ENVIRONMENTAL IMPACT ASSESSMENT PROCESS
FINAL ENVIRONMENTAL IMPACT REPORT

PROPOSED WATERSHED (PHASE I & II) SOLAR ENERGY FACILITY NEAR LICHTENBURG, NORTH WEST PROVINCE

DEA Ref. No: 14/12/16/3/3/2/556
14/12/16/3/3/2/557

FINAL REPORT FOR SUBMISSION TO DEA
28 FEBRUARY 2014

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PROJECT DETAILS

DEA Reference No.	:	14/12/16/3/3/2/556 14/12/16/3/3/2/557
Title	:	Environmental Impact Assessment Process Final Environmental Impact Assessment Report: Proposed Watershed (Phase I & II) Solar Energy Facility near Lichtenburg, North West Province
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Client	:	FRV Energy South Africa(Pty) Ltd
Report Status	:	Final Environmental Impact Assessment Report for submission to DEA
Review Period	:	28 February 2014

When used as a reference this report should be cited as: Savannah Environmental (2014) Final Environmental Impact Assessment Report: Proposed Watershed (Phase I & II) Solar Energy Facility near Lichtenburg, North West 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 150 MW 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 portion 1, 9, 10 and 18 the Farm Houthaalbomen 31 within the Ditsobotla Local Municipality, North West 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 ten 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 **Phase I** facility.
Chapter 7: Presents the assessment of environmental impacts associated with the proposed **Phase II** facility.
Chapter 8: Presents the conclusions of the EIA, as well as an impact statement on the proposed **Phase I** project.
Chapter 9: Presents the conclusions of the EIA, as well as an impact statement on the proposed **Phase II** project.
Chapter 10: 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 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 **07 February 2014 – 27 February 2014**. 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	Written comment from the Department of Environmental Affairs indicating that the activities applied for under GNR 546 applies. In addition, a graphical representation of the proposed development within the respective geographical areas must be provided.	Reports were sent through to the Department of Environmental Affairs and no comments were received (refer to Appendix D2). Refer to Appendix E for relevance of GNR 546
1.4	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 ore advanced technologies.	Refer to section 2.5.5 of the EIA report and EMPr
1.5	The total footprint of the proposed development should be indicated. exact locations of the infrastructure, power line and associated infrastructure should be mapped at an appropriate scale	Refer to table 2.1 of the EIA report.
1.6	Should a water use license be required, proof of application for a license needs to be submitted.	Proof of application will be submitted with the final layout plan of the proposed project to be submitted to the Department for authorisation.
1.7	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.	A contractor will be appointed to handle all waste and refuse removal to be disposed of at a registered landfill. 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.
1.8	A copy of the final site layout map. All available	Refer to Appendix L of the

No.	Information	Provided / Reference
	biodiversity information must be used in the finalisation of the layout map. Existing infrastructure must be used as far as possible e.g. roads. The layout map must indicate the following: » panel positions and its associated infrastructure; » foundation footprint » permanent laydown area footprint » 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 infrastructure; » Substation(s) and /or transformer(s) sites including their entire footprint; » cable routes and trench dimensions (where they are not along internal roads); » connection routes (including pylon positions) to the distribution/transmission network; » cut and fill areas at panel sites, along roads and at substation/transformer sites indicating the expected volume of each cut and fill; » borrow pits » spoil and heaps (temporary for topsoil and subsoil and permanently from excess material); » all existing infrastructure on the site, especially roads; » buffers areas » building, including accommodation; and » all "no-go" areas	EIA report. Cable routes and spoil and heaps for soil the proposed project will be included in the final layout which will be submitted to the Department for approval
1.9	An environmental sensitivity map indicating environmental sensitive areas and features identified during the EIA process	Refer to Appendix L of the EIA report.
1.10	A map combining the final layout map superimposed (overlain) on the environmental sensitivity map.	Refer to Appendix L
1.11	A shape file of the preferred development	Refer to the electronic

No.	Information	Provided / Reference
	layout/footprint must be submitted to this Department	version (CD)

EXECUTIVE SUMMARY

FRV Energy South Africa (Pty) Ltd is proposing the establishment of a commercial photovoltaic solar energy facility with an export capacity of up to 150MW, as well as associated infrastructure on a site located approximately 46km north-west of Lichtenburg, within the North West Province. The project is proposed to be developed on portion 1, 9, 10 and 18 of the farm Houthaalbomen (refer to **Figure 1 showing the initial layout**). The layout was revised to accommodate stakeholder comments (refer to Figure 2).

The proposed facility and associated infrastructure (i.e. the development footprint) would occupy an area of approximately 380 hectares (ha) of the 560 ha. The project is known as the **Watershed Solar Energy Facility** and is proposed to comprise of two development phases. Each phase will have an export capacity of up to 75MW and are referred to as follows:

» Watershed Phase I Solar Energy Facility, North West Province
» Watershed Phase II Solar Energy Facility, North West Province

The Watershed Solar Energy Facility is proposed to accommodate several arrays of photovoltaic (PV) panels with associated infrastructure in order to generate up to **150 MW export capacity** of electricity. Each phase of the facility will comprise of the following:

» Arrays of photovoltaic (PV) panels.
» Mounting structure to be either rammed steel piles or piles with pre-manufactured concrete footings to support the PV panels.
» Cabling between project components, to be lain underground where practical.
» A new on-site substation (150 x 150m in extent) to evacuate the power from the facility into the Eskom grid.
» A new overhead power line looping in and out of to an existing Eskom power line that runs from the Watershed Substation east of the R505, approximately parallel to the southern periphery of the selected property.
» Internal access roads (4 – 8 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, 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 3** for the sensitivity map).

OVERALL CONCLUSION (IMPACT STATEMENT) – PHASE I & II

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 portion 1, 9, 10 and 18 of the farm Houthaalbomen 31 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 North West include the following:

» The potential to harness and utilise solar energy resources within the North West 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 North West 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.

Based on findings of the specialist studies undertaken within this EIA and the sensitivity map below (**Figure 8.2**), the Watershed (Phase I& II) Solar Energy Facility does not have environmental flaws that may prevent the proposed project from being develop neither does it pose a threat to the ecological sensitive areas. The layout has been designed

to avoid all environmental sensitive area with the proposed site.

The significance levels of the majority of identified negative impacts can be reduced by implementing the recommended mitigation measures. The project is therefore considered to meet the requirements of sustainable development. Environmental specifications for the management of potential impacts are detailed within the draft Environmental Management Programme (EMPr) included within **Appendix J**.

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**.

OVERALL RECOMMENDATION – PHASE I & II

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 developmental impacts of the Watershed (Phase I & II) Solar Energy Facility project can be mitigated to an acceptable level. In terms of this conclusion, the EIA project team support the decision for environmental authorisation.

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 J 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.
- Clear as little grassland vegetation as possible. Aim to maintain vegetation where it will not interfere with the construction or operation of the development. Rehabilitate an acceptable vegetation layer according to rehabilitation recommendations of the relevant EMP.
- The high biodiversity and conservation value and associated classification as CBA 2 area should be excluded from the development as far as possible. Any alteration of or disturbance to the habitat should be avoided.
- 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.

» It is recommended that weeds and invasives in the remaining natural grassland on the western portion of the study area be eradicated and controlled, but that the area is excluded as much as possible from the development.

» All declared alien plants must be identified and managed in accordance with the Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983), the implementation of a monitoring programme in this regard is recommended.

» Develop emergency maintenance operational plan to deal with any event of contamination, pollution, or spillages.

» Access roads to the development should follow existing tracks as far as possible. Where new access routes will be necessary, suitable erosion control measures must be implemented.

» Undertake a heritage walkthrough survey for watershed (Phase II) prior construction activities

» 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.

» In terms of ancillary infrastructure, it is recommended that access roads and other on-site infrastructure be planned so that the clearing of vegetation is minimised.

» Consolidate infrastructure as far as possible and make use of already disturbed areas rather than pristine sites, wherever possible.

» 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.

» Compile a comprehensive storm water management method statement, as part of the final design of the project and

implement during construction and operation.

» All rehabilitated areas should be monitored for at least a year following decommissioning, and remedial actions implemented as and when required.

» An independent **Environmental Control Officer** (ECO) must be appointed by FRV Energy South Africa (Pty) Ltd prior to the commencement of any authorised activities.

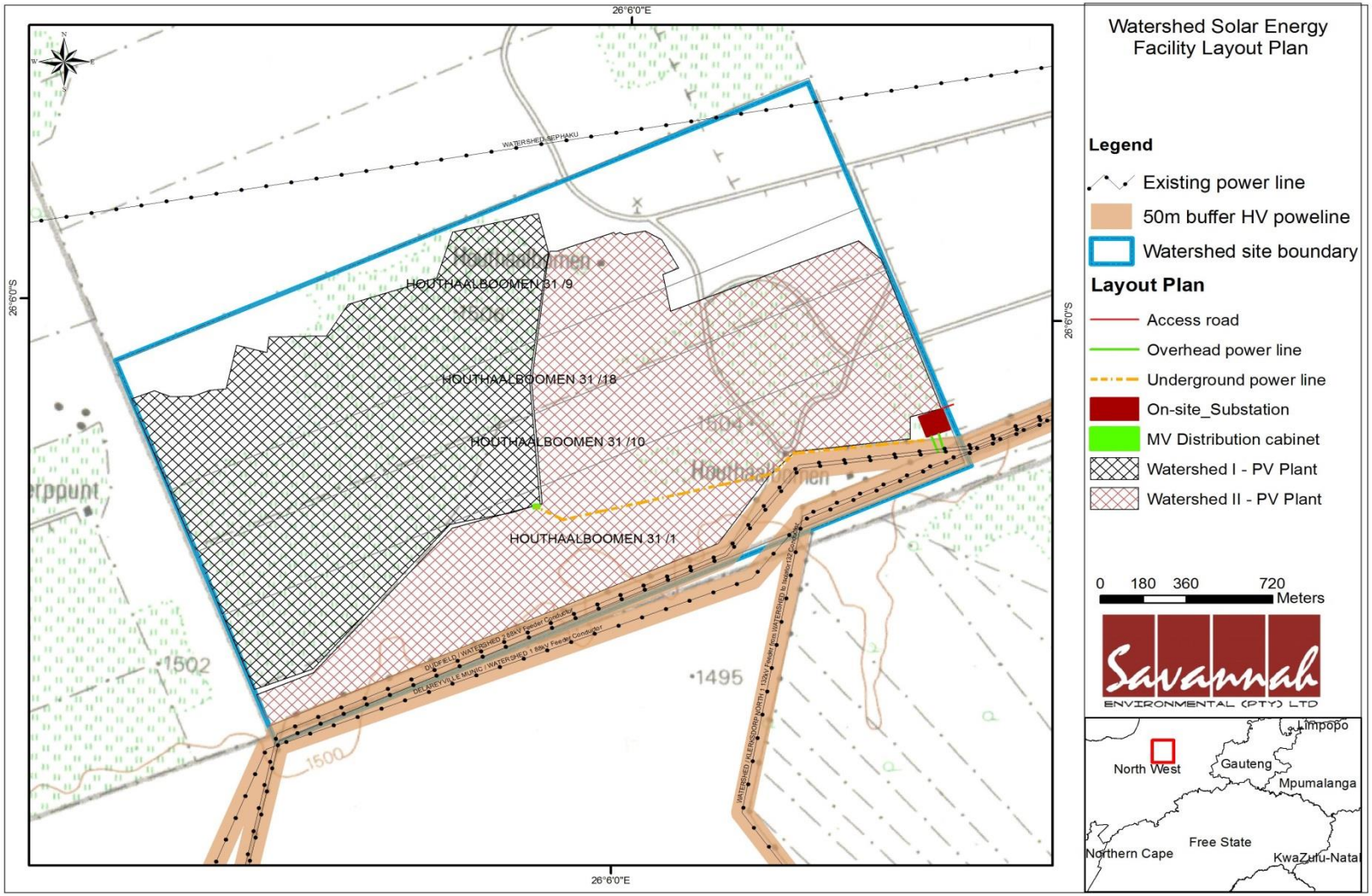

Figure 1: Initial Layout Map showing the proposed Watershed Solar Energy Facility (Phase I and II)

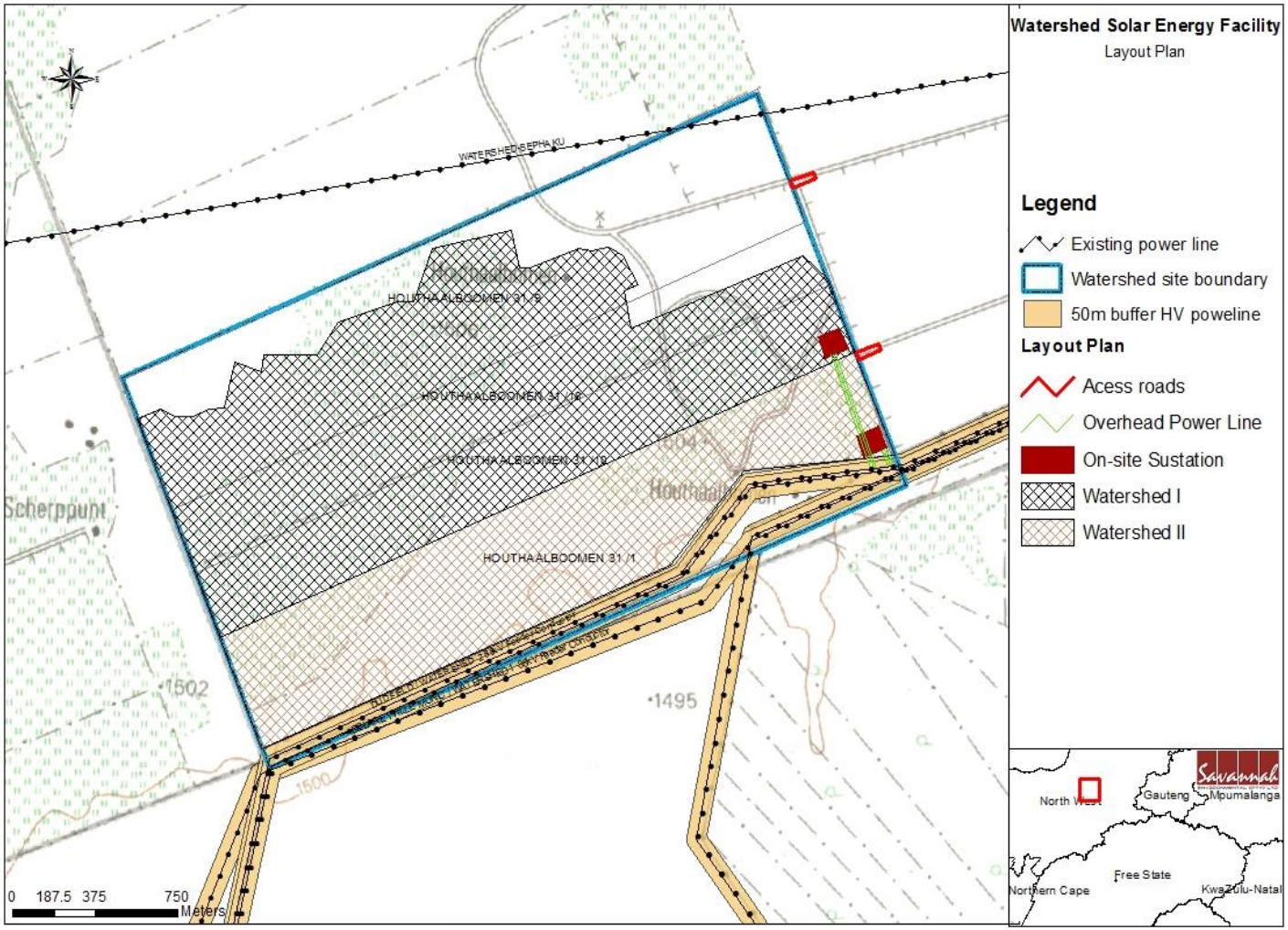

Figure 2: Revised[1] Layout Map showing the proposed Watershed Solar Energy Facility (Phase I and II)

[1] the same area is affected as the original layout

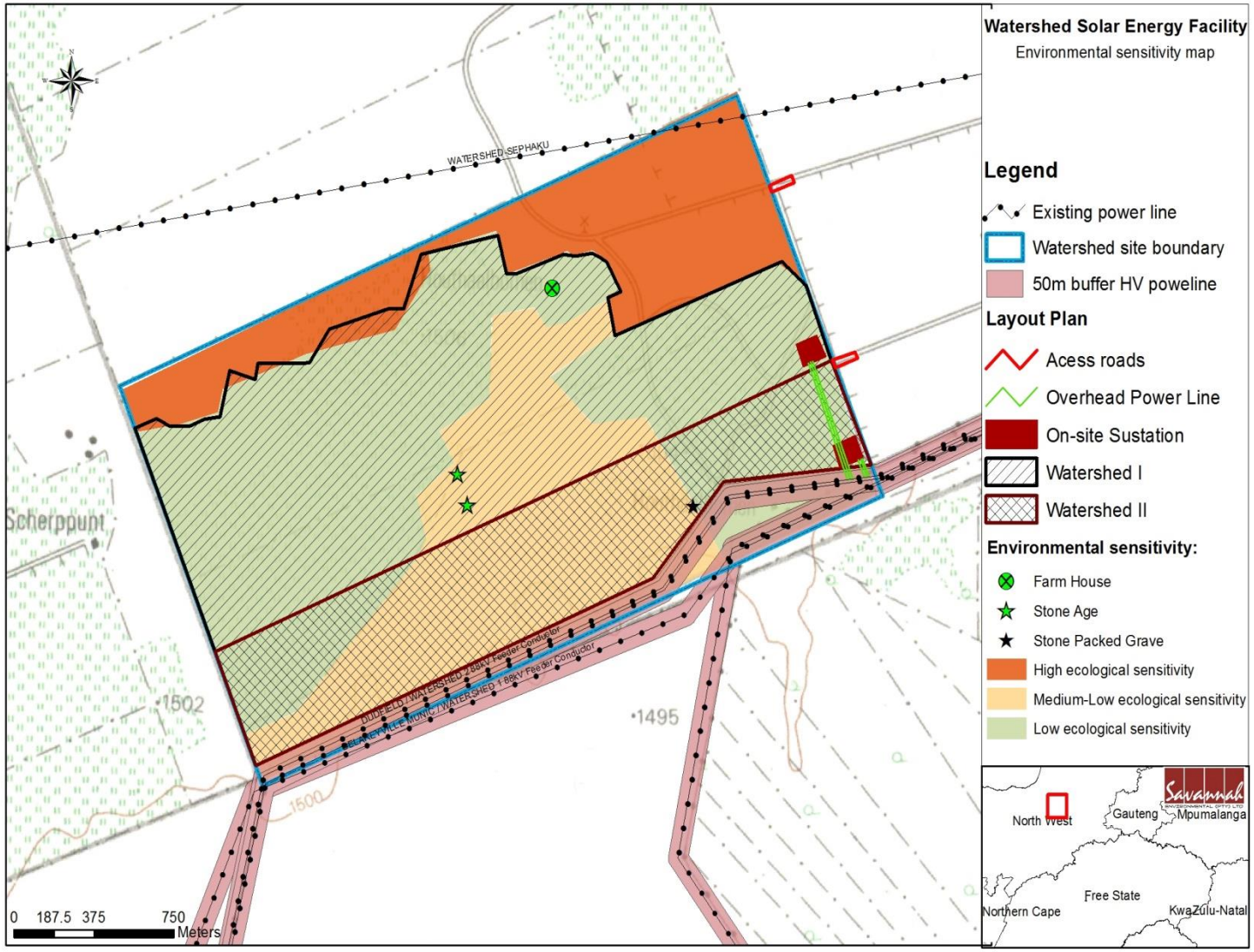

Figure 3: Environmental Sensitivity Map for the proposed Watershed Solar Energy Facility (Phase I and II)

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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 the establishment of a commercial photovoltaic solar energy facility with an export capacity of up to 150MW, as well as associated infrastructure on a site located approximately 6km north-west of Lichtenburg, within the North West Province. The project is proposed to be developed on portion 1, 9, 10 and 18 of the farm Houthaalbomen 31 which covers an area of approximately 560 ha. The proposed facility and associated infrastructure (i.e. the development footprint) would occupy an area of approximately 380 hectares (ha) of the 560 ha. The project is known as the **Watershed Solar Energy Facility** and is proposed to comprise of two development phases (refer to **Figure. 1.1**). Each phase will have an export capacity of up to 75MW and are referred to as follows:

» Watershed Phase I Solar Energy Facility, North West Province
» Watershed Phase II Solar Energy Facility, North West Province

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,. A level surface area (i.e. with a minimal gradient in the region of 1%) is preferred for the installation of PV panels. The site slope and aspect of the proposed development area is predominantly flat.
» **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 power line connection. This is preferred from an environmental and technical perspective.

The nature and extent of the Watershed (Phase I & II) 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 ten 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 **Phase I** facility.

Chapter 7: Presents the assessment of environmental impacts associated with the proposed **Phase II** facility.

Chapter 8: Presents the conclusions of the EIA, as well as an impact statement on the proposed **Phase I** project.

Chapter 9: Presents the conclusions of the EIA, as well as an impact statement on the proposed **Phase II** project.

Chapter 10: 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 Watershed Solar Energy Facility is proposed to accommodate several arrays of photovoltaic (PV) panels with associated infrastructure in order to generate up to **150 MW export capacity** of electricity. Each phase of the facility will comprise of the following:

» Arrays of photovoltaic (PV) panels.
» Mounting structure to be either rammed steel piles or piles with pre-manufactured concrete footings to support the PV panels.
» Cabling between project components, to be lain underground where practical.
» A new on-site substation (150 x 150m in extent) to evacuate the power from the facility into the Eskom grid.
» A new overhead power line looping in and out of to an existing Eskom power line that runs from the Watershed Substation east of the R505, approximately parallel to the southern periphery of the selected property.
» Internal access roads (4 – 8 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, and offices.

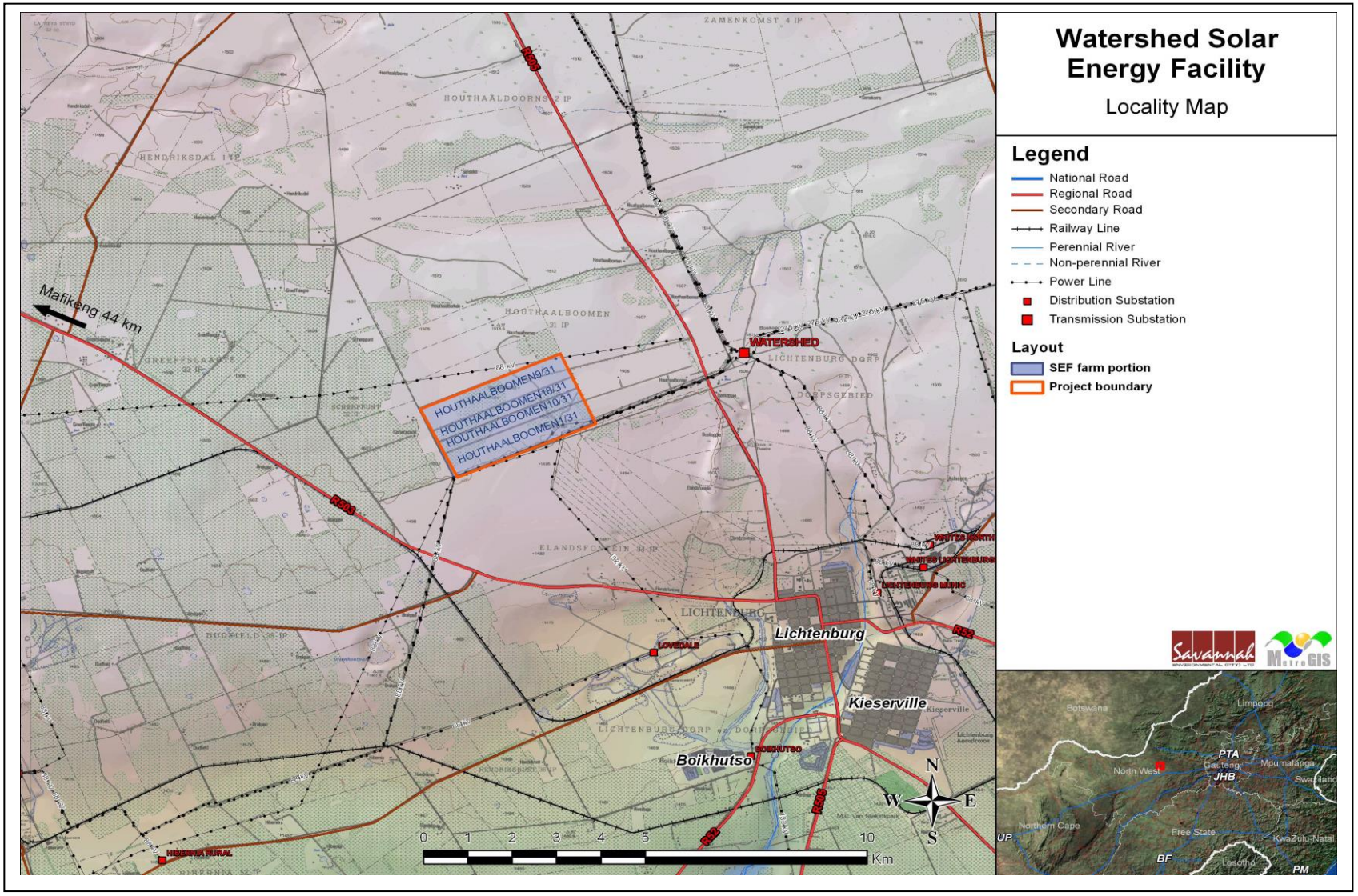

Figure 1.1: Locality map illustrating the location of the development site considered for the proposed Watershed (Phase I & II) Solar Energy Facility

The overarching objective for the development of the Watershed (Phase I & II) 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 which will serve to inform the final design of the facility.

The scope of the proposed Watershed (Phase I & II) 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 study area falls within the Carletonville Dolomite Grassland – as defined by Mucina and Rutherford (2006). This vegetation type is not listed as threatened by legislation, but is considered vulnerable by Mucina and Rutherford (2006) due to high levels of transformation. Resulting from the screening site visit, the farm portion can be divided into three types of state of vegetation:
  - Areas that show high levels of previous disturbance, most likely including cultivation, considered low sensitivity
  - Areas with natural but disturbed grassland, often dolomite present
  - Areas with natural and relatively undisturbed grassland with occasional trees and relatively high species diversity, occasionally with dolomite, which should be regarded as having higher sensitivity. These are areas that could be classified as CBA 2 areas, as indicated by the North West Province Biodiversity Assessment.
- **Agricultural Potential:** Although no areas of sensitivity occur on the site itself, the area next to the proposed site development has been used for agriculture (i.e. maize farming). These areas are sensitive as they might impact on agricultural production in the area and should not be impacted upon by proposed development.
- **Social receptors:** There are farm settlements or residences which occur at irregular intervals throughout the study area. Some of these, in close proximity to the proposed development site, include: *Houthaalbomen, Boskoppie, Elandsfontein, Brakpan, Scherppunt, Greeflaagte*, etc. The population density of the region is indicated as approximately 19 people per km^2, predominantly concentrated within the town of Lichtenburg.

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. However, areas of potential environmental sensitivity were identified through the scoping phase (as detailed above. These areas of sensitivity relate only to the ecological aspects of the site and are illustrated in the sensitivity map (refer to **Figure 1.2**). It was recommended that infrastructure should be placed so as to consider the implementation of mitigation measures to minimise impacts to identified sensitive areas. Subsequently, the layout/ design of the two phases of the solar energy facility have been undertaken by the developer. The proposed layout of infrastructure is discussed further in Chapter 2.

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

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

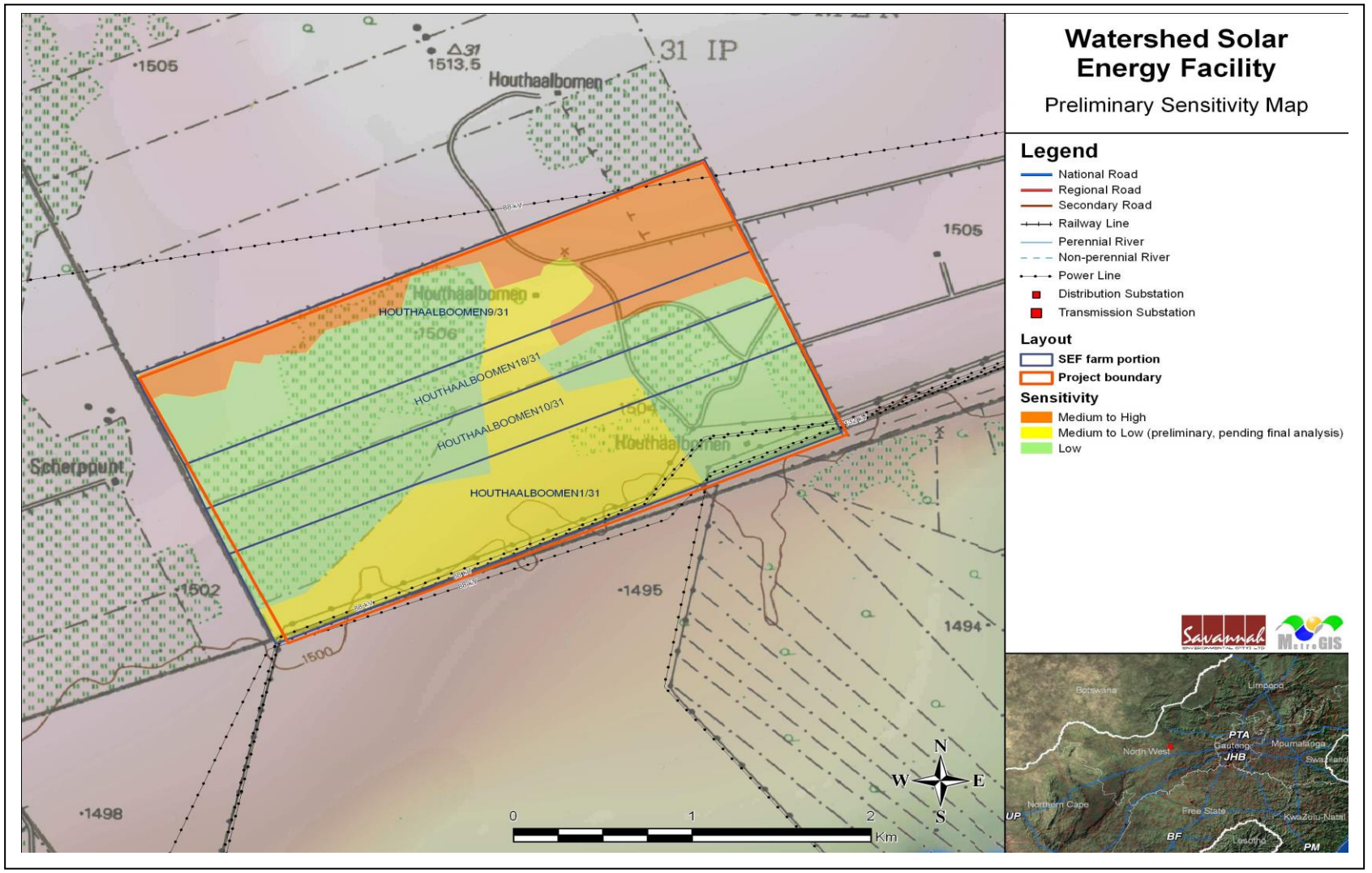

Figure 1.2: Scoping Phase Environmental Sensitivity Map for the proposed Watershed (Phase I II) Solar Energy Facility

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 the North West Department of Economic Development, Environment, Conservation and Tourism (DEDECT)) will act as a commenting authority. An application for authorisation for each project phase has been accepted by DEA under application reference numbers:

» Watershed Phase I Solar Energy Facility (DEA Ref. No. 14/12/16/3/3/2/556)
» Watershed Phase II Solar Energy Facility (DEA Ref. No. 14/12/16/3/3/2/557)

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 for Watershed (Phase I & II) Solar Energy facility[2]

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 overhead power line looping in and out of to an existing Eskom power line that runs from the Watershed Substation east of the R505, approximately parallel to the southern periphery of the selected property 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	*The construction of the proposed solar facility may impede on drainage lines on the site due to infrastructure such as storm water structures, power line and access roads.*	There are no wetlands within the development area but wetlands do exists outside development areas and may fall within 32 metres from the proposed development depending on the final design of the facility. In this instance, a water use application may be required prior construction.

[2] 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 determined through the EIA process as being not relevant to the project (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
		watercourse, excluding where such construction will occur behind 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 would require the infilling and deposition of materials within watercourses, specifically associated with road crossings.*	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 outside 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~~	*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 8 m

Relevant Notice	Activity No.	Description of Listed Activity	Relevant Component(s) of Facility	Applicability of proposed project to listed activity
		~~authorisation was obtained for the route determination in terms of activity 5 of Government Notice 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.	*Each PV facility will have an export capacity of up to 75M W.*	Each proposed PV facility will have an export capacity of approximately 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,	*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
		recreational, industrial or institutional use where the total area to be transformed is 20 hectares or more; ~~Except where such physical alteration takes place for:~~ ~~(ii) Linear development activities.~~ (iii) ~~Agriculture or afforestation where activity 16 in this schedule will apply.~~		
~~GN546, 18June 2010~~	~~12~~	~~The clearance of an area of 300 square metres or more of vegetation where 75% or more of the vegetative cover constitutes indigenous vegetation~~ ~~(b). Within a critical biodiversity areas as identified in bioregional plans~~	~~*The proposed development falls within a critical biodiversity area and vegetation may be impacted upon during construction.*~~	The listed activity was found to be not applicable
~~GN 546, 18 June 2010~~	~~13(c)ii~~	~~The clearance of an area of 1 hectare or more of vegetation where 75% or more of the vegetative cover constitutes indigenous vegetation.~~	~~*An area of 1 ha or more of indigenous vegetation cover may need to be cleared.*~~	The listed activity was found to be not applicable

Relevant Notice	Activity No.	Description of Listed Activity	Relevant Component(s) of Facility	Applicability of proposed project to listed activity
GN546, 18June 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	*An area of 5 ha or more of indigenous vegetation cover would need to be cleared to accommodate the facility*	The establishment of each 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.

The EIA phase was conducted in accordance with the requirements of the EIA Regulations in terms of Section 24(5) of NEMA.

1.4. Objectives of the EIA Process

The Scoping Phase was completed in **August 2013** with the submission of a Final Scoping Report to the DEA, and the acceptance of scoping was received from DEA on **11 September 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 draft EIA Report provided stakeholders with an opportunity to verify that issues they have raised through the EIA Process have been captured and adequately considered. The final EIA Report 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 specialist** from Savannah Environmental who are responsible for this project are:

» **Lusani Rathanya** - the principle author of this report holds an Honours Bachelor degree in Environmental Management and Analysis with 1.5 year of experience 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.
» **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.
» **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)
» 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 Watershed (Phase I & II) Solar Energy Facility near Lichtenburg, North West 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 Watershed Solar Energy Facility is proposed to be developed as a commercial 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 Watershed 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 Watershed 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, 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 Watershed 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**. In summary, the following is relevant:

At a provincial level, the need for the project complies with the North West Renewable Energy Strategy (RES) for the North West Province (NWP) (2012) (refer to Chapter 3 for more details in this regard). The Renewable Energy Strategy (RES) for the North West Province (NWP) (2012) was developed by DEDECT to enable the NWP to participate competitively within the emerging renewable energy sector of South Africa, while addressing the NWP's contribution to greenhouse gas emissions and the use of non-renewable fossil fuel resources.

The RES notes that the NWP is the fourth largest electricity consuming province in South Africa (12%). The bulk of electricity is currently obtained from conventional coal-fired plants in Mpumalanga. Approximately 63% of the electricity supplied to the NWP is consumed in its mining sector. Many rural communities within the NWP are affected by energy poverty – a legacy of historic neglect and underdevelopment – and make use of wood fuel, with impacts on the environment and health. At the same time, the emerging renewables sector holds potential for employment creation, green manufacturing, and commercial energy generation (linked to the IRP). The key objectives of the RES are therefore to:

» Reduce the North West Province's contribution to climate change;
» alleviate energy poverty in the province; and
» Promote economic development and job creation in the province by developing a green economy.

In line with national policy, provincial energy use from renewables targets are set at 15% for 2015, 30% by 2025, and 50% by 2050. Various renewable energy source options were investigated in the RES. Solar (photovoltaic as well as solar water heaters), Municipal Solid Waste, hydrogen and fuel cell technologies, bio-mass, and energy efficiency were identified as sub-sectors/ sources which hold the greatest competitive potential in the NWP.

Solar

With regard to solar energy, the RES notes that the NWP has a very good potential with daily average solar radiation rates of greater than 8 000 MJ/m^2. Only the Northern Cape Province (NCP) receives more radiation than the NWP. While the area around Upington (NCP) receives the highest solar radiation levels, levels in the Watershed study area are only 11% lower (8 500-9 000 MJ/m^2), ~40% more than areas in South Africa which receive least radiation (e.g. Durban). Both PV and

concentrated thermal (CSP) technology options are suitable for the NWP. As availability of cooling water is a key factor associated with CSP, the technology is indicated as being of Low potential for development in water-stressed areas. PV development is however considered to be a High potential/ priority for the study area.

The main IDP and SDP objective of Ditsobotla Local Municipality is actively promoting industrial development that contributes to economic growth in the area, to upgrade and maintain electricity network, and provide continuous and quality electricity by 2017. The construction of the proposed solar energy facility will assist in meeting these objectives.

The current land-use on the site is agriculture (grazing). The development of the Watershed Solar Energy Facility will allow 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 some of the site, while also generating renewable energy from the sun and providing an additional source of income to the landowner and contributing to the sustainability of the farm. 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 150 MW. An area of approximately 380 ha in extent will be occupied by the PV panels and associated infrastructure. A layout of the proposed Watershed 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. The layout was revised to accommodate comments raised by the stakeholders. **Table 2.1** summarises the dimensions of the project components.

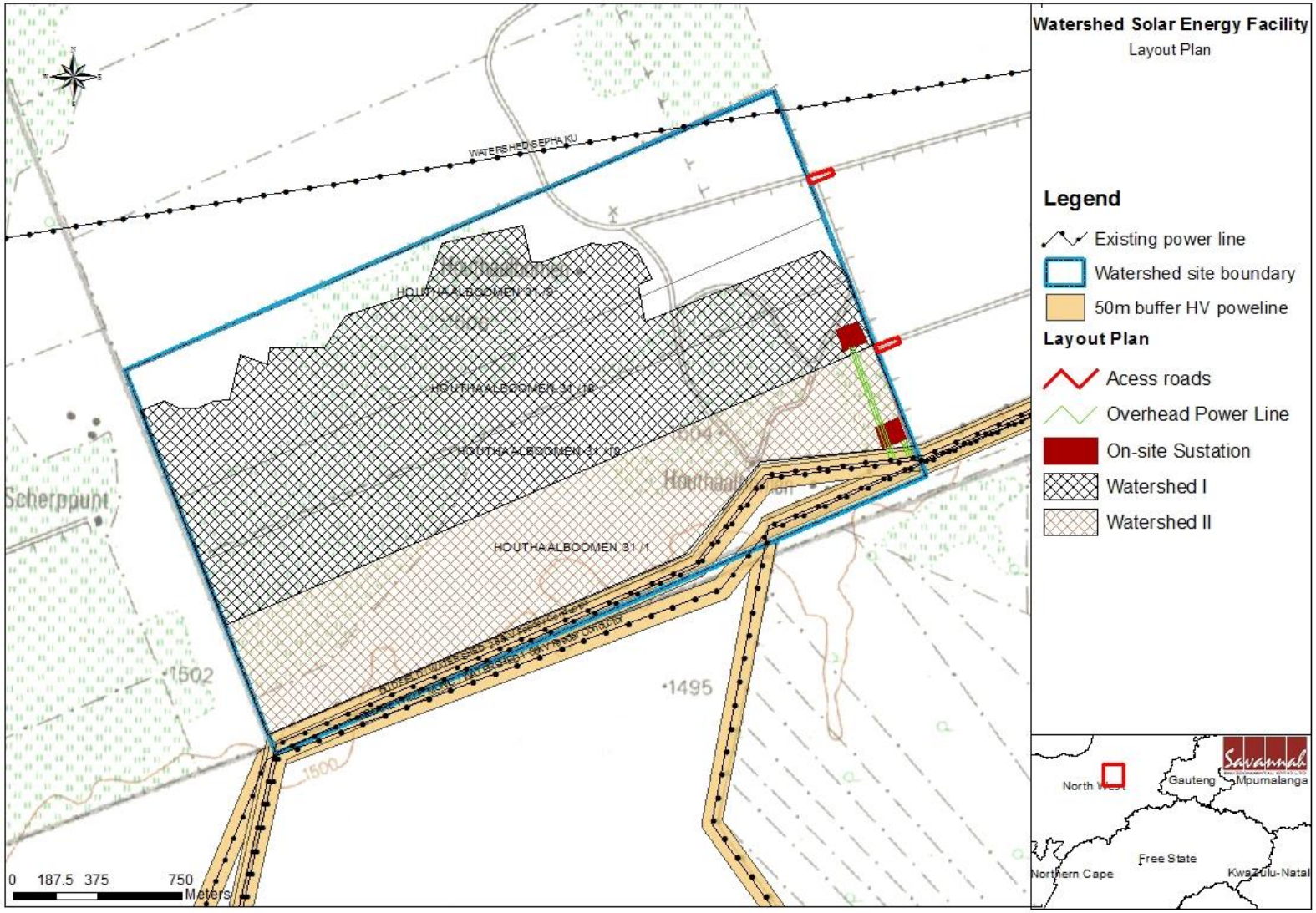

Figure 2.1: Layout for the proposed Watershed (Phase I & II) Solar Energy Facility and associated infrastructure

Table 2.1: Technical details for **each proposed facility**

Component	Description/ Dimensions
Location of the site	~ 6 km north-west of Lichtenburg
Municipal Jurisdiction	» Ditsobotla Local Municipality » Ngaka Modiri Molema District Municipality
Extent of the proposed development footprint	~ 180ha (phase I) ~ 200ha (phase II)
PV Panel area	~173 ha
Laydown area	~2ha
Extent of broader site available for both developments development	~560 ha
Site access	Use of existing access road to the Farm Houthaalbomen. 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

Component	Description/ Dimensions
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: 20mx10m (4m high)
Width and length of internal roads	Width: 4-6 m Length: 20m
Height of Fencing	2.5m
Office / workshop (size)	Maintenance building: 20mx5m 2,5 m height Warehouse: 20mx10m 4 m height Fence height: 2,5 m
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 a 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 a power line that runs from the Watershed substation east of the R505, approximately parallel to the southern periphery of the site in order to connect to the national grid. The length of the power line is ~ 90 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

Component	Description/ Dimensions
	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, each proposed facility will require numerous cells arranged in multiples/arrays which will be fixed to a support structure.

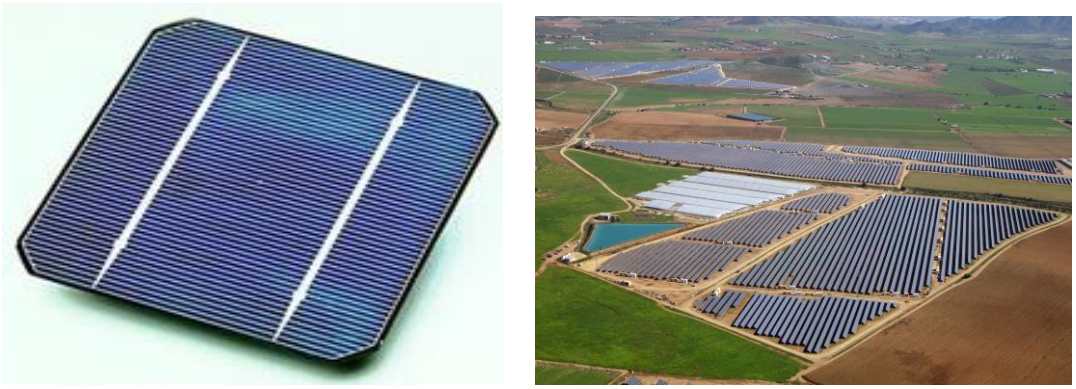

Figure 2.2: Figures showing a typical PV cell and an array of PV panels (source: http://www.frv.com/multimedia-files/)

» ***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. 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: energy blog)

2.4 Project Alternatives

In accordance with the requirements of the EIA Regulations[3], 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.

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

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

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 560 ha in extent, will therefore be sufficient for the installation of both the proposed facilities, 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 - Access to the proposed development area is afforded by a secondary (gravel) road that joins the R505 arterial road near the Watershed substation, east of the proposed site. 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 demarcated 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 runs from the Watershed substation east of the R505, approximately parallel to the southern periphery of the site enabling a short distance for grid connection (i.e. a power line approximately 90 m in length). Through the construction of a loop-in loop-out connection power line, the electricity generated at the PV facilities 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 scoping phase indicated that there are no environmental fatal flaws associated with the site proposed for the PV development although areas of high sensitivity have been identified.

2.4.2. Layout Design Alternatives

As indicated above, the proposed Watershed PV facility (Phase 1 and 2) is expected to have a developmental footprint (~360ha) which is smaller than the broader farm

(~560ha). 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 as well as 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 Watershed Solar Energy Facility. The preferred option will be informed by financial, technical and environmental factors.

Fixed Mounted PV System (Preferred Alternative)

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. This system 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 and, as such, are less suitable to operations in South Africa. This is because:

» 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 Watershed (Phase I & II) 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 150 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 9th 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 North West 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 each phase of 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

Access to the proposed development area is afforded by a secondary (gravel) road that joins the R505 arterial road near the Watershed substation, east of the proposed site. 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 ~20m 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)[4] 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.).

[4] 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)

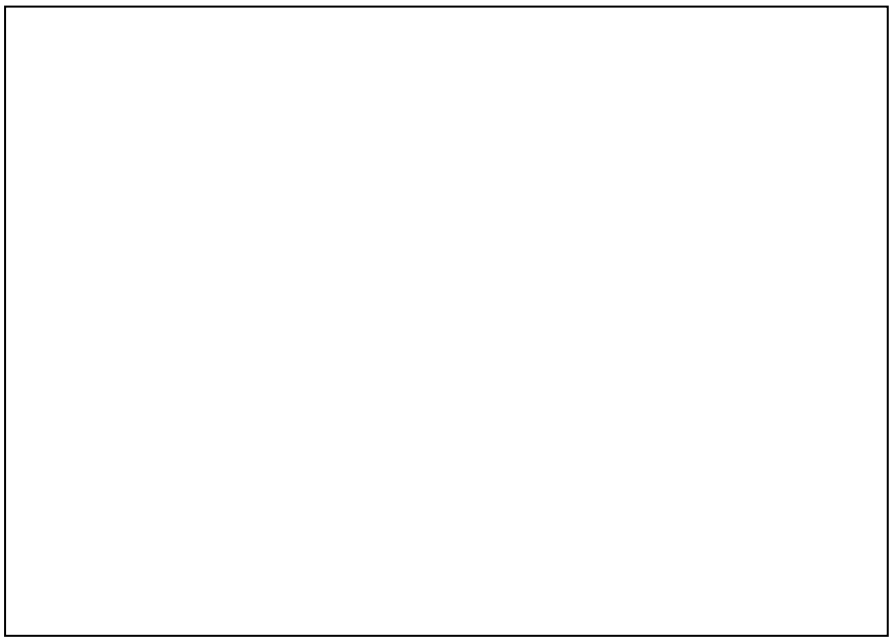

Figure 2.5 Mounting of the frame for the PV panels (Courtesy of Igeam, 2011)

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 runs parallel to the site) will be required to evacuate the power from each facility 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 that runs past the site is approximately 90 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 runs parallel the development site. This power line, in turn, connects to the Watershed 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 Watershed (Phase I & II) Solar Energy Facility.

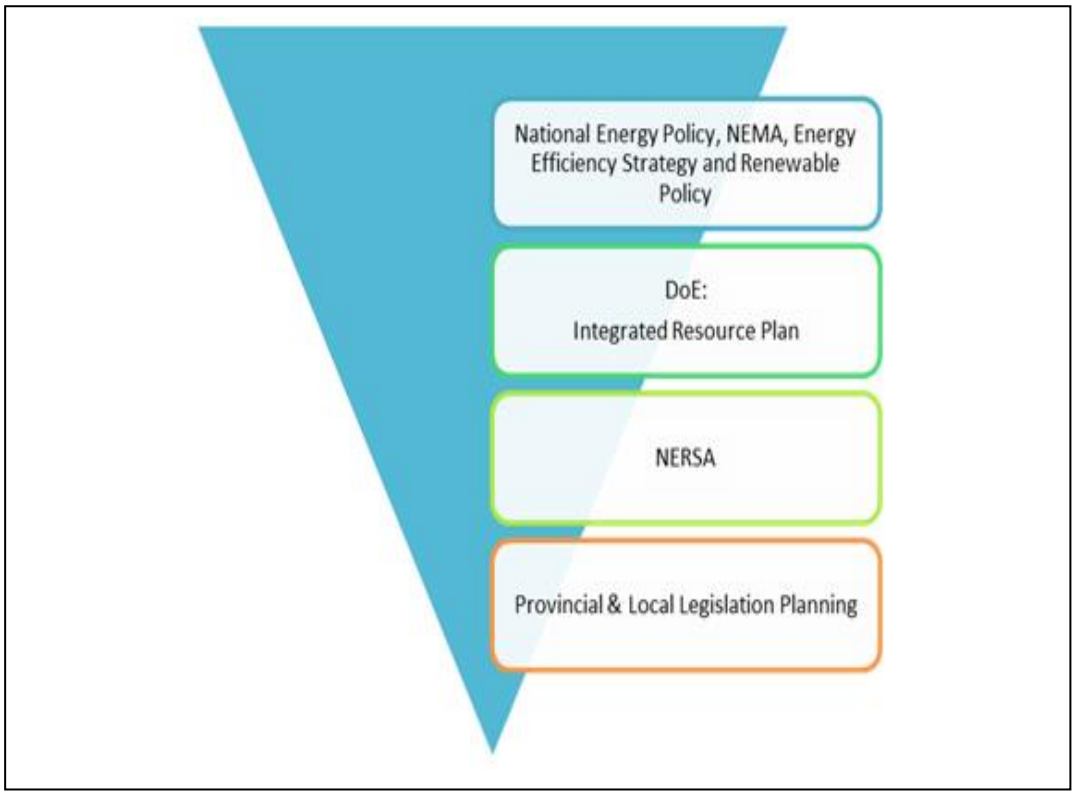

Figure 3.1: Hierarchy of electricity policy and planning documents

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 (December, 1998). 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[5], 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-subsidised 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 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.

[5] 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)

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 Renewable Energy Strategy for the North West Province (2012)

The Renewable Energy Strategy (RES) for the North West Province (NWP) (2012) was developed by DEDECT to enable the NWP to participate competitively within the emerging renewable energy sector of South Africa, while addressing the NWP's contribution to greenhouse gas emissions and the use of non-renewable fossil fuel resources.

The RES notes that the NWP is the fourth largest electricity consuming province in South Africa (12%). The bulk of electricity is currently obtained from conventional coal-fired plants in Mpumalanga. Approximately 63% of the electricity supplied to the NWP is consumed in its mining sector. Many rural communities within the NWP are affected by energy poverty – a legacy of historic neglect and underdevelopment – and make use of wood fuel, with impacts on the environment and health. At the same time, the emerging renewables sector holds potential for employment creation, green manufacturing, and commercial energy generation (linked to the IRP). The key objectives of the RES are therefore to:

» Reduce the North West Province's contribution to climate change;
» alleviate energy poverty in the province; and

» Promote economic development and job creation in the province by developing a green economy.

In line with national policy, provincial energy use from renewables targets are set at 15% for 2015, 30% by 2025, and 50% by 2050. Various renewable energy source options were investigated in the RES. Solar (photovoltaic as well as solar water heaters), Municipal Solid Waste, hydrogen and fuel cell technologies, bio-mass, and energy efficiency were identified as sub-sectors/ sources which hold the greatest competitive potential in the NWP.

Solar

With regard to solar energy, the RES notes that the NWP has a very good potential with daily average solar radiation rates of greater than 8 000 MJ/m^2. Only the Northern Cape Province (NCP) receives more radiation than the NWP. While the area around Upington (NCP) receives the highest solar radiation levels, levels in the Watershed study area are only 11% lower (8 500-9 000 MJ/m^2), ~40% more than areas in South Africa which receive least radiation (e.g. Durban). Both PV and concentrated thermal (CSP) technology options are suitable for the NWP. As availability of cooling water is a key factor associated with CSP, the technology is indicated as of Low potential for the water-stressed areas. PV development is however considered High potential/ priority for the study area.

During the status quo assessment for the RES, no barriers to the generation and use of solar PV systems within the NWP were identified, except for the only slightly lower levels of solar irradiation levels compared to the NCP and parts of Limpopo. The RES notes that this could potentially be offset by sufficient economies of scale. The NWP has sufficient land area available and the electricity grid infrastructure is good in the areas of high economic activity and in the proximity of the numerous mines and related large industries concentrated in certain areas of the NWP. The infrastructure in the NWP is also generally good in these same areas. This implies that, although the NWP is not a preferred destination for Solar PV projects, it can be made one if some of the general barriers are removed for project developers by the Province.

Solar PV – key actions

Based on the above, following key actions are proposed for the NWP with regard to Solar PV:

» Identify a suitable entity linked to the NWPG to drive the opportunities associated with solar PV projects under the REIPPP;
» The NWP should initiate a project as part of the implementation plan to identify suitable areas within the NWP which complies with the following requirements:
  * Suitable and proven measured levels of solar irradiation;
  * Long-term lease or option agreements possible;
  * Good grid infrastructure in close proximity;

- Suitable connection point into the electricity grid;
- Low impact on agriculture and environment;
- Suitable access to and around site for effective execution; and
- In close proximity to communities that could benefit from local economic development and job creation;

» The NWPG should also explore the possibility of packaging the most suitable and viable land areas for solar PV project developers to attract them to the NWP;

» The NWP should focus on developing the local content of components for the PV industry. As the IRP-2 allocation would soon be concluded, risk and uncertainty is however associated with the manufacturing of PV components. Long-term procurement programmes are consequently needed in order to stimulate further investment in local manufacturing and ensure that there is a long-term future for the solar PV industry. .

The development of the proposed Watershed Solar Energy Facility Phase I & II will assist the province in meeting their objectives of reducing climate change factors, reducing poverty through job creation and transfer of skills within the North West Province.

3.2.2. North West Provincial Spatial Development Framework (2008)

The NWP Provincial Spatial Development Framework and Environmental Management Plan (PSDF–EMP) is one of the fundamental implementation instruments of the NWP Growth and Development Strategy 2004-2014, and provides the spatial dimension for this strategy. As such, the PSDF-EMF is aligned with the 2003 National Spatial Development Perspective (NSDP), and the key emphasis is on economic growth and poverty eradication.

The spatial rationale is underpinned by the need to address issues related to spatial planning, socio-economic development, infrastructure and conservation of natural resources. Key socio-economic issues which would require strategic planning provision include: Employment (including youth and women); Poverty eradication; attracting Investment; Economic growth; HIV / AIDS and other diseases; Food security; Physical infrastructure (including availability of industrial land); Illiteracy; Tourism development; Population growth, urbanization and migration.

Natural resource issues include inadequate water resources for future development; Bush encroachment and alien invasive species; Land and soil degradation; and Overgrazing. With regard to spatial planning, the legacy of Apartheid-era policy is identified as a key issue, especially as parts of the NWP were formerly part of the Bophuthatswana Bantustan, and are consequently extremely underdeveloped.

The proposed project will assist in eradicating poverty through job creation and alien invasive species will be eradicated as per the environmental management plan (refer to **Appendix J and K**).

3.2.3 Ngaka Modiri Molema District Municipality (NMMDM) IDP 2011-2012

The NMMDM IDP notes that the DM is an area of scenic beauty and strong developmental contrasts. As a District, it is the seat of the Capital City (Mafikeng) of the North West Province. The key economic sectors include agriculture, mining, manufacturing and tourism. The tourism potential of the area is linked to its pristine landscapes and open spaces. In terms of its location, the NMMDM is strategically located on the intersections of the Platinum Western Corridor which links the economic hub of Gauteng with Botswana and Namibia to the west.

The vision of the NMMDM is "To be a District Municipality that delivers sustainable quality services". In promoting this vision the District aims to:

» Jointly focus and deliver on key national and provincial priorities;
» Eliminate the service backlogs by 2014 by delivering on the constitutional obligation to provide basic services to all;
» Improve services provision to comply with the set standard;
» Develop economic sectors and spatial localities in accordance with people's need and potential;
» Protect and use the natural resource base in a sustainable manner.

The DM mission is *"To provide transparent and people centred governance"*

Of specific importance to the District are the following sectoral growth and economic development pillars are identified by the North West PGDS:

- Tourism;
- Mining and Energy;
- Agricultural and Rural Development;
- Manufacturing Trade and Finance;
- Construction Transport and Infrastructure.

The North West Province has experienced a decline in the mining sector and this has resulted in an increase in the level of unemployment. The proposed project will create jobs during the construction and operational phase and this will assist in reducing unemployment to a certain level.

3.2.4. Ditsobotla Local Municipality (DLM) IDP 2011-2016

The DLM IDP notes that the vision for the municipality is: "A developmental municipality dedicated to the social and economic up-liftment of its communities". The Mission Statement in the IDP is: "Sustainable service delivery through: transparent administration; dedicated staff; implementation of municipal programmes; and consultation with communities."

The IDP lists five key performance areas, of which the following two are relevant to the proposed solar energy facilities:

» Local Economic Development (LED);
» Basic Service Delivery and Infrastructure Development;

In terms of LED the IDP highlights the need to support the development of Small Medium and Micro Enterprises (SMMEs). The IDP also identifies the need for the implementation of skills development and training programmes to assist with the development of SMMEs and local economic development.

In terms of Infrastructure Development the IDP highlights the impact that the current limited energy supply has had on economic development in the DLM and in Lichtenburg specifically. The current energy capacity problems were also raised by the LED and IDP Managers who both indicated that energy supply constraints were hampering the development of new projects in the DLM. To address this the IDP refers to the need to expand the current supply by 20 MVA.

The key issues and needs identified in the IDP that are relevant to the proposed solar energy facilities include:

» High levels of poverty and unemployment;
» Low levels of education and skills ;
» Low income levels and limited employment opportunities;
» Current challenges associated with services delivery and backlogs.

In order to address these challenges the DLM aims to create and support an environment that is conducive for economic growth and provides sustainable employment opportunities. In addition, the DLM aims to implement a well-structured infrastructure and service delivery programme that will enable residents to meet their social and economic needs.

The proposed Watershed Solar Energy Facility Phase I & II will be delivery service to the community through job creation and to the country by adding electricity to

the national grid. Furthermore, the development of the proposed facility will boost the local economy.

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 North West – Department of Economic Development, Environment, Conservation and Tourism (DEDECT).* This department is the commenting authority for this project.
» *Heritage North West* - This is the provincial authority responsible for the management and conservation of heritage sites.
» *Department of Agriculture North West* – 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 Ditsobotla Local Municipality which is part of the Ngaka Modiri Molema 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 Ditsobotla and Ngaka Modiri Molema 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 assessed in this report. A listing of relevant legislation is provided in **Table 3.1**.

Table 3.1: 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 facilities have been identified and are discussed 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 of a project proponent to consider a project holistically, and to consider the cumulative effect of a variety of	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
	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. Therefore 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 North West Department of Water Affairs	The facility will not trigger any water uses as listed in Section 21 of the NWA.
Minerals and Petroleum Resources Development Act (Act No 28 of 2002)	A mining permit or mining right may be required where a mineral in question is to be mined (e.g. materials from a borrow pit) in accordance with the provisions of the Act. Requirements for Environmental Management Programmes and Environmental Management Plans are set out in S39 of the Act. S53 Department of Mineral Resources: Approval	Department of Mineral Resources	As no borrow pits are expected to be required for the construction of the facility, no mining permit or right is required to be obtained. A Section 53 application will be submitted the North West DMR office.

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
	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). » 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).	South African Heritage Resources Agency	A heritage impact assessment has been undertaken as part of this EIA process (refer to Appendix G).

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
	» 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 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	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 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, Forestry and Fisheries	This Act will find application throughout the life cycle of the project. In this regard, soil erosion prevention and soil conservation strategies must be developed and implemented. In addition, a weed control and management plan must be implemented.
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 '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'.	Department of Agriculture, Forestry and Fisheries	An application for a permit will be submitted to Department of Agriculture, Forestry and Fisheries for any protected tree species on site to be removed/damaged or cut
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	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

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
	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.		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. 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	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
	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 will 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 will have to be in place prior to any subdivision approval in terms of S24 and S17 of the Act.
National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008)	The Minister may by notice in the *Gazette* publish a list of waste management activities that have, or are likely to have, a detrimental effect on the environment. The Minister may amend the list by – » Adding other waste management activities to the list. » Removing waste management activities from the list. » Making other changes to the particulars on the list. In terms of the Regulations published in terms of this Act (GN 922, 29 November 2013), A Basic Assessment or Environmental Impact Assessment is required to be undertaken for identified listed activities.	National Department of Water and Environmental Affairs North West Department of Environmental Affairs (general waste)	As no waste disposal 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 is required to be undertaken in accordance with the requirements of the Act.

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
	Any person who stores waste must at least take steps, unless otherwise provided by this Act, to ensure that: » The containers in which any waste is stored, are intact and not corroded or in » Any other way rendered unlit for the safe storage of waste. » Adequate measures are taken to prevent accidental spillage or leaking. » The waste cannot be blown away. » Nuisances such as odour, visual impacts and breeding of vectors do not arise; and » Pollution of the environment and harm to health are prevented.		
National Road Traffic Act (Act No 93 of 1996)	» The technical recommendations for highways (TRH 11): "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	» South African National Roads Agency Limited (national roads) » North West 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

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
	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.		limitations (height and width).
Provincial Legislation			
The Renewable Energy Strategy (RES) for the North West Province (2012)	Developed by DEDECT to enable the NWP to participate competitively within the emerging renewable energy sector of South Africa, while addressing the NWP's contribution to greenhouse gas emissions and the use of non-renewable fossil fuel resources.	North West Province	The proposed project is a renewable project and will assist the province in meeting their goal of participating in the renewable sector.

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 (EMP) 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 September 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 Ditsobotla 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 August 2013. The Final Scoping Report and Plan of Study for the EIA were accepted by the DEA, as the competent authority, in September 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 & 7). 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
» 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[6] 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).

[6] "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.

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 NW DEDECT) 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 to DEA following the 21-day public review period.
» Provision of an opportunity for DEA and NW DEDECT 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 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	» North West – Department of Economic Development, Environment, Conservation and Tourism(DEDECT) » North West - Agriculture » North West – Roads and Public Works » North west - Water Affairs » South African Heritage Resources Agency National » SANRAL Eastern Region » North West Heritage » Department of Agriculture » Department of Energy
Municipalities	» Ditsobotla Local Municipality » Ngaka Modiri Molema 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:

* Mafikeng Mail (English – 28 June 2013)
* Noordwester (Afrikaans – 28 June 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:

* Mafikeng Mail (English – 28 June 2013)
* Noordwester (Afrikaans – 28 June 2013)

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

* Mafikeng Mail (English - 15 November 2013)
* Noordwester (Afrikaans – 15 November 2013)

Proof of newspaper advertisement placed has been attached in Appendix D.

» **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

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.

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 have been incorporated into Comments and Response Reports and are 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 for both Phases

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**
Jaco van der Walt of Heritage Contracts and Archaeological Consulting CC	Heritage impact assessment	**Appendix G**
Lourens du Plessis of MetroGIS	Visual impact assessment	**Appendix H**
Tony Barbour of Tony Barbour Environmental Consulting and Research	Social impact assessment	**Appendix I**

Specialist studies considered direct, indirect, cumulative, and residual environmental impacts associated with the development of the proposed Watershed (Phase I & II) 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 EMP is included as **Appendix J (Phase I) and Appendix K (Phase II)**.

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 – I** for specialist study specific limitations.

DESCRIPTION OF THE RECEIVING ENVIRONMENT CHAPTER 5

This section of the Final EIA Report provides a description of the environment that may be affected by the proposed Watershed (Phase I & II) 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 – I**.

5.1 Regional Setting: Location of the Study Area

The identified sites for the proposed PV facilities are situated approximately 6km by road north-west of Lichtenburg on Portion 1, 9, 10 and 18 of the farm Houthaalbomen *31*. This farm is located in an area that has a distinct rural and agricultural character, with some mining/quarrying activity (cement works) located south-east of the proposed development site at a distance of 5km at the closest. The Watershed substation is located at a distance of 3.4km east of the proposed site. A large number of power lines, associated with this substation, are located south and north of the site. The power lines traversing the sites to the south include:

» Watershed-Klerksdorp North No.1 132kV
» Delareyville Municipal-Watershed No.1 88kV
» Dudfield-Watershed No.1 and No.2 88kV

The power line traversing the sites to the north is the Watershed-Sephaku 88kV line.

5.2 Climatic Conditions

The climate for the Watershed site has been derived from climatic data summarised for Lichtenburg (worldweatheronlin.com, climate-data.org), located 6 km south-east of the site. The area receives about 580 - 600 mm of rain on average per year. From May to September, rainfall is minimal, with most rainfall occurring from November to March, peaking between December and March.

Temperatures in summer peak during December and January at a daily average maximum of 29°C, with an average of 19°C for June. During July, minimum temperatures are on average 2-3°C, with severe frosts during winter common.

5.3 Access and Transport Routes in the region

Access to the proposed development area is afforded by a secondary (gravel) road that joins the R505 arterial road near the Watershed substation, east of the proposed site.

5.4 Biophysical Characteristics of the Study Area

5.4.1 Topography

The topography or terrain morphology of the region is broadly described as *Plains and Pans* or *Slightly Undulating Plains* of the *Central Interior Plain* (refer to **Figure 5.1**). The slope of the entire study area is extremely even (flat) with a very gradual drop (approximately 50m) from the northern section of the study area (1510m above sea level) to the *Die Vlei* River (1460m) which flows through Lichtenburg.

5.4.2 Geology & Land Types

The geology of the site is dolomite and chert belonging to the Chuniespoort Group. In the neighbouring land type, Bc11, there is thick aeolian sand overlying the bedrock.

There is a single land type that dominates most of the site (Fa11), with only a very small area in the south western corner falling into the neighbouring land type (Bc11) (refer to **Figure 5.2**). Land type Fa11 is dominated by shallow soils that have formed in weathering bedrock, but it also contains deeper, red Hutton soils in patches. Land type Bc11 is a more agriculturally suitable one, dominated by moderately deep to deep red and yellow loamy soils with a fluctuating water table in the subsoil. Land type Bc11 supports cultivated agriculture in the area.

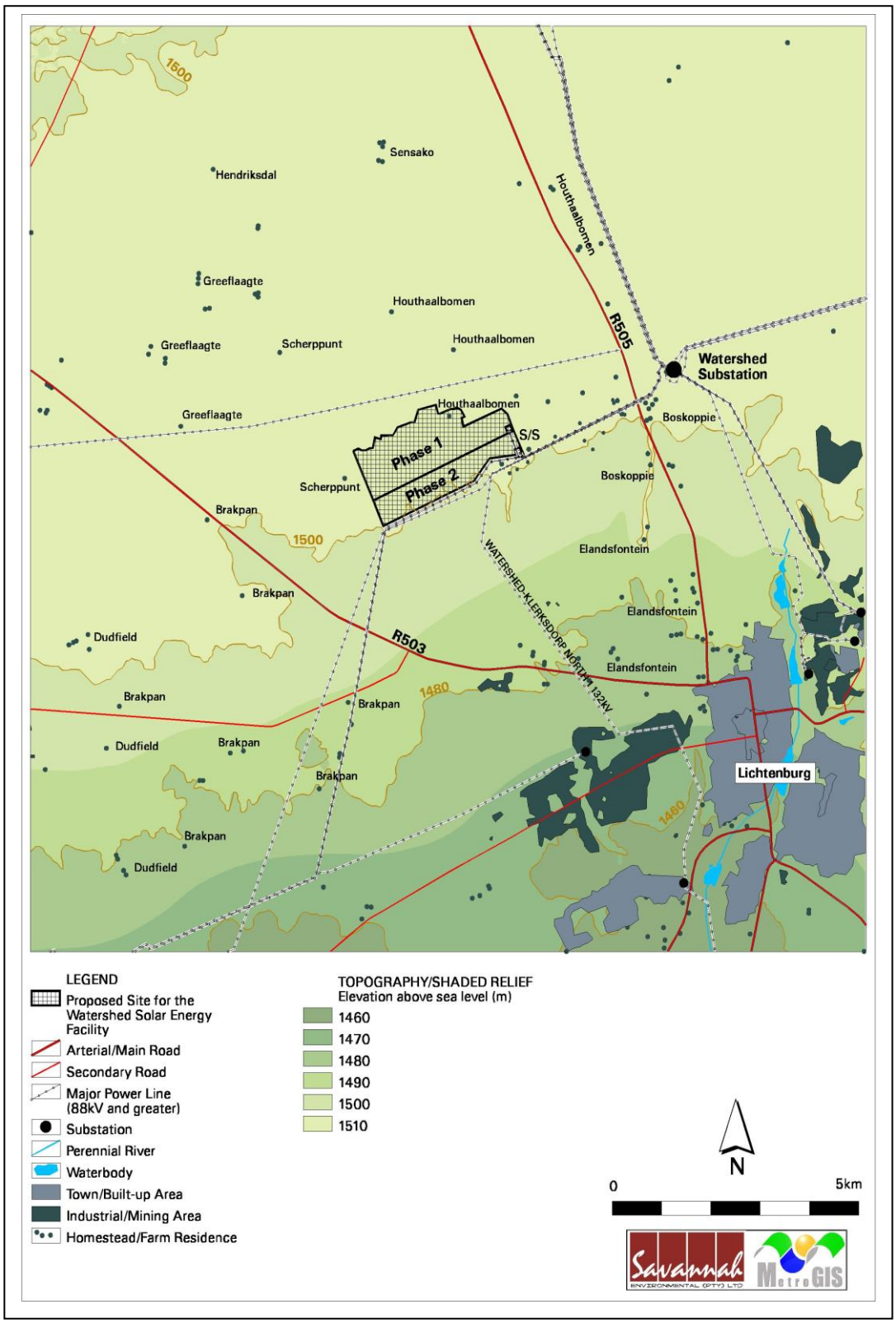

Figure 5.1: A map indicating the topography of the proposed Watershed (Phase I & II) Solar Energy Facility site and surrounding environment

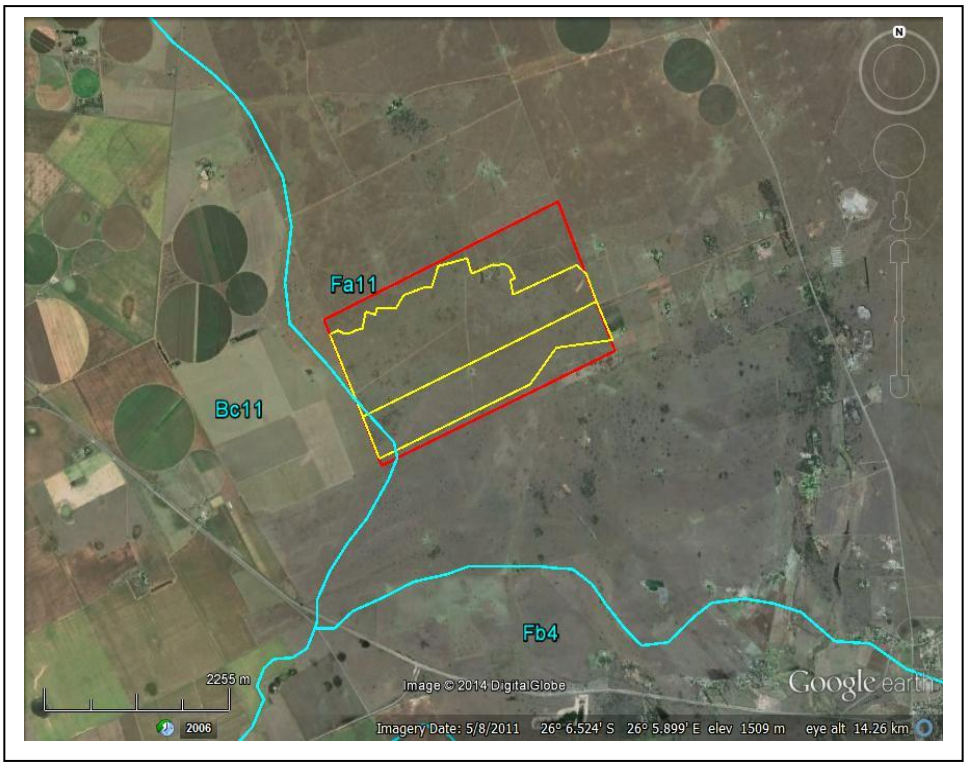

Figure 5.2: Land types with the proposed Watershed (Phase I & II) Solar Energy Facility

5.4.4 Agricultural Potential

Agricultural potential of the site is limited. As an indication of agricultural potential on the site, the land is classified on AGIS as having a potential maize yield (50 percentile) of mostly between 0.6 and 1.4 tons per hectare. The natural grazing capacity of the site is given as 11-15 hectares per large stock unit.

The major limitation to agriculture is that extremely shallow, rocky soils dominate the site, with only patches of deeper more agriculturally suitable soils interspersed between them. The aridity and lack of access to water are also limitations.

5.4.5 Land use and Land capability of the Study Area

There is no land on the site that has been cultivated within the last 10 years. The site is used only for grazing of cattle, and there is no agricultural infrastructure present.

Land use activities within the broader region are predominantly described as maize farming (both dryland and irrigated agriculture), with some

mining/quarrying activity (cement works located west of Lichtenburg) evident towards the south-east of the proposed site (refer to **Figure 5.3**).

Farm settlements or residences occur at irregular intervals throughout the study area. Some of these, in close proximity to the proposed development sites, include: *Houthaalbomen, Boskoppie, Elandsfontein, Brakpan, Scherppunt, Greeflaagte*, etc. The population density of the region is indicated as approximately 19 people per km^2, predominantly concentrated within the town of Lichtenburg.

The site has a land capability classification, on the 8 category scale, as: Class 6 - Non-arable, low to moderate potential grazing land. Land on the site is classified as having low susceptibility to water erosion, as it is level to gently sloping, and the soils have a favourable erodibility index.

5.4.6 Water Resources

The site can be described as flat with some minor depressions, without any drainage lines or natural wetlands. Man-made water infrastructure is restricted to one small dam near the old farm house and further boreholes and associated cattle-watering points.

5.5. Ecological Profile

5.5.1. Vegetation

The study area falls within the Carletonville Dolomite Grassland (refer to **Figure 5.4**) – as defined by Mucina and Rutherford (2006). Carletonville Dolomite Grassland is a species-rich grassland on slightly undulating plains dissected by prominent rocky chert and/or dolomite ridges. Depending on specific underlying geology and soils, the species composition of plant communities within this vegetation type varies in a complex mosaic pattern, and several species may be co-dominant.

Typical plant communities are dominated by the grasses *Brachiaria serrata*, *Cynodon dactylon*, *Digitaria tricholaenoides*, *Diheteropogon amplectans*, *Themeda triandra*, *Eragrostis chloromelas*, *Setaria sphacelata,* and *Heteropogon contortus*. Prominent forbs and low shrubs include *Acalypha angustata*, *Barleria macrostegia*, *Crabbea angustifolia*, *Dicoma anomala,* and several *Helichrysum* species. The diversity of perennial grasses and forbs is typically high for these grasslands.

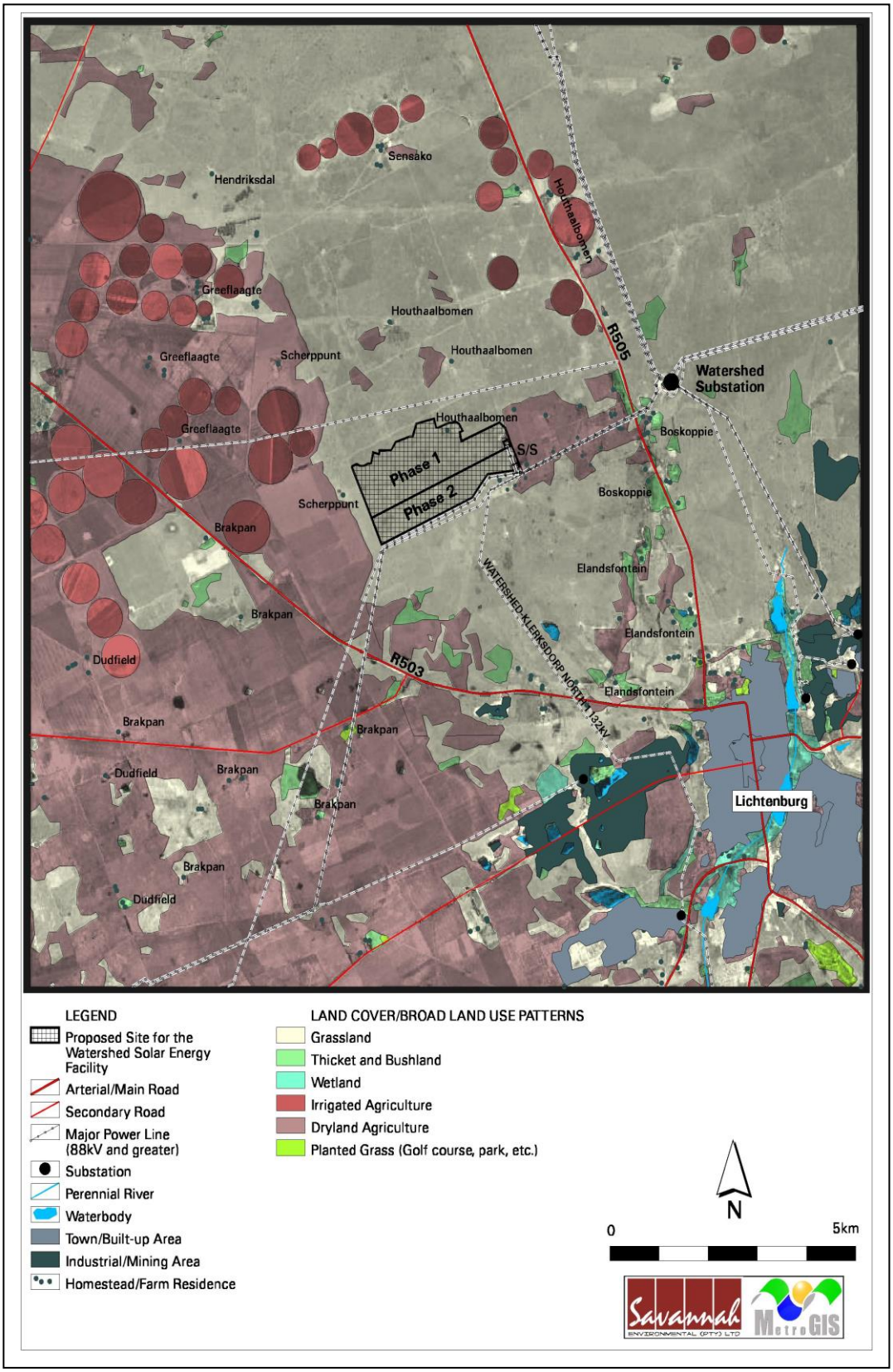

Figure 5.3: Land cover map for the proposed Watershed (Phase I & II) Solar Energy Facility

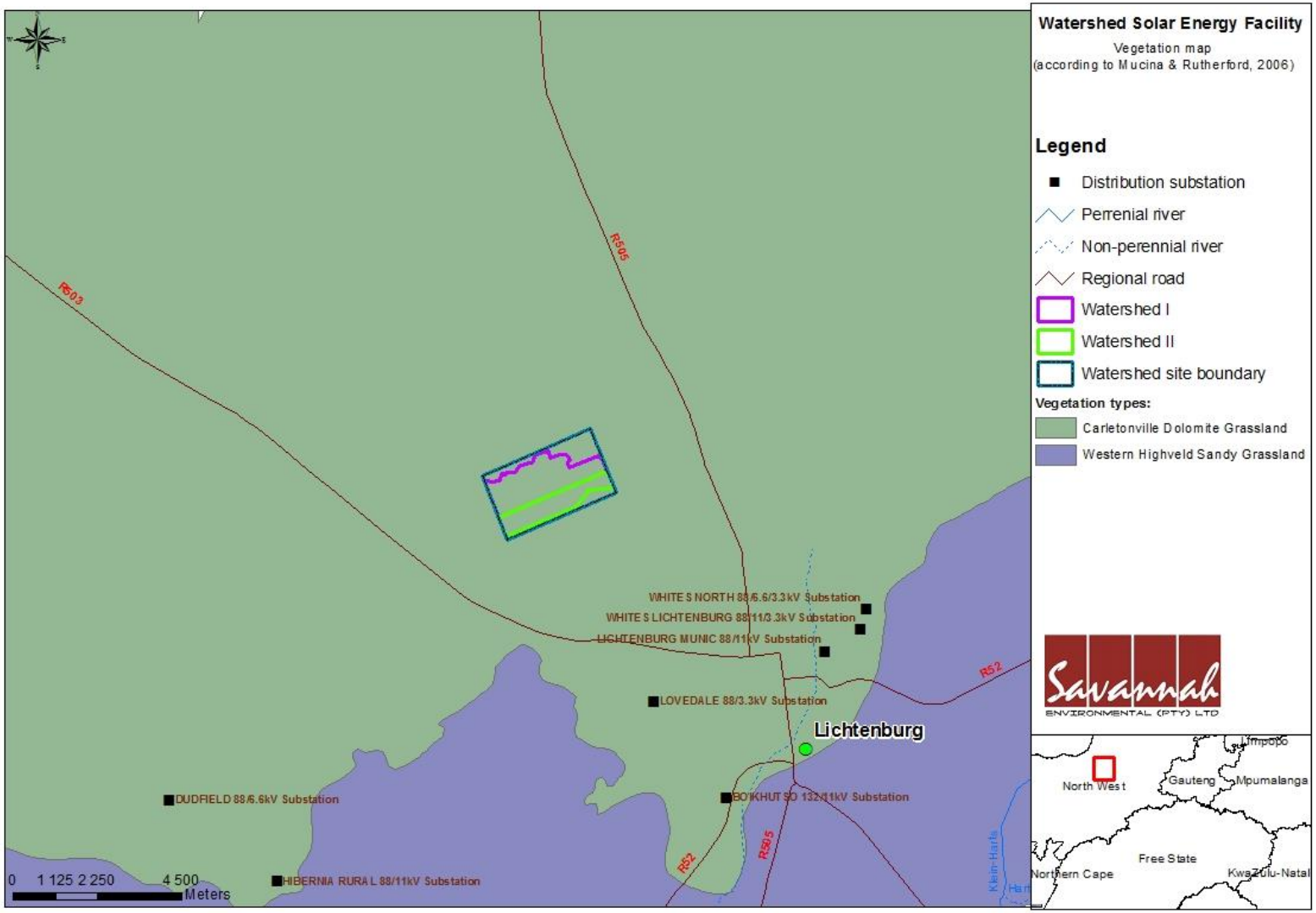

Figure 5.4: Vegetation Map indicating the vegetation found within the proposed Watershed (Phase I & II) Solar Energy Facility development site and surrounding area

The typical low grasslands are interspersed with a low density of high shrubs and low trees. Most of these are *Acacia*, *Ziziphus* and *Searsia* species. Soils are loamy and appear relatively shallow with sections of prominent surface rock (dolomite). Grazing capacity is estimated to be approximately 11 – 15 ha / large livestock unit.

This vegetation type is not listed as threatened by current legislation, but is considered vulnerable by Mucina and Rutherford (2006). Only a small percentage of the vegetation is currently within statutory and private conservation areas, whilst almost a quarter of the vegetation has been transformed by cultivation, urban sprawl and mining. Degradation of the ecosystem may, however, be widespread throughout the province.

Three vegetation units could be identified (refer to **Figure 5.5**):

» Unit 1: *Searsia pyroides – Aristida meridionalis* grasslands are distributed mostly over the southern section of the study area. The grasslands are not very dense, probably due to past management regimes, but also due to relatively shallow soils and a high degree of surface rockiness. The herb layer is interrupted by solitary low trees or smaller clumps of higher shrubs surrounded by a species-composition that favours the slightly more shaded microhabitat.

» Unit 2: *Acacia hereroensis – Helichrysum zeyheri* grasslands cover the slightly raised northern section of the study area. Surface rockiness is variable, but can be high. Grasslands are in a relatively good condition, although by the time of the survey much of the early-growing forb species had already withered and were no longer identifiable. The grasslands are interspersed with solitary high shrubs or low trees, or occasional open low woodlands, dominated by *Acacia hereroensis*.

» Unit 3: *Hyparrhenia hirta – Eragrostis lehmanniana* grasslands occupy the more central sections of the study area. Large heaps of stones removed from the upper soil layer indicate past cultivation practices in this area, but this could have occurred more than 20 years ago. The undulating grasslands are relatively dense, but the species composition of the grass layer and the presence of only a few isolated low trees still reveal the semi-natural state of this vegetation.

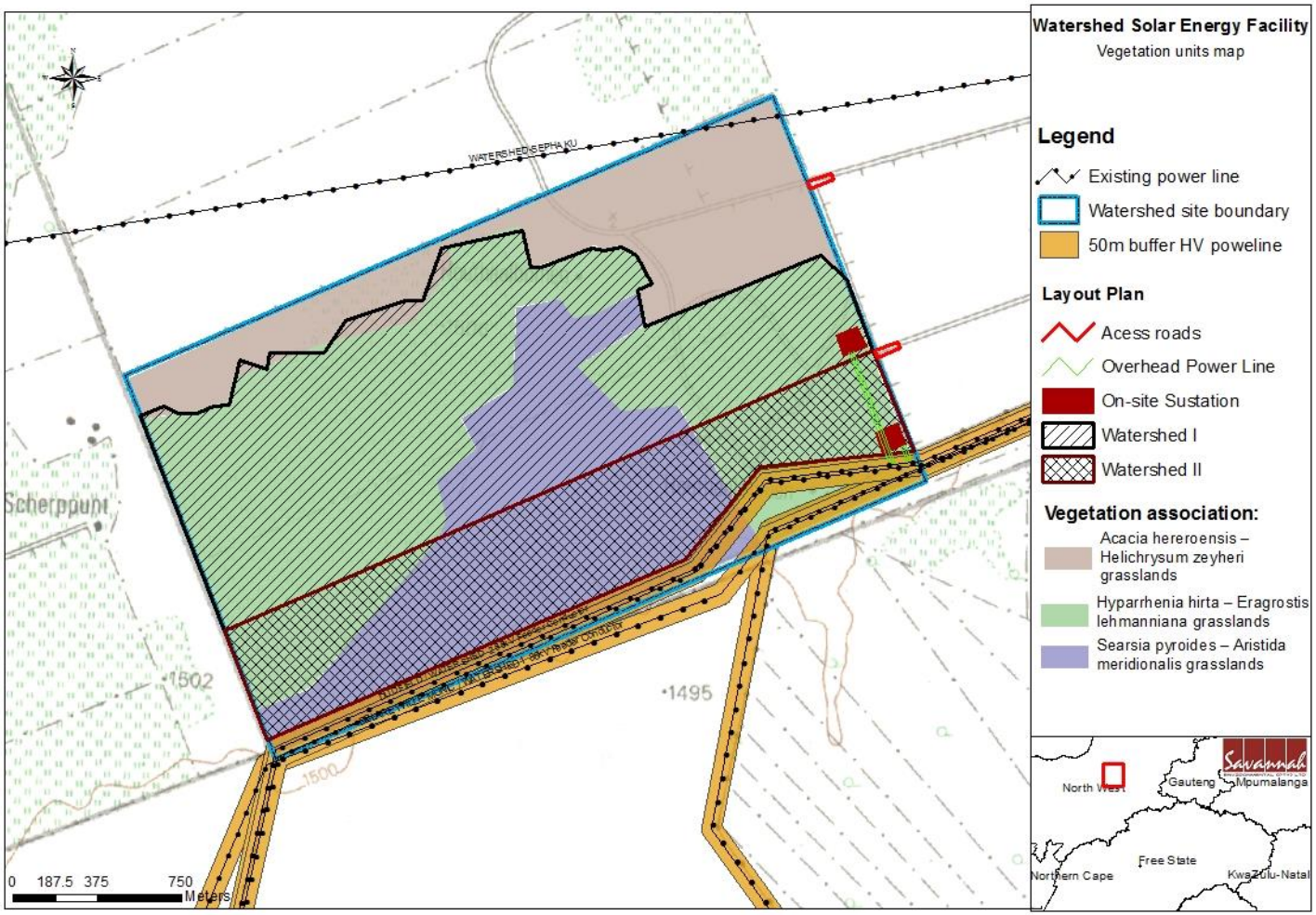

Figure 5.5: Map indicating the vegetation units within the proposed Watershed (Phase I & II) Solar Energy Facility

The entire study area has been mapped as a CBA 2 area by the North West Province Biodiversity Conservation Assessment (NWDACE 2009), restricting the options for development. However, as is indicated in Section 5.2 of the Schedule of Threatened Terrestrial Ecosystems in South Africa (Government Notice 1002, 9 Dec 2011), "it is important to ground-truth the presence of indigenous vegetation of the ecosystem in question. Spatial data on the location of ecosystems and on land cover is always subject to errors of scale, and land cover data is never 100% up to date". The same can be assumed to apply to the study area, of which only the extent of vegetation unit 2 has been identified as definite CBA 2 area. Vegetation unit 1 could be regarded as a CBA 2 area in poor ecological state, where development should be limited, but vegetation unit 3 has been highly disturbed in the past.
The relevant sensitivities of the vegetation units as determined by this study are presented in **Figure 5.6**.

5.6 Social Characteristics of the Study Area and Surrounds

5.6.1 Population

Based on the Census 2011 data, the population of DLM has grown by an average of 1.35% from 147599 in 2001 to 168902. The total number of households also increased from 35582 in 2001 to 44 500 in 2011, with an average size of 3.8 persons. In terms of age, approximately 46% of the population are younger than 20 years of age. In addition people younger than 15 years account for 32.6% of the population. The population of the DLM can therefore be described a relatively young. This highlights the need to ensure that education facilities are functional and employment opportunities are created. The highest concentration of people over 40 years of age is located in urban areas of Lichtenburg and Coligny.

5.6.2 Age Structure

The population of the NMMDM increased by 77 859 over the period 2001-2011, which represents an increase of ~ 9%. The increase in the population of the DLM increased by 21 303 (~ 13%) over the same period. This represents a significant increase over the 10 year period. The increase in the population in the NMMDM was linked to an increase in the 15-64 and 65 and older age groups. There was a decrease in the less than 15 age group. In the DLM there was an increase in the less than 15 and 65 and older age groups.

Figure 5.6: Ecology sensitivity map for the proposed Watershed (Phase I & II) Solar Energy Facility

There was a decrease in the economically active 15-64 year age group which is a concern for the development of the area, as this is the working portion of the population. As expected, the number of households in both the NMMDM and DLM increased, however, the size of the household sizes in both areas decreased slightly. The dependency ratio in the NMMDM decreased from 66.2 to 64.5, while it increased for the DLM, from 58.8 to 61.5. The increase in the DLM indicates that there are an increasing number of people who are dependent the economically active 15-64 age group. The age dependency ratio is the ratio of dependents, people younger than 15 or older than 64, to the working, age population, those ages 15-64.

The age dependency ratio (% of working-age population) in South Africa in 2010 was 53.29. Over the past 50 years, the value for this indicator has fluctuated between 84.43 in 1966 and 53.29 in 2010. The percentage of formal dwellings in the NMMDM increased marginally. However, in the DLM there was a decrease in the percentage of formal dwellings. This implies that a number of the increased households in the DLM are informal dwellings, which is a concern in terms of service delivery.

5.6.3 Education levels

The education levels in the DLM have improved since 2001. In this regard the percentage of the population of school-going age without schooling dropped 9% from 24% to 15% between the period 2001 and 2011. Approximately 20% can be classified as having completed Grade 12 which represents a 4% growth, and 6.5% have higher education qualifications.

5.6.4 Employment

The economically active population of the DLM is 53.5% which represents a total population of 89 518. Approximately 42.2% is unemployed and 57.8% employed (Ditsobotla, SDF Review). The official unemployment rate in both the NMMDM and DLM has decreased for the ten year period between 2001 and 2011. In the NMMDM the rate fell from 47.7% to 33.7%, a significant decrease of 14%. The decrease in the DLM was 14.2%. Youth unemployment in both the NMMDM and DLM also dropped over the same period. At the same time the education levels improved, with the percentage of the population over 20 years of age with no schooling dropping 10 and 9 % for the NMMDM and DLM respectively. The percentage of the population over the age of 20 with matric also increased in both the NMMDM and DLM by 4.2% and 4.3% respectively.

5.6.5 Economic context

The Ditsobotla Local Municipality contributes 22.7% to the district economy. In terms of contribution, the finance and business services sector represent the largest contributing sector with a contribution of 24.7%, followed by the trade sector (19.1%) and the manufacturing sector (11.8%). The general government service is the fourth largest contributor with 11.4%. Although Agriculture and Mining are two key sectors, they only contributed 7.7% and 1% to the local economy in 2010. The economy for the period 1995 - 2009 was higher than the rate for the district and province. The average annual growth for the municipality for the period 1995 – 2009 was 3.8% compared to the national annual average of 3.3% and the provincial average of 2.3%.

5.6. Heritage Profile

To the north of the study area towards Zeerust and to the north-west towards Mafikeng, the area is well known for Later Iron Age stone walled settlements archaeologically referred to as Molokwane settlements (Pistorius 1992, Booyens 1998, Huffman 2007). Two sites were recorded consisting of a concentration of MSA artefacts (Site 1 and 2) and a third site consisting of a single grave (Site 3) a fourth site consist of a farm labourer dwelling (Site 4) that according to the owner is approximately 20 years old. A further total of 20 occurrences were mapped and recorded but not digitally photographed. Artefacts at these locations consist mainly of MSA with some flakes micro-lithic in nature flakes possibly LSA. The low number of sites recorded can be attributed to a lack of sustainable water sources (no pans exist in the development footprint) in the development area as well as the lack of raw material for the manufacturing of stone tools.

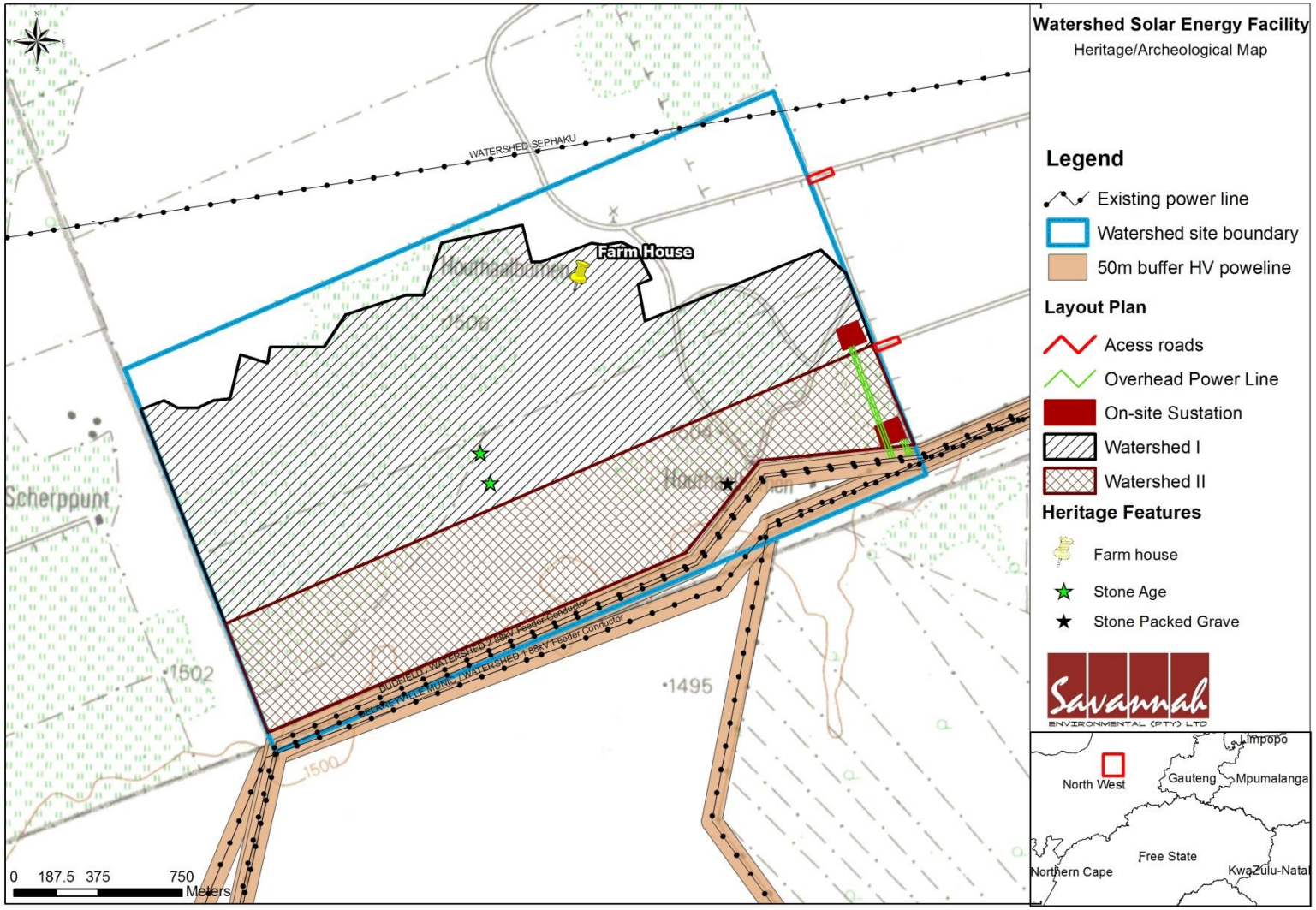

Figure 5.7: Map indicating heritage sites recorded within the proposed Watershed (Phase I & II) Solar Energy Facility development area

5.6.1. Findings of the field survey

Site 1 and 2: Stone Age concentrations

The sites consist of a low to medium density of artefacts (3 -5 artefacts per m²) with a MSA and possible LSA component. Artefacts consist of unretouched flakes, blades, radial cores mainly on CCS. The sites are located in close proximity to each other and the artefacts are scattered in varying densities over an area of 20 x 10 meters. It is unsure if this was a manufacturing/knapping site as there is a lateral distribution of artefacts due to the extensive ploughing activities in the past.

These sites are already disturbed by the extensive agricultural activities conducted on the farm but fall inside the proposed development footprint and will be impacted on by the proposed solar facility.

Heritage significance: Generally Protected B (GP.B)

Site 3: Possible grave

The site consists of a single grave of an adult (based on size) orientated east to west. The site is located in the southern portion of the development footprint within the southern boundary. Grave dressing consists of locally sourced rocks with no headstone or inscription.

Based on the current lay out the site will be directly impacted on by the proposed development as it is located in the proposed development footprint.

Heritage significance: The site is of high social significance **-**Generally Protected A (GP.A)

Site 4: Farm labourer dwelling and associated cattle kraal

The site consists of a rectangular structure with a pitch corrugated iron roof. The rectangular structure consists of several rooms/divisions with various alterations conducted over the years. The building is constructed with cement bricks and subsequently plastered. To the east of the dwelling is a rectangular stone walled cattle kraal measuring approximately 26 x 22 meters. Although the walls collapsed in certain areas the remaining walls are approximately 1.2 meters high.

Heritage significance: Generally Protected C (GP.C)

Artefacts were observed in low densities over much of the study area where CCS strongly dominates the MSA component. Artefacts consist mostly of radial and bipolar cores and large flakes. The LSA component is mostly made from chert and is micro lithic supporting an ascription to the LSA.

Collection of artefacts at Site 1 & 2.

Core found at occurrence WPT 003.

Single grave at Site 3.

Deep sand cover.

Range of artefacts exposed by borrowing animals from WPT 015.

Collection of artefacts from occurrence WPT 19 & 20.

Farm labourer dwelling (site 4) viewed from the north.

Dwelling viewed from the south.

Collapsed kraal wall at site 4.

Windmill at site 4.

ASSESSMENT OF POTENTIAL IMPACTS: PHASE I 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 Watershed (Phase I) Solar Energy Facility (refer to **Figure 6.1**). This assessment is conducted for a 75 MW facility and for all the facility's components including:

» Arrays of photovoltaic (PV) panels
» Mounting structure to be either rammed steel piles or piles with pre-manufactured concrete footings to support the PV panels.
» Cabling between project components, to be lain underground where practical.
» A new on-site substation (150 x 150m in extent) to evacuate the power from the facility into the Eskom grid.
» A new overhead power line looping in and out of to an existing Eskom power line that runs from the Watershed Substation east of the R505, approximately parallel to the southern periphery of the selected property.
» Internal access roads (4 – 8 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, and offices.

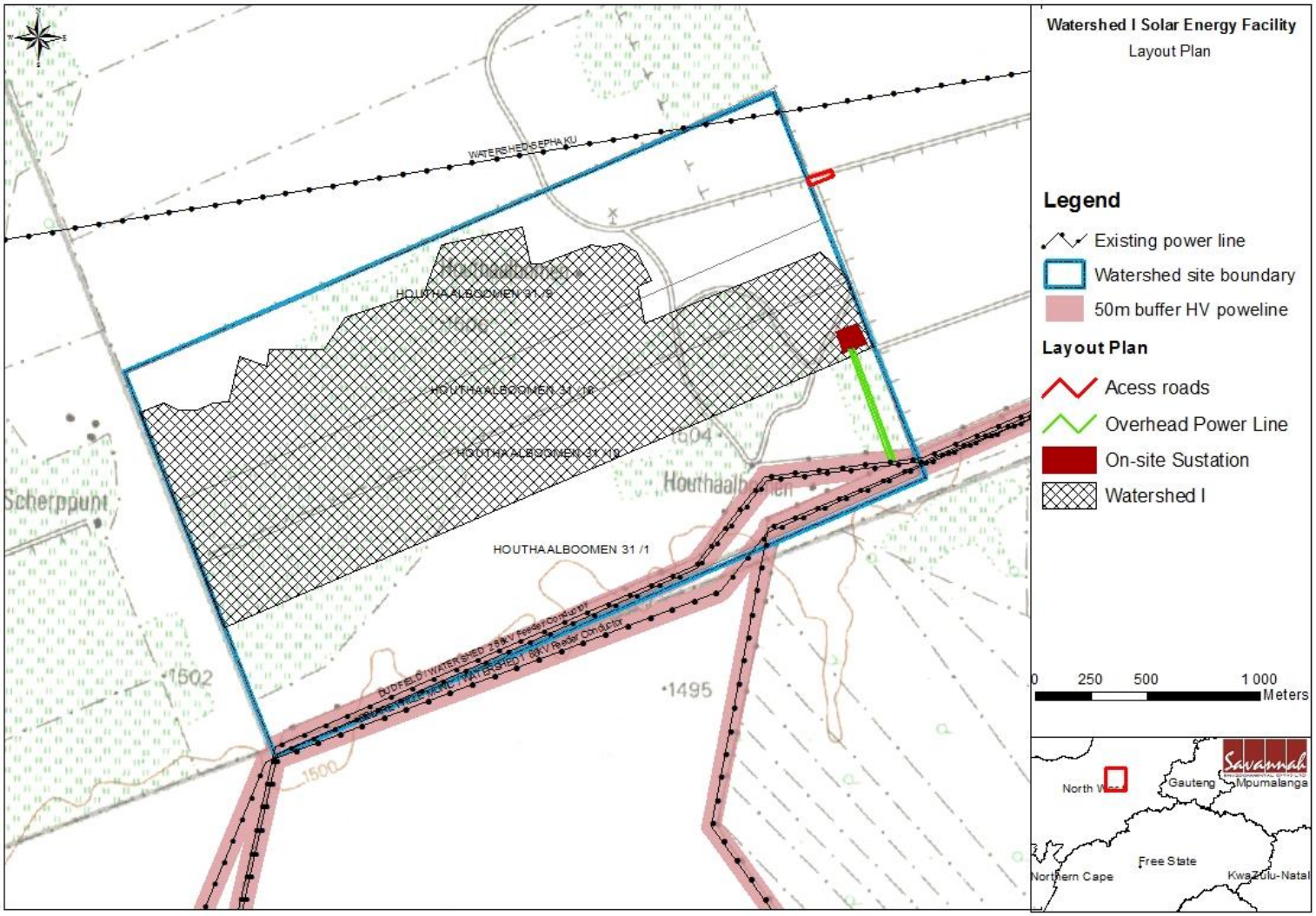

Figure 6.1: Layout map showing Phase I of the proposed Watershed solar Energy Facility and associated infrastructure

The development of the Watershed (Phase I) 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 of 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 6.3.

6.1.1 PV Panel technology (Fixed vs Tracking)

Impacts on the environment associated with the project will be influenced by the type 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
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

The proposed Watershed (Phase I) Solar Energy facility will have a development footprint of approximately 180 ha.

6.1.2 Potential Impacts on Ecology

The selected property falls within the Carletonville Dolomite Grassland – as defined by Mucina and Rutherford (2006). This vegetation type is not listed as threatened by legislation, but is considered vulnerable by Mucina and Rutherford (2006) due to high levels of transformation.

Three vegetation units could be identified within the site (refer to **Figure 6.2**):

» Unit 1: *Searsia pyroides – Aristida meridionalis* grasslands are distributed mostly over the southern section of the study area. The grasslands are not very dense, probably due to past management regimes, but also due to

relatively shallow soils and a high degree of surface rockiness. The herb layer is interrupted by solitary low trees or smaller clumps of taller shrubs surrounded by a species-composition that favours the slightly more shaded microhabitat.

- Conservation status: medium
- Sensitivity: medium-low
- Development options: restrict impact to the minimal possible

» Unit 2: *Acacia hereroensis – Helichrysum zeyheri* grasslands cover the slightly raised northern section of the study area. Surface rockiness is variable, but can be high. Grasslands are in a relatively good condition, although by the time of the survey much of the early-growing forb species had already withered and were no longer identifiable. The grasslands are interspersed with solitary high shrubs or low trees, or occasional open low woodlands, dominated by *Acacia hereroensis*. This vegetation unit is considered to be a CBA 2 area.

- Conservation status: High
- Sensitivity: HIGH
- Development options: regard as No-Go Area

» Unit 3: *Hyparrhenia hirta – Eragrostis lehmanniana* grasslands occupy the more central sections of the study area. Large heaps of stones removed from the upper soil layer indicate past cultivation practices here, but this could have occurred more than 20 years ago. The undulating grasslands are relatively dense, but the species composition of the grass layer and the presence of only a few isolated low trees still reveal the semi-natural state of this vegetation.

- Conservation status: Low
- Sensitivity: Low
- Development options: concentrate development on this area

Solar energy facilities require relatively large areas of land for placement of infrastructure. The proposed Watershed (Phase I) Solar Energy Facility and associated infrastructure requires ~180ha for the establishment of the proposed panels and associated infrastructure. The main expected negative impact from an ecological perspective 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).

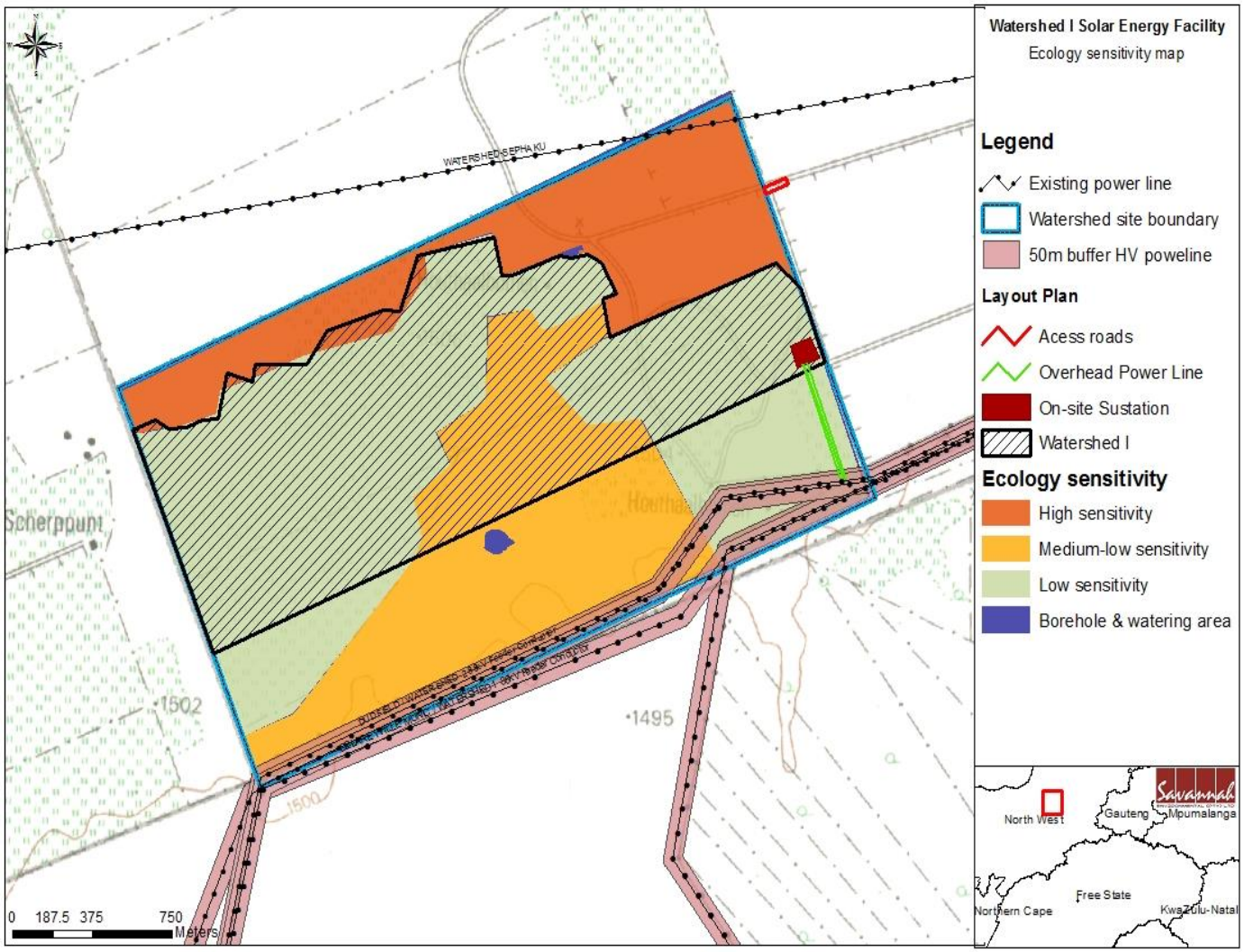

Figure 6.2: Sensitivity map indicating sensitive ecological areas within the proposed Watershed (phase I) Solar Energy Facility

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 and internal maintenance roads: 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 revegetation potential of soil surface

Note: relatively large access roads already exist on and to the land portion

	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 existing access roads, otherwise negative
Reversibility	Not reversible	Relatively reversible
Irreplaceable loss of resources?	Probable	Not likely
Can impacts be mitigated?	Reasonably well	

Mitigation:

» After the final layout has been developed, 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 to impact upon individuals
  * 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 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 (erosion management plan required) » Prevent leakage of oil or other chemicals or any other form of pollution, as this may infiltrate local groundwater reserves » Monitor the establishment of (alien) invasive species and remove as soon as detected, whenever possible before regenerative material can be formed » After decommissioning, if access roads or portion thereof will not be of further use to the landowner, remove all foreign material and rip area to facilitate the establishment of vegetation, followed by a suitable revegetation program
Cumulative impacts: » Possible erosion of areas lower than the access road » Possible contamination of groundwater reserves due to oil or other spillage » Possible spread and establishment of alien invasive species
Residual impacts: » Altered vegetation composition and structure » Altered topsoil conditions » Potential barren areas » Potential for erosion and invasion by weed or alien species

Activity: Construction and operation of PV panels on semi-natural or degraded vegetation and disturbed areas (**tracking or Fixed 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, site-specific altered distribution of rainfall and resultant runoff patterns, general increase in runoff from PV and/or bare areas and associated accelerated erosion, reduction of habitat 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?	Probable	Slight Probability

Can impacts be mitigated?	Reasonably	

Mitigation:

» After the final layout has been developed, 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, 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, rehabilitate an acceptable vegetation layer according to rehabilitation recommendations of the relevant EMP
  * Use only species that were part of the original indigenous species composition as listed 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

» Remove all invasive vegetation before and after construction

» Continuously monitor the establishment of new invasive species and remove as soon as detected, whenever possible before regenerative material can be formed, 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 revegetation or soil erosion control efforts accordingly

» Prevent leakage of oil or other chemicals, strictly prohibit littering of any kind

Cumulative impacts:

» 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 remaining natural vegetation of CBA 2 ecosystems (**tracking or fixed 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 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, altered vegetation cover, site-specific altered distribution of rainfall and resultant runoff patterns, increase in runoff from PV panels and/or bare areas and accelerated erosion, loss of habitat and resource availability for terrestrial fauna, possible increase of detrimental effects during periods of extreme weather events, e.g. increased flooding, severe erosion or dust due to lower buffering capacity of sparser vegetation		
	Without mitigation	**With mitigation**
Extent	Local (3)	Local (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	High (9)	High (8)
Probability	Definite (5)	Definite (5)
Significance	**High (80)**	**Medium (70)**
Status (positive, neutral or negative)	Negative	Negative
Reversibility	Low reversibility	Partially reversible
Irreplaceable loss of resources?	Highly Probable	Moderate Probability
Can impacts be mitigated?	Reasonably but with limited full restoration potential	
Mitigation: » Avoid / exclude as far as possible from development » IF a limited area will be affected, conduct a thorough footprint investigation after the final layout has been approved, to detect and map (by GPS) any protected plant species and active animal burrows * Protected plant species: must be relocated or obtain a permit to impact upon individuals * 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, strictly prohibit any disturbance outside the demarcated footprint area
- » Clear as little grassland vegetation as possible, aim to maintain vegetation where it will not interfere with the construction or operation of the development, rehabilitate an acceptable vegetation layer according to rehabilitation recommendations of the relevant EMP
    - o use only species that were part of the original indigenous species composition as listed in the specialist report
- » After construction, rehabilitate an acceptable vegetation layer according to rehabilitation recommendations of the relevant EMP
    - o 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.
    - o 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.
    - o A strong herb layer will also suppress the re-emergence of weed species from existing seed banks
- » Remove all alien invasive vegetation
- » Continuously monitor the establishment of new invasive species and remove as soon as detected, whenever possible before regenerative material can be formed, 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 revegetation efforts accordingly
- » The rehabilitation plan for all affected areas after decommissioning must aim to re-introduce all non-weed indigenous species listed in the specialist report as a minimum, taking the observed original cover percentages as a guideline of acceptable vegetation cover
- » Prevent leakage of oil or other chemicals, strictly prohibit littering of any kind

Cumulative impacts:

- » Considerable loss of biodiversity and further reduction, fragmenting and possibly threatening of an ecosystem
- » Erosion of areas around the panels and continued erosion of the development area with associated siltation and/or erosion of lower-lying wetlands
- » Alteration of occupancy by terrestrial fauna, possible reduction of available habitat and food availability to terrestrial fauna
- » Spread and establishment of invasive species

» Loss of viable populations of indigenous flora
Residual impacts: » Altered topsoil characteristics » Altered vegetation composition, lower vegetative cover and loss of species diversity

Activity: PV array *components* and their continued maintenance and eventual decommissioning: regular washing: 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: altered runoff and associated vegetation and erosion patterns, contamination of the environment by possible toxic substances and glass		
Environmental impact: localised increase in runoff and accelerated erosion, possible release of toxic substances and/or heavy metals and associated contamination of soil and groundwater		
	Without mitigation	**With mitigation**
Extent	Regional (4)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Low (4)	Small (0)
Probability	Definite (5)	Probable (3)
Significance	**Medium (60)**	**Low (15)**
Status (positive, neutral or negative)	Negative	Neutral
Reversibility	Partially reversible	Reversible
Irreplaceable loss of resources?	Probable	Not likely
Can impacts be mitigated?	Reasonably	
Mitigation: » Where panels need to be washed, no polluting chemicals may be used, and the use of water should be minimal » Where water is used for washing, monitor areas around the PV arrays for signs of accelerated erosion and establishment of weeds or alien invasive species and manage according to the erosion- and invasive species management plan *		
Cumulative impacts: » Possible pollution of surrounding areas Possible increase in and spread of alien invasive species beyond the site		
Residual impacts: » None expected if mitigation measures are implemented		

a) Implications for Project Implementation

» Intact remaining natural vegetation (i.e. vegetation unit 2) should be totally excluded from or avoided by the development as far as possible.
» Excluding intact Carletonville Dolomite Grassland (vegetation unit 2) from the Watershed Phase 1 development area and limiting the impact on natural

grasslands of vegetation unit 1 will prevent the cumulative effect of loss of high biodiversity areas that could arise from the proposed development.

» 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 implemented. The low to medium-low ecological sensitivity of the larger portion of the study area is due to past land-use practices and abiotic limitations on biodiversity persistence.
» 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 impact on fauna is expected to be small or 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 more sensitive areas as recommended.

6.1.3 Potential Impacts on Soils and Agricultural Potential

The natural vegetation on the development site has been transformed by agriculture. The land is in a reasonable condition. There is no evidence of erosion or other significant degradation on the site.

Agricultural potential of the site is limited. As an indication of agricultural potential on the site, the land is classified on AGIS as having a potential maize yield (50 percentile) of mostly between 0.6 and 1.4 tons per hectare. The natural grazing capacity of the site is given as 11-15 hectares per large stock unit.

The major limitation to agriculture is that extremely shallow, rocky soils dominate the site, with only patches of deeper more agriculturally suitable soils interspersed between them. The aridity and lack of access to water are also limitations.

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.) And 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	**Low (20)**	**Low (4)**
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*:*		
Residual impacts*:* Altered soil structure		

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 solar energy facility infrastructure; And having the effect of: taking affected portions of land out of agricultural production.		
	Without mitigation	**With mitigation**
Extent	Low (1) - Site	Low (1) - Site
Duration	Long term (4)	Long term (4)
Magnitude	Minor (2)	Minor (2)
Probability	Definite (5)	Definite (5)
Significance	**Medium (35)**	**Medium (35)**
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 development site.		
Residual impacts*:* No mitigation possible so same as impacts without mitigation		

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 solar energy facility rental on less agriculturally suitable land combined with agricultural use;
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 stock farming during the operation of the solar energy facility.

Cumulative impacts:
Creation of more sustainable farming practices by affected landowners

Residual impacts:
None

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	**Low (16)**	**Low (6)**
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:

Altered soil structure
Residual impacts*:*
Altered soil structure

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 through the provision of an additional income to the affected landowner.
» The significance of agricultural impacts is influenced by the fact that the proposed development area has very limited agricultural potential. The farm has a land capability classification of class 6, non-arable, low to moderate potential grazing land. Soils are predominantly shallow Mispah and Glenrosa soils on underlying rock with interspersed pockets of deeper Hutton soils between them. The patchy nature of the distribution of Hutton soils makes them non-viable for cultivation.
» 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 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).

6.1.4 Assessment of Potential Impacts on Heritage Resources

The topography of the area is relatively flat and was historically extensively used for crop farming but is currently used for grazing purposes. An existing power line forms the southern boundary of the study area and will be used for connection into the grid.

The following heritage sites were recorded within the site:

» The sites consist of a low to medium density of artefacts (3 -5 artefacts per m²) with a MSA and possible LSA component. Artefacts consist of un-retouched flakes, blades, radial cores mainly on CCS. The sites are located in close proximity to each other and the artefacts are scattered in varying densities over an area of 20 x 10 meters. It is unsure if this was a manufacturing/knapping site as there is a lateral distribution of artefacts due to the extensive ploughing activities in the past.
» These sites are already disturbed by the extensive agricultural activities conducted on the farm but fall inside the proposed development footprint and will be impacted on by the proposed solar facility.

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

Nature: During the construction phase activities resulting in disturbance of surfaces and/or sub-surfaces may destroy, damage, alter, or remove from its original position archaeological and paleontological material or objects: 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 (2)	Low (1)
Probability	Probable (4)	Probable (4)
Significance	**Medium (45)**	**Low (28)**
Status (positive or negative)	Negative	Negative
Reversibility	Not reversible	Not reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	
Mitigation: It is recommended that earth works must be monitored during construction to determine if any stratigraphy exist that was not disturbed by ploughing, if any stratigraphy is encountered further mitigation measures might be recommended by the archaeologist. A surface sample should be collected as an analysis of these artefacts will determine the age and industries of the Stone Age component. If any archaeological or cultural material is uncovered during construction or operation a qualified archaeologist must be contacted to verify and record the find. Mitigation will then include documentation and sampling of the material. This will also be required if any paleontological material is uncovered.		
Cumulative impacts:		

Archaeological and cultural sites are non-renewable and impact on any archaeological context or material will be permanent and destructive.
Residual Impacts: Depletion of archaeological record of the area.

Nature: During the construction phase activities resulting in disturbance of surfaces and/or sub-surfaces may destroy, damage, alter, or remove from its original position archaeological and paleontological material or objects: 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 (2)	Low (1)
Probability	Probable (4)	Probable (4)
Significance	**Medium (45)**	**Low (28)**
Status (positive or negative)	Negative	Negative
Reversibility	Not reversible	Not reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	
Mitigation: It is recommended that earth works must be monitored during construction to determine if any stratigraphy exist that was not disturbed by ploughing, if any stratigraphy is encountered further mitigation measures might be recommended by the archaeologist. A surface sample should be collected as an analysis of these artefacts will determine the age and industries of the Stone Age component. If any archaeological or cultural material is uncovered during construction or operation a qualified archaeologist must be contacted to verify and record the find. Mitigation will then include documentation and sampling of the material. This will also be required if any paleontological material is uncovered.		
Cumulative impacts: Archaeological and cultural sites are non-renewable and impact on any archaeological context or material will be permanent and destructive.		
Residual Impacts: Depletion of archaeological record of the area.		

b) Implications for Project Implementation

» The impacts to heritage resources by the proposed development are not considered to be highly significant and the impact on archaeological sites can very easily be mitigated.
» All of these recorded occurrences and **Site 1 & 2** will be impacted on by the proposed development.
» A farm labourer dwelling and associated infrastructure was also recorded (**Site 4**) and is located within the development footprint.

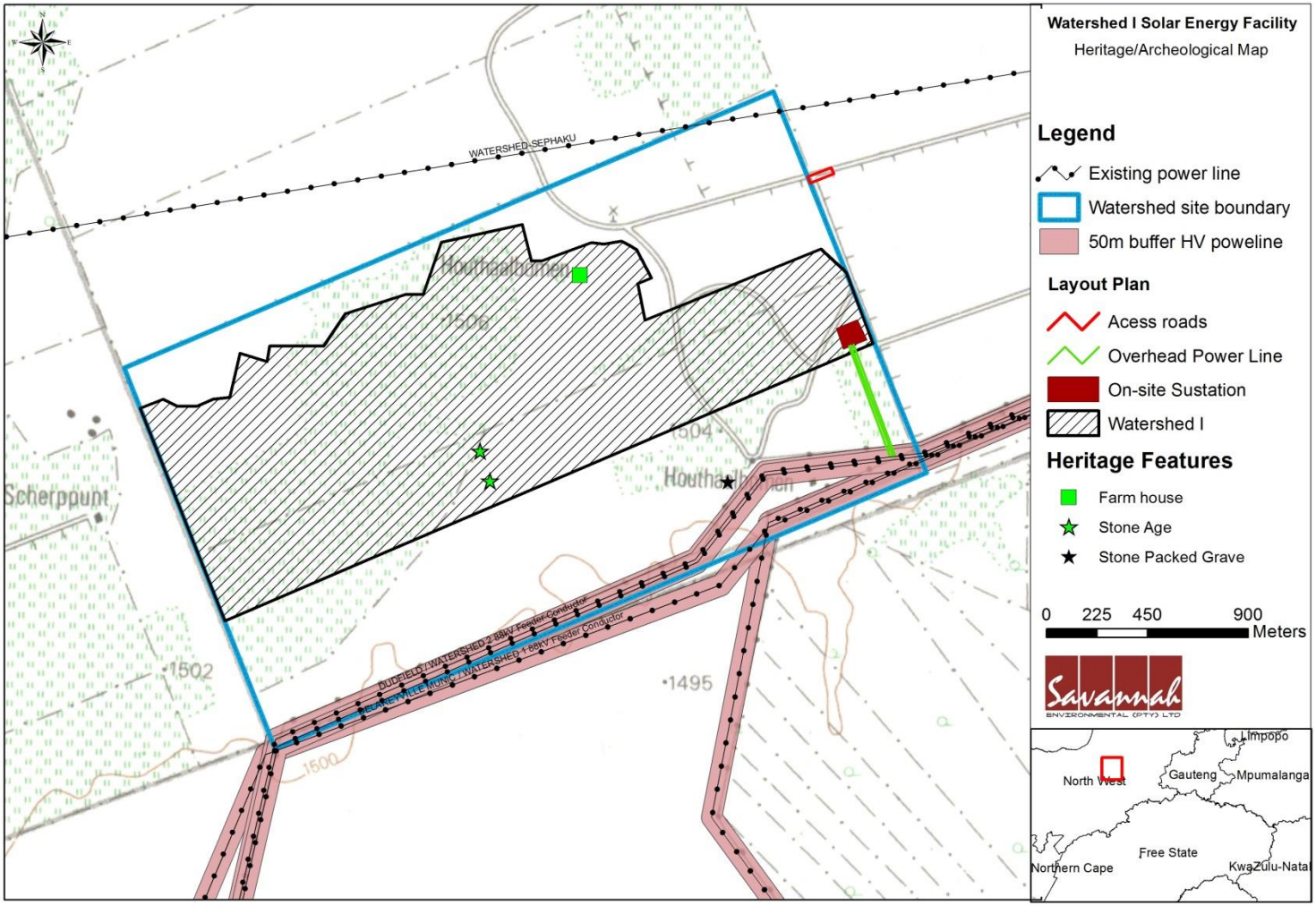

Figure 6.3: Distribution of heritage resources within the proposed Watershed (Phase I) solar energy facility and in relation to the proposed development footprint

6.1.5 Assessment of Potential Visual Impacts

The topography or terrain morphology of the region is broadly described as *Plains and Pans* or *Slightly Undulating Plains* of the *Central Interior Plain*. The slope of the entire study area is extremely even (flat) with a very gradual drop (approximately 50m) from the northern section of the study area (1510m above sea level) to the *Die Vlei* River (1460m) which flows through Lichtenburg. This perennial river, wetlands and farm dams near this town, account for the dominant hydrological features within this region that receives between 500mm to 650mm rainfall per annum.

Potential visual exposure

The visual impact assessments for the Watershed (Phase I & II) Solar Energy Facility were combined because the main visual receptors within a 2 km radius are located around phase II of the project. The result of the viewshed analyses for Phases I and II of the proposed facility is shown on the map below (**refer to Figure 6.4**). The viewshed analyses were undertaken from a number of vantage points within the proposed development areas 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. The visibility analysis map indicates potential visual exposure for each phase individually as well as the combined area potentially visible from both phases (i.e. the area of potential cumulative/collective visual exposure).

No dedicated viewshed analyses were undertaken for the other ancillary infrastructure (i.e. the on-site substation, overhead power line connection, administrative building, internal access roads and workshop). These structures are located within the proposed development site and are not expected to be highly visible amongst the PV panel infrastructure (i.e. the area of potential visual exposure will fall entirely within the viewshed catchment of the PV panels).

It is evident from the preliminary viewshed analyses that the two phases of the proposed facility display very similar viewshed patterns. This is due to the close proximity of the two phases to each other, as well as the flat topography surrounding the development site. Individual exposure is relevant for very limited areas/localities and will be addressed where individual visual receptors are expected to be influenced.

» The facility has a fairly large area of potential visibility (i.e. within a 4km radius of the site), with some additional exposure to the north-east and south-east of the site. The 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 proposed facility includes mainly vacant land or agricultural fields and a number of farmsteads. These include *Scherppunt* (located west of Phase I), *Houthaalbomen* north and a few unnamed (unidentified) residences located east of the site (located between Phase II and the R505). Some of these are located immediately east and south-east of the Phase II PV arrays and the on-site substation and are expected to have a very high level of visual exposure of the project infrastructure.
» Visibility between the 2-4km radii includes sections of the R505 and R503 arterial roads and a number of farm residences, namely *Boskoppie, Elandsfontein, Brakpan* and *Scherppunt* north.
» The intensity of visual exposure is expected to subside beyond a 4km radius with the predominant visibility expected to the north-east and the south-east. This zone includes limited potentially sensitive visual receptors and comprises mainly vacant land, agricultural fields and parts of the cements works west of Lichtenburg. The northern outlying sections of Lichtenburg are also theoretically exposed to the proposed development within this zone.
» 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.

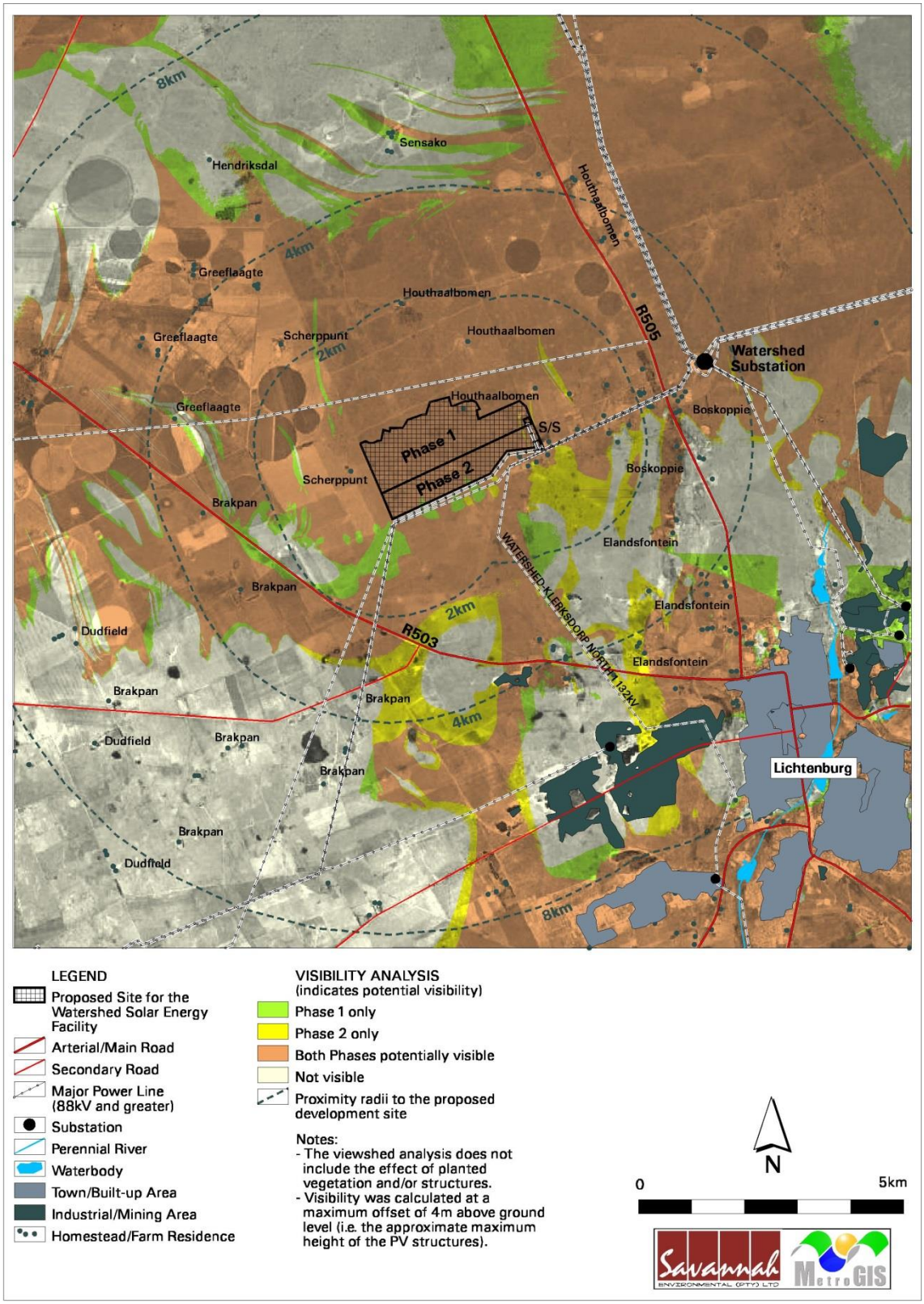

Figure 6.4: Viewshed generated for the proposed Watershed (Phase I & II) Solar Energy Facility

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 6.5**.

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 (both phases), 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.

  Homesteads and residences located within this zone include the residences *Houthaalbomen* south *(*located on the farm earmarked for the development), *Houthaalbomen* north, *Scherppunt* (expected to be influenced by the development of Phase I) and a number of unidentified residences located east of Phase II. It is assumed that the residents of *Houthaalbomen* south are supportive of the proposed PV development and is not expected to be negatively influenced thereby. The other residents within this zone may experience **high** visual impacts.

  At least two residences (and associated buildings and structures) are located immediately south and south-east of the proposed solar energy facility site. The location of these adjacent to, and sharing a common border with the proposed Phase II PV arrays and substation, indicates a potentially **very high** visual impact.

» The potential visual exposure within the 2km to 4km zone from the SEF (both phases) 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: *Brakpan, Elandsfontein, Boskoppie* and *Scherppunt* (north).

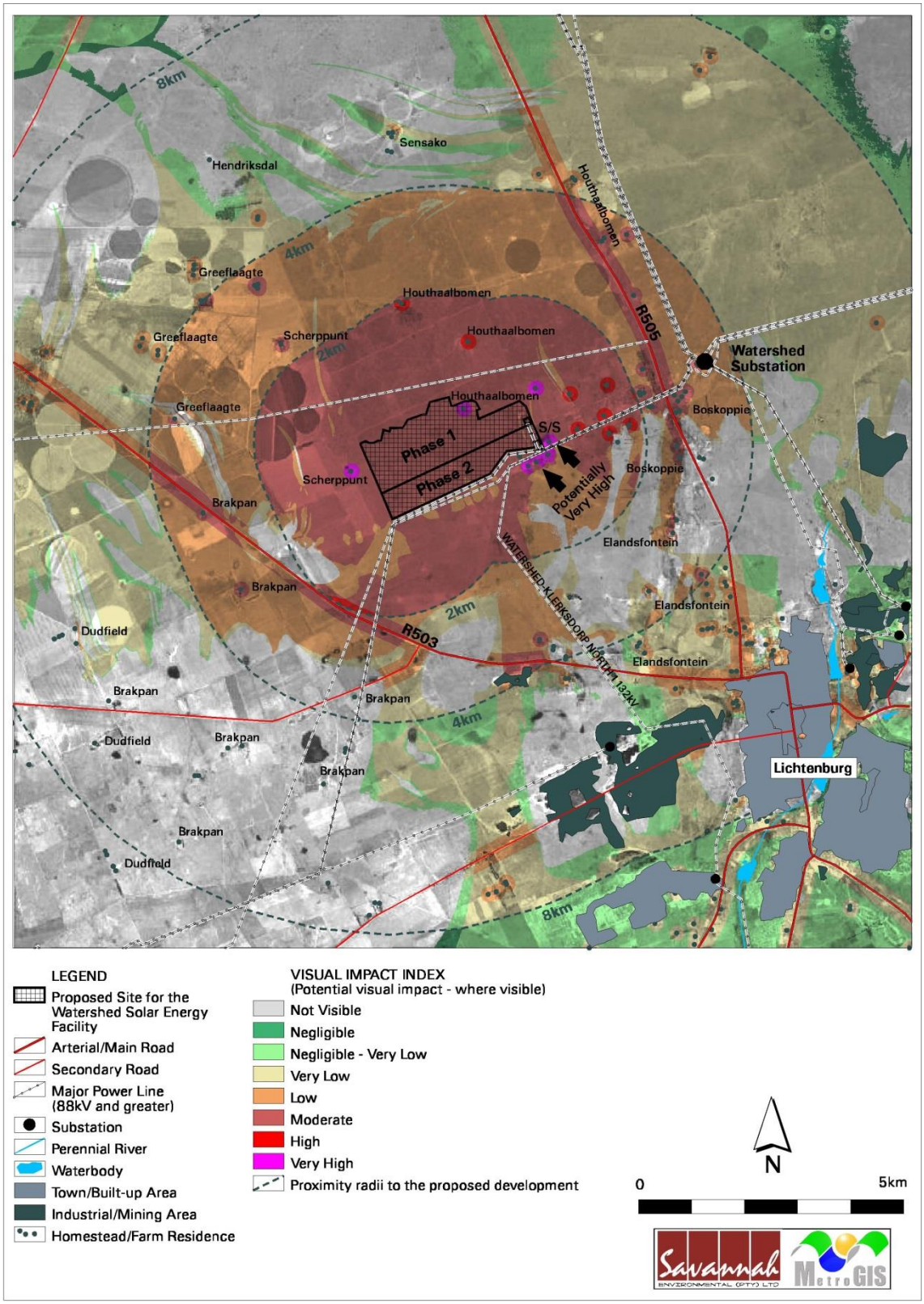

Figure 6.5: Visual impact index of the proposed Watershed (Phase I & II) Solar Energy Facility

Sections of both the R505 and R503 arterial roads are also included in this zone, and are expected to have a **moderate** potential visual impact, where exposed.

» 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 north-western built-up areas of Lichtenburg.

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

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

Nature of Impact: Visual impact of construction 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.		
	Without Mitigation	**With Mitigation**
Extent	Local **(4)**	Local **(4)**
Duration	Short Term **(2)**	Short Term **(2)**
Magnitude	Very high **(10)**	High**(8)**
Probability	Highly probable **(4)**	Probable **(3)**
Significance	**High (64)**	**Moderate (42)**
Status (positive, neutral or negative)	Negative	Negative
Reversibility	Recoverable **(3)**	Recoverable **(3)**
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	

Mitigation:

» Ensure that vegetation is not unnecessarily cleared or removed during the construction period.
» Reduce the construction period through careful logistical planning and productive implementation of resources.
» Plan the placement of lay-down areas and temporary construction equipment camps in order to minimise vegetation clearing (i.e. in already disturbed areas) wherever possible.
» Restrict the activities and movement of construction workers and vehicles to the immediate construction site and existing access roads.
» Ensure that rubble, litter, and disused construction materials are appropriately stored (if not removed daily) and then disposed regularly at licensed waste facilities.
» Reduce and control construction dust through the use of approved dust suppression techniques as and when required, especially on the dirt road giving access to the site (i.e. whenever dust becomes apparent).

» Restrict construction activities to daylight hours in order to negate or reduce the visual impacts associated with lighting. » Rehabilitate all disturbed areas, construction areas, roads, slopes etc. immediately after the completion of construction works.
Cumulative impacts: *None.*
Residual impacts: *None*

Nature of Impact: Visual impact on users of arterial 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		
	Without Mitigation	**With Mitigation**
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: 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 south-western (Phase I) borders of the solar energy facility in order to shield the structures from observers travelling along these roads.		
Cumulative impacts: The construction of the solar energy facility (two phases) 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 phases to each other and to the existing visual disturbances (power lines) allows for the effective connection with the power grid without incurring any additional expanded visual impacts (i.e. lengthy overhead power lines).		

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.

	Without Mitigation	**With Mitigation**
Extent	Local **(4)**	Local **(4)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Very high **(10)**	Moderate **(6)**
Probability	Highly probable **(4)**	Highly probable **(4)**
Significance	**High (72)**	**Moderate (56)**
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 borders of the Phase I PV plant in order to shield the structures from observers residing at the abovementioned homesteads.
» Engage with landowners in order to inform, plan and execute mitigation measures.

Cumulative impacts:
The construction of the solar energy facility (two phases) 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 phases to each other and to the existing visual disturbances (power lines) allows for the effective connection with the power grid without incurring any additional expanded visual impacts (i.e. lengthy overhead power lines).

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.

	Without Mitigation	**With Mitigation**
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 (where required) along the borders of the solar energy facility 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, the substation, mining activities, etc. 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 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.

	Without Mitigation	**With Mitigation**

Extent	Local **(4)**	Local **(4)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	High **(8)**	Moderate **(6)**
Probability	Highly probable **(4)**	Probable **(3)**
Significance	**High (64)**	**Moderate (42)**
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 two phases for 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 R503 arterial road traversing south-west 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 **high** to **very high** significance and may be mitigated to **moderate** 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 facilityis likely to be of **high** significance, and may be mitigated to **moderate**.

» The potential visual impact associated with lighting at the facility at night (especially glare) is expected to be of **high** significance and may be mitigated to **moderate**.

6.1.6 Assessment of Potential Social Impacts

a) <u>Impact tables summarising the significance of Social impacts of the PV facility during the construction and operation</u>

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<u>: GN 544, 18 June 2010 activity 10 (i); GN 544, 18 June 2010 Activity 22(ii) and GN 545, 18 June activity 1</u>

	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 :

Employment

» Where reasonable and practical the contractors appointed by the proponent should appoint local contractors and implement a 'locals first' policy, especially for semi and low-skilled job categories. However, due to the low skills levels in the area, the majority of skilled posts are likely to be filled by people from outside the area.
» Where feasible, efforts should be made to employ local contactors that are compliant with Broad Based Black Economic Empowerment (BBBEE) criteria;
» Before the construction phase commences the proponent and its contractors should meet with representatives from the DLM to establish the existence of a skills database for the area. If such as database exists it should be made available to the contractors appointed for the construction phase.
» The local authorities, community representatives, and organisations on the interested and affected party database should be informed of the final decision regarding the project and the potential job opportunities for locals and the employment procedures

that the proponent intends following for the construction phase.

» Where feasible, training and skills development programmes for locals should be initiated prior to the initiation of the construction phase.
» The recruitment selection process should seek to promote gender equality and the employment of women wherever possible.

Business

» The proponent should seek to develop a database of local companies, specifically Broad Based Black Economic Empowerment (BBBEE) companies, which qualify as potential service providers (e.g. construction companies, catering companies, waste collection companies, security companies etc.) prior to the commencement of the tender process for construction contractors. These companies should be notified of the tender process and invited to bid for project-related work;
» The proponent, in consultation with the DLM and the local Chamber of Commerce, should identify strategies aimed at maximising the potential benefits associated with the project.

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)	Medium Term for community as a whole (3)
Magnitude	Low for the community as a whole (4)	Low for community as a whole (4)
Probability	Probable (3)	Probable (3)
Significance	**Low for the community as a whole (27)**	**Low for the community as a whole (24)**
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 projects in the area may exacerbate these impacts.

Residual 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. Community members affected by STDs etc. and associated impact on local community and burden 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	No
Irreplaceable loss of resources?	Yes	Yes
Can impact be mitigated?	Yes	Yes

Mitigation:

- The proponent should liaise with the DLM 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 TLM, 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:

Presence of workers may lead to increased security risk.

Residual impacts:

Psychological effects associated with attacks or crime related events that may last for many years.

Nature: Potential loss of livestock, poaching and damage to farm infrastructure associated with the 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	Medium Term (3)	Medium Term (3)
Magnitude	Moderate (6) (Due to reliance on agriculture and livestock for maintaining livelihoods)	Low (4)
Probability	Probable (3)	Probable (3)

Significance	**Medium (33)**	**Low (24)**
Status	Negative	Negative
Reversibility	Yes, compensation paid for stock losses etc.	Yes, compensation paid for stock losses etc.
Irreplaceable loss of resources?	No	No
Can impact be mitigated?	Yes	Yes

Mitigation:

» The proponent should enter into an agreement with the affected landowners whereby the company will compensate for damages to farm property and disruptions to farming activities. This includes losses associated with stock theft and damage to property etc. This agreement should be finalised before the commencement of the construction phase;
» The proponent should investigate the option of establishing a MF (see above) that includes local farmers and develop a Code of Conduct for construction workers. Should such a MF be required it should be established prior to commencement of the construction phase. The Code of Conduct should be signed by the proponent, the neighbouring landowners and the contractors before the contractors move onto site;
» The proponent should hold contractors liable for compensating farmers and communities in full for any stock losses and/or damage to farm infrastructure that can be linked to construction workers. This should be contained in tender documents for contractors and the Code of Conduct to be signed between the proponent, the contractors and neighbouring landowners. The agreement should also cover loses and costs associated with fires caused by construction workers or construction related activities (see below);
» The EMP must outline procedures for managing and storing waste on site, specifically plastic waste that poses a threat to livestock if ingested;
» Contractors appointed by the proponent should ensure that all workers are informed at the outset of the construction phase of the conditions contained on the Code of Conduct, specifically consequences of stock theft and trespassing on adjacent farms.
» Contractors appointed by the proponent should ensure that construction workers who are found guilty of stealing livestock, poaching and/or damaging farm infrastructure should be charged as per the conditions contained in the Code of Conduct. All dismissals must be in accordance with South African labour legislation;
» The housing of construction workers on the site should be limited to security personnel.

Cumulative impacts:

No**,** provided losses are compensated for

Residual impacts:

Not applicable if losses are compensated for

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	Moderate (6)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	**Medium (33)**	**Low (24)**
Status	Negative	Negative
Reversibility	Yes	
Irreplaceable loss of resources?	No	No
Can impact be mitigated?	Yes	

Mitigation:

» Movement of construction vehicles along the Elandsfontein Road should be confined to period between 7h30 and 18h00 on weekdays and 8h00 and 13h00 on Saturdays. No construction related vehicles should be allowed to use the road on Sundays and public holidays.
» Abnormal loads along the R505 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 the Elandsfontein Road 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:

» Increased traffic congestion
» Increases in dust and noise nuisance

Residual 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 no responsible for the damage. Reduced quality of road surfaces and impact on road users.

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: Reduce carbon emissions via the use of numerous renewable energy developments, and associated benefits in terms of global warming and climate change.		
Residual impacts: Net reduction in carbon emissions		

b). Implication for project implementation

» The findings of the SIA undertaken for the proposed Watershed (Phase I) Solar Energy Facility indicate that the development will create employment and business opportunities for locals during both the construction and operational phase of the project.
» The establishment of a Community Trust will also 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 Watershed (Phase I) Solar Energy Facility as proposed be supported, subject to the implementation of the recommended enhancement and mitigation measures contained in the SIA report.

6.1.7 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 25-30 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[7]. 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 Watershed (Phase I) Solar Energy Facility, there are other projects proposed around the site and in the broader Lichtenburg area (refer to **Figure 6.6** and **Table 6.1** below).

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

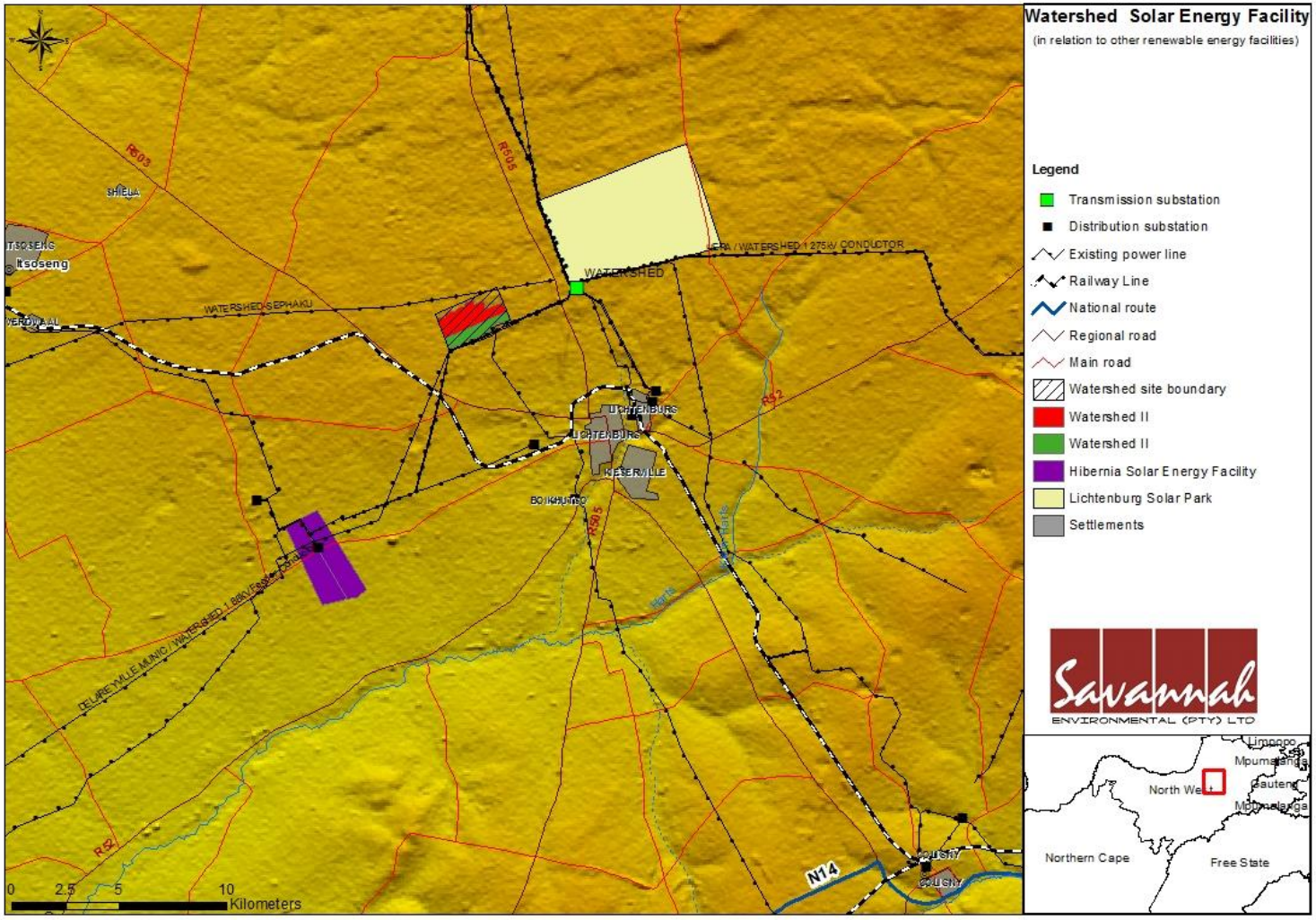

Figure 6.6: Cumulative Impacts map associated with the proposed Watershed (Phase I) Solar Energy Facility

Table 6.1: Proposed solar energy facilities within the Watershed (Phase I) project and surrounding areas

Project	Applicant/ Developer	DEA Ref. No	Location	Status
Lichtenburg Solar Park	Matrigenix (Pty) Ltd	14/12/16/3/3/3/270	portion of portion 10 of the Farm Lichtenburg Town and Townlands 27 IP	EIA process on-going
Watershed (Phase II) Solar Energy Facility	FRV Energy (Pty) Ltd	14/12/16/3/3/2/557	Portion 1,9 and 10 of the farm Houthaalbomen 31	EIA process on-going
Hibernia Solar Energy Facility	Megawatt One Photovoltaic (Pty) Ltd	14/12/16/3/31/910	Portion 9 and 32 of the farm Hibernia 52	BA process on-going

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

» **Ecology**: The selected property falls within the Carletonville Dolomite Grassland – as defined by Mucina and Rutherford (2006). This vegetation type is not listed as threatened by legislation, but is considered vulnerable by Mucina and Rutherford (2006) due to high levels of transformation. By excluding intact Carletonville Dolomite Grassland (vegetation unit 2) from the Watershed development and limiting the impact on natural grasslands of vegetation unit 1 will prevent the cumulative effect of loss of high biodiversity areas that could arise from the Watershed development.
» **Soil & Agricultural Potential** - The broader study area is known for agriculture. However, the specific site proposed for the solar facility occurs on an area considered unsuitable for cultivation due to underlying soils. 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 landowners through provision of an additional source of income, thereby contributing to the sustainability of the farming practices on the affected properties.
» **Visual** - The visual integrity of the area has already been impacted by the existing power lines within and around the site. In addition, at a broader level the visual integrity of the area has been negatively impacted by the mining activities and mining related infrastructure. The potential for cumulative impacts on the area's sense of place and landscape character 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 DLM. 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 associated with traffic congestion, spread of diseases and theft.

6.3. Assessment of the Do Nothing Alternative

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

At a local level, the level of unemployment will remain the same and there will not be any transfer of skills to people in terms of the construction and operation of the solar energy facility. The landowners would have lost an opportunity of using his land in a sustainable manner. 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. 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 9th 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 North West power grid will lose an opportunity to benefit from the additional generated power being evacuated directly into the Province's grid at the Watershed Substation. The 'do nothing alternative is, therefore, not a preferred alternative.

6.4 Summary of Impacts

Table 6.2 summarises all potential impacts associated with the proposed Watershed (Phase I) Solar Energy Facility.

Table 6.2: Summary of impacts associated with the proposed Watershed (Phase I) Solar Energy Facility

Construction / Decommissioning Impacts	Significance of Impact		
	Without mitigation	**With mitigation**	**Listed Activities (18 June 2010)**
Upgrading and/or creation of site access and internal maintenance roads	H (50)	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)
Construction and operation of PV panels on semi-natural or degraded vegetation and disturbed areas (**tracking or Fixed panel option**)	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)
Activity: Construction and operation of PV panels on remaining natural vegetation of CBA 2 ecosystems (**tracking or fixed panel option**)	H (80)	H (70)	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 of agricultural land use	M (35)	M (35)	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 (16)	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)
Generation of multiple land use income	L (27)	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)
Loss and disturbance of heritage structures	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)
Loss and disturbance of archaeological and palaeontological material or objects	M (45)	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)
Visual impact of construction on sensitive visual receptors.	H (64)	M (42)	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	L (27)	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)
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)
Potential loss of livestock, poaching and damage to farm infrastructure associated with the presence of construction workers on site	M (33)	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)

Potential noise, dust and safety impacts associated with movement of construction related traffic to and from the site	M (33)	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)

Operational Impacts	**Significance of Impact**		
	Without mitigation	**With mitigation**	**Listed Activities (18 June 2010)**
Spread of alien invasive species	H (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)
Increase in runoff and erosion	M (38)	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 on users of arterial and secondary roads in close proximity to the proposed SEF	M (42)	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 SEF.	H (72)	M (56)	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 of lighting on sensitive visual receptors.	H (64)	M (42)	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**

ASSESSMENT OF POTENTIAL IMPACTS: PHASE II CHAPTER 7

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 Watershed (Phase II) Solar Energy Facility (refer to **Figure 7.1**). This assessment is conducted for a 75 MW facility and for all the facility's components including:

» Arrays of photovoltaic (PV) panels
» Mounting structure to be either rammed steel piles or piles with pre-manufactured concrete footings to support the PV panels.
» Cabling between project components, to be lain underground where practical.
» A new on-site substation (150 x 150m in extent) to evacuate the power from the facility into the Eskom grid.
» A new overhead power line looping in and out of to an existing Eskom power line that runs from the Watershed Substation east of the R505, approximately parallel to the southern periphery of the selected property.
» Internal access roads (4 – 8 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, and offices.

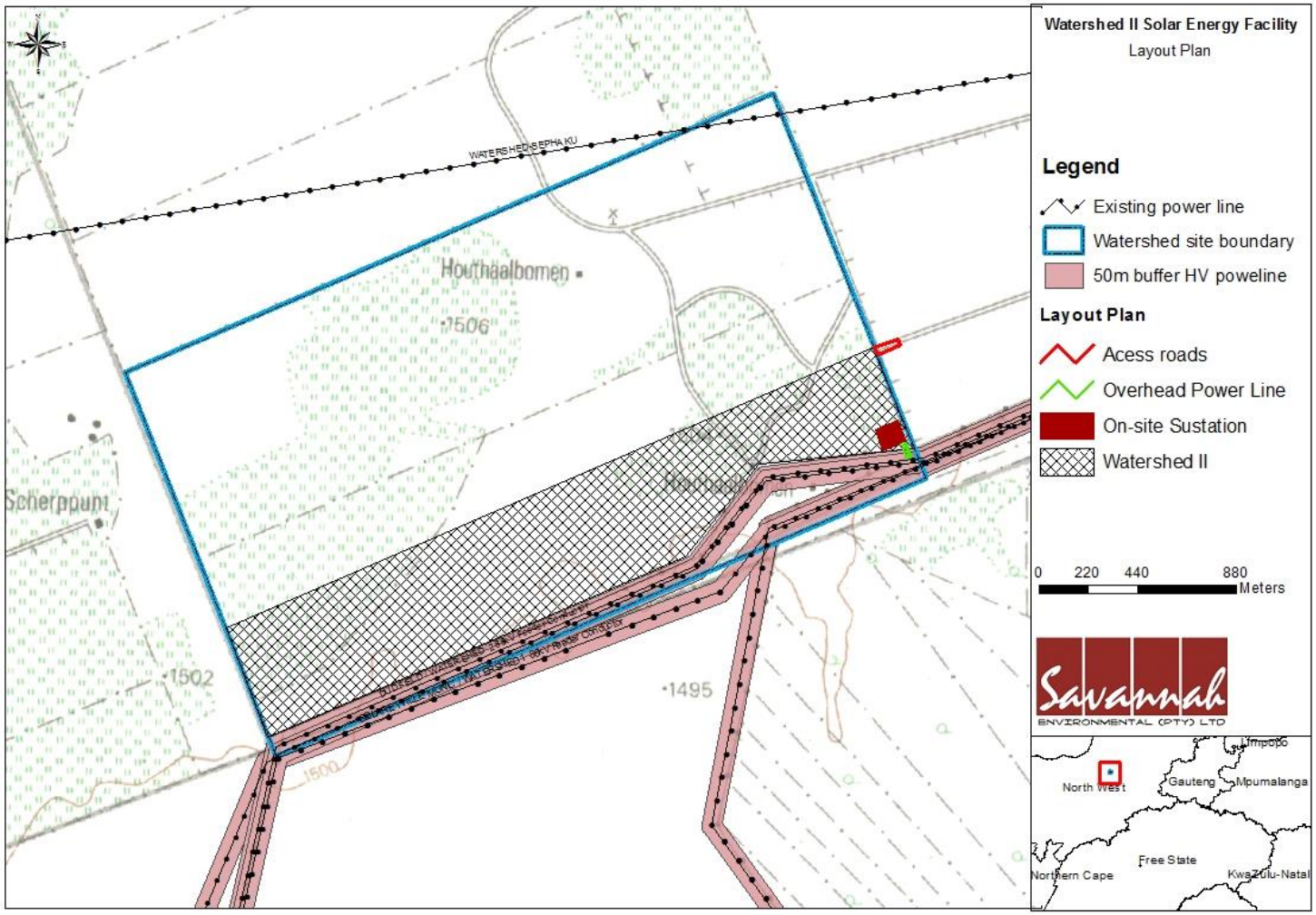

Figure 7.1: Layout map showing Phase II of the proposed Watershed solar Energy Facility and associated infrastructure

The development of the Watershed (Phase II) 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.

7.1 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 of 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 7.3.

7.1.1 PV Panel technology (Fixed vs Tracking)

Impacts on the environment associated with the project will be influenced by the type 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
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

The proposed Watershed (Phase II) Solar Energy facility will have a development footprint of approximately 200 ha.

7.1.2 Potential Impacts on Ecology

The selected property falls within the Carletonville Dolomite Grassland – as defined by Mucina and Rutherford (2006). This vegetation type is not listed as threatened by legislation, but is considered vulnerable by Mucina and Rutherford (2006) due to high levels of transformation.

Three vegetation units could be identified within the site (refer to **Figure 7.2**):

» Unit 1: *Searsia pyroides – Aristida meridionalis* grasslands are distributed mostly over the southern section of the study area. The grasslands are not

very dense, probably due to past management regimes, but also due to relatively shallow soils and a high degree of surface rockiness. The herb layer is interrupted by solitary low trees or smaller clumps of taller shrubs surrounded by a species-composition that favours the slightly more shaded microhabitat.

- Conservation status: medium
- Sensitivity: medium-low
- Development options: restrict impact to the minimal possible

» Unit 2: *Acacia hereroensis – Helichrysum zeyheri* grasslands cover the slightly raised northern section of the study area. Surface rockiness is variable, but can be high. Grasslands are in a relatively good condition, although by the time of the survey much of the early-growing forb species had already withered and were no longer identifiable. The grasslands are interspersed with solitary high shrubs or low trees, or occasional open low woodlands, dominated by *Acacia hereroensis*. This vegetation unit is considered to be a CBA 2 area.

- Conservation status: High
- Sensitivity: HIGH
- Development options: regard as No-Go Area

» Unit 3: *Hyparrhenia hirta – Eragrostis lehmanniana* grasslands occupy the more central sections of the study area. Large heaps of stones removed from the upper soil layer indicate past cultivation practices here, but this could have occurred more than 20 years ago. The undulating grasslands are relatively dense, but the species composition of the grass layer and the presence of only a few isolated low trees still reveal the semi-natural state of this vegetation.

- Conservation status: Low
- Sensitivity: Low
- Development options: concentrate development on this area

Solar energy facilities require relatively large areas of land for placement of infrastructure. The proposed Watershed (Phase II) Solar Energy Facility and associated infrastructure requires ~200ha for the establishment of the proposed panels and associated infrastructure. The main expected negative impact from an ecological perspective 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).

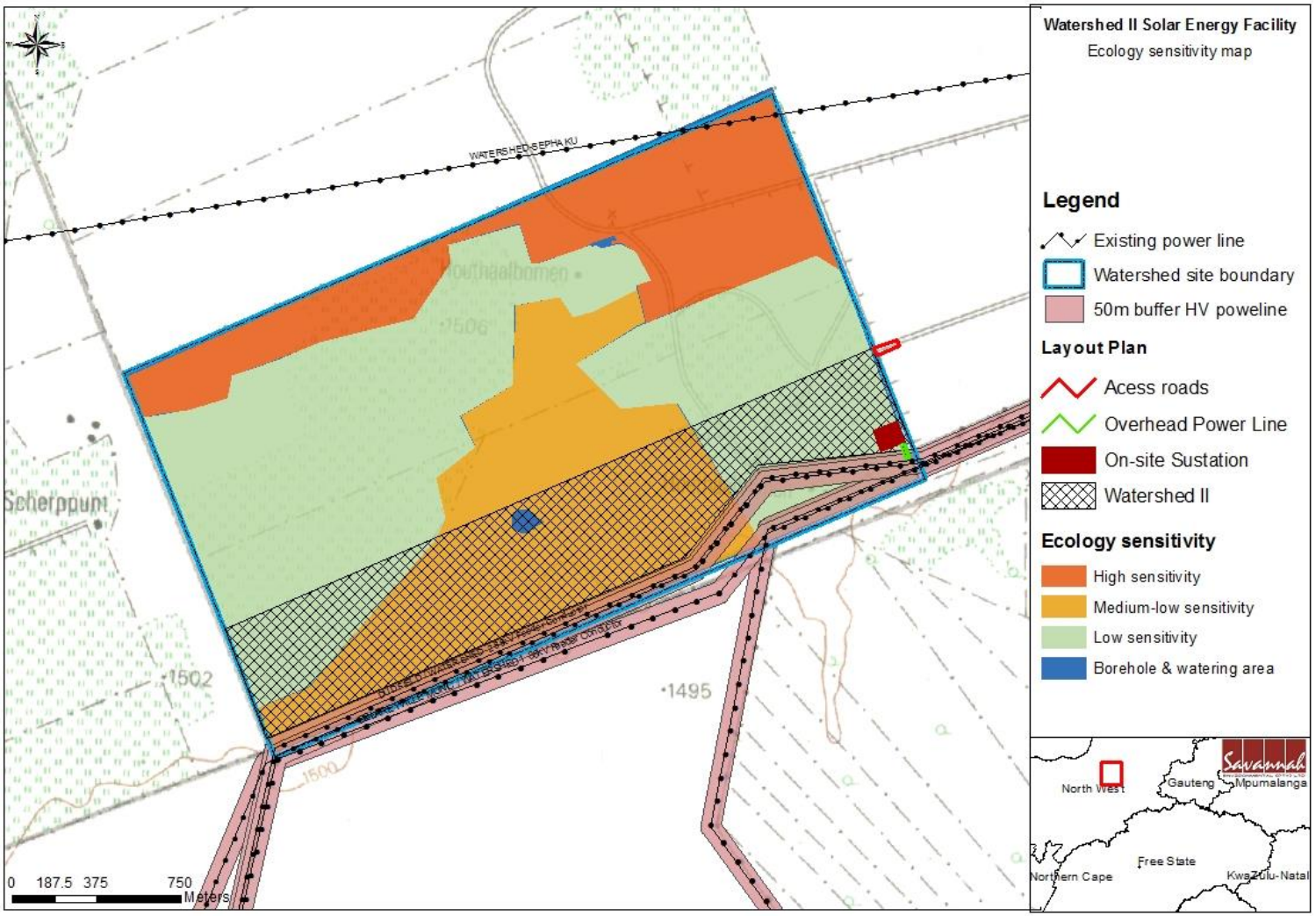

Figure 7.2: Sensitivity map indicating sensitive ecological areas within the proposed Watershed (phase II) Solar Energy Facility

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 and internal maintenance roads: 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 revegetation potential of soil surface

Note: relatively large access roads already exist on and to the land portion

	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 existing access roads, otherwise negative
Reversibility	Not reversible	Relatively reversible
Irreplaceable loss of resources?	Probable	Not likely
Can impacts be mitigated?	Reasonably well	

Mitigation:

» After the final layout has been developed, 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 to impact upon individuals
  * 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 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 (erosion management plan required) » Prevent leakage of oil or other chemicals or any other form of pollution, as this may infiltrate local groundwater reserves » Monitor the establishment of (alien) invasive species and remove as soon as detected, whenever possible before regenerative material can be formed » After decommissioning, if access roads or portion thereof will not be of further use to the landowner, remove all foreign material and rip area to facilitate the establishment of vegetation, followed by a suitable revegetation program
Cumulative impacts: » Possible erosion of areas lower than the access road » Possible contamination of groundwater reserves due to oil or other spillage » Possible spread and establishment of alien invasive species
Residual impacts: » Altered vegetation composition and structure » Altered topsoil conditions » Potential barren areas » Potential for erosion and invasion by weed or alien species

Activity: Construction and operation of PV panels on semi-natural or degraded vegetation and disturbed areas (**tracking or Fixed 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, site-specific altered distribution of rainfall and resultant runoff patterns, general increase in runoff from PV and/or bare areas and associated accelerated erosion, reduction of habitat 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?	Probable	Slight Probability

Can impacts be mitigated?	Reasonably	

Mitigation:

» After the final layout has been developed, 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, 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, rehabilitate an acceptable vegetation layer according to rehabilitation recommendations of the relevant EMP
  * Use only species that were part of the original indigenous species composition as listed 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
» Remove all invasive vegetation before and after construction
» Continuously monitor the establishment of new invasive species and remove as soon as detected, whenever possible before regenerative material can be formed, 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 revegetation or soil erosion control efforts accordingly
» Prevent leakage of oil or other chemicals, strictly prohibit littering of any kind

Cumulative impacts:

» 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 remaining natural vegetation of CBA 2 ecosystems (**tracking or fixed 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 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, altered vegetation cover, site-specific altered distribution of rainfall and resultant runoff patterns, increase in runoff from PV panels and/or bare areas and accelerated erosion, loss of habitat and resource availability for terrestrial fauna, possible increase of detrimental effects during periods of extreme weather events, e.g. increased flooding, severe erosion or dust due to lower buffering capacity of sparser vegetation		
	Without mitigation	**With mitigation**
Extent	Local (3)	Local (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	High (9)	High (8)
Probability	Definite (5)	Definite (5)
Significance	**High (80)**	**Medium (70)**
Status (positive, neutral or negative)	Negative	Negative
Reversibility	Low reversibility	Partially reversible
Irreplaceable loss of resources?	Highly Probable	Moderate Probability
Can impacts be mitigated?	Reasonably but with limited full restoration potential	
Mitigation: » Avoid / exclude as far as possible from development » IF a limited area will be affected, conduct a thorough footprint investigation after the final layout has been approved, to detect and map (by GPS) any protected plant species and active animal burrows * Protected plant species: must be relocated or obtain a permit to impact upon individuals * 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, strictly prohibit any disturbance outside the demarcated footprint area
- » Clear as little grassland vegetation as possible, aim to maintain vegetation where it will not interfere with the construction or operation of the development, rehabilitate an acceptable vegetation layer according to rehabilitation recommendations of the relevant EMP
    - o use only species that were part of the original indigenous species composition as listed in the specialist report
- » After construction, rehabilitate an acceptable vegetation layer according to rehabilitation recommendations of the relevant EMP
    - o 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.
    - o 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.
    - o A strong herb layer will also suppress the re-emergence of weed species from existing seed banks
- » Remove all alien invasive vegetation
- » Continuously monitor the establishment of new invasive species and remove as soon as detected, whenever possible before regenerative material can be formed, 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 revegetation efforts accordingly
- » The rehabilitation plan for all affected areas after decommissioning must aim to re-introduce all non-weed indigenous species listed in the specialist report as a minimum, taking the observed original cover percentages as a guideline of acceptable vegetation cover
- » Prevent leakage of oil or other chemicals, strictly prohibit littering of any kind

Cumulative impacts:

- » Considerable loss of biodiversity and further reduction, fragmenting and possibly threatening of an ecosystem
- » Erosion of areas around the panels and continued erosion of the development area with associated siltation and/or erosion of lower-lying wