping phase and to identify any other potentially overlooked surface water resources in the field. The results are presented below. Ultimately, it was found that the proposed development area contains a total of two (2) surface water features, comprising of:

- One (1) Hillslope Seep Wetland and,
- One (1) Unchannelled Valley-Bottom Wetland.

When compared to the database and desktop findings, the in-field investigation revealed the presence of a hillslope seep wetland, and the identified depression wetland within the scoping phase was identified in-field as an unchannelled valley-bottom wetland.

Additionally, an erosion channel was identified within the proposed development area, and a further two (2) surface water features, namely, an unchannelled valley-bottom wetland to the south-east, and a non-perennial river and associated riparian habitat (corridor) to the west of the proposed development.

A graphic illustration of the findings is presented in Figure 28. The general characteristics of each wetland hydrogeomorphic type are elaborated on below. Where wetlands of the same hydrogeomorphic type were markedly different or possessed unique characteristics, these are distinguished in the text.

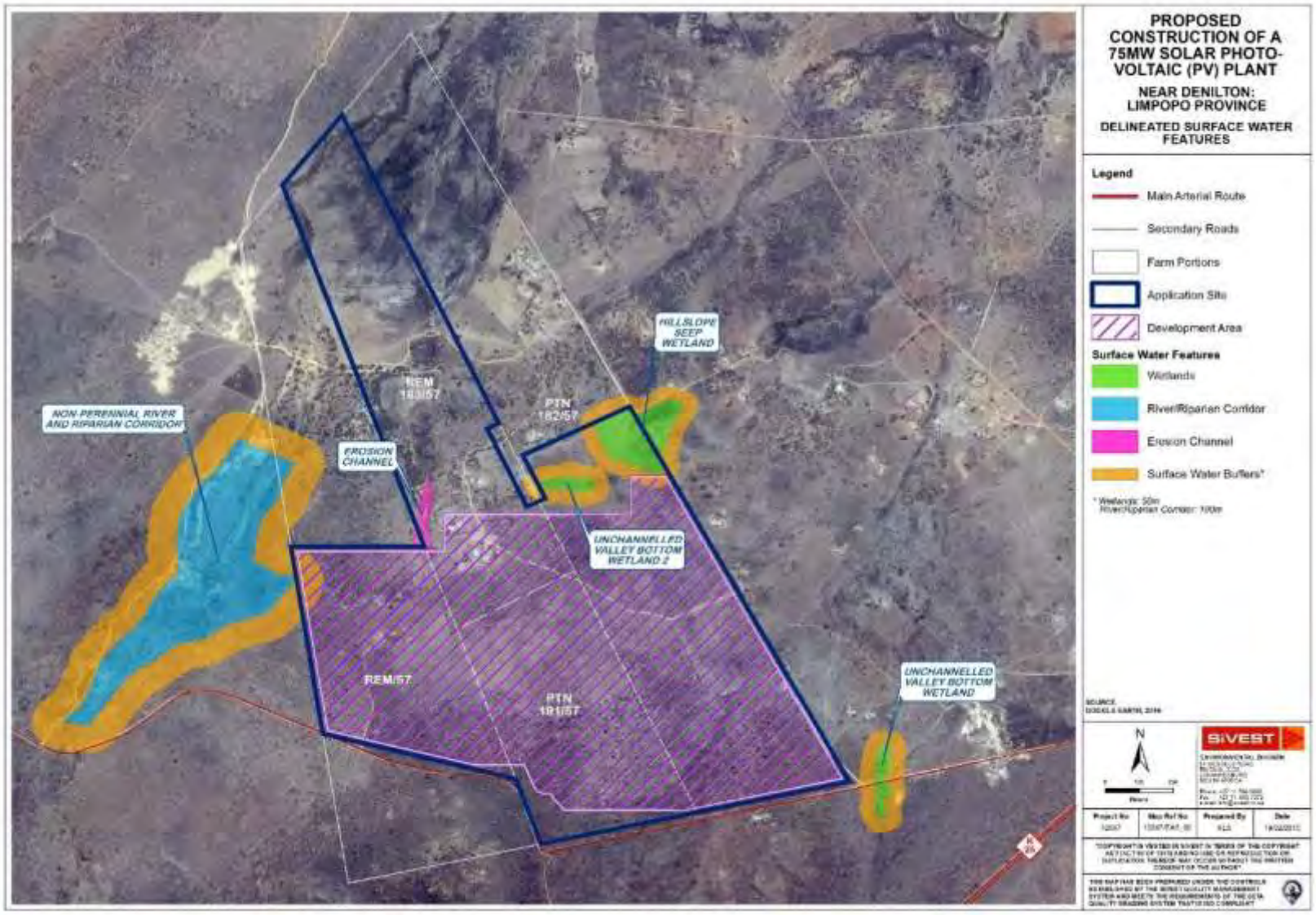


Figure 28. In-field delineated surface water resources within the proposed development area.

8.2.1 Hillslope Seep Wetland

As previously mentioned, one (1) hillslope seep wetland was identified.

- Terrain and Soils

The hillslope seep wetland was identified within the north-eastern portion of the development area. The wetland is located midslope, and is intersected by the presence of a dirt road, which aids with surface water drainage in a northerly direction. The hillslope seep wetland comprises of a shallow soil profile underlain by intruded bedrock, resulting in a perched water table. Soil wetness characteristics were distinguishable, mainly in the form of iron oxide accumulations (orange mottles) commonly associated with seasonal/temporary wetlands. The texture of the soil samples were predominantly sandy and could be described as a soft plinthic B horizon. The Westleigh Soil Form (typical wetland soil form) could be attributed as the dominant soil form for this wetland.

- Vegetation

The hillslope wetland was observed to be dominated by grasses and sedges. Grasses such as *Eragrostis plana, Sporobolus ioclados, Hyparrhenia filipendula, Eragrostis rotifer, Sporobolus africanus, Urochloa panicoides*, *Digitaria eriantha* and obligate wetland grass species *Andropogon eucomus* were found within the outer portions of the wetland. Sedge species such as *Cyperus congestus (facultative wetland species), Schoenoplectus muricinux (obligate wetland species), Cyperus digitatus* (obligate wetland species), *Bulbostylis hispidula* (facultative species), *Cyperus compressus* (facultative wetland species) and *Cyperus longus* var. *longus (*obligate wetland species) identified within the within the wetland.

8.2.2 Unchannelled Valley-Bottom Wetlands

As previously mentioned, two (2) unchannelled valley-bottom wetlands were identified.

- Terrain and Soils

Unchannelled valley-bottom wetland 1 and 2 were identified within the northern portion, and directly to the southeast outside of the development area, respectively. Both wetlands were located within the footslope, moving towards a valley bottom. Unchannelled valley-bottom wetland 1 drains in a north-easterly direction, whereas unchannelled valley-bottom wetland drains in an easterly direction. Unchannelled valley-bottom wetland 1 is intersected by a dirt road, and as a result surface water flow is channelled through a culvert within this section. Unchannelled valley-bottom wetland 2 surface flow has been obstructed by the presence of a small man-made impoundment used for drinking purposes for cattle.

The soils were identified to comprise of an Orthic A underlain by a Soft Plinthic B horizon, characteristic of the Westleigh soil form. Additionally, soil wetness characteristics were distinguishable, in the form of slight yellow/orange mottles, commonly associated with temporary/seasonal wetlands.

- Vegetation

The vegetation within the unchannelled valley-bottoms has been altered through previous cultivation and cattle grazing activities. Additionally, in some instances, informal refuse dumping has taken place. Over and above the vegetation impacts, the vegetation identified at each of the unchannelled valley-bottom wetlands was found to be similar. The vegetation comprised of grasses such as *Hyperthelia dissoluta, Tricholaena monachne, S. africanus, H. hirta, D. eriantha,* sedges and reeds such as *C. longus* var. *longus* (obligate wetland species) and *Arundo donax* (obligate alien wetland species), respectively.

8.2.3 Erosion Channel

As previously mentioned, one (1) area containing erosion channels was identified.

- Terrain and Soils

The erosion channel area was located along the northern boundary of the proposed development area. The erosion channels drain in a northerly direction.

The soils were identified to comprise of an Orthic A underlain by a Hard Plinthic B horizon (often exposed), characteristic of a truncated member of the Dresden soil form. No soil wetness characteristics were distinguishable.

- Vegetation

No vegetation was found within the erosion channels, due to the highly eroded nature of the top soils, exposed subsoil horizons and bedrock.

8.2.4 Topography and Soil Characteristics associated with the Watercourse and associated Riparian Habitat

As previously mentioned, one unnamed, non-perennial watercourse which exhibited an associated riparian habitat was identified. The unnamed, non-perennial watercourse and associated riparian habitat was identified along the western boundary of the proposed development area. The terrain in this region is pre-dominantly flat landscape, intersected by gently undulating rocky outcrops, channelling the surface water run-off in the form of a severely incised channel with high riverbanks. The bed of the watercourse expressed fine to sandy alluvial soils.

- Vegetation

The riparian habitat associated with these watercourse comprises of densely clumped patches of vegetation, made up of *Acacia exuvialis, Kiggelaria africana* and *Acacia caffra* located on the elevated banks of the watercourse.

- Alluvial Soils and Deposited Materials

Limited evidence of recent surface flows could be identified. However, flow events in the form of fine, sandy and sometimes course sediments were observed. The soils were unstructured, and light brown in colour.

- Wetland Buffer Zones

The Gauteng Minimum Requirements for Biodiversity Studies (GDACE, 2009) were utilised to implement a suitable buffer zone around the delineated wetland and riparian habitats for the proposed development. In accordance with these guidelines, a buffer zone of 50m was to be applied to the delineated wetland as it is located outside an urban area, and a 100m buffer was applied to the watercourse and associated riparian habitat.

8.3 Agricultural Potential and Soils

The Agricultural Potential Assessment was conducted by M.N. Mushia, S.D. Mkula and D.G. Paterson of ARC Institute for Soil, Climate and Water and is included in Appendix 6C.

8.3.1 Agricultural Potential

The general potential class of each map unit for arable agriculture (cultivated crops), and the main limiting factors, is given in Table 19below.

Table 19: Agricultural Potential (arable)

Agricultural Potential	Map unit	Limitations	Area (ha)
High	**Cv, Hu**	Few to none – deep, friable, well-drained soils	**30.5**
Moderate to high	**Av**	Few limitations. Moderately deep to deep, friable soils. Underlying plinthite may occur at shallow depth in places	**53.4**
Low	**Gs, Ms**	Shallow with underlying weathering rock/ underlying hard rock as limiting factor	**122.8**

Low	**Er**	Highly eroded area with exposed rocks	**1.4**
None	**Bu**	Constructed land	**1.3**
Total			**209.4**

The study area is dominated by low potential soils (**Gs, Ms, Er, Bu** map units), which occupy almost 60% of the area, mainly in the south. The remainder of the area has a mixture of high potential soils (**Cv, Hu** map units) and moderate to high potential soils (**Av** map unit). The high potential and moderate to high potential soils can be used for a wide variety of crops due to their favourable texture and available soil rooting depth.

The low potential soils (**Ms, Gs**) should not be cultivated, as growth and yields will be restricted due to underlying rock.

8.3.2 Grazing Capacity

Where soils are not recommended for cultivation, they may be used for grazing by livestock. The average long-term sustainable carrying capacity for the study area is around 8-10 ha per large stock unit (Schoeman & van der Walt, 2004).

8.3.3 Erosion Hazard

The soils are generally stable, with moderate clay content. Coupled with the gentle slopes, as long as a vegetation cover is maintained and proper soil conservation practices are followed, there should not be a significant susceptibility to erosion by water.

8.3.4 Potential Impact

The establishment of infrastructure, such as the solar panel arrays and associated substation, will have an impact on the soil resource in that the soils will no longer be available for agriculture. There is little or no cultivation being practiced in the surrounding area, but the fact remains that the south-eastern corner of the site has deep, high potential soils (see Figure 29).

Figure 29: Soil Map

8.4 Visual

The full Visual Impact Assessment was conducted by Andrea Gibb and includes an external peer review by Keagan Allan of SRK Consulting. The full report is included in Appendix 6D.

8.4.1 Sensitive Visual Receptor Locations

A sensitive receptor location is defined as a site from where a receptor/s, would potentially be adversely impacted by a proposed development. This takes into account a subjective factor on behalf of the viewer – i.e. whether the viewer would consider the impact as a negative impact. As described above, the adverse impact is often associated with the alteration of the visual character of the area in terms of the intrusion of the proposed development into a 'view', which may affect the 'sense of place'.

The table below provides details of the potentially sensitive visual receptor locations that were identified during the field investigation. Most of these receptors encompass areas or clusters of land usage rather than individual points. It is also important to note that the degree of visual impact experienced and sensitivity of the receptor will vary from one inhabitant to another, as it is largely based on the viewer's perception. Factors influencing the degree of visual impact experienced by the viewer include the following:

- Value placed by the viewer on the natural scenic characteristics of the area.
- The viewer's sentiments toward the proposed structures. These may be positive (a symbol of progression toward a less polluted future) or negative (foreign objects degrading the natural landscape).
- Degree to which the viewer will accept a change in the typical visual character of the surrounding area.

Table 20: Potentially Sensitive Visual receptors in the study area

Name	Receptor Type
Dennilton Residential Suburb	Low density residential area
Ga-Ngolvane/Phukukane Residential Community	Dense settlement
Metshipe Residential Community	Dense Settlement
Farm Dwellings (East)	Cluster of dwellings
Phooko Agricultural Holdings	Dwellings
Mabusa Nature Reserve	Nature Reserve
R25	Road

The existing dwellings on the development site have been excluded from this assessment as it has been assumed that the occupants would have a vested interest in the development and would therefore not perceive the proposed development in a negative light.

It should be noted that the Mabusa Nature Reserve has been partially degraded as it is utilised as a major thoroughfare for residents in the area. In addition, no accommodation or formal economic activities are located within the part of the reserve adjacent to the application site. Although the visual impact on the reserve would be limited it has been included as a potentially sensitive visual receptor location as the Thembisile Local Municipality plans to develop a tourism/conservation area belt, and the Mabusa Nature Reserve forms part of this project (Urban-Econ, 2015).

In many cases, roads, along which people travel, are considered as sensitive receptors. The primary thoroughfare in the study area is the R25 provincial road. The road is the primary access road into Dennilton from the south, and carries much of the local access traffic to and from the town. The road does not form part of a tourism route but it does border the Mabusa Nature Reserve and may be valued or utilised for its scenic or tourism potential. As a result the road is classed as a sensitive receptor road – i.e. a road along which motorists may object to the potential visual intrusion imposed by a PV plant.

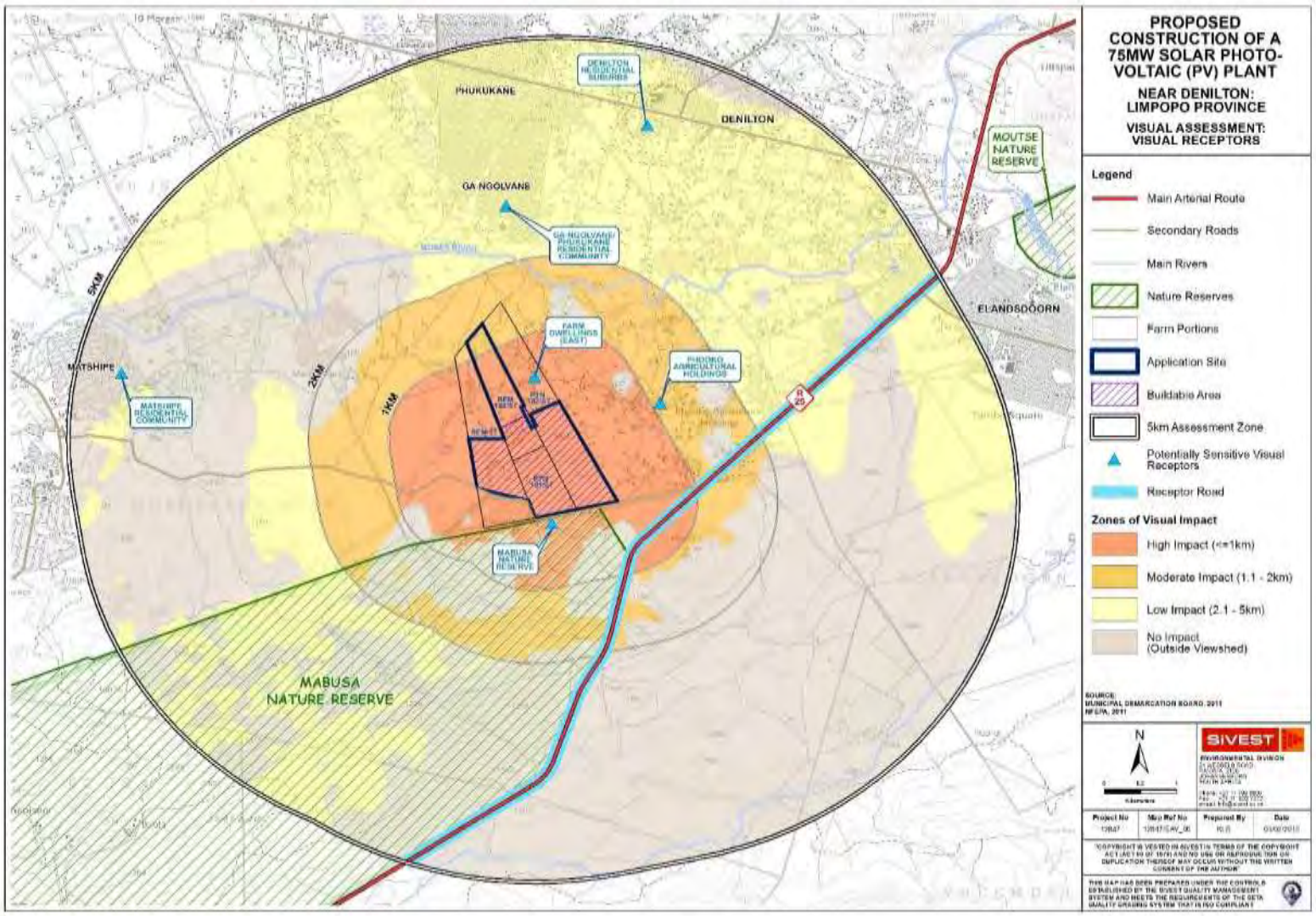


Figure 30: Visually sensitive receptors within the study area

8.4.2 Visual Sensitivity of the Study Area

Visual Sensitivity can be defined as the inherent sensitivity of an area to potential visual impacts associated with a proposed development. It is based on the physical characteristics of the area (i.e. topography, landform and land cover), spatial distribution of potential receptors and the likely value judgements of these receptors towards a new development (Oberholzer: 2005). A viewer's perception is usually based on the perceived aesthetic appeal of an area and on the presence of economic activities (such as recreational tourism) which may be based on this aesthetic appeal. The table below outlines the factors used to rate the visual sensitivity of the study area. The ratings are specific to the visual context of the receiving environment within the study area.

Table 21: Environmental factors used to define visual sensitivity of the study area

FACTORS	**RATING**									
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Pristine / natural character of the environment										
Presence of sensitive visual receptors										
Aesthetic sense of place / scenic visual character										
Value to individuals / society										
Irreplaceability / uniqueness / scarcity value										
Cultural or symbolic meaning										
Scenic resources present in the study area										
Protected / conservation areas in the study area										
Sites of special interest present in the study area										
Economic dependency on scenic quality										
Local jobs created by scenic quality of the area										
International status of the environment										
Provincial / regional status of the environment										
Local status of the environment										
**Scenic quality under threat / at risk of change										

**Any rating above '5' will trigger the need to undertake an assessment of cumulative visual impacts.

Low						**Moderate**								**High**
10	**20**	**30**	**40**	**50**	**60**	**70**	**80**	**90**	**100**	**110**	**120**	**130**	**140**	**150**

Based on the above factors, the study area is rated as having a low visual sensitivity. This is mainly due to the transformation and degradation of the landscape as a result of human activity in conjunction with a low density of sensitive receptor locations and the absence of tourism facilities or other sites of cultural significance.

The relatively low degree of visual sensitivity of the area under the current baseline is an important factor that has a bearing on the likely visual impacts that would be associated with the proposed PV Plant.

8.4.3 Sensitive Receptor Impact Rating

In order to assess the impact of the proposed development on the sensitive receptor locations listed above, a matrix that takes into account a number of factors has been developed (Table **22**), and is applied to each receptor location.

The matrix has been based on a number of factors as listed below:

- Distance of receptor away from the proposed development (distance banding)
- Primary focus / orientation of the receptor
- Presence of screening factors (topography, vegetation etc.)
- Visual character and sensitivity of the surrounding area
- Visual contrast of the development with the landscape pattern and form

These factors are considered to be the most important factors when assessing the visual impact of a proposed development on a sensitive receptor in this context. It must be remembered that the experiencing of visual impacts is a complex and qualitative phenomenon, and thus difficult to accurately quantify; thus the matrix should be seen as a representation of the likely visual impact at a receptor location.

Table 22: Visual assessment matrix used to rate the impact of the development on sensitive receptors

	VISUAL IMPACT RATING			
VISUAL FACTOR	**HIGH**	**MEDIUM**	**LOW**	**OVERRIDING FACTOR: NIL**
Distance of receptor away from proposed development	0 ≤ 1km **Score: 3**	1km ≤ 2km **Score: 2**	2km ≤ 5km **Score: 1**	5km < (outside of the study area)
Primary focus / orientation of receptor	'Arc of view' directly towards the proposed development **Score: 3**	'Arc of view' partially towards the proposed development / no primary orientation **Score: 2**	'Arc of view' in opposite direction of the proposed development **Score: 1**	
Presence of screening factors	No screening factors – development highly visible **Score: 3**	Screening factors partially obscure the development **Score: 2**	Screening factors obscure most of the development **Score: 1**	Screening factors completely block any views towards the development, i.e. the development is not within the viewshed
Visual character and sensitivity of the area / surrounding views	**Scenic:** Highly natural; almost no visually 'degrading' factors, the area is valued for its scenic quality and is **highly sensitive to change** **Score: 3**	**Rural / pastoral:** Mostly natural with typical rural infrastructure present, the area is valued for its uninhabited nature and is **potentially sensitive to change** **Score: 2**	**Transformed:** Presence of industrial-type infrastructure (e.g. urban areas and outlying residential areas), not highly valued and **not sensitive to change** **Score: 1**	
Visual Contrast	**High contrast** with the pattern and form of the natural landscape elements (vegetation and land form), typical land use and/or human elements (infrastructural form) **Score: 3**	**Moderate contrast** with the pattern and form of the natural landscape elements (vegetation and land form), typical land use and/or human elements (infrastructural form) **Score: 2**	**Corresponds** with the pattern and form of the natural landscape elements (vegetation and land form), typical land use and/or human elements (infrastructural form) **Score: 1**	

Categories of impact:

High Visual Impact = 13-15

Medium Visual Impact = 9 -12

Low Visual Impact = 5-8

As described above, distance of the viewer / receptor location away from the development is an important factor in the context of experiencing of visual impacts. A high impact rating has thus been assigned to receptor locations that are located within 1km of the proposed development. Beyond 5km, the visual impact would be virtually nil, as the development would appear to merge with the elements on the horizon. Any receptor location beyond this distance has therefore been assigned an overriding nil impact rating. As such, despite the impact rating assigned to the other visual factors, the overall impact rating would remain nil, as the proposed development would not visually influence any receptors located more than 5km from the development. Where a receptor is located within more than one distance band, such as a receptor road, it is assigned the score according to the closest distance it will get from the proposed development i.e. the highest visual impact experienced.

The orientation of a receptor becomes important in many cases, as the receptor location is typically oriented in a certain direction, e.g. with views towards a certain area from a highly frequented area like a porch or garden. The visual impact of a development could thus be potentially much greater if the development intruded into such a view, and thus the highest rating has been given to a situation where the development would cross directly across an 'arc of view / orientation' – i.e. the 180^{o} panorama in a certain direction. Where the receptor does not have a primary orientation, such as a residential community where the dwellings are focused in different directions, it has been assigned a medium rating.

The presence of screening factors is equally important in this context as the distance away from the development. Screening factors can be vegetation, buildings, as well as topography. For example, a grove of trees located between a receptor location and an object could completely shield the object from the receptor. Topography (relative elevation and aspect) plays a similar role as a receptor location in a deep or incised valley will have a very limited viewshed and may not be able to view an object that is in close proximity, but not in its viewshed. As such, the complete screening of the development has also been assigned an overriding nil impact rating, as the development would not impose any impact on the receptor.

