ENVIRONMENTAL IMPACT ASSESSMENT PROCESS
FINAL ENVIRONMENTAL IMPACT REPORT

PROPOSED GROOTKOP SOLAR ENERGY FACILITY NEAR ALLANRIDGE, FREE STATE PROVINCE
DEA Ref. No: 14/12/16/3/3/2/515

FINAL REPORT FOR SUBMISSION TO DEA
31 March 2014

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PROJECT DETAILS

DEA Reference No.	:	14/12/16/3/3/2/515
Title	:	Environmental Impact Assessment Process Final Environmental Impact Assessment Report: Proposed Grootkop Solar Energy Facility near Allanridge, Free State Province
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Client	:	FRV Energy South Africa(Pty) Ltd
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When used as a reference this report should be cited as: Savannah Environmental (2014) Final Environmental Impact Assessment Report: Proposed Grootkop Solar Energy Facility near Allanridge, Free State Province for FRV Energy South Africa (Pty) Ltd

PURPOSE OF THE ENVIRONMENTAL IMPACT ASSESSMENT REPORT

FRV Energy South Africa (Pty) Ltd, as an independent power producer (IPP), is proposing the establishment of a 75MW export capacity solar energy facility for the purpose of commercial electricity generation. FRV Energy South Africa (Pty) Ltd has identified a technically feasible site located on the Farm Hilton 30 within the Mathjabeng Local Municipality, Free State Province (refer to **Figure 1.1**).

FRV Energy South Africa (Pty) Ltd has appointed Savannah Environmental as the independent environmental consultant to undertake the Environmental Impact Assessment (EIA) for the proposed facility. The EIA process is being undertaken in accordance with the requirements of the EIA Regulations of June 2010 (of GNR543) promulgated in terms of the National Environmental Management Act (NEMA; Act No. 107 of 1998).

The Final EIA Report consists of eight sections:

Chapter 1:	Provides background to the proposed facility and the environmental impact assessment.
Chapter 2:	Provides a description of the proposed project.
Chapter 3:	Provides an overview of the regulatory and legal context for electricity generation projects and the EIA process.
Chapter 4:	Outlines the process which was followed during the EIA Phase, including the consultation program that was undertaken and input received from interested parties.
Chapter 5:	Describes the existing biophysical and socio-economic environment.
Chapter 6:	Presents the assessment of environmental impacts associated with the proposed facility.
Chapter 7:	Presents the conclusions of the EIA, as well as an impact statement on the proposed project.
Chapter 8:	Provides a list of references and information sources used in undertaking the studies for this EIA Report.

The Scoping Phase of the EIA process identified potential issues associated with the proposed project, and defined the extent of the studies required within the EIA Phase. The EIA Phase addresses those identified potential environmental impacts and benefits associated with all phases of the project including design, construction and operation, and recommends appropriate mitigation measures for potentially significant environmental impacts. The EIA report aims to provide the environmental authorities with sufficient information to make an informed decision regarding the proposed project.

The release of a draft EIA Report provided stakeholders with an opportunity to verify that the issues they have raised to date have been captured and adequately considered within the study. The Final EIA Report has incorporated all issues and responses, and has been made available for public review prior to submission to the National Department of Environmental Affairs (DEA), the decision-making authority for the project.

INVITATION TO COMMENT ON THE FINAL EIA REPORT

The Final Environmental Impact Assessment Report was made available on the Savannah website (www.savannahsa.com) to Registered I&APs for review for a 21-day period from 06 January 2014 – 27 January. Electronic copies (CD) were made available on request. Comments received were incorporated into the Final Environmental Impact Assessment report submitted to DEA.

PROJECT / EIA INFORMATION LIST – DEA REQUIREMENTS

According to the requirements of the DEA, site, technical and environmental information on the proposed project are to be included in this EIA report or appended to this report. The tables below indicate where this information has been provided.

No.	Information	Provided / Reference
1.1	The Final EIR should include at least one A3 regional map of the area and the locality map: * maps are relatable to one another; * cardinal points; * co-ordinates; * legible legends; * indicate alternatives; * latest land cover; * vegetation types of the study area; and * A3 locality size locality map	Attached in the EIA report as Appendix L3
1.2	Methodology of impact assessment must comply with regulation 31(2) (l) of GN R543.	Refer to chapter 6 of the EIA report for the impact assessment methodology
1.3	Details of the future plans for the site and infrastructure after decommissioning in 20-30 years and the possibility of upgrading the proposed infrastructure to more advanced technologies	Refer to chapter 2 section 2.5.3
1.4	The total footprint of the proposed development should be indicated. Exact locations of the power plan and associated infrastructure should be mapped at an appropriate scale.	Attached in the EIA report as Appendix L3
1.5	Should a Water Use License be required, proof of application for a license needs to be submitted	Refer to Appendix D of the EIA report, minutes of meetings and comments received from DWA
1.6	Information on services required on the site, e.g. sewage, refuse removal, water and electricity. Who will supply these services and has an agreement and confirmation of capacity been obtained? Proof of these agreements must be provided	Refer to Chapter 2 table 2.1 detailing services required by the proposed project
1.7	A copy of the final site layout plan. Existing infrastructure must be used as far as possible e.g. The layout must indicate the following: * Panel positions and its associated infrastructure; * foundation footprint; * permanent laydown area footprint;	A final site layout will be submitted to DEA together with the CEMP and OEMP prior construction. A preliminary layout has been attached in Appendix L3 of the EIA report

No.	Information	Provided / Reference
	* construction period laydown footprint * internal roads indicating width (construction period width and operation period width) and with numbered sections between the other site elements which they serve (to make commenting on sections possible); * wetlands, drainage lines, rivers, stream and water crossing of roads and cables indicating the type of bridging structures that will be used; * the location of sensitive environmental features on site e.g. CBAs, heritage sites, wetlands, drainage lines etc, that will be affected by the facility and its associated instractructure; * sub-sattion (s) and/or transformer (s) sites including their entire footprint; * cable routes and trench dimensions (where they are not along internal roads0; * connection routes (including pylon positions) to the distribution/transmission network; * cut and fill areas at panel sites, along roads and at sub-station/transformer sites indicating the expected volume of each cut and fill; * borrow pits * spoil heaps (temporary for topsoil and subsoil and permanently for excess material); * all existing infrastructure on the site, especially roads; * buffer areas * buildings, including accommodation; and all no go areas	
1.8	An environmental sensitivity map indicting environmental sensitivity areas and features identified during the EIA process.	Attached in the EIA report as Appendix L3
1.9	A map combining the Final layout plan superimposed (overlain) on the environmental sensitivity map	Attached in the EIA report as Appendix L3
1.10	A shape file of the preferred development layout/footprint.	Refer to attached CD

EXECUTIVE SUMMARY

FRV Energy South Africa (Pty) Ltd is proposing to establish a commercial photovoltaic solar energy facility with an export capacity of up to 75MW, as well as associated infrastructure on a site located approximately 9 km south-east of Allanridge, Free State Province (refer to **Figure 1**).

The project is proposed to be developed on the Farm Kalkoen-krans which covers an area of approximately 450 ha. The proposed facility and associated infrastructure (i.e. the development footprint) would occupy an area of approximately 180 hectares (ha) of the 450 ha.

The solar energy facility proposes to generate up to 75 MW of electricity and will be comprised of the following infrastructure:

» Solar panels with an export capacity of up to 75MW.
» Mounting structures for the solar panels to be either rammed steel piles or piles with pre-manufactured concrete footings to support the PV panels.
» Cabling between the structures, to be lain underground where practical.
» transformer to collect all energy generated from the PV panels
» A new power line will loop in loop out to the existing power line from the proposed on-site substation (~150m x 150m in extent) in order to evacuate electricity generated to the national grid. Internal access roads (4 – 6 m wide roads will be constructed but will keep to existing roads as far as possible) and fencing (approximately 2.5 m in height).
» Associated buildings including a workshop area for maintenance, storage (i.e. fuel tanks), and offices.

The nature and extent of this facility, as well as potential environmental impacts associated with the construction and operation of a facility of this nature are explored in more detail in this Environmental Impact Assessment (EIA) Report

In summary, the following conclusions have been drawn from the specialist studies undertaken (refer to **Figure 2** for the sensitivity map):

OVERALL CONCLUSION (IMPACT STATEMENT)

Global climate change is widely recognised as being one of the greatest environmental challenges facing the world today. How a country sources its energy plays a big part in tackling climate change. As a net off-setter of carbon, renewable energy technologies can assist in reducing carbon emissions, and can play a big part in ensuring security of energy supply, as other sources of energy are depleted or become less accessible. South Africa currently relies on coal-powered energy to meet more than 90% of its energy needs. As a result, South Africa is one of the highest per capita producers of carbon emissions in the world and Eskom, as an energy utility, has been identified as the world's second largest producer of carbon emissions. With the aim of reducing South Africa's dependency on coal generated energy, and to address climate change concerns, the South African Government has set a target, through the Integrated Resource Plan (IRP) for electricity to develop 17.8 GW of renewables (including 8,4GW solar) within the period 2010 – 2030.

The technical viability of establishing a solar energy facility with an export capacity of 75 MW on a site located on the Farm Hilton 30 has been established by FRV Energy South Africa (Pty) Ltd. The positive implications of establishing a solar energy facility on the identified site within the Free State include the following:

» The potential to harness and utilise solar energy resources within the Free State Province
» The project would assist the South African government in reaching their set targets for renewable energy.
» The project would assist the South African government in the implementation of its green growth strategy and job creation targets.
» The project would assist the district and local municipalities in reducing level of unemployment through the creation of jobs and supporting local business
» The National electricity grid in the Free State Province would benefit from the additional generated power.
» Promotion of clean, renewable energy in South Africa
» Creation of local employment, business opportunities and skills development for the area.

The findings of the specialist studies undertaken within this EIA to assess both the benefits and potential negative impacts anticipated as a result of the proposed project conclude that the majority of the proposed development site is of low to moderate environmental sensitivity and could be considered suitable for the proposed development. There are however impacts of high sensitivity that would result from the development of the proposed project. The significance levels of these identified negative impacts can only be reduced by not impacting on the surrounding areas unnecessarily during construction and through the implementation of appropriate mitigation measures during the operational phase. Environmental specifications for the management of potential impacts are detailed within the draft Environmental Management Programme (EMPr) included within **Appendix K**.

With reference to the information available at this planning approval stage in the project cycle, the **confidence** in the environmental assessment undertaken is regarded as **acceptable** provided all measures are taken to reduce identified environmental impacts and to **protect and preserve** surrounding **wetlands**.

OVERALL RECOMMENDATION

Based on the nature and extent of the proposed project, the local level of disturbance predicted as a result of the construction and operation of the facility and associated infrastructure, the findings of the EIA, and the understanding of the significance level of potential environmental impacts, it is the opinion of the EIA project team that the proposed development site could be considered suitable for the proposed Grootkop Solar Energy Facility provided impacts are **restricted** to development footprint through the implementation of identified mitigation measures. In terms of this conclusion, the EIA project team support the decision for environmental authorisation of the proposed project.

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

» The draft Environmental Management Programme (EMPr) as contained within **Appendix K** of this report should form part of the contract with the Contractors appointed to construct and maintain the proposed solar energy facility, and will be used to ensure compliance with environmental specifications and management measures. The implementation of this EMPr for all life cycle phases of the proposed project is considered to be key in achieving the appropriate environmental management standards as detailed for this project.
» An independent **Environmental Control Officer** (ECO) must be appointed by FRV Energy South Africa (Pty) Ltd prior to the commencement of any authorised activities.
» During construction, unnecessary disturbance to habitats should be strictly controlled and the footprint of the impact should be kept to a minimum.
» Disturbed areas should be rehabilitated as soon as possible once construction is complete in an area.
» Several alien invasive plants have been observed on the study site, with more species in close proximity. For all species, there is a very high risk of spread throughout the project area following disturbance. This implies that a detailed Invasive Plant Management Plan will have to be in place prior to commencement of the activity and be diligently followed and updated throughout the project cycle up to the decommissioning phase.

- All declared aliens must be identified and managed in accordance with the Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983), the implementation of a monitoring programme in this regard is recommended.
- Develop emergency maintenance operational plan to deal with any event of contamination, pollution, or spillages.
- Access roads to the development should follow existing tracks. Where new access routes will be necessary, suitable erosion control measures must be implemented.
- No Archaeological mitigation is necessary prior to the start of construction (based on approval by SAHRA), but management measures would need to be taken into account to avoid damage to the informal cemetery. Damage can be caused by construction vehicles unknowingly damaging the graves. To prevent this, the area should be demarcated with a fence and all construction activities should be located at least 15 m away from the fence around the cemetery.
- It is recommended that the existing vegetation cover be maintained in all areas outside of the actual development footprint, both during construction and operation of the proposed facility. This will minimise visual impact as a result of cleared areas, power line servitudes and areas denuded of vegetation.
- Access roads to the development must strictly adhere to existing or delineated tracks only'
- Consolidate infrastructure as far as possible and make use of already disturbed areas rather than pristine sites, wherever possible.
- Compile a comprehensive storm water management method statement, as part of the final design of the project and implement during construction and operation.
- All discharge points should incorporate sediment traps upstream of the discharge. These should be regularly inspected and cleaned to maintain capacity.
- Discharge points should be protected against erosion and should incorporate measures to dissipate energy and disperse flows. Regular inspections and maintenance of all stormwater management infrastructure should be undertaken.
- All laydown areas and temporary stockpiles, construction camps, toilet facilities etc. should be kept at least 50m from the remaining wetland edge. Immediately rehabilitate disturbed areas following completion of construction.
- Avoid wetland areas as far as possible. Maintain a buffer of 50m from the wetland edge unless a wetland crossing is unavoidable.
- Once the facility has exhausted its life span, the main facility and all associated infrastructure not

required for the post rehabilitation use of the site should be removed and all disturbed areas appropriately rehabilitated. An ecologist should be consulted to give input into rehabilitation specifications.

» All rehabilitated areas should be monitored for at least a year following decommissioning, and remedial actions implemented as and when required.
» Portable toilets must be located well outside of remaining wetland areas within demarcated construction site.
» To prevent spillages, vehicles should be well maintained and no diesel or oil should be stored on site. Spills should be cleaned up with approved absorbent material. Oil contaminated material and soil should be disposed of at a registered hazardous waste site together with other hazardous waste (e.g. tyres, PVC).

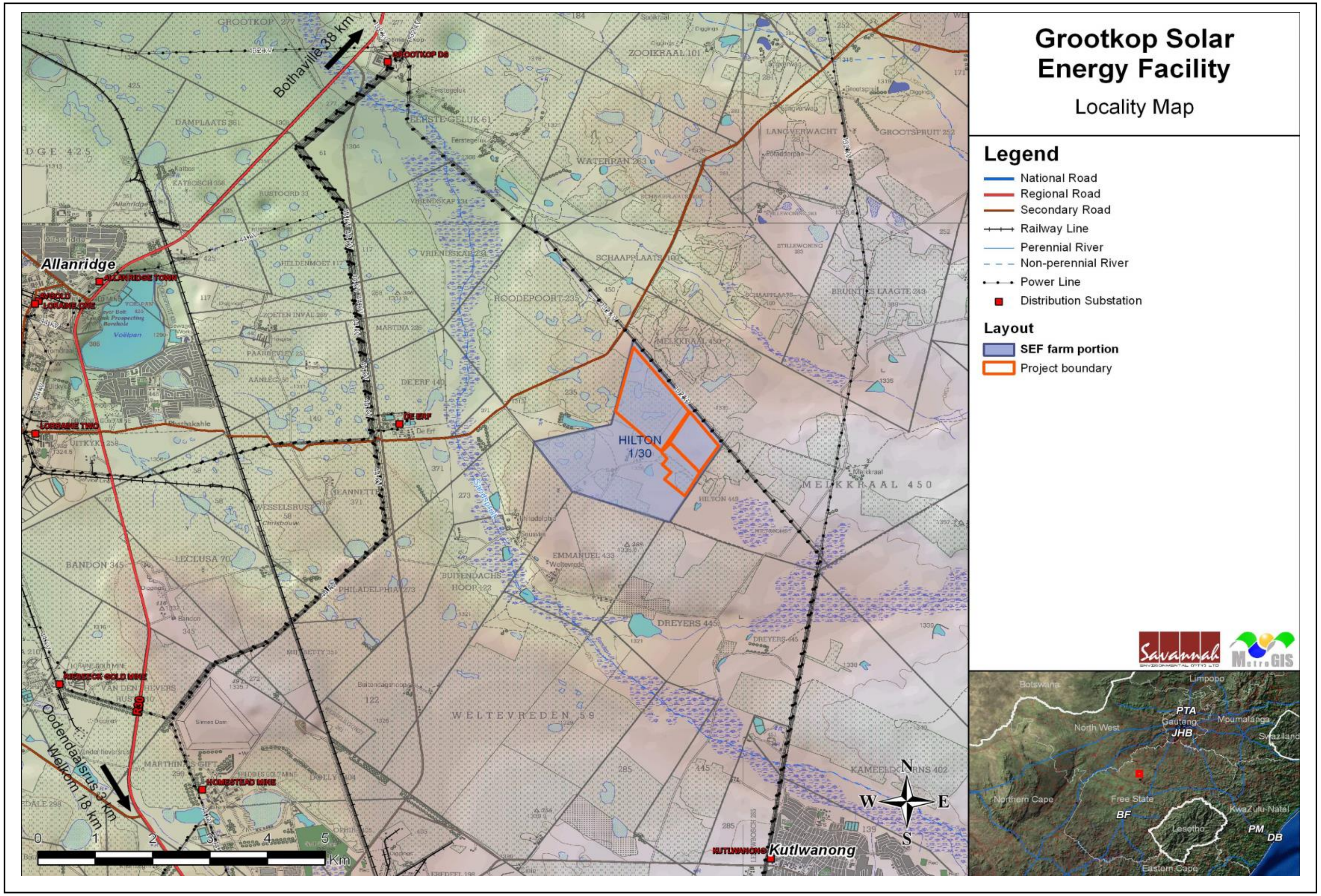

Figure 1: Locality Map of the proposed Grootkop Solar Energy Facility

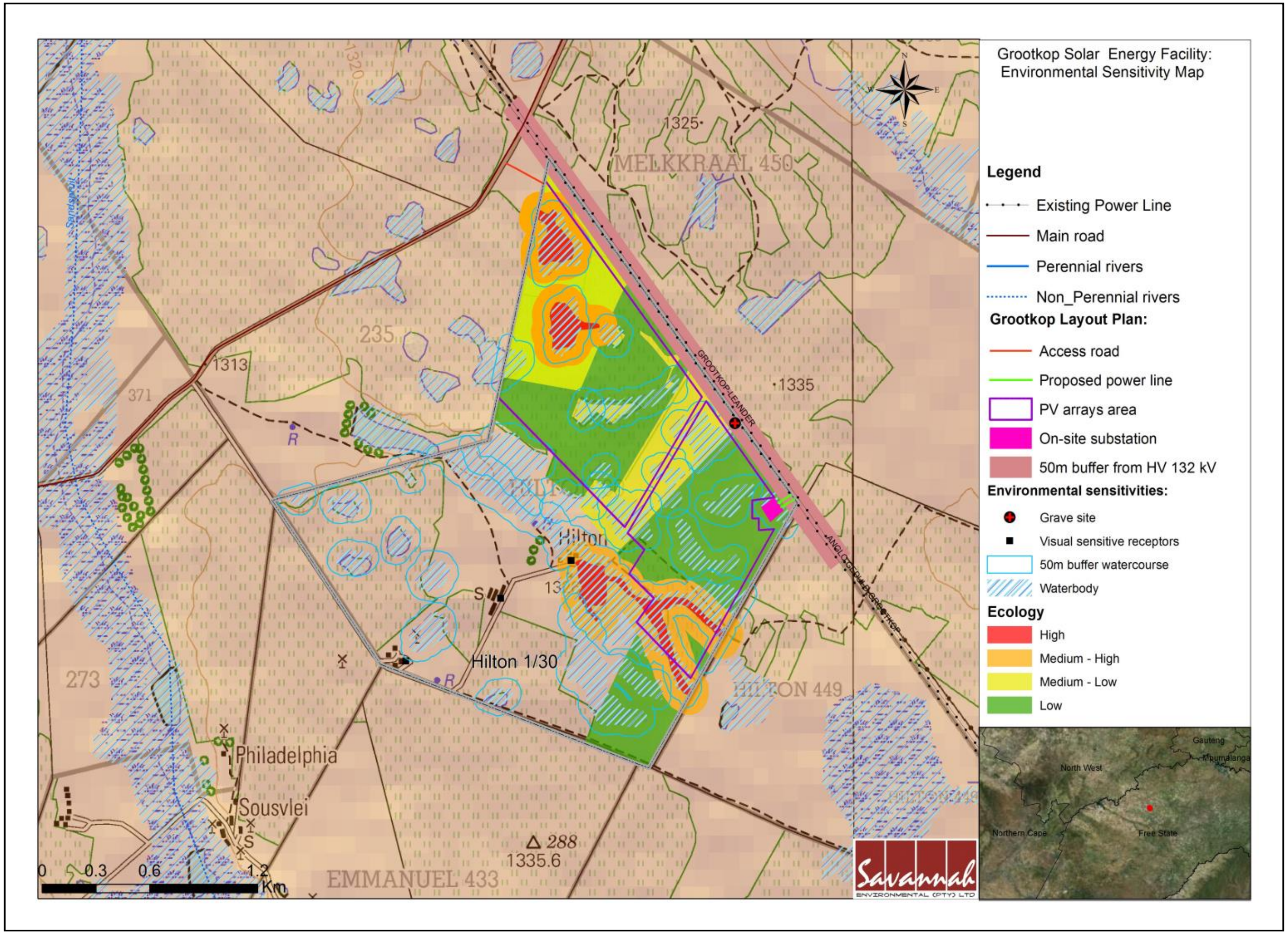

Figure 2: Environmental Sensitivity Map for the proposed Grootkop Solar Energy Facility

TABLE OF CONTENTS

PAGE

APPENDICES

DEFINITIONS AND TERMINOLOGY

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

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

Cumulative impacts: 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.

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

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

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

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

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

i. The land, water and atmosphere of the earth;
ii. Micro-organisms, plant and animal life;
iii. Any part or combination of (i) and (ii) and the interrelationships among and between them; and

iv. The physical, chemical, aesthetic and cultural properties and conditions of the foregoing that influence human health and well-being.

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

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

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

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

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

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

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

Indirect impacts: Indirect or induced changes that may occur as a result of the activity (e.g. the reduction of water in a stream that supply water to a reservoir that supply water to the activity). These types of impacts include all the potential impacts that do not manifest immediately when the activity is undertaken or which occur at a different place as a result of the activity.

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

Photovoltaic effect: Electricity can be generated using photovoltaic panels (semiconductors) which are comprised of individual photovoltaic cells that absorb solar energy to produce electricity. The absorbed solar radiation excites the electrons inside the cells and produces what is referred to as the Photovoltaic Effect.

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

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

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

ABBREVIATIONS AND ACRONYMS

BID	Background Information Document
CO_2	Carbon dioxide
DEA	National Department of Environmental Affairs
DEADP	Department of Environment Affairs and Development Planning
DoE	Department of Energy
DWA	Department of Water Affairs
EAP	Environmental Assessment Practitioner
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
GIS	Geographical Information Systems
GG	Government Gazette
GN	Government Notice
GHG	Green House Gases
GWh	Giga Watt Hour
I&AP	Interested and Affected Party
IDP	Integrated Development Plan
IPP	Independent Power Producer
km^2	Square kilometres
km/hr	Kilometres per hour
kV	Kilovolt
MAR	Mean Annual Rainfall
m^2	Square meters
m/s	Meters per second
MW	Mega Watt
NEMA	National Environmental Management Act (Act No. 107 of 1998)
NERSA	National Energy Regulator of South Africa
NHRA	National Heritage Resources Act (Act No. 25 of 1999)
NGOs	Non-Governmental Organisations
NWA	National Water Act (Act No. 36 of 1998)
SAHRA	South African Heritage Resources Agency
SANBI	South African National Biodiversity Institute
SANRAL	South African National Roads Agency Limited
SDF	Spatial Development Framework

INTRODUCTION CHAPTER 1

FRV Energy South Africa (Pty) Ltd is proposing to establish a commercial photovoltaic solar energy facility with an export capacity of up to 75MW, as well as associated infrastructure on a site located approximately 9 km south-east of Allanridge within the Free State Province. The project is proposed to be developed on the Farm Hilton 30 which covers an area of approximately 450 ha. The proposed facility and associated infrastructure (i.e. the development footprint) would occupy an area of approximately 180 hectares (ha) within the broader 450 ha site. The proposed development site is shown in **Figure 1.1**.

The proposed project development site is considered suitable and favourable by the developer from a technical perspective due to the following site characteristics:

» **Climatic conditions:** Climatic conditions determine the economic viability of a solar energy facility as it is directly dependent on the annual direct solar irradiation values for a particular area.
» **Topographic conditions:** The local site conditions are optimum for a development of this nature. For instance the site slope and aspect for the proposed site is predominantly flat. A level surface area (i.e. with a minimal gradient in the region of 1%) is preferred for the installation of PV panels.
» **Extent of the site:** Significant land area is required for the proposed development. The site is larger than the area required for development which allows for the avoidance of any identified environmental and/or technical constraints.
» **Proximity:** This site is located in close proximity to an existing electricity grid connection, which minimises the need for a long connection power line. This is preferred from an environmental and technical perspective.

The nature and extent of the Grootkop Solar Energy Facility, as well as the potential environmental impacts associated with the construction, operation and decommissioning phases are explored in more detail in this Final EIA Report. The Final EIA Report consists of eight chapters, which include:

Chapter 1: Provides background to the proposed facility and the environmental impact assessment.
Chapter 2: Provides a description of the proposed project and infrastructure.
Chapter 3: Provides an overview of the regulatory and legal context for electricity generation projects and the EIA process.

Chapter 4: Outlines the process which was followed during the EIA Phase, including the consultation process that was undertaken and input received from interested parties.
Chapter 5: Describes the existing biophysical and socio-economic environment.
Chapter 6: Presents the assessment of environmental impacts associated with the proposed facility and associated infrastructure.
Chapter 7: Presents the conclusions of the EIA, as well as an environmental impact statement on the proposed project.
Chapter 8: Provides a list of references and information sources used in undertaking the studies for this EIA Report.

1.1. Summary of the proposed Development

The Grootkop Solar Energy Facility is proposed to accommodate several arrays of photovoltaic (PV) panels with associated infrastructure in order to generate up to **75 MW** of electricity. The facility will comprise of the following infrastructure:

» Solar panels with an export capacity of up to 75MW.
» Mounting structures for the solar panels to be either rammed steel piles or piles with pre-manufactured concrete footings to support the PV panels.
» Cabling between the structures, to be lain underground where practical.
» Transformer to collect all energy generated from the PV panels.
» A new power line which will connect to the existing power line that runs adjacent the site from the proposed on-site substation (~150m x 150m in extent) in order to evacuate electricity generated to the national grid.
» Internal access roads (4 – 6 m wide roads will be constructed but will keep to existing roads as far as possible) and fencing (approximately 2.5 m in height).
» Associated buildings including a workshop area for maintenance, storage (i.e. fuel tanks, etc.), and offices.

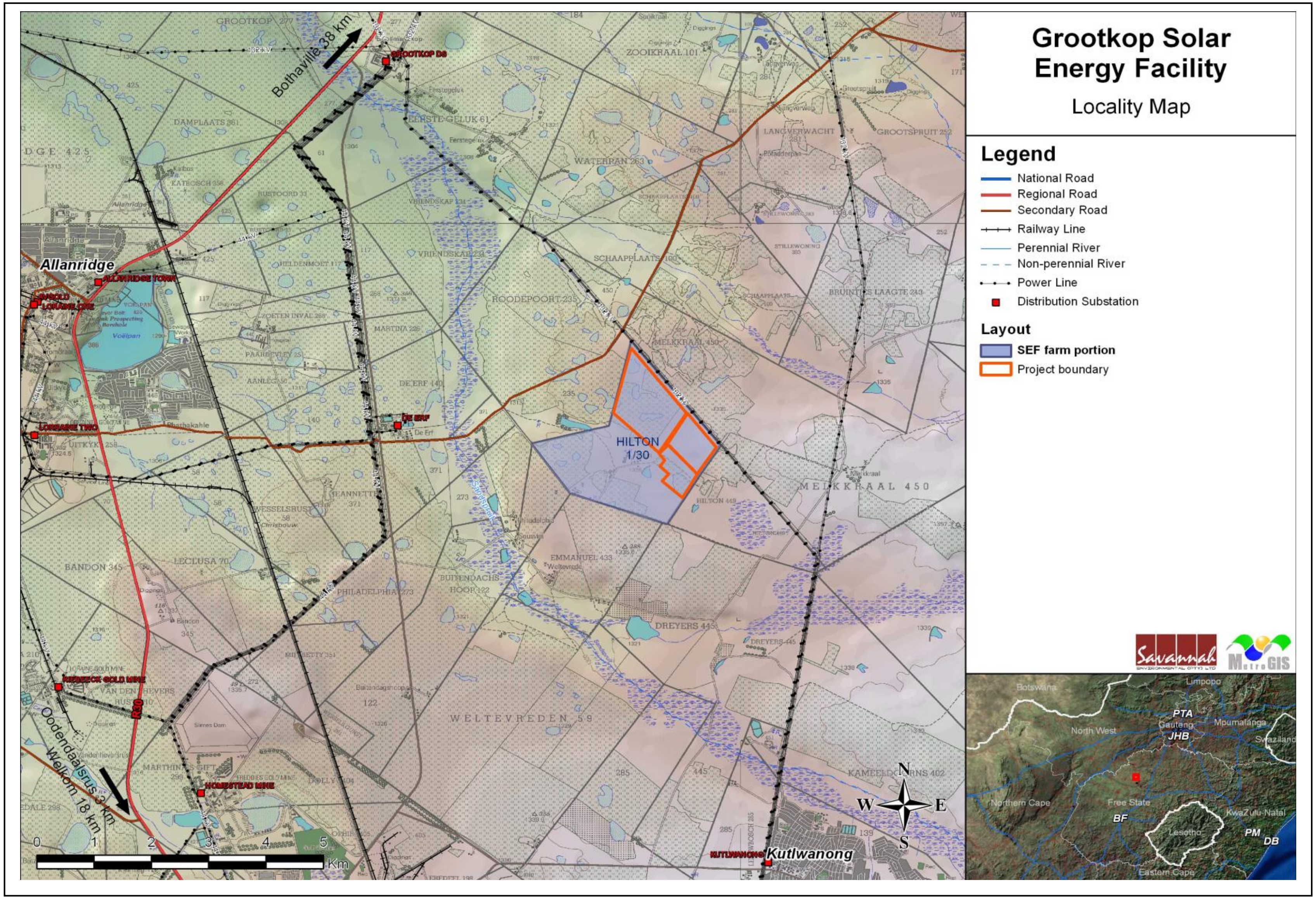

Figure 1.1: Locality map illustrating the location of the development site considered for the proposed Grootkop Solar Energy Facility

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

The scope of the proposed Grootkop Solar Energy Facility, including details of all elements of the project (for the design/planning, construction, operation and decommissioning Phases) is discussed in more detail in **Chapter 2.**

1.2. Conclusions from the Scoping Phase

The full extent of the project development site (i.e. the entire extent of the farm portion) was evaluated within the Scoping phase of the EIA process. The following sensitive environmental features were identified (shown in Figure 1.2):

- **Vegetation:** The proposed site falls mostly within the original extent of Vaal-Vet Sandy Grassland as described by Mucina and Rutherford (2006). Most of this vegetation on the project site has been previously transformed by cultivation. The remaining extent of this vegetation type has been listed in the threatened terrestrial ecosystems for South Africa (2011) as Endangered. Outside of the proposed development area, closer to larger drainage lines and small rivers, the grassland vegetation merges into Highveld Alluvial Vegetation, which is considered as least threatened. Several protected and red-data species potentially occur on and around the site. However, it is unlikely that the development will compromise the survival of any of the species of conservation concern, provided the final layout is designed in accordance to findings of the EIA.
- **Agriculture Potential:** The area adjacent to the proposed site for development has been used for agriculture (i.e. maize farming). The area where the project site is located is of low or non-existent agriculture potential
- **Wetlands:** The proposed solar facility area is situated in the C25B catchment. In terms of receiving water resources that might be impacted by activities on site, these include the wetland areas and the major Sandspruit River that drains the entire immediate catchment area. The Sandspruit River is a tributary of the Vaal River. According to the National Freshwater Ecosystem Priority Areas data set (Nel et al., 2011), the Sandspruit River is in a moderately modified condition (PES C). In addition, a number of seasonal pans occur within and around the site. These could be of some importance in terms of biodiversity, potentially supporting pan-adapted aquatic invertebrates and associated vertebrates. The

proposed site has wetlands which are sensitive and should be regarded as "no go areas" for any development activities.

» **Social receptors:** There are farm settlements or residences which occur at irregular intervals throughout the study area. Some of these are located, in close proximity to the proposed development site, including: Hilton (located on the farm itself), Philadelphia, Sousvlei, Weltevrede and Melkkraal. These residences could be impacted from a visual perspective.

No environmental fatal flaws were identified to be associated with development of the proposed facility on the site during the scoping phase of the EIA. It was recommended that infrastructure should be placed so as to consider the implementation of mitigation measures to minimise impacts to identified sensitive areas. These areas of sensitivity relate to the ecological and wetland aspects of the site and are illustrated in the sensitivity map (refer to Figure 1.2). Subsequently, the preliminary design of the solar energy facility has been undertaken by the developer. The proposed layout of infrastructure is discussed further in Chapter 2.

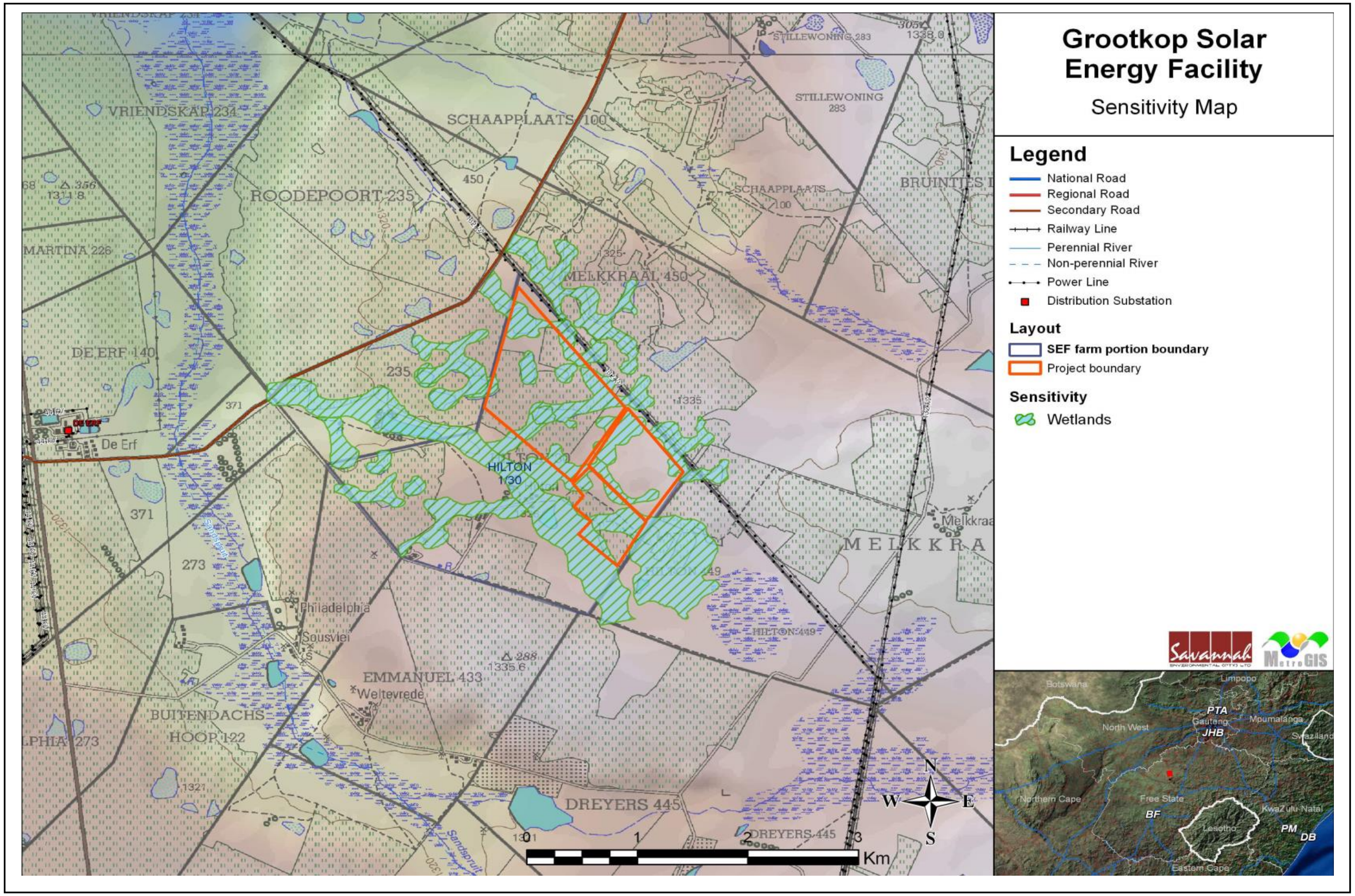

Figure 1.2: Scoping Phase Environmental Sensitivity Map for the proposed Grootkop Solar Energy Facility

From the conclusions of the Scoping Phase of the EIA, the potentially significant issues identified as being related to the **construction** of the Grootkop Solar Energy Facility include, *inter alia*:

» Loss of or disturbance to protected flora and fauna and associated habitats (local and site specific).
» Loss of soil and impacts on agricultural potential.
» Loss and disturbance to wetland and other water resources.
» Soil erosion during construction activities.
» Socio-economic impacts, both positive and negative (including job creation and business opportunities, impacts associated with construction workers in the area).

The potentially significant issues related to the **operation** of the Grootkop Solar Energy Facility include, *inter alia*:

» Visual impacts and impacts on "sense of place" on nearby residential areas and observers travelling on main roads.
» Positive socio-economic impacts.
» Generation of clean, renewable energy (positive).

The potentially significant issues related to the decommissioning of the Grootkop Solar Energy facility will include, inter alia:

» Loss of or disturbance to protected flora and fauna and associated habitats (local and wetlands).
» Soil erosion during decommissioning activities.
» Socio-economic impacts, both positive and negative (including job creation, nuisance).

1.3. Requirement for an Environmental Impact Assessment Process

The proposed solar energy facility is subject to the requirements of the EIA Regulations published in terms of Section 24(5) of the National Environmental Management Act (NEMA, Act No. 107 of 1998). This section provides a brief overview of the EIA Regulations and their application to this project.

NEMA is the national legislation that provides for the authorisation of "listed activities". In terms of Section 24(1) of NEMA, the potential impact on the environment associated with these activities must be considered, investigated, assessed and reported on to the competent authority that has been charged by NEMA with the responsibility of granting environmental authorisations. As this is a proposed electricity generation project and thereby considered to be of national importance, the National Department of Environmental Affairs (DEA) is the competent authority and Free State Department of Economic Development, Tourism and Environmental Affairs (DEDTEA) will act as a commenting authority. An application for authorisation has been accepted by DEA for the proposed project under application reference number **14/12/16/3/3/2/515**.

Compliance with the requirements of the EIA Regulations ensures that decision-makers are provided with an opportunity to consider the potential environmental impacts of a project early in the project development process and to assess if potential environmental impacts can be avoided, minimised or mitigated to acceptable levels. Comprehensive, independent environmental studies are required in accordance with the EIA Regulations to provide the competent authority with sufficient information in order to make an informed decision. FRV Energy South Africa (Pty) Ltd appointed Savannah Environmental (Pty) Ltd as the independent Environmental Consultants to conduct the EIA process for the proposed project.

An EIA is an effective planning and decision-making tool for the project developer as it allows for the identification and management of potential environmental impacts. It provides the developer with the opportunity of being fore-warned of potential environmental issues. Subsequently it may assist with the resolution of issues reported on in the Scoping and EIA Phases as well as promoting dialogue with interested and affected parties (I&APs) and stakeholders. In terms of sections 24 and 24D of NEMA, as read with the EIA Regulations R543, a Scoping Phase and an EIA are required to be undertaken for this proposed project as the proposed project includes the following "listed activities" in terms of GN R544, R545 and R546 (GG No 33306 of 18 June 2010).

Table 1.1: Activities applied for to be authorised[1]

Relevant Notice	Activity No.	Description of Listed Activity	Relevant Component(s) of Facility	Applicability of proposed project to listed activity
GN544, 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.	*The construction of a 132kV overhead power line from the solar facility to the Eskom electricity grid*	A new power line which will connect to the existing power line that runs adjacent the site from the proposed on-site substation (~150m x 150m in extent) in order to evacuate electricity generated to the national grid.
GN544, 18 June 2010	11	The construction of (ii). channels ~~vi) bulk storm water outlet structures; and~~ (xi). infrastructure or structures covering 50 square metres or more Where such construction occurs within a watercourse or within 32 metres of a watercourse, measured from the edge of a watercourse, excluding where such construction will occur behind	*The construction of the proposed solar facility may impede on drainage lines on the site due to infrastructure such as access roads.*	Wetlands have been identified on site which may be impacted upon by development due to their current state (disturbed due to agricultural practices). A water use license application will be submitted to DWA prior construction

[1] An application was amended to included and remove listed activities based on the findings of the scoping study which was conducted. Some listed activities were deemed unnecessary (indicated by deletion in Table 1.1) whereas some were crucial in the assessment of the proposed facility.

Relevant Notice	Activity No.	Description of Listed Activity	Relevant Component(s) of Facility	Applicability of proposed project to listed activity
		the development setback line.		
~~GN544, 18 June 2010~~	~~13~~	~~The construction of facilities or infrastructure for the storage, or for the storage and handling, of a dangerous good, where such storage occurs in containers with a combined capacity of 80 but not exceeding 500 cubic metres.~~	~~*The facility may require the storage and handling of dangerous goods such as fuels, oil or chemicals.*~~	The listed activity was deemed not applicable as the storage and handling of dangerous goods will be less than 500 cubic metres.
GN544, 18 June 2010	18	The infilling or depositing of any material of more than 5 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock or more than 5 cubic metres from (i). a water course	*The proposed activity might require the infilling and deposition of materials within watercourses.*	The infilling or depositing of material for access roads will be obtained from a registered borrow pit. Infilling or depositing of these access roads may impact on watercourse within development area.
GN544, 18 June 2010	22	The construction of a road, outside urban areas, ~~(i) with a reserve wider than 13.5 metres or,~~ (ii) where no road reserve exists where the road is wider than 8 metres ~~(iii) for which an environmental authorisation was obtained for the route determination in terms of activity 5 of Government Notice~~	*Access roads will be required to the site and within the site.*	The proposed facility falls outside urban areas and internal roads will be constructed where no road reserve exists and will not exceed 8m.

Relevant Notice	Activity No.	Description of Listed Activity	Relevant Component(s) of Facility	Applicability of proposed project to listed activity
		~~387 of 2006 or activity 18 of Notice 545 of 2010.~~		
~~GN 544, 18 June 2010~~	~~26~~	~~Any process or activity identified in terms of section 53 (1) of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004)~~ ~~(i) Impacts on orange or red data plant species may be a process or activity identified in terms of section 53(1) of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004).~~	~~*The applicability of this activity will be confirmed during the EIA Phase.*~~	The listed activity was found to be not applicable as no red data plant species are located within the site.
GN545, 18 June 2010	1	The construction of facilities or infrastructure, for the generation of electricity where the output is 20 megawatts or more.	*The PV facility will have an export capacity of up to 75MW.*	The proposed PV facility will have an export capacity of more than 75 MW to be transmitted to the national grid.
GN545, 18 June 2010	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~~	*The PV facility will have a developmental footprint of more than 20 ha.*	The establishment of the proposed 75 MW facility will transform the land from agriculture to a PV facility.

Relevant Notice	Activity No.	Description of Listed Activity	Relevant Component(s) of Facility	Applicability of proposed project to listed activity
		~~such physical alteration takes place for:~~ ~~(ii) Linear development activities.~~ (iii) ~~Agriculture or afforestation where activity 16 in this schedule will apply.~~		
GN546, 18 June 2010	4	The construction of a road wider than 4 metres with a reserve less than 13.5 metres (Free State 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	*Access roads may be constructed during the development of the proposed facility.*	There is an existing road to the proposed site but internal access roads (4 – 6m wide) will be constructed outside urban areas where sensitive areas have been identified and have been mapped as no-go areas in this EIA report.
GN546, 18 June 2010	14	The clearance of an area of 5 hectares or more of vegetation where 75% or more of the vegetative cover constitutes indigenous vegetation, (i) All areas outside urban area	*The project will be taking place outside urban areas and 75% or more of the vegetative cover constitutes natural vegetation.*	The establishment of the proposed 75 MW facility and access roads will require the clearance of indigenous vegetation within the site.

Activities deleted in the list above are those which were initially considered to be potentially applicable to the project but have been confirmed as not applicable through the EIA process. Activity 13 Listing Notice 1 (GN 544) Activity 26 Listing Notice 2 (GN545) is not applicable as the proposed development will not use or handle dangerous goods exceeding 500 cubic metres and the site is not considered to be located in a sensitive environment. The area surrounding the proposed site for the PV facility falls within a critical biodiversity area (CBA) as identified by National Assessment of Threatened Ecosystem but the proposed development area falls outside of the CBA area.

1.4. Objectives of the EIA Process

The Scoping Phase was completed in **July 2013** and the acceptance of scoping was received from DEA on **16 August 2013**. The scoping phase included desk-top studies and served to identify potential impacts associated with the proposed project and to define the extent of studies required within the EIA Phase. The Scoping Phase included input from the project proponent, specialists with experience in the study area and in EIAs for similar projects, as well as a public consultation process with key stakeholders that included both government authorities and interested and affected parties (I&APs).

The EIA Phase (i.e. the current phase) assesses identified environmental impacts (direct, indirect, and cumulative as well as positive and negative) associated with the different project development phases (i.e. design, construction, operation, and decommissioning). The EIA Phase also recommends appropriate mitigation measures for potentially significant environmental impacts. The release of a final EIA Report provides stakeholders with an opportunity to verify that issues they have raised through the EIA Process have been captured and adequately considered. The final EIA Report has incorporated all issues and responses raised during the public review phase prior to submission to DEA.

1.5. Details of the Environmental Assessment Practitioner

Savannah Environmental was contracted by FRV Energy South Africa (Pty) Ltd as the independent consultant to undertake the EIA process for the proposed project. Neither Savannah Environmental nor any of its specialist sub-consultants are subsidiaries of or are affiliated to FRV Energy South Africa (Pty) Ltd. Furthermore, Savannah Environmental does not have any interests in secondary developments that may arise out of the authorisation of the proposed project.

Savannah Environmental is a specialist environmental consultancy which provides a holistic environmental management service, including environmental assessment and planning to ensure compliance with relevant environmental legislation.

Savannah Environmental benefits from the pooled resources, diverse skills and experience in the environmental field held by its team that has been actively involved in undertaking environmental studies for a wide variety of projects throughout South Africa and neighbouring countries. Strong competencies have been developed in project management of environmental processes, as well as strategic environmental assessment and compliance advice, and the assessment of environmental impacts, the identification of environmental management solutions and mitigation/risk minimising measures.

Savannah Environmental has developed a detailed understanding of impacts associated with the construction and operation of renewable energy facilities through their involvement in numerous EIA processes for these projects.

The Environmental Assessment practitioners (EAPs) and public participation consultant from Savannah Environmental who are responsible for this project are:

» **Jo-Anne Thomas**, the principle Environmental Assessment Practitioner (EAP) for this project, is a registered Professional Natural Scientist and holds a Master of Science degree. She has 15 years' experience consulting in the environmental field with a. Her key focus is on strategic environmental assessment and advice; management and co-ordination of environmental projects, which includes integration of environmental studies and environmental processes into larger engineering-based projects and ensuring compliance to legislation and guidelines; compliance reporting; the identification of environmental management solutions and mitigation/risk minimising measures; and strategy and guideline development. She is currently involved in undertaking siting processes as well as EIAs for several renewable energy projects across the country.
» **Lusani Rathanya** - the principle author of this report holds an Honours Bachelor degree in Environmental Management and Analysis with over a year conducting EIAs. Her key focus is on environmental impact assessments, waste and water licences, environmental management plans and programmes, as well as compiling proposals and budget for a variety of environmental projects. She is currently involved in several EIAs for renewable energy projects EIAs across the country.
» **Gabriele Wood:** the public participation consultant for this project, hold an Honours Bachelor degree in Anthropology and has 6 years' experience in Public Participation and Social consultancy including professional execution of public participation consulting for a variety of projects as well as managing and coordinating public participation processes for Environmental Impact Assessments (EIA).

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

» Ecology – Marianne Strohbach (Savannah Environmental)
» Soils and Agricultural Potential – Johann Lanz (Johann Lanz Consulting)
» Wetlands - Bhuti Dlamini (Wetland Consulting Services (Pty) Ltd)
» Heritage and Desktop Palaeontological Assessment – Jaco van der Walt (Heritage Contracts and Archaeological Consulting CC)
» Visual – Lourens du Plessis (MetroGIS)
» Social – Tony Barbour (Tony Barbour Environmental Consultancy)

In order Refer to **Appendix A** for the curricula vitae for Savannah Environmental and specialists.

DESCRIPTION OF THE PROPOSED PROJECT CHAPTER 2

This chapter provides an overview of the proposed Grootkop Solar Energy Facility near Allanridge, Free State Province. The project scope includes the planning and design, construction, operation and decommissioning phases during which potential impacts will vary in terms of their nature and significance. This chapter also describes the project alternatives considered, including the "Do-Nothing" alternative - that is the alternative of not establishing the solar energy facility.

2.1 Purpose of the Proposed Project

The Grootkop Solar Energy Facility is proposed to be developed as a commercial energy facility to add new capacity for generation of renewable energy to the national electricity supply (which is short of generation capacity to meet current and expected demand) and to aid in achieving the goal of a 30% share of all new power generation being derived from independent power producers (IPPs), as targeted by the Department of Energy (DoE).

Globally there is an increasing pressure on countries to increase their share of renewable energy generation due to concerns such as exploitation of non-renewable resources. South Africa currently depends on fossil fuels for the supply of approximately 90% of its primary energy needs. With economic development over the next several decades resulting in an ever-increasing demand for energy, there is some uncertainty as to the availability of economically extractable coal reserves for future use in conventional power generation. Furthermore, several of South Africa's power stations are nearing the end of their economic life, require refurbishment, or have been recently returned to service (re-commissioned) at great expense (i.e. the Camden, Komati, and Grootvlei Power Stations).

This, together with the current electricity imbalances in South Africa highlight the significant role that renewable energy can play in terms of power supplementation. Given that renewables can generally be deployed in a decentralised manner close to consumers, they offer the opportunity for improving grid strength and supply quality, while reducing expensive transmission and distribution losses. At present, South Africa is some way off from exploiting the diverse gains from renewable energy and from achieving a considerable market share in the industry.

In order to meet the long-term goal of a sustainable renewable energy industry, a target of 17.8 GW of renewables by 2030 has been set by the Department of Energy (DoE) within the Integrated Resource Plan (IRP) 2010 and incorporated in the Renewable Energy Independent Power Procurement Programme (REIPPP). The energy procured through this programme will be produced mainly from wind, solar, biomass, and small-scale hydro (with wind and solar comprising the bulk of the power generation capacity). This 17,8GW of power from renewable energy amounts to ~42% of all new power generation being derived from renewable energy forms by 2030. It is the intention of FRV Energy South Africa that the proposed Grootkop Solar Energy Facility will contribute towards this goal for renewable energy.

In responding to the growing electricity demand within South Africa, as well as the country's targets for renewable energy, FRV Energy South Africa (Pty) Ltd is proposing the establishment of the Grootkop Solar Energy Facility to add new capacity to the national electricity grid through the Department of Energy's Renewable Energy IPP Procurement Programme. Should the project be selected as a Preferred Bidder through this process, FRV Energy South Africa (Pty) Ltd will be required to apply for a generation license from the National Energy Regulator of South Africa (NERSA), as well as a power purchase agreement from Eskom (typically for a period of 20 – 25 years) in order to build and operate the proposed facility. As part of the agreement, the FRV Energy South Africa (Pty) Ltd will be remunerated per kWh by Eskom who will be financially backed by government. Depending on the economic conditions following the lapse of this period, the facility can either be decommissioned or the power purchase agreement may be renegotiated and extended.

It is considered viable that long-term benefits for the community and/or society in general can be realised should the site identified prove to be acceptable from a technical and environmental perspective for the establishment of the proposed PV facility. The Grootkop Solar Energy Facility has the potential to contribute to national electricity supply and to increase the security of supply to consumers. In addition, it may provide both economic stimulus to the local economy through the construction process and long term employment (i.e. management and maintenance) during the operation phase.

2.1.1 The desirability of the proposed project

The use of solar irradiation for electricity generation is essentially a non-consumptive use of a natural resource. A solar energy facility also qualifies as a Clean Development Mechanism (CDM) project (i.e. a financial mechanism developed to encourage the development of renewable technologies) as it meets all international requirements in this regard. The proposed site was selected for the development of a solar energy facility based on its predicted climate (solar resource), suitable proximity in relation to the existing electricity grid, and minimum technical constraints from a construction and technical perspective. FRV Energy South Africa (Pty) Ltd considers this area, and specifically the demarcated site, to be highly preferred for solar energy facility development.

Conformance of the proposed project to the regional planning of the area has been discussed in **Chapter 3**.

At a provincial level, the need for the project complies with the Free State Provincial Spatial Development Framework (FS PSDF) (refer to Chapter 3 for more details in this regard). The Free State PSDF is a provincial spatial and strategic planning policy that responds to and complies with, in particular, the National Development Plan (NDP) Vision 2030 and the National Spatial Development Perspective (NSDP). This framework promotes a developmental state in accordance with the principles of global sustainability as is stated by, among others, the South African Constitution and the enabling legislation.

Locally, the project is in line with the Matjhabeng Local Municipality (MLM) IDP (refer to Chapter 3 for more details in this regard). The IDP makes reference to the importance of promoting the development of Small Medium Micro Enterprises (SMMEs) and the creation of local business support infrastructure and forums for SMMEs and the implementation of a Local Economic Development programme. The proposed facility will be creating jobs at a business and individual level.

The current land-use on the site is agriculture (cultivation and cattle grazing). The development of the Grootkop Solar Energy Facility will allow cultivation and current livestock grazing to continue on areas of the farm portions which will not be occupied by solar panels and associated infrastructure. Therefore the current land-use will be retained on much of the site, while also generating renewable energy from the sun and providing an additional source of income to the landowner. This represents a win-win situation of landowners, the site and the developer.

2.2 Description of the Proposed Solar Energy Facility

The facility is proposed to accommodate either static or tracking photovoltaic (PV) arrays, to harness the solar resource on the site. The facility is proposed to have an export capacity of up to 75 MW. An area of approximately 180 ha in extent will be occupied by the PV panels & associated infrastructure. A layout of the proposed Grootkop Solar Energy Facility and associated infrastructure has been provided by the project developer, and is indicated in **Figure 2.1**. This is the layout which has been assessed within this EIA Report. **Table 2.1** summarises the dimensions of the project components.

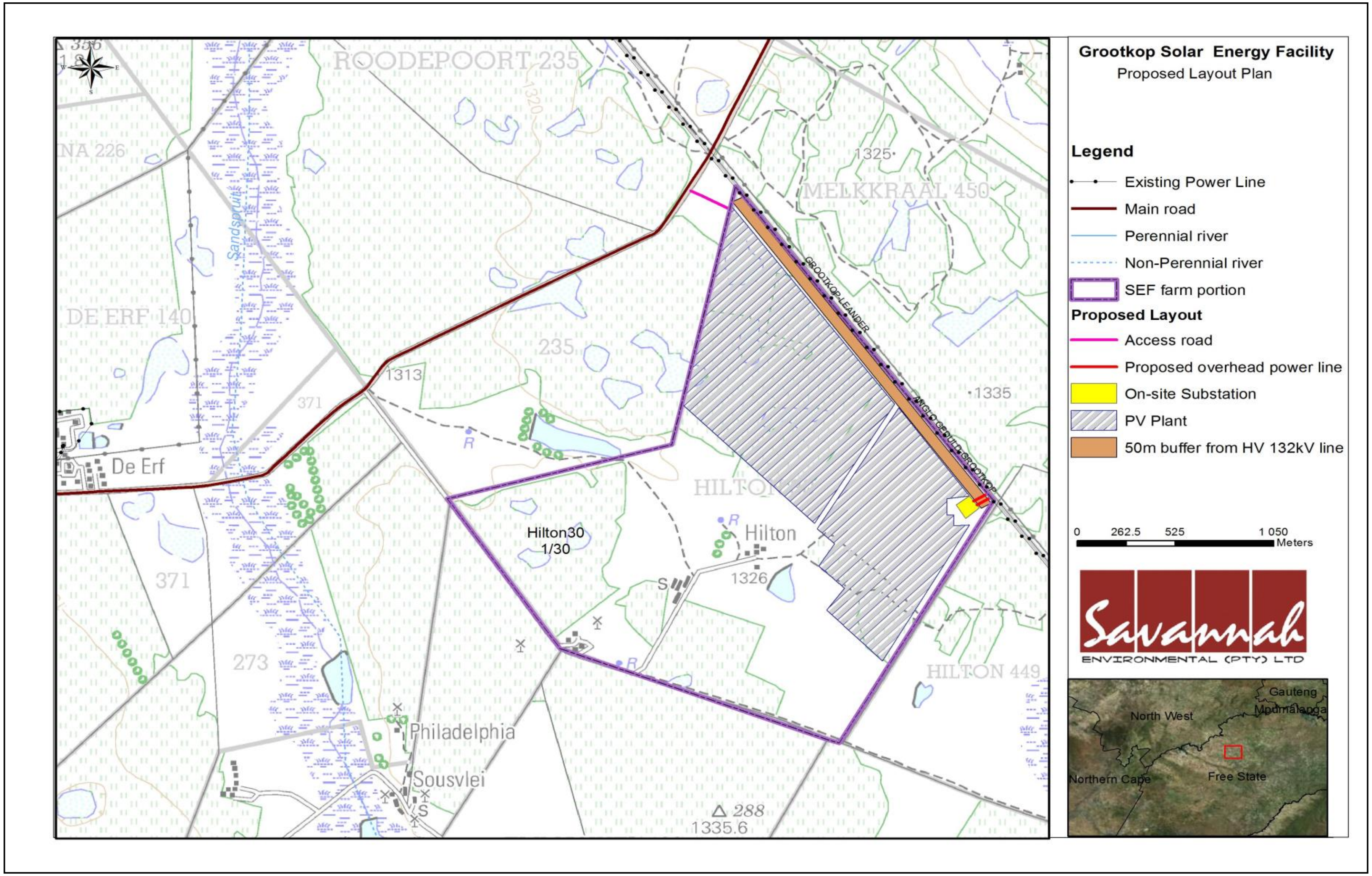

Figure 2.1: Layout for the proposed Grootkop Solar Energy Facility and associated infrastructure

Table 2.1: Technical details of the proposed facility

Component	Description/ Dimensions
Location of the site	~9 km south east of Allanridge
Municipal Jurisdiction	» Mathjabeng Local Municipality » Lejweleputswa District Municipality
Extent of the proposed development footprint	~ 180ha
PV Panel area	~173 ha
Laydown area	~2ha
Extent of broader site available for development	~450 ha
Site access	Use of existing access road to the Farm Hilton. A new access road to the PV facility will be developed within the farm boundaries.
Export capacity	75 MW
Proposed technology	Ground-mounted photovoltaic panels utilising static or tracking technology
Cabling	Cabling between the project components is to be lain underground between 2 – 4 meters deep where practical.
Water use	» Water will be sourced or purchased from the Local Municipality. » ~8367m^3 required during the construction phase for general use and 3744m^3 for annual operations for cleaning the PV panels. » No effluent will be produced except for the normal sewage from site and operations staff. » All waste will be disposed of at an authorised waste disposal facility.
Panel Spec (installed capacity)	250W
Panel Dimensions	1650mm x 950mm
Number of Panels	352 000 x 250W
Number of inverters	75
Main Transformer capacity	Height of the PV box (inverter +transformer): 40 feet container: • Length 2,025m • Width 2,352m • Height 2,393m

Final Height of installed panels from ground level	4m
Height of inverters	Length: 2,025m Width: 2,352m Height: 2,393m
Height of Transformers	40 feet container
Height of Buildings	• Maintenance building: 20m x 5m (2,5 m high) • Warehouse: 20m x 10m (4m high)
Width and length of internal roads	Width: 4-6 m Length: 300 m
Height of Fencing	2.5m
Office / workshop (size)	Maintenance building: 20mx5m (2,5 m height) Warehouse: 20mx10m (4 m height)
Substation	A new 132 kV on-site substation (150m x 150m in extent) to evacuate the power from the facility into the Eskom grid via loop in loop out connection
Power line connection	A loop-in and loop-out power line will evacuate electricity from the on-site substation to the Grootkop 132kV power line which runs adjacent the site in order to connect to the national grid. The length of the loop in and out power line is up to 80 m in length and servitude of up to 36 m wide.
Mounting Structure	Mounting structure (up to 4m in height) to be either rammed steel piles or piles with pre-manufactured concrete footings to support the PV panels.
Services required	• Sewage and Refuse material - all sewage and refuse material generated during the establishment of the proposed site will be collected by a contractor to a registered landfill site • Water and electricity – water will be obtained from the municipality or licence will be obtained for abstracting water from underground. Electricity will be generated from generators for any electrical work on site.

Infilling or depositing material	Any infilling or depositing material that may be required for project development will be obtained from a licensed borrow pit and any excess material will be transported to a registered landfill site.

2.3 Solar Energy as a Power Generation Technology

The generation of electricity can be easily explained as the conversion of energy from one form to another. Solar energy facilities operate by converting solar energy into a useful form (i.e. electricity). Solar technologies can be divided into two categories, those that use thermal energy from the sun and those that use the light energy. The former uses water (i.e. solar thermal) whereas the latter does not (i.e. photovoltaic technology which is proposed for this project).

The use of solar energy for electricity generation is a non-consumptive use of a natural resource and consumes no fuel for continuing operation. Renewable energy is considered a 'clean source of energy' with the potential to contribute greatly to a more ecologically, socially, and economically sustainable future. The challenge now is ensuring solar energy projects are able to meet all economic, social, and environmental sustainability criteria.

2.3.1 How do Grid Connected Photovoltaic Facilities Function?

Solar energy facilities convert solar energy to a useful form, such as electricity. Solar energy facilities produce an insignificant quantity of greenhouse gases over its lifecycle as compared to conventional coal-fired power stations. The operational phase of a solar facility does not produce carbon dioxide, sulphur dioxide, mercury, particulates, or any other type of air pollution, as do fossil fuel power generation technologies.

Globally, the solar PV market grew by 110% in 2008. Although South Africa has high levels of irradiation and could achieve between 4.5 kWh/m^2 and 6.55 kWh/m^2 from a solar PV panel, the installed capacity country-wide is currently only 12 MW, although there are a number of facilities currently under construction as part of the DoE REIPPP.

Solar energy facilities, such as those using PV technology use the energy from the sun to generate electricity through a process known as the Photovoltaic Effect. This is achieved using the following components:

» ***Photovoltaic Cells:*** An individual photovoltaic cell is made of silicone which acts as a semiconductor (refer to **Figure 2.2**). The cell absorbs solar radiation which energises the electrons inside the cells and produces electricity. Individual PV cells are linked and placed behind a protective glass sheet to form a photovoltaic panel. A single cell is sufficient to power a small device such as an emergency telephone, however to produce 75 MW of power, the proposed facility will require numerous cells arranged in multiples/arrays which will be fixed to a support structure.

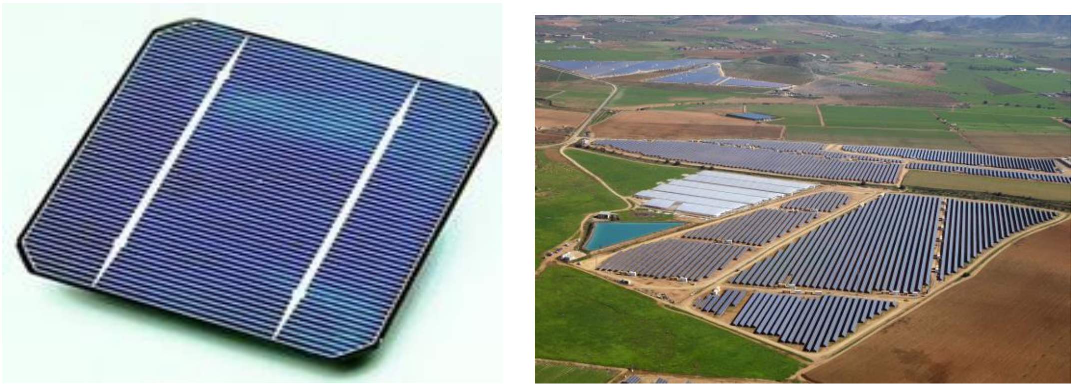

Figure 2.2: Figures showing a typical PV cell and an array of PV panels (source: http://www.frv.com/multimedia-files/)

» ***Support Structure:*** In fixed mounted PV systems, the PV panels will be fixed to a support structure which will allow for them to be set at an angle so to receive the maximum amount of solar radiation (refer to **Figure 2.3**). The angle of the panels is dependent on the latitude of the proposed facility and may be adjusted to optimise for summer or winter solar radiation characteristics. The height of the PV arrays is expected to be up to 4 m.

  A 'single axis tracker' will track the sun from east to west, while a dual axis tracker will in addition be equipped to account for the seasonal waning of the sun. When the tracking panel is vertical the structure may be up to a maximum height of approximately 20m.

Figure 2.3: The support structures elevate the panels and allow for single axis tracking of the sun for increased efficiency (Source: Gigaom)

2.4 Project Alternatives

In accordance with the requirements of the EIA Regulations[2], alternatives are required to be considered within the EIA process, and may refer to any of the following:

» Site alternatives
» Design or layout alternatives
» Technology alternatives
» No-go alternative

2.4.1. Site Alternative

Due to the nature of the development (i.e. a renewable energy facility), the location of the project is largely dependent on technical factors such as solar irradiation (i.e. the fuel source), climatic conditions, extent and topography of the site and available grid connection. The proposed site was identified by the proposed developer as being technically feasible. No feasible site alternatives within the broader area were identified for this specific project by the project developer.

The following characteristics were considered in determining the feasibility of the proposed site:

[2] GNR543 27(e) calls for the applicant to identify feasible and reasonable alternatives for the proposed activity

Site Extent - space is a restraining factor for the development of a PV facility. An area of approximately 180 ha will be utilised for a facility of up to 75 MW. The proposed site, which is approximately 450 ha in extent, will therefore be sufficient for the installation of the proposed facility, and should allow for the avoidance of any identified environmental and/or technical constraints in terms of the final design of the facility.

Land availability and Site access - The land is available for lease by the developer. The site can be accessed via secondary (local) road that joins the R30 at Odendaalsrus, to the south, or the R30 near Allanridge to the north. The site is therefore appropriately located for easy transport of components and equipment as well as labour movement to and from the site.

Climatic Conditions - the economic viability of a PV facility is directly dependent on the annual direct solar irradiation values. The site has been indicated as an area of high irradiation, which indicates that the regional location of the project is appropriate for a solar energy facility.

Gradient - a level surface area is preferred for the installation of PV panels. The slope of the proposed site is considered to be acceptable from a development perspective, which reduces the need for extensive earthworks and associated levelling activities, thereby minimising environmental impacts.

Grid Connection – there is an existing Eskom 132kV power line that traverses diagonally across the selected site enabling a short distance for grid connection (i.e. a power line approximately 80 m in length). Through the construction of a loop-in loop-out connection power line, the electricity generated at the PV facility could be evacuated from the proposed on-site substation directly into the grid without the need for construction of power lines outside the boundaries of the property.

Environmental sensitivity – establishment of a PV facility requires a large amount of land which may result in adverse impacts on the environment. The studies undertaken during this EIA phase indicated that there are wetlands within the site proposed for the development of Grootkop Solar energy Facility. These would need to be avoided or, where not possible to avoid, additional mitigation will be required to minimise impacts on these systems.

2.4.2. Layout Design Alternatives

As indicated above, the proposed Grootkop PV facility is expected to have a developmental footprint (~180ha) which is smaller than the broader farm (~450ha). Therefore the facility and associated infrastructure (i.e. PV panels, internal roads, etc.) can be appropriately located to avoid sensitive areas within the broader study area. The extent of the site therefore allows for the identification of design layout and siting alternatives within the site boundaries.

The EIA Phase aims to confirm environmentally sensitive areas on the site which should be avoided by the proposed development as far as possible. These areas have been considered in greater detail than in the scoping study through site-specific specialist studies. The information from these studies will be used to inform the final layout alternatives for the proposed development site and recommendations regarding a preferred alternative. Specific design alternatives will include *inter alia* the layout of the PV panels and the internal access roads.

2.4.3 Technology Alternatives

As it is the intention of FRV Energy South Africa (Pty) Ltd to develop renewable energy projects as part of the DoE's REIPPP, only renewable energy technologies are being considered. Solar energy is considered to be the most suitable renewable energy technology for this site, based on the site location, ambient conditions and energy resource availability (i.e. solar irradiation). Solar PV was determined as the most suitable option for the proposed site as large volumes of water are not needed for power generation purposes compared to concentrated solar power technology (CSP). PV is also preferred when compared to CSP technology because of the lower visual profile.

Very few technological options exist as far as PV technologies are concerned; those that are available are usually differentiated by weather and temperature conditions that prevail – so that optimality is obtained by the final choice. The impacts of any of the PV technology choices on the environment are very similar. The construction, operation and decommissioning activities associated with the facility will also be the same irrespective of the technology chosen. There are a number of different solar PV technologies, i.e.:

» Fixed / static PV panels;
» Tracking PV panels (with solar panels that rotate to follow the sun's movement); and
» Concentrated PV Plants (CPV technology).

Fixed or tracking PV is being considered for the proposed Grootkop Solar Energy Facility. The preferred option will be informed by financial, technical and environmental factors.

<u>Fixed Mounted PV System (Preferred Alternative)</u>

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

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

Single Axis Tracking System

A 'single axis tracker' will track the sun from east to west, while a dual axis tracker will in addition be equipped to account for the seasonal waning of the sun. These systems utilise moving parts and complex technology, including solar irradiation sensors to optimise the exposure of PV panels to sunlight. Tracking systems are a new technology. These systems result in a higher efficiency of the facility but are more complex as:

- A high degree of maintenance is required due to the nature of the machinery used in the system, which consists of numerous components and moving parts. A qualified technician is required to carry out regular servicing of these parts, which places a question on the feasibility of this system given the remote location of the proposed project site.
- The costs of the system are necessarily higher than a fixed mounted system due to the maintenance required for its upkeep and its complex design.
- A larger project site is required for this system given that the separate mountings need to be placed a distance apart to allow for their tracking movement.
- A power source is needed to mechanically drive the tracking system and this would offset a certain portion of the net energy produced by the plant

2.4.5. The 'Do-Nothing' Alternative

The 'do-nothing' alternative is the option of not constructing the proposed Grootkop Solar Energy Facility. Should this alternative be selected, there would be no impacts on the site due to the construction and operation activities of a solar energy facility. However, there will be impacts at a local and a broader scale. .

However, at a broader scale, the benefits of additional capacity to the electricity grid and those associated with the introduction of renewable energy would not be realised. Although the facility is only proposed to contribute 75 MW to the grid capacity, this would assist in meeting the growing electricity demand throughout the country and would also assist in meeting the government's goal for renewable energy.

At a broader scale, the benefits of this solar energy facility would not be realised. The generation of electricity from renewable energy resources offers a range of potential socio-economic and environmental benefits for South Africa. These benefits include:

» **Increased energy security:** The current electricity crisis in South Africa highlights the significant role that renewable energy can play in terms of power supplementation. In addition, given that renewables can often be deployed in a decentralised manner close to consumers, they offer the opportunity for improving grid strength and supply quality, while reducing expensive transmission and distribution losses.

» **Resource saving:** Conventional coal fired plants are major consumers of water during their requisite cooling processes. It is estimated that the achievement of the targets in the Renewable Energy White Paper will result in water savings of approximately 16.5 million kilolitres, when compared with wet cooled conventional power stations. This translates into revenue savings of R26.6 million. As an already water-stressed nation, it is critical that South Africa engages in a variety of water conservation measures, particularly due to the detrimental effects of climate change on water availability.

» ***Exploitation of our significant renewable energy resource:*** At present, valuable national resources including biomass by-products, solar radiation and wind power remain largely unexploited. The use of these energy flows will strengthen energy security through the development of a diverse energy portfolio.

» ***Pollution reduction:*** The releases of by-products through the burning of fossil fuels for electricity generation have a particularly hazardous impact on human health and contribute to ecosystem degradation. The use of solar radiation for power generation is considered a non-consumptive use of a natural resource which produces zero greenhouse gas emissions.

» ***Climate friendly development:*** The uptake of renewable energy offers the opportunity to address energy needs in an environmentally responsible manner and thereby allows South Africa to contribute towards mitigating climate change through the reduction of greenhouse gas (GHG) emissions. South Africa is estimated to be responsible for approximately 1% of global GHG emissions and is currently ranked 9^{th} worldwide in terms of per capita carbon dioxide emissions.

» ***Support for international agreements:*** The effective deployment of renewable energy provides a tangible means for South Africa to demonstrate its commitment to its international agreements under the Kyoto Protocol, and for cementing its status as a leading player within the international community.

» ***Employment creation:*** The sale, development, installation, maintenance and management of renewable energy facilities have significant potential for job creation in South Africa.

» ***Acceptability to society:*** Renewable energy offers a number of tangible benefits to society including reduced pollution concerns, improved human and ecosystem health and climate friendly development.

» ***Support to a new industry sector:*** The development of renewable energy offers the opportunity to establish a new industry within the South African economy.

The 'do nothing' alternative will not assist the South African government in addressing climate change, in reaching the set targets for renewable energy, nor will it assist in supplying the increasing electricity demand within the country. In addition the Free State power grid will be deprived of an opportunity to benefit from the additional generated power being evacuated directly into the Province's grids. The 'do nothing alternative is assessed within this report.

2.5 Proposed Activities during the Project Development Stages

2.5.1 Construction Phase

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

In order to construct the proposed project, a series of activities will need to be undertaken. The construction process is discussed in more detail below.

Conduct Surveys

Prior to initiating construction, a number of surveys will be required including, but not limited to, a geotechnical survey, a site survey and confirmation of the micro-siting footprint, and survey of the substation site and road servitudes.

Establishment of Access Roads to the Site

The site can be accessed via secondary (local) road that joins the R30 at Odendaalsrus, to the south, or the R30 near Allanridge to the north. The existing access to the farm from this road is considered adequate and will be utilised. Within the site itself, access will be required to the individual facility components for construction purposes (and later limited access for maintenance). Upgrade of access roads within the site will be required and new access roads will need to be constructed (4-6m in width and ~300m in length). Access track construction would normally comprise of compacted rock-fill with a layer of higher quality surfacing stone on top. The strength and durability properties of the rock strata at the proposed site are not known at this stage; this will need to be assessed via a geotechnical study to be conducted by the project proponent. Depending on the results of these studies, it may be possible, in some areas, to strip off the existing vegetation and ground surface and level the exposed formation to form an access track surface. The final layout of the access roads will be determined following the identification of site related sensitivities.

Undertake Site Preparation

Site preparation activities will include clearance of vegetation within the footprint of the PV arrays as well as within the footprint of other facility infrastructure. These activities will require the stripping of topsoil which will need to be stockpiled, backfilled and/or spread on site.

Transport of Components and Equipment to Site

The components and equipment required for the construction of the proposed facility will be brought to site in sections by means of national and then proposed internal access road. Some of the components (e.g. substation transformer) may be defined as abnormal loads in terms of the Road Traffic Act (Act No. 29 of 1989)[3] by virtue of the dimensional limitations (i.e. weight). Typical civil engineering construction equipment will need to be brought to the site (e.g. excavators, trucks, graders, compaction equipment, cement trucks, etc.).

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

Establishment of Laydown Areas on Site

Laydown and storage areas will be required for the typical construction equipment which will be required on site. The laydown area is proposed to be up to 20mx10m (4m high) in extent.

Erect PV Panels and Construct Substation & Invertors

The PV cells will be arranged in arrays. The frames will be fixed onto the ground with the use of concrete, depending on the soil conditions at the site. This will make the installation of the plant less invasive for the territory and facilitate the decommissioning at the end of its production cycle. The height of the PV panel structure will be up to 4 m.

Figure 2.4: Frame, structural details (Courtesy of Igeam, 2011)

Figure 2.5 Mounting of the frame for the PV panels (Courtesy of Igeam, 2011)

Inverters will be installed to facilitate the connection between the solar energy facility and the Eskom electricity grid via the 132kV power line. The position of the inverters within the footprint of the broader site will be informed by the final positioning of the PV components.

Construct On-site substation and Power line

An on-site substation and associated power line (looping into and out of the power line which traverses the site) will be required to evacuate the power into the Eskom grid.

The area required for the on-site substation will be up to maximum of 150m x 150m in extent. Substations are constructed in the following simplified sequence:

Step 1: Survey the area
Step 2: Final design of the substation and placement of the infrastructure
Step 3: Issuing of tenders and award of contract to construction companies
Step 4: Vegetation clearance and construction of access roads (where required)
Step 5: Construction of foundations
Step 6: Assembly and erection of infrastructure on site
Step 7: Connect conductors
Step 8: Rehabilitation of disturbed area and protection of erosion sensitive areas
Step 9: Testing and commissioning

The power line looping into and out of the existing power line traversing the site is approximately 80 m in length. Power lines are constructed in the following simplified sequence:

Step 1: Survey of the route
Step 2: Selection of best-suited conductor, towers, insulators, foundations
Step 3: Final design of line and placement of towers
Step 4: Issuing of tenders and award of contract to construction companies
Step 5: Vegetation clearance and construction of access roads (where required)
Step 6: Tower pegging
Step 7: Construction of foundations
Step 8: Assembly and erection of towers on site
Step 9: Stringing of conductors
Step 10: Rehabilitation of disturbed area and protection of erosion sensitive areas
Step 11: Testing and commissioning

Establishment of Ancillary Infrastructure

Ancillary infrastructure will include a workshop, storage areas, office and a temporary contractor's equipment camp. The establishment of these facilities/buildings will require the clearing of vegetation and levelling of the development site and the excavation of foundations prior to construction.

Undertake Site Rehabilitation

Once construction is completed and once all construction equipment is removed, the site must be rehabilitated where practical and reasonable. On full commissioning of the facility, any access points to the site which are not required during the operational phase must be closed and rehabilitated.

2.5.2 Operation Phase

The electricity that is generated from the PV panels will be stepped up through the on-site inverters and transformers at the on-site substation. This electricity will be fed into the electricity grid via a loop in loop out connection to the existing Eskom 132kV power line which traverses the development site. This power line, in turn, connects to the Grootkop substation.

It is anticipated that a full-time security, maintenance and control room staff will be based on site. Each component within the solar energy facility will be operational except under circumstances of mechanical breakdown, unfavourable weather conditions or maintenance activities.

2.5.3 Decommissioning Phase

The operation phase of the project is expected to have a lifespan of more than 20 – 25 years (with maintenance) and the power plant infrastructure would only be decommissioned once it has reached the end of its economic life. If economically feasible/desirable, the decommissioning activities would comprise the disassembly and replacement of the individual components with more appropriate technology/ infrastructure available at that time. However, if not deemed so, then the facility would be completely decommissioned by undertaking the decommissioning activities described below.

Site Preparation

Site preparation activities will include confirming the integrity of the access to the site to accommodate the required equipment (e.g. lay down areas) and the mobilisation of decommissioning equipment.

Disassemble and Replace Existing Components

The components would be disassembled, reused and recycled (where possible), or disposed of in accordance with regulatory requirements.

REGULATORY AND LEGAL CONTEXT CHAPTER 3

3.1 Policy and Planning Context

The need to expand electricity generation capacity in South Africa is based on national policy and informed by on-going strategic planning undertaken by the Department of Energy (DoE). The hierarchy of policy and planning documentation that support the development of renewable energy projects such as solar energy facilities is illustrated in **Figure 3.1**. These policies are discussed in more detail in the following sections, along with the provincial and local policies or plans that have relevance to the development of the proposed Grootkop Solar Energy Facility.

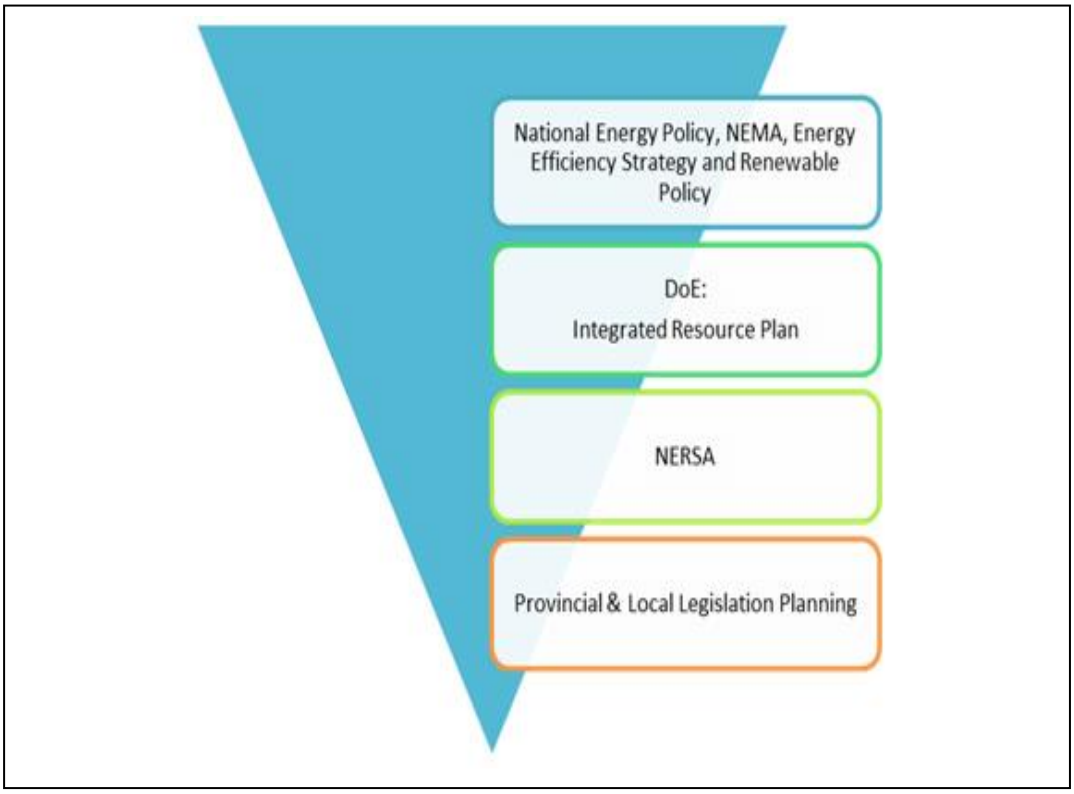

Figure 3.1: Hierarchy of electricity policy and planning documents

3.1.1 White Paper on the Energy Policy of South Africa

Investment in renewable energy initiatives, such as the proposed solar energy facility, is supported by the White Paper on Energy Policy for South Africa (December1998). In this regard the document notes: "Government policy is based on an understanding that renewables are energy sources in their own right, are not limited to small-scale and remote applications, and have significant medium and long-term commercial potential".

"Renewable resources generally operate from an unlimited resource base and, as such, can increasingly contribute towards a long-term sustainable energy future". The support for renewable energy policy is guided by a rationale that South Africa has a very attractive range of renewable resources, particularly ***solar*** and wind and that renewable applications are in fact the least cost energy service in many cases; more so when social and environmental costs are taken into account. Government policy on renewable energy is thus concerned with meeting the following challenges:

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

The White Paper also acknowledges that South Africa has neglected the development and implementation of renewable energy applications, despite the fact that the country's renewable energy resource base is extensive and many appropriate applications exist. The White Paper also notes that renewable energy applications have specific characteristics that need to be considered. Advantages include:

» Minimal environmental impacts in operation in comparison with traditional supply technologies; and
» Generally lower running costs, and high labour intensities.

Disadvantages include:

» Higher capital costs in some cases;
» Lower energy densities; and
» Lower levels of availability, depending on specific conditions, especially with sun and wind based systems.

The IRP 2010 also allocates 43% of new energy generation facilities in South Africa to renewables.

3.1.2 Renewable Energy Policy in South Africa, 1998

This White Paper on Renewable Energy (November, 2003) (further referred to as the White Paper) supplements the *White Paper on Energy Policy*, which recognizes that the medium and long-term potential of renewable energy is significant. This

Paper sets out Government's vision, policy principles, strategic goals and objectives for promoting and implementing renewable energy in South Africa.

The White Paper notes that while South Africa is well-endowed with renewable energy resources that have the potential to become sustainable alternatives to fossil fuels, these have thus far remained largely untapped. As signatory to the Kyoto Protocol[4], Government is determined to make good the country's commitment to reducing greenhouse gas emissions. To this purpose, Government has committed itself to the development of a framework in which a national renewable energy framework can be established and operate.

South Africa is also a signatory of the Copenhagen Accord, a document that delegates at the 15th session of the Conference of Parties (COP 15) to the United Nations Framework Convention on Climate Change agreed to "take note of" at the final plenary on 18 December 2009. The accord endorses the continuation of the Kyoto Protocol and confirms that climate change is one of the greatest challenges facing the world. In terms of the accord South Africa committed itself to a reduction target of 34% compared to business as usual.

Apart from the reduction of greenhouse gas emissions, the promotion of renewable energy sources is aimed at ensuring energy security through the diversification of supply (in this regard, also refer to the objectives of the National Energy Act). Government's long-term goal is the establishment of a renewable energy industry producing modern energy carriers that will offer in future years a sustainable, fully non-subsidized alternative to fossil fuels.

3.1.3 National Integrated Resource Plan, 2010 - 2030

The current iteration of the Integrated Resource Plan (IRP) for South Africa, initiated by the Department of Energy (DoE) after a first round of public participation in June 2010, led to the Revised Balanced Scenario (RBS) that was published in October 2010. The document outlines the proposed generation new build fleet for South Africa for the period 2010 to 2030. This scenario was derived based on the cost-optimal solution for new build options (considering the direct costs of new build power plants), which was then "balanced" in accordance with qualitative measures such as local job creation. In addition to all existing and

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[4] The **Kyoto Protocol** is a protocol to the United Nations Framework Convention on Climate Change (UNFCCC), aimed at fighting global warming. The UNFCCC is an international environmental treaty with the goal of achieving "stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system."[The Protocol was initially adopted on 11 December 1997 in Kyoto, Japan and entered into force on 16 February 2005. As of November 2009, 187 states have signed and ratified the protocol (Wikipedia)

committed power plants, the RBS included a nuclear fleet of 9,6 GW; 6,3 GW of coal; 11,4 GW of renewables; and 11,0 GW of other generation sources.

A second round of public participation was conducted in November/December 2010, which led to several changes to the IRP model assumptions. The main changes were the disaggregation of renewable energy technologies to explicitly display solar photovoltaic (PV), concentrated solar power (CSP) and wind options; the inclusion of learning rates, which mainly affected renewables; and the adjustment of investment costs for nuclear units, which until then represented the costs of a traditional technology reactor and were too low for a newer technology reactor (a possible increase of 40%).

Additional cost-optimal scenarios were generated based on the changes. The outcomes of these scenarios, in conjunction with the following policy considerations, led to the Policy-Adjusted IRP:

- The installation of renewables (solar PV, CSP and wind) were brought forward in order to accelerate a local industry;
- To account for the uncertainties associated with the costs of renewables and fuels, a nuclear fleet of 9,6 GW was included in the IRP;
- The emission constraint of the RBS (275 million tons of carbon dioxide per year after 2024) was maintained; and
- Energy efficiency demand-side management (EEDSM) measures were maintained at the level of the RBS.

	New build options							
	Coal (PF, FBC, imports, own build)	Nuclear	Import hydro	Gas – CCGT	Peak – OCGT	Wind	CSP	Solar PV
	MW	MW	MW	MW	MW	MW	MW	MW
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[1]	0	0	0	0	400	0	300
2015	500[1]	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[4]	100[4]	300[4]
2019	250	0	0	237[3]	0	400[4]	100[4]	300[4]
2020	250	0	0	237[3]	0	400	100	300
2021	250	0	0	237[3]	0	400	100	300
2022	250	0	1 143[2]	0	805	400	100	300
2023	250	1 600	1 183[2]	0	805	400	100	300
2024	250	1 600	283[2]	0	0	800	100	300
2025	250	1 600	0	0	805	1 600	100	1 000
2026	1 000	1 600	0	0	0	400	0	500
2027	250	0	0	0	0	1 600	0	500
2028	1 000	1 600	0	474	690	0	0	500
2029	250	1 600	0	237	805	0	0	1 000
2030	1 000	0	0	948	0	0	0	1 000
Total	6 250	9 600	2 609	2 370	3 910	8 400	1 000	8 400

Firm commitment necessary now

Final commitment in IRP 2012

1. Built, owned & operated by IPPs 2. Commitment necessary due to required high-voltage infrastructure, which has long lead time 3. Commitment necessary due to required gas infrastructure, which has long lead time 4. Possibly required grid upgrade has long lead time and thus makes commitment to power capacity necessary

Figure 3.1: National Energy Development Commitments before the next IRP

Figure 3.1 above indicates the new capacities of the Policy commitment. The dates shown in **Figure 3.1** indicate the latest that the capacity is required in order to avoid security of supply concerns. The document notes that projects could be concluded earlier than indicated.

The Policy-Adjusted IRP includes the same amount of coal and nuclear new builds as the RBS, while reflecting recent developments with respect to prices for renewables. In addition to all existing and committed power plants (including 10 GW committed coal), the plan includes 9,6 GW of nuclear; 6,3 GW of coal; 17,8 GW of renewables; and 8,9 GW of other generation sources. The Policy-Adjusted IRP has therefore resulted in an increase in the contribution from renewables from 11,4 GW to 17,8 GW. The key recommendations contained in the Policy-Adjusted IRP Final Report (March 2011) that have a bearing on the renewable energy sector include:

General

» The dark shaded projects in **Figure 3.1** need to be decided before the next IRP iteration, with the identified capacities thereafter assumed as "committed" projects;
» The light shaded options should be confirmed in the next IRP iteration; and
» All non-shaded options could be replaced during the next, and subsequent, IRP iterations if IRP assumptions change and thus impact on the quantitative model results.

PV Solar energy

» Solar PV programme 2012-2015: In order to facilitate the connection of the first solar PV units to the grid in 2012 a firm commitment to this capacity is necessary. Furthermore, to provide the security of investment to ramp up a sustainable local industry cluster, the first four years from 2012 to 2015 require firm commitment; and
» Solar PV 2016 to 2019: Grid upgrades might become necessary for the second round of solar PV installations from 2016 to 2019, depending on their location. To trigger the associated tasks in a timely manner, a firm commitment to these capacities is necessary in the next round of the IRP at the latest. By then, the assumed cost decreases for solar PV will be confirmed.

3.1.4 Electricity Regulation Act, 2006

Under the National Energy Regulator Act, 2004 (Act No 40 of 2004), the Electricity Regulation Act, 2006 (Act No 4 of 2006) and all subsequent relevant Acts of Amendment, NERSA has the mandate to determine the prices at and conditions under which electricity may be supplied by licence to Independent Power Producers

(IPPs). NERSA has recently awarded electricity generation licences for new generation capacity projects under the IPP procurement programme.

3.1.5 National Development Plan

The National Planning Commission tasked with outlining a developmental growth vision and plan for the country during the course of 2011 released documents providing a diagnostic overview and vision statement/ plan. The National Development Plan (NDP) contains a plan aimed at eliminating poverty and reducing inequality by 2030, and provides that such should be the guiding objectives of the NDP over the next 20 years. While the Plan aims to address poverty and exclusion on the one hand, it simultaneously attempts to nurture economic growth by creating a virtuous cycle of expanding opportunities, building capabilities, poverty reduction, involving communities in their own development, all leading to rising living standards.

The NDP identifies 9 key challenges and associated remedial plans. While all nine challenges and plans are envisaged as part of integrated whole, the highest priorities are regarded as employment creation and improving the quality of national education. Managing the transition towards a low carbon national economy is identified as one of the 9 key national challenges. Expansion and acceleration of commercial renewable energy is identified as a key intervention strategy.

3.2 Provincial and Local Context

3.2.1 Free State Province Provincial Growth and Development Strategy

The Free State Provincial Growth and Development Strategy (FSPGDS) is a nine-year strategy (2004-2014) which aims to achieve the objectives of Vision 2014. As a provincial policy framework, it sets the tone and pace for shared growth and development in the Province. It addresses the key social, economic, environmental and spatial imperatives in the Province. Underlying the FSGDS are the following imperatives:

» The need to effectively use scarce resources within the Province, whilst addressing the real causes of development challenges.
» The need to accelerate service delivery based on a common provincial development agenda as the basis for provincial strategic direction.
» The need to identify investment opportunities and provide an environment of certainty critical for private-sector investment.
» The need to promote intergovernmental coordination between the three spheres of government.

» The need to facilitate the implementation of the People's Contract within the Province.
» The need to provide a common vision as the basis for common action amongst all stakeholders, both inside and outside government.
» The need to provide a framework for budgets, implementation, performance management and spatial development.

The implementation of the FSGDS is informed by the following vision, mission, and value statements.

Vision: A unified prosperous Free State that the fulfils the needs of all its people

Mission: Serving the people of the Province by working effectively with our social partners through:

» Economic growth, development, and employment.
» Human and social development.
» Justice and crime prevention.
» Efficient governance and administration.

The FSPGDS states the importance of applying the principles of sustainable development, specifically:

» Acknowledge the ecological limitation of the environment;
» Ensure integrated development planning and implementation;
» Actively address economic and social inequalities;
» Promote economic infrastructure investment and development spending in areas of potential and need according to the principles of the NSDP;
» Acknowledge the importance of BEE, as well as the need to broaden access to the economy; and
» Promote labour intensive approaches to development.

The FSPGDS identifies a number of key provincial priorities. The priorities that are relevant to the proposed solar energy facility include:

» Economic development, employment, and investment;
» Human and social development. Economic growth is underpinned by a good socio-economic environment.

The following key objectives are set for economic development, employment and investment:

» To achieve an economic growth rate of 6%-7% per annum;

» To reduce unemployment from 30% to 15%;
» To reduce the number of households living in poverty by 5% per annum;
» To provide adequate infrastructure for economic growth and development.

Regarding the above objectives and the discussion of development trajectories, trade-offs, and barriers, the key strategic approaches towards the economy are divided into economic driving and economic enabling strategies. The key economic drivers that are relevant to the renewable energy sector are:

» Expanding the manufacturing sector in key sub-sectors
» Developing tourism

To enhance these drivers, the following enabling strategies are followed:

» Emphasising SMME development;
» Providing economic infrastructure;
» Promoting human resource development;
» Creating an enabling environment.

SMME development: The FSPGDS acknowledges the key role played by SMMEs in terms of economic development and job creation. To bolster economic growth and create employment opportunities, SMME development is high on the agenda of government.

Tourism: The emphasis in respect of tourism is to optimise its benefits. More specifically, the weekend tourism market for the north and north-eastern parts of the Province should be explicitly marketed. Emphasis is on nature tourism and heritage tourism. Events tourism should be focused on in the larger urban areas of Bloemfontein and Welkom. Human resource development and economic growth: Providing the skills for a growing economy will be done by means of the learnership, providing skills through the FET sector and internships.

The FSPGDS also identifies a number of barriers to economic growth and infrastructure that need urgent attention in order to foster economic growth. The barriers that are pertinent to the renewable energy sector include:

» The lack of appropriate skills.
» Access to capital;
» Poor institutional arrangements in respect of business support.
» Lack of basic infrastructure and the maintenance of basic infrastructure.
» Lack of appropriate R&D to foster the emphasis in the NSDP on innovation and economy, appropriate R&D is vital to the economic development of the

Province. Not only should partnerships with local research institutions be fostered, but various national institutions also exist to assist in this regard;

» The HIV and AIDS pandemic.

The FSPGDS also identifies a number of natural constraints to economic growth and development. These include, low rainfall coupled with the limited soil potential and the impact of this on agriculture, limited water availability and depletion of mineral resources. What is of interest is that none of the natural constraints impact on the renewable energy sector, specifically the solar energy sector. Solar energy, specifically PV solar energy, therefore provides the Free State with an opportunity to diversify its economy in a way that is not affected by natural constraints such as low rainfall and limited water supplies.

Agriculture dominates the Free State landscape, with cultivated land covering 32 000 square kilometres, and natural veld and grazing a further 87 000 square kilometres of the province. Due to the climate change, Free State's agricultural potential has been declining and this has led to an increase in the level of unemployment. The proposed solar energy facility will create jobs during its construction and operation phase and this will decrease the level of unemployment currently being experienced in this province. Furthermore the proposed project will boost the local economy and attract tourists in the area.

3.2.2. Lejweleputswa District Municipality Integrated Development Plan

The LDM IDP is informed by and aligned with the Free State Provincial Growth and Development Strategy (FSGDS) and other governmental programmes and policies. In this regard the FSPGDS identified four key priority areas, two of which are relevant to the proposed solar energy project, namely:

» Economic development, employment and investment;
» Social and Human Development.

The IDP identifies a number of priority areas, of which the following are regarded as relevant:

» Local Economic Development
» Basic Service Delivery and Infrastructure Investment

The proposed solar energy facility will boost the local economy through job creation and supporting local business.

3.2.3 Matjhabeng Local Municipality Integrated Development Plan

The vision of the MLM is to be a benchmark developmental municipality in service delivery excellence. The mission is:

» Be a united, non-racial, non-sexist, transparent, responsible municipality;
» Provide municipal services in an economic, efficient and effective way;
» Promote a self-reliant community through the promotion of a culture of entrepreneurship;
» Create a conducive environment for growth and development.

The IDP makes reference to the importance of promoting the development of SMMEs and the creation of local business support infrastructure and forums for SMMEs and the implementation of a Local Economic Development programme.

The IDP lists agriculture, agri-tourism and mining as key sectors for development. The employment creation potential in the agricultural sector is under-utilised while there are multiple linkages that can be established between agriculture and other sectors to advance SMME development. This sector creates the following opportunities:

» Development of urban agriculture;
» Promotion of small scale, intensive farming;
» Organic and hydroponic cultivation; and
» Development and promotion of agro-industries.

For the mining sector the major challenges include the over-dependence of the local economies on mining. Linked to these key sectors is the need to consider youth development. The key issues pertaining to both the province and the MLM include:

» African youths are the majority in the Free State and they are also the most disadvantaged. Consequently all attempts at intervening on behalf of youths should mainly target the African youth.
» There is an inherent lack of skills particularly amongst the African and Coloureds youth, which leads to high unemployment amongst these groups.
» Youths are both perpetrators and victims of wrong social behaviors. They are at risk by being exposed to risky sexual behavior and HIV & AIDS and by being head of a household.

In an attempt to address these issues the IDP recommends a number of interventions which could potentially be linked to and benefit from the establishment of a Community Trust associated with the proposed solar facility. These include:

» Implementing adult literacy and numeracy programmes;
» Providing Adult Basic Education and Training (ABET) in accordance with the ABET Act;
» Implementing skills development programmes;
» Implementing learnership programmes; and
» Implementing school nutrition programmes.

The Mathjabeng Local municipality is the largest municipality within the Lejweleputswa district. The proposed project will boost the local economy and transfer skills for development through job creation.

3.3. Regulatory Hierarchy for Energy Generation Projects

The South African energy industry is evolving rapidly, with regular changes to legislation and industry role-players. The regulatory hierarchy for an energy generation project of this nature consists of three tiers of authority who exercise control through both statutory and non-statutory instruments – that is National, Provincial and local levels. As solar energy development is a multi-sectorial issue (encompassing economic, spatial, biophysical, and cultural dimensions) various statutory bodies are likely to be involved in the approval process for solar energy facility project and the related statutory environmental assessment process.

3.3.1. Regulatory Hierarchy

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

» *Department of Energy:* This department is responsible for policy relating to all energy forms, including renewable energy, and are responsible for forming and approving the IRP (Integrated Resource Plan for Electricity). It is the controlling authority in terms of the Electricity Regulation Act (Act No 4 of 2006).
» *National Energy Regulator of South Africa (NERSA):* This body is responsible for regulating all aspects of the electricity sector, and will ultimately issue licenses for solar energy developments to generate electricity.
» *Department of Environmental Affairs (DEA):* This Department is responsible for environmental policy and is the controlling authority in terms of NEMA and the EIA Regulations. The DEA is the competent authority for this project, and charged with granting the relevant environmental authorisation.
» *The South African Heritage Resources Agency (SAHRA):* The National Heritage Resources Act (Act No 25 of 1999) and the associated provincial regulations provides legislative protection for listed or proclaimed sites, such as urban conservation areas, nature reserves and proclaimed scenic routes.

» *South African National Roads Agency Limited (SANRAL):* This department is responsible for all National road routes.
» *Department of Water Affairs (DWA):* This department is responsible for effective and efficient water resources management to ensure sustainable economic and social development.
» *Department of Forestry and Fishery (DAFF):* This department the custodian of South Africa's agriculture, fisheries and forestry resources and is primarily responsible for the formulation and implementation of policies governing the Agriculture, Forestry and Fisheries Sector.

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

» *Provincial Government of the Free State – Department of Economic Development, Tourism and Environmental Affairs (DEDTEA).* This department is the commenting authority for this project.
» *Heritage Free State* - This is the provincial authority responsible for the management and conservation of heritage sites.
» *Free State Department of Agriculture* – this is a provincial authority responsible for the management and conservation of agricultural land

At **Local Level** the local and municipal authorities are the principal regulatory authorities responsible for planning, land use, and the environment. The site falls within the Matjhabeng Local Municipality which is part of the Lejweleputswa District Municipality.

In terms of the Municipal Systems Act (Act No. 32 of 2000) it is compulsory for all municipalities to go through an Integrated Development Planning (IDP) process to prepare a five-year strategic development plan for the area under their control. The Mathjabeng and Lejweleputswa Municipality's IDPs will be used to inform the assessment of social impacts for EIA process. There are also numerous non-statutory bodies and environmental lobby groups that play a role in various aspects of planning and the environment that will influence solar energy development (i.e. Sustainable Energy Society of South Africa).

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

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

» National Environmental Management Act (Act No 107 of 1998)
» EIA Regulations, published under Chapter 5 of the NEMA (GNR R543 in Government Gazette 33306 of 18 June 2010)

» Guidelines published in terms of the NEMA EIA Regulations, in particular:
  * Companion to the National Environmental Management Act (NEMA) Environmental Impact Assessment (EIA) Regulations of 2010 (Draft Guideline; DEA, 2010)
  * Public Participation in the EIA Process (DEA, 2010)
» International guidelines – the Equator Principles

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

Table 3.1: Initial review of relevant policies, legislation, guidelines, and standards applicable to the proposed PV Facility

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
National Legislation			
National Environmental Management Act (Act No 107 of 1998)	The Environmental Assessment Regulations have been promulgated in terms of Chapter 5 of the Act. Listed activities which may not commence without an environmental authorisation are identified within these Regulations. In terms of S24(1) of NEMA, the potential impact on the environment associated with these listed activities must be assessed and reported on to the competent authority charged by NEMA with granting of the relevant environmental authorisation. In terms of GN R543, R544, R545 and R546 of 18 June 2010, an Environmental Assessment Process is required to be undertaken for the proposed project.	Department of Environmental Affairs – competent authority	The listed activities triggered by the proposed solar energy facility have been identified and have been assessed in this report.
National Environmental Management Act (Act No 107 of 1998)	In terms of the Duty of Care Provision in S28(1) the project proponent must ensure that reasonable measures are taken throughout the life cycle of this project to ensure that any pollution or degradation of the environment associated with this project is avoided, stopped or minimised. In terms of NEMA, it has become the legal duty	Department of Environmental Affairs	While no permitting or licensing requirements arise directly by virtue of the proposed project, this section has found application during the Environmental Assessment Process through the consideration of potential impacts (cumulative, direct, and indirect). It will continue to apply throughout the life cycle of the project.

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
	of a project proponent to consider a project holistically, and to consider the cumulative effect of a variety of impacts.		
Environment Conservation Act (Act No 73 of 1989)	National Noise Control Regulations (GN R154 dated 10 January 1992)	Department of Environmental Affairs Local Authorities	Noise impacts are expected to be associated with the construction phase of the project and are not likely to present a significant intrusion to the local community. There is no requirement for a noise permit in terms of the legislation.
National Water Act (Act No 36 of 1998)	Water uses under S21 of the Act must be licensed, unless such water use falls into one of the categories listed in S22 of the Act or falls under the general authorisation (and then registration of the water use is required). Consumptive water uses may include the taking of water from a water resource - Sections 21a and b. Non-consumptive water uses may include impeding or diverting of flow in a water course - Section 21c; and altering of bed, banks or characteristics of a watercourse - Section 21i.	Department of Water Affairs Provincial Department of Water Affairs	The facility will trigger water uses as listed in Section 21 of the NWA as the proposed project will be impacting upon wetlands.
Minerals and Petroleum Resources Development Act (Act No 28 of 2002)	A mining permit or mining right may be required where a mineral in question is to be mined (e.g. materials from a borrow pit) in accordance with the provisions of the Act. Requirements for Environmental Management	Department of Mineral Resources	A Section 53 application will be submitted the Free State DMR office should this be deemed necessary.

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
	Programmes and Environmental Management Plans are set out in S39 of the Act. S53 Department of Mineral Resources: Approval from the Department of Mineral Resources (DMR) may be required to use land surface contrary to the objects of the Act in terms of section 53 of the Mineral and Petroleum Resources Development Act, (Act No 28 of 2002): In terms of the Act approval from the Minister of Mineral Resources is required to ensure that proposed activities do not sterilise a mineral resources that might occur on site.		
National Environmental Management: Air Quality Act (Act No 39 of 2004)	Measures in respect of dust control (S32) – draft regulations promulgated. Measures to control noise (S34) - no regulations promulgated yet.	Department of Environmental Affairs	No permitting or licensing requirements arise from this legislation.
National Heritage Resources Act (Act No 25 of 1999)	» Stipulates assessment criteria and categories of heritage resources according to their significance (S7). » Provides for the protection of all archaeological and palaeontological sites, and meteorites (S35). » Provides for the conservation and care of cemeteries and graves by SAHRA where this is not the responsibility of any other authority (S36).	South African Heritage Resources Agency	An HIA was undertaken for the proposed facility and a heritage permit is not required.

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
	» Lists activities which require developers any person who intends to undertake to notify the responsible heritage resources authority and furnish it with details regarding the location, nature, and extent of the proposed development (S38). » Requires the compilation of a Conservation Management Plan as well as a permit from SAHRA for the presentation of archaeological sites as part of tourism attraction (S44).		
National Environmental Management: Biodiversity Act (Act No 10 of 2004)	» Provides for the MEC/Minister to identify any process or activity in such a listed ecosystem as a threatening process (S53) » A list of threatened and protected species has been published in terms of S 56(1) - Government Gazette 29657. » Three government notices have been published, i.e. GN R 150 (Commencement of Threatened and Protected Species Regulations, 2007), GN R 151 (Lists of critically endangered, vulnerable and protected species) and GN R 152 (Threatened or Protected Species Regulations). » Provides for listing threatened or protected ecosystems, in one of four categories: critically endangered (CR), endangered (EN), and vulnerable (VU) or protected. The first national list of threatened terrestrial	Department of Environmental Affairs	As the applicant will not carry out any restricted activity, as is defined in S1 of the Act, no permit is required to be obtained in this regard.

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
	ecosystems has been gazetted, together with supporting information on the listing process including the purpose and rationale for listing ecosystems, the criteria used to identify listed ecosystems, the implications of listing ecosystems, and summary statistics and national maps of listed ecosystems (National Environmental Management: Biodiversity Act: National list of ecosystems that are threatened and in need of protection, (G 34809, GN 1002), 9 December 2011). » This Act also regulates alien and invader species. » Under this Act, a permit would be required for any activity which is of a nature that may negatively impact on the survival of a listed protected species.		
Conservation of Agricultural Resources Act (Act No 43 of 1983)	» Prohibition of the spreading of weeds (S5) » Classification of categories of weeds & invader plants (Regulation 15 of GN R1048) & restrictions in terms of where these species may occur. » Requirement & methods to implement control measures for alien and invasive plant species (Regulation 15E of GN R1048).	Department of Agriculture	This Act will find application throughout the life cycle of the project. In this regard, soil erosion prevention and soil conservation strategies have been developed and will be implemented.
National Forests Act (Act No. 84 of 1998)	According to this act, the Minister may declare a tree, group of trees, woodland or a species of trees as protected. The prohibitions provide that	Department of Agriculture, Forestry and Fisheries	Should any protected tree species occur on the site an application for a permit for removal/damage/cutting or pruning of this

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
	'no person may cut, damage, disturb, destroy or remove any protected tree, or collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree, except under a licence granted by the Minister'.		protected tree species needs to be submitted to the Department of Agriculture, Forestry and Fisheries prior to commencements of construction.
National Veld and Forest Fire Act (Act 101 of 1998)	In terms of S12 the applicant must ensure that the firebreak is wide and long enough to have a reasonable chance of preventing the fire from spreading, not causing erosion, and is reasonably free of inflammable material. In terms of S17, the applicant must have such equipment, protective clothing, and trained personnel for extinguishing fires.	Department of Agriculture, Forestry and Fisheries (DAFF)	While no permitting or licensing requirements arise from this legislation, this Act will find application during the construction and operational phase of the project.
Hazardous Substances Act (Act No 15 of 1973)	This Act regulates the control of substances that may cause injury, or ill health, or death due to their toxic, corrosive, irritant, strongly sensitising or inflammable nature or the generation of pressure thereby in certain instances and for the control of certain electronic products. To provide for the rating of such substances or products in relation to the degree of danger; to provide for the prohibition and control of the importation, manufacture, sale, use, operation, modification, disposal or dumping of such substances and products.	Department of Health	It is necessary to identify and list all the Group I, II, III, and IV hazardous substances that may be on the site and in what operational context they are used, stored or handled. If applicable, a license is required to be obtained from the Department of Health.

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
	Group I and II: Any substance or mixture of a substance that might by reason of its toxic, corrosive etc., nature or because it generates pressure through decomposition, heat or other means, cause extreme risk of injury etc., can be declared as Group I or Group II substance; Group IV: any electronic product; and Group V: any radioactive material. The use, conveyance, or storage of any hazardous substance (such as distillate fuel) is prohibited without an appropriate license being in force.		
Development Facilitation Act (Act No 67 of 1995)	Provides for the overall framework and administrative structures for planning throughout the Republic. S (2 - 4) provides general principles for land development and conflict resolution.	Local Municipality	The applicant must submit a land development application in the prescribed manner and form as provided for in the Act. A land development applicant who wishes to establish a land development area must comply with procedures set out in the Act.
Subdivision of Agricultural Land Act (Act No 70 of 1970)	Details land subdivision requirements and procedures. Applies for subdivision of all agricultural land in the province	Department of Agriculture	Subdivision in terms of S24 and S17 of the Act needs to be adhered to.
National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008)	The Minister may by notice in the *Gazette* publish a list of waste management activities that have, or are likely to have, a detrimental effect on the environment. The Minister may amend the list by –	National Department of Water and Environmental Affairs Provincial Department of Environmental Affairs	As no waste disposal or treatment site is to be associated with the proposed project, no permit is required in this regard. Waste handling, storage and disposal during construction and operation phase are required to be

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
	» Adding other waste management activities to the list. » Removing waste management activities from the list. » Making other changes to the particulars on the list. In terms of the Regulations published in terms of this Act (GN 922, 29 November 2013), A Basic Assessment or Environmental Impact Assessment is required to be undertaken for identified listed activities. Any person who stores waste must at least take steps, unless otherwise provided by this Act, to ensure that: » The containers in which any waste is stored, are intact and not corroded or in » any other way rendered unlit for the safe storage of waste. » Adequate measures are taken to prevent accidental spillage or leaking. » The waste cannot be blown away. » Nuisances such as odour, visual impacts and breeding of vectors do not arise; and » Pollution of the environment and harm to health are prevented.	(general waste)	undertaken in accordance with the requirements of the Act and associated Norms and Standards.

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
National Road Traffic Act (Act No 93 of 1996)	» The technical recommendations for highways (TRH 11): "Final Guidelines for Granting of Exemption Permits for the Conveyance of Abnormal Loads and for other Events on Public Roads" outline the rules and conditions which apply to the transport of abnormal loads and vehicles on public roads and the detailed procedures to be followed in applying for exemption permits are described and discussed. » Legal axle load limits and the restrictions imposed on abnormally heavy loads are discussed in relation to the damaging effect on road pavements, bridges, and culverts. » The general conditions, limitations, and escort requirements for abnormally dimensioned loads and vehicles are also discussed and reference is made to speed restrictions, power/mass ratio, mass distribution, and general operating conditions for abnormal loads and vehicles. Provision is also made for the granting of permits for all other exemptions from the requirements of » the National Road Traffic Act and the relevant Regulations.	» South African National Roads Agency Limited (national roads) » Provincial Department of Transport	An abnormal load/vehicle permit may be required to transport the various components to site for construction. These include route clearances and permits which will be required for vehicles carrying abnormally heavy or abnormally dimensioned loads. » Transport vehicles exceeding the dimensional limitations (length) of 22m. » Depending on the trailer configuration and height when loaded, some of the substation components may not meet specified dimensional limitations (height and width).
Provincial Legislation			
Free State Province Provincial Growth	As a provincial policy framework, it sets the tone and pace for shared growth and development in	Free State Province	A permit is not required but this documentation has been incorporated in this report and will remain

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
and Development Strategy	the Province. It addresses the key social, economic, environmental and spatial imperatives in the Province.		applicable through the life cycle of the proposed project.
Local legislation			
Lejweleputswa District Municipality Integrated Development Plan	The plan aims at: » Economic development, employment and investment; » Social and Human Development.	Local Municipality	A permit is not required but this documentation has been incorporated in this report and will remain applicable through the life cycle of the proposed project.
Matjhabeng Local Municipality Integrated Development Plan	The plan aims at: » Development of urban agriculture; » Promotion of small scale, intensive farming; » Organic and hydroponic cultivation; and » Development and promotion of agro-industries.	Local municipality	A permit is not required but this documentation has been incorporated in this report and will remain applicable through the life cycle of the proposed project.

APPROACH TO UNDERTAKING THE EIA PHASE CHAPTER 4

An EIA process is regulated by the EIA Regulations which involves the identification of and assessment of direct, indirect, and cumulative environmental impacts (both positive and negative) associated with a proposed project. The EIA process forms part of the feasibility studies for a project, and comprises a Scoping Phase and EIA Phase which culminates in the submission of an EIA Report together with an Environmental Management Programme (EMPr) to the competent authority for decision-making.

The EIA Process for the proposed facility has been undertaken in accordance with the EIA Regulations in terms of Sections 24 and 24D of NEMA, as read with the EIA Regulations of GNR544; GNR545; and GNR546 of Section 24(5) of NEMA (Act No. 107 of 1998). The environmental studies for this proposed project were undertaken in two phases, in accordance with the EIA Regulations.

4.1. Phase 1: Scoping Phase

The Scoping Study, which was completed in **August 2013** with the acceptance of Scoping by the DEA, served to identify potential issues associated with the proposed project and define the extent of studies required within the EIA Phase. This was achieved through an evaluation of the proposed project, involving the project proponent, specialist consultants, and a consultation process with key stakeholders that included both relevant government authorities and interested and affected parties (I&APs).

I&APs were provided with the opportunity to receive information regarding the proposed project, to participate in the process and to raise issues or concerns. Furthermore, the Draft Scoping Report was made available at Welkom City Library, Allanridge Library and on the Savannah Environmental website for I&AP review and comment for a 30-day period. All the comments, concerns, and suggestions received during the Scoping Phase and the review period were included in the Final Scoping Report.

The Scoping Report was submitted to the National Department of Environmental Affairs in **July 2013**. The Final Scoping Report and Plan of Study for the EIA were accepted by the DEA, as the competent authority, in **August 2013**. In terms of this acceptance, an EIA was required to be undertaken for the proposed project.

4.2. Phase 2: Environmental Impact Assessment Phase

Through the Scoping Study, a number of issues requiring further study for all components of the project were highlighted. These issues have been assessed in detail within the EIA Phase of the process (refer to Chapter 6). The EIA Phase aims to achieve the following:

- » Provide a comprehensive assessment of the social and biophysical environments affected by the proposed alternatives put forward as part of the project.
- » Assess potentially significant impacts (direct, indirect, and cumulative, where required) associated with the proposed facility.
- » Comparatively assess any alternatives put forward as part of the project (i.e. in this case the options of storage versus no storage were assessed).
- » Identify and recommend appropriate mitigation measures for potentially significant environmental impacts.
- » Undertake a fully inclusive public participation process to ensure that I&AP are afforded the opportunity to participate, and that their issues and concerns are recorded.

The EIA Report addresses potential direct, indirect, and cumulative[5] impacts (both positive and negative) associated with all phases of the project including design, construction, operation and decommissioning. In this regard the EIA Report aims to provide the relevant authorities with sufficient information to make an informed decision regarding the proposed project.

4.2.1. Tasks to be completed during the EIA Phase

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

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

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

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

4.2.2 Authority Consultation

The National DEA is the competent authority for this application. A record of all authority consultation undertaken prior to the commencement of the EIA Phase is included within the Scoping Report and this EIA report. Consultation with the regulating authorities (i.e. DEA and FS DEDTEA) has continued throughout the EIA process. On-going consultation included the following:

- » Submission of a final Scoping Report following a 30-day public review period and consideration of stakeholder comments received
- » Ad hoc discussions with DEA in order to clarify the findings of the Scoping Report and the issues identified for consideration in the EIA Phase.

The following will also be undertaken as part of this EIA process:

- » Submission of a final EIA Report following the 30-day public review period.
- » Provision of an opportunity for DEA and FS DEDTEA representatives to visit and inspect the proposed site, and the study area.
- » Consultation with Organs of State that may have jurisdiction over the project, including:
  - * Provincial and local government departments (including South African Heritage Resources Agency, Department of Water Affairs, South African National Roads Agency Limited, Department of Agriculture, etc.).
  - * Government Structures (including the Department of Public Works, Roads and Transport, etc)

A record of all authority consultation undertaken prior to the commencement of the EIA Phase is included within the Scoping Report. A record of the consultation in the EIA process is included within **Appendix B**.

4.2.3 Public Involvement and Consultation

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

» Information containing all relevant facts in respect of the proposed project was made available to potential stakeholders and I&APs.
» Participation by potential I&APs was facilitated in such a manner that all potential stakeholders and I&APs were provided with a reasonable opportunity to comment on the proposed project.
» Comment received from stakeholders and I&APs was recorded and incorporated into the EIA process.

Below is a summary of the key public participation activities conducted thus far.

» **Identification of I&APs and establishment of a database**
Identification of I&APs was undertaken by **Savannah Environmental** through existing contacts and databases, recording responses to site notices and the newspaper advertisement, as well as through the process of networking. The key stakeholder groups identified include authorities, local and district municipalities, public stakeholders, Parastatals and Non-Governmental Organisations (refer to **Table 4.1** below).

Table 4.1: Key stakeholder groups identified during the EIA Process

Stakeholder Group	Department
National and Provincial Authorities	» Free State – Department of Economic Development, Tourism and Environmental Affairs (DEDTEA) » Free State - Agriculture » Free State – Roads and Public Works » Free State - Water Affairs » South African Heritage Resources Agency National » SANRAL Eastern Region » Free State Heritage » Department of Agriculture » Department of Energy
Municipalities	» Mathjabeng Local Municipality » Lejweleputswa District Municipality
Public stakeholders	» Advertisement placed to inform the public of the availability of the report and public meeting » letters we set to I & A parties
Parastatals & service providers	» Eskom Transmission and Distribution » South African Heritage Resources Agency –

Through on-going consultation with key stakeholders and I&APs, issues raised through the Scoping Phase for inclusion within the EIA Phase were confirmed. All relevant stakeholder and I&AP information has been recorded within a database of affected parties (**refer to Appendix C**). While I&APs were encouraged to register their interest in the project from the onset of the process, the identification and registration of I&APs has been on-going for the duration of the EIA Process and the project database has been updated on an on-going basis.

» **Newspaper Advertisements**

During the scoping phase a first round of adverts were placed in order to notify and inform the public of the proposed project and notify the public on the availability of the Draft Scoping report for public review and public meeting. These adverts were placed as follows:

* Volksblad (English – 09 May 2013)
* Vista (Afrikaans – 09 May 2013)

During the scoping phase, a second round of newspaper adverts was placed to inform the public of the review date of the report and details of the public meeting. These adverts were placed in the following newspapers:

* Volksblad (English - 22 May 2013
* Vista (Afrikaans – 23 May 2013)

During the EIA phase, a third round of newspaper adverts were placed to inform the public of the availability of the Draft EIA report in the following newspapers:

* Volksblad (English – 24 October 2013)
* Vista (Afrikaans – 24 October 2013)

» **Consultation**

In order to accommodate the varying needs of stakeholders and I&APs, the following opportunities have been provided for I&AP issues to be recorded and verified through the EIA phase, including:

* Focus group meetings (stakeholders invited to attend)
* Written, faxed or e-mail correspondence

<u>Public meeting was not held during the EIA phase as there was no attendance during the scoping phase, rather Focus group meetings were held with different stakeholders. The meetings gave different stakeholders the opportunity to raise their concerns one on one and have their concerns addressed.</u>

In order to further facilitate comments on the Draft EIA report and to provide feedback on the findings of the specialist scoping studies focus group meetings were held with landowners and adjacent landowners. Records of all consultation undertaken are included within **Appendix D**.

During the EIA phase the Final EIA Report was made available to registered I&APs for a 21-day review period. Records of all consultation undertaken are included within **Appendix D**.

4.2.4 Identification and Recording of Issues and Concerns

Issues and comments raised by I&APs over the duration of the EIA process will be incorporated into Comments and Response Report and included in the Final EIA report.

4.2.5 Assessment of Issues Identified through the Scoping Process

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

Table 4.1: Specialist studies undertaken within the EIA Phase

Specialist	Area of Expertise	Refer Appendix
Marianne Strohbach of Savannah Environmental	Ecological impact assessment	**Appendix E**
Johann Lanz of Johann Lanz Soil Scientist	Soil and Agricultural Potential	**Appendix F**
Bhuti Dlamini of Wetland Consulting Services	Wetland impact assessment	**Appendix G**
Jaco van der Walt of Heritage Contracts and Archaeological Consulting CC	Heritage impact assessment	**Appendix H**
Lourens du Plessis of MetroGIS	Visual impact assessment	**Appendix I**
Tony Barbour of Tony Barbour Environmental Consulting and Research	Social impact assessment	**Appendix J**

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

» The **nature**, a description of what causes the effect, what will be affected, and how it will be affected
» The **extent**, wherein it is indicated whether the impact will be local (limited to the immediate area or site of development), regional, national or international. A score of between 1 and 5 is assigned as appropriate (with a score of 1 being low and a score of 5 being high)

- The **duration**, wherein it is indicated whether:
  - The lifetime of the impact will be of a very short duration (0–1 years) – assigned a score of 1
  - The lifetime of the impact will be of a short duration (2-5 years) - assigned a score of 2
  - Medium-term (5–15 years) – assigned a score of 3
  - Long term (> 15 years) - assigned a score of 4
  - Permanent - assigned a score of 5
- The **magnitude**, quantified on a scale from 0-10, where a score is assigned:
  - 0 is small and will have no effect on the environment
  - 2 is minor and will not result in an impact on processes
  - 4 is low and will cause a slight impact on processes
  - 6 is moderate and will result in processes continuing but in a modified way
  - 8 is high (processes are altered to the extent that they temporarily cease)
  - 10 is very high and results in complete destruction of patterns and permanent cessation of processes
- The **probability of occurrence**, which describes the likelihood of the impact actually occurring. Probability is estimated on a scale, and a score assigned:
  - Assigned a score of 1–5, where 1 is very improbable (probably will not happen)
  - Assigned a score of 2 is improbable (some possibility, but low likelihood)
  - Assigned a score of 3 is probable (distinct possibility)
  - Assigned a score of 4 is highly probable (most likely)
  - Assigned a score of 5 is definite (impact will occur regardless of any prevention measures)
- The **significance**, which is determined through a synthesis of the characteristics described above (refer formula below) and can be assessed as low, medium or high
- The **status**, which is described as either positive, negative or neutral
- The degree to which the impact can be reversed
- The degree to which the impact may cause irreplaceable loss of resources
- The degree to which the impact can be mitigated

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

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

S = Significance weighting
E = Extent
D = Duration
M = Magnitude
P = Probability

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

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

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

4.2.6 Assumptions and Limitations

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

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

Refer to the specialist studies in **Appendices E – J** for specialist study specific limitations.

DESCRIPTION OF THE RECIEVING ENVIRONMENT CHAPTER 5

This section of the Final EIA Report provides a description of the environment that may be affected by the proposed Grootkop Solar Energy Facility and associated infrastructure. This information is provided in order to assist the reader in understanding the receiving environment within which the proposed facility is situated. Features of the biophysical, social and economic environment that could directly or indirectly be affected by, or could affect, the proposed development have been described. This information has been sourced from both existing information available for the area as well as collected field data, and aims to provide the context within which this EIA is being conducted. A more detailed description of each aspect of the affected environment is included within the specialist reports contained within **Appendices E – J**.

5.1 Regional Setting: Location of the Study Area

FRV Energy South Africa (Pty) Ltd (FRV) is proposing the establishment of a 75MW Solar Photovoltaic (PV) Facility within the Mathjabeng Local Municipality which forms part of the Lejweleputswa District Municipality in the Free State Province. The proposed site identified for the facility is located approximately 9km south-east of Allanridge and about 6km north of Kutlwanong.

The proposed site is located immediately south-west of the *Anglo Geduld-Grootkop 132kV* and *Grootkop-Leander 132kV* power lines. The electricity generated by the facility is expected to be evacuated into one of these lines via a loop-in/loop-out connection.

5.2 Climatic Conditions

The climate information for the area proposed for the Grootkop facility has been derived from climatic data summarised for Allanridge and Odendaalsrus (worldweatheronline.com, climate-data.org), located approximately 6 km west and 9 km south of Grootkop respectively. The area receives about 450 - 550 mm of rain on average per year. From May to September, rainfall is minimal. Most rainfall occurs from November to March, peaking between January and March. Temperatures in summer peak during December and January at a daily average of 29°C, with an average of 17°C for June. During July, night temperatures are on average 0°C, with frosts during winter being common.

5.3 Access and Transport Routes in the region

Access to the proposed development area is afforded by a secondary (local) road that joins the R30 at Odendaalsrus, to the south, or the R30 near Allanridge to the north.

5.4 Biophysical Characteristics of the Study Area

5.4.1 Topography and hydrology

The topography or terrain morphology of the region is broadly described as *plains and pans* of the Central Interior Plain. The slope of the entire study area is even (flat) with a very gradual drop (less than 70m) from the south-east (near the R34) to the north-west where the Sandspruit exits the study area. This non-perennial river, pans and farm dams account for the dominant hydrological features within this region.

5.4.2 Geology & Land Types

The regional geological formations of the area consist of aeolian and colluvial sand overlying sandstone, mudstone and shale of the Karroo Supergroup (mostly the Ecca Group) as well as the older Ventersdorp Supergroup andesites and basement gneisses in the north. Specifically within the project area the underlying geology consists of Sandstone, mudstone and Shale. Dominant soil forms are mostly Avalon, Westleigh and Clovelly. From a wetland perspective, weathering of the underlying lithology produces sandy soil which typically supports a mosaic of hillslope seepage wetlands on site. **Figure 5.2** indicates the underlying geological formations on and immediately around the site.

The soils on site are predominantly deep, well-drained, yellow, sandy soils of the Clovelly soil form. Included in this land type however are numerous pans, which, according to the land type data, occupy approximately 3% of the land type. On the proposed site, pans are more common and occupy more than the 3% average for the land type. The soils of land type Db1, which surrounds the site, are similar to those of the pans within land type Ae39 (refer to **Figure 5.3**). These are shallower, more clay-rich soils where internal drainage is seriously limited by an underlying clay horizon (G horizon). They are associated with low-lying, wetter areas.

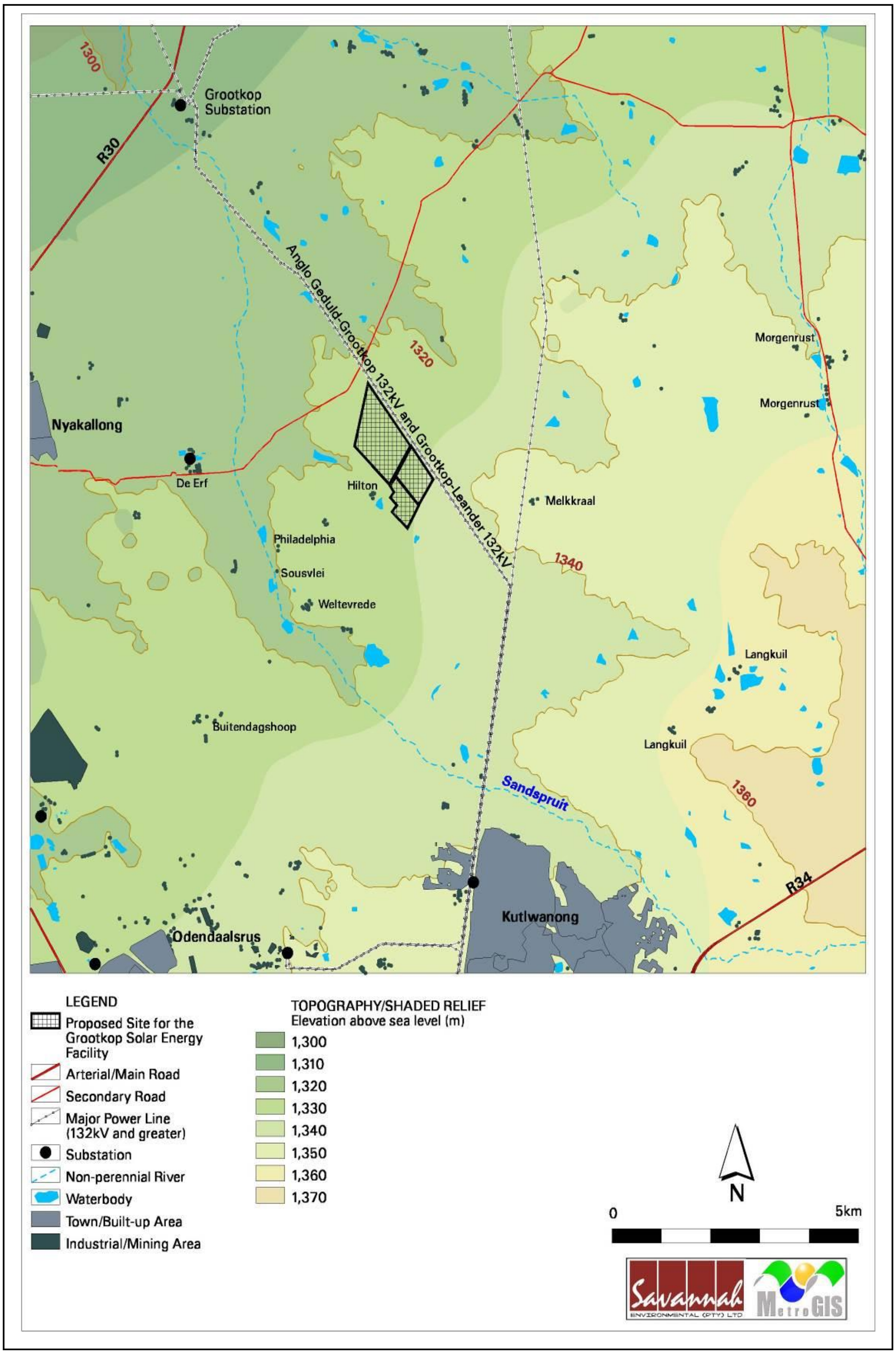

Figure 5.1: Map indicating the topography of the proposed Grootkop Solar Energy Facility site and surrounding environment

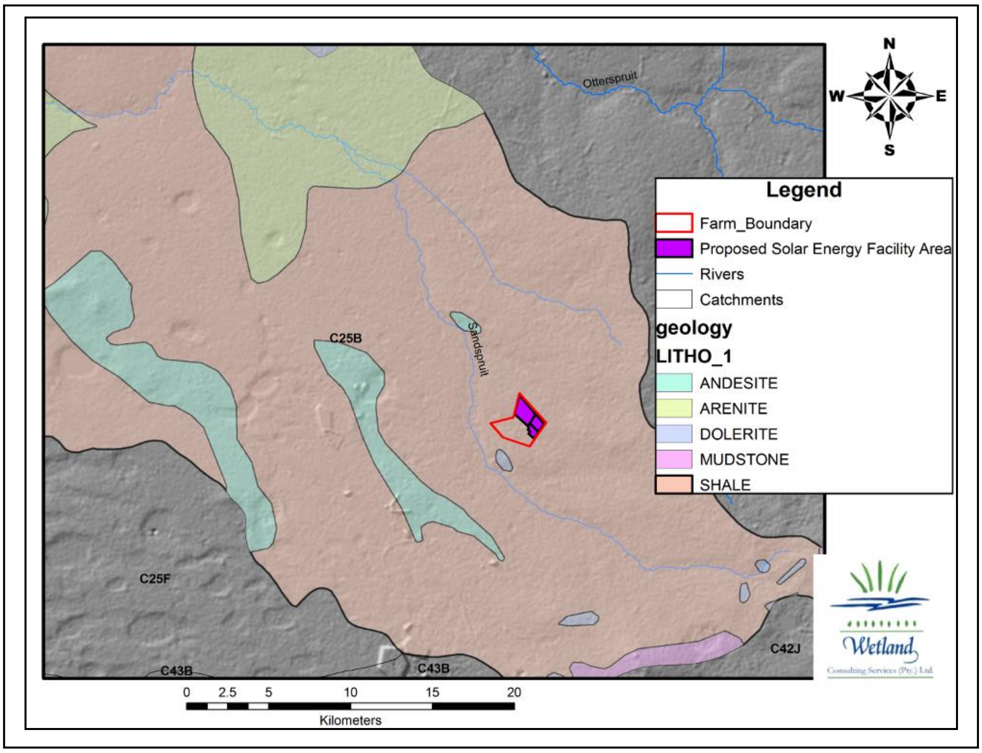

Figure 5.2: Map indicating the geological formation underlying the proposed Grootkop Solar Energy Facility and the surrounding areas

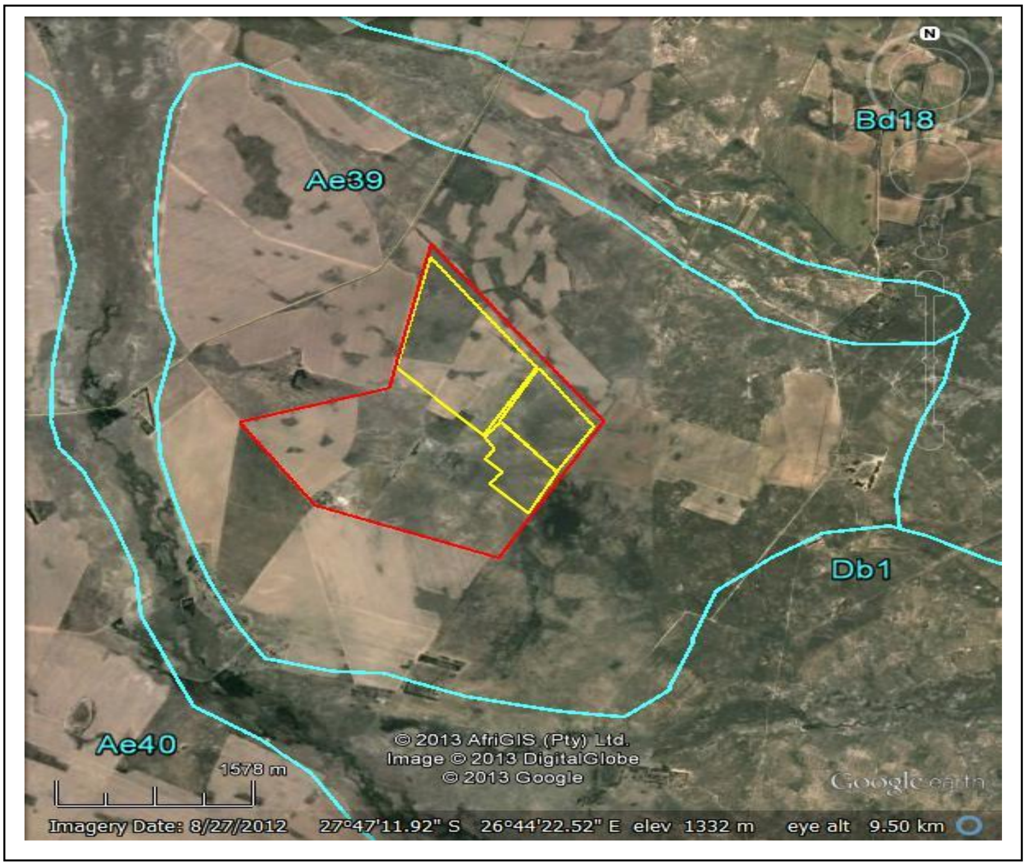

Figure 5.3: Land types of the proposed Grootkop Solar Energy Facility in relation to the surrounding environment

5.4.4 Agricultural Potential

As an indication of agricultural potential on the site, the land is classified on AGIS as having a potential maize yield (50 percentile) of between 0.6 and 2.4 tons per hectare. The natural grazing capacity of the site is given as 11-15 hectares per large stock unit. According to the landowner, yields of maize on the cultivated land on the proposed solar site are marginal and lower than those on the western side of the same farm.

5.4.5 Land use and Land capability of the Study Area

The largest portion of the area selected and regarded suitable for the development was previously cultivated, then left fallow before being ripped and sown with a mixture of grass species, and is currently used for cattle grazing.

The farm overall is used for mixed agriculture, consisting of cultivated areas and grazing areas. Land use activities within the broader region are predominantly described as maize and wheat farming, with some mining activity evident towards the west (Allanridge) and the south (Odendaalsrus). Farm settlements or residences occur at irregular intervals throughout the study area. Some of these, in close proximity to the proposed development site, include: Hilton (located on the farm itself), Philadelphia, Sousvlei, Weltevrede and Melkkraal (refer to **Figure 5.4**). The population density of the region is indicated as approximately 173 people per km^2, predominantly concentrated within the previously mentioned built-up centres.

An existing Eskom power line runs along the north-eastern boundary of the farm portion, enabling a short distance for grid connection with minimal possible impact on avifauna or ecology.

Land capability is the combination of soil suitability and climate factors (refer to **Figure 5.5**). The entire area has a land capability classification, on the 8 category scale, as Class 4 - marginal potential arable land. The pan areas within the proposed site are however not suitable for cultivation.

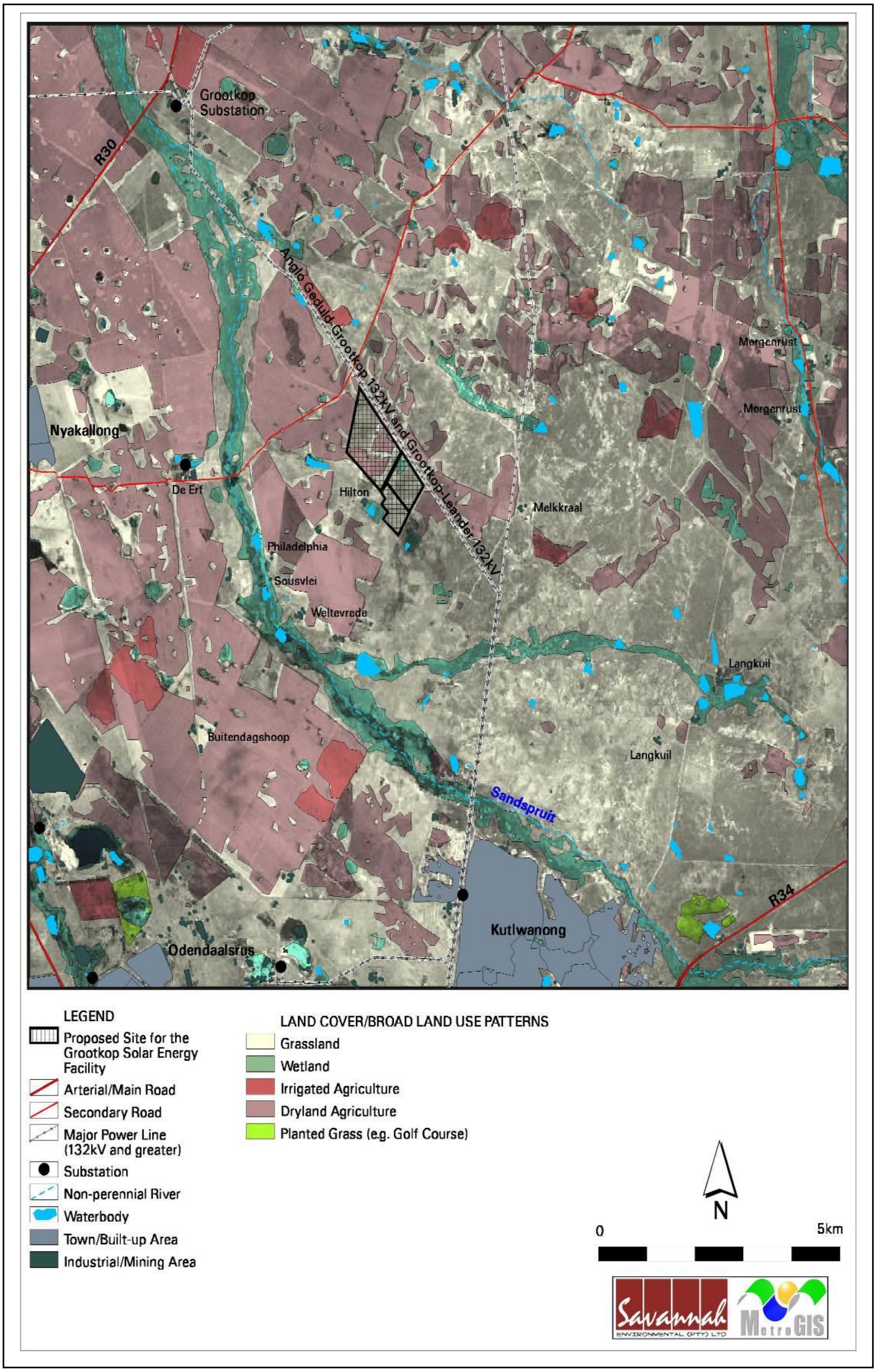

Figure 5.4: Land cover map for the proposed Grootkop Solar Energy Facility

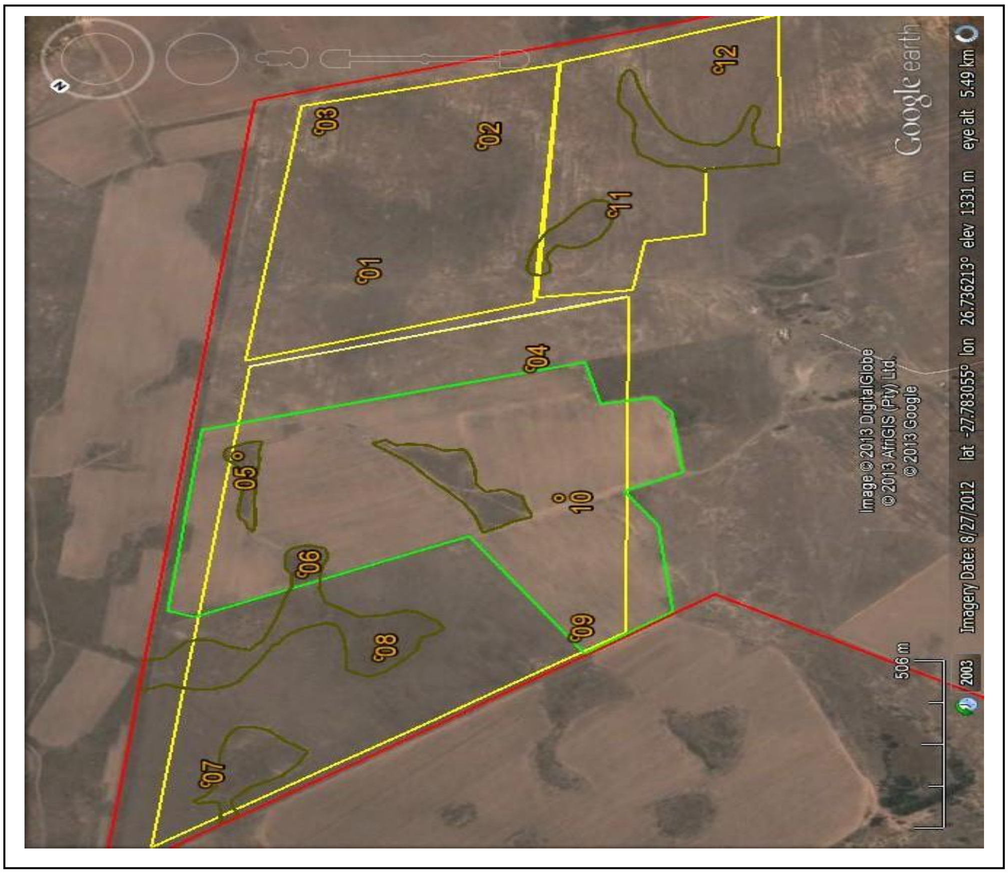

Figure 5.5: Land Capability map for the proposed Grootkop Solar Energy Facility. Cultivated land is indicated with a bright green boundary. Pan areas of shallow clay soil, not suitable for cultivation, are indicated with a dull green boundary.

5.4.6 Water Resources

The area affected by the proposed development is located immediately to the south east of the town of Allanridge in the Free State Province, and as such falls within the Vaal River Catchment (C), and more specifically within quaternary catchment C25B which is drained by the Sandspruit River and its tributaries. The area receives an average annual rainfall of between 450mm and 550mm, of which approximately 5mm (1 %) ends up as run-off.

<u>Wetlands</u>

The delineated wetlands within the site are illustrated in **Figure 5.6** below. Approximately 26.5 % (109.35 ha) of the study area (450 ha) was classified as wetland, with most of the wetland area consisting of shallow, ephemeral pans classified as depressions in terms of the hydro-geomorphic classification system. A total of 17 depressions, ranging in size from 0.7 ha to over 5 ha in size, were identified on site. In addition to the depressions a small drainage line classified as an unchannelled valley bottom system and an associated seepage area were recorded on site.

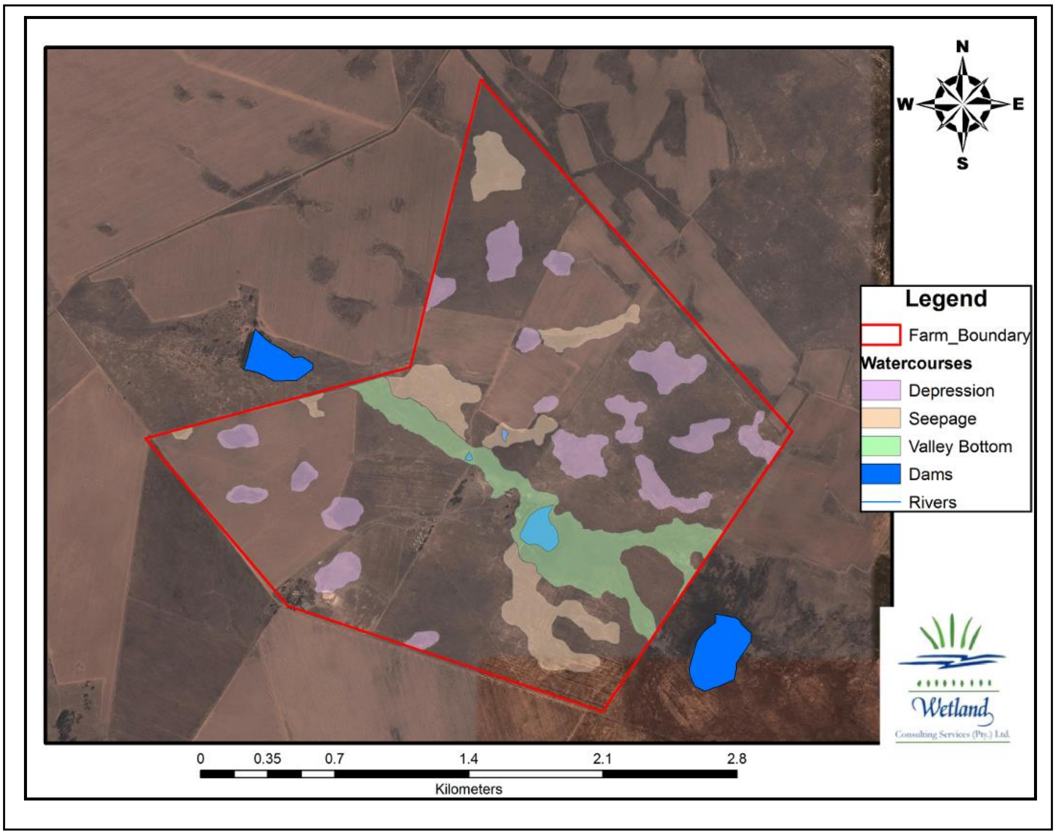

Figure 5.6: Map of the delineated wetlands and watercourses within the Grootkop study area

Pans in the surrounding landscape

The National Wetland Inventory (2009) (NWI) dataset as incorporated into the Atlas of Freshwater Ecosystem Priority Areas of South Africa (Nel *et al*., 2011) indicates that more than 622 pans occur within a 20km radius of the study area. As the NWI makes extensive use of remote sensing data and thus excludes many of the smaller and less distinct pans, the actual number of pans is likely to be significantly higher (within the study area 17 pans were identified on site (indicated as depressions on Figure 5.6), while the NWI only identified 6). The majority of these pans are less than 5 ha in size and represent shallow, ephemeral depressions in the landscape. Larger pans do occur, as for example the large pan located ~17 km south east of the site, which exceeds 144 ha in size. **Figures 5.7** below indicate the pans and their size distribution in the surrounding landscape.

When comparing the pans on site as captured in the NWI with the pans in the surrounding area, it is clear that the pans, ranging in size from 1.5 ha to 5 ha, fall within the most common size classes of pans within the area and the habitat represented by these pans is thus well represented within the surrounding landscape.

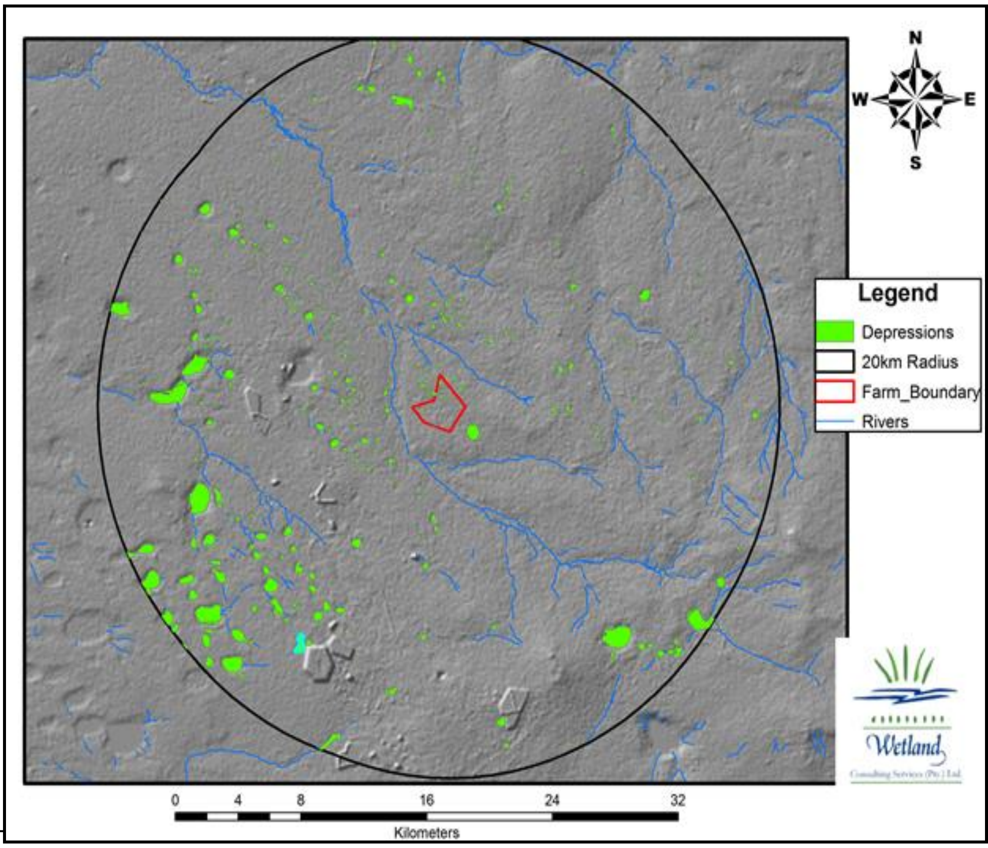

Figure 5.7: Map indicating the pans within and surrounding proposed area.

Biodiversity

The pans and wetlands on site are mostly shallow, ephemeral systems that seldom hold surface water and are thus limited in the role they can play in supporting aquatic biodiversity. However, the "paucity of permanent waters in arid and semi-arid areas means that even temporary waters have an ecological significance much greater than in temperate areas" (Allan *et al.*, 1995). Not only do they provide habitats than can at times support aquatic biodiversity and avifauna, but they also play an important role in supporting biodiversity within the terrestrial habitats through the provision of surface water. The role of the pans in supporting biodiversity is further enhanced by the large number of pans found within the general area of the Grootkop site. Given the highly variable and often very localised nature of rainfall within the area (mostly derived from thunderstorms), periods of inundation are highly variable even between pans in close proximity to one another (Allan *et al.*, 1995). As one pan dries up, mobile species such as avifauna move to nearby pans that still contain surface water. As a collective panfield, the pans can thus support species that the individual pans would not have been able to support.

5.5. Ecological Profile

5.5.1. Vegetation

The proposed property falls within the original extent of the Vaal-Vet Sandy Grassland (Unit Gh 10) as defined by Mucina and Rutherford (2006), merging into Highveld Alluvial Vegetation on the banks of larger drainage lines and the Sandspruit (refer to **Figure 5.10**) beyond the farm portion.

Landscapes of the Vaal-Vet Sandy Grassland consist of slightly irregular undulating plains with vegetation dominated by low-growing tussock grasses and an abundance of karroid shrubs and succulents. The grass layer consists of a high diversity of grasses, of which species such as *Themeda triandra, Anthephora pubescens, Elionurus muticus, Eragrostis* and *Digitaria* species are typical. The low shrub component is dominated by *Felicia muricata, Helichrysum* species, *Pentzia globosa,* and *Anthospermum rigidum* (Mucina and Rutherford 2006). The diversity of the herbaceous layer may vary significantly from year to year depending on utilisation and rainfall amount and timing, which influence the germination of annuals and resprouting of species with woody below-ground rootstocks.

The remaining extent of the Vaal-Vet Sandy Grassland has been listed in the threatened terrestrial ecosystems for South Africa (2011) as Endangered, as more than 63% of this vegetation type has been irreversibly transformed. Less than 0.3% of the ecosystem is protected in the Bloemhof Dam, Schoonspruit, Sandveld, Faan Meintjies, Wolwespruit, and Soetdoring Nature Reserves.

The landscape and vegetation features of the Highveld Alluvial Vegetation (Unit Aza 5) can best be described as a flat topography, supporting riparian thickets dominated by *Acacia karroo* and accompanied by seasonally flooded grasslands. The grasslands on the floodplains are increasingly reduced to disturbed herb lands that are prone to invasion by alien plants. Important trees in this vegetation type include *Acacia karroo, Salix mucronata* subsp. *mucronata,* and *Ziziphus mucronata*. Characteristic shrubs are: *Searsia pyroides, Lycium hirsutum, Ehretia rigida,* and *Grewia flava*. Common grasses include *Setaria verticillata, Panicum maximum, Agrostis lachnantha,* and *Eragrostis plana* (Mucina & Rutherford 2006).

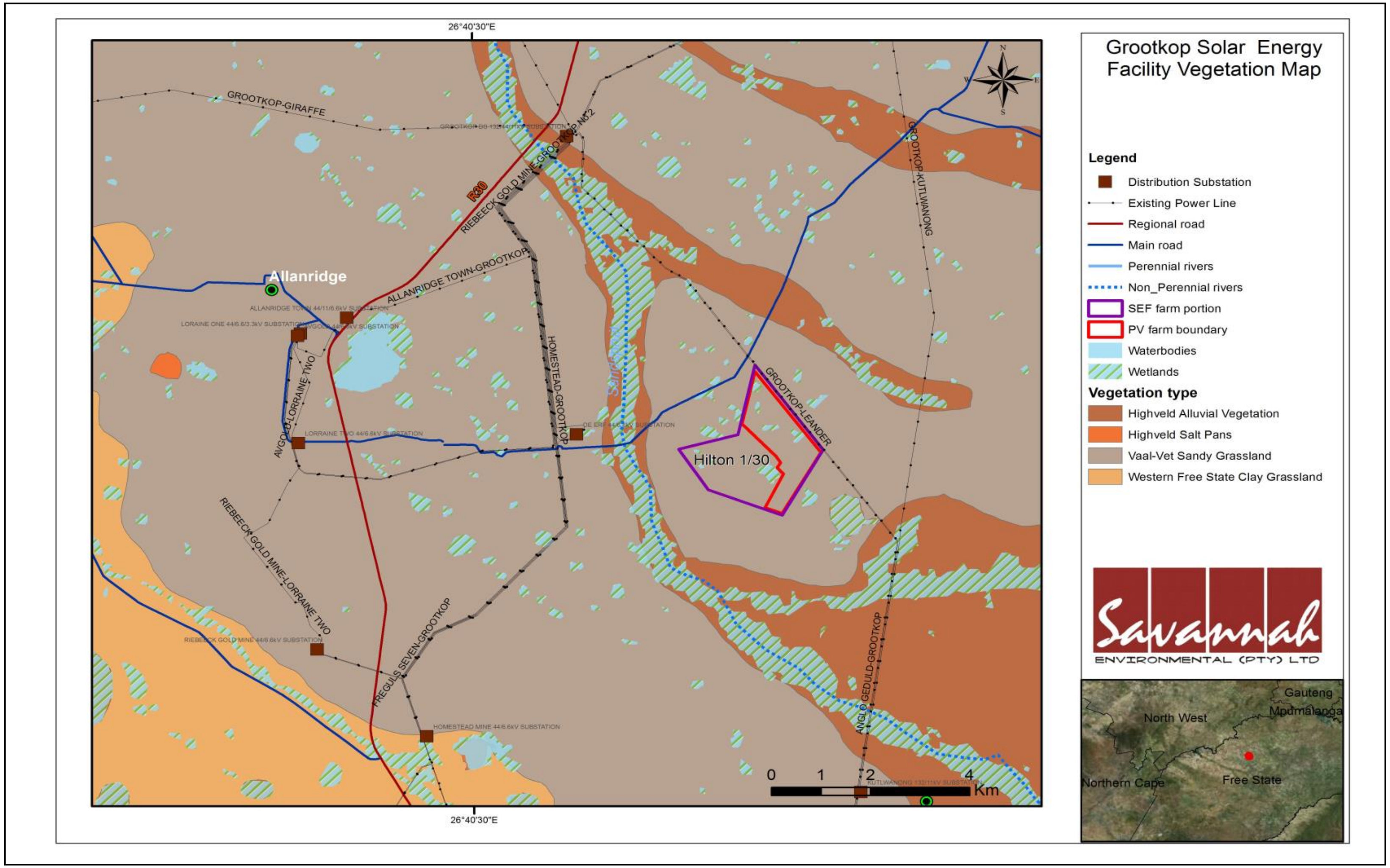

Figure 5.10: Vegetation Map indicating the vegetation found within the proposed Grootkop Solar Energy Facility development site and surrounding area

The conservation status of the Highveld Alluvial Vegetation is considered least threatened. The conservation target set for this vegetation unit is 31%, of which almost 10% is statutorily conserved in Baberspan (Ramsar site), Bloemhof Dam, Christiana, Faan Meintjies, Sandveld, Schoonspruit, Soetdoring, and Wolwespruit Nature Reserves. Dams and cultivation practices pose the biggest threats to this vegetation type. Weeds and invasive species readily establish in these riparian areas due to more favourable soil moisture and nutrient status, and such weeds are largely introduced from seeds washed down from smaller tributaries and upstream disturbed areas (Mucina & Rutherford 2006).

Vegetation of the study area historically consisted of Vaal-Vet Sandy Grassland. The majority of the study area has been transformed to cultivated lands several decades ago, of which the larger portion has later been converted to grazing lands. Only a small, relatively isolated section of the study area still consists of Vaal-Vet Sandy Grassland, a listed threatened ecosystem. This remaining natural grassland is in a relatively degraded state, most likely due to its isolation as well as soil configuration.

Three vegetation units could be identified within the development area (refer to **Figure 5.11**):

» Unit 1: *Eragrostis plana – Alternanthera nodiflora* grasslands are restricted to smaller seepage and/or seasonal wetland areas. Depending on the amount and duration of seasonal inundation, the species composition may vary from wetland to wetland and from year to year. It is generally a dense grassland, where grasses are interspersed with rushes and sedges, and several herbs. Although overall biodiversity may be low, the species present are those that typically can tolerate and/or are restricted to environments where soils are seasonally saturated with water.

» Unit 2: The *Panicum coloratum – Pentzia globosa* grasslands are what can be considered remaining natural Vaal-Vet Sandy Grassland. The vegetation is in a relatively poor state and thus prone to invasion by alien invasive species.

» Unit 3: *Eragrostis lehmanniana – Helichrysum paronychioides* grasslands are the semi-natural grazing lands that have been re-established on formerly transformed cultivation lands. The vegetation composition varies quite a bit within the area, depending on soil microtopography and time since the establishment of the grazing. The diversity of grasses is already relatively high, but the composition of the dwarf shrubs and other forbs is still indicative of high levels of past disturbance.

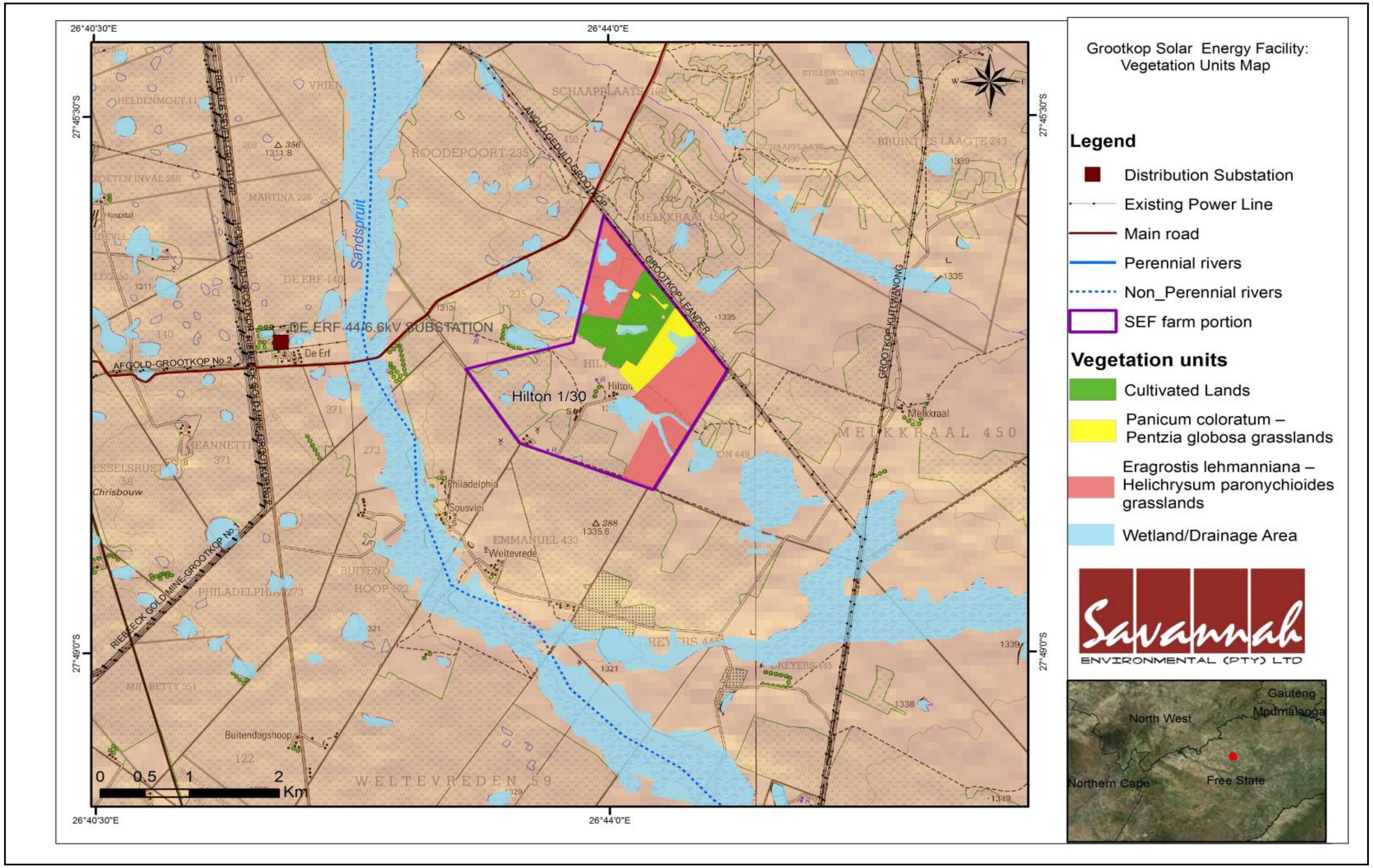

Figure 5.11: Vegetation units as surveyed and defined for the proposed Grootkop Solar Energy Facility.

The vegetation unit (i.e. Eragrostis plana) shown in **Figure 5.12** below is restricted to wetland areas consisting of larger distinct depressions in the landscape which accumulate seepage and runoff, and drainage lines linking up to seasonal vleis or dams. The transition of these wetlands into the surrounding vegetation is gradual.

The vegetation consists of a dense grass layer, with the grass species being generally more robust and diverse than those species of the surrounding grasslands. A variable number of rushes and/or sedges is further typical for this vegetation, as are plant species that are specifically restricted to wetland habitats, such as the cape water clover (actually a fern), *Marsilea* species. The generally higher moisture level of these areas makes them prone to invasion by alien plant species.

Soils are generally more loamy or clay-enriched than on the surrounding plains, with a typically higher organic content.

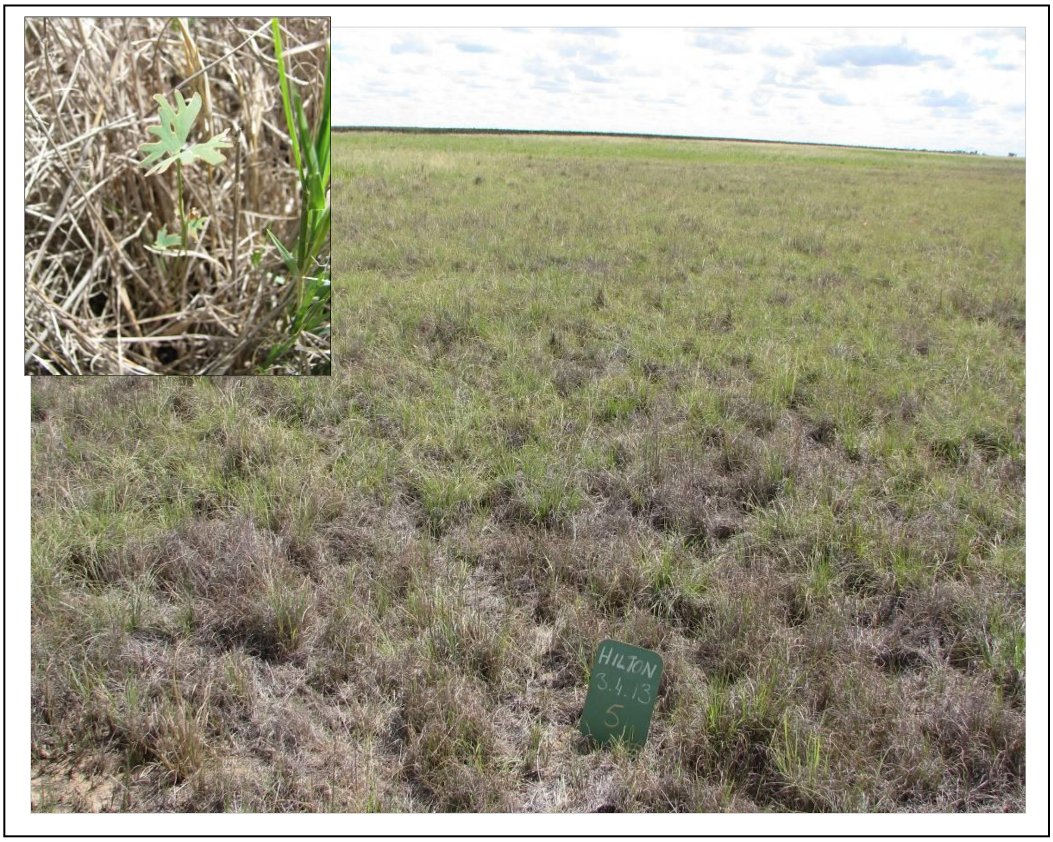

Figure 5.12: Dense grasses and species in a depression forming a seasonal wetland. A *Marsilea* species (water clover) typical for wetland habitats found in these grasses is shown in the insert.

The vegetation unit (i.e. Panicum coloratum) shown in **Figure 5.13** below has not been used in the past for cultivation or even intensive grazing due to unsuitable soils and overall low vegetation productivity. Although this vegetation is part of the threatened Vaal-Vet Sandy Grassland, its ecological state is too poor to be a representative section of the grassland.

The dominance of *Panicum coloratum* rather than *Themeda triandra* or *Antephora pubescens* indicate a natural ecological barrier to the establishment and vigour of the biodiversity that would be more typical for the Vaal-Vet Sandy Grassland. The poor state is further confirmed by a relatively high presence and diversity of alien and indigenous invasives and weeds, whilst the diversity of forbs and geophytes is relatively limited. The latter may also be attributable to the relatively poor rains of the recent season. Overall, this portion of the Vaal-Vet Sandy Grassland is already isolated, in a poor ecological state, and thus of low conservation value.

Figure 5.13: The remaining Vaal-Vet Sandy Grassland vegetation within the development area. Low shrubs typical for this vegetation type are present, but the grass layer is not representative and the overall biodiversity is in a poor ecological state.

The grasslands (i.e. *Eragrostis lehmanniana*) are gently sloping and soils consist of sandy loams, prone to surface capping and thus excessive runoff and associated sheet erosion where not adequately covered with vegetation (refer to **Figure 5.14**). The vegetation composition itself is very patchy, depending on microtopography and soil conditions. In the most recently established grasslands, termite activity is still relatively high (aided by the bare soils still present there). Smaller localities have a concentration of the protected *Ammocharis coranica*. Due to the high disturbance levels of the past, the diversity of more typical low shrubs and resprouting forbs is still relatively low, but a high diversity of alien and indigenous invasives and weeds is present.

Figure 5.14: Semi-natural grasslands on previously transformed areas

The study area was investigated during the vegetation survey for signs or the presence (observations) of amphibians, reptiles, and mammals. Due to the high disturbance levels of the study area and surrounding farms (on-going ploughing and movement of livestock), observations of mammals and reptiles was very limited. Species and signs of such sighted during the survey on and in the vicinity of the study area include:

» Scrub Hare (*Lepus saxatilis)*
» Signs of Aardvark (*Orycteropus afer* – refer to **Figure 5.15***)*

Figure 5.15: Aardvark holes close to termite mounds observed on the study area

The Aardvark conservation status is worldwide considered as least threatened, but on a smaller scale is often regarded as vulnerable. Its activity was observed mainly on the more recently established semi-natural grasslands on the south-eastern portions of the study area, where termite activity is still relatively high. Abandoned burrows of Aardvark are often inhabited by other animal species.

5.6 Social Characteristics of the Study Area and Surrounds

5.6.1 Population

In 2001 the population of the Free State was ~ 2.7 (Census 2001), and increase over the 2.64 million in 2011 The population grew at a rate of 0.6% between 1996 and 2001, which was lower than the national population growth rate ~ 2% per annum for the same period. This has been attributed to a number of factors, including the declining contribution of the agricultural and the mining sectors in the area. The impact of HIV/AIDS has also been identified as a contributing factor. The FSPGDS indicates that the Province's population is expected to stabilise at about 2.89 million people by 2010. Based on the data from Census 2011, the population of the Free State was 2 633 504.

5.6.2 Age and Gender Structure

In terms of the age breakdown, the largest percentage of youths is found in the communal areas where 34.9% of the population fall within this category. The lowest percentage is found in larger urban areas, where 25.6% of the population are youths. The percentage of children increases from the larger urban areas (25.6%), to regional towns (27.3%), to medium-sized towns (30.8%), to small towns (32.8%), and to communal areas (34.9%). The cities have the highest percentage of youths (39.3%), while the commercial farms, communal areas, and small towns have the lowest percentage. This pattern reflects the lack of employment in the rural areas and the associated small rural towns and the tendency for the youth to migrate to the bigger urban centres to search for work.

The highest percentage of elderly people is found in the small towns (8.4%), regional towns (8.1%), and the communal areas (7.8%). The province's gender statistics also reflect the tendency for males, especially younger males, to relocate in search of work. In this case the migration of males to the Free State in search of work on the mines has decreased. This is reflected by the increase in the percentage of females between 1996 and 2001. In 1996, 50.7% of the Province's population was female. This increased to 52.1% in 2001. The FSPGDS notes that the main reason for the increase in the percentage of females is the decline of the mining industry and, therefore, a decline in the number of male migrant workers.

The tendency for males to migrate to the cities from the urban areas in search of work is also reflected in the gender statistics. Cities (51.8%), followed by regional towns (52.6%), medium-sized and small towns (52.7%) have the lowest percentage of females compared to rural areas (53.8%). Commercial farms have the lowest percentage of females (48.9%).

5.6.3 Education levels

Level of education is one of the most important contributors to the HDI. The percentage of people five years and older in the Free State in 2001 who had not completed primary school and who, as a result, are classified as functionally illiterate was 43.4%. The national figure was 45.7%. Only 14.6% of people five years and older had completed Grade 12 or higher in 2001. The DM with the lowest education levels was the Xhariep DM (52.5% functionally illiterate), followed by the Thabo Mofutsanyane DM (46.8%). The Motheo DM (now the MMM) had the lowest number of people over the age of five who were functionally illiterate (39%). The education levels in the Province are low and this will impact on ability to promote economic growth.

5.6.4 Employment

In 2004, ~500 000 people were unemployed, which represented an unemployment rate of 39.1%. This represents an almost 10% increase from the 1996 level of 29.9%. Lejweleputswa DM had almost a third of the unemployed (30.9%), followed by the Thabo Mofutsanyane DM and the Motheo DM (now the MMM). The Lejweleputswa DM also experienced the highest poverty rate increase of all five districts. The FSPGDS identifies unemployment as one of the key challenges facing the Province.

5.6.5 Economic context

The nominal GDP of the Province, which measures the total of final products and services produced within the Province, amounted to just over R65 billion in 2004 (Global Insight, 2006). This represents only 4.7% of South Africa's total GDP. The Free State therefore has the third smallest economy in South Africa after the Northern Cape and Limpopo Province. The 4.7% is also less than the comparative size (6.3%) of the provincial population. By comparison, the populations of Gauteng and the Western Cape are substantially smaller than the contribution of their economies, while the Free State and some of the other Provinces, such as the Eastern Cape and Limpopo, contribute less towards the domestic economy than their contribution to the national population.

Spatially, the FSPGDS identifies five distinct spatial patterns in the Province economy. First, large-scale agricultural output is prevalent in the northern and north-eastern Free State. Maize and wheat are the main agricultural products grown in these areas. Although agriculture is also dominant in the southern and south-western parts, it is less extensive and more dependent on stock farming.

The second is the dominance of the petrochemical industry in Sasolburg. This industry is closely related to the Sasol factories, with ~ 20% of the employment in the Manufacturing sector located in Sasolburg.

The third major economic hub is the Free State Goldfields, which is dominated by the gold-mining industry. As indicated above, the mining sector played key role historically in the development of the Province's economy. However, following the boom in the late 1980s the sector has been in decline, which has impacted significantly on the local economies of the mining towns.

The fourth spatial characteristic of the Province's economy is the large-scale manufacturing infrastructure which is located in the former homeland areas. This infrastructure was created through the policy of economic decentralisation under apartheid. The operation of these firms was highly subsidised and in the process, large manufacturing estates were erected in the Phuthaditjhaba, Thaba Nchu, and Botshabelo areas. With the phasing-out of the subsidies, jobs were lost.

The fifth characteristic of the Province's economy is the dominance of Bloemfontein, mainly as a public-sector and retail city. Although Bloemfontein is one of the few urban areas where a positive economic growth is being experienced, it compares very poorly with other secondary cities in South Africa (Centre for Development and Enterprise, 2005). Bloemfontein and Sasolburg together contribute approximately 51% of the Province's economy and if Welkom is added, this rises to above 60%.

At a District Municipal level the MMM (Previously the Motheo DM) and the Fezile Dabi are the districts with the highest contribution to the Province's economy. In terms of GDP, the MMM and Fezile Dabi contributed to almost two-thirds (64.7%) of the Province's economy. In contrast, Thabo Mofutsanyana and Xhariep together contributed to only 14.6% of the total output of the Province's economy. While Lejweleputswa contributed the most towards the provincial economy in 1996, it dropped to third place (20.8%) in 2004. The top five localities in terms of contributions to the economy during 2004 were Bloemfontein (R 17.7 billion), Sasolburg (R 15.2 billion), Welkom (R6.5 billion), Kroonstad (R2.3 billion) and Bethlehem (R2.2 billion).

In terms of future economic development, there is likely to be a decline in the role played by mining, which will also impact negatively on employment in the Province. The FSPGDS notes that it is unlikely that the mining industry will ever again contribute more than its current contribution to GDP. In addition, the mining industries will never again absorb the percentages of labour that have historically been the case. The economic future of the agriculture also appears to be less than prosperous based on limited economic growth over the period from 1996 to 2004. However, the labour-absorption capacity of agriculture compared to other sectors is still relatively high. In addition, the ability of the agricultural sector to absorb low skilled labour is higher than the secondary and tertiary economic sectors. In terms of economic development at district and local levels, agricultural diversification is seen as a key strategy for farmers. This includes looking at new products such as olives, organic farming, and essential oils.

Tourism is identified a key economic sector for the future. The FSPGDS identifies a number of strategies aimed at promoting the tourism sector. These include events tourism, such as sporting and festivals, weekend tourism, aimed at the market in the north and north-eastern of the Province, specifically Gauteng, and international tourists.

5.7. Heritage

The topography of the area is relatively flat and is utilised for extensive agricultural purposes. The 132kV power line from Grootkop to Kutlwanong forms the north eastern boundary of the site and will be used for connection into the grid.

The scoping study highlighted the fact that it was not anticipated that early stone age (ESA) sites or late stone age site (LSA) of significance will be encountered due to the lack of caves in the area. It was however anticipated that some middle stone age (MSA) finds might be possible around pans on the farm. . One cultural site, consisting of a cemetery, was identified during the survey. This site is located on the northern periphery of the development footprint inside the 50 meter buffer zone of the 132 kV line (refer to **Figure 5.16**).

No Iron Age occurrences were expected since the study area is situated outside the western periphery of distribution of Late Iron Age settlements in the Free State. However to the north of the study area, ceramics from the Thabeng facies belonging to the Moloko branch of the Urewe tradition were recorded at Oxf 1 and Platberg32/71 (Maggs 1976, Mason 1986). Similarly to the east Makgwareng ceramics belonging to the Blackburn Branch of the Urewe tradition was recorded (Dreyer 1992 and Maggs 1976).

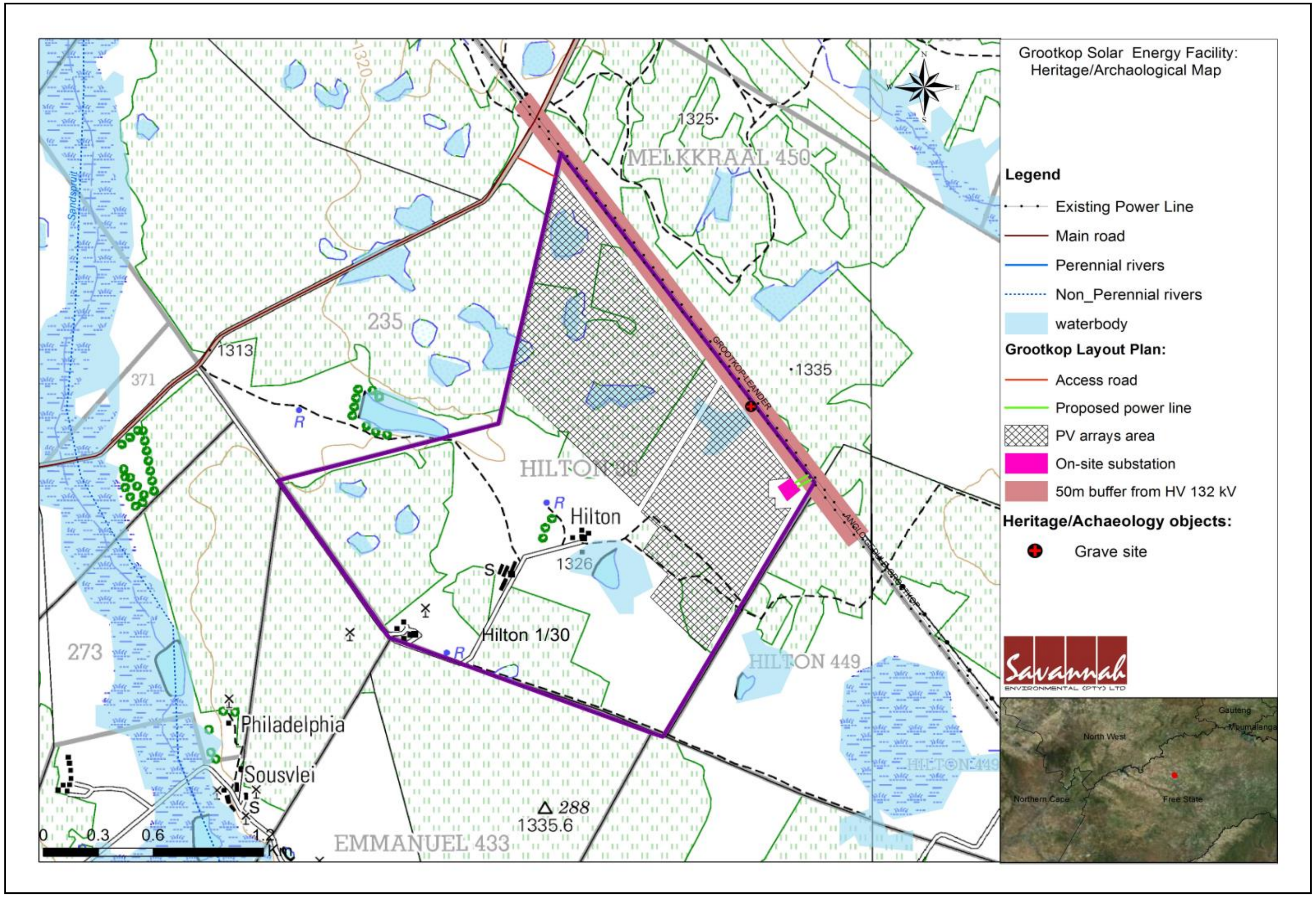

Figure 5.16: Map indicating heritage site within the proposed Grootkop Solar Energy Facility

5.7.1. Findings of the field survey

Site Number	Site 1	**1:50 000 map nr**	2726 DC
Site Data	**Description:**		
Type of site	Open site		
Site categories	Informal Cemetery		
Context	**Site 1** consists of more than 50 graves that are aligned east to west. The site is located on the northern periphery of the study area within a 50 meter buffer zone of the existing 132kV power line that forms the northern boundary of the study area. Most of the graves are just demarcated with a single upright stone while others consist of a stone packed dressing or granite headstones.		
Cultural affinities, approximate age and significant features of the site;	Inscriptions on the headstones at site 1 indicate the site is at least 35 years old as the oldest visible date is 1978.		
Estimation or measurement of the extent	The site covers an area of 0.02 ha.		

Photographs

Field Rating (Recommended grading or field significance) of the site:	Generally Protected A
Statement of Significance (Heritage Value)	High social significance

ASSESSMENT OF POTENTIAL IMPACTS CHAPTER 6

This chapter serves to assess the significance of the positive and negative environmental impacts (direct, indirect, and cumulative) expected to be associated with the development of the proposed Grootkop Solar Energy Facility. This assessment is conducted for a 75 MW facility and for all the facility's components including:

» Solar array with an export capacity of 75MW.
» Mounting structures for the solar panels to be either rammed steel piles or piles with pre-manufactured concrete footings to support the PV panels.
» Cabling between the structures, to be lain underground where practical.
» Transformers to collect all energy generated from the PV panels
» A new power line which will loop in and out into an existing power line that runs adjacent the proposed site in order to evacuate energy into an existing Grootkop substation i.e. national grid
» Internal access roads (4 – 6m wide) will be constructed but will keep to existing roads as far as possible
» Fencing (approximately 2.5 m in height).
» Associated buildings including a workshop area for maintenance, storage (i.e. fuel tanks, etc.), and offices.

The development of the Grootkop Solar Energy Facility will comprise the following phases:

» *Pre-Construction and Construction* – will include pre-construction surveys; site preparation; establishment of the access road, electricity generation infrastructure, power line servitudes, construction camps, laydown areas, transportation of components/construction equipment to site; and undertaking site rehabilitation and establishment and implementation of a storm water management plan. This phase is expected to take approximately 16 months.
» *Operation* – will include operation of the facility and the generation of electricity. The operational phase is expected to extend in excess of 20 - 25 years.
» *Decommissioning* – depending on the economic viability of the plant, the length of the operational phase may be extended. Alternatively decommissioning will include site preparation; disassembling of the components of the facility; clearance of the site and rehabilitation. Note that impacts associated with decommissioning are expected to be similar to construction. Therefore, these impacts are not considered separately within this chapter.

6.1. Assessment of the Potential Impacts associated with the Construction and Operation Phases

The sections which follow provide a summary of the findings of the assessment undertaken for potential impacts associated with the construction and operation of the proposed solar energy facility on the identified site. The assessment of potential issues presented in this chapter has involved key input from specialist consultants, the public and the project developer. Issues were assessed in terms of the criteria detailed in Chapter 4 (section 4.2.5). The nature of the potential impact is discussed, and the significance is calculated with and without the implementation of mitigation measures. Recommendations are made regarding mitigation/enhancement and management measures for potentially significant impacts and the possibility of residual and cumulative impacts are noted. Cumulative impacts are assessed in Section 6.2.

6.1.1 PV Panels technology (Fixed vs Tracking)

Impacts on the environment associated with the project will be influenced by the types of PV panel array to be used. PV technologies being considered for the proposed project are fixed and tracking. The most important differences relate mainly to the ecological environment (Tsoutsos *et al*. 2005, Turney and Fthenakis 2011, Strohbach 2012), and can be summarised as follows:

Aspect influenced	Fixed panel	Tracking panel
Size of land required	Smaller (approx. 2ha per MW)	Larger
Shading and associated change of vegetation	More continuous and intense shading Less stable and dense vegetation expected, reduced buffering capacity of extreme weather events by vegetation expected	More variable and less intense overall shading More stable and denser vegetation cover expected, smaller reduction of buffering capacity of extreme weather events expected
Effect on runoff and accelerated erosion	Larger continuous panel area, more concentrated runoff, constant runoff edges potentially create more erosion, especially where vegetation is weakened	Smaller continuous panel areas, runoff more dissipated, moderate variation of runoff edges that are expected to create less erosion where vegetation is weakened

Aspect influenced	Fixed panel	Tracking panel
Mounting height	PV panels may be as low as 50 cm above ground to allow for higher panels, increasing the limits of permissible vegetation due to maintenance and fire risks	Expected to be more than 1 m off the ground, increasing the possibility of low vegetation establishment and small fauna movement without compromising safety

6.1.2. Potential Impacts on Ecology

The selected property falls within the original extent of Vaal-Vet Sandy Grassland as described by Mucina and Rutherford (2006), of which a large portion on the property has been previously transformed. The remaining extent of this vegetation type has been listed in the threatened terrestrial ecosystems for South Africa (2011) as Endangered. Beyond the proposed development area, closer to larger drainage lines and small rivers, the grassland vegetation merges into Highveld Alluvial Vegetation, which is considered as least threatened (refer to **Figure 6.1**).

Solar energy facilities require relatively large areas of land for placement of infrastructure. The proposed Grootkop PV facility requires ~180ha. The main expected negative impact will be due to loss of vegetation, loss of species of conservation concern, and loss of habitat which may have direct or indirect impacts on individual species. Potential impacts and the relative significance of the impacts are summarised below (refer to **Appendix E - Ecology Report** for more details).

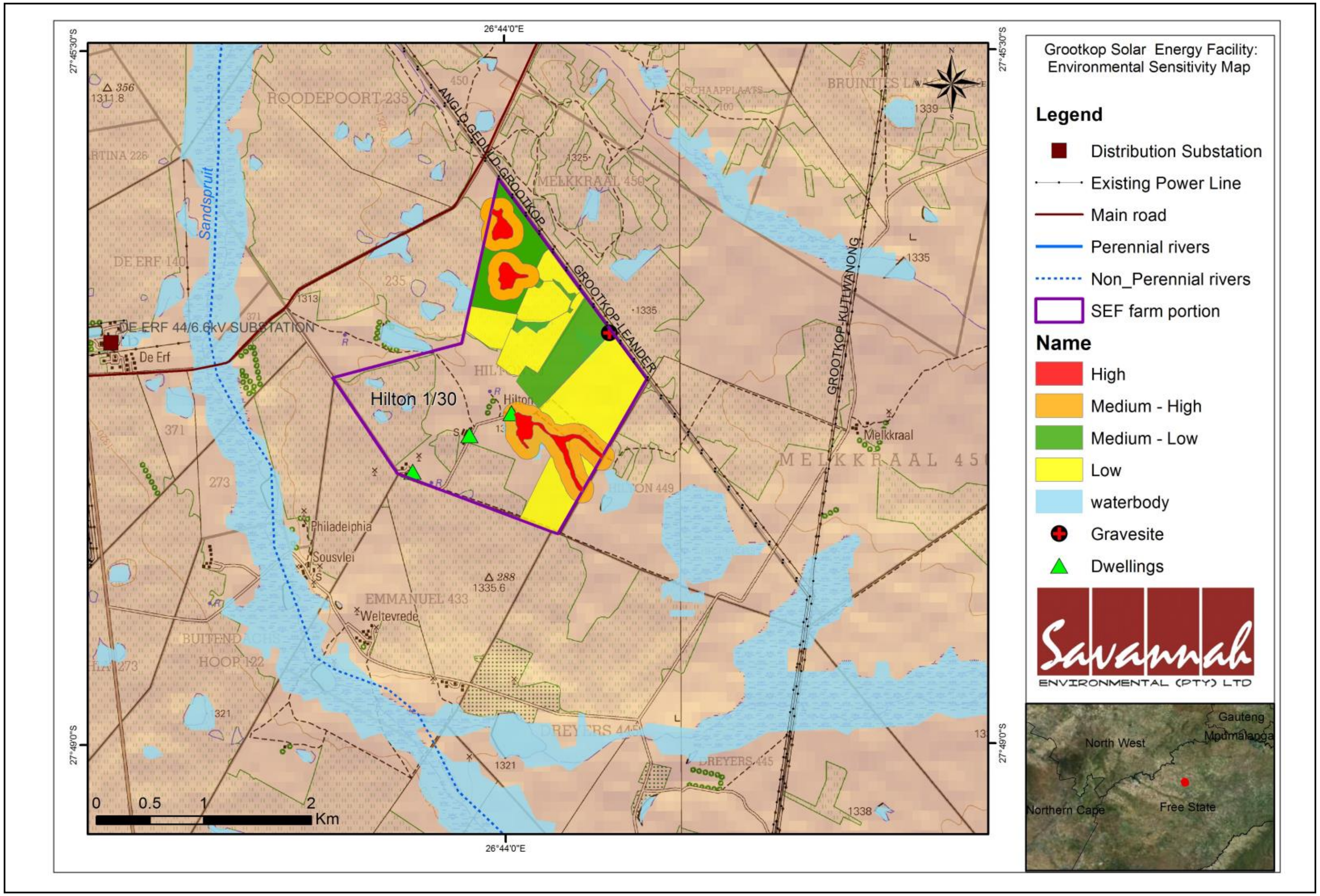

Figure 6.1: Sensitivity map indicating sensitive ecological areas within the proposed Grootkop Solar Energy Facility

a) Summary of impacts associated with the proposed solar energy facility during the construction and operational phase

Activity: Upgrading and/or creation of site access road (4-6m in width and fence (2.5m in height: GN 544,18 June 2010 activity 22 (ii) and GN546,18 June 2010 activity 4ii(cc)		
Environmental Aspect: Removal of vegetation, compaction and disturbance of soils, creation of runoff zone, destruction of animal burrows, possible traversing of drainage areas, impact on protected species, alteration of soil surface properties		
Environmental impact: Loss of vegetation, increase in runoff and erosion, possible distribution of alien invasive species, possible disturbance and reduction of habitat or injury to burrowing vertebrates, possible change of natural runoff and drainage patterns, possible loss of protected species, possible permanent loss of re-vegetation potential of soil surface.		
	Without mitigation	***With mitigation***
Extent	Local (2)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Low (4)	Minor (1)
Probability	Definite (5)	Definite (5)
Significance	**Medium (50)**	**Medium (30)**
Status (positive, neutral or negative)	Negative	*Neutral* where on transformed areas or utilising existing access roads *Minimal new negative impacts expected*
Reversibility	Not reversible	Relatively reversible
Irreplaceable loss of resources?	Probable	Not likely
Can impacts be mitigated?	Reasonably well	

Mitigation:

- Avoid remaining natural grasslands when planning any new roads.
- After the final layout has been compiled, conduct a thorough footprint investigation to detect and map (by GPS) any protected plant species and animal burrows
  - Protected plant species: must be relocated or obtain a permit
  - Animal burrows: must be monitored by ECO prior to construction for activity/presence of animal species. If detected, such animals must be relocated by a qualified professional
- During construction: create designated turning areas and strictly prohibit any off-road driving or parking of vehicles and machinery outside designated areas
- Keep the clearing of natural and semi-natural grasslands to a minimum
- If filling material is to be used, this should be sourced from areas free of invasive species
- Topsoil (the upper 25 cm of soil) is an important natural resource; where it must be stripped, never mix it with subsoil or any other material. Store and protect it separately until it can be re-applied. Minimise handling of topsoil
- Reinforce portions of existing access routes that are prone to erosion. Create structures or low banks to drain the access road rapidly during rainfall events, yet

preventing erosion of the track and surrounding areas » Ensure that runoff from compacted or sealed surfaces is slowed down and dispersed sufficiently to prevent accelerated erosion from being initiated (storm water and erosion management plan required) » Ensure adequate drainage where access roads cross drainage lines or seepage areas » Prevent leakage of oil or other chemicals or any other form of pollution » Monitor the establishment of (alien) invasive species and remove as soon as detected, whenever possible before regenerative material can be formed » After decommissioning, if access road or portion thereof will not be of further use to the landowner or the project, remove all foreign material and rip area to facilitate the establishment of vegetation, followed by a suitable re-vegetation program
Cumulative impacts: » Possible erosion of areas lower than the access road » Possible contamination of lower-lying drainage lines, rivers and wetlands due to oil or other spillage » Possible spread and establishment of alien invasive plant species
Residual impacts: » Altered vegetation composition and structure » Altered topsoil conditions » Potential barren areas » Potential for erosion and invasion by weed or alien species

Activity: Construction and operation of PV panels on natural, semi-natural vegetation and disturbed areas (**tracking panel option**): GN 544, 18 June 2010 activity 11(ii) (xi) and GN 545, 18 June 2010 activity 18 (i); GN 545, 18 June 2010 activity 1 and GN 545, 18 June 2010 activity 1; GN 546, 18 June 2010 activity 14(i).		
Environmental Aspect: Removal of or excessive damage to vegetation, compaction of topsoil, creation of runoff zone, redistribution and concentration of runoff from panel surfaces, artificial shading of vegetation, displacement of terrestrial vertebrates, reduced buffering capacities of the landscapes during extreme weather events		
Environmental impact: Loss of vegetation and/or species of conservation concern, loss of and alteration of microhabitats, altered vegetation cover, general increase in runoff from PV and/or bare areas and associated accelerated erosion, reduction of habitat and resource availability for terrestrial fauna, possible increase of detrimental effects during periods of extreme weather events, e.g. increased flooding, severe erosion or dust due to lower buffering capacity of sparser vegetation		
	Without mitigation	***With mitigation***
Extent	Local (2)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	High (7)	Moderate (5)
Probability	Definite (5)	Definite (5)
Significance	**High (65)**	**Medium (50)**
Status (positive, neutral or negative)	Negative	Negative
Reversibility	Partially reversible	Partially reversible
Irreplaceable loss of resources?	Highly Probable	Slight Probability
Can impacts be	Reasonably well	

mitigated?		

Mitigation:

- After the final layout has been compiled, conduct a thorough footprint investigation to detect and map (by GPS) any protected plant species and active animal burrows
  - Protected plant species: must be relocated or obtain a permit
  - Animal burrows: must be monitored by ECO prior to construction for activity/presence of animal species. If detected, such animals must be removed and relocated by a qualified professional
- Keep areas affected to a minimum, and strictly prohibit any disturbance outside the demarcated footprint area
- Clear as little indigenous vegetation as possible.
- Aim to maintain vegetation where it will not interfere with the construction or operation of the development
- After construction, rehabilitate an acceptable vegetation layer according to rehabilitation recommendations of the relevant EMP
  - Use species that were part of the original indigenous species composition similar to the remaining natural vegetation as listed in the specialist report, or sow with *Digitaria eriantha* and *Themeda triandra*. It is expected that *Cynodon dactylon* will re-establish by itself.
  - The higher level of shading anticipated from fixed panels may prevent or slow the re-establishment of desirable grass species, thus re-establishment must be monitored and species composition adapted if the above species fail to establish sufficiently.
  - A strong herb layer will also suppress the re-emergence of weed species from existing seed banks.
- Aim to maintain a buffer zone of a minimum of 50 to 100 m around drainage lines and/or seepage areas
- Remove all invasive vegetation before and after construction and continuously up to decommissioning
- If filling material is to be used, this should be sourced from areas free of invasive species
- Topsoil (the upper 25 cm of soil) is an important natural resource; where it must be stripped, never mix it with subsoil or any other material, store and protect it separately until it can be re-applied, minimise handling of topsoil
- Temporarily stored topsoil must be re-applied within 6 months. Topsoils stored for longer need to be managed according to a detailed topsoil management plan
- Monitor the area below the PV panels regularly after larger rainfall events to determine where erosion may be initiated and then mitigate by modifying the soil micro-topography and re-vegetation or soil erosion control efforts accordingly
- Prevent leakage of oil or other chemicals
- Strictly prohibit littering of any kind
- Monitor the establishment of all invasive species and remove as soon as detected, whenever possible before regenerative material can be formed

Cumulative impacts:

- If mitigation measures are not strictly followed the following could occur:
  - erosion of areas around the panels and continued erosion of the development area with associated siltation and/or erosion of lower-lying wetlands
  - contamination of drainage lines, lower-lying rivers or wetlands
  - alteration of occupancy by terrestrial fauna beyond the project area, possible

reduction of available habitat and food availability to terrestrial fauna ▪ spread and establishment of invasive species
Residual impacts: » altered topsoil characteristics » altered vegetation composition

Activity: Construction and operation of PV panels on natural, semi-natural vegetation and disturbed areas (**fixed panel option**): GN 544, 18 June 2010 activity 11(ii) and GN 544, 18 June 2010 activity 18; GN 545, 18 June 2010 activity 1 and GN 544, 18 June 2010 activity 15; GN 546, 18 June 2010 activity 14(i).		
Environmental Aspect: Removal of or excessive damage to vegetation, compaction of soils, creation of runoff zone, redistribution and concentration of runoff from panel surfaces, artificial shading of vegetation, displacement of terrestrial vertebrates, reduced buffering capacities of the landscapes during extreme weather events		
Environmental impact: Loss of vegetation and/or species of conservation concern, loss of and alteration of microhabitats, strongly altered and reduced vegetation cover, increase in *concentrated* runoff from PV panels and higher accelerated erosion, reduction of habitat and resource availability for terrestrial fauna, possible increase of detrimental effects during periods of extreme weather events, e.g. increased flooding, severe erosion or dust due to lower buffering capacity of sparser vegetation		
	Without mitigation	***With mitigation***
Extent	Local (2)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	High (8)	High (7)
Probability	Definite (5)	Definite (5)
Significance	**High (70)**	**High (60)**
Status (positive, neutral or negative)	Negative	Negative
Reversibility	Partially reversible	Partially reversible
Irreplaceable loss of resources?	Highly Probable	Slight Probability
Can impacts be mitigated?	Reasonably	
Mitigation: » After the final layout has been approved, conduct a thorough footprint investigation to detect and map (by GPS) any protected plant species and active animal burrows ▪ Protected plant species: must be relocated or obtain a permit ▪ Animal burrows: must be monitored by ECO prior to construction for activity/presence of animal species. If detected, such animals must be removed and relocated by a qualified professional/contractor » Keep areas affected to a minimum, and strictly prohibit any disturbance outside the demarcated footprint area » Clear as little grassland vegetation as possible, aim to maintain all indigenous vegetation where it will not interfere with the construction or operation of the development, rehabilitate an acceptable vegetation layer according to rehabilitation recommendations of the relevant EMP o use only species that were part of the original indigenous species composition as described in the specialist report		

- After construction, rehabilitate an acceptable vegetation layer according to rehabilitation recommendations of the relevant EMP
  - Use species that were part of the original indigenous species composition similar to the remaining natural vegetation as listed in the specialist report, or sow with *Digitaria eriantha* and *Themeda triandra*. It is expected that *Cynodon dactylon* will re-establish by itself.
  - The higher level of shading anticipated from fixed panels may prevent or slow the re-establishment of desirable grass species, thus re-establishment must be monitored and species composition adapted if the above species fail to establish sufficiently.
  - A strong herb layer will also suppress the re-emergence of weed species from existing seed banks
- Aim to maintain a buffer zone of a minimum of 50 to 100 m around drainage lines and/or seepage areas
- Remove all invasive vegetation
- If filling material is to be used, this should be sourced from areas free of invasive species
- Topsoil (the upper 25 cm of soil) is an important natural resource; where it must be stripped, never mix it with subsoil or any other material, store and protect it separately until it can be re-applied, minimise handling of topsoil
- Temporarily stored topsoil must be re-applied within 6 months, topsoils stored for longer need to be managed according to a detailed topsoil management plan
- Monitor the area below and around the PV panels regularly after larger rainfall events to determine where erosion may be initiated and then mitigate by modifying the soil micro-topography and erosion control and/or revegetation efforts accordingly
- Due to the fixed nature and larger runoff surfaces of the PV panels, the development area should be adequately landscaped and rehabilitated to include vegetated contour buffer strips that can contain expected accelerated erosion
  - Runoff may have to be specifically channeled or stormwater adequately controlled to prevent localised rill and gully erosion
- Prevent leakage of oil or other chemicals, strictly prohibit littering of any kind
- Monitor the establishment of all invasive species and remove as soon as detected, whenever possible before regenerative material can be formed

Cumulative impacts:

- If mitigation measures are not strictly followed the following could occur:
  - erosion of areas around the panels and continued erosion of the development area with associated siltation and/or erosion of lower-lying wetlands
  - contamination of drainage lines, lower-lying rivers or wetlands
  - alteration of occupancy by terrestrial fauna, possible reduction of available habitat and food availability to terrestrial fauna
  - spread and establishment of invasive species

Residual impacts:

- altered topsoil characteristics
- altered vegetation composition

b) Implications for Project Implementation

- » The proposed photovoltaic facility development on the site will not have significant impacts on the above-ground ecology of the site, if all mitigation measures are followed, and the development follows all recommendations of the wetland study. The largely low ecological sensitivity of the larger portion of the study area is due to the past land-use history, during which most areas were transformed and small sections of natural remaining grasslands affected by fragmentation.
- » Potentially significant negative impacts on the ecological environment could be soil degradation issues because of construction activity; possible introduction of alien invasive plants and a long-term (more than 8 months) low or absent vegetation cover after construction. With the diligent implementation of mitigating measures by the developer, contractors, and operational staff, the severity of these impacts can be minimised.
- » The riparian areas of vegetation unit 1, as well as lower-lying drainage lines and rivers that were not specifically assessed must be regarded as No Go Areas,
- » The impact on fauna is expected to be small to negligent. Presence of indigenous terrestrial vertebrates within the study area is low due to current land use. Animals that may be permanently present can be relocated or will move away during construction, and may resettle after construction, depending on safety specifications necessitated by the development. No restricted or specific habitat of vertebrates exists on the study area and will be affected by the proposed development; especially if the proposed development remains outside the recommended buffers around wetland and seepage areas.

6.1.3. Assessment of Potential Impacts on wetlands

a) Summary of impacts associated with the proposed solar energy facility during the construction and operational phase

Nature: Loss and disturbance of wetland habitat Approximately 44.8 ha of wetland habitat falls directly within the footprint of the proposed PV arrays and substation (GN 544, 18 June 2010 activity 11(ii) & (xi)). It is expected that this wetland habitat will be permanently destroyed. Approximately 13 depressions (pans) and several seepage areas fall completely within the footprint of the development; with a further portion of the valley bottom partially affected. It is likely that the remaining portions of the partially impacted valley bottom wetland will change possibly to become channelled. In addition, wetland habitat immediately adjacent to the construction footprints is likely to be disturbed during the construction phase.		
	Without mitigation	***With mitigation***

<table>
<tr><td>Extent</td><td>High (5)</td><td rowspan="9">No mitigation measures can be attempted on site, the only option available is to revise the footprint of the development to be outside the wetland area. However due to the extent of the depressions on site this option will not be feasible. Attempts can only be initiated to save remaining wetland areas outside the footprint of the proposed development on site</td></tr>
<tr><td>Duration</td><td>Permanent (5)</td></tr>
<tr><td>Magnitude</td><td>High (10)</td></tr>
<tr><td>Probability</td><td>Definite (5)</td></tr>
<tr><td>Significance</td><td>High (100)</td></tr>
<tr><td>Status (positive or negative)</td><td>Negative</td></tr>
<tr><td>Reversibility</td><td>Low</td></tr>
<tr><td>Irreplaceable loss of resources?</td><td>No</td></tr>
<tr><td>Can impacts be mitigated?</td><td>Yes</td></tr>
<tr><td colspan="3">Mitigation
There appears to be no means to mitigate against the loss of wetland habitat falling within the footprint of the proposed developments. The only means to avoid this impact would be to consider a different site where no wetlands are present, though given the number of pans in the area, this might also prove difficult.

In order to prevent disturbance and damage to the remaining wetlands on site, it is recommended that all remaining wetlands are buffered with a distance of 50m. This buffer zone should be excluded from all construction related activities on site (i.e. no stockpiles, constructor's camps etc. should be located within the wetlands or their buffer zones). If required, the wetlands and associated buffer zones should be fenced off. Alternatively the construction site and associated activities should be contained within the fenced off construction site. A normal 5 strand cattle fence is recommended as this will allow for free movement of small wildlife such as Suricate, Ground Squirrel and Porcupine, which were found to be common on site.</td></tr>
<tr><td colspan="3">Cumulative Impacts
All wetlands located within the proposed PV plant, associated construction and operational activities as well as substation footprint will be lost. This is likely to indirectly impact on the wetland areas outside the footprint which fall within the same catchment area as the wetland areas to be lost. As such there will be a number of wetland systems that will be lost in the region including a number of directly affected depressions, seepage areas and valley bottom wetland systems. This will contribute to cumulative loss of wetland habitat within the region.

The close proximity of the proposed solar facility to other wetland areas outside its footprint is also likely to result in some indirect impacts to the wetland habitat and thus resulting in some degradation of wetland habitat, most specifically in terms of increased sediment inputs to the wetlands. The proposed activities will thus contribute somewhat towards degradation of wetland habitat within the region</td></tr>
<tr><td colspan="3">Residual Impacts
The residual impacts due to loss and disturbance of wetland habitats are high, specifically within the area directly affected by the footprint of the proposed PV plant and associated infrastructures. This is because opportunities for onsite mitigation of wetland habitat loss are not feasible.</td></tr>
</table>

Nature: Increased sedimentation

During the construction phase it is expected that most of the proposed PV array and substation footprint areas will be cleared of vegetation and some earthworks will likely also take place on site (GN 546, 18 June 2010 activity 14(i)). These activities will expose the disturbed, bare soil to erosion by wind and water. High intensity rainfall events which result in surface runoff could result in significant volumes of sediment being transported off the construction site and into downslope water courses. However, given the flat terrain of the site and the poor drainage off the site, it is unlikely that significant concentrated run-off will develop, with the possible exception of the valley bottom. Transported sediment loads are thus expected to be reduced and are unlikely to be transported into any downstream wetlands.

	Without mitigation	***With mitigation***
Extent	Medium (3)	Low (1)
Duration	Short-term (1)	Short-term (1)
Magnitude	Low (4)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	**Low (24)**	**Low (18)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	

Mitigation:

- Major vegetation clearing activities and earthworks should be undertaken during the dry season as far as practically possible.
- The footprint of vegetation clearing should be limited to the direct footprint of the proposed development and should be phased. The construction servitude should be fenced off prior to the commencement of construction activities and all construction activities should be limited to this area.
- Where possible vegetation clearing should be limited to removal of trees and shrubs only (if required), with the grass layer maintained as far as possible.
- Access roads and construction roads should include regular low level humps to slow down stormwater flow and direct stormwater off the road surfaces and into adjacent grassland at regular intervals to minimise erosive energy of stormwater runoff.
- Stormwater infrastructure should include sediment traps.

Cumulative Impacts

The volume of sediments that are washed or blown into receiving watercourses will compound downstream impacts, particularly due to construction, agriculture and at road crossings. Sedimentation may impact on the capacity of downstream weirs and dams, particularly within the Sandspruit downstream. This may lead to increased turbidity and additional sediment loads may put pressure on fish and macro-invertebrates within the Sandspruit. Increase in flows due to additional flows from stormwater on site may cause erosion and gullies within the downstream watercourses and thus impact on the ecological status of the downstream rivers and the entire catchment areas downstream.

Residual Impacts

The residual impacts due to increases in sedimentation during construction to the remaining systems are expected to be low due to low significance of the respective impacts after mitigation. It is also anticipated that with proper implemented mitigation

measures as proposed, the system will recover within a short period of time.

Nature: Water quality deterioration: GN 544, 18 June 2010 activity 10 (i); GN 544, 18 June 2010 Activity 22(ii) and GN 545, 18 June activity 1)
Numerous hazardous substances will be used and stored on site during the construction phase of the project. These substances will include: diesel, oil, cement and other construction materials (volumes of hazardous substances stored on site will not exceed 500 cubic metres). Spillages or leaks of these substances could enter downslope water courses via surface run-off during high intensity storm events or groundwater via infiltration, leading to water quality deterioration within the receiving water courses and making the water less fit for use by downstream water users as well as being deleterious to aquatic biodiversity.

	Without mitigation	***With mitigation***
Extent	Medium (3)	Low (1)
Duration	medium-term (3)	Medium-term (3)
Magnitude	Moderate (6)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	**Low (36)**	**Low (24)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	

Mitigation:

» All potentially polluting and hazardous substances used and stored on site should be stored in clearly demarcated areas.

» Storage areas for diesel, oil and other polluting substances must have adequate spillage containment measures to contain any spills within the direct area of the spill. Ideally, all potentially polluting substances should be stored in bunded areas of sufficient capacity to contain the full volume plus 10% of the storage containers.

» All re-fuelling areas and workshops should make use of drip trays to capture fuel and oil spills during re-fuelling or during vehicle maintenance and repairs.

» Stormwater should be diverted around the storage areas of polluting substances to prevent contamination of clean stormwater.

» Sufficient quantities of spill clean-up materials (e.g. Drizit or Spillsorb) should always be available on site. Once used, absorbent material and contaminated soil should be disposed of at a registered hazardous waste disposal site. The following guidelines apply to the use of polluting substances on site, and specifically to the use of cement and concrete:
  - Carefully control all on-site operations that involve the use of cement and concrete.
  - Limit concrete mixing to single sites where possible.
  - Use plastic trays or liners when mixing concrete. Do not mix concrete directly on the ground.

» Dispose of all visible remains of excess cement and concrete after the completion of tasks. Dispose of in the approved manner (solid waste concrete may be treated as inert construction rubble, but wet cement and liquid slurry, as well as cement powder must be treated as hazardous waste).

Cumulative Impacts

All wetlands located within the proposed PV plant, associated construction and operational activities as well as substation footprint will be lost. This is likely to indirectly impact on the wetland areas outside the footprint which fall within the same catchment area as the wetland areas to be lost. As such there will be a number of wetland systems that will be lost in the region including a number of directly affected depressions, seepage areas and valley bottom wetland systems. This will contribute to cumulative loss of wetland habitat within the region.

Residual Impacts

The residual impacts due to water quality deterioration during construction to the remaining systems are expected to be low due to low significance of the respective impacts after mitigation. It is also anticipated that with proper implemented mitigation measures as proposed, the system will recover within a short period of time.

Nature: Increased flows within the watercourse: GN 544, 18 June 2010 activity 10 (i); GN 544, 18 June 2010 Activity 22(ii) and GN 545, 18 June activity 1)

Volumes of water will be imported to the study area during construction. This water will be used mostly for dust suppression, PV panel cleaning as well as other uses including building of workshop and offices. Large volumes of the water are thus likely to infiltrate into the soil of the area. This could lead to increased surface run-off during rainfall events as the soil becomes saturated more easily, as well as increased seepage of water through the soil profile and into groundwater. The drainage line and downslope pans are the systems most likely to be impacted in this regard, with increased flows likely to lead to changes in vegetation. The dry climate of the area and high evaporation rates of the area will, however, limit the significance of this impact considerably, as much of the imported water used on site will probably be lost to evaporation before it enters any of the wetlands.

	Without mitigation	***With mitigation***
Extent	High (5)	Medium (3)
Duration	Medium-term (3)	Short-term (2)
Magnitude	High (8)	Medium (4)
Probability	Highly Probable (4)	Probable (3)
Significance	**High (64)**	**Low (27)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	

Mitigation:

Water usage on site should be minimised and re-use of water should be maximised. No discharge of dirty water to the environment should be allowed.

Cumulative Impacts

All wetlands located within the proposed PV plant, associated construction and operational activities as well as substation footprint will be lost. This is likely to indirectly impact on the wetland areas outside the footprint which fall within the same catchment area as the wetland areas to be lost. As such there will be a number of wetland systems that will be lost in the region including a number of directly affected depressions, seepage areas and valley bottom wetland systems. This will contribute to cumulative loss of wetland habitat

within the region.
Residual Impacts ***T***he residual impacts due to increased flows during construction to the remaining systems are expected to be low due to low significance of the respective impacts after mitigation. It is also anticipated that with proper implemented mitigation measures as proposed, the system will recover within a short period of time.

Nature: Increased flows during the operation phase of the proposed facility and associated infrastructure: GN 544, 18 June 2010 activity 10 (i); GN 544, 18 June 2010 Activity 22(ii) and GN 545, 18 June activity 1)		
	Without mitigation	***With mitigation***
Extent	High (5)	Medium (3)
Duration	Permanent (5)	Medium-term (3)
Magnitude	High (10)	Medium (4)
Probability	Definite (5)	Probable (3)
Significance	**High (100)**	**Low (30)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	
Mitigation: No discharge of any treated or untreated water may take place on site unless authorised by the DWA. The increased soil moisture due to washing of PV arrays is likely to encourage establishment of grass under the PV arrays and should thus be seen as a positive impact. A stormwater management plan must be compiled to address this, i.e. how additional water generated on site will be managed without compromising the receiving watercourses.		
Cumulative Impacts All wetlands located within the proposed PV plant, associated construction and operational activities as well as substation footprint will be lost. This is likely to indirectly impact on the wetland areas outside the footprint which fall within the same catchment area as the wetland areas to be lost. As such there will be a number of wetland systems that will be lost in the region including a number of directly affected depressions, seepage areas and valley bottom wetland systems. This will contribute to cumulative loss of wetland habitat within the region.		
Residual Impacts The residual impacts due to increased flows during construction to the remaining systems are expected to be low due to low significance of the respective impacts after mitigation. It is also anticipated that with proper implemented mitigation measures as proposed, the system will recover within a short period of time.		

Nature: Stormwater discharge during the operation phase of the proposed facility and associated infrastructure: GN 544, 18 June 2010 activity 10 (i); GN 544, 18 June 2010 Activity 22(ii) and GN 545, 18 June activity 1)

The discharge of stormwater is likely to occur as a point source discharge and be of higher velocity and concentration than pre-development flows and thus poses a significant erosion risk at the point of discharge. There is no drainage line leaving the site that could be used to discharge stormwater into as the site is located within an endorheic area. The stormwater would thus need to be discharged into terrestrial areas or the unchannelled valley bottom system downstream of the proposed site.

	Without mitigation	***With mitigation***
Extent	High (4)	Medium (3)
Duration	Permanent (5)	Medium-term (3)
Magnitude	High (10)	Medium (4)
Probability	Definite (5)	Probable (3)
Significance	**High (95)**	**Low (30)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	

Mitigation:

» A detailed stormwater management plan must form part of the proposed development plan.
» The direct infiltration of rainwater into the soil should be encouraged to minimise generation of stormwater runoff.
» Stormwater discharge points must be suitably protected against erosion through use of, for example, Reno-mattresses, energy dissipaters etc.

Cumulative Impacts

All wetlands located within the proposed PV plant, associated construction and operational activities as well as substation footprint will be lost. This is likely to indirectly impact on the wetland areas outside the footprint which fall within the same catchment area as the wetland areas to be lost. As such there will be a number of wetland systems that will be lost in the region including a number of directly affected depressions, seepage areas and valley bottom wetland systems. This will contribute to cumulative loss of wetland habitat within the region.

Residual Impacts

The residual impacts due to loss and disturbance of wetland habitats are high, specifically within the area directly affected by the footprint of the proposed PV plant and associated infrastructures. This is because opportunities for onsite mitigation of wetland habitat loss are not feasible.

b) Implications for Project Implementation

» Most of the wetland systems on site are considered to still be in a largely natural to moderately modified state, with the only exception being the pan below the homestead which is considered moderately to largely modified.
» In conclusion development of the proposed Solar Energy facility is expected to result in a number of impacts to the wetlands, most notably the expected loss of wetland habitat and biodiversity where the delineated wetlands fall within the footprints of the proposed development.

6.1.4 Potential Impacts and Soils and Agricultural Potential

The soils on site are predominantly deep, well-drained, yellow, sandy soils of the Clovelly soil form. Included in this land type however are numerous pans, which, according to the land type data, occupy approximately 3% of the land type. On the proposed site, pans are more common and occupy more than the 3% average for the land type. The soils of land type Db1, which surrounds the site, are similar to those of the pans within land type Ae39. These are shallower, more clay-rich soils where internal drainage is seriously limited by an underlying clay horizon (G horizon). They are associated with low-lying, wetter areas. These soils are not suitable for cultivation, and their presence amongst the other soils decreases the agricultural suitability of the land and the effectiveness with which it can be cultivated, as they divide up suitable areas into patches.

a) Summary of impacts associated with the proposed solar energy facility during the construction and operational phase

Nature: Loss of topsoil: GN 544, 18 June 2010 activity 10 (i); GN 544, 18 June 2010 Activity 22(ii) and GN 545, 18 June activity 1). Caused by: poor topsoil management (burial, erosion, etc.) during construction related soil profile disturbance (levelling, excavations, disposal of spoils from excavations etc.) Having the effect of: loss of soil fertility on disturbed areas after rehabilitation.		
	Without mitigation	***With mitigation***
Extent	Low (1) - Site	Low (1) - Site
Duration	Short (2)	Short (2)
Magnitude	Minor (2)	Small (1)
Probability	Highly probable (4)	Very improbable (1)
Significance	**20 (Low)**	**4 (Low)**
Status	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation: » Strip and stockpile topsoil from all areas where soil will be disturbed. » After cessation of disturbance, re-spread topsoil over the surface. » Dispose of any sub-surface, clay spoils from excavations where they will not impact on agricultural land, or where they can be effectively covered with topsoil.		
Cumulative impacts: None		
Residual impacts: None		

Nature: Loss of agricultural land use: GN 544, 18 June 2010 activity 10 (i); GN 544, 18 June 2010 Activity 22(ii) and GN 545, 18 June activity 1)Caused by: direct occupation of land by footprint of energy facility infrastructure;

Having the effect of: taking affected portions of land out of agricultural production (grazing in this instance).		
	Without mitigation	***With mitigation***
Extent	Low (1) - Site	Low (1) - Site
Duration	Long term (4)	Long term (4)
Magnitude	Minor (3)	Minor (3)
Probability	Definite (5)	Definite (5)
Significance	**40 (Medium)**	**40 (Medium)**
Status	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	No	
Cumulative impacts: The overall loss of agricultural land in the region due to other developments. The significance is low due to the limited agricultural potential of the solar panel site.		
Residual impacts: No mitigation possible. Therefore residual impacts are the same as impacts without mitigation.		

Nature: Soil Erosion: GN 544, 18 June 2010 activity 10 (i); GN 544, 18 June 2010 Activity 22(ii) and GN 545, 18 June activity 1)Caused by: alteration of run-off characteristics due to panel surfaces and access roads; And having the effect of: loss and deterioration of soil resources.		
Comment: There is low risk of erosion due to the very gentle slopes.		
	Without mitigation	***With mitigation***
Extent	Low (1) - Site	Low (1) - Site
Duration	Long term (4)	Long term (4)
Magnitude	Minor (3)	Small (1)
Probability	improbable (2)	Very improbable (1)
Significance	**16 (Low)**	**6 (Low)**
Status	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation: Implement an effective system of run-off control which collects and disseminates run-off water from hardened surfaces and prevents potential down slope erosion. This should be in place and maintained during all phases of the development.		
Cumulative impacts: None		
Residual impacts: Low		

Nature: Generation of multiple land use income: GN 544, 18 June 2010 activity 10 (i);

GN 544, 18 June 2010 Activity 22(ii) and GN 545, 18 June activity 1)Caused by: the multiple land use of energy facility rental on less agriculturally suitable land combined with cultivation on more suitable land; And having the effect of: providing land owners with increased cash flow to support agricultural activities.		
	Without mitigation	***With mitigation***
Extent	Low (1) - Site	Low (1) - Site
Duration	Long term (4)	Long term (4)
Magnitude	Low (4)	Low (4)
Probability	Probable (3)	Highly probable (4)
Significance	**Low (27)**	**Medium (36)**
Status	Positive	Positive
Reversibility	High	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	To a limited extent	
Mitigation: Continue utilization of the additional parts of the farm for cultivation and stock farming during the operation of the energy facility.		
Cumulative impacts: None		
Residual impacts: None		

b) Implications for Project Implementation

» The development will have low to medium negative impact on agricultural resources and productivity, but it will also deliver low to medium positive impacts on agriculture.

» The productive cultivation which takes place on the more agriculturally suitable parts of the farm will be able to continue unchanged for the duration of and after the project.

» The significance of agricultural impacts is influenced by the fact that the solar panel sites have limited agricultural potential. The entire farm has a land capability classification of class 4, marginal potential arable land, but the soils on the solar panel site are less viable for cultivation than those on the western part of the farm. This has been confirmed by the landowner.

» Soils that are suitable for cultivation on the farm are deep, yellow, sandy, well-drained soils predominantly of the Clovelly soil form. Those that are unsuited are soils that are limited in depth by dense clay in the subsoil, and poor drainage and are predominantly of the Katspruit soil form.

6.1.5 Assessment of Potential Impacts on Heritage

One cultural site consisting of a cemetery was identified during the survey. This site is located on the northern periphery of the development footprint inside the 50 meter buffer zone from the 132 kV line (refer to **Figure 6.2**). The site will not be directly impacted by the proposed facility or associated infrastructure.

a) Heritage impacts associated with the construction and operation phase of the proposed facility

Nature: Destruction to heritage materials: GN 544, 18 June 2010 activity 10 (i); GN 544, 18 June 2010 Activity 22(ii) and GN 545, 18 June activity 1)		
	Without mitigation	***With mitigation***
Extent	Local (2)	Local (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	Low (8)	Low (6)
Probability	Improbable (1)	Improbable (1)
Significance	**Low (15)**	**Low (12)**
Status (positive or negative)	Negative	Negative
Reversibility	Not reversible	Not reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	
Mitigation: There is no direct impact foreseen on site 1 as it is located within the power line buffer zone, but it is recommended that the site should be demarcated to protect it during construction.		
Cumulative impacts: Archaeological and cultural sites are non-renewable and impact on any archaeological context or material will be permanent and destructive. Multiple developments in an area could result in cumulative impacts on this resource.		
Residual Impacts: Loss of heritage resources		

b) Implications for Project Implementation

» One site of heritage significance was identified during the survey, i.e. an informal cemetery.
» The site consists of at least 50 graves with the oldest visible date 1978. The site is located on the northern periphery of the development footprint falling within a 50 meter buffer zone of an existing power line that will facilitate protection of the site.
» Therefore no direct impact is foreseen on the site by the proposed development.

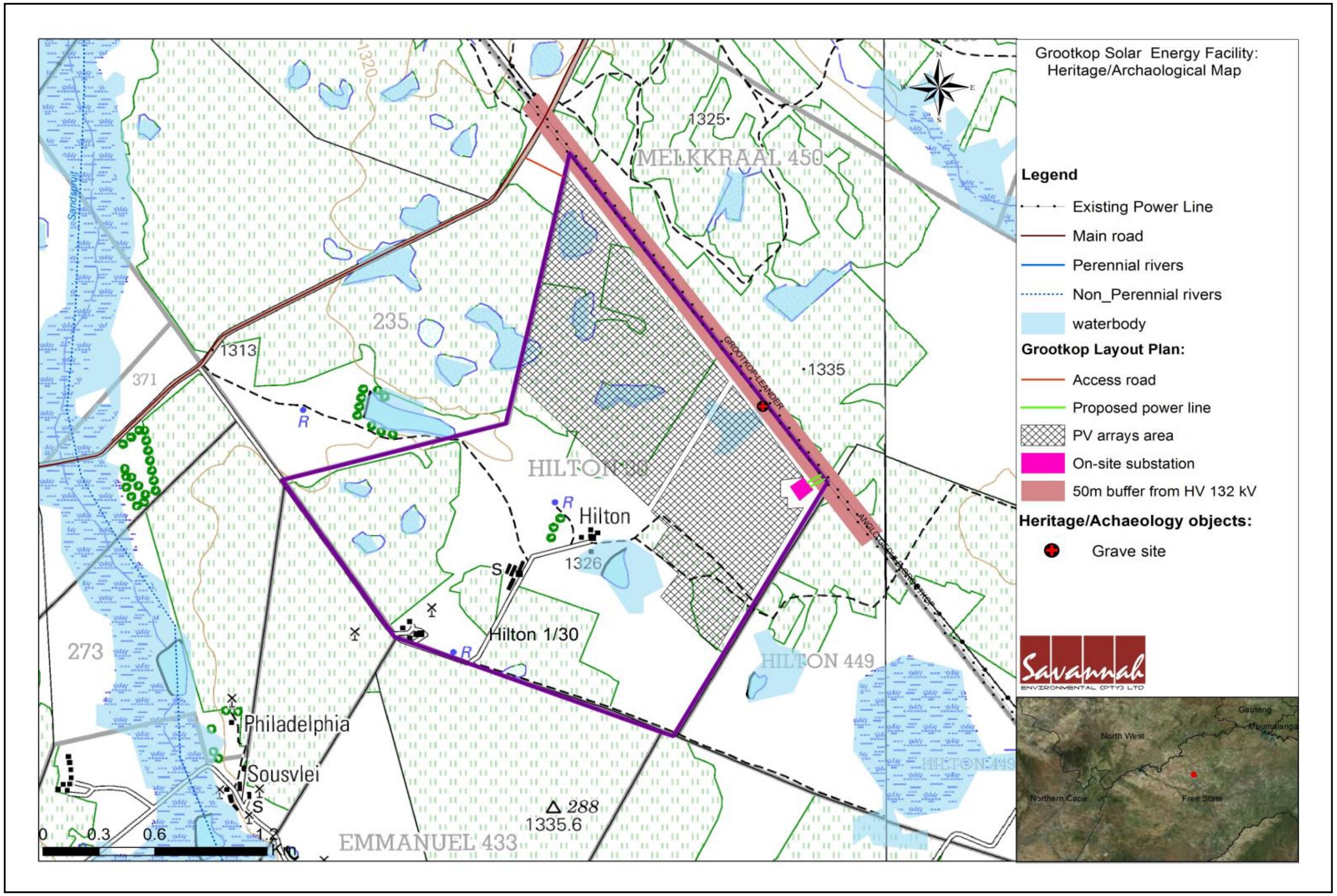

Figure 6.2: Distribution of heritage resources within the proposed Grootkop solar energy facility and in relation to the proposed development footprint

6.1.6 Assessment of Potential Visual Impacts

The result of the viewshed analyses for the proposed facility is shown in **Figure 6.3**. The viewshed analyses were undertaken from a number of vantage points within the proposed development area at an offset of 4m above average ground level. This was done in order to determine the general visual exposure (visibility) of the area under investigation, simulating the maximum height of the proposed structures (PV panels) associated with the facility.

» It is evident from the preliminary viewshed analyses that the proposed facility would have a fairly large area of potential visibility (i.e. within an 8km radius of the site), especially to the lower lying areas west of the site. This area of exposure is generally restricted to vacant farmland and agricultural fields, but may contain some potentially sensitive visual receptors. This pattern of exposure is generally attributed to the flat topography of the study area, with no hills or ridges influencing or interrupting the viewshed analysis.
» Theoretical visibility within a 2km radius of the facility includes mainly vacant land or agricultural fields and a section of the secondary road traversing between Nyakallong and farms located north-east of the site.
» Visibility between the 2-4km radii includes sections of the abovementioned secondary road as well as farm residences located south-west of the site. These include: *Philadelphia, Sousvlei* and *Weltevrede*.
» Visibility subsides considerably beyond a 4km radius with only limited exposure expected to the south-west and north-west of the site. This zone includes sections of the towns of Kutlwanong, Odendaalsrus and Nyakallong. However, the built-up nature of these areas and the occurrence of built structures and associated visual clutter are expected to virtually nullify the potential visual exposure, or at the very least restrict it to the outlying areas of these towns.
» Visibility beyond 8km from the proposed development is expected to be negligible and highly unlikely due to the distance between the object (development) and the observer.

It is envisaged that the structures (where visible from shorter distances) may constitute a high visual prominence, potentially resulting in a high visual impact.

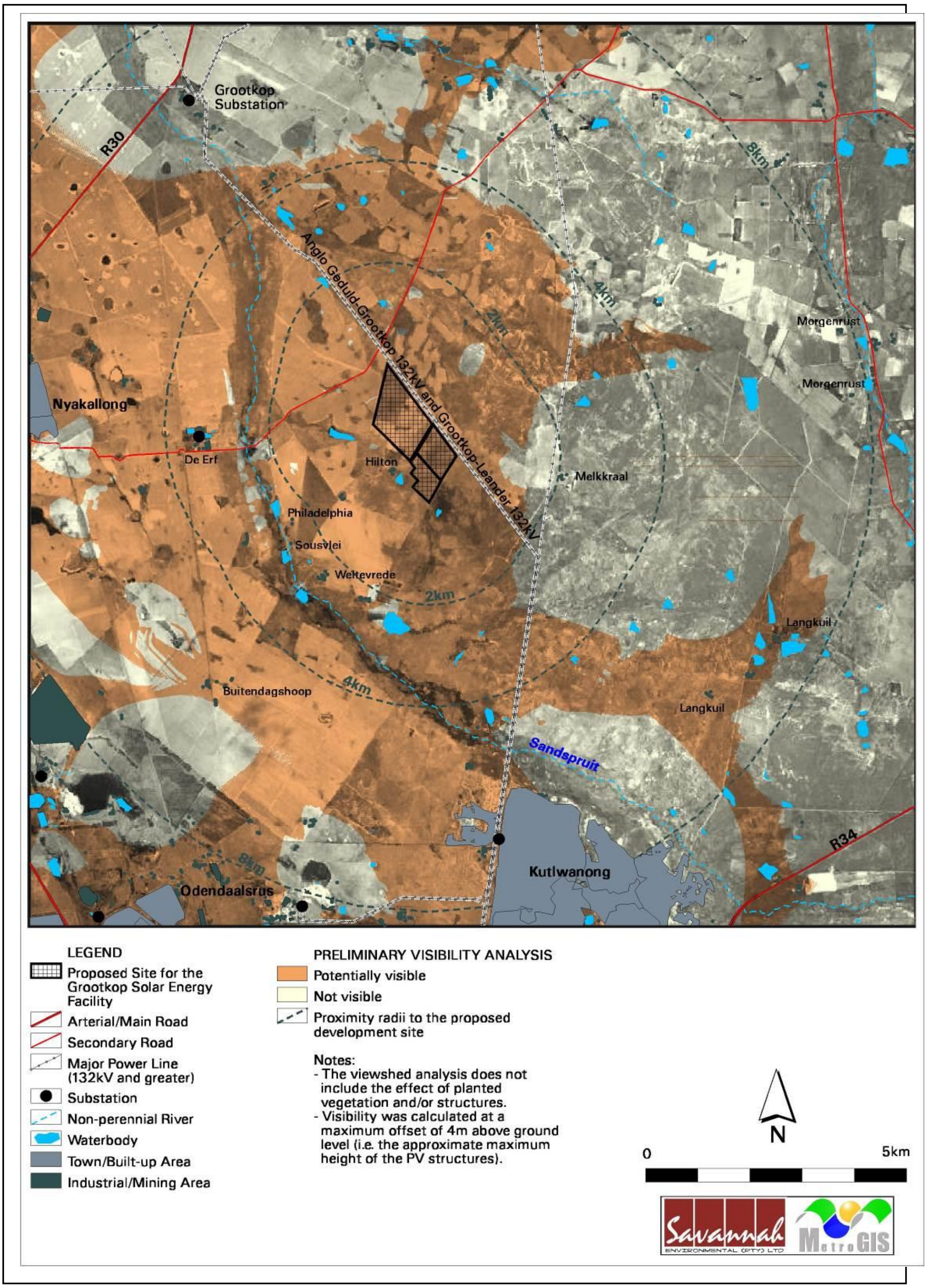

Figure 6.3: Viewshed generated for the proposed Grootkop Solar Energy Facility

Visual impact index

The combined results of the visual exposure, viewer incidence/perception and visual distance of the proposed solar energy facility are displayed on **Figure 6.4**.

The quantitative analyses of possible impact have been integrated as a visual impact index. The sum of values assigned for each visual impact parameter is used to identify and visualise areas of high, moderate and low visual impact. Typically a location with close proximity to the proposed facility, a high viewer incidence, a predominantly negative perception and high visual exposure would have a high value on the index, thereby signifying a high visual impact. The following is of relevance:

» The visual impact index map indicates a core zone of **moderate** visual impact within a 2km radius from the facility, where the facility may be visible from land generally devoid of sensitive visual receptors (i.e. vacant natural land or agricultural fields).

  Where sensitive visual receptors occur within the 2km radius from the facility and exposure is likely, the visual impact is anticipated to be **high** due to the relative close proximity of the observer to the solar energy facility. This zone includes sections of the secondary road traversing north-west of the facility.

  Homesteads and residences located within this zone only include the residences *(Hilton)* located on the farm earmarked for the development. The assumption is that the residents of these homesteads are supportive of the proposed PV development and is not expected to be negatively influenced thereby.

  The extent of potential visual impact within the 2km to 4km zone from the solar energy facility is restricted to the north, south and west of the facility. This area is expected to have a **low** visual impact, where sensitive visual receptors are generally absent, but may be **moderate** where observers are present. Homesteads and residences located within this zone include: *De Erf, Philadelphia, Sousvlei and Weltevrede* (all located west or south-west of the facility.

  The visual impact beyond 4km and up to 8km from the solar energy facility, is expected to be **very low**, but may potentially be **low** where observers are present. There are a number of homesteads located within this zone, as well as the built-up areas of Kutlwanong and Nyakallong.

» Visibility beyond 8km from the proposed development is expected to have a **negligible** visual impact.

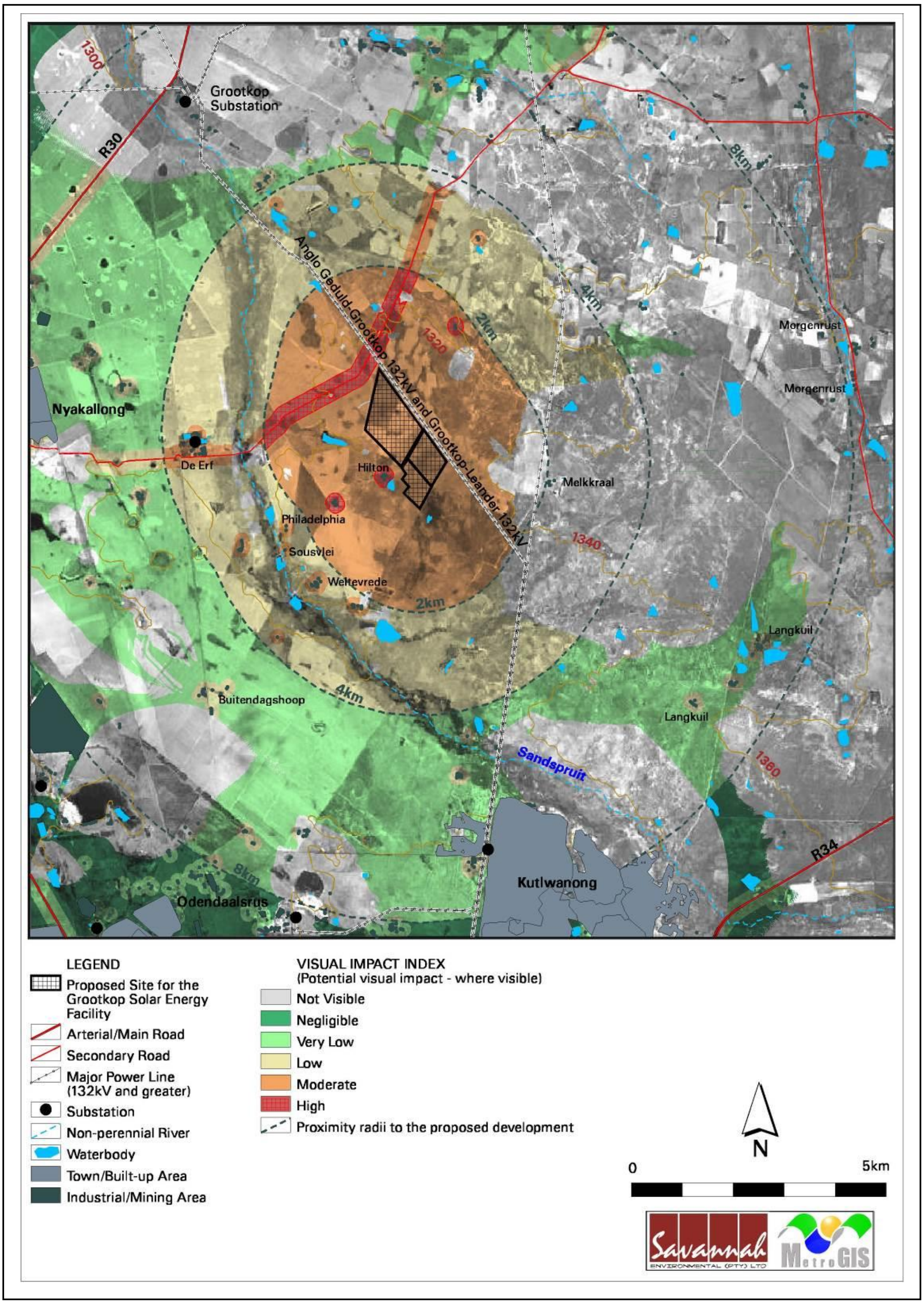

Figure 6.4: Visual impact index of the proposed Grootkop Solar Energy Facility

a) Impact tables summarising the significance of visual impacts of the PV facility during the construction and operation

<table>
<tr><td colspan="3">Nature of Impact:
Visual impact on users of arterial and secondary roads in close proximity to the proposed Solar Energy Facility: GN 544, 18 June 2010 activity 10 (i); GN 544, 18 June 2010 Activity 22(ii) and GN 545, 18 June activity 1)</td></tr>
<tr><td></td><td>No mitigation</td><td>Mitigation considered</td></tr>
<tr><td>Extent</td><td>Local (4)</td><td>Local (4)</td></tr>
<tr><td>Duration</td><td>Long term (4)</td><td>Long term (4)</td></tr>
<tr><td>Magnitude</td><td>High (8)</td><td>Low (4)</td></tr>
<tr><td>Probability</td><td>Probable (3)</td><td>Improbable (2)</td></tr>
<tr><td>Significance</td><td>Moderate (48)</td><td>Low (24)</td></tr>
<tr><td>Status (positive, neutral or negative)</td><td>Negative</td><td>Negative</td></tr>
<tr><td>Reversibility</td><td>Recoverable (3)</td><td>Recoverable (3)</td></tr>
<tr><td>Irreplaceable loss of resources?</td><td>No</td><td>No</td></tr>
<tr><td>Can impacts be mitigated?</td><td colspan="2">Yes</td></tr>
<tr><td colspan="3">General mitigation/management:
<u>Planning:</u>
» Retain and maintain natural vegetation in all areas outside of the development footprint.
<u>Operations:</u>
» Maintain the general appearance of the facility as a whole.
<u>Decommissioning:</u>
» Remove infrastructure not required for the post-decommissioning use of the facility.
» Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications.
» Monitor rehabilitated areas post-decommissioning and implement remedial actions.

Site specific mitigation measures:
» Plant vegetation barriers along the north-western border of the SEF in order to shield the structures from observers travelling along this road.</td></tr>
<tr><td colspan="3">Cumulative impacts:
The construction of the solar energy facility is expected to increase the cumulative visual impact within the region, considering the visual exposure of the power line infrastructure already present at this locality. Alternatively, the close proximity of the proposed site to the existing visual disturbances (power lines) allows for the effective connection with the power grid without incurring any additional expanded visual impacts.</td></tr>
</table>

Residual impacts:
The visual impact will be removed after decommissioning, provided the solar energy facility infrastructure is removed and the site is rehabilitated to its original (current) status. Failing this, the visual impact will remain.

Nature of Impact: Visual impact on residents of homesteads and settlements in close proximity to the proposed solar energy facility: GN 544, 18 June 2010 activity 10 (i); GN 544, 18 June 2010 Activity 22(ii) and GN 545, 18 June activity 1) The potential visual impact on residents of homesteads in close proximity to the SEF is expected to be of **moderate** significance. The residences in question are *De Erf* (3.2km from the SEF), *Philadelphia* (2.4km), *Sousvlei* (2.6km) and *Weltevrede* (2.4km) west and south-west of the proposed development site. Residences located on the farm earmarked for the development are not included in this assessment.		
	No mitigation	***Mitigation considered***
Extent	Local **(4)**	Local **(4)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Moderate **(6)**	Low **(4)**
Probability	Probable **(3)**	Improbable **(2)**
Significance	Moderate **(42)**	Low **(24)**
Status (positive, neutral or negative)	Negative	Negative
Reversibility	Recoverable **(3)**	Recoverable **(3)**
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
General mitigation/management: <u>Planning:</u> » Retain and maintain natural vegetation in all areas outside of the development footprint. <u>Operations:</u> » Maintain the general appearance of the facility as a whole. <u>Decommissioning:</u> » Remove infrastructure not required for the post-decommissioning use of the facility. » Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications. » Monitor rehabilitated areas post-decommissioning and implement remedial actions. ***Site specific mitigation measures:*** » Plant vegetation barriers along the western and south-western borders of the SEF in order to shield the structures from observers residing at the abovementioned homesteads.		

Cumulative impacts: The construction of the solar energy facility is expected to increase the cumulative visual impact within the region, considering the visual exposure of the power line infrastructure already present at this locality. Alternatively, the close proximity of the proposed site to the existing visual disturbances (power lines) allows for the effective connection with the power grid without incurring any additional expanded visual impacts.
Residual impacts: The visual impact will be removed after decommissioning, provided the solar energy facility infrastructure is removed and the site is rehabilitated to its original (current) status. Failing this, the visual impact will remain.

Nature of Impact: Visual impact on sensitive visual receptors within the region: GN 544, 18 June 2010 activity 10 (i); GN 544, 18 June 2010 Activity 22(ii) and GN 545, 18 June activity 1) The visual impact on the users of roads (R30) and the residents of towns (Nyakallong and Kutlwanong), settlements and homesteads within the region (i.e. beyond the 4km radius) is expected to be **low** for the proposed solar energy facility, both before and after the implementation of mitigation measures.		
	No mitigation	***Mitigation considered***
Extent	Regional **(3)**	Regional **(3)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Low **(4)**	Low **(4)**
Probability	Improbable **(2)**	Very Improbable **(1)**
Significance	Low **(22)**	Low **(11)**
Status (positive, neutral or negative)	Negative	Negative
Reversibility	Recoverable **(3)**	Recoverable **(3)**
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
General mitigation/management: Planning: » Retain and maintain natural vegetation in all areas outside of the development footprint. Operations: » Maintain the general appearance of the facility as a whole. Decommissioning: » Remove infrastructure not required for the post-decommissioning use of the facility. » Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications. » Monitor rehabilitated areas post-decommissioning and implement remedial actions. ***Site specific mitigation measures:*** » Plant vegetation barriers along the western and south-western borders of the solar energy facility in order to shield the structures from observers residing at		

the abovementioned homesteads, settlements and towns.
Cumulative impacts: The construction of the solar energy facility is expected to increase the cumulative visual impact within the region, considering the visual exposure of the power line infrastructure already present at this locality. Alternatively, the close proximity of the proposed site to the existing visual disturbances (power lines) allows for the effective connection with the power grid without incurring any additional expanded visual impacts.
Residual impacts: The visual impact will be removed after decommissioning, provided the SEF infrastructure is removed and the site is rehabilitated to its original (current) status. Failing this, the visual impact will remain.

Nature of Impact: Visual impact of lighting on sensitive visual receptors: GN 544, 18 June 2010 activity 10 (i); GN 544, 18 June 2010 Activity 22(ii) and GN 545, 18 June activity 1) Lighting impacts relate to the effects of glare and sky glow. The source of glare light is unshielded luminaries which emit light in all directions and which are visible over long distances. Sky glow is the condition where the night sky is illuminated when light reflects off particles in the atmosphere such as moisture, dust or smog. The sky glow intensifies with the increase in the amount of light sources. Each new light source, especially upwardly directed lighting, contribute to the increase in sky glow. It is possible that the PV plant may contribute to the effect of sky glow within the environment which is currently undeveloped.		
	No mitigation	***Mitigation considered***
Extent	Local **(4)**	Local **(4)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	High **(8)**	Moderate **(6)**
Probability	Probable **(3)**	Improbable **(2)**
Significance	Moderate **(48)**	Low **(28)**
Status (positive, neutral or negative)	Negative	Negative
Reversibility	Recoverable **(3)**	Recoverable **(3)**
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation: Planning: » Shielding the sources of light by physical barriers (walls, vegetation, or the structure itself); » Limiting mounting heights of lighting fixtures, or alternatively using foot-lights or bollard level lights; » Making use of minimum lumen or wattage in fixtures; » Making use of down-lighters, or shielded fixtures; » Making use of Low Pressure Sodium lighting or other types of low impact lighting. » Making use of motion detectors on security lighting. This will allow the site to remain		

in relative darkness, until lighting is required for security or maintenance purposes
Cumulative impacts: The development of the facility will contribute to an increase in light sources within the region, and as a result an increase in lighting impact at night.
Residual impacts: The visual impact will be removed after decommissioning, provided the facility and ancillary infrastructure is removed. Failing this, the visual impact will remain.

c) Implications for Project Implementation

» The solar energy facility could potentially have a **moderate** visual impact on road users travelling along the secondary road traversing north of the facility. This impact may be mitigated to **low**.
» The potential visual impact on residents of homesteads in close proximity to the solar energy facility is expected to be of **moderate** significance and may be mitigated to **low** significance.
» The visual impact on the users of roads and the residents of towns, settlements and homesteads within the region (i.e. beyond the 4km radius) is expected to be **low** for the proposed solar energy facility, both before and after the implementation of mitigation measures.
» The potential visual impact of construction activities on sensitive visual receptors within close proximity to the proposed solar energy facility is likely to be of **moderate** significance, and may be mitigated to **low**.
» The potential visual impact associated with lighting at the facility at night (especially glare) is expected to be of **moderate** significance and may be mitigated to **low**.

The anticipated visual impacts listed above (post mitigation measures) are expected to be of low significance and the solar energy facility development is not considered to be fatally flawed from a visual perspective.

6.1.7 Assessment of Potential Social Impacts

a) Social Impacts - Construction Phase

Impacts associated with the construction phase of a project are usually of a short duration, temporary in nature, but could have long term effects on the surrounding environment. The operational life of a PV facility is between 20 - 25 years, after which the facility would possibly be upgraded to continue its lifespan if feasible, or decommissioned. The impacts usually associated with the operational phase are therefore perceived by affected parties to be more severe.

Nature: Creation of employment and business opportunities during the construction phase: GN 544, 18 June 2010 activity 10 (i); GN 544, 18 June 2010 Activity 22(ii) and GN 545, 18 June activity 1)

	Without Mitigation	***With Enhancement***
Extent	Local – Regional (2)	Local – Regional (3)
Duration	Short Term (2)	Short Term (2)
Magnitude	Low (4)	Low (4)
Probability	Highly probable (4)	Highly probable (4)
Significance	**Medium (32)**	**Medium (36)**
Status	Positive	Positive
Reversibility	N/A	N/A
Irreplaceable loss of resources?	N/A	N/A
Can impact be enhanced?	Yes	
Enhancement : Opportunity to up-grade and improve skills levels in the area.		
Cumulative impacts: Opportunity to up-grade and improve skills levels in the area.		
Residual impacts: Improved pool of skills and experience in the local area.		

Nature: Potential impacts on family structures and social networks associated with the presence of construction workers: GN 544, 18 June 2010 activity 10 (i); GN 544, 18 June 2010 Activity 22(ii) and GN 545, 18 June activity 1)		
	Without Mitigation	***With Mitigation***
Extent	Local (2)	Local (1)
Duration	Medium Term for community as a whole (3) Long term-permanent for individuals who may be affected by STDs etc. (5)	Medium Term for community as a whole (3) Long term-permanent for individuals who may be affected by STDs etc. (5)
Magnitude	Low for the community as a whole (4) High-Very High for specific individuals who may be affected by STDs etc. (10)	Low for community as a whole (4) High-Very High for specific individuals who may be affected by STDs etc. (10)
Probability	Probable (3)	Probable (3)
Significance	**Low for the community as a whole (27)** **Moderate-High for specific individuals who may be affected by STDs etc. (57)**	**Low for the community as a whole (24)** **Moderate-High for specific individuals who may be affected by STDs etc. (51)**
Status	Negative	Negative
Reversibility	No in case of HIV and AIDS	No in case of HIV and AIDS
Irreplaceable loss of resources?	Yes, if people contract HIV/AIDS. Human capital plays a critical role in communities that rely on farming for their livelihoods	

Can impact be mitigated?	Yes, to some degree. However, the risk cannot be eliminated	

Mitigation:

- Where possible, the proponent should make it a requirement for contractors to implement a 'locals first' policy for construction jobs, specifically semi and low-skilled job categories. This will reduce the potential impact that this category of worker could have on local family and social networks;
- The proponent should consider the establishment of a Monitoring Forum (MF) for the construction phase. The MF should be established before the construction phase commences and should include key stakeholders, including representatives from the local community, local councillors, farmers, and the contractor. The role of the MF would be to monitor the construction phase and the implementation of the recommended mitigation measures. The MF should also be briefed on the potential risks to the local community associated with construction workers;
- The proponent and the contractors should, in consultation with representatives from the MF, develop a Code of Conduct for the construction phase. The code should identify what types of behaviour and activities by construction workers are not permitted. Construction workers that breach the code of good conduct should be dismissed. All dismissals must comply with the South African labour legislation;
- The proponent and the contractor should implement an HIV/AIDS awareness programme for all construction workers at the outset of the construction phase;
- The movement of construction workers on and off the site should be closely managed and monitored by the contractors. In this regard the contractors should be responsible for making the necessary arrangements for transporting workers to and from site on a daily basis;
- The contractor should make necessary arrangements to enable workers from outside the area to return home over weekends and or on a regular basis during the 18 month construction phase. This would reduce the risk posed by non-local construction workers to local family structures and social networks;
- The contractor should make the necessary arrangements for ensuring that all non-local construction workers are transported back to their place of residence once the construction phase is completed. This would reduce the risk posed by non-local construction workers to local family structures and social networks;
- As per the agreement with the local farmers in the area, no construction workers, will be permitted to stay overnight on the site. Security personnel will be housed in the vicinity of the site.

Cumulative impacts:

Impacts on family and community relations that may, in some cases, persist for a long period. Also in cases where unplanned / unwanted pregnancies occur or members of the community are infected by an STD, specifically HIV and/ or AIDS, the impacts may be permanent and have long term to permanent cumulative impacts on the affected individuals and/or their families and the community. The development of other solar energy (and other) projects in the area may exacerbate these impacts.

Residual impacts:

Community members affected by STDs etc. and associated impact on local community and burden on services etc.

Nature: Potential safety and security risk posed by presence of construction workers on site: GN 544, 18 June 2010 activity 10 (i); GN 544, 18 June 2010 Activity 22(ii) and GN 545, 18 June activity 1)		
	Without Mitigation	***With Mitigation***
Extent	Local (2)	Local (1)
Duration	Short Term (2)	Short Term (2)
Magnitude	Moderate (6)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	**Medium (30)**	**Low (21)**
Status	Negative	Negative
Reversibility	No, if local residents are murdered or physically harmed	No, if local residents are murdered or physically harmed
Irreplaceable loss of resources?	Yes, if family member is murdered	Yes, if family member is murdered
Can impact be mitigated?	Yes	Yes
Mitigation: » The proponent should liaise with the MLM with regard the need to establish a Monitoring Forum (MF) for the construction phase. The MF should be established before the construction phase commences and should include key stakeholders, including representatives from MLM, the local community, local councillors, and the contractor. The role of the MF would be to monitor the construction phase and the implementation of the recommended mitigation measures. The MF should also be briefed on the potential risks to the local community associated with construction workers; » The proponent and the contractors should, in consultation with representatives from the MF, develop a Code of Conduct for the construction phase. The code should identify what types of behaviour and activities by construction workers are not permitted. Construction workers that breach the code of good conduct should be dismissed. All dismissals must comply with the South African labour legislation; » The movement of construction workers on and off the site should be closely managed and monitored by the contractors. In this regard the contractors should be responsible for ensuring that construction workers respect the rights of local farmers and do not pose safety and security threat to them and their families.		
Cumulative impacts: Increase in safety and security around the site and neighbouring areas		
Residual impacts: Include psychological effects associated with attacks or crime related events that may last for many years.		

Nature: Potential loss of livestock, crops and houses, damage to farm infrastructure and threat to human life associated with increased incidents of veld fires: GN 544, 18 June 2010 activity 10 (i); GN 544, 18 June 2010 Activity 22(ii) and GN 545, 18 June activity 1)		
	Without Mitigation	***With Mitigation***

Extent	Local (4) (Rated as 4 due to potential severity of impact on local farmers)	Local (2) (Rated as 2 due to potential severity of impact on local farmers)
Duration	Short Term (2)	Short Term (2)
Magnitude	Moderate due to reliance on livestock for maintaining livelihoods (6)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	**Medium (36)**	**Low (24)**
Status	Negative	Negative
Reversibility	Yes, compensation paid for stock and losses and damage etc.	
Irreplaceable loss of resources?	No	No
Can impact be mitigated?	Yes	

Mitigation:

» Contractor should ensure that open fires on the site for cooking or heating are not allowed except in designated areas;

» No smoking on the site, except in designated areas should be permitted;

» Contractor should ensure that construction related activities that pose a potential fire risk, such as welding, are properly managed and are confined to areas where the risk of fires has been reduced. Measures to reduce the risk of fires include clearing working areas and avoiding working in high wind conditions when the risk of fires is greater. In this regard special care should be taken during the high risk dry, windy winter months;

» Contractor should provide adequate fire fighting equipment on-site;

» Contractor should provide fire-fighting training to selected construction staff;

» As per the conditions of the Code of Conduct, in the advent of a fire being caused by construction workers and or construction activities, the appointed contractors must compensate farmers for any damage caused to their farms. The contractor should also compensate the fire fighting costs borne by farmers and local authorities.

Cumulative impacts:

None, provided losses are compensated for.

Residual impacts:

Potential loss of income and impact on livelihoods and economic viability of affected farms.

Nature: Potential noise, dust and safety impacts associated with movement of construction related traffic to and from the site: GN 544, 18 June 2010 activity 10 (i); GN 544, 18 June 2010 Activity 22(ii) and GN 545, 18 June activity 1)

	Without Mitigation	***With Mitigation***
Extent	Local-Regional (2)	Local-Regional (1)
Duration	Medium Term (3)	Medium Term (3)
Magnitude	Low (4)	Low (4)
Probability	Probable (3)	Probable (3)

Significance	**Low (27)**	**Low (24)**
Status	Negative	Negative
Reversibility	Yes	
Irreplaceable loss of resources?	No	No
Can impact be mitigated?	Yes	
Mitigation: » Abnormal loads should be timed to avoid times of the year when traffic volumes are likely to be higher, such as start and end of school holidays, long weekends and weekends in general etc. » The contractor must ensure that all damage caused to local farm roads by the construction related activities, including heavy vehicles, is repaired before the completion of the construction phase. The costs associated with the repair must be borne by the contractor. » Dust suppression measures must be implemented for heavy vehicles such as wetting of gravel roads on a regular basis and ensuring that vehicles used to transport sand and building materials are fitted with tarpaulins or covers. » All vehicles must be road-worthy and drivers must be qualified, made aware of the potential road safety issues, and need for strict speed limits.		
Cumulative impacts: If damage to roads is not repaired then this will affect the farming activities in the area and result in higher maintenance costs for vehicles of local farmers and other road users. The costs will be borne by road users who were not responsible for the damage.		
Residual impacts: Reduced quality of road surfaces and impact on road users		

Nature: The activities associated with the construction phase, such as establishment of access roads and the construction camp, movement of heavy vehicles and preparation of foundations for the PV facility, on site substation and power line may damage farmlands and result in a loss of farmlands for future farming activities: GN 544, 18 June 2010 activity 10 (i); GN 544, 18 June 2010 Activity 22(ii) and GN 545, 18 June activity 1)		
	Without Mitigation	***With Mitigation***
Extent	Local (3)	Local (1)
Duration	Long term-permanent if disturbed areas are not effectively rehabilitated or compensation is not paid (5)	Medium Term if damaged areas are rehabilitated (3)
Magnitude	Low (4)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	**Medium (36)**	**Low (28)**
Status	Negative	Negative
Reversibility	Yes, disturbed areas can be rehabilitated	Yes, disturbed areas can be rehabilitated
Irreplaceable loss of resources?	Yes, loss of farmland. However, disturbed areas can be rehabilitated	Yes, loss of farmland. However, disturbed areas can be rehabilitated

Can impact be mitigated?	Yes, however, loss of farmland cannot be avoided	Yes, however, loss of farmland cannot be avoided
Mitigation: » The footprint associated with the construction related activities (access roads, construction platforms, workshop etc.) should be minimised. » An Environmental Control Officer (ECO) should be appointed to monitor the construction phase. » All areas disturbed by construction related activities, such as access roads on the site, construction platforms, workshop area etc., should be rehabilitated at the end of the construction phase. » The implementation of a rehabilitation programme should be included in the terms of reference for the contractor/s appointed. The specifications for the rehabilitation programme should be drawn up a suitably qualified ecologist. » The implementation of the Rehabilitation Programme should be monitored by the ECO.		
Cumulative impacts: Overall loss of farmland could affect the livelihoods of the affected farmer, and the workers on the farm and their families. However, disturbed areas can be rehabilitated and loses would be off-set by compensation for the lease of the land.		
Residual impacts: Land would be available for farming once rehabilitation has been completed.		

b) <u>Social Impacts associated with the operational phase of the proposed facility</u>

Nature: Creation of employment and business opportunities associated with the operational phase: GN 544, 18 June 2010 activity 10 (i); GN 544, 18 June 2010 Activity 22(ii) and GN 545, 18 June activity 1)		
	Without Mitigation	***With Enhancement***
Extent	Local and Regional (1)	Local and Regional (2)
Duration	Long term (4)	Long term (4)
Magnitude	Moderate (6)	Moderate (6)
Probability	Probable (3)	Highly Probable (4)
Significance	**Medium (33)**	**Medium (48)**
Status	Positive	Positive
Reversibility	N/A	
Irreplaceable loss of resources?	No	
Can impact be enhanced?	Yes	
Enhancement » The proponent should implement a training and skills development programme for locals during the first 5 years of the operational phase. The aim of the programme should be to maximise the number of locals employed during the operational phase of the project.		

» The proponent, in consultation with the MLM, should investigate the opportunities for establishing a Community Trust (see above comments).
Cumulative impacts: Creation of permanent employment and skills and development opportunities for members from the local community and creation of additional business and economic opportunities in the area
Residual impacts: Creation of pool of people with experience in field of solar energy who are economically mobile

Nature: Establishment of a Community Trust funded by revenue generated from the sale of energy. The revenue can be used to fund local community development: GN 544, 18 June 2010 activity 10 (i); GN 544, 18 June 2010 Activity 22(ii) and GN 545, 18 June activity 1)		
	Without Mitigation	***With Enhancement***
Extent	Local and Regional (2)	Local and Regional (3)
Duration	Long term (4)	Long term (4)
Magnitude	Moderate (6)	Moderate (6)
Probability	Probable (3)	Definite (5)
Significance	**Medium (36)**	**High (65)**
Status	Positive	Positive
Reversibility	N/A	
Irreplaceable loss of resources?	No	
Can impact be enhanced?	Yes	
Enhancement: » The proponent in consultation with the MLM should establish criteria for identifying and funding community projects and initiatives in the area. The criteria should be aimed at maximising the benefits for the community as a whole and not individuals within the community; » The proponent in consultation with the MLM should ensure that strict financial management controls, including annual audits, should be implemented to ensure that the funds generated for the community trust from the SEF are managed for benefit of the community as a whole and not individuals within the community.		
Cumulative impacts: Promotion of social and economic development and improvement in the overall well-being of the community		
Residual impacts: Investment in local economic development in the area that would benefit the community post operational phase		

Nature: Promotion of clean, renewable energy: GN 544, 18 June 2010 activity 10 (i); GN 544, 18 June 2010 Activity 22(ii) and GN 545, 18 June activity 1)		
	Without Mitigation	***With Mitigation*** (The provision of renewable energy infrastructure is in

		itself a mitigation measure)
Extent	Local, Regional and National (4)	Local, Regional and National (4)
Duration	Long term (4)	Long term (4)
Magnitude	Low (4)	Low (4)
Probability	Highly Probable (4)	Highly Probable (4)
Significance	**Medium (48)**	**Medium (48)**
Status	Positive	Positive
Reversibility	Yes	
Irreplaceable loss of resources?	Yes, impact of climate change on ecosystems	
Can impact be mitigated?	Yes	
Enhancement: » Use the project to promote and increase the contribution of renewable energy to the national energy supply. » Implement a training and skills development programme for locals during the first 5 years of the operational phase. The aim of the programme should be to maximise the number of South African's employed during the operational phase of the project.		
Cumulative impacts: Reduction in carbon emissions via the use of renewable energy and associated benefits in terms of global warming and climate change.		
Residual impacts: Not applicable after decommissioning		

c) <u>Implication for project implementation</u>

» The findings of the SIA undertaken for the proposed Grootkop Solar Energy Facility indicate that the development will create employment and business opportunities for locals during both the construction and operational phases of the project.
» The establishment of a Community Trust will create an opportunity to support local economic development in the area.
» The development of renewable energy has also been identified as a key growth sector by the MLM and also represents an investment in clean, renewable energy infrastructure, which, given the challenges created by climate change, represents a positive social benefit for society as a whole.
» It is therefore recommended that the Grootkop Solar Energy Facility as proposed be supported, subject to the implementation of the recommended enhancement and mitigation measures contained in the SIA report.

6.1.8. Assessment of power line and substation

A new on-site substation will be constructed on the site to evacuate the power from the facility via a 132kV power line into the Eskom grid. The proposed site is located immediately south-west of the *Anglo Geduld-Grootkop 132kV* and *Grootkop-Leander 132kV* power lines. The power line required to link into the

Eskom grid will be ~80m in length and will be located entirely on the property affected by the solar facility. No adjacent properties will be traversed by the power line and substation.

Activity: Construction of a short power line as part of the grid connection: (GN 544, 18 June 2010 activity 10(i))		
Environmental Aspect: Limited removal of vegetation, compaction of soils, temporary or permanent damage to animal burrows		
Environmental impact: Loss of vegetation, increase in runoff and erosion, disturbance of burrowing animals		
	Without mitigation	***With mitigation***
Extent	Local (2)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Minor (2)	Small (0)
Probability	Definite (5)	Definite (5)
Significance	**Medium (40)**	**Low (25)**
Status (positive, neutral or negative)	Negative	Neutral to slightly negative
Reversibility	Partially reversible	Reversible
Irreplaceable loss of resources?	Probable	Not likely
Can impacts be mitigated?	Reasonably	
Mitigation: » After the final layout has been compiled, conduct a thorough footprint investigation to detect and map (by GPS) any protected plant species and animal burrows ▪ Protected plant species: must be relocated or obtain a permit where affected by pylons, maintenance tracks or construction ▪ Animal burrows: must be monitored by ECO prior to construction for activity/presence of animal species. If detected, such animals must be removed and relocated by a qualified professional/contractor » During construction: create designated servitude areas and strictly prohibit any off-road driving or parking of vehicles and machinery outside designated areas » Limit clearing of indigenous vegetation to pylon positions only » Prevent spillage of construction material, oils or other chemicals, strictly prohibit other pollution » Monitor the establishment of invasive species and remove as soon as detected, whenever possible before regenerative material can be formed		
Cumulative impacts: » Possible erosion of surrounding areas if no mitigation is implemented, no major cumulative impact on flora or fauna expected (excluding avifauna)		
Residual impacts: » Very localised alteration of soil surface characteristics		

Activity: Construction of substation and other electricity-related buildings, workshops, offices, guardhouses, etc. : (GN 544, 18 June 2010 activity 10(i))

Environmental Aspect: Removal of vegetation, compaction and alteration of topsoils, creation of runoff zone, redistribution and concentration of runoff from sealed surfaces, displacement of terrestrial vertebrates		
Environmental impact: Loss of vegetation and/or species of conservation concern, loss of microhabitats, altered and reduced vegetation cover, altered distribution of rainfall and resultant runoff patterns, increase in *concentrated* runoff from sealed surfaces and possibly higher accelerated erosion, reduction of habitat and resource availability for terrestrial fauna		
	Without mitigation	***With mitigation***
Extent	Local (2)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Moderate (6)	Minor (2)
Probability	Definite (5)	Definite (5)
Significance	**Medium (60)**	**Medium (35)**
Status (positive, neutral or negative)	Negative	Negative
Reversibility	Partially reversible	Reversible
Irreplaceable loss of resources?	Probable	Not likely
Can impacts be mitigated?	Reasonably	

Mitigation:

- » Avoid high sensitivity zones as far as possible
- » After the final layout has been compiled, conduct a thorough footprint investigation to detect and map (by GPS) any protected plant species and animal burrows
  - Protected plant species: must be relocated or obtain a permit
  - Animal burrows: must be monitored by ECO prior to construction for activity/presence of animal species. If detected, such animals must be removed and relocated by a qualified professional/contractor
- » Maintain a minimum buffer of 50 to 100 m from any drainage line or wetland
- » Limit disturbance to footprint area as far as practically possible
- » Place infrastructure as far as possible on sites that have been already transformed
- » During construction: stay within demarcated footprint areas and strictly prohibit any off-road driving or parking of vehicles and machinery outside designated areas
- » Prevent spillage of construction material and other pollutants, contain and treat any spillages immediately
- » Topsoil (the upper 25 cm of soil) is an important natural resource; where it must be stripped, never mix it with subsoil or any other material, store and protect it separately until it can be re-applied, minimise handling of topsoil
- » Temporarily stored topsoil must be re-applied within 6 months. Topsoils stored for longer need to be managed according to a detailed topsoil management plan
- » Rehabilitate and re-vegetate all areas outside footprint area that have been disturbed
- » After decommissioning remove all foreign material prior to starting the rehabilitation
- » The rehabilitation plan for all temporarily affected areas and for the development area after decommissioning must aim to re-introduce all non-weed indigenous species listed in the specialist report as a minimum, taking the observed original cover percentages as a guideline of acceptable vegetation cover
- » Monitor the establishment of invasive species and remove as soon as detected, whenever possible before regenerative material can be formed

Cumulative impacts: » If mitigation measures are not strictly followed the following could occur: ▪ erosion of areas around sealed surfaces and continued erosion of the development area with associated siltation and/or erosion of lower-lying wetlands ▪ contamination of drainage lines, lower-lying rivers or wetlands ▪ spread and establishment of invasive species » alteration of occupancy by terrestrial fauna, small reduction of available habitat and food availability to terrestrial fauna
Residual impacts: » altered topsoil characteristics » altered vegetation composition

Nature: Potential visual impact and impact on sense of place associated with the power line and substation: (GN 544, 18 June 2010 activity 10(i))		
	Without Mitigation	***With Mitigation***
Extent	Local (2)	Local (1)
Duration	Long term (4)	Long term (4)
Magnitude	Minor (2)	Minor (2)
Probability	Probable (3)	Probable (3)
Significance	**Low (24)**	**Low (21)**
Status	Negative	Negative
Reversibility	Yes	
Irreplaceable loss of resources?	No	
Can impact be mitigated?	Yes	
Enhancement: The development of the proposed power line and substation would represent an enhancement measure. However, the impact of large facilities on the sense of place and landscape are issues need to be addressed in the location, design and layout of the proposed plant.		
Cumulative impacts: Limited visual and impact on sense of place		
Residual impacts: Not applicable as impact is removed after decommissioning.		

6.1.9 Impacts resulting from the decommissioning phase

Given the relatively small number of people employed during the operational phase (~ 60), the social impact on the local community associated with decommissioning is likely to be low. In addition, the potential impacts can be effectively managed with the implementation of a retrenchment and downscaling programme. With mitigation, the impacts are assessed to be Low (negative).

The proponent should also investigate the option of establishing an Environmental Rehabilitation Trust Fund to cover the costs of decommissioning and rehabilitation of disturbed areas. The Trust Fund should be funded by a percentage of the revenue generated from the sale of energy to the national grid over the 20-25 year operational life of the facility. The rationale for the establishment of a Rehabilitation Trust Fund is linked to the experiences with the mining sector in South Africa and failure of many mining companies to allocate sufficient funds during the operational phase to cover the costs of rehabilitation and closure.

6.2. Assessment of Potential Cumulative Impacts

A cumulative impact, in relation to an activity, refers to the impact of an activity that in itself may not be significant, but may become significant when added to the existing and potential impacts eventuating from similar or diverse undertaking in the area[6.] Based on information available at the time of undertaking the EIA, the impact of solar facilities on the landscape is therefore likely to be a key issue in South Africa, specifically given South African's strong attachment to the land and the growing number of solar plant applications.

In the case of the proposed Grootkop Solar Energy Facility, there are other projects proposed within the vicinity of the Grootkop site (refer to **Figure 6.5** and **Table 6.1** below).

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

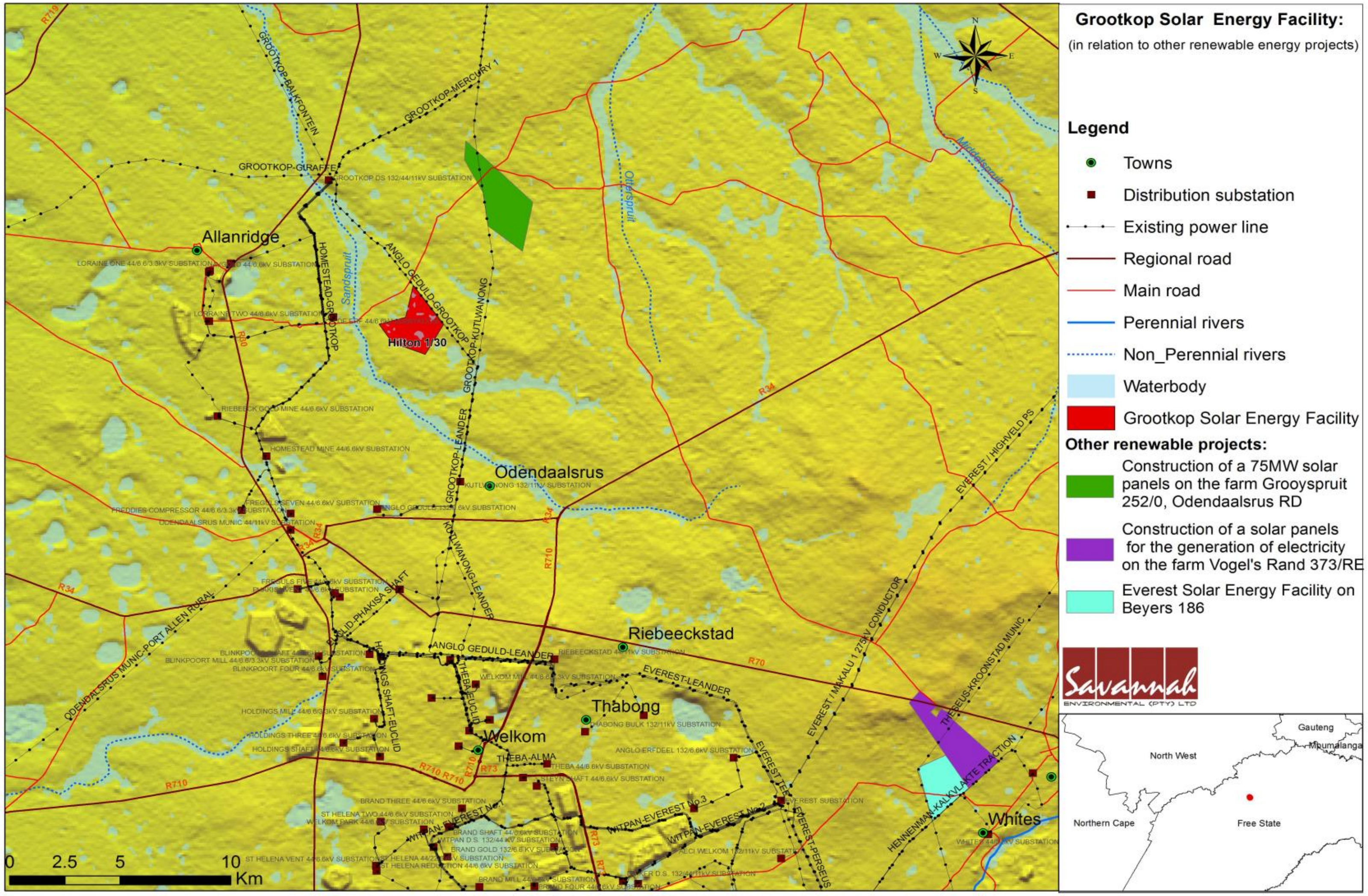

Figure 6.5: Cumulative Impacts map associated with the proposed Grootkop Solar Energy Facility and other known similar developments in the broader area

Table 6.1: PV facility within the same vicinity as the proposed Grootkop Solar Energy Facility

Project	Applicant/ Developer	DEA Ref. No	Location	Status
Construction of a 75MW solar facility	Solaire direct Southern Africa (Pty) Ltd	14/12/16/3/3/2/376	Farm Grooyspruit 252/0, Odendaalsrus RD	Scoping & EIA phase on-going
Construction of solar panels	Vogelsrand Trust	14/12/16/3/3/1/534	Farm Vogel's Rand 373/RE	Basic Assessment process on-going
Proposed Everest Solar Energy Facility near Hennenman	FRV Energy South Africa (Pty) Ltd	14/12/3/3/2/512	Farm Beyers 186	EIA phase on-going

The potential ***cumulative impacts*** as a result of the proposed project are expected to be associated predominantly with:

» **Ecology**: The study area is surrounded on all sides by cultivated lands, with only a small section of wetland. It is highly unlikely that a cumulative effect of loss of high biodiversity areas could arise from the Grootkop development because the land has been previously used for agricultural purposes. The cumulative impact in this regard is therefore expected to be of **low significance**.
» **Soil & Agricultural Potential** - The study area is known for agriculture. However, the specific site proposed for the solar facility occurs on an area considered less for cultivation than the surrounding areas. Numerous solar energy facilities in the area could results in loss of arable and grazing land, and a decrease in agricultural production. However, the development of these facilities could also contribute positively to the local farmers through provision of an additional source of income, thereby contributing to the sustainability of the farming practices on the affected properties. The cumulative impact in this regard is therefore expected to be of **low significance**.
» **Wetlands:** All wetlands located within the proposed PV plant and associated infrastructure footprint will be lost. This is likely to indirectly impact on the wetland areas outside the footprint which fall within the same catchment area as the wetland areas to be lost. However, the cumulative impact is expected to be limited provided that the wetlands outside of the development footprint are protected during construction and the mitigation measures recommended are implemented during operation. Further development within the same area which results in the further loss of wetlands could however result in impacts on the wetland systems. This could contribute to cumulative loss of wetland

habitat within the region. The cumulative impact in this regard is therefore expected to be of **medium to high significance**.

» **Visual** - The visual integrity of the area has already been impacted by the existing power lines that traverse the area. In addition, at a broader level the visual integrity of the area has been negatively impacted by the mining activities and associated mine dumps and mining related infrastructure. The potential for cumulative impacts on the area's sense of place and landscape character due to the establishment of the proposed solar facility and other proposed renewable energy projects in the area is therefore limited. The cumulative impact in this regard is therefore expected to be of **low significance**.**Social** - The proposed solar energy facility and establishment of other proposed renewable energy projects in the area have the potential to result in significant positive cumulative socio-economic impacts for the MLM. The positive cumulative impacts include creation of employment, skills development and training opportunities (construction and operational phase), creation of downstream business opportunities and stimulation of the local property market. The significance of this impact is rated as High positive with enhancement. The potential negative impacts would be traffic congestion, spread of diseases and theft. The cumulative impact in this regard is therefore expected to be of **low significance**.

6.3. Assessment of the Do Nothing Alternative

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

At a local level, the level of unemployment will remain the same and there won't be any transfer of skills to people in terms of the construction and operation of the solar energy facility. Furthermore, the community would lose the opportunity to improve and uplift their infrastructures through the community trust.

At a broader scale, the benefits of additional capacity to the electricity grid and those associated with the introduction of renewable energy would not be realised. Although the facility is only proposed to contribute 75 MW to the grid capacity, this would assist in meeting the growing electricity demand throughout the country and would also assist in meeting the government's goal for renewable energy.

At a broader scale, the benefits of this solar energy facility would not be realised. The generation of electricity from renewable energy resources offers a range of potential socio-economic and environmental benefits for South Africa. These benefits include:

» **Increased energy security:** The current electricity crisis in South Africa highlights the significant role that renewable energy can play in terms of power supplementation. In addition, given that renewables can often be deployed in a decentralised manner close to consumers, they offer the opportunity for improving grid strength and supply quality, while reducing expensive transmission and distribution losses.
» **Resource saving:** Conventional coal fired plants are major consumers of water during their requisite cooling processes. It is estimated that the achievement of the targets in the Renewable Energy White Paper will result in water savings of approximately 16.5 million kilolitres, when compared with wet cooled conventional power stations. This translates into revenue savings of R26.6 million. As an already water-stressed nation, it is critical that South Africa engages in a variety of water conservation measures, particularly due to the detrimental effects of climate change on water availability.
» ***Exploitation of our significant renewable energy resource:*** At present, valuable national resources including biomass by-products, solar radiation and wind power remain largely unexploited. The use of these energy flows will strengthen energy security through the development of a diverse energy portfolio.
» ***Pollution reduction:*** The releases of by-products through the burning of fossil fuels for electricity generation have a particularly hazardous impact on human health and contribute to ecosystem degradation. The use of solar radiation for power generation is considered a non-consumptive use of a natural resource which produces zero greenhouse gas emissions.
» ***Climate friendly development:*** The uptake of renewable energy offers the opportunity to address energy needs in an environmentally responsible manner and thereby allows South Africa to contribute towards mitigating climate change through the reduction of greenhouse gas (GHG) emissions. South Africa is estimated to be responsible for approximately 1% of global GHG emissions and is currently ranked 9^{th} worldwide in terms of per capita carbon dioxide emissions.
» ***Support for international agreements:*** The effective deployment of renewable energy provides a tangible means for South Africa to demonstrate its commitment to its international agreements under the Kyoto Protocol, and for cementing its status as a leading player within the international community.
» ***Employment creation:*** The sale, development, installation, maintenance and management of renewable energy facilities have significant potential for job creation in South Africa.

» ***Acceptability to society:*** Renewable energy offers a number of tangible benefits to society including reduced pollution concerns, improved human and ecosystem health and climate friendly development.
» ***Support to a new industry sector:*** The development of renewable energy offers the opportunity to establish a new industry within the South African economy.

The 'do nothing' alternative will not assist the South African government in addressing climate change, in reaching the set targets for renewable energy, nor will it assist in supplying the increasing electricity demand within the country. In addition the Free State power grid will lose an opportunity to benefit from the additional generated power being evacuated directly into the Province's grids. The 'do nothing alternative is, therefore, not a preferred alternative.

6.4 Summary of Impacts

Table 6.2 below illustrates all potential impacts associated with the proposed Grootkop Solar Energy Facility.

Table 6.2: Summary of impacts associated with the proposed Grootkop Solar Energy Facility

Construction / Decommissioning Impacts	Significance of Impact		
	Without mitigation	**With mitigation**	**Listed Activities (18 June 2010)**
Impact of PV facility and associated infrastructure on natural, semi-natural vegetation and disturbed areas (**tracking PV**)	H (65)	M (50)	GN 544 activity 10(i); GN 544 activity22 (ii); GN 545 activity 1, GN 545 activity 15 GN 546 activity 4ii(cc) GN 546 activity 14(i)
Impact of PV facility and associated infrastructure on natural, semi-natural vegetation and disturbed areas (**fixed PV**)	H (70)	M (60	GN 544 activity 10(i); GN 544 activity22 (ii); GN 545 activity 1, GN 545 activity 15 GN 546 activity 4ii(cc) GN 546 activity 14(i)
Impact on vegetation during the construction of power lines	M (40)	L (25)	GN 544 activity 10(i) GN 546 activity 14(i)
Impact on vegetation during the construction of substation and other electricity-related buildings, workshops, offices, guardhouses, etc.	M (60)	M (35)	GN 544 activity 10(i) GN 546 activity 14(i)

Loss of agricultural land use	M (40)	M (40)	GN 544 activity 10(i); GN 544 activity22 (ii); GN 545 activity 1, GN 545 activity 15 GN 546 activity 4ii(cc) GN 546 activity 14(i)
Soil erosion	L (27)	L (6)	GN 544 activity 10(i); GN 544 activity22 (ii); GN 545 activity 1, GN 545 activity 15 GN 546 activity 4ii(cc) GN 546 activity 14(i)
Loss of topsoil	L (20)	L (4)	GN 544 activity 10(i); GN 544 activity22 (ii); GN 545 activity 1, GN 545 activity 15 GN 546 activity 4ii(cc) GN 546 activity 14(i)
Loss and disturbance of wetland habitat	H (100)	-	GN 544 activity 11 (ii)(xi) GN 544 activity 10(i); GN 544 activity22 (ii); GN 545 activity 1, GN 545 activity 15 GN 546 activity 4ii(cc) GN 546 activity 14(i)
Increased sedimentation of wetlands and watercourses	L (24)	L (18)	GN 544 activity 11 (ii)(xi) GN 544 activity 10(i); GN 544 activity22 (ii); GN 545 activity 1, GN 545 activity 15

			GN 546 activity 4ii(cc) GN 546 activity 14(i)
Water quality deterioration	M (36)	L (24)	GN 544 activity 11 (ii)(xi) GN 544 activity 10(i); GN 544 activity22 (ii); GN 545 activity 1, GN 545 activity 15 GN 546 activity 4ii(cc) GN 546 activity 14(i)
Increased flows within the watercourse	H (64)	L (27)	GN 544 activity 11 (ii)(xi) GN 544 activity 10(i); GN 544 activity22 (ii); GN 545 activity 1, GN 545 activity 15 GN 546 activity 4ii(cc) GN 546 activity 14(i)
Destruction of heritage material (cemetery)	L (15)	L (8)	GN 544 activity 10(i); GN 544 activity22 (ii); GN 545 activity 1, GN 545 activity 15 GN 546 activity 4ii(cc) GN 546 activity 14(i)
Visual impact of construction on sensitive visual receptors in close proximity to the proposed solar energy facility.	M (36)	L (20)	GN 544 activity 10(i); GN 544 activity22 (ii); GN 545 activity 1, GN 545 activity 15 GN 546 activity 4ii(cc) GN 546 activity 14(i)
Visual impact of lighting on sensitive visual receptors.	M (48)	L (28)	GN 544 activity 10(i); GN 544 activity22 (ii); GN 545 activity 1,

			GN 545 activity 15 GN 546 activity 4ii(cc) GN 546 activity 14(i)
Creation of employment and business opportunities during the construction phase	M (32)	M (36)	GN 544 activity 10(i); GN 544 activity22 (ii); GN 545 activity 1, GN 545 activity 15 GN 546 activity 4ii(cc) GN 546 activity 14(i)
Potential impacts on family structures and social networks associated with the presence of construction workers	M (57)	M (51)	GN 544 activity 10(i); GN 544 activity22 (ii); GN 545 activity 1, GN 545 activity 15 GN 546 activity 4ii(cc) GN 546 activity 14(i)
Potential safety and security risk posed by presence of construction workers on site	M (30)	L (21)	GN 544 activity 10(i); GN 544 activity22 (ii); GN 545 activity 1, GN 545 activity 15 GN 546 activity 4ii(cc) GN 546 activity 14(i)

Operational Impacts	Significance of Impact		
	Without mitigation	With mitigation	Listed Activities (18 June 2010)
Increase in runoff and erosion	M (60)	L (15)	GN 544 activity 10(i); GN 544 activity22 (ii); GN 545 activity 1, GN 545 activity 15 GN 546 activity 4ii(cc) GN 546 activity 14(i)
Spread of alien species	M (48)	L (21)	GN 544 activity 10(i); GN 544 activity22 (ii); GN 545 activity 1, GN 545 activity 15 GN 546 activity 4ii(cc) GN 546 activity 14(i)
Water quality deterioration	M (36)	L 24)	GN 544 activity 10(i); GN 544 activity22 (ii); GN 545 activity 1, GN 545 activity 15 GN 546 activity 4ii(cc) GN 546 activity 14(i)
Increased flow within wetland systems	H (100)	M (30)	GN 544 activity 10(i); GN 544 activity22 (ii); GN 545 activity 1, GN 545 activity 15 GN 546 activity 4ii(cc) GN 546 activity 14(i)
Stormwater discharge	H (95)	M (30)	GN 544 activity 10(i); GN 544 activity22 (ii); GN 545 activity 1,

			GN 545 activity 15 GN 546 activity 4ii(cc) GN 546 activity 14(i)
Visual impact on users of arterial and secondary roads in close proximity to the proposed solar energy facility	H (64)	L (24)	GN 544 activity 10(i); GN 544 activity22 (ii); GN 545 activity 1, GN 545 activity 15 GN 546 activity 4ii(cc) GN 546 activity 14(i)
Visual impact on residents of homesteads and settlements in close proximity to the proposed solar energy facility.	H (64)	M (36)	GN 544 activity 10(i); GN 544 activity22 (ii); GN 545 activity 1, GN 545 activity 15 GN 546 activity 4ii(cc) GN 546 activity 14(i)
Visual impact on sensitive visual receptors within the region.	L (22)	L (11)	GN 544 activity 10(i); GN 544 activity22 (ii); GN 545 activity 1, GN 545 activity 15 GN 546 activity 4ii(cc) GN 546 activity 14(i)
Potential visual impact and impact on sense of place associated with power lines	L (24)	L (21)	GN 544 activity 10(i); GN 544 activity22 (ii); GN 545 activity 1, GN 545 activity 15 GN 546 activity 4ii(cc) GN 546 activity 14(i)
Visual impact associated with the proposed solar facility and the potential impact on the areas rural sense of place.	M (36)	L (27)	GN 544 activity 10(i); GN 544 activity22 (ii); GN 545 activity 1, GN 545 activity 15

			GN 546 activity 4ii(cc) GN 546 activity 14(i)
Creation of employment and business opportunities associated with the operational phase	M (33)	H (48)	GN 544 activity 10(i); GN 544 activity22 (ii); GN 545 activity 1, GN 545 activity 15 GN 546 activity 4ii(cc) GN 546 activity 14(i)
Establishment of a Community Trust funded by revenue generated from the sale of energy. The revenue can be used to fund local community development	M (36)	H (65)	GN 544 activity 10(i); GN 544 activity22 (ii); GN 545 activity 1, GN 545 activity 15 GN 546 activity 4ii(cc) GN 546 activity 14(i)
Promotion of clean, renewable energy	M (48)	M (48)	GN 544 activity 10(i); GN 544 activity22 (ii); GN 545 activity 1, GN 545 activity 15 GN 546 activity 4ii(cc) GN 546 activity 14(i)

L	**Low**	M	**Medium**	H	**High**

CONCLUSIONS AND RECOMMENDATIONS CHAPTER 7

The Grootkop Solar Energy Facility is proposed to be developed as a commercial solar energy facility to be located on the Farm Hilton 30, which falls within the Mathjabeng Local Municipality, Free State Province (refer to Figure 7.1). The purpose of the proposed facility is to add new capacity for generation of power from renewable energy to the national electricity supply (which is short of generation capacity to meet current and expected demand), and to aid in achieving the goal of a 30% share of all new power generation being derived from independent power producers (IPPs), as targeted by the Department of Energy (DoE).

Globally there is increasing pressure on countries to increase their share of renewable energy generation due to concerns such as climate change and exploitation of non-renewable resources. In order to meet the long-term goal of a sustainable renewable energy industry, a goal of 17,8GW of renewables by 2030 has been set by the Department of Energy (DoE) within the Integrated Resource Plan (IRP) 2010. This energy will be produced mainly from wind, solar, biomass, and small-scale hydro (with wind and solar comprising the bulk of the power generation capacity). This amounts to ~42% of all new power generation being derived from renewable energy forms by 2030. This is however dependent on the assumed learning rates and associated cost reductions for renewable options.

As such FRV Energy South Africa (Pty) Ltd, as an IPP, is investigating the establishment of a 75 MW photovoltaic solar energy facility and associated infrastructure for the purpose of commercial electricity generation. The proposed facility will require approximately 180 ha and will be comprised of the following primary elements (refer to Chapter 2 for more details):

» Solar array with an export capacity of 75MW.
» Mounting structures for the solar panels to be either rammed steel piles or piles with pre-manufactured concrete footings to support the PV panels.
» Cabling between the structures, to be lain underground where practical.
» transformer to collect all energy generated from the PV panels
» A new power line which will loop in and out into an existing power line that runs adjacent the proposed site in order to evacuate energy into an existing Grootkop substation i.e. national grid
» Internal access roads (4 – 6 m wide) will be constructed but will keep to existing roads as far as possible) and fencing (approximately 2.5 m).
» Associated buildings including a workshop area for maintenance, storage, and offices

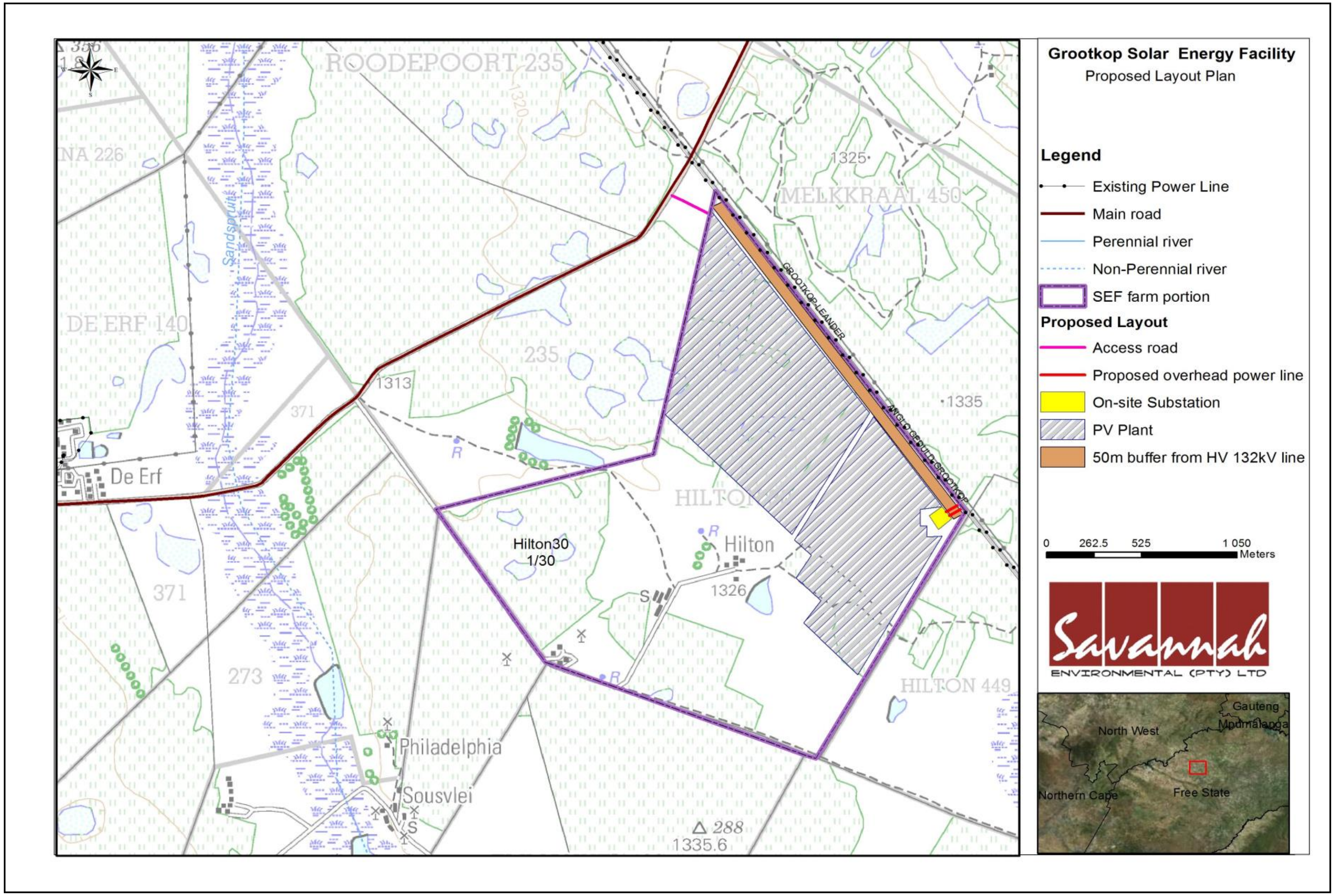

Figure 7.1: Layout map illustrating the location of the development site for the proposed Grootkop Solar Energy Facility and preliminary layout of the proposed facility

An EIA process, as defined in the NEMA EIA Regulations, is a systematic process of identifying, assessing, and reporting environmental impacts associated with an activity. The EIA process forms part of the feasibility phase of a project and informs the final design of a development. In terms of the EIA Regulations published in terms of Section 24(5) of the National Environmental Management Act (NEMA, Act No. 107 of 1998), FRV Energy South Africa (Pty) Ltd requires authorisation from the National Department of Environmental Affairs (DEA) (in consultation with the Free State Department of Economic Development, Tourism and Environmental Affairs (DEDTEA)) for the establishment of the proposed facility. In terms of sections 24 and 24D of NEMA, as read with the EIA Regulations of GNR543, GNR544, GNR545; and GNR546, a Scoping and an EIA Phase have been undertaken for the proposed project. As part of this EIA process comprehensive, independent environmental studies have been undertaken in accordance with the EIA Regulations. The following key phases have been involved thus far in the EIA Process.

» *Notification Phase* - organs of state, stakeholders, and interested and affected parties (I&APs) were notified of the proposed project using adverts, site notices, background information documents, and stakeholder letters. Details of registered parties have been included within an I&AP database for the project.
» *Scoping Phase* – potential issues associated with the proposed project and environmental sensitivities (i.e. over the broader project development site), as well as the extent of studies required within the EIA Phase were identified.
» *EIA Phase* – potentially significant biophysical and social impacts[7] and identified feasible alternatives put forward as part of the project have been comprehensively assessed through specialist investigations. Appropriate mitigation measures have been recommended as part of a draft Environmental Management Programme (EMPr) (refer to **Appendix K)**.

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

7.1. Evaluation of Grootkop Solar Energy Facility

The preceding chapters of this report together with the specialist studies contained within **Appendices E -J** provide a detailed assessment of the potential impacts that may result from the proposed project. This chapter concludes the EIA Report for Grootkop Solar Energy Facility by providing a summary of the conclusions of the

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

assessment of the proposed site for the development of the PV solar energy facility. In so doing, it draws on the information gathered as part of the EIA process and the knowledge gained by the environmental specialist consultants and presents an informed opinion of the environmental impacts associated with the proposed project.

From the conclusions of the detailed EIA studies undertaken, it has been concluded that **there are** sensitive areas within the development footprint which should be avoided as far as possible (refer to **Figure 7.2**). The majority of the site is however considered to be of low to moderate sensitivity and could be considered suitable for development of the proposed PV facility provided the recommended mitigation measures are implemented during construction and operation. Some areas of high sensitivity have been identified within the development area. These areas should be avoided as far as possible.

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

7.1.1. Impacts on Ecology

The selected property falls within the original extent of Vaal-Vet Sandy Grassland as described by Mucina and Rutherford (2006), of which a large portion on the property has been previously transformed. The remaining extent of this vegetation type has been listed in the threatened terrestrial ecosystems for South Africa (2011) as Endangered. Beyond the proposed development area, closer to larger drainage lines and small rivers, the grassland vegetation merges into Highveld Alluvial Vegetation, which is considered as least threatened.

Annual and geophytic species have highly variable emerging patterns, depending on the timing and amount of rainfall received during a season. It is thus quite possible that especially the diversity of geophytic (bulbous) and annual species within the study area will be higher than could be determined during the survey.

Three vegetation units could be identified within the proposed development area:

» Unit 1: *Eragrostis plana – Alternanthera nodiflora* grasslands
Sensitivity rating: HIGH sensitivity
» Unit 2: *Panicum coloratum – Pentzia globosa* grasslands
Sensitivity rating: Medium - Low sensitivity
» Unit 3: The *Eragrostis lehmanniana – Helichrysum paronychioides* grasslands
Sensitivity rating: Low sensitivity overall
Medium-high sensitivity within 100 m of wetlands

Medium-low sensitivity where grass-layer consists of well-established palatable grasses

Of the three vegetation units, only units 2 and 3 are considered suitable for the development as the vegetation present has already been altered from the original historic cover and composition.

The riparian areas of vegetation unit 1, as well as lower-lying drainage lines and rivers must be regarded as No Go Areas, and a buffer of preferably between 50 to 500 m (depending on the specific activity), maintained between any development and these areas. Access roads to the development must strictly adhere to existing or delineated tracks only.

Several alien invasive plants have been observed on the study site, with more species in close proximity. For all species, there is a very high risk of spread throughout the project area following disturbance. This implies that a detailed Invasive Plant Management Plan will have to be in place prior to commencement of the activity and be diligently followed and updated throughout the project cycle up to the decommissioning phase.

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

7.1.2. Impacts on wetlands

Approximately 26.5 % (109.35 ha) of the broader study area can be classified as wetlands, with most of the wetland area consisting of shallow, ephemeral pans classified as depressions in terms of the hydro-geomorphic classification system. A total of 17 depressions, ranging in size from 0.7 ha to over 5 ha in size, were identified on site. In addition to the depressions a small drainage line classified as an unchannelled valley bottom system, spring and associated seepage areas were recorded on site.

Most of the wetland systems on site are considered to still be in a largely natural to moderately modified state, with the only exception being the pan below the homestead which is considered moderately to largely modified.

Development of the proposed Grootkop Solar Energy facility is expected to result in a number of impacts to the wetlands, most notably the expected loss of wetland habitat and biodiversity where the delineated wetlands fall within the footprints of the proposed development. This impact is expected to be of **high significance** and cannot be mitigated. A water use license will be required to be obtained to impact on these wetlands. A number of additional impacts were identified including sedimentation and increased flows within the wetlands. It is expected that the majority of these could be successfully mitigated through the implementation of the proposed mitigation measures. Impacts on wetlands as a result of the project could be considered **acceptable** provided wetlands within the surrounding areas are protected during construction and appropriate mitigation implemented during operation to minimise any downstream impacts.

7.1.3. Soil and Agricultural Potential Impacts

» The development will have low to medium negative impact on agricultural resources and productivity, but it will also deliver low to medium positive impacts on agriculture. The development of these facilities could also contribute positively to the local farmers through provision of an additional source of income, thereby contributing to the sustainability of the farming practices on the affected properties.
» The productive cultivation which takes place on the more agriculturally suitable parts of the farm will be able to continue unchanged for the duration of and after the project.
» The significance of agricultural impacts is influenced by the fact that the solar panel site has limited agricultural potential. The entire farm has a land capability classification of class 4, marginal potential arable land, but the soils on the solar panel site are less viable for cultivation than those on the western part of the farm.
» Soils that are suitable for cultivation on the farm are deep, yellow, sandy, well-drained soils predominantly of the Clovelly soil form. Those that are unsuited are soils that are limited in depth by dense clay in the subsoil, and poor drainage and are predominantly of the Katspruit soil form.
» Three potential negative impacts of the development on agricultural resources and productivity were identified as:
    * Loss of agricultural land use caused by direct occupation of land by the solar energy facility footprint (medium significance with and without mitigation).
    * Soil erosion caused by alteration of the surface run-off characteristics (low significance with and without mitigation).
    * Loss of topsoil in disturbed areas, causing a decline in soil fertility (low significance with and without mitigation).

» One potential positive impact of the development on agricultural resources and productivity was identified as:
    * Generation of multiple land use income through rental for energy facility on less agriculturally suitable land, combined with cultivation on more suitable land. This will provide land owners with increased cash flow to support agricultural activities (low significance without mitigation; medium significance with mitigation).

7.1.4. Heritage Impacts

Only one site of social significance was identified on the site. This site will not be impacted directly by the proposed project as it falls outside development area. From an archaeological point of view, there is no reason why the development cannot proceed. If any possible finds such as tool scatters, bone or fossil remains are exposed or noticed during construction, the operations must be stopped and a qualified archaeologist must be contacted to assess the find.

7.1.5. Visual Impacts

» The solar energy facility could potentially have a **moderate** visual impact on road users travelling along the secondary road traversing north of the facility. This impact may be mitigated to **low**.
» The potential visual impact on residents of homesteads in close proximity to the solar energy facility is expected to be of **moderate** significance and may be mitigated to **low** significance.
» The visual impact on the users of roads and the residents of towns, settlements and homesteads within the region (i.e. beyond the 4km radius) is expected to be **low** for the proposed solar energy facility, both before and after the implementation of mitigation measures.
» The potential visual impact of construction activities on sensitive visual receptors within close proximity to the proposed solar energy facility is likely to be of **moderate** significance, and may be mitigated to **low**.
» The potential visual impact associated with lighting at the facility at night (especially glare) is expected to be of **moderate** significance and may be mitigated to **low**.

The anticipated visual impacts are expected to be of low significance with the implementation of appropriate mitigation, and the solar energy facility development is not considered to be fatally flawed from a visual perspective.

7.1.6. Impacts on the Social Environment

» The findings of the SIA indicate that the development of the proposed Grootkop Solar Energy Facility will create employment and business opportunities for locals during both the construction and operational phases of the project. The enhancement measures listed in the report should be implemented in order to enhance these benefits. In addition, the proposed establishment of a number of other renewable energy facilities in the area will create significant socio-economic opportunities for the MLM, which, in turn, will result in a positive social benefit. These benefits will assist to offset the negative impacts associated with the decline in the mining sector over the last 10-15 years.
» The establishment of a Community Trust funded by revenue generated from the sale of energy from the proposed solar energy facility also creates an opportunity to support local economic development in the area. Given the size of the proposed facility (75MW) this will represent a significant social benefit for an area where there are limited opportunities.
» The proposed development represents an investment in clean, renewable energy infrastructure, which, given the challenges created by climate change, represents a positive social benefit for society as a whole.
» The establishment of the proposed Grootkop Solar Energy Facility is supported by the findings of the SIA.

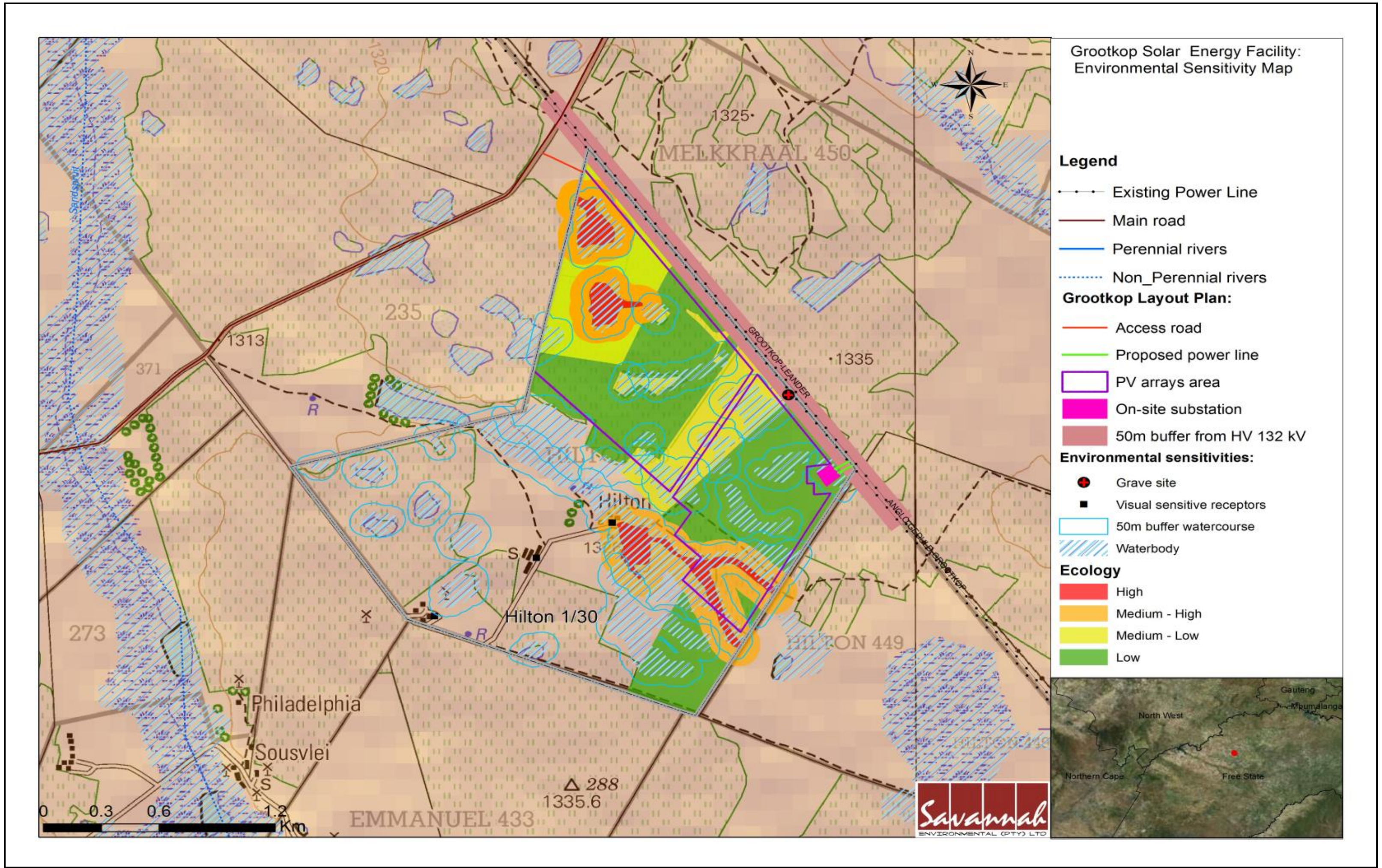

Figure 7.2: Sensitivity map for the proposed Grootkop Solar Energy Facility

7.2 Assessment of Potential Cumulative Impacts

A cumulative impact, in relation to an activity, refers to the impact of an activity that in itself may not be significant, but may become significant when added to the existing and potential impacts eventuating from similar or diverse undertaking in the area[8]. Based on information available at the time of undertaking the EIA, the impact of solar facilities on the landscape is therefore likely to be a key issue in South Africa, specifically given South African's strong attachment to the land and the growing number of solar plant applications.

The potential ***cumulative impacts*** as a result of the proposed project are expected to be associated predominantly with:

» **Ecology**: The study area is surrounded on all sides by other cultivated lands, with only a small section of wetland. It is highly unlikely that a cumulative effect of loss of high biodiversity areas could arise from the Grootkop development because the land has been previously used for agricultural purposes.

» **Soil & Agricultural Potential** - The study area is known for agriculture. However, the specific site proposed for the solar facility occurs on an area considered less for cultivation than the surrounding areas. Numerous solar energy facilities in the area could results in loss of arable and grazing land, and a decrease in agricultural production. However, the development of these facilities could also contribute positively to the local farmers through provision of an additional source of income, thereby contributing to the sustainability of the farming practices on the affected properties.

» **Wetlands:** All wetlands located within the proposed PV plant and associated infrastructure footprint will be lost. This is likely to indirectly impact on the wetland areas outside the footprint which fall within the same catchment area as the wetland areas to be lost. However, the cumulative impact is expected to be limited provided that the wetlands outside of the development footprint are protected during construction and the mitigation measures recommended are implemented during operation. Further development within the same area which results in the further loss of wetlands could however result in impacts on the wetland systems. This could contribute to cumulative loss of wetland habitat within the region.

» **Visual** - The visual integrity of the area has already been impacted by the existing power lines that traverse the area. In addition, at a broader level the visual integrity of the area has been negatively impacted by the mining activities and associated mine dumps and mining related infrastructure. The potential for cumulative impacts on the area's sense of place and landscape

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

character due to the establishment of the proposed solar facility and other proposed renewable energy projects in the area is therefore limited.

» **Social** - The proposed solar energy facility and establishment of other proposed renewable energy projects in the area have the potential to result in significant positive cumulative socio-economic impacts for the MLM. The positive cumulative impacts include creation of employment, skills development and training opportunities (construction and operational phase), creation of downstream business opportunities and stimulation of the local property market. The significance of this impact is rated as High positive with enhancement. The potential negative impacts would be traffic congestion, spread of diseases and theft.

7.3. Overall Conclusion (Impact Statement)

Global climate change is widely recognised as being one of the greatest environmental challenges facing the world today. How a country sources its energy plays a big part in tackling climate change. As a net off-setter of carbon, renewable energy technologies can assist in reducing carbon emissions, and can play a big part in ensuring security of energy supply, as other sources of energy are depleted or become less accessible. South Africa currently relies on coal-powered energy to meet more than 90% of its energy needs. As a result, South Africa is one of the highest per capita producers of carbon emissions in the world and Eskom, as an energy utility, has been identified as the world's second largest producer of carbon emissions. With the aim of reducing South Africa's dependency on coal generated energy, and to address climate change concerns, the South African Government has set a target, through the Integrated Resource Plan (IRP) for electricity to develop 17.8 GW of renewables (including 8,4GW solar) within the period 2010 – 2030.

The technical viability of establishing a solar energy facility with an export capacity of 75 MW on a site located on the Farm Hilton 30 has been established by FRV Energy South Africa (Pty) Ltd. The positive implications of establishing a solar energy facility on the identified site within the Free State include the following:

» The potential to harness and utilise solar energy resources within the Free State Province
» The project would assist the South African government in reaching their set targets for renewable energy.
» The project would assist the South African government in the implementation of its green growth strategy and job creation targets.
» The project would assist the district and local municipalities in reducing level of unemployment through the creation of jobs and supporting local business

» The National electricity grid in the Free State Province would benefit from the additional generated power.
» Promotion of clean, renewable energy in South Africa
» Creation of local employment, business opportunities and skills development for the area.

The findings of the specialist studies undertaken within this EIA to assess both the benefits and potential negative impacts anticipated as a result of the proposed project conclude that the majority of the proposed development site is of low to moderate environmental sensitivity and could be considered suitable for the proposed development. There are however impacts of high sensitivity that would result from the development of the proposed project. The significance levels of these identified negative impacts can only be reduced by not impacting on the surrounding areas unnecessarily during construction and through the implementation of appropriate mitigation measures during the operational phase. Environmental specifications for the management of potential impacts are detailed within the draft Environmental Management Programme (EMPr) included within **Appendix K**.

With reference to the information available at this planning approval stage in the project cycle, the **confidence** in the environmental assessment undertaken is regarded as **acceptable** provided all measures are taken to reduce identified environmental impacts and to **protect and preserve** surrounding **wetlands**.

7.4. Overall Recommendation

Based on the nature and extent of the proposed project, the local level of disturbance predicted as a result of the construction and operation of the facility and associated infrastructure, the findings of the EIA, and the understanding of the significance level of potential environmental impacts, it is the opinion of the EIA project team that the proposed development site could be considered suitable for the proposed Grootkop Solar Energy Facility provided impacts are **restricted** to development footprint through the implementation of identified mitigation measures. In terms of this conclusion, the EIA project team support the decision for environmental authorisation of the proposed project.

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

» The draft Environmental Management Programme (EMPr) as contained within **Appendix K** of this report should form part of the contract with the Contractors appointed to construct and maintain the proposed solar energy facility, and will be used to ensure compliance with environmental specifications and management measures. The implementation of this EMPr for all life cycle phases of the proposed project is considered to be key in achieving the appropriate environmental management standards as detailed for this project.

» An independent **Environmental Control Officer** (ECO) must be appointed by FRV Energy South Africa (Pty) Ltd prior to the commencement of any authorised activities.
» During construction, unnecessary disturbance to habitats should be strictly controlled and the footprint of the impact should be kept to a minimum.
» Disturbed areas should be rehabilitated as soon as possible once construction is complete in an area.
» Several alien invasive plants have been observed on the study site, with more species in close proximity. For all species, there is a very high risk of spread throughout the project area following disturbance. This implies that a detailed Invasive Plant Management Plan will have to be in place prior to commencement of the activity and be diligently followed and updated throughout the project cycle up to the decommissioning phase.
» All declared aliens must be identified and managed in accordance with the Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983), the implementation of a monitoring programme in this regard is recommended.
» Develop emergency maintenance operational plan to deal with any event of contamination, pollution, or spillages.
» Access roads to the development should follow existing tracks. Where new access routes will be necessary, suitable erosion control measures must be implemented.
» No Archaeological mitigation is necessary prior to the start of construction (based on approval by SAHRA), but management measures would need to be taken into account to avoid damage to the informal cemetery. Damage can be caused by construction vehicles unknowingly damaging the graves. To prevent this, the area should be demarcated with a fence and all construction activities should be located at least 15 m away from the fence around the cemetery.
» It is recommended that the existing vegetation cover be maintained in all areas outside of the actual development footprint, both during construction and operation of the proposed facility. This will minimise visual impact as a result of cleared areas, power line servitudes and areas denuded of vegetation.
» Access roads to the development must strictly adhere to existing or delineated tracks only’
» Consolidate infrastructure as far as possible and make use of already disturbed areas rather than pristine sites, wherever possible.
» Compile a comprehensive storm water management method statement, as part of the final design of the project and implement during construction and operation.

» All discharge points should incorporate sediment traps upstream of the discharge. These should be regularly inspected and cleaned to maintain capacity.
» Discharge points should be protected against erosion and should incorporate measures to dissipate energy and disperse flows. Regular inspections and maintenance of all stormwater management infrastructure should be undertaken.
» All laydown areas and temporary stockpiles, construction camps, toilet facilities etc. should be kept at least 50m from the remaining wetland edge. Immediately rehabilitate disturbed areas following completion of construction.
» Avoid wetland areas as far as possible. Maintain a buffer of 50m from the wetland edge unless a wetland crossing is unavoidable.
» Once the facility has exhausted its life span, the main facility and all associated infrastructure not required for the post rehabilitation use of the site should be removed and all disturbed areas appropriately rehabilitated. An ecologist should be consulted to give input into rehabilitation specifications.
» All rehabilitated areas should be monitored for at least a year following decommissioning, and remedial actions implemented as and when required.
» Portable toilets must be located well outside of remaining wetland areas within demarcated construction site.
» To prevent spillages, vehicles should be well maintained and no diesel or oil should be stored on site. Spills should be cleaned up with approved absorbent material. Oil contaminated material and soil should be disposed of at a registered hazardous waste site together with other hazardous waste (e.g. tyres, PVC).

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