The visual character of the surrounding area and views is also considered in the matrix, as introducing a development into a natural area may adversely affect or degrade scenic views experienced by receptors. Although pastoral' or rural landscapes often have a relative density of anthropogenic (human) infrastructure (e.g. fences, centre pivots, buildings such as barns and farmhouses), views of these landscape are often perceived as sensitive to visual impacts, particularly to visual impacts of more industrial or large-scale infrastructure. A moderate rating is thus assigned to the visual character of these views. Transformed industrial landscapes have been assigned a low impact rating as a new development is unlikely to be regarded as negative within this context.

The visual contrast of a development refers to the degree to which the development would be congruent with the surrounding environment. It is based whether or not the development would

conform to the land use, settlement density, structural scale, form and pattern of natural elements that define the structure of the surrounding landscape. The visual compatibility is an important factor to be considered when assessing the impact of the development on receptors within a specific context. A development that is incongruent with the surrounding area could have a significant visual impact on sensitive receptors as it may change the visual character of the landscape.

It should be noted that this rating matrix is a relatively simplified way to assign a likely representative visual impact, which allows a number of factors to be considered. Part of its limitation lies in the quantitative assessment of what is largely a qualitative or subjective impact.

The tables below present the results of the visual impact matrix.

Table 23: Visual impact of the proposed PV plant on Dennilton residential suburb

VISUAL FACTOR	RATING
Distance of receptor away from proposed development	**LOW:** The receptor is located approximately 4.2km from the proposed buildable area.
Primary focus / orientation of receptor	**MEDIUM:** Residential community with varying orientation.
Presence of screening factors	**MEDIUM:** Existing vegetation and built infrastructure would partially obscure views of the PV site.
Visual character and sensitivity of the area / surrounding views	**LOW:** Dennilton is a small local service centre with a fairly low density of residential development. Landscape quality in the town and in the residential areas appears to be fairly degraded and the view towards the development reflects a largely undeveloped, but transformed peri-urban landscape in various stages of degradation.
Visual Contrast	**MEDIUM:** The receptor's immediate surrounds are largely transformed by urban development, but the view towards the development shows scattered buildings and some linear infrastructure interspersed with grassland and trees. The PV panels may be partially obscured by the existing vegetation, but the development is still likely to appear as a dark grey mass or 'blanket' contrasting with the relatively uniform flat landscape.

Dennilton is a very small town with some low intensity business activity. It is possible that receptors in this area may associate the proposed development with employment creation and potential economic growth in the area. As such they are not likely to associate the development with any negative visual impacts.

Figure 31: View south from Dennilton *(Google Street View 2013)*

Figure 32: View south east from Dennilton *(Google Street View 2013)*

Table 24: Visual impact of the proposed PV plant on Ga-Ngolvane/Phukukane residential community

VISUAL FACTOR	RATING
Distance of receptor away from proposed development	**LOW:** The receptor is a residential community covering a fairly large area, but at its closest point is approximately 2.7km from the proposed buildable area.
Primary focus / orientation of receptor	**MEDIUM:** Residential community with varying orientation.
Presence of screening factors	**MEDIUM:** Existing vegetation and built infrastructure would partially obscure views of the PV site.
Visual character and sensitivity of the area / surrounding views	**LOW:** This is a residential community with a fairly low density of residential development. Landscape quality in the town and in the residential areas appears to be fairly degraded and views towards the development reflect a largely undeveloped, but transformed peri-urban landscape in various stages of degradation.
Visual Contrast	**MEDIUM:** The receptor's immediate surrounds are largely transformed by urban development, but the view towards the development shows scattered buildings and some linear infrastructure interspersed with grassland and trees. The PV panels may be partially obscured by the existing vegetation, but the development is still likely to appear as a dark grey mass or 'blanket' contrasting with the relatively uniform flat landscape.

This area is essentially a rural settlement with relatively poor quality built infrastructure and a high degree of landscape degradation. It is possible that receptors in this area may associate the proposed development with employment creation and potential economic growth in the area. As such they are not likely to associate the development with any negative visual impacts.

Figure 33: View south from main road through Phukukane *(Google Street View 2013)*

Figure 34: Landscape degradation in Phukukane *(Google Street View 2013)*

Table 25: Visual impact of the proposed PV plant on Metshipe residential community

VISUAL FACTOR	RATING
Distance of receptor away from proposed development	**N/A:** The receptor lies outside the viewshed for the proposed development.
Primary focus / orientation of receptor	**NIL:** The receptor lies outside the viewshed for the proposed development.
Presence of screening factors	**N/A:** The receptor lies outside the viewshed for the proposed development.
Visual character and sensitivity of the area / surrounding views	**N/A:** The receptor lies outside the viewshed for the proposed development.
Visual Contrast	**N/A:** The receptor lies outside the viewshed for the proposed development.

Table 26: Visual impact of the proposed PV plant on Farm Dwellings (East)

VISUAL FACTOR	RATING
Distance of receptor away from proposed development	**HIGH:** The receptor is an isolated cluster of houses approximately 450m from the proposed buildable area.
Primary focus / orientation of receptor	**MEDIUM:** Cluster of dwellings with varying orientation.
Presence of screening factors	**MEDIUM:** Existing vegetation and built infrastructure would partially obscure views of the PV site.
Visual character and sensitivity of the area / surrounding views	**MEDIUM:** This receptor location essentially comprises dwellings and ancillary infrastructure associated with rural pastoral environments. Views towards the development reflect a largely undeveloped, but transformed landscape in various stages of degradation.

Visual Contrast	**MEDIUM:** The PV panels may be partially obscured by the existing vegetation and built infrastructure, but the development is still likely to contrast with the surrounding landscape, appearing as a dark grey mass or 'blanket' contrasting with the relatively uniform flat landscape. The impact of this contrast is however reduced by the degree of degradation in the landscape due to human activities.

The poor quality of the buildings in this area and landscape degradation would suggest high levels of poverty and generally poor living conditions. It is therefore possible that receptors in this area could regard the proposed development in a positive light as it could result in employment creation and economic growth in the area.

Figure 35: Poor quality buildings east of the development site

Figure 36: Dwellings east of the development site

Table 27: Visual impact of the proposed PV plant on Phooko Agricultural Holdings

VISUAL FACTOR	RATING
Distance of receptor away from proposed development	**HIGH:** The receptor is an area of agricultural holdings covering a fairly large area, but at its closest point is approximately 800km from the proposed buildable area.
Primary focus / orientation of receptor	**MEDIUM:** Dwellings with varying orientation.
Presence of screening factors	**MEDIUM:** Existing vegetation and built infrastructure would partially obscure views of the PV site.
Visual character and sensitivity of the area / surrounding views	**MEDIUM:** This receptor location essentially comprises dwellings and ancillary infrastructure associated with peri-urban smallholdings. Views towards the development reflect a largely undeveloped, but transformed peri-urban landscape in various stages of degradation.
Visual Contrast	**MEDIUM:** The PV panels may be partially obscured by the existing vegetation and built infrastructure, but the development is still likely to contrast with the surrounding landscape, appearing as a dark grey mass or 'blanket' contrasting with the relatively uniform flat landscape.

	The impact of this contrast is however reduced by the degree of degradation in the landscape due to human activities.

Figure 37: View of screening vegetation in Phooko Agricultural Holdings

Figure 38: View of screening vegetation in Phooko Agricultural Holdings

Table 28: Visual impact of the proposed PV plant on Mabusa Nature Reserve

VISUAL FACTOR	RATING
Distance of receptor away from proposed development	**HIGH:** The receptor is a nature reserve which extends well beyond the study area, but is located directly adjacent to the application site and forms its southern border.
Primary focus / orientation of receptor	**LOW:** Areas of the nature reserve which are inside the viewshed are unlikely to orientate towards the proposed development.
Presence of screening factors	**LOW:** Existing wooded vegetation and topography would obscure most views of the PV site from large portions of the nature reserve.
Visual character and sensitivity of the area / surrounding views	**MEDIUM:** This receptor itself is a nature reserve characterised by a highly natural landscape and little degradation. Views towards the development however reflect a largely undeveloped, but transformed peri-urban landscape in various stages of degradation which is less sensitive to change.
Visual Contrast	**HIGH:** The PV panels may be partially obscured by the existing vegetation and topography, but the development is still likely to contrast with the surrounding natural landscape, appearing as a dark grey mass or 'blanket' contrasting with the relatively uniform flat landscape.

Figure 39: Typical vegetation and topography in the Mabusa Reserve *(Google Street View, 2013)*

Table 29: Visual impact of the proposed PV plant on the R25

VISUAL FACTOR	RATING
Distance of receptor away from proposed development	**HIGH:** The receptor is a section of the R25 main arterial route which falls within the viewshed for the PV site. At its closest point, the road is approximately 620m from the buildable area.
Primary focus / orientation of receptor	**MEDIUM:** The road does not have a primary focus/orientation.
Presence of screening factors	**LOW:** Existing vegetation, topography and built infrastructure would obscure most views of the PV site from the road.
Visual character and sensitivity of the area / surrounding views	**MEDIUM:** Views towards the development however reflect a largely undeveloped, but transformed peri-urban landscape in various stages of degradation.
Visual Contrast	**MEDIUM:** The PV panels may be partially obscured by the existing vegetation and topography, but the development is still likely to contrast with the surrounding landscape, appearing as a dark grey mass or 'blanket' contrasting with the relatively uniform flat landscape. The impact of this contrast is however reduced by the degree of degradation in the landscape due to human activities.

Figure 40: View towards application site from R25 *(Google Street View, 2015)*

A summary of the above impact ratings are provided in the summary table below.

Table 30: Visual impact of the proposed solar plant on receptor locations - summary and results

Potentially Sensitive Receptor Location	**Distance**	**Orientation**	**Screening**	**Character / Sensitivity**	**Contrast**	**OVERALL IMPACT RATING**
Dennilton Residential Suburb	Low (1)	Medium (2)	Medium (2)	Low (1)	Medium (2)	**LOW (8)**
Ga-Ngolvane/ Phukukane Residential Community	Low (1)	Medium (2)	Medium (2)	Low (1)	Medium (2)	**LOW (8)**
Metshipe Residential Community	N/A		Nil	N/A		**NIL (0)**
Farm Dwellings (East)	High (3)	Medium (2)	Medium (2)	Medium (2)	Medium (2)	**MEDIUM (11)**
Phooko Agricultural Holdings	High (3)	Medium (2)	Medium (2)	Medium (2)	Medium (2)	**MEDIUM (11)**
Mabusa Nature Reserve	High (3)	Low (1)	Low (1)	Medium (2)	High (3)	**MEDIUM (10)**

Potentially Sensitive Receptor Location	Distance	Orientation	Screening	Character / Sensitivity	Contrast	OVERALL IMPACT RATING
R25	High (3)	Medium (2)	Low (1)	Medium (2)	Medium (2)	**MEDIUM (10)**

8.5 Heritage

The Heritage Assessment was conducted by Wouter Fourie and is included in Appendix 6E. The fieldwork identified 14 heritage finds. The following sections list and describe the finds and sites.

8.5.1 Archaeological

Site Number	Lat	Lon	Type Find	Description	Significance	Heritage Rating
NK09	E29.133	S25.308	Site	Iron Age pottery scatter	Low	4B

A low-density scatter of potsherds and some iron slag (NK09) was found to be concentrated just east of the road that runs between Phookwane hill and the south-western boundary of the study area. Although the finds were sporadic, it must be seen as significant if the position of the archaeological site on Phookwane hill is taken in to account. The site extent is over an area of 50x50 meters

- Mitigation

Monitoring by an archaeologist will be required during construction.

Figure 41: View of area where pottery and slag was found

8.5.2 Cemetery

Site Number	Lat	Lon	Type Find	Description	Significance	Heritage Rating
NK01	E29.1417	S25.3040	Site	Cemetery containing 11 -12 graves	High	3A

NK01 is s cemetery situated just outside the development area on the eastern side of the current access road to the property. The site consist of a cemetery with 11 possibly 12 graves of the Malibe/Malebe/Malabye family. The grave date between 1969 and 2013, with all having granite headstones and dressing (Figure 42).

Figure 42: View of the partially fenced cemetery

8.5.3 Historical

Ten heritage sites (Table 31) of historical significance were identified during the fieldwork. The twelve sites are all homestead consisting of one to three multi room mud brick structures. Two of the homesteads (NK02 and NK03) are still utilised and is very well kept and in good condition. The remaining eight sites are all ruined and of low heritage value.

During the field work only one person was found at home (NK02). Mr Simon Mabilane indicated that he has been residing on the property for the last 30 years. He also indicated that he was only aware of one cemetery (NK01)

Although Mr Mabilane gave no indication of other graves or burials, ethnographical evidence (Cocks, et al., 2006) and personal experience over years of fieldwork has indicated that the possibility of stillborn burials in and around African homesteads does occur.

Table 31: Historical Sites

Site Number	Lat	Lon	Type Find	Description	Significance	Heritage Rating
NK02-03	E29.1310	S25.2991	Site	Homestead with extended outbuildings	Medium	4A
 **Figure 43: View of main house facade (NK03)**				 **Figure 44: Homestead with Mr Simon Mabilane (NK02)**		
NK04	E29.1326	S25.3052	Site	Ruined African homestead	Low	4B
 **Figure 45: Northern facade of mud brick ruin**				 **Figure 46: painted motif on wall**		
NK05	E29.1328	S25.3075	Site	Ruined African homestead	Low	4B
 **Figure 47: Northern façade of mud brick ruin**				 **Figure 48: Back porch of ruin**		
NK06	E29.1335	S25.3088	Site	Ruined African homestead	Low	4B

Figure 49: mud foundation of ruin visible

NK07	E29.1337	S25.3097	Site	Ruined African homestead	Low	4B

Figure 50: Granite monument in the memory of AJ Nel (one of the previous owners of the farm)

NK08	E29.1342	S25.30693	Site	Ruined African homestead	Low	4B

Figure 51: Remains of mud brick structure

NK10	E29.1288	S25.3028	Site	Ruined homestead	Low	4B

Figure 52: Ruin of farm house in western section of study area

NK11	E29.1379	S25.3077	Site	Ruined African homestead	Low	4B

Figure 53: Low mud walls just visible in grass

NK12	E29.13820	S25.30889	Site	Ruined African homestead	Low	4B

Figure 54: Remains of mud brick walls on southern boundary of study area

NK13	E29.1376	S25.3089	Site	Ruined African homestead	Low	4B

Figure 55: Remains of large mud brick house

NK14	E29.1359	S25.3073	Site	Ruined African homestead	Low	4B

8.6 Socio Economic

The socio economic assessment was conducted by Elena Broughton and is included in Appendix 6F.

The primary land use profile of the project site consists of subsistence farming, crop and livestock farming, and tourism. No one lives permanently on any of the farms that include the proposed project site. The table below presents the land use and socio-economic profile of the farms that form part of the proposed project.

Table 32: Land use and socio-economic profile of the farms making up the proposed project site

Affected Farms	Predominant land use	Residents	Employees	
			Male	Female
Part of Portion 182 of Kikvorschfontein 57 (70 ha)	Livestock (11 Ngunis cattle) and subsistence crop farming (maize field)	0	1 (seasonal and part-time)	0
Part of Remainder 183 of Kikvorschfontein 57 (50 ha)	Livestock farming (20 cows) for private use	0	0	0
Portion 191 of Kikvorschfontein 57 (42 ha)	No farming activities	0	0	0
Portion of Kikvorschfontein 57 (30 ha)	No farming activities	0	0	0

As seen in Table **32**, economic activities are limited on these portions with only subsistence livestock farming for private use happening on Portion 182 and Remainder 183. It is envisaged that grazing for livestock on parts of Portion 182 (70 hectares) and Remainder 183 (50 hectares), where some of the solar panels are to be erected will no longer be possible during construction and operation of the plant; thus impacting negatively on livestock farming. Indeed, grazing for the 11 Ngunis cattle (Portion 182) and 20 cows (Remainder 183) will only be possible on the remaining parts of the respective portions, which are not included in the project, leaving limited space for the cattle to graze. However, grazing on the parts of the farms used for the project could resume following the closure and rehabilitation. As there are no residents living on the proposed project site, no one will have to be relocated. Employment and revenue loss is also limited due to the small-scale farming activities on the proposed site.

8.6.1 Assumptions regarding surrounding area

The following table shows the predominant land use and socio-economic profile of the farms adjacent to the project site.

Table 33: Land use and socio-economic profile of the farms adjacent to the proposed project site

Adjacent farms	Predominant land use	Residents	Employees	
Part of Portion 182 of Kikvorschfontein 57 (60 ha)	Livestock (11 Ngunis cattle) and crop farming for private use	6 living in two houses	1 (part time and seasonal)	0
Part of Remainder 183 of Kikvorschfontein 57 (26 ha)	Livestock farming (20 cows) and crop farming for private use	40 residents living in 6 houses	0	0
Mabusa Game Reserve	Game reserve and tourist resort (lodge is located 15 km from the proposed site)	15 (sleep at the reserve when they are on duty)	10	4
Farm (unknown reference and size)	Crop and livestock farming for private use: four cows and vegetables	1	0	0
Two portions adjacent to portion 57 (80 ha approx.)	No farming activities; there is a house on this portion but no one lives there at the moment	0	0	0

As presented in Table 33, no one lives permanently on the directly affected land portions. Only one person is employed on a part-time basis to watch the 11 Ngunis on Portion 182 of Kikvorschfontein 57. As seen above, subsistence livestock farming is currently undertaken on both parts of Portion 182 of Kikvorschfontein 57, and while this activity will be reduced because of the power plant it will not completely stop. The temporary employee might therefore keep his job during the life-span of the solar plant. From Table 33, it also emerges that economic activities on the adjacent farms are limited and mainly consist of subsistence farming. It is envisaged that agriculture activities on these farms will not be affected during construction and operation of the solar plant because of limited environmental impacts.

8.6.2 Feedback received from interviews

The establishment of the proposed solar PV plant will be associated with positive impacts related to expenditure on construction and operating activities that generally lead to production, employment, and income earning benefits. However, there will also be negative socio-economic effects including visual transformation and changing living standards. It is expected that there will be noise and dust pollution during construction of the facility, and the landscape will also be modified. This could have negative effects on the quality of life of the people living there, as the concerned community is used to a quiet rural life.

Based on the interviews conducted, only one respondent raised the issue of increased influx of people that could lead to more noise and criminality; but the owner of one of the farms also thought that with appropriate security measures this risk could easily be mitigated. The other respondents only pointed to the positive impact of the project in terms of employment opportunities, especially for the youth, which shows general support of the project by the land owners in the surrounding area. One respondent even stressed that the community living in the proposed project area wishes to interact more with people and see their community develop.

Local government officials responsible for Environmental Management, Integrated Development Plan (IDP) and Local Economic Development (LED) at the Elias Motsoaledi Local Municipality also dwelled on the envisaged positive impacts of the project and highlighted the potential for job creation, development, revitalisation of the area, energy sources diversification, increased knowledge of new technologies, and training opportunities. The person in charge of environmental management at the municipality stressed the importance of safety measures to guarantee environmental protection.

Regarding the adjacent Mabusa Nature Reserve situated in Mpumalanga, the proposed solar PV plant could also have negative impacts on its economic activities. However, as the main economic activity is concentrated in the Zithabiseni tourist resort, which is located about 15km away from the proposed site, it is expected that the visual impact or noise disturbance associated with the project establishment will be limited, even non-existent. Nevertheless, the manager of the reserve raised some concerns about the animals living in the northern part of the reserves that borders the proposed project site, which could be disturbed by the project and possibly poached.

8.6.3 Temporary increase in production

Establishment of the proposed solar PV project will be associated with numerous capital expenses. Considering the latest local content requirements, the achievement of the local content threshold is only possible by localising expenses of Balance of the Plant and importantly procurement of solar PV panels assembled in South Africa and in some instances even solar PV mounting systems. Expenses on Balance of Payment would usually include expenditure on transport and erection of solar PV modules, electrical and grid connection, foundation, and civil works. If goods and services are procured locally, i.e. within South Africa, it increases the production of the respective industries, which has a positive impact on the national economy and economies of the municipalities where inputs are procured. The expected minimum localised capital investment of R533 000 (2014 prices) required for the construction of the proposed project will, therefore, stimulate the national economy. The size of the Elias Motsoaledi LM's economy was estimated at R8 058 million in 2013 prices. It is difficult to comment on the percentage of procurement that will take place locally; it can however, be assumed that local businesses will benefit from sub-contracting opportunities, consumer

expenditure of the construction crew, and an increase in income of locals who are directly employed in the construction activities or benefit from the project through local procurement.

Nokukhanya (the project developer) indicated that it would develop a database of local Black Economic Empowerment (BEE) service providers and ensure that they are informed of tenders and job opportunities. It plans to identify and involve small businesses to supply products that are locally made and accessible. To this end, Nokukhanya envisages to introduce database registration methods to approve suppliers using the procurement policy to accommodate Small, Micro, and Medium Enterprises (SMME) and BEE service providers. Suppliers will be required to complete a profile evaluation form, which will contain a statement of their ownership/control and internal Black Empowerment Programme. Areas that will receive specific attention during this evaluation are: black ownership, black management, size of the enterprise relating to turnover and staff, purchases from HDSA suppliers, percentage female management and percentage disabled people employed. It is important to note that in this accreditation process quality, service, and health and safety requirements as prescribed by the Nokukhanya Procurement Policy will play a pivotal role in the acceptance of any supplier as a Nokukhanya vendor.

Based on the experience and knowledge of other solar PV studies undertaken by Urban-Econ, it is envisaged that there will be a significant increase in local business sales over the construction period resulting directly from the envisaged construction activities and as a result of production and consumption induced impacts. It is expected that a great share of the increase in new business sales will be a result of indirect effects such as an increase in sales of companies providing products and services to contractors and engineers involved in construction of the solar PV plant. It is no surprise that the manufacturing sector will be the biggest beneficiary when considering the extent of goods and services required for the development of the solar plant, which could potentially be sourced in South Africa and which could include assembles solar PV panels and mounting systems among others.

In addition to the direct and indirect impacts resulting from the initial capital investment, construction of the solar PV plant will result in significant consumption induced increases in new business sales. The construction activities will lead to the creation of new employment opportunities through direct and indirect effects, which will in turn increase income levels of the respective households, thereby driving household consumption upwards. The largest growth in new business sales will be experienced by the manufacturing, trade and accommodation, transport, and business services sectors. Some of these effects are expected to be localised in the Elias Motsoaledi LM, as workers employed during the construction phase will create demand for accommodation, local transport services, trade, and personal services.

8.6.4 Temporary stimulation of GDP-R

The initial capital injection will set-off a value-adding activity, leading to a positive impact on the Gross Domestic Product per Region (GDP-R), or increasing the total value of all “final” goods and services produced within the borders of the country during a year. Also, there will be an increase

in employment as a result of the construction activities that will entail increase in GDP-R in the country as a result of consumption induced effects in addition to the direct and indirect impacts. Sectors that will experience the largest temporary growth in value added as a result of this investment will include the manufacturing industry, the trade, transport, finance, and business services sectors.

It is difficult to comment on the spatial distribution of the economies likely to benefit. It can, however, be assumed that the majority of value-added will be created across South Africa; the Elias Motsoaledi LM economy will experience some benefits chiefly related to expenditure incurred by the contractors while working on the construction of the solar PV plant such as expenses on transport, accommodation, and personal services.

8.6.5 Temporary employment creation

The establishment of the solar PV plant is expected to create about 365 Full-time Equivalent (FTE) jobs over the construction period (refer to Chapter 4 for the definition of FTE jobs and assumptions). It is envisaged that 80% of the employment opportunities created as a result of direct impacts will be filled by suitable individuals from local communities; spatial distribution of the employment created through indirect and induced effects is likely to be predominantly spread throughout South Africa.

According to the official statistics, the Elias Motsoaledi LM had 23 920 unemployed individuals in 2011. It is envisaged that 292 job opportunities (i.e. 80% of 365 FTE jobs) will be made available to individuals from within the municipality. On average, about 243 workers (i.e. 365 FTE jobs divided by 1.5 year period) is expected to be on site during any time of the construction period, which means that the project will have the potential to reduce unemployment in the municipality for a temporary period provided that the local unemployed individuals will be suitable and willing to work on site.

It is expected that the sectors with the largest expected growth in temporary employment during the construction period will be construction, manufacturing, trade and accommodation, agriculture, and transport, with the construction and manufacturing industries making a significant contribution to the expected growth in employment over the period.

8.6.6 Impact on skills development

Establishment of the PV plant gives way to a host of skills transfer and skills development opportunities particularly for the labour force in the local municipality. By the time the Nokukhanya PV plant is established, over 30 solar PV plants will already be constructed in the country considering the approved projects under Bid Windows 1, 2, and 3. This means that the local expertise to build such facilities will already be established. However, the development of the project in the Elias Motsoaledi LM will allow for the transfer of construction-related skills to the local

communities. This will increase the employability of the local labour and their chances of finding employment opportunities on similar projects or other construction projects. Furthermore, the project developer plans to provide training programmes, including solar PV technical skills and installation, and general business management. Finally, people employed at businesses along the supply chain will also benefit from this activity as they will be offered an opportunity to extend their skills base, which means that the impact on skills development will be extend beyond the boundaries of the municipality.

8.6.7 Impact on household income

The creation of approximately over 365 FTE person-years over the construction period will lead to an expected increase in households' earnings. Based on previous solar PV studies, those employed in the construction and manufacturing industries are likely to receive the largest portion of the increased income earnings. Other sectors benefitting from the construction activities will include transport, trade and accommodation, financing, and community, and government services. This increase in household income, although temporarily, will result in an increase in the standard of living of the benefitting households.

Although it cannot be stated conclusively what portion of the income attributable to production and consumption induced impacts will be enjoyed by local households, it can be assumed that there will be some earnings from these impacts since those working on the construction of the plant, even if not local community members, will rely on local businesses to provide personal services.

8.6.8 Increase in government revenue due to the capital investment

The proposed solar PV plant's construction phase is expected to last 18 months; during this time companies and workers will earn income and pay government taxes such as payroll and income taxes. In addition, the increased spending power will translate into more purchases, which should increase the Value Added Tax base for government.

Although the spending of the money earned by government through tax collection is difficult to associate with a specific budget item, any revenue received by government is allocated towards certain budget items, provinces or local municipalities to support and assist with the improvement of their service delivery. Thus, this revenue will most likely be spent on improving socio-economic conditions of the population one way or another.

8.6.9 Temporary increase in crime and social conflicts associated with influx of people

Any significant construction project tends to attract job seekers and migrants to the area. The influx of job seekers and migrant construction workers can lead to the creation of social disturbances and conflicts in the local economy, including increase in crime around the site (for example, poaching

of game livestock) and elsewhere in the community (for example, burglaries, assaults, etc.), adverse health impacts, xenophobia, and other social conflicts.

The significance of such impacts is dependent on the proportion of workers that are brought from outside the area, on the socio-economic conditions observed in the local economy, and to a certain extent on the approach adopted by the developer with respect to accommodation of workers (i.e. on-site or amongst local communities). The bigger the number of migrant workers used in the construction and the larger the project attracts job seekers, the greater the chances are for occurrence of social conflicts.

The construction crew on site is estimated to comprise of about 243 workers (i.e 365 FTE jobs divided by 1.5 years of work), of who a significant number will be unskilled and semi-skilled workers and the rest skilled workers. The local economy of Elias Motsoaledi is relatively small and is not sufficiently diversified to supply the entire work force for the construction of the facility. The project owner plans to hire as many people from the local communities as feasible, i.e. 80% of jobs are expected to be created within the local community. Some skilled workers will probably be also found in these communities as the local construction sector is small but yet employed about 7 326 people back in 2011. This, though, means that some construction workers will still have to move to the area from other areas in the province and the country to work on site. In addition to the people who will come from outside the area and contracted to work on the project, the facility will probably attract job seekers from various parts of Limpopo and Mpumalanga and possibly the rest of South Africa.

All of the above suggests that the construction of the solar PV plant could attract a notable number of people to the area inclusive of workers and job seekers, which could lead to a number of social conflicts and result in an increase in the crime situation as described below.

The movement of construction workers from outside the nearby communities could result in social conflicts between the local population and the migrant workers, as the former could perceive the latter stealing the employment opportunities in the area that are already in short supply in the local municipality. Influx of people into the area, especially job seekers, could further lead to a temporary increase in the level of crime, prostitution, and possibly deterioration of health amongst the local communities due to the spread of sexually transmitted diseases. The issue of semi-skilled and unskilled construction workers and job seekers who would migrate to the area from outside local communities and who would decide to stay in the area after the project's establishment is another concern. Left without income, these individuals could resolve to crime and contribute to the increase in the level of poverty in the local communities.

The influx of job seekers and social conflicts associated with immigration of temporary workers is difficult to mitigate; however, appropriate awareness campaigns and strict adherence to the recruiting practices could potentially reduce the adverse effects. In any case, addressing the challenges related to potential social impacts is best to be done in partnership with the

stakeholders, specifically the adjacent and surrounding property owners, local communities, councils, and municipal authorities. This would promote transparency, information sharing, and build good relationships among the parties. In addition, all opportunities that would assist in engaging the community into the project should be investigated and if feasible should be realised. This specifically refers to employing the community in providing ancillary services (i.e. transportation and catering) to the project, which could eliminate the potential alienation of the local people towards the project as well as migrant workers.

The project developer plans that as the majority of employees will come from the community or nearby towns they will reside in their homes, whereas the rest of the workers coming from outside the nearby communities will stay in guest houses around the area to support local business and the hospitality service. The installation of a camp on-site is not envisaged by the developer but if the need arises, a camp including accommodation, food catering, medical and alcohol screening, and sanitation facilities will be constructed. Furthermore, due to the location of the project and the size of the project, the influx of job seekers is not expected to be as high as for example would have been expected if the mine were to be established in the area. This means that the possibility of conflicts among the local population and migrants to the area (including construction crew and job seekers) will be relatively limited.

Given the above, it is therefore expected that the movement of people to the area is not expected to be of great significance, although the movement of people between the local communities and project site will most likely increase drastically during the construction period. Theft of livestock and increase the incident of burglaries in the area will therefore be among the greatest concerns in this instance. The manager of the Mabusa Nature Reserve expressed some concerns about the animals (mainly kudus) living in the northern part of the reserve adjacent to the project site. It was noted that some parts of the fence separating the reserve from the project site have been damaged, implying that some poaching may occur of the area sees a greater presence of people particularly those who would not be able to find employment on site. In order to mitigate this risk the project developer could discuss with the reserve manager and ensure that all the damaged fences shared by the project site properties with the nature reserve property are repaired or replaced.

Strict control over the movement of workers during the working hours and outside working hours will also need to be exercised by the developer to ensure the security of the people residing and visiting the farms in the area. Furthermore, strict access control will need to be exercised to eliminate the unauthorised movement of people not only to the site but also to the nearby properties.

8.6.10 Deterioration of living conditions due to change in sense of place and influx of people

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. While a community living in poverty would be more accepting to the industrial development that would promise new employment opportunities, a more affluent residential area would most likely oppose to such intrusion, as it would not be associated with any gains to that community.

The area under analysis is rural. The R25 is relatively close to the project site but far enough for noise levels to be very low. Noise and light intrusion during night are very low in the area. Aside from a farmstead in the area, observed built infrastructure includes transmission lines and unpaved roads.

The establishment of the solar PV plant is expected to increase noise levels in the area during day-time largely due to movement of vehicles on the regional and access roads and possibly create light intrusion at night in the zone of influence. This will alter the way the surrounding environment is experienced by local residents within the zone of influence. As construction activities advance and the footprint of the facility as well as the built area of the solar PV plant grows, the visual impact will also become more apparent and the sense of place experienced by households residing within the visually affected area will become more altered.

Farms directly adjacent to the proposed site will experience the biggest change in the sense of place. Farms located further away may be less affected as far as noise and light intrusion are concerned but could still experience the change in the sense of place due to visual disturbances. Considering the noise and visual zones of influences, it is predicted that over 45 people living on the nearby farms will be affected by both noise and visual effects. However, as mentioned previously, concerns about noise levels, movement of people and vehicles and changing environment were very low among the people interviewed.

8.6.11 Increased pressure on local government to provide housing, services delivery and adequate economic and social infrastructure

The construction of the solar PV plant will put some pressure on both economic and social infrastructure in the local economy. The establishment of the proposed facility will increase the traffic along the R25 road, which could lead to the deterioration of the road infrastructure and require greater expenditure on road maintenance by the municipality.

Influx of people to the area and employment of construction workers from outside the local communities can increase the demand for community and social services such as health and recreational facilities; however considering that the majority of construction workers will most likely be sourced from the local communities, the extent of the pressure on social infrastructure will largely be dependent on the number of people that move into the community in hope to find

employment; given that 80% of the jobs are planned to be filled by local labour, the pressure on social infrastructure is not expected to increase significantly.

8.6.12 Sustainable increase in production and GDP-R due to operations

Once operational, it is estimated that the proposed PV facility will generate an annual turnover of R123.9 million. In the process of generating this income, inputs from a variety of sectors such as the financing, business services, transport, utilities, and community and government services sectors will be purchased. In addition to the new business sales created each year directly attributable to the proposed project, new business sales will also be generated as a result of indirect and induced effects.

Due to the fact that the economy of the Elias Motsoaledi LM is quite small and relatively undiversified it is reasonable to assume that a significant portion of the inputs required will be procured from outside, which means that other local economies in the country will benefit from these expenses. Nonetheless, it is estimated that local businesses involved in sectors such as transport, trade, community services, and financing and business services will experience some increase in annual turnover. Nationwide, industries expected to benefit the most from production induced or indirect impacts include the insurance, business activity, and transport industries; while increased consumer spending as a result of increased household income will benefit agriculture, trade, real estate, and health and social services significantly more than the production induced impacts would.

It is important to note though that the production and consumption induced multiplier effects of the project during operations will be relatively small compared to conventional electricity generating industries. This is because the energy source used to produce electricity by the proposed solar PV plant comes free, unlike in conventional power stations where fossil fuels and transportation thereof comprise a significant portion of operating expenditure. As such limited operating expenses are required to marinating operations of solar PV facilities, which further limits the project's multiplier effects. Although the annual operating expenses are expected to be relatively small compared to other utility projects, it is expected that a notable portion of the direct impacts will be accrued in the local economy, thus increasing its output and contributing to its growth albeit of a small percentage.

8.6.13 Sustainable increase in GDP-R of the local, regional and national economies

New business sales, of which a significant share will be the direct result of operations of the proposed solar PV facility, will be generated. The rest will be due to indirect and induced effects. In addition to the utilities sector, it is expected that the biggest overall stimulus will be experienced by the community and government service, business services, transport, and trade and accommodation sectors.

Operations at the solar PV plant will require labour, this creation of direct employment opportunities coupled with the job opportunities created as a result of various multiplier effects is expected to stimulate value-adding activities in the community and government services, financing, and transport industries primarily.

The Elias Motsoaledi LM's economy was valued at R8 058 million in current prices. Considering the envisaged revenue, the project's value added would most likely range between R80 million and R100 million per annum, suggesting that it will increase the local economy by about 1%. The Elias Motsoaledi economy predominantly is a service economy, where much of the growth in recent years attributed to the expansion of sectors such as trade and business and finance sectors. This is though not sustainable, since it means that the economy is largely reliant on local purchasing power for growth. An injection such as the proposed project that entails the growth of the utilities sectors holds great potential for much needed diversification of the Elias Motsoaledi economy.

8.6.14 Creation of sustainable employment positions due to operations

During the operational period, the proposed solar PV plant will create and support about 65 jobs annually over a 25-year-period, which amounts to 1 625 person-years created over the entire operational period. It is envisaged that 80% of these jobs will be occupied by local workers, including 80% by unskilled and semi-skilled workers. The project has the potential to positively impact on the employment situation in the area, although it will not drastically change the unemployment situation in the local municipality. Skilled development programmes planned to be provided by the project owner are also expected to increase the chances of local labour to be employed in skilled and possibly highly skilled positions.

In addition to the direct jobs created by the facility and supported for at least 25 years, additional jobs will be created through production and consumption induced impacts. It should be noted though that some of these jobs might not be new job opportunities but might represent existing jobs that will be retained due to the proposed PV plant operation. The jobs supported by the solar PV plant operation through the multiplier impact will be distributed among various economic sectors particularly agriculture, utilities, financial and business services, manufacturing and community services sectors. Some of these jobs will be supported in the local municipality, depending on where selected services will be procured and where the employees of the plant will come from. This will further assist in improving the local unemployment situation.

8.6.15 Skills development of permanently employed workers at the plant

Establishing and operating the plant will result in improved skills among the staff as the facility will provide training programmes. It should, however, be noted that most of the jobs required to support operations of the plant are unskilled and semiskilled jobs that do not present significant opportunities for skills transfer (i.e. panel cleaners and security personnel). Nonetheless, most of

the required skills during the operational phase will be taught to staff through day-to-day operations, indicating that the facility will contribute to knowledge and skills development of the staff.

8.6.16 Improved standards of living of households benefiting from operations

The new jobs that will be created as a result of operations of the solar PV plant will result in increased household income of benefitting individuals. Sectors expected to receive the greatest stimulus include the finance, government and community services, and business services sectors. It is likely that households benefitting from the increased income as a result of the multiplier effects will be spread across South Africa; however, some of the benefits will be concentrated locally.

In 2014, the majority of households in Elias Motsoaledi earned an income of less than R1 600 per month, including 13.5% who had no income at all. This has put the local authorities' ability to provide basic services and infrastructure under strain. The increase in the local tax base will improve this scenario, leading to the positive effect of the increased employment on living standard of community members being enjoyed by more than just those able to obtain employment.

8.6.17 Sustainable increase in government revenue due to operations

The project, throughout its operations, will contribute to an increase in government revenue through payments of company-related direct and indirect taxes and payroll taxes. This additional income will be used by various constituencies to support provision of public services. This annual contribution will be made over the life of the project.

8.6.18 Local community economic and social development benefits derived from the project operations

Any renewable energy project approved by government under Renewable energy Independent Power Producer Procumbent Programme (Re IPPPP) will need to allocate a certain percentage of its revenue towards socio-economic and enterprise development activities in the local communities. Furthermore, the Community Trust that will probably be set up will also receive certain allocations in the form of dividends that could be used to improve the livelihoods of the beneficiaries. As a result, the proposed PV plant will fund local welfare and community development initiatives that will be directed at uplifting local people, improving their standards of living and assisting them in securing sustainable employment opportunities either through provision of training or development of local enterprises. It is envisaged that the Socio-Economic Development (SED) and Enterprise Development (ED) allocations alone will make about R2.6[2] million available for investment into the local community on an annual basis, which amounts to R65 million to be invested in the local

[2] This figure is calculated based on the estimated projects annual average business sales and the assumption that 1.5% and 0.6% of the revenue are to be allocated towards SED and ED commitments

communities within a 50 km radius from the project site over 25 years. Proper investigation and planning would allow directing these funds to address the most pertinent challenges faced by the communities, which could substantially improve their livelihoods and standard of living.

8.6.19 Impact on the sense of place and deterioration of living conditions in the zone of influence

The alternation of the sense of place in view of the local residents and visitors to the area will start during the construction period. However, the causes, effects and spatial distribution of various environmental impacts taking place during operation will be different in some instances to that taking place during construction, which necessitates a separate analysis of the impact during operations.

Noise and dust pollution is expected to be of a lesser concern during operations compared to the construction phase; although the movement of workers between the communities where they reside and the site will increase traffic on the local roads and increase the noise levels compared to the no-go option. The largest alteration during the operational phase with regard to the sense of place will though be in the form of visual impact during a day and light intrusion during the night. All of these will alter the sense of place of the people living, working, and visiting the area.

As mentioned previously, the interviews with the land-owners and residents in the area revealed that they strongly support the proposed solar PV project being built in the area. Only two of them have raised concerns over possible security issues (theft and poaching) but these risks can significantly been mitigated by taking adequate measures.

The land-owners and residents in the area are willing to sacrifice the change in the sense of place that could be brought by the establishment of a PV plant, suggesting that they do not foresee the impact to be of notable significance but rather focus on the benefits of the project for the community. While not a strong concern for the community at present, it is advisable that all efforts be made to address the drivers to the change of the sense of place, such as visual effects, noise, and night illumination to make them less intrusive.

8.7 Geotechnical

The full Geotechnical Assessment was conducted by Steven Bok and Cecilia Canahai of Jeffares and Green and is included in Appendix 6G.

From a geotechnical perspective, no fatal flaws have been identified on the proposed development. The Geotechnical investigations indicate that adequate founding conditions for the proposed infrastructure occur at relatively shallow depths below ground level over the major portion of the proposed development footprint. However certain geotechnical constraints have been identified. These are discussed in broad terms below.

8.7.1 Potential Geotechnical Constraints

- Compressible Soils with Low Bearing Capacity

Predominantly sandy to fine gravelly soils with “loose” consistencies were observed from surface over the major portion of the proposed development footprint. The thickness of the loose soil horizons was generally thin over the northern and central sections. However the loose soils were found to extend to below the typical founding depth for light structures over the southern section of the proposed development footprint.

- Potentially Collapsible Soils

Soils with an open-voided soil structure, typically associated with collapsible soils, were observed in a number of trial pits. As such, collapse settlement may be problematic for foundations.

Laboratory testing must be undertaken in order to further assess the potential for collapse settlement prior to design of the infrastructure foundations.

- Shallow Groundwater Conditions

Groundwater seepage was observed in a limited number of trial pits in the extreme north of the proposed development footprint. Shallow groundwater conditions may be encountered in the southern and central sections of the proposed development footprint after rainfall events.

- Corestone Boulders

The presence of hard corestones within residual granitic soils is potentially problematic for foundations and excavations. While corestones were not observed in the trial pits, a limited number of corestone boulders were observed at surface in the northern section of the development footprint.

Potential constraints that the geotechnical conditions may impose on the proposed development are provided in Table 34. Possible engineering solutions to mitigate the risks imposed by these conditions are provided.

Table 34: Potential Geotechnical Constraints

Possible Geotechnical Constraints				Possible Engineering Solutions
Description	**Extent**	**Probability**	**Magnitude**	
Compressible Soils with Low Bearing Capacity Collapsible soil fabric	Southern section of development footprint	High	Medium	Increase founding size Increase foundation depth Pre-compaction Reinforced foundations
Collapsible soil fabric Collapse settlement of foundations	Variable – sporadic over the development footprint	Medium	Medium	Increase foundation depth to below collapsible horizon/s Pre-compaction Reinforced foundations
Inundation / Shallow ground water conditions*	Northern section of development footprint	Medium	Medium	Dewater excavations during construction Plan construction during the dry season Surface and groundwater drainage systems
Corestone boulders	Northern section of development footprint	Low	Medium	Removal of bounders beneath foundations Use of large excavation plant

*Seasonal

8.7.2 Impact of Development on the Geological and Geotechnical Environment

In terms of the impact that the development will have on the geological and geotechnical environment, sites of particular geological interest or scientific importance were not identified with the development boundary.

The solar panel array layouts will have a low impact on the geology and soils, and all three alternative substation options are considered to have a low impact on the geology and soils.

9 ENVIRONMENTAL IMPACT ASSESSMENT

9.1 Methodology for Impact Assessment

The EIA Methodology assists in evaluating the overall effect of a proposed activity on the environment. The determination of the effect of an environmental impact on an environmental parameter is determined through a systematic analysis of the various components of the impact. This is undertaken using information that is available to the environmental practitioner through the process of the environmental impact assessment. The impact evaluation of predicted impacts was undertaken through an assessment of the significance of the impacts.

9.1.1 Determination of Significance of Impacts

Significance is determined through a synthesis of impact characteristics which include context and intensity of an impact. Context refers to the geographical scale i.e. site, local, national or global whereas Intensity is defined by the severity of the impact e.g. the magnitude of deviation from background conditions, the size of the area affected, the duration of the impact and the overall probability of occurrence. Significance is calculated as shown in Table 35.

Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. The total number of points scored for each impact indicates the level of significance of the impact.

9.1.2 Impact Rating System

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

- planning
- construction
- operation
- decommissioning

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

- Rating System Used To Classify Impacts

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

Table 35: Description

NATURE		
Include a brief description of the impact of environmental parameter being assessed in the context of the project. This criterion includes a brief written statement of the environmental aspect being impacted upon by a particular action or activity.		
GEOGRAPHICAL EXTENT		
This is defined as the area over which the impact will be expressed. Typically, the severity and significance of an impact have different scales and as such bracketing ranges are often required. This is often useful during the detailed assessment of a project in terms of further defining the determined.		
1	Site	The impact will only affect the site
2	Local/district	Will affect the local area or district
3	Province/region	Will affect the entire province or region
4	International and National	Will affect the entire country
PROBABILITY		
This describes the chance of occurrence of an impact		
1	Unlikely	The chance of the impact occurring is extremely low (Less than a 25% chance of occurrence).
2	Possible	The impact may occur (Between a 25% to 50% chance of occurrence).
3	Probable	The impact will likely occur (Between a 50% to 75% chance of occurrence).
4	Definite	Impact will certainly occur (Greater than a 75% chance of occurrence).
REVERSIBILITY		
This describes the degree to which an impact on an environmental parameter can be successfully reversed upon completion of the proposed activity.		
1	Completely reversible	The impact is reversible with implementation of minor mitigation measures
2	Partly reversible	The impact is partly reversible but more intense mitigation measures are required.

3	Barely reversible	The impact is unlikely to be reversed even with intense mitigation measures.
4	Irreversible	The impact is irreversible and no mitigation measures exist.
IRREPLACEABLE LOSS OF RESOURCES		
This describes the degree to which resources will be irreplaceably lost as a result of a proposed activity.		
1	No loss of resource.	The impact will not result in the loss of any resources.
2	Marginal loss of resource	The impact will result in marginal loss of resources.
3	Significant loss of resources	The impact will result in significant loss of resources.
4	Complete loss of resources	The impact is result in a complete loss of all resources.
DURATION		
This describes the duration of the impacts on the environmental parameter. Duration indicates the lifetime of the impact as a result of the proposed activity		
1	Short term	The impact and its effects will either disappear with mitigation or will be mitigated through natural process in a span shorter than the construction phase (0 – 1 years), or the impact and its effects will last for the period of a relatively short construction period and a limited recovery time after construction, thereafter it will be entirely negated (0 – 2 years).
2	Medium term	The impact and its effects will continue or last for some time after the construction phase but will be mitigated by direct human action or by natural processes thereafter (2 – 10 years).
3	Long term	The impact and its effects will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter (10 – 50 years).
4	Permanent	The only class of impact that will be non-transitory. Mitigation either by man or natural process will not occur in such a way or such a time span that the impact can be considered transient (Indefinite).
CUMULATIVE EFFECT		

This describes the cumulative effect of the impacts on the environmental parameter. A cumulative effect/impact is an effect which in itself may not be significant but may become significant if added to other existing or potential impacts emanating from other similar or diverse activities as a result of the project activity in question.		
1	Negligible Cumulative Impact	The impact would result in negligible to no cumulative effects
2	Low Cumulative Impact	The impact would result in insignificant cumulative effects
3	Medium Cumulative impact	The impact would result in minor cumulative effects
4	High Cumulative Impact	The impact would result in significant cumulative effects
INTENSITY/ MAGNITUDE		
Describes the severity of an impact		
1	Low	Impact affects the quality, use and integrity of the system/component in a way that is barely perceptible.
2	Medium	Impact alters the quality, use and integrity of the system/component but system/ component still continues to function in a moderately modified way and maintains general integrity (some impact on integrity).
3	High	Impact affects the continued viability of the system/ component and the quality, use, integrity and functionality of the system or component is severely impaired and may temporarily cease. High costs of rehabilitation and remediation.
4	Very high	Impact affects the continued viability of the system/component and the quality, use, integrity and functionality of the system or component permanently ceases and is irreversibly impaired (system collapse). Rehabilitation and remediation often impossible. If possible rehabilitation and remediation often unfeasible due to extremely high costs of rehabilitation and remediation.
SIGNIFICANCE		
Significance is determined through a synthesis of impact characteristics. Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. This describes the significance of the impact		

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

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

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

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

Table 36: Rating of impacts

IMPACT TABLE FORMAT	
Environmental Parameter	A brief description of the environmental aspect likely to be affected by the proposed activity e.g. Surface water
Issue/Impact/Environmental Effect/Nature	A brief description of the nature of the impact that is likely to affect the environmental aspect as a result of the proposed activity e.g. alteration of aquatic biota The environmental impact that is likely to positively or

IMPACT TABLE FORMAT		
	negatively affect the environment as a result of the proposed activity e.g. oil spill in surface water	
Extent	A brief description indicating the chances of the impact occurring	
Probability	A brief description of the ability of the environmental components recovery after a disturbance as a result of the proposed activity	
Reversibility	A brief description of the environmental aspect likely to be affected by the proposed activity e.g. Surface water	
Irreplaceable loss of resources	A brief description of the degree in which irreplaceable resources are likely to be lost	
Duration	A brief description of the amount of time the proposed activity is likely to take to its completion	
Cumulative effect	A brief description of whether the impact will be exacerbated as a result of the proposed activity	
Intensity/magnitude	A brief description of whether the impact has the ability to alter the functionality or quality of a system permanently or temporarily	
Significance Rating	A brief description of the importance of an impact which in turn dictates the level of mitigation required	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	4	1
Probability	4	1
Reversibility	4	1
Irreplaceable loss	4	1
Duration	4	1
Cumulative effect	4	1
Intensity/magnitude	4	1
Significance rating	-96 (high negative)	-6 (low negative)
Mitigation measures	Outline/explain the mitigation measures to be undertaken to ameliorate the impacts that are likely to arise from the proposed activity. Describe how the mitigation measures have reduced/enhanced the impact with relevance to the impact criteria used in analysing the significance. These measures will be detailed in the EMPr.	

The 2010 regulations also specify that alternatives must be compared in terms of impact assessment.

9.2 Environmental Impact Assessment

9.2.1 Biodiversity

- Planning

No impacts are expected during planning.

- Construction

Table 37: Rating of impacts on loss, fragmentation or degradation of faunal habitat during construction

IMPACT TABLE	
Environmental Parameter	Faunal habitat
Issue/Impact/Environmental Effect/Nature	Loss, degradation or fragmentation of faunal habitat.
Extent	The impact will affect habitat on site and possibly in surrounding areas.
Probability	The impact may possibly happen.
Reversibility	Barely reversible, since loss of habitat will be relatively permanent and extensive rehabilitation would be required to reverse the impact.
Irreplaceable loss of resources	Marginal loss of resources will occur. Faunal habitat on site is not the only habitat available for fauna. Species of concern for the area mostly have wide ranges.
Duration	The impact will be long-term (for the duration of the project, after which natural ecological successional processes could restore some habitat that was lost.
Cumulative effect	Low cumulative impact. Added to existing impacts on natural habitat, the current project will cause additional loss of habitat, but not to a significant extent.
Intensity/magnitude	Medium. Regional habitat will continue to function.
Significance Rating	**Prior to mitigation measures:** Low negative **After mitigation measures:**

	Low negative	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	2	2
Reversibility	3	3
Irreplaceable loss	2	2
Duration	3	3
Cumulative effect	2	2
Intensity/magnitude	2	2
Significance rating	-26 (low negative)	-26 (low negative)
Mitigation measures	No mitigation measures required. However, any of the mitigation measures listed for "Impacts on indigenous natural vegetation" would help to limit impacts on faunal habitat.	

Table 38: Rating of impacts on displacement of mobile fauna during construction

IMPACT TABLE	
Environmental Parameter	Fauna
Issue/Impact/Environmental Effect/Nature	Displacement of populations due to construction activities on site.
Extent	The impact will affect populations on site and possibly in surrounding areas.
Probability	The impact is unlikely to happen, because there do not appear to be significant resident populations of fauna on site.
Reversibility	Barely reversible, since loss of habitat will be relatively permanent and extensive rehabilitation would be required to reverse the impact.
Irreplaceable loss of resources	No loss of resources is expected.
Duration	The impact will be long-term (for the duration of the project, after which natural ecological successional processes could restore some habitat that was lost.
Cumulative effect	Low cumulative impact. Added to existing impacts on natural habitat, the current project will cause additional displacement, but not to a significant extent.
Intensity/magnitude	Low. Impacts will be barely perceptible.

Significance Rating	**Prior to mitigation measures:** Low negative **After mitigation measures:** Low negative	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	1	1
Reversibility	3	3
Irreplaceable loss	1	1
Duration	3	3
Cumulative effect	1	1
Intensity/magnitude	1	1
Significance rating	-10 (low negative)	-10 (low negative)
Mitigation measures	No mitigation measures required.	

Table 39: Rating of impacts on indigenous natural vegetation during construction

IMPACT TABLE	
Environmental Parameter	Indigenous natural vegetation
Issue/Impact/Environmental Effect/Nature	Loss, degradation or fragmentation of vegetation.
Extent	The impact will affect natural vegetation on site and possibly in immediately surrounding areas.
Probability	The impact will definitely happen.
Reversibility	Barely reversible, since loss of habitat will be relatively permanent and extensive rehabilitation would be required to reverse the impact.
Irreplaceable loss of resources	Marginal loss of resources will occur. Vegetation on site is mostly secondary or degraded.
Duration	The impact will be long-term (for the duration of the project, after which natural ecological successional processes could restore some vegetation that was lost.
Cumulative effect	Low cumulative impact. Added to existing impacts on natural habitat, the current project will cause additional loss of vegetation, but not to a significant extent.
Intensity/magnitude	Medium. Regional vegetation will continue to function.

Significance Rating	**Prior to mitigation measures:** Medium negative **After mitigation measures:** Medium negative	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	4	4
Reversibility	3	3
Irreplaceable loss	2	2
Duration	3	3
Cumulative effect	2	2
Intensity/magnitude	2	2
Significance rating	-30 (medium negative)	-30 (medium negative)
Mitigation measures	No mitigation measures will change the significance score. However, the following mitigation measures would help to limit impacts: ▪ Establish a stormwater management plan. ▪ Compile a rehabilitation programme. ▪ Compile an Alien Plant Management Plan. ▪ Undertake regular monitoring.	

Table 40: Rating of impacts on loss of individuals of protected trees during construction

IMPACT TABLE	
Environmental Parameter	Protected trees, as per National Forests Act.
Issue/Impact/Environmental Effect/Nature	Loss of individuals.
Extent	The impact will affect natural vegetation on site and possibly in immediately surrounding areas.
Probability	The impact will definitely happen.
Reversibility	Partly reversible. Individuals can be cultivated to replace lost specimens.
Irreplaceable loss of resources	Marginal loss of resources will occur. The species is relatively common throughout its range.
Duration	The impact will be medium-term.
Cumulative effect	Low cumulative impact. Cumulative effects will not be significant.

Intensity/magnitude	Low. Loss of some individuals will be insignificant compared to the number that probably occur in surrounding areas.	
Significance Rating	**Prior to mitigation measures:** Low negative **After mitigation measures:** Low negative	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	4	4
Reversibility	2	2
Irreplaceable loss	2	1
Duration	2	2
Cumulative effect	2	1
Intensity/magnitude	1	1
Significance rating	-13 (low negative)	-11 (low negative)
Mitigation measures	It is a legal requirement to obtain permits for specimens that will be lost. Trees lost to the development can be cultivated and planted in appropriate places in surrounding areas. This will reduce the irreplaceable loss of resources as well as the cumulative effect.	

- Operation

Table 41: Rating of impacts on mortality of individuals of fauna during operation

IMPACT TABLE	
Environmental Parameter	Fauna, especially species on Red Lists
Issue/Impact/Environmental Effect/Nature	Loss of individuals.
Extent	The impact will affect individuals on site and possibly in immediately surrounding areas.
Probability	The impact may possibly happen.
Reversibility	Partly reversible. Preventative measures could reduce mortality to below replacement levels.
Irreplaceable loss of resources	Marginal loss of resources will occur. The species is relatively common throughout its range.
Duration	The impact will be long-term.

Cumulative effect	Low cumulative impact. Cumulative effects will not be significant.	
Intensity/magnitude	Low. Loss of some individuals will be insignificant compared to population replacement levels.	
Significance Rating	**Prior to mitigation measures:** Low negative **After mitigation measures:** Low negative	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	2	2
Reversibility	2	2
Irreplaceable loss	2	2
Duration	3	3
Cumulative effect	2	2
Intensity/magnitude	1	1
Significance rating	-12 (low negative)	-12 (low negative)
Mitigation measures	Visibility devices could be placed on overhead power lines, if necessary. This will reduce the probability slightly, but not to an extent that it will change the impact rating scores. The mitigation measure is therefore not required unless monitoring identifies this as an issue during operation.	

Table 42: Rating of impacts on the establishment and spread of declared weeds during operation

IMPACT TABLE	
Environmental Parameter	Vegetation and habitat
Issue/Impact/Environmental Effect/Nature	Loss of habitat due to invasion by alien plants
Extent	The impact will affect habitat on site and possibly in immediately surrounding areas.
Probability	The impact will probably happen in the absence of control measures.
Reversibility	Partly reversible in the absence of control measures. Completely reversible if mitigation measures applied. Preventative measures will stop the impact from occurring.
Irreplaceable loss of resources	Marginal to significant loss of resources will occur. Uncontrolled invasion can affect all nearby natural habitats.

Duration	The impact will be long-term.	
Cumulative effect	Low cumulative impact. Cumulative effects will not be significant.	
Intensity/magnitude	Medium. Severe invasion can alter the functioning of natural ecosystems.	
Significance Rating	**Prior to mitigation measures:** Medium negative **After mitigation measures:** Low negative	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	3	2
Reversibility	2	1
Irreplaceable loss	3	2
Duration	3	3
Cumulative effect	2	2
Intensity/magnitude	2	1
Significance rating	-28 (medium negative)	-11 (low negative)
Mitigation measures	Compile and implement an alien management plan. Undertake regular monitoring to detect alien invasions early so that they can be controlled.	

- Decommissioning

Biodiversity impacts during the decommissioning phase are potentially similar to those during the construction phase.

9.2.2 Surface Water

- Planning

No impacts are expected during planning.

- Construction

Table 43: Rating of impacts associated with the construction lay-down area during construction

IMPACT TABLE	
Environmental Parameter	Surface Water Resources

Issue/Impact/Environmental Effect/Nature	Impacts associated with the construction lay-down area near to surface water resources and the associated buffer zones	
Extent	Site	
Probability	Possible	
Reversibility	Partly reversible	
Irreplaceable loss of resources	Marginal loss of resources	
Duration	Short term	
Cumulative effect	Low cumulative impact	
Intensity/magnitude	Medium	
Significance Rating	**Prior to mitigation measures:** Low negative **After mitigation measures:** Low negative	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	2	1
Reversibility	2	1
Irreplaceable loss	2	1
Duration	1	1
Cumulative effect	2	1
Intensity/magnitude	2	1
Significance rating	- 20 (low negative)	- 6 (low negative)
Mitigation measures	**Seasonal Scheduling of the Construction Process** – It is important that construction activities must be scheduled to take place over the dry winter season when flows are low (June/July/August/September). **Location of the Lay-down Area** – The lay-down area must not be placed within any surface water resources or the associated buffer zones. Environmental authorisation and a water use license will be required should the construction lay-down area need to be placed inside a surface water resource. **Preventing Fire Risks to Surface Water Resources and People** - Operational fire extinguishers are to be available	

	in the case of a fire emergency. Given the dry seasons that the study site experiences, a fire management and emergency plan must be compiled and implemented for the proposed development.

Table 44: Rating of impacts associated with vehicle and machinery degradation during construction

IMPACT TABLE		
Environmental Parameter	Surface Water Resources	
Issue/Impact/Environmental Effect/Nature	Vehicle and machinery degradation to surface water resources and the associated buffer zones	
Extent	Site	
Probability	Possible	
Reversibility	Partly reversible	
Irreplaceable loss of resources	Marginal loss of resources	
Duration	Short term	
Cumulative effect	Medium cumulative Impact	
Intensity/magnitude	Medium	
Significance Rating	**Prior to mitigation measures:** Low negative **After mitigation measures:** Low negative	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	2	1
Reversibility	2	2
Irreplaceable loss	2	2
Duration	1	1
Cumulative effect	2	1
Intensity/magnitude	2	1
Significance rating	- 20 (low negative)	- 8 (low negative)
Mitigation measures	**Preventing Physical Degradation of Surface Water Resources** – Surface water resources and the associated buffer zones are to be designated as “highly sensitive areas”. Vehicle access is not to be allowed in the highly sensitive areas. Construction workers are only allowed in	

	the designated construction areas of the proposed development and not into the surrounding surface water resources. Highly sensitive areas are to be clearly demarcated prior to the commencement of construction and no access beyond these areas is to be allowed. **Preventing Soil Contamination** – No vehicles are to be allowed in the highly sensitive areas unless authorised. Should vehicles be authorised in highly sensitive areas, all vehicles and machinery are to be checked for oil, fuel or any other fluid leaks before entering the required construction areas. All vehicles and machinery must be regularly serviced and maintained before being allowed to enter the construction areas. No fuelling, re-fuelling, vehicle and machinery servicing or maintenance is to take place in the highly sensitive areas. The study site is to contain sufficient spill contingency measures throughout the construction process. These include, but are not limited to, oil spill kits to be available, fire extinguishers, fuel, oil or hazardous substances storage areas must be bunded to prevent oil or fuel contamination of the ground and/or nearby surface water resources or associated buffer zones.

Table 45: Rating of impacts for construction phase human degradation of flora and fauna associated with surface water resources

IMPACT TABLE	
Environmental Parameter	Surface Water Resources
Issue/Impact/Environmental Effect/Nature	Human degradation to fauna and flora associated with surface water resources
Extent	Site
Probability	Possible
Reversibility	Completely reversible
Irreplaceable loss of resources	Marginal loss of resources
Duration	Short term
Cumulative effect	Low cumulative impact

Intensity/magnitude	Low	
Significance Rating	**Prior to mitigation measures:** Low negative **After mitigation measures:** Low negative	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	2	1
Reversibility	1	1
Irreplaceable loss	2	1
Duration	1	1
Cumulative effect	2	1
Intensity/magnitude	1	1
Significance rating	- 9 (low negative)	- 6 (low negative)
Mitigation measures	**Minimising Human Physical Degradation of Sensitive Areas** - Construction workers are only allowed in designated construction areas and not into the surface water resources designated as highly sensitive. The highly sensitive areas are to be clearly demarcated and no access beyond these areas is to be allowed. No animals on the construction site or surrounding areas are to be hunted, captured, trapped, removed, injured, killed or eaten. Should any party be found guilty of such an offence, stringent penalties should be imposed. The appointed ECO is to be contacted should removal of any fauna be required during the construction phase. No “long drop” toilets are allowed on the study site. Suitable temporary chemical sanitation facilities are to be provided. Temporary chemical sanitation facilities must be placed at least 100 meters from any surface water resource where required. Temporary chemical sanitation facilities must be placed over a bunded or a sealed surface area and adequately maintained to prevent pollution impacts. No water is to be extracted unless a water use license is granted for specific quantities.	

	No hazardous or building materials are to be stored or brought into the highly sensitive areas. Should a designated storage area be required, the storage area must be placed at the furthest location from the highly sensitive areas. Appropriate safety measures as stipulated above must be implemented. No cement mixing is to take place in a surface water resource. In general, any cement mixing should take place over a bin lined (impermeable) surface or alternatively in the load bin of a vehicle to prevent the mixing of cement with the ground. Importantly, no mixing of cement directly on the surface is allowed in the sensitive and RoW areas.

Table 46: Rating of impacts for construction phase erosion, increased storm water run-off and increased sedimentation impacts

IMPACT TABLE		
Environmental Parameter	Surface Water Resources	
Issue/Impact/Environmental Effect/Nature	Erosion, increased storm water run-off and increased sedimentation impacting on surface water resources	
Extent	Site	
Probability	Probable	
Reversibility	Partly reversible	
Irreplaceable loss of resources	Significant loss of resources	
Duration	Long term	
Cumulative effect	Low cumulative impact	
Intensity/magnitude	Medium	
Significance Rating	**Prior to mitigation measures:** Medium negative **After mitigation measures:** Low negative	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	3	1
Reversibility	2	1

Irreplaceable loss	3	2
Duration	3	2
Cumulative effect	2	2
Intensity/magnitude	3	2
Significance rating	- 42 (medium negative)	- 18 (low negative)
Mitigation measures	**Preventing Increased Run-off and Sedimentation Impacts** - Vegetation clearing should take place in a phased manner, only clearing areas that will be constructed on immediately. Vegetation clearing must not take place in areas where construction will only take place in the distant future. An appropriate storm water management plan formulated by a suitably qualified professional must accompany the proposed development to deal with increased run-off in the designated construction areas. In general however, adequate structures must be put into place (temporary or permanent where necessary in extreme cases) to deal with increased/accelerated run-off and sediment volumes. The use of silt fencing and potentially sandbags or hessian "sausage" nets can be used to prevent erosion in susceptible construction areas. Grass blocks on the perimeter of the building structure footprints can also be used to reduce run-off. Where required more permanent structures such as attenuation ponds and gabions can be constructed if need be. All impacted areas are to be adequately sloped to prevent the onset of erosion.	

Table 47: Rating of impacts for construction phase erosion, increased storm water run-off and increased sedimentation impacts

IMPACT TABLE	
Environmental Parameter	Surface Water Resources
Issue/Impact/Environmental Effect/Nature	Erosion, increased storm water run-off and increased sedimentation impacting on surface water resources
Extent	Site
Probability	Probable
Reversibility	Partly reversible

Irreplaceable loss of resources	Significant loss of resources	
Duration	Long term	
Cumulative effect	Low cumulative impact	
Intensity/magnitude	Medium	
Significance Rating	**Prior to mitigation measures:** Medium negative **After mitigation measures:** Low negative	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	3	1
Reversibility	2	1
Irreplaceable loss	3	2
Duration	3	2
Cumulative effect	2	2
Intensity/magnitude	3	2
Significance rating	- 42 (medium negative)	- 18 (low negative)
Mitigation measures	**Preventing Increased Run-off and Sedimentation Impacts** - Vegetation clearing should take place in a phased manner, only clearing areas that will be constructed on immediately. Vegetation clearing must not take place in areas where construction will only take place in the distant future. An appropriate storm water management plan formulated by a suitably qualified professional must accompany the proposed development to deal with increased run-off in the designated construction areas. In general however, adequate structures must be put into place (temporary or permanent where necessary in extreme cases) to deal with increased/accelerated run-off and sediment volumes. The use of silt fencing and potentially sandbags or hessian "sausage" nets can be used to prevent erosion in susceptible construction areas. Grass blocks on the perimeter of the building structure footprints can also be used to reduce run-off. Where required more permanent structures such as attenuation	

	ponds and gabions can be constructed if need be. All impacted areas are to be adequately sloped to prevent the onset of erosion.

- Operation

Table 48: Impact rating for operation phase vehicle damage

IMPACT TABLE		
Environmental Parameter	Surface Water Resources	
Issue/Impact/Environmental Effect/Nature	Vehicle damage to surface water resources	
Extent	Site	
Probability	Possible	
Reversibility	Partly reversible	
Irreplaceable loss of resources	Marginal loss of resources	
Duration	Long term	
Cumulative effect	Medium cumulative impact	
Intensity/magnitude	High	
Significance Rating	**Prior to mitigation measures:** Medium negative **After mitigation measures:** Low negative	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	2	1
Reversibility	2	2
Irreplaceable loss	2	1
Duration	3	2
Cumulative effect	3	2
Intensity/magnitude	3	2
Significance rating	- 39 (medium negative)	- 22 (low negative)
Mitigation measures	**Minimising Vehicle Damage to the Surface Water Resources** – Potential impacts can be avoided by the routing of access roads outside of and away from surface water resources and associated buffer zones.	

	Where access through surface water resources and associated buffer zones are unavoidable and are absolutely required, it is recommended that any road plan and associated structures be submitted to the relevant environmental and water departments for approval prior to implementation. Access roads authorised in sensitive areas will have to be regularly monitored and checked for erosion. Monitoring should be conducted on a monthly basis. Moreover, after short or long periods of heavy rainfall or after long periods of sustained rainfall the roads will need to be checked for erosion and rehabilitation measures will need to be employed. Where erosion begins to take place, this must be dealt with immediately to prevent severe erosion damage to the surface water resources. Should large scale erosion occur, a rehabilitation plan will be required. Input, reporting and recommendations from a suitably qualified surface water specialist must be obtained in this respect.

Table 49: Impact rating for storm-water run-off associated with roads, the substation and operation control buildings

IMPACT TABLE	
Environmental Parameter	Surface water resources
Issue/Impact/Environmental Effect/Nature	Hardening of Surfaces
Extent	Site
Probability	Possible
Reversibility	Partly reversible
Irreplaceable loss of resources	Marginal loss of resource
Duration	Long term
Cumulative effect	Medium cumulative impact

Intensity/magnitude	Medium	
Significance Rating	**Prior to mitigation measures:** Low negative **After mitigation measures:** Low negative	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	2	2
Reversibility	2	1
Irreplaceable loss	2	2
Duration	3	3
Cumulative effect	3	3
Intensity/magnitude	2	1
Significance rating	-26 (low negative)	-12 (low negative)
Mitigation measures	Any hardstand area, building or substation inside or within 100m proximity to a surface water resource must have energy dissipating structures on the perimeter of the structures to prevent increased run-off entering adjacent areas or surface water resources. This can be in the form of hard concrete structures or soft structures such as grass blocks for example. Alternatively, a suitable operational storm water management design or plan can be compiled and implemented that accounts for the use of appropriate alternative structures or devices that will prevent increased run-off entering adjacent areas or surface water resources.	

- Decommissioning

Surface water impacts during the decommissioning phase are potentially similar to those during the construction phase.

9.2.3 Agricultural Potential and Soils

- Planning

No impacts are expected during planning.

- Construction and Operation

Table 50: Rating of impacts on soils during construction and operation

IMPACT TABLE		
Environmental Parameter	Soils	
Issue/Impact/Environmental Effect/Nature	Loss of agricultural soil	
Extent	The portion of the site where infrastructure is situated will be affected.	
Probability	There will definitely be an impact on the environment	
Reversibility	The impact should be more or less completely reversible with proper mitigation measures	
Irreplaceable loss of resources	The impact will result in a marginal loss of resources	
Duration	Long-term, for the life of the project	
Cumulative effect	Low cumulative impact	
Intensity/magnitude	Medium – environment will be moderately affected	
Significance Rating	**Prior to mitigation measures:** -28 (low negative) **After mitigation measures:** -28 (low negative)	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	4	4
Reversibility	2	2
Irreplaceable loss	2	2
Duration	3	3
Cumulative effect	2	2
Intensity/magnitude	2	2
Significance rating	-28 (low negative)	-28 (low negative)
Mitigation measures	The main mitigation measures will involve ensuring that the minimum surface disturbance takes place, both in terms of soil excavation and vegetation removal. If normal construction methods are used for foundations and infrastructure, then post-project rehabilitation should be successful once the infrastructure is removed. Where roads or paths are constructed, soil conservation measures	

	(run-off channels, drains etc.) as well as regular maintenance) will also be required.

- Decommissioning

Soils and agricultural impacts during the decommissioning phase are potentially similar to those during the construction phase.

9.2.4 Visual

- Planning

No visual impacts are expected during planning.

- Construction

Table 51: Rating of visual impacts of the proposed PV plant during construction

IMPACT TABLE	
Environmental Parameter	Visual Impact
Issue/Impact/Environmental Effect/Nature	Large construction vehicles and equipment during the construction phase will alter the character of the study area and expose visual receptors to visual impacts associated with the construction phase. The construction activities may be perceived as an unwelcome visual intrusion, particularly in more natural undisturbed settings.
Extent	Local / District (2)
Probability	Probable (3)
Reversibility	Completely reversible (1)
Irreplaceable loss of resources	No loss (1)
Duration	Short term (1)
Cumulative effect	Low cumulative effects (2)
Intensity/magnitude	Medium (2)
Significance Rating	**Prior to mitigation measures:** Low negative impact

	After mitigation measures: Low negative impact	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	2	2
Probability	3	2
Reversibility	1	1
Irreplaceable loss	1	1
Duration	1	1
Cumulative effect	2	2
Intensity/magnitude	2	2
Significance rating	-20 (negative low)	-18 (negative low)
Mitigation measures	▪ Carefully plan to reduce the construction period. ▪ Where possible, minimise vegetation clearing and rehabilitate cleared areas as soon as possible. ▪ Maintain a neat construction site by removing rubble and waste materials regularly. ▪ Make use of existing gravel access roads where possible. ▪ Ensure that dust suppression techniques are implemented on all access roads.	

** Please note in the context of the visual environment 'resources' are defined as scenic / natural views that are almost impossible to replace.*

- Operation

Table 52: Rating of visual impacts of the proposed PV plant during operation

IMPACT TABLE	
Environmental Parameter	Visual Impact
Issue/Impact/Environmental Effect/Nature	The proposed PV plant could exert a visual impact by altering the visual character of the surrounding area and exposing sensitive visual receptor locations to visual impacts. The development may be perceived as an unwelcome visual intrusion, particularly in more natural undisturbed settings.
Extent	Local/district (2)
Probability	Definite (4)
Reversibility	Irreversible (4)
Irreplaceable loss of resources	Marginal (2)

Duration	Long term (3)	
Cumulative effect	Medium cumulative effects (3)	
Intensity/magnitude	Medium (2)	
Significance Rating	**Prior to mitigation measures:** Medium negative impact **After mitigation measures:** Medium negative impact	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	2	2
Probability	4	3
Reversibility	4	4
Irreplaceable loss	2	2
Duration	3	3
Cumulative effect	3	3
Intensity/magnitude	2	2
Significance rating	-36 (medium negative)	-34 (medium negative)
Mitigation measures	▪ Light fittings for operations and security at night should reflect the light toward the ground and prevent light spill. ▪ The operations and maintenance buildings should not be illuminated at night. ▪ Bury cables under the ground where possible. ▪ The operation and maintenance building should be painted with natural tones that fit with the surrounding environment. Non-reflective surfaces should be utilised where possible.	

** Please note in the context of the visual environment 'resources' are defined as scenic / natural views that are almost impossible to replace.*

- Decommissioning

Visual impacts during the decommissioning phase are potentially similar to those during the construction phase.

9.2.5 Heritage

- Planning

No impacts are expected during planning.

- Construction

Table 53: Rating of impacts on palaeontology during construction

IMPACT TABLE		
Environmental Parameter	Palaeontological sensitive rock formations	
Issue/Impact/Environmental Effect/Nature	Due to the age and igneous nature of the Nebo Granite, no fossils will occur and a Low Palaeontological sensitivity	
Extent	Localised	
Probability	Low probability of encountering fossils exist	
Reversibility	Fossils are none renewable.	
Irreplaceable loss of resources	Low probability due to geology	
Duration	The loss of the fossil record will be permanent	
Cumulative effect	Low cumulative impact over the site	
Intensity/magnitude	Magnitude of the impact pre-mitigation is rated as low	
Significance Rating	**Prior to mitigation measures:** -10 (low negative) **After mitigation measures:** -10 (low negative)	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	1	1
Reversibility	4	4
Irreplaceable loss	2	2
Duration	1	1
Cumulative effect	1	1
Intensity/magnitude	1	1
Significance rating	-10 (low negative)	-10 (low negative)
Mitigation measures	None required	

Table 54: Rating of impacts on archaeological sites during construction

IMPACT TABLE

Environmental Parameter	Possible Iron Age remains in south western corner of the development area	
Issue/Impact/Environmental Effect/Nature	A low density scatter of pottery fragments and iron slag is present in the area of NK09. Construction could unearth sub-surface deposits	
Extent	Site	
Probability	Possible	
Reversibility	Partly reversible	
Irreplaceable loss of resources	Archaeological sites are irreplaceable	
Duration	Permanent	
Cumulative effect	Low	
Intensity/magnitude	Low	
Significance Rating	**Prior to mitigation measures:** -16 (low negative) **After mitigation measures:** -15 (low negative)	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	2	1
Reversibility	4	4
Irreplaceable loss	4	4
Duration	4	4
Cumulative effect	1	1
Intensity/magnitude	1	1
Significance rating	-16 (low negative)	-15 (low negative)
Mitigation measures	Monitoring by and archaeologist will be required during construction.	

Table 55: Rating of impacts on historical/recent history during construction

IMPACT TABLE	
Environmental Parameter	Homesteads
Issue/Impact/Environmental Effect/Nature	The structures and homesteads have a low heritage significance however the possibility of stillborn burials at these sites does pose a possible impact.
Extent	Site

Probability	Low	
Reversibility	Low	
Irreplaceable loss of resources	Loss of human remains is irreplaceable	
Duration	Permanent	
Cumulative effect	Low	
Intensity/magnitude	High	
Significance Rating	**Prior to mitigation measures:** -48 (medium negative) **After mitigation measures:** -15 (low negative)	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	2	1
Reversibility	4	4
Irreplaceable loss	4	4
Duration	4	4
Cumulative effect	1	1
Intensity/magnitude	3	1
Significance rating	-48 (medium negative)	-15 (low negative)
Mitigation measures	▪ Where the structures are to be impacted directly by the development, a consultation process to determine if any graves or still born burial exist in and around the ruins, must be conducted; ▪ If it is found that there are burials associated with the ruins, a grave relocation process must be initiated. ▪ An archaeologist to identify any significant cultural or possible human remains must monitor the demolition of the structures.	

Table 56: Rating of impacts on cemeteries during construction

IMPACT TABLE	
Environmental Parameter	Impact on cemetery outside development area
Issue/Impact/Environmental Effect/Nature	The cemetery is situated on the eastern border of the property and could be affected by construction.

Extent	Site	
Probability	Possible	
Reversibility	Heritage resources are non-renewable.	
Irreplaceable loss of resources	The graves in the cemetery is irreplaceable	
Duration	Short	
Cumulative effect	Low	
Intensity/magnitude	Low	
Significance Rating	**Prior to mitigation measures:** -11 (low negative) **After mitigation measures:** -10 (low negative)	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	2	1
Reversibility	4	4
Irreplaceable loss	2	2
Duration	1	1
Cumulative effect	3	3
Intensity/magnitude	1	1
Significance rating	-11 (low negative)	-10 (low negative)
Mitigation measures	▪ The cemetery needs to be fenced and a 20m safety buffer needs to be included inside the development footprint to ensure protection of the cemetery.	

- Operation

No heritage impacts are anticipated during the operational phase.

- Decommissioning

Heritage impacts during the decommissioning phase are potentially similar to those during the construction phase.

9.2.6 Socio-economic

- Planning

No impacts are expected during planning.

- Construction

Table 57: Rating of impacts on economic production during construction

IMPACT TABLE		
Environmental Parameter	Economic Production: An activity that uses inputs of varied nature to produce goods and services	
Issue/Impact/Environmental Effect/Nature	Increase in production of the national and local economies due to project capital expenditure. The impact takes place due to the investment on the project that will be spent in the country. Besides the direct impact, it involves the indirect and induced effects that are created when either suppliers of goods and services to the project experience and increase in demand or when businesses servicing households experience an increase in demand for their products.	
Extent	The national economy will experience an increase in production.	
Probability	The impact will definitely take place, although the extent thereof may vary from the predicted amount.	
Reversibility	The impact is irreversible, as the capital spent on the project cannot be paid back.	
Irreplaceable loss of resources	No loss of resources.	
Duration	Construction is expected to last 18 months, the duration of this impact is therefore rated as short-term.	
Cumulative effect	Negligible, as there is no additional renewable energy projects or other major developments planned for the area in the near future.	
Intensity/magnitude	The domestic expenditure will value over R0.5 bn, which will result in the multiplier effect thus increasing the total magnitude of the impact to high.	
Significance Rating	**Prior to mitigation measures:** Medium positive **After mitigation measures:** Medium positive	
	Pre-mitigation impact rating	Post mitigation impact rating

Extent	4	4
Probability	4	4
Reversibility	4	4
Irreplaceable loss	1	1
Duration	1	1
Cumulative effect	1	1
Intensity/magnitude	3	3
Significance rating	45 (medium positive)	45 (medium positive)
Mitigation measures	In order to optimise the stimulation of the local economy through direct, indirect, and induced effects, the following should be applied where possible: ▪ Procure construction materials, goods, and products from local suppliers if feasible ▪ Employ local contractors where possible The proposed mitigation measures will possibly increase the positive impact in the local economy; however, this will not affect the weighting thereof.	

Table 58: Rating of impacts on GDP-R during construction

IMPACT TABLE	
Environmental Parameter	GDP-R: The total value of all final goods and services produced within a region during a year.
Issue/Impact/Environmental Effect/Nature	Increase in production of the national and local economies due to project capital expenditure that will lead to the creation of value added. The impact takes place due to the investment on the project that will be spent in the country. Besides the direct impact, it involves the indirect and induced effects that are created when either suppliers of goods and services to the project experience and increase in demand or when businesses servicing households experience an increase in demand for their products.
Extent	The national economy will experience an increase in production.
Probability	The impact will definitely take place.
Reversibility	Once capital is spent, its benefits cannot be reversed.
Irreplaceable loss of resources	No loss of resources.
Duration	Construction is expected to last 18 months, the duration of this impact is therefore rated as short-term.

Cumulative effect	The cumulative impact is rated as negligible. No additional renewable energy projects or other major developments planned for the area in the near future.	
Intensity/magnitude	Significant stimulation of the local economy is expected.	
Significance Rating	**Prior to mitigation measures:** Medium positive **After mitigation measures:** Medium positive	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	4	4
Probability	4	4
Reversibility	4	4
Irreplaceable loss	1	1
Duration	1	1
Cumulative effect	1	1
Intensity/magnitude	3	3
Significance rating	45 (medium positive)	45 (medium positive)
Mitigation measures	In order to optimise the stimulation of the local economy through direct, indirect and induced effects, the following should be applied where possible: ▪ Procure construction materials, goods, and products from local suppliers if feasible ▪ Employ local contractors where possible The proposed mitigation measures will possibly increase the positive impact in the local economy; however, this will not affect the weighting thereof.	

Table 59: Rating of impacts on employment during construction

IMPACT TABLE	
Environmental Parameter	Employment: measured in FTE person-years.
Issue/Impact/Environmental Effect/Nature	The impact is generated through capital expenditure that shocks the economy. It involves the creation of direct new job opportunities related to the construction of the proposed solar plant and employment opportunities that will be indirectly created through the increased expenditure in sectors supplying goods and services to the construction activity and in sectors benefiting from the increase of consumer expenditure.

Extent	The creation of new employment opportunities will occur throughout the country, depending on the areas where certain inputs will be procured.	
Probability	Job creation will definitely occur, however, the number could differ from the figure provided.	
Reversibility	Irreversible as employment created, albeit for a temporary period, cannot be undone.	
Irreplaceable loss of resources	No loss of resources.	
Duration	Construction is expected to last 18 months, the duration of this impact is therefore rated as short-term.	
Cumulative effect	The cumulative impact is rated as negligible. No additional renewable energy projects or other major developments planned for the area in the near future.	
Intensity/magnitude	Considering the current situation with regard to employment in the Elias Motsoaledi LM, the number of jobs created for the local community is expected to be notable and will reduce the unemployment rate in the area, albeit temporarily; nationally the impact will be diluted, therefore the impact is rated as medium.	
Significance Rating	**Prior to mitigation measures:** Medium positive **After mitigation measures:** Medium positive	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	4	4
Probability	4	4
Reversibility	4	4
Irreplaceable loss	1	1
Duration	1	1
Cumulative effect	1	1
Intensity/magnitude	3	3
Significance rating	45 (medium positive)	45 (medium positive)
Mitigation measures	The following is recommended to increase the employment opportunities created in the local communities, where feasible: ▪ Employ labour-intensive methods in construction, where feasible. ▪ Employ local residents and communities, where possible.	

	▪ Sub-contract to local construction companies, where possible. ▪ Utilise local suppliers, where possible. The proposed mitigation measures could increase the positive impact on the local economy but would not change the total impact; therefore, the ratings assigned for the impact before mitigations will not be affected.

Table 60: Rating of impacts on skills development during construction

IMPACT TABLE	
Environmental Parameter	Skills development; It is expected that those gaining employment as a result of construction activities will either be honing an existing skill or acquiring a new skill.
Issue/Impact/Environmental Effect/Nature	Individuals will benefit from skills development as a result of the temporary employment that is being created. Unlike the employment, however, this benefit will likely to last the individuals their lifetime, if practiced.
Extent	The temporary increase in availability of new job opportunities will be nationwide; it follows that skills development will also occur nationwide.
Probability	Possible; one cannot be certain that low or unskilled individuals benefiting from jobs created through direct or multiplier effects will be able to acquire new skills and will be able to utilise the opportunity to retain acquired skills.
Reversibility	Once skills are obtained, they cannot be lost unless they are not being used and/or become outdated; for this reason this impact is receiving a rating of barely reversible.
Irreplaceable loss of resources	No loss of resources.
Duration	Construction is expected to last 18 months. Since the impact refers to the actual activity when new skills are developed, its duration is limited by the construction phase timeframes; this impact is thus rated as being short-term.
Cumulative effect	Negligible, as there is no additional renewable energy projects or other major developments planned for the area in the near future.
Intensity/magnitude	More people residing in the Elias Motsoaledi LM was never exposed to any schooling than in the district and country; based on this high level assessment of the skills available in the LM, it is envisaged that the opportunity for skills development presented by the project, albeit of short duration, will have a positive high impact on the skills level

	within the LM. In the context of the national economy, though this impact will be of a lower magnitude.	
Significance Rating	**Prior to mitigation measures:** Medium positive **After mitigation measures:** Medium positive	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	4	4
Probability	2	3
Reversibility	3	3
Irreplaceable loss	1	1
Duration	1	1
Cumulative effect	1	1
Intensity/magnitude	3	3
Significance rating	36 (medium positive)	39 (medium positive)
Mitigation measures	In order to improve the chances of skills being developed during the construction period it is recommended that contractors are encouraged to provide learnerships and share knowledge with the employees. This mitigation measure could potentially improve the weighting of the impact in terms of its probability.	

Table 61: Rating of impacts on household income during construction

IMPACT TABLE	
Environmental Parameter	Household income: the result of a household's member engaging in economic activity; has a direct link to the standard of living of these households.
Issue/Impact/Environmental Effect/Nature	It is expected that certain households will experience an increase in income as a result of the jobs being created through direct, indirect and induced effects.
Extent	The temporary increase in availability of new job opportunities will be nationwide; it follows that an increase in household income will take place along similar geographical boundaries.
Probability	The increase in income of certain households will definitely occur.
Reversibility	Rated as irreversible as earned income cannot be withdrawn.
Irreplaceable loss of resources	No loss of resources.

Duration	Construction is expected to last 18 months, the duration of this impact is therefore rated as short-term.	
Cumulative effect	Negligible, as there is no additional renewable energy projects or other major developments planned for the area in the near future.	
Intensity/magnitude	Based on solar PV case studies, the impact is considered to be high. The income earned by households located in the Elias Motsoaledi LM will be on average higher than the average income of these households, leading to an improvement of these households' living standards. The impact within the national economy, though will be less significant.	
Significance Rating	**Prior to mitigation measures:** Medium positive **After mitigation measures:** Medium positive	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	4	4
Probability	4	4
Reversibility	4	4
Irreplaceable loss	1	1
Duration	1	1
Cumulative effect	1	1
Intensity/magnitude	3	3
Significance rating	45 (medium positive)	45 (medium positive)
Mitigation measures	It is advisable that where possible the positive effects on the local communities and their standard of living are increased through the increase in local procurement spent and recruitment practices: ▪ Recruit local labour as far as feasible to increase the benefits to the local households. ▪ Employ labour-intensive methods in construction, where feasible. ▪ Sub-contract to local construction companies, where possible. ▪ Use local suppliers where feasible and arrange with the local Small and Medium Enterprises to provide transport, catering, and other services for the construction crew.	

Table 62: Rating of impacts on government revenue during construction

IMPACT TABLE		
Environmental Parameter	Government revenue: government obtains its revenue by collecting taxes and rates from the country's residents and business.	
Issue/Impact/Environmental Effect/Nature	An increase in the tax base as a result of the investment in the proposed project will result in increased taxes payable to government.	
Extent	The fiscal gain will be collected by the national government and used in the national budget; it is not possible to pinpoint exact regions benefitting from this increase.	
Probability	Definite; the impact will definitely take place, although one cannot be certain of the exact amount that government will be collecting as a result of this phase of the proposed project.	
Reversibility	The increase in government revenue will occur for the limited period of time; however, once government income is earned it cannot be given back to the businesses or employees who had to pay rates and taxes.	
Irreplaceable loss of resources	No loss of resources, instead the project actually holds the potential for increased resources from the government's perspective.	
Duration	Construction is expected to last 18 months, increase in the revenue collectible by government is therefore rated as short-term.	
Cumulative effect	Negligible, as there is no additional renewable energy projects or other major developments planned for the area in the near future.	
Intensity/magnitude	The impact of the project's assumed contribution to national tax is rated as low considering the revised consolidated tax revenue for South Africa of R997.7 billion in 2014/2015 and given the small contribution the project is going to make to the national revenue.	
Significance Rating	**Prior to mitigation measures:** Low positive **After mitigation measures:** Low positive	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	4	4
Probability	4	4
Reversibility	4	1
Irreplaceable loss	1	1

Duration	1	1
Cumulative effect	1	1
Intensity/magnitude	1	1
Significance rating	15 (low positive)	15 (low positive)
Mitigation measures	No mitigations	

Table 63: Rating of impacts on temporary increases in crime during construction

IMPACT TABLE	
Environmental Parameter	Social pathologies; social factors such as deterioration of health; increase in crime; prostitution; and drugs among others.
Issue/Impact/Environmental Effect/Nature	It is expected that an increase of migrant workers and specifically job seekers who will likely have difficulty in finding employment and be left without steady income will increase the prevalence of certain social pathologies in the relatively small local community of Dennilton. In addition, the increase in movement of people in the area where the site is located may also lead to increase in incidents of livestock poaching and burglaries.
Extent	The local community.
Probability	Probable; it cannot be stated for sure that social pathologies will increases, but considering trends observed in other areas where major construction projects are implemented, it is likely to occur.
Reversibility	This impact will not be limited only to the construction phase. Social ills developing in a community over a significant timeframe will be hard to eradicate, this impact is thus rated as only partly reversible. This is particularly applicable if the migrant workers and job seekers choose to stay in the community after construction is complete.
Irreplaceable loss of resources	This impact could be associated with some losses of personal goods and livestock.
Duration	Rated as long-term based on the fact that migrant workers and job seekers could stay in the area for the life of the project and possibly longer.
Cumulative effect	The cumulative impact is rated as negligible. No additional renewable energy projects or major developments are planned for the near future in the area, thus, no additional influx of migrant workers is expected.

Intensity/magnitude	Rated as medium due to the fact that an increase in social pathologies will negatively affect the quality and integrity of the area affected.	
Significance Rating	**Prior to mitigation measures:** Medium negative **After mitigation measures:** Medium negative	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	2	2
Probability	3	2
Reversibility	2	2
Irreplaceable loss	2	2
Duration	3	1
Cumulative effect	1	1
Intensity/magnitude	3	3
Significance rating	39 (medium negative)	30 (medium negative)
Mitigation measures	The developers could implement the following measures to limit the occurrence of an increase in social pathologies: ▪ Set up a recruitment office in the nearby towns and adhere to strict labour recruitment practices that would reduce the desire of potential job seekers to loiter around the properties in hope to find temporary employment ▪ Ensure that the development site is fenced and the access controlled to limit or completely eliminate the possibility of livestock theft and burglaries at the residential properties. ▪ Employ locals as far as feasible through the creation of the local skills database and recruitment of suitable candidates. ▪ It is recommended that if possible, the project developers implement health awareness campaigns to curb the potential of spreading disease, use of drugs, or alcohol abuse for example.	

Table 64: Rating of impacts on deterioration of living conditions during construction

IMPACT TABLE	
Environmental Parameter	Sense of place, living and working conditions: these conditions are influenced by a variety of factors and can be quite subjective as each factor has a varying degree of

	influence for each person depending on what each individual values are.	
Issue/Impact/Environmental Effect/Nature	The construction activities will increase the traffic on the road and will generate a number of other negative impacts that will change the living and working conditions in the area, as well as the perception of the area among local residents and visitors.	
Extent	The biggest impact will be felt close to the project site, although it is likely to have some watered down impact on the rest of the municipality.	
Probability	Definite; should the proposed project be implemented these impacts will materialise.	
Reversibility	Should the plant cease operations, decommissioning can commence and the area will be restored. This impact is therefore rated as completely reversible.	
Irreplaceable loss of resources	This impact has no loss of physician or monetary resources, but will lead to the deterioration of the area's aesthetics.	
Duration	Rated as long-term based on the fact that these changes will take effect over the lifespan of the project, i.e. continue into the operational phase.	
Cumulative effect	Negligible, as there is no additional renewable energy projects or other major developments planned for the area in the near future.	
Intensity/magnitude	Rated as low considering the small population that will be impacted in the zone of influence.	
Significance Rating	**Prior to mitigation measures:** Low negative **After mitigation measures:** Low negative	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	4	4
Reversibility	1	1
Irreplaceable loss	1	1
Duration	3	3
Cumulative effect	1	1
Intensity/magnitude	1	1
Significance rating	11 (low negative)	11 (low negative)

Mitigation measures	▪ The mitigation measures proposed by other specialists should be adhered to ▪ Natural areas that are not affected by the footprint should be retain as such and avoided to be disturbed during construction ▪ Movement of workers and vehicles on the roads should be limited to working hours and workdays

Table 65: Rating of impacts on basic services and social and economic infrastructure during construction

IMPACT TABLE	
Environmental Parameter	Basic services and social and economic infrastructure; water provision and adequate sanitation are two of the basic services that are already strained within the municipality and the area where the proposed project is to be established.
Issue/Impact/Environmental Effect/Nature	The influx of jobseekers to the area and migration of workers will increase the demand for basic services, as well as social and economic infrastructure in the area. Thus will put pressure on the local municipality to ensure that the current services are not further deteriorated.
Extent	The added strain on infrastructure will be felt by the local municipality.
Probability	Probable; an influx of migrant workers will put additional strain on the region's infrastructure.
Reversibility	This impact is partly reversible but will require significant investment to provide adequately for the area with a temporary increase in population and straining infrastructure.
Irreplaceable loss of resources	This impact is not associated with any losses of resources; however, deterioration of man-made infrastructure is probable.
Duration	Rated as medium-term, as impacts may last post the construction phase until mitigated.
Cumulative effect	Negligible, as there is no additional renewable energy projects or other major development planned for the area in the near future.
Intensity/magnitude	Rated as high, considering the existing challenges already experienced by the area.
Significance Rating	**Prior to mitigation measures:** Medium negative

	After mitigation measures: Low negative	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	2	2
Probability	3	3
Reversibility	2	2
Irreplaceable loss	1	1
Duration	2	2
Cumulative effect	1	1
Intensity/magnitude	3	2
Significance rating	33 (medium negative)	22 (low negative)
Mitigation measures	▪ Engage with local authorities and inform them of the development as well discuss with them the ability of the municipality to meet the demands for social and basic services created by the migrant construction workers ▪ Where feasible, assist the municipality in ensuring that the quality of the local social and economic infrastructure does not deteriorate further (especially the local roads)	

- Operation

Table 66: Rating of impacts of sustainable increase in production and GDP-R due to operation

IMPACT TABLE	
Environmental Parameter	Economic Production; an activity that uses inputs of varied nature to produce goods and services
Issue/Impact/Environmental Effect/Nature	An increase in production or new business sales within the country is expected that is to be generated as a result of the annual operating expenditure and revenue derived from the operations of the solar PV plant.
Extent	The national economy will experience an increase in production.
Probability	Probable; the national economy will definitely experience an increase in production.
Reversibility	The impact is irreversible as production created cannot be "undone" or withdrawn.
Irreplaceable loss of resources	No loss of resources.
Duration	This impact is rated as long-term since it will be experienced over the entire operational life of the project.

Cumulative effect	Negligible, as there is no additional renewable energy projects or other major development planned for the area in the near future.	
Intensity/magnitude	The direct impact associated with the project will lead to positive change in the local economy's structure. However, it significance will be of medium intensity due to the expected magnitude and the size of the local economy.	
Significance Rating	**Prior to mitigation measures:** Medium positive **After mitigation measures:** Medium positive	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	4	4
Probability	3	3
Reversibility	4	4
Irreplaceable loss	1	1
Duration	3	3
Cumulative effect	1	1
Intensity/magnitude	2	2
Significance rating	32 (medium positive)	32 (medium positive)
Mitigation measures	In order to increase the benefit to the local economy, thereby improving the intensity of the impact felt by the Elias Motsoaledi LM, operators should procure goods and services locally where possibly. However, it will not change the overall significance of the impact.	

Table 67: Rating of impacts of sustainable increase in GDP-R of the local, regional and national economies during operation

IMPACT TABLE	
Environmental Parameter	GDP-R; the total value of all final goods and services produced within a region during a year.
Issue/Impact/Environmental Effect/Nature	The national and local economies will experience an increase in value added.
Extent	The national economy will experience an increase in value added.
Probability	Definite; the national economy will definitely experience an increase in value added.
Reversibility	The impact is irreversible as production created cannot be "undone" or withdrawn.
Irreplaceable loss of resources	No loss of resources.

Duration	This impact is rated as long-term since it will be experienced over the entire operational life of the project.	
Cumulative effect	Negligible, as there is no additional renewable energy projects or other major development planned for the area in the near future.	
Intensity/magnitude	The direct impact associated with the project will lead to the change in the local economy's structure but will have a diluted effect on the national economy.	
Significance Rating	**Prior to mitigation measures:** Medium positive **After mitigation measures:** Medium positive	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	4	4
Probability	4	4
Reversibility	4	4
Irreplaceable loss	1	1
Duration	3	3
Cumulative effect	1	1
Intensity/magnitude	2	2
Significance rating	34(medium positive)	34(medium positive)
Mitigation measures	The solar PV facility should be encouraged to procure materials, goods, services and products required for the operation of the plant from local suppliers to increase the impact on local and regional economies, without jeopardising its own efficiency and competitiveness. However, this might have an impact on the local economy and will not affect the estimate of the total value-added to be generated by the project. Thus, it will not change the rating.	

Table 68: Rating of impacts of creation of sustainable employment positions during operation

IMPACT TABLE	
Environmental Parameter	Sustainable employment opportunities
Issue/Impact/Environmental Effect/Nature	The project is expected to create over 1600 person-years throughout its operational lifespan, including 80% from the local communities, and will create and support for the duration of its operations employment opportunities created through multiplier effects.

Extent	The national economy will benefit from an increase in long-term employment opportunities.	
Probability	New jobs will definitely be created.	
Reversibility	The created employment opportunities are expected to last for the duration of the project, during which time the impact will be irreversible.	
Irreplaceable loss of resources	No loss of resources.	
Duration	This impact is considered long-term since it will last for at least the life of the project.	
Cumulative effect	Negligible, as there is no additional renewable energy projects or other major developments planned for the area in the near future.	
Intensity/magnitude	The impact is considered to have a medium intensity rating since the creation of permanent formal sector employment within the local economy will have a positive effect on the employment situation in the area and the standard of living of the local community. Nationwide, the impact will be of a lower intensity.	
Significance Rating	**Prior to mitigation measures:** Medium positive **After mitigation measures:** Medium positive	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	4	4
Probability	4	4
Reversibility	4	4
Irreplaceable loss	1	1
Duration	3	3
Cumulative effect	1	1
Intensity/magnitude	2	2
Significance rating	34(medium positive)	34(medium positive)
Mitigation measures	▪ Local labour should be considered for employment as far as feasible, and if necessary appropriate skills development programmes should be implemented ▪ Local small business should also be approached to investigate the possibility of supplying inputs for maintenance and operations where viable, this should increase local indirect employment creation.	

Table 69: Rating of impacts on skills development of permanently employed workers at the plant during operation

IMPACT TABLE		
Environmental Parameter	Skills development; long term knowledge transfer and skills development will take place as a result of the expected new employment creation.	
Issue/Impact/Environmental Effect/Nature	Those directly involved with operation will gain new skills or be given the opportunity to practice existing skills.	
Extent	It is envisaged that the benefits will be distributed among the entire economy.	
Probability	This impact is rated as possible to take place, considering the current skills base, labourers with the required skills may not be available locally without training.	
Reversibility	Irreversible; skills once gained cannot be lost.	
Irreplaceable loss of resources	No loss of resources.	
Duration	Long-term considering the duration of the phase.	
Cumulative effect	Negligible, as there is no additional renewable energy projects or other major developments planned for the area in the near future.	
Intensity/magnitude	Impact is rated as being of low intensity due to the nature of skills required for the operations.	
Significance Rating	**Prior to mitigation measures:** Low positive **After mitigation measures:** Low positive	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	4	4
Probability	2	3
Reversibility	4	4
Irreplaceable loss	1	1
Duration	3	3
Cumulative effect	1	1
Intensity/magnitude	1	1
Significance rating	15 (low positive)	16 (low positive)
Mitigation measures	In order to improve the chances of skills being developed during the operational period it is recommended that vocational skills transfer/training programmes be	

	developed and knowledge sharing among employees encouraged. This mitigation measure could potentially improve the weighting of the impact in terms of its probability and increase its significance slightly.

Table 70: Rating of impacts of improved standards of living of households benefiting from operations

IMPACT TABLE		
Environmental Parameter	Household income; the result of a households' members engaging in economic activity; has a direct link to the standard of living of these households.	
Issue/Impact/Environmental Effect/Nature	It is expected that the households benefitting will experience an increase in income as a result of the sustainable jobs created through the operation of the solar plant directly and its multiplier effects.	
Extent	The availability of new jobs and subsequently an increase to household income will be spread across the national economy.	
Probability	Definite.	
Reversibility	This impact is irreversible, as the job created will not be ceased until the plant is operating.	
Irreplaceable loss of resources	No loss of resources.	
Duration	This impact will be relevant over at least the operational life of the project and is thus rated long-term.	
Cumulative effect	Negligible, as there is no additional renewable energy projects or other major development planned for the area in the near future.	
Intensity/magnitude	Employment within Elias Motsoaledi is currently dominated by formal sector opportunities and there is a high unemployment rate; the availability of more sustainable jobs will improve the lives of the local community. However, within the national economy the benefits of the increased sustainable income will be less prominent. The impact is rated as medium intensity.	
Significance Rating	**Prior to mitigation measures:** Medium positive **After mitigation measures:** Medium positive	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	4	4

Probability	4	4
Reversibility	4	4
Irreplaceable loss	1	1
Duration	3	3
Cumulative effect	1	1
Intensity/magnitude	2	2
Significance rating	34(medium positive)	34(medium positive)
Mitigation measures	Local procurement of labour and required goods and services should be encouraged as far as feasible to increase the benefit to the local households. This, though, will not affect the overall rating.	

Table 71: Rating of impacts of sustainable increase in government revenue during operation

IMPACT TABLE	
Environmental Parameter	Government revenue; government obtains its revenue by collecting taxes and rates from the country's citizen's and business.
Issue/Impact/Environmental Effect/Nature	The impact takes place mostly with payment of salaries and wages, as well as payment of company taxes.
Extent	The fiscal gain will be collected by the national government and used in the national budget; it is not possible to pinpoint exact regions benefitting from this increase.
Probability	Definite; although, it cannot be certain of the exact amount that government will be collecting as a result of this phase of the proposed project.
Reversibility	Government will collect the taxes and have the increased revenue available to improve socio-economic conditions somewhere in South Africa, for this reason, this impact is rated as irreversible.
Irreplaceable loss of resources	No loss of resources.
Duration	This impact is rated as long-term since the government will be collecting increased revenue as a result of the project and its multiplier effects for at least 25 years.
Cumulative effect	Negligible, as there is no additional renewable energy projects or other major development planned for the area in the near future.
Intensity/magnitude	For the tax period of 2014/2015, the revised consolidated tax revenue for South Africa was estimated at R997.7 billion, the impact of the project's assumed contribution is relatively small.

Significance Rating	**Prior to mitigation measures:** Low positive **After mitigation measures:** Low positive	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	4	4
Probability	4	4
Reversibility	4	4
Irreplaceable loss	1	1
Duration	3	3
Cumulative effect	1	1
Intensity/magnitude	1	1
Significance rating	17 (low positive)	17 (low positive)
Mitigation measures	No mitigation measures.	

Table 72: Rating of impacts of local community economic and social development benefits during operation

IMPACT TABLE	
Environmental Parameter	SED and ED initiatives; as part of the RE IPPPP, project owners are required to spend a portion of their turnover on the upliftment of the community where the project is located.
Issue/Impact/Environmental Effect/Nature	Currently the economic base of Dennilton is small, the anticipated injection will have a significant positive impact on the standard of living of its community.
Extent	The impact will affect the local municipality; it is envisaged to be geared towards Dennilton and nearby villages due to their proximity to the site but could potentially be extended in the future.
Probability	Definite; spending on SED and ED initiatives is prescribed by government under the RE IPPPP.
Reversibility	The investment will take place annually for the life of the project. It can be assumed that once these investments are injected into the benefitting community it will be irreversible.
Irreplaceable loss of resources	No loss of resources.
Duration	This impact is rated as long-term since the SED and ED initiatives will take place annually for the life of the project.

Cumulative effect	Negligible, as there is no additional renewable energy projects planned for the area in the near future.	
Intensity/magnitude	The Elias Motsoaledi economy is in dire need for stimulus and investment in infrastructure; these development initiatives will therefore have a medium intensity impact.	
Significance Rating	**Prior to mitigation measures:** Medium positive **After mitigation measures:** Medium positive	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	2	2
Probability	4	4
Reversibility	4	4
Irreplaceable loss	1	1
Duration	3	3
Cumulative effect	1	1
Intensity/magnitude	3	3
Significance rating	45 (medium positive)	45 (medium positive)
Mitigation measures	It is recommended that the project owner develops practical SED and ED programmes throughout the project's lifespan. The plan should be developed in consultation with local authorities and existing strategy documents to identify community projects that would result in the greatest social benefits. With regard to ED initiatives, focus should be on developing plans to support and create sustainable, self-sufficient enterprises. It is important that these plans be reviewed annually and where possible updated.	

Table 73: Rating of impacts of Impact on the sense of place and deterioration of living conditions in the zone of influence during operation

IMPACT TABLE	
Environmental Parameter	Sense of place, living and working conditions: these conditions are influenced by a variety of factors and can be quite subjective as each factor has a varying degree of influence for each person depending on what each individual values are.
Issue/Impact/Environmental Effect/Nature	Operation activities will increase the traffic on the road and will generate a number of other negative impacts that will change the living and working conditions in the area, as well as the perception of the area among local residents and visitors.

Extent	The biggest impact will be felt close to the project site, although it is likely to have some watered down impact on the rest of the municipality.	
Probability	Definite; should the proposed project be implemented these impacts will materialise.	
Reversibility	Should the plant cease operations, decommissioning can commence and the area will be restored. This impact is therefore rated as completely reversible.	
Irreplaceable loss of resources	This impact has no loss of physician or monetary resources, but will lead to the deterioration of the area's aesthetics.	
Duration	Rated as long-term based on the fact that these changes will take effect over the lifespan of the project, i.e. continue into the operational phase.	
Cumulative effect	Negligible, as there is no additional renewable energy projects or other major developments planned for the area in the near future.	
Intensity/magnitude	Rated as low considering the small population that will be impacted in the zone of influence.	
Significance Rating	**Prior to mitigation measures:** Low negative **After mitigation measures:** Low negative	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	4	4
Reversibility	1	1
Irreplaceable loss	1	1
Duration	3	3
Cumulative effect	1	1
Intensity/magnitude	1	1
Significance rating	11 (low negative)	11 (low negative)
Mitigation measures	▪ The mitigation measures proposed by the visual specialist should be adhered to ▪ Natural areas that are not affected by the footprint should be retain as such and avoided to be disturbed during construction ▪ Movement of workers and vehicles on the roads should be limited to working hours and workdays	

- Decommissioning

Socio-economic impacts stimulated during the closure phase are expected to be similar to those that take place during the construction phase. They will be of a shorter duration and will be associated with a smaller expenditure than that observed during construction. Besides the positive impacts on production, employment, household income, and government revenue that could ensue from the project, some negative impacts could also occur. These would largely be related to a slight increase in noise in the area surrounding the site, increase in traffic congestion on the R25, and concerns over local safety and security due to a greater number of people accessing the area, all of which will negatively impact on the livelihoods of the people and the standard of living in the area.

9.2.7 Geotechnical

- Planning

No impacts are expected during planning.

- Construction

Table 74: Rating of impacts of layout alternatives 1 and 2, and laydown areas 1 and 2 on soils during construction

IMPACT TABLE	
Environmental Parameter	Soils
Issue/Impact/Environmental Effect/Nature	Soil disturbance during construction may destabilise the soil and lead to soil erosion. Construction and use of access roads by heavy duty vehicles, construction equipment and maintenance vehicles may destabilise the soil and lead to soil erosion.
Extent	Site only
Probability	Possible due to gentle topography and our assessment that the sub-soils have a moderate erosion potential.
Reversibility	Completely reversible
Irreplaceable loss of resources	Marginal loss of resources (soil)
Duration	Medium term (effects will last for some time after construction phase but will be mitigated by direct human action or by natural processes thereafter)
Cumulative effect	Negligible cumulative impact

Intensity/magnitude	Low (with mitigation) Medium (without mitigation)	
Significance Rating	**Prior to mitigation measures:** Low negative **After mitigation measures:** Low negative	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	2	1
Reversibility	1	1
Irreplaceable loss	2	1
Duration	2	2
Cumulative effect	1	1
Intensity/magnitude	2	1
Significance rating	18 (low negative impact)	7 (low negative impact)
Mitigation measures	▪ Design and construction of stormwater management systems ▪ Use of berms and drainage channels to direct water away from the construction areas where necessary ▪ Minimise earthworks and levelling ▪ Rehabilitate disturbed areas as soon as possible after construction ▪ Correct engineering design of all access roads	

Table 75: Rating of impacts of substation and O&M building alternative 1 (south –west) and 3 (south-east) during construction

IMPACT TABLE	
Environmental Parameter	Soils
Issue/Impact/Environmental Effect/Nature	Soil disturbance during construction may destabilise the soil and lead to soil erosion. Runoff from substation site may cause soil erosion during operation.
Extent	Site only.
Probability	Possible due to gentle topography and our assessment that the sub-soils have a moderate erosion potential.
Reversibility	Completely reversible
Irreplaceable loss of resources	Marginal loss of resources (soil)

Duration	Medium term (effects will last for some time after construction phase but will be mitigated by direct human action or by natural processes thereafter)	
Cumulative effect	Negligible cumulative impact	
Intensity/magnitude	Low (with mitigation) Medium (without mitigation)	
Significance Rating	**Prior to mitigation measures:** Low negative **After mitigation measures:** Low negative	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	2	1
Reversibility	1	1
Irreplaceable loss	2	1
Duration	2	2
Cumulative effect	1	1
Intensity/magnitude	2	1
Significance rating	18 (negative low impact)	7 (negative low impact)
Mitigation measures	▪ Design and construction of stormwater management system including stormwater outfalls ▪ Use of berms and drainage channels to direct water away from the construction areas where necessary ▪ Minimise earthworks and levelling ▪ Rehabilitate disturbed areas as soon as possible after construction	

Table 76: Rating of impacts of substation and O&M building alternative 2 (north) during construction

IMPACT TABLE	
Environmental Parameter	Soils
Issue/Impact/Environmental Effect/Nature	Soil disturbance during construction may destabilise the soil and lead to soil erosion. Runoff from substation site may cause soil erosion during operation.
Extent	Site only.
Probability	Probably due to shallow groundwater conditions, subsoils that have a moderate erosion potential and existing erosion in the vicinity of the proposed site.

Reversibility	Completely reversible	
Irreplaceable loss of resources	Marginal loss of resources (soil)	
Duration	Medium term (effects will last for some time after construction phase but will be mitigated by direct human action or by natural processes thereafter)	
Cumulative effect	Negligible cumulative impact	
Intensity/magnitude	Low (with mitigation) Medium (without mitigation)	
Significance Rating	**Prior to mitigation measures:** Low negative **After mitigation measures:** Low negative	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	3	2
Reversibility	1	1
Irreplaceable loss	2	1
Duration	2	2
Cumulative effect	1	1
Intensity/magnitude	2	1
Significance rating	20 (negative low impact)	8 (negative low impact)
Mitigation measures	▪ Design and construction of stormwater management system including stormwater outfalls ▪ Use of berms and drainage channels to direct water away from the construction areas where necessary ▪ Minimise earthworks and levelling ▪ Rehabilitate disturbed areas as soon as possible after construction	

- Operation

No impacts are expected during operation.

- Decommissioning

Geotechnical impacts during the decommissioning phase are potentially similar to those during the construction phase.

10 CUMULATIVE IMPACTS AND MITIGATION MEASURES

10.1 Cumulative Impacts

There are no other existing or planned renewable projects in the Dennilton area, and very little development taking place in the vicinity of the proposed project. Cumulative impacts are not expected to be significant as a result of the proposed project, however each specialist assessed the potential for cumulative project impacts. These are shown in Table 77 below.

Table 77: Cumulative impacts resulting from the proposed development

Environmental Parameter	Cumulative Impact
Biodiversity	▪ Low cumulative impacts
Surface Water	▪ Low to medium cumulative surface water impacts
Agricultural Potential and Soils	▪ Low cumulative impacts
Visual	▪ Low to medium cumulative impacts
Heritage	▪ None identified
Socio-economic	▪ Cumulative effects will be negligible
Geotechnical	▪ None identified

10.2 Mitigation Measures

10.2.1 Biodiversity

- **Surface Runoff and Stormwater Management Plan**
  This plan must indicate how all surface runoff generated as a result of the project and associated activities (during both the construction and operational phases) will be managed (e.g. artificial wetlands/stormwater and flood retention ponds) prior to entering any natural drainage system or wetland and how surface water runoff will be retained outside of any demarcated buffer/flood zones and subsequently released to simulate natural hydrological conditions.
- **Rehabilitation Programme**

Rehabilitation Programme should be established before operation. The programme must address the rehabilitation of the existing habitats as well as rehabilitation after closure. This Rehabilitation Programme must be approved by the relevant government departments.

- **Botanical walk-through survey**
  A preconstruction walk-through survey should be undertaken to list the identity and location of all listed and protected species. The results of the walk-through survey should provide an indication of the number of individuals of each listed species that are likely to be impacted by the proposed development
- **Obtain permits for protected plants**
  It is a legal requirement that permits will be required for any species protected according to National or Provincial legislation. The identity of species affected by such permit requirements can only be identified during the walk-through survey (previous mitigation measure). It is common practice for the authorities that issue the permits to require search and rescue of affected plants. There are a number of individuals of the protected tree, Sclerocarya birrea subsp. caffra, that occur on site. The location and condition of each individual tree must be recorded and a permit obtained for the removal of each of these.
- **Alien plant management plan**
  It is recommended that a monitoring programme be implemented to enforce continual eradication of alien and invasive species, especially within the riparian habitat. An Alien Invasive Programme is an essential component to the successful conservation of habitats and species. Alien species, especially invasive species are a major threat to the ecological functioning of natural systems and to the productive use of land. In terms of the amendments of the regulations under the Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983), landowners are legally responsible for the control of alien species on their properties. The protection of our natural systems from invasive species is further strengthened within Sections 70-77 of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004). This programme should include monitoring procedures. According to the Conservation of Agricultural Resources Act (Act No. 43 of 1983), all declared aliens that occur on the property must be effectively controlled. In terms of this Act alien species were listed as declared weeds and invaders and ascribed to one of the following categories:
  - Category 1: Prohibited and must be controlled.
  - Category 2 (commercially used plants): May be grown in demarcated areas provided that there is a permit and that steps are taken to prevent their spread.
  - Category 3 (ornamentally used plants): May no longer be planted. Existing plants may be retained as long as all reasonable steps are taken to prevent the spreading thereof, except within the flood line of watercourses and wetlands.
- **Undertake regular monitoring**
  Monitoring should be undertaken to evaluate the success of mitigation measures. Monitoring methods must be in accordance with features that need to be monitored and can form part of a monitoring programme to be compiled.

10.2.2 Surface Water

- In general, all surface water resources must be avoided as far as possible to prevent direct impacts. Where this is not achievable, the relevant water use license and environmental authorisations are to be applied for before construction is allowed to commence in any of the identified surface water resources identified in this report.
- Importantly, where any structures are within 100m of any surface water resource, adequate run-off mitigation measures need to be accounted for as stipulated in the surface water specialist report above to prevent/minimize erosion and sedimentation impacts. These two impacts are the primary concern for the proposed development.

10.2.3 Agricultural Potential and Soils

- The main mitigation measures will involve ensuring that the minimum surface disturbance takes place, both in terms of soil excavation and vegetation removal. If normal construction methods are used for foundations and infrastructure, then post-project rehabilitation should be successful once the infrastructure is removed. Where roads or paths are constructed, soil conservation measures (run-off channels, drains etc.) as well as regular maintenance) will also be required.

10.2.4 Visual

- Carefully plan to reduce the construction period.
- Where possible, minimise vegetation clearing and rehabilitate cleared areas as soon as possible.
- Maintain a neat construction site by removing rubble and waste materials regularly.
- Make use of existing gravel access roads where possible.
- Ensure that dust suppression techniques are implemented on all access roads.
- Light fittings for operations and security at night should reflect the light toward the ground and prevent light spill.
- The operations and maintenance buildings should not be illuminated at night.
- Bury cables under the ground where possible.
- The operation and maintenance building should be painted with natural tones that fit with the surrounding environment. Non-reflective surfaces should be utilised where possible.

10.2.5 Heritage

Archaeological Sites

- Monitor find spot areas if construction is going to take place through them.
- A management plan for the heritage resources needs then to be compiled and approved for implementation during construction and operations.

Historical sites

- Where the structures are to be impacted directly by the development, a consultation process to determine if any graves or still born burial exist in and around the ruins, must be conducted;
- If it is found that there are burials associated with the ruins, a grave relocation process must be initiated.
- An archaeologist to identify any significant cultural or possible human remains must monitor the demolition of the structures.

Cemetery

- The cemetery needs to be fenced and a 20m safety buffer needs to be included inside the development footprint to ensure protection of the cemetery.

10.2.6 Socio-economic

- Procure construction materials, goods, and products from local suppliers if feasible
- Employ local contractors where possible
- Employ labour-intensive methods in construction, where feasible.
- Employ local residents and communities, where possible.
- Sub-contract to local construction companies, where possible.
- Utilise local suppliers, where possible, and arrange with the local Small and Medium Enterprises to provide transport, catering, and other services for the construction crew.
- In order to improve the chances of skills being developed during the construction period it is recommended that contractors are encouraged to provide learnerships and share knowledge with the employees
- Recruit local labour as far as feasible to increase the benefits to the local households.
- Set up a recruitment office in the nearby towns and adhere to strict labour recruitment practices that would reduce the desire of potential job seekers to loiter around the properties in hope to find temporary employment
- Ensure that the development site is fenced and the access controlled to limit or completely eliminate the possibility of livestock theft and burglaries at the residential properties.
- Employ locals as far as feasible through the creation of the local skills database and recruitment of suitable candidates.
- It is recommended that if possible, the project developers implement health awareness campaigns to curb the potential of spreading disease, use of drugs, or alcohol abuse for example.
- Natural areas that are not affected by the footprint should be retain as such and avoided to be disturbed during construction
- Movement of workers and vehicles on the roads should be limited to working hours and workdays

- Engage with local authorities and inform them of the development as well discuss with them the ability of the municipality to meet the demands for social and basic services created by the migrant construction workers
- Where feasible, assist the municipality in ensuring that the quality of the local social and economic infrastructure does not deteriorate further (especially the local roads)
- Local small business should also be approached to investigate the possibility of supplying inputs for maintenance and operations where viable, this should increase local indirect employment creation.
- It is recommended that the project owner develops practical SED and ED programmes throughout the project's lifespan. The plan should be developed in consultation with local authorities and existing strategy documents to identify community projects that would result in the greatest social benefits. With regard to ED initiatives, focus should be on developing plans to support and create sustainable, self-sufficient enterprises. It is important that these plans be reviewed annually and where possible updated.

10.2.7 Geotechnical

- Geotechnical constraints may be mitigated by conventional design and construction methods.
- Design and construction of stormwater management system including stormwater outfalls
- Use of berms and drainage channels to direct water away from the construction areas where necessary
- Minimise earthworks and levelling
- Rehabilitate disturbed areas as soon as possible after construction
- Correct engineering design of all access roads.

11 DESCRIPTION AND COMPARATIVE ASSESSMENT OF ALL ALTERNATIVES IDENTIFIED

Various specialists identified site specific sensitive areas during the scoping phase of the EIA that should ideally be precluded from the buildable area. These include the surface water specialist and the heritage specialist. Based on these sensitive areas, two (2) alternative PV array areas, two (2) alternative laydown areas and an indicative road layout were proposed that avoid all sensitive areas. Additionally, three (3) alternative substation and three (3) alternative O&M building areas were put forward for consideration. These layouts are presented in Figure 56, Figure 57 and Figure 58. Due to the elimination of all surface water features and heritage sites from the potential buildable area, the proposed layouts were severely constrained in terms of the area available. The two layout alternatives are therefore relatively similar, however the three substation alternatives were positioned as far apart as possible. Identifying two relatively similar layouts that are both environmentally feasible was considered more beneficial to the EIA process than only considering one alternative against the option of not implanting the activity or no-go alternative.

All the identified alternatives are considered to be beneficial from an environmental perspective as they have been positioned to avoid all the highly sensitive areas that were identified by the specialists during the scoping phase.

Each of these alternatives are comparatively assessed below in terms of the findings from the specialist studies conducted during the EIA. Table 78 below highlights the issues and preferences associated with each alternative thereby identifying the preferred alternative.

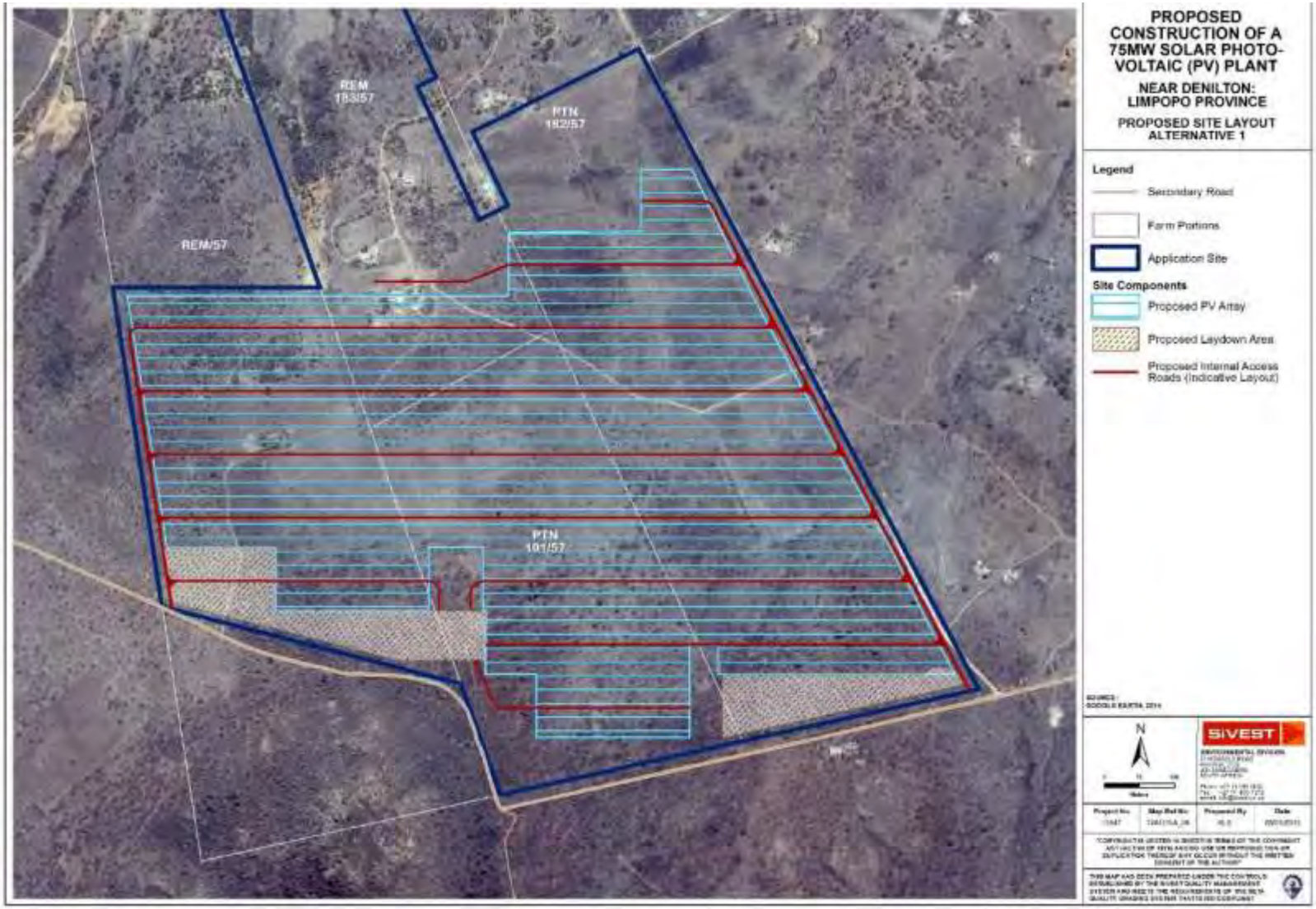


Figure 56: Proposed Site Layout Alternative 1

Figure 57: Proposed Site Layout Alternative 2

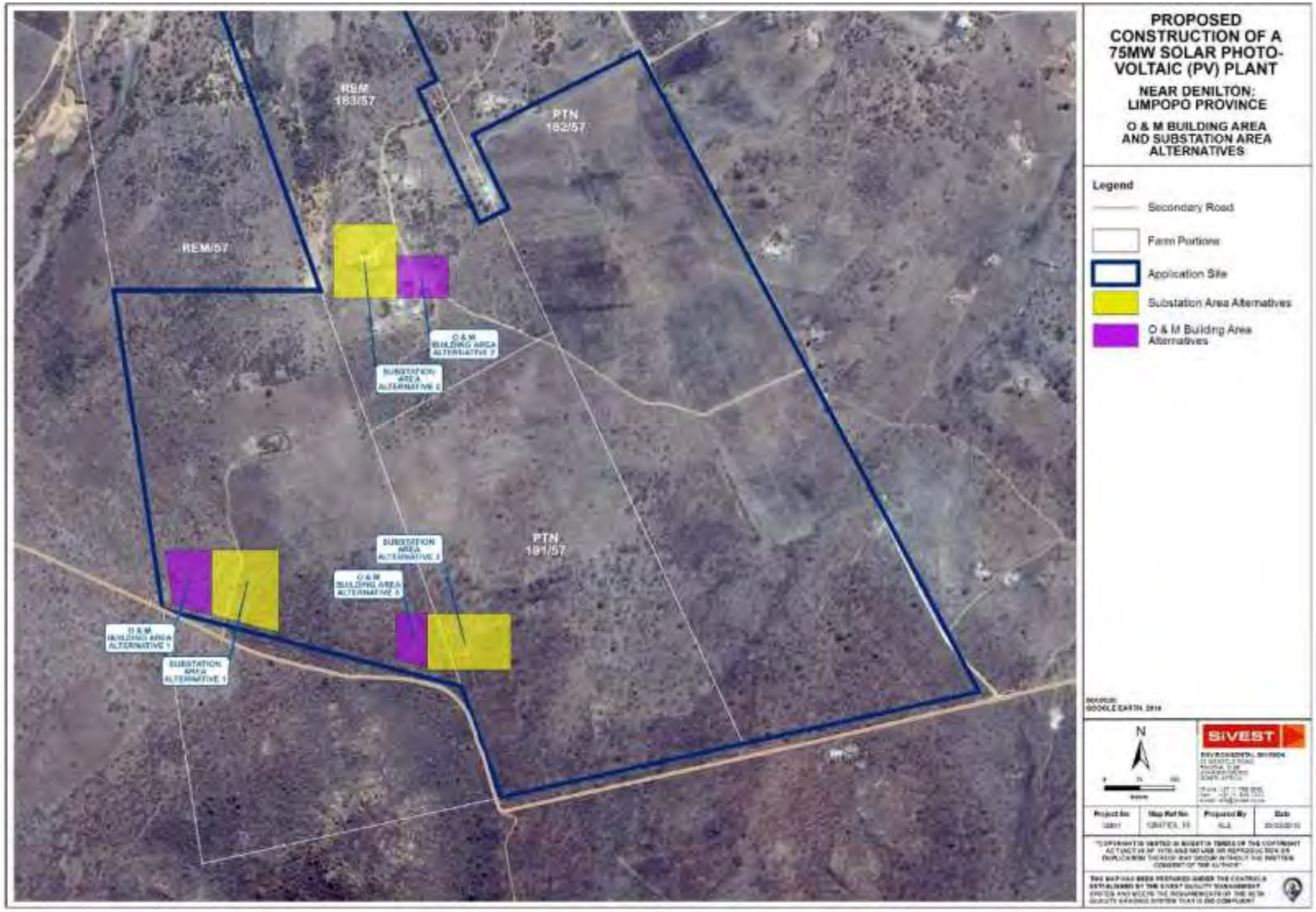


Figure 58: Substation and O&M Building Alternatives

Key

PREFERRED	The alternative will result in a low impact / reduce the impact
FAVOURABLE	The impact will be relatively insignificant
NOT PREFERRED	The alternative will result in a high impact / increase the impact
NO PREFERENCE	The alternative will result in equal impacts

Table 78: Alternatives Assessment summarising the impacts, highlighting issues/concerns and indicating the preference associated with each solar panel array layout alternative

Alternative	Environmental Aspect	Preference	Concerns / Impact Summary	Fatal Flaws
Solar Panel Array Layout Alternative 1 (No Preference)	Biodiversity	No Preference	Both array alternatives affect almost the exact same footprint, which consists primarily of old lands and surrounding areas of slightly degraded woodland.	No Fatal Flaws
	Surface Water	No Preference	No surface water features will be affected.	No Fatal Flaws
	Agricultural Potential and Soils	No Preference	Will result in the same area being disturbed.	No Fatal Flaws
	Heritage	Preferred	Both show minimal impact on heritage resources	No Fatal Flaws
	Visual	No Preference	Both alternatives will have a similar visual impact	No Fatal Flaws
	Socio-economic	No Preference	Layout alternatives cannot be differentiated from a socio-economic perspective.	No Fatal Flaws
	Geotechnical	No Preference	Low impact on the geology and soils	No Fatal Flaws

Alternative	Environmental Aspect	Preference	Concerns / Impact Summary	Fatal Flaws
Solar Panel Array Layout Alternative 2 (No Preference)	Biodiversity	No Preference	Both array alternatives affect almost the exact same footprint, which consists primarily of old lands and surrounding areas of slightly degraded woodland.	No Fatal Flaws
	Surface Water	No Preference	No surface water features will be affected.	No Fatal Flaws
	Agricultural Potential and Soils	No Preference	Will result in the same area being disturbed.	No Fatal Flaws
	Heritage	Preferred	Both show minimal impact on heritage resources	No Fatal Flaws
	Visual	No Preference	Both alternatives will have a similar visual impact	No Fatal Flaws
	Socio-economic	No Preference	Layout alternatives cannot be differentiated from a socio-economic perspective.	No Fatal Flaws
	Geotechnical	No Preference	Low impact on the geology and soils	No Fatal Flaws

Table 79: Alternatives Assessment summarising the impacts, highlighting issues/concerns and indicating the preference associated with each substation and associated buildings alternative

Alternative	Environmental Aspect	Preference	Concerns / Impact Summary	Fatal Flaws
Substation and OM Alternative 1 (south-west) (Preferred Alternative)	Biodiversity	No Preference	Both this option and Alternative 3 are in slightly degraded woodland areas. Impacts are not highly significant for either option.	No Fatal Flaws
	Surface Water	Preferred	No surface water features will be affected.	No Fatal Flaws
	Agricultural Potential and Soils	Preferred	Situated on shallow soils.	No Fatal Flaws

Alternative	Environmental Aspect	Preference	Concerns / Impact Summary	Fatal Flaws
	Heritage	Preferred	Does not impact on heritage resources.	No Fatal Flaws
	Visual	Preferred	Alternative 1 will have the lowest visual impact as no potentially sensitive visual receptor locations are within close proximity.	No Fatal Flaws
	Socio-economic	No Preference	Layout alternatives cannot be differentiated from a socio-economic perspective.	No Fatal Flaws
	Geotechnical	Preferred	Low impact on the geology and soils.	No Fatal Flaws
Substation and OM Alternative 2 (north) (Not Preferred)	Biodiversity	Favourable	No natural habitat will be affected by this option.	No Fatal Flaws
	Surface Water	Favourable	This alternative is viewed as favourable due to the proximity to the identified erosion channel.	No Fatal Flaws
	Agricultural Potential and Soils	Preferred	Situated on shallow soils.	No Fatal Flaws
	Heritage	Not Preferred	Impacts on NK02 and NK03 which are still in use.	No Fatal Flaws
	Visual	Favourable	Although Alternative 2 is located within 700m from the surrounding farm dwellings to the east, there is a high level of landscape degradation in this area. In addition, the receptors may regard the proposed development in a positive light as it could result in employment creation and economic growth in the area.	No Fatal Flaws
	Socio-economic	No Preference	Layout alternatives cannot be differentiated from a socio-economic perspective.	No Fatal Flaws
	Geotechnical	Favourable	Shallower groundwater conditions. Higher erosion potential as compared to Alternative 1 and 3.	No Fatal Flaws
	Biodiversity	No Preference	Both this option and Alternative 1 are in slightly degraded woodland areas. Impacts are not highly significant for either option.	No Fatal Flaws

Alternative	Environmental Aspect	Preference	Concerns / Impact Summary	Fatal Flaws
Substation and OM Alternative 3 (south-east) (Favourable)	Surface Water	Preferred	No surface water features will be affected.	No Fatal Flaws
	Agricultural Potential and Soils	Preferred	Situated on shallow soils.	No Fatal Flaws
	Heritage	Preferred	Does not impact on heritage resources	No Fatal Flaws
	Visual	Not Preferred	Alternative 3 is located in close proximity (approximately 300m) to the Mabusa Nature Reserve. Although no formal economic tourism activities take place within this part if the reserve, the Thembisile Local Municipality plans to develop a tourism/conservation area belt and the Mabusa Nature Reserve forms part of this project.	No Fatal Flaws
	Socio-economic	No Preference	Layout alternatives cannot be differentiated from a socio-economic perspective.	No Fatal Flaws
	Geotechnical	Preferred	Low impact on the geology and soils.	No Fatal Flaws

Table 80: Alternatives Assessment summarising the impacts, highlighting issues/concerns and indicating the preference associated with laydown area alternative

Alternative	Environmental Aspect	Preference	Concerns / Impact Summary	Fatal Flaws
Laydown Alternative 1 (No Preference)	Biodiversity	No Preference	Both array alternatives affect almost the exact same footprint, which consists primarily of old lands and surrounding areas of slightly degraded woodland.	No Fatal Flaws
	Surface Water	No Preference	No surface water features will be affected.	No Fatal Flaws

Alternative	Environmental Aspect	Preference	Concerns / Impact Summary	Fatal Flaws
	Agricultural Potential and Soils	No Preference	Western portion of each on low to moderate potential soils, eastern portion of each on high potential soils	No Fatal Flaws
	Heritage	Preferred	Does not impact on heritage resources	No Fatal Flaws
	Visual	No Preference	Both alternatives will have a similar visual impact	No Fatal Flaws
	Socio-economic	No Preference	Layout alternatives cannot be differentiated from a socio-economic perspective.	No Fatal Flaws
	Geotechnical	No Preference	Low impact on the geology and soils	No Fatal Flaws
Laydown Alternative 2 (No Preference)	Biodiversity	No Preference	Both array alternatives affect almost the exact same footprint, which consists primarily of old lands and surrounding areas of slightly degraded woodland.	No Fatal Flaws
	Surface Water	No Preference	No surface water features will be affected.	No Fatal Flaws
	Agricultural Potential and Soils	No Preference	Western portion of each on low to moderate potential soils, eastern portion of each on high potential soils	No Fatal Flaws
	Heritage	Preferred	Does not impact on heritage resources	No Fatal Flaws
	Visual	No Preference	Both alternatives will have a similar visual impact	No Fatal Flaws
	Socio-economic	No Preference	Layout alternatives cannot be differentiated from a socio-economic perspective.	No Fatal Flaws
	Geotechnical	No Preference	Low impact on the geology and soils	No Fatal Flaws

11.1 Preferred Alternative Selection

As depicted in Table 78, Table 79 and Table 80above, solar panel array area 1 and 2, and laydown area alternatives 1 and 2 are equally preferable to the specialists, and there were no fatal flaws identified by the specialists. **Substation and O&M building alternative 1** are considered the preferred alternative overall as they were determined to have the fewest impacts by the majority of the specialists. Substation and O&M building alternative 3 is considered favourable, and substation and O&M building alternative 2 is considered not preferred because of potential impacts on heritage features. There were no major issues or concerns related to the associated infrastructure alternatives, and no fatal flaws identified by any of the specialists. All alternatives for the substation and O&M building, laydown area and solar panel array layout were considered to be suitable for the proposed project.

In order to facilitate the best configuration with preferred **alternative 1 substation** and **O&M building areas**; the **solar panel array area** and **laydown area** were adjusted slightly and a preferred layout was established (Figure 59). The layout alternatives assessed by the specialists in the EIA phase were preliminary determined by potential sensitive areas that were identified during the scoping phase. As a result of detailed EIA phase assessment, certain areas that were previously thought to be sensitive were found not to be so. In some cases the preferred layout has been amended slightly to include the areas previously excluded. This is the case in the southern section of the array layout where an area was previously excluded to avoid potential heritage resources. These were found not to occur and the array layout was subsequently changed to include this area. Roads have also been removed from the preferred layout because this will need to be determined by the panel layout which will only be finalised by the Engineering, Procurement and Construction team (EPC). Notwithstanding, the potential impact of roads has been assessed by the specialists and all roads will be located within the preferred array area.

Figure 59: Preferred Site Layout

A sensitivity map was also compiled for the proposed study area, based on the negative mapping / sensitivity assessment exercise that was undertaken by all the specialists during the EIA phase. This is indicated in Figure 60 below. The sensitivity map includes sensitive areas identified by the heritage, surface water and biodiversity specialists. No other on-site sensitive areas were identified by any other specialists.

Figure 60: Composite Sensitivity Map

As indicated above, the environmentally preferred layout was decided upon based on this sensitivity mapping and the recommendations in Table 78, Table 79, and Table 80 .

11.2 No Go Alternative

The No-Go Alternative is the option of not establishing the proposed Nokukhanya solar power plant near Dennilton, implying a continuation of the current situation or the status quo. The “no-go” or “no-action” alternative is regarded as a type of alternative that provides the means to compare the impacts of project alternatives with the scenario of a project not going ahead. In evaluating the “no-go” alternative it is important to take into account the implications of foregoing the benefits of the proposed project.

The No-Go option would therefore result in not contributing to meeting the demand for electricity and more specifically renewable energy targets in South Africa. This would also hinder the economic injection that the project promises to provide for the surrounding towns of Dennilton and Elandsdoorn, among others, in the form of short term employment, long term job creation and financial injection.

Although the negative impacts identified, such as visual impacts and impacts on biodiversity, surface water and heritage, would not occur if the project did not go ahead, the socio economic

benefit of the proposed project should not be overlooked. The No-Go alternative has thus been eliminated due to the fact that the identified environmental impacts can be suitably mitigated and that by not building the project, the socio-economic benefits would be lost.

12 ENVIRONMENTAL MONITORING AND AUDITING

The Environmental Management Programme (EMPr) becomes a tool by which compliance on the proposed site can be measured against. In order to utilise this tool, environmental monitoring needs to take place with regular audits against the EMPr to ensure that all aspects are attended to.

Environmental monitoring establishes benchmarks to judge the natural and magnitude of potential environmental and social impacts.

Some of the key parameters for monitoring and auditing of the proposed project include the following inter alia:

- Soil erosion and siltation.
- Oil spillages
- Dust and gaseous emissions.
- Water quality
- Change in biodiversity
- Socio-economic change
- Land use changes.

The overall objective of environmental and social monitoring is to ensure that mitigation measures are implemented and that they are effective. Environmental and social monitoring will also enable responses to new and developing issues of concern. The activities and indicators that have been recommended for monitoring are presented in the EMPr.

Environmental monitoring will be carried out to ensure that all construction activities comply and adhere to environmental provisions and standard specifications, so that all mitigation measures are implemented. The contractor shall employ an officer responsible for implementation of social/environmental requirements. This person will maintain regular contact with the local / district Environmental Officers. The contractor and proponent will have a responsibility to ensure that the proposed mitigation measures are properly implemented during the construction phase.

The environmental monitoring program will operate through the preconstruction, construction, and operation phases. It will consist of a number of activities, each with a specific purpose with key indicators and criteria for significance assessment. The following aspects will be subject to monitoring:

- Encroachment into sensitive areas
- Maintenance of project footprint
- Vegetation maintenance around project work sites, workshops and camps

- Health & Safety

Monitoring should be undertaken at a number of levels. Firstly, it should be undertaken by the Contractor at work sites during construction, under the direction and guidance of the Supervision Consultant who is responsible for reporting the monitoring to the implementing agencies. It is not the Contractor's responsibility to monitor land acquisition and compensation issues. It is recommended that the Contractor employ local full time qualified environmental inspectors for the duration of the Contract. The Supervision Consultant should include the services of an international environmental and monitoring specialist on a part time basis as part of their team.

Environmental monitoring is also an essential component of project implementation. It facilitates and ensures the follow-up of the implementation of the proposed mitigation measure, as they are required. It helps to anticipate possible environmental hazards and/or detect unpredicted impacts over time.

Periodic ongoing monitoring will be required during the life of the Project and the level can be determined once the Project is operational.

The EMPr is included in Appendix 8.

13 COMPLIANCE WITH WORLD BANK STANDARDS AND EQUATOR PRINCIPLES

This report has been prepared to comply with various environmental legislation as well as World Bank Standards (IFC Guidelines) and the Equator Principles. Thus in order to ensure compliance with these, a checklist has been compiled to ensure that all aspects of these guidelines have been taken into account when compiling this document. Table 81 below indicates that all applicable performance standards have been complied with.

The performance standards which have not been addressed at this stage as indicated in Table 81 below will be addressed at a later stage when the proponent has reached financial closure. Therefore, the compliance level is partially compliant at this stage. It is important to note that the project proponent is committed to achieving compliance with the EPs.

The coding key is as follows:

Compliance level			
Clear			
Not assessed/determined	Not compliant	Partially compliant	Compliant

Appendix 1 includes a handbook highlighting how the client plans to comply with the IFC Standards.

Table 81: Compliance with Equator Principles

PRINCIPLES	**COMPLIANCE LEVEL**	**REFERENCE**
Performance Standard 1 Environmental & Social Reporting		
1. Baseline Information		Refer to Chapter 6
2. Impacts and Risks		Refer to Chapter 9
3. Global impacts		N/A
4. Transboundary		N/A
5. Disadvantaged / vulnerable groups		Refer to Chapter 8.6
6. Third party		Refer to Chapter 8.6
7. Mitigation measures		Refer to Chapter 10.2 and the EMPr - Appendix 8
8. Documentation of Assessment process		Refer to Chapter 9
9. Action Plans		No major Action Plans required as mostly generic mitigation measures have been required.

10 Organizational capacity		Refer to Appendix 1
11. Training		Refer to Appendix 1
12. Grievance mechanism	The proponent will commit to full compliance with this standard when financial closure has been reached. The proponent is fully aware of the implications of this standard and this information will be made available in due course as part of the development planning for the project.	Refer to Appendix 1
Performance Standard 2, Labour & Working Conditions		
1. Human Resource Policy	The proponent commit to full compliance with this standard when financial closure has been reached. The proponent is fully aware of the implications of this standard and this information will be made available in due course as part of the development planning for the project.	Refer to Appendix 1
2. Working relationship		Refer to Appendix 1
3. Working conditions with and terms of employment		Refer to Appendix 1
4. Workers organization		Refer to Appendix 1
5. Non-discrimination and equal opportunities		Refer to Appendix 1
7. Occupational Health and Safety		Refer to Appendix 1
8. Non-employee workers		Refer to Appendix 1
9. Supply Chain		Refer to Appendix 1
10. Labour Assessment Component of a Social and Environmental Assessment		Refer to Appendix 1
Performance Standard 3, Pollution		

1. Pollution Prevention, Resource Conservation & Energy Efficiency		Refer the EMPr - Appendix 8
2. Wastes		Refer the EMPr - Appendix 8
3. Hazardous material		Refer the EMPr - Appendix 8
4. Emergency preparedness & response	The proponent commit to full compliance with this standard when financial closure has been reached. The proponent is fully aware of the implications of this standard and this information will be made available in due course as part of the development planning for the project.	Refer to Appendix 1
5. Technical guidance – ambient considerations		Refer to Appendix 1
6. Greenhouse gas emissions		No greenhouse gas emissions will result from the proposed development
Performance Standard 4, Health & Safety		
1. Hazardous materials safety		Refer the EMPr - Appendix 8
2.Environmental and natural resource issues		Refer to chapters 6 and 8
Performance Standard 5, Land Acquisition		**Refer to chapter 5**
Performance Standard 6, Biodiversity		**Refer to Chapter 6.5 and 8.1**
Performance Standard 7, Indigenous People		**Refer to Chapter 8.6**
Performance Standard 8, Cultural Heritage		**Refer to Chapter 8.5**

14 EVALUATION AND RECOMMENDATIONS

Table 82 summarises the key recommendations for the environmental issues identified in the EIAr. In order to achieve appropriate environmental management standards and ensure that the findings of the environmental studies are implemented through practical measures, the recommendations from this EIA must be included within an Environmental Management Programme (EMPr). This EMPr should form part of the contract with the contractors appointed to construct and maintain the proposed. The EMPr would be used to ensure compliance with environmental specifications and management measures. The implementation of this EMPr for all life cycle phases (i.e. construction, operation and de-commissioning) of the proposed project is considered to be key in achieving the appropriate environmental management standards as detailed for this project.

An Environmental Management Programme is included with this Environmental Impact Assessment Report.

It is also recommended that the process of communication and consultation with the community representatives is maintained after the closure of this EIA process, and, in particular, during the construction phase associated with the proposed project.

14.1 Summary of Findings

Table 82: Summary of findings and Recommendations

Environmental Parameter	Summary of major findings	Recommendations
Biodiversity	The study area consists of a combination of previously cultivated fields and remaining patches of woodland in various states of degradation. There is also a small section of riparian habitat running through the northern part of the site, but this is not affected by the placement of the proposed infrastructure. Large proportions of the infrastructure are proposed to be located within transformed or degraded areas. However, remaining patches of natural vegetation on site are included in Provincial Critical Biodiversity Areas and therefore potentially have elevated conservation status. There are a number of threatened or protected species that could potentially be affected by the proposed project. This includes one plant species listed as Near Threatened, one as Declining and one as Rare, as well as eleven mammal and ten bird species of conservation concern. There are no threatened reptile or amphibian species that are likely to occur in the study area. There is one protected tree species that occurs on site. Significant parts of the site have been previously cultivated and are therefore not considered to have high sensitivity or	▪ **Surface Runoff and Stormwater Management Plan** This plan must indicate how all surface runoff generated as a result of the project and associated activities (during both the construction and operational phases) will be managed (e.g. artificial wetlands/stormwater and flood retention ponds) prior to entering any natural drainage system or wetland and how surface water runoff will be retained outside of any demarcated buffer/flood zones and subsequently released to simulate natural hydrological conditions. ▪ **Rehabilitation Programme** Rehabilitation Programme should be established before operation. The programme must address the rehabilitation of the existing habitats as well as rehabilitation after closure. This Rehabilitation Programme must be approved by the relevant government departments. ▪ **Botanical walk-through survey** A preconstruction walk-through survey should be undertaken to list the identity and location of all listed and protected species. The results of the walk-through

	biodiversity value. However, remaining natural habitats are within areas designated as having high conservation value in the Provincial Conservation Plan. The areas of affected vegetation are relatively disturbed woodlands and are not considered to have high biodiversity value on site, despite inclusion into CBA2 and ESA areas in the Provincial Conservation plan. The proposed project is assessed as having impacts of mostly low negative significance and one impact of medium negative significance on some relatively small areas of natural vegetation. To conclude, the project will not have highly significant impacts on the ecological receiving environment and impacts that will occur can be controlled and reduced to low significance. Impacts on natural vegetation are assessed as having medium significance, but will only affect relatively small areas of disturbed woodland.	survey should provide an indication of the number of individuals of each listed species that are likely to be impacted by the proposed development ▪ **Obtain permits for protected plants** It is a legal requirement that permits will be required for any species protected according to National or Provincial legislation. The identity of species affected by such permit requirements can only be identified during the walk-through survey (previous mitigation measure). It is common practice for the authorities that issue the permits to require search and rescue of affected plants. There are a number of individuals of the protected tree, Sclerocarya birrea subsp. caffra, that occur on site. The location and condition of each individual tree must be recorded and a permit obtained for the removal of each of these. ▪ **Alien plant management plan** It is recommended that a monitoring programme be implemented to enforce continual eradication of alien and invasive species, especially within the riparian habitat. An Alien Invasive Programme is an essential component to the successful conservation of habitats and species. Alien species, especially invasive species are a major threat to the ecological functioning of natural systems and to the productive use of land. In terms of the amendments of the regulations under the Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983), landowners are legally

		responsible for the control of alien species on their properties. The protection of our natural systems from invasive species is further strengthened within Sections 70-77 of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004). This programme should include monitoring procedures. ▪ **Undertake regular monitoring** Monitoring should be undertaken to evaluate the success of mitigation measures. Monitoring methods must be in accordance with features that need to be monitored and can form part of a monitoring programme to be compiled.
Surface Water	Ultimately, it was found that there are three (3) wetlands, one (1) watercourse with an associated riparian habitat, and one (1) erosion channel within and/or in close proximity of the proposed development area. More specifically, the wetlands include one (1) hillslope seep wetland, and two (2) unchannelled valley-bottom wetlands. In terms of potentially applicable water related legislature, it is anticipated that no water use license requirements or environmentally listed activities are expected to be triggered, as the proposed development is not located within the delineated surface water resources. Therefore, no water use license or environmental authorisation (from a surface water perspective) is anticipated. This however should be confirmed with the relevant government departments.	▪ As stipulated in the surface water specialist report, the proposed alternative locations for the site layouts and construction lay-down areas are suitably placed from a surface water perspective as no surface water resources are to be directly affected. It is highly recommended that the proposed substation alternative 1 and 3 locations be preferred, as substation alternative 2 is located within close proximity to an identified erosion channel and is vulnerable to further erosion. ▪ In general, all surface water resources must be avoided as far as possible to prevent direct impacts. Where this is not achievable, the relevant water use license and environmental authorisations are to be applied for before construction is allowed to

	Foreseen potential negative impacts in terms of the pre-construction, construction, operation and decommissioning phases of the proposed development were identified and assessed. Mitigation measures have been stipulated and must be implemented as part of the Environmental Management Programme (EMPr) for the proposed development.	commence in any of the identified surface water resources identified in this report. ▪ Importantly, where any structures are within 100m of any surface water resource, adequate run-off mitigation measures need to be accounted for as stipulated in the surface water specialist report to prevent/minimize erosion and sedimentation impacts. These two impacts are the primary concern for the proposed development.
Agricultural Potential and Soils	The establishment of infrastructure, such as the solar panel arrays and associated substation, will have an impact on the soil resource in that the soils will no longer be available for agriculture. There is little or no cultivation being practiced in the surrounding area, but the fact remains that the south-eastern corner of the site has deep, high potential soils.	▪ The main mitigation measures will involve ensuring that the minimum surface disturbance takes place, both in terms of soil excavation and vegetation removal. If normal construction methods are used for foundations and infrastructure, then post-project rehabilitation should be successful once the infrastructure is removed. Where roads or paths are constructed, soil conservation measures (run-off channels, drains etc.) as well as regular maintenance) will also be required.
Visual	The visual impact assessment conducted for the proposed PV plant has demonstrated that a large portion of the study area has a pastoral visual character and is not valued for its scenic significance. Potentially sensitive receptor locations were identified in the study area, however the proposed development will have a low or medium impact on most of these receptors. In addition, several of these receptors are likely to associate the proposed development with employment creation and potential economic growth in the	▪ Carefully plan to reduce the construction period. ▪ Where possible, minimise vegetation clearing and rehabilitate cleared areas as soon as possible. ▪ Maintain a neat construction site by removing rubble and waste materials regularly. ▪ Make use of existing gravel access roads where possible. ▪ Ensure that dust suppression techniques are implemented on all access roads.

	area. The assessment revealed that overall the proposed PV plant would have a low visual impact during construction and a medium visual impact during operation, with very few mitigation measures available. Overall it can be concluded that the visual impact of the PV plant would be reduced due to the number and nature of visual receptors present and the degree of transformation of the natural environment. The facility does not however correspond with the typical land use and would visually contrast with the existing character of the landscape, although this contrast would be less significant in areas that have already been highly degraded by human activities.	▪ Light fittings for operations and security at night should reflect the light toward the ground and prevent light spill. ▪ The operations and maintenance buildings should not be illuminated at night. ▪ Bury cables under the ground where possible. ▪ The operation and maintenance building should be painted with natural tones that fit with the surrounding environment. Non-reflective surfaces should be utilised where possible.
Heritage	The historical significance of the region with regards to the Ndebele and the proclamation of the KwaNdebele homeland have been described in the background research. The presence of Late Iron Age (LIA) stone walling, on the south western boundary the study area, as well as the numerous historical ruins of African homesteads necessitate extensive fieldwork to evaluate and recommend the necessary mitigation measures, where required. The development of the PV facility near Dennilton is underlain by Mogolian aged Nebo Granite of the Lebowa Granite Suite, Bushveld Complex. Due to the age and igneous nature of the Nebo Granite, no fossils will be present and Low Palaeontological Sensitivity is allocated. No further Palaeontological mitigation is recommended.	Archaeological Sites ▪ Monitor find spot areas if construction is going to take place through them. ▪ A management plan for the heritage resources needs then to be compiled and approved for implementation during construction and operations. Historical sites ▪ Where the structures are to be impacted directly by the development, a consultation process to determine if any graves or still born burial exist in and around the ruins, must be conducted; ▪ If it is found that there are burials associated with the ruins, a grave relocation process must be initiated.

	A total of 14 heritage sites were identified, of which 13 are located within the development boundary and the 14th a cemetery located on the eastern boundary just of the current access road.	▪ An archaeologist to identify any significant cultural or possible human remains must monitor the demolition of the structures. Cemetery ▪ The cemetery needs to be fenced and a 20m safety buffer needs to be included inside the development footprint to ensure protection of the cemetery.
Socio-economic	Given the socio-economic challenges experienced by the Elias Motsoaledi LM (i.e. lack of revenue and access to basic services, unemployment, and growth stagnation) and the feedback from the directly affected landowners and residents, the positive impacts associated with the project in the context of the national economy and specifically the Elias Motsoaledi LM and Dennilton in particular, far outweigh the negative effects. On a national level, the project will assist government in achieving its goal of job creation, upliftment of rural communities, and sustainable development. More importantly, it will contribute towards creating energy security, which is vital for the country's economy. From a local perspective, the project will likely lead to a more sustainable local growth, diversified local economy, creation of new employment opportunities, increase in household income, and additional investment into the local community facilities and businesses. It will also be associated with some negative impacts during construction and operation, however these are possible to manage and mitigate. Considering the above, it is recommended that the project is approved for	▪ Procure construction materials, goods, and products from local suppliers if feasible ▪ Employ local residents and contractors where possible ▪ Employ labour-intensive methods in construction, where feasible. ▪ In order to improve the chances of skills being developed during the construction period it is recommended that contractors are encouraged to provide learnerships and share knowledge with the employees ▪ Set up a recruitment office in the nearby towns and adhere to strict labour recruitment practices that would reduce the desire of potential job seekers to loiter around the properties in hope to find temporary employment. ▪ Ensure that the development site is fenced and the access controlled to limit or completely eliminate the possibility of livestock theft and burglaries at the residential properties.

	development, under the condition that the proposed mitigations are implemented.	▪ It is recommended that if possible, the project developers implement health awareness campaigns to curb the potential of spreading disease, use of drugs, or alcohol abuse for example. ▪ Where feasible, assist the municipality in ensuring that the quality of the local social and economic infrastructure does not deteriorate further (especially the local roads) ▪ It is recommended that the project owner develops practical SED and ED programmes throughout the project's lifespan.
Geotechnical	The geotechnical study did not identify any fatal flaws that, from a purely geotechnical perspective, would prevent the construction of the development. The area under investigation is underlain by one rock type, the Nebo Granite. The bedrock is covered with a soils mantle comprised of colluvial, pedogenic and residual soils. Adequate founding conditions for the proposed infrastructure occur at relatively shallow depths below ground level over the major portion of the proposed development footprint. However, the following geotechnical constraints were identified: ▪ Compressible soils with low bearing capacity ▪ Potentially collapsible soils ▪ Shallow ground water conditions ▪ Corestone boulders	▪ Geotechnical constraints may be mitigated by conventional design and construction methods. ▪ Design and construction of stormwater management system including stormwater outfalls ▪ Use of berms and drainage channels to direct water away from the construction areas where necessary ▪ Minimise earthworks and levelling ▪ Rehabilitate disturbed areas as soon as possible after construction ▪ Correct engineering design of all access roads.

A summary of the impact rating of the proposed development according to each environmental aspect are provided in Table 83 and Table 84 below.

Key

LOW NEGATIVE		**LOW POSITIVE**	
MEDIUM NEGATIVE		**MEDIUM POSITIVE**	
HIGH NEGATIVE		**HIGHPOSITIVE**	

Table 83: Impact rating summary for the proposed solar PV power plant during the construction phase

Environmental Aspect	Environmental Impacts	Impact Rating without Mitigation	Impact Rating with Mitigation
Biodiversity	Loss, fragmentation or degradation of faunal habitat	-26 (low negative)	-26 (low negative)
	Displacement of mobile fauna	-10 (low negative)	-10 (low negative)
	Impacts on indigenous natural vegetation	-30 (medium negative)	-30 (medium negative)
	Impacts on threatened plants	0	0
	Loss of individuals of protected trees	-13 (low negative)	-11 (low negative)
Surface Water	Construction Lay-down Area	- 20 (low negative)	- 6 (low negative)
	Vehicle and Machinery Degradation	- 20 (low negative)	- 8 (low negative)
	Human Degradation of Wetland Flora and Fauna	- 9 (low negative)	- 6 (low negative)
	Increased Run-off and Sedimentation	- 42 (medium negative)	- 18 (low negative)
Agricultural Potential and Soils	Loss of agricultural soil	-28 (low negative)	-28 (low negative)
Visual	Visual impact of the proposed PV plant during construction	-20 (low negative)	-18 (low negative)
Heritage	Impact on palaeontological sensitive rock formations	-10 (low negative)	-10 (low negative)
	Impact on possible Iron Age remains in south western corner of the development area	-16 (low negative)	-15 (low negative)
	Impact on homesteads, including the possibility of stillborn burials at these sites.	-48 (medium negative)	-15 (low negative)
	Impact on cemetery outside development area	-11 (low negative)	-10 (low negative)
Socio-economic	Temporary increase in production	45 (medium positive)	45 (medium positive)
	Temporary stimulation of GDP-R	45 (medium positive)	45 (medium positive)

	Temporary employment creation	45 (medium positive)	45 (medium positive)
	Increased household income and standard of living	45 (medium positive)	45 (medium positive)
	Skills development	36 (medium positive)	39 (medium positive)
	Increase in government revenue	15 (low positive)	15 (low positive)
	Increase in social pathologies	-39 (medium negative)	-30 (medium negative)
	Deterioration of living and working conditions	-11 (low negative)	-11 (low negative)
	Added pressure on social and economic infrastructure	-33 (medium negative)	- 22 (low negative)
Geotechnical	Rating of impacts of layout alternatives 1 and 2, and laydown areas 1 and 2 on soils during construction	-18 (low negative)	-7 (low negative)
	Rating of impacts of substation and O&M building alternative 1 (south –west) and 3 (south-east) on soils during construction	-18 (low negative)	-7 (low negative)
	Rating of impacts of substation and O&M building alternative 2 (north) on soils during construction	-20 (low negative)	-8 (low negative)

Table 84: Impact rating summary for the proposed solar PV power plant during the operational phase

Environmental Aspect	Environmental Impacts	Impact Rating without Mitigation	Impact Rating with Mitigation
Biodiversity	Mortality of individuals of fauna	-12 (low negative)	-12 (low negative)
	Establishment and spread of declared alien plants	-28 (medium negative)	-11 (low negative)
Surface Water	Vehicle Damage	- 39 (medium negative)	- 22 (low negative)
	Stormwater run-off associated with hard stand areas, the substation and buildings	-26 (low negative)	-12 (low negative)
Agricultural Potential and Soils	Loss of agricultural soil	-28 (low negative)	-28 (low negative)
Visual	Visual impacts of the proposed PV plant during operation	-36 (medium negative)	-34 (medium negative)
Socio-economic	Sustainable increase in production	32 (medium positive)	32 (medium positive)
	Sustainable increase in GDP-R	34 (medium positive)	34 (medium positive)

	Creation of long-term employment opportunities	34 (medium positive)	34 (medium positive)
	Increased household income and standard of living	34 (medium positive)	34 (medium positive)
	Skills development	15 (low positive)	16 (low positive)
	Sustainable increase in government revenue stream	17 (low positive)	17 (low positive)
	Investment in local communities due to SED and ED	45 (medium positive)	45 (medium positive)
	Impact on sense of place	-11 (low negative)	-11 (low negative)

14.2 Conclusion

The findings of the specialist studies undertaken within this EIA provide an assessment of both the benefits and potential negative impacts anticipated as a result of the proposed PV project. The findings conclude that there are no environmental fatal flaws that should prevent the proposed project from proceeding. Areas of special concern have however been identified which will require site specific mitigation measures. These are included within the EMPr to ensure that these areas receive special attention.

It was determined during the EIA that the proposed project will result in limited potential negative impacts and certain positive impacts. A preferred site layout has been identified which is less environmentally sensitive and will result in the least environmental impact.

A detailed public participation process was followed during the EIA process which conforms to the public consultation requirements as stipulated in the EIA Regulations. In addition, all issues raised by I&APs were captured in the EIAr and where possible, mitigation measures provided in the EMPr to address these concerns.

As sustainable development requires all relevant factors to be considered, including the principles contained in section 2 of NEMA, the EIAr has strived to demonstrate that where impacts were identified, these have been considered in the determination of the preferred site layout.

It is the opinion of the EAP that the information and data provided in this EIAr is sufficient to enable the DEA to consider all identified potentially significant impacts and to make an informed decision on the application. Further, it is the opinion of the EAP that the proposed project be allowed to proceed provided that the following conditions are adhered to:

- The proposed PV arrays should be constructed within the environmentally preferred PV array area.
- The environmentally preferred laydown area should be utilised during construction.
- The substation and O&M building should be constructed within the environmentally preferred **Alternative 1** areas.
- All onsite roads should be located within the authorised area for the PV array.
- All feasible and practical mitigation measures recommended by the various specialists should be implemented, where applicable to the authorised PV array area, authorised substation area, authorised O&M building or authorised laydown area.
- Final EMPr should be approved by DEA prior to construction.

SiVEST as the EAP is therefore of the view that:

- A preferred substation and O&M building site, PV panel array layout and construction laydown area have been identified which are less environmentally sensitive compared to the other considered alternatives.
- Through the implementation of mitigation measures, together with adequate compliance monitoring, auditing and enforcement thereof by the appointed ECO as well as competent authority, the potential detrimental impacts associated with the PV Plant can be mitigated to acceptable levels

It is trusted that the EIAr provides the reviewing authority with adequate information to make an informed decision regarding the proposed project.

15 REFERENCES

ARC-ISCW, 2011. Agroclimatology database. ARC-Institute for Soil, Climate and Water, Pretoria.

Canahai, C., (2015) Environmental Impact Assessment for the proposed construction of a 75MW Solar Photovoltaic Plant near Dennilton, Limpopo Province: GEOTECHNICAL STUDY PHASE 2: EIA PHASE, Jeffares & Green, Sunninghill

Coetzee, C.J. (1980). Die strewe tot etniese konsolidasie en nasionale selfverwesenliking by die Ndebele van Transvaal. Unpublished D.Phil thesis. Potchefstroom University for CHO, Potchefstroom.

Cocks, M. L., Bangay, L., Wiersum, K. F., & Dold, A. P. 2006. Seeing the wood for the trees: the role of woody resources for the construction of gender specific household cultural artefacts in non-traditional communities in the Eastern Cape, South Africa. Environment, Development and Sustainability, 8(4), 519-533.

De Beer, F.C. (1986). Groepsgebondenheid in die Familie–Opvolgings–en Erfreg van die Noord–Ndebele, Unpublished D.Phil thesis, University of Pretoria, Pretoria.

Department of Energy. (2011). Integrated Resource Plan 2010 - 2030.

Department of Energy. (2013). IRP 2010-2030 Update Report.

Department of Environmental Affairs (2013): Guideline for Renewable Energy

Department of Minerals and Energy. (2003). White paper on Renewable Energy.

Dollar, E.S.J., James, C.S., Rogers, K.H. & Thoms, M.C. 2007: A framework for interdisciplinary understanding of rivers as ecosystems. Geomorphology, 8, 147–162.

Elias Motsoaledi Local Municipality. (2013). Elias Motsoaledi Integrated Development Plan.

Eskom, (2010) Guide to Independent Power Producer (IPP) processes in South Africa and Eskom, June 2010

Fairbanks, D.H.K., Thompson, M.W., Vink, D.E., Newby, T.S., Van Den Berg, H.M & Everard, D.A. 2000. The South African Land-Cover Characteristics Database: a synopsis of the landscape. S.Afr.J.Science 96: 69-82.

Fourie, H.C.M. (1921). AmaNdebele van Fene Mahlangu en hun religieus'–sociaal leven. D.Phil–proefskrif, Rijks Universitei, Ulrecht, La Riviere en Voorhoewe. Zwolle

Fourie, W., (2015) Nokukhanya Solar Facility: Heritage Impact Assessment Report, PGS Heritage

Gauteng Department of Agriculture, Conservation and Environment (GDACE), 2005: Minimum Requirements for Biodiversity Assessments (Version 2). Directorate of Nature Conservation.

Geological Survey of South Africa. 1978. 2528 Pretoria 1:250 000 Geological Map. Government Printer, Pretoria.

Geological Survey, 1981. 1:250 000 scale geological map 2528 Pretoria. Department of Mineral and Energy Affairs, Pretoria.

Gibb, A., (2015) Proposed Construction of the Nokukhanya 75MW Solar Photovoltaic Plant near Dennilton, Limpopo Province: Visual Impact Assessment Report – Impact Phase, SiVEST Environmental, Rivonia

Google Earth Pro. (2013). Map Data 2013 and 2013 AfriGIS (Pty) Ltd.

Google Earth Pro. (2015). Map Data 2015 and 2015 AfriGIS (Pty) Ltd.

Hoare, D., (2015) Ecological study on the potential impacts of the proposed Nokukhanya 75MW Solar Plant near Dennilton, Limpopo Province, David Hoare Consulting, Pretoria

Huffman, T.N. 2007. Handbook of the Iron Age: The Archaeology of Pre-Colonial Farming Societies in Southern Africa. Pietermaritzburg, University of KwaZulu-Natal Press.

IUCN (2001). IUCN Red Data List categories and criteria: Version 3.1. IUCN Species Survival Commission: Gland, Switzerland.

Jonas, 1989. Sibbeverband by die Ndundza-Ndebele. Pretoria; research report for the University of South Africa

Limpopo Provincial Government (2009). Limpopo Employment Growth and Development Plan 2009-2014.

Limpopo Provincial Government (2013). Green Economy Plan.

Massie, R.H. 1905. The Native tribes of the Transvaal. Londen: Harrison and Sons.

McCarthy, T. & Rubidge, B., 2005: The Story of Earth&Life: a Southern African Perspective on a 4.6-Billion-year Journey. Cape Town, Struik Publishers. 333 pp.

Mucina L., and Rutherford M.C., (eds) 2006. The Vegetation of South Africa, Lesotho and Swaziland. Strelitzia 19. South African National Biodiversity Institute, Pretoria.

Mucina, L., Rutherford, M.C. and Powrie, I.W. (editors) 2005. Vegetation map of South Africa, Lesotho and Swaziland, 1:1 000 000 SCALE SHEET MAPS South African National Biodiversity Institute, Pretoria.

Mushia, M.N., Mkula, S.D., and Paterson, D.G., (2015) Soil Information for the Proposed Nokukhanya 75MW Solar Photovoltaic (PV) Plant near Dennilton, Limpopo Province, ARC-Institute for Soil, Climate and Water, Pretoria

Nelson, 2008. An Archaeozoological and Ethnographic investigation in to the animal utilization practices of the Ndzundza Ndebele of the Steelpoort River Valley, South Africa, 1700AD-1900AD. Masters dissertation. University of Pretoria.

Nkangala District Municipality. (2014). Retrieved from http://www.nkangaladm.gov.za/index.php/2014-02-25-17-36-25/ndm-background

Oberholzer, B. 2005. Guideline for involving visual & aesthetic specialists in EIA processes: Edition 1. CSIR Report No ENV-S-C 2005 053 F. Republic of South Africa, Provincial Government of the Western Cape, Department of Environmental Affairs & Development Planning, Cape Town.

Partridge, T.C. 1998: Of diamonds, dinosaurs and diastrophism: 150 million years of landscape evolution in southern Africa. South African Journal of Geology 101: 3 167–184.

Partridge, T. C., & Maud, R.R. 1987: Geomorphic evolution of southern Africa since the Mesozoic. South African Journal of Geology 90: 179–208.

Partridge, T. C., Dollar, E. S. J., Moolman, J., & Dollar, 2010. The geographic provinces of South Africa, Lesotho and Swaziland: A physiographic subdivision for earth and environmental scientists. Transactions of the Royal Society of South Africa, 65: 1-47.

Phatlane, S.N. 1998. The Kwa-Ndebele independence issue : a critical appraisal of the crises around independence in Kwa-Ndebele 1982-1989. Masters dissertation, University of South Africa.

Quantec. (2014). Standardised Regional Database.

Roodt, F. 2006. Phase 1 Heritage Resources Impact Assessment (Scoping & Evaluation), Ntwane/Elandsdoorn, Groblersdal, Mpumalanga. Letter of recommendation for exemption. Completed for AGES Environmental.

SABC News. (2014, July). Retrieved from http://www.sabc.co.za/news/a/fc9dc88044b73e21884cf93bfe17c0b1/Transport-Ministry-still-working-on-Moloto-Rail-Corridor-study

Saks, D. 2008. AN AFRICAN MASADA. Nyabela, Mampuru and the Defence of Mapochstad. Military History Journal Vol 14 No 4 - December 2008

SAWEA, 2010. Proposed Integrated Resource Plan: Submission by the Wind Energy Industry.

Schoeman, J.L. & van der Walt, M., 2004. Overview of the status of the agricultural natural resources of South Africa. Report No. GW/A/2004/13. ARC-Institute for Soil, Climate & Water, Pretoria.

Sekhukhune District Municipality. (2014). Sekhukhune Integrated Development Plan.

Stats SA. (2014). Census 2011.

Taylor, S., and Fyfe, A., (2015) Solar Photovoltaic (PV) Power Plant near Dennilton, Limpopo Province: Surface Water Impact Assessment Report – Impact Phase, SiVEST Environmental, Rivonia

Thembisile Hani Local Municipality. (2013). Thembisile Hani Integrated Development Plan.

Urban-Econ (2015). Socio-economic Impact Report: Environmental Impact Assessment for the Proposed 75MW Solar PV Plant near Dennilton, Urban-Econ Development Economists. Hatfield.

Weinert, H.H. (1980). The Natural Road Construction Materials of Southern Africa. H & R Academica.

Van Jaarsveld, F.A. 1986. Die Mapoch-oorog, 1882-1883. Scientia Militaria, South African Journal of Military Studies, Vol 16, Nr 1, 1986.

Victor, J. E., & Keith, M. (2004). The Orange List: a safety net for biodiversity in South Africa: commentary. South African Journal of Science, 100(3 & 4), p-139.

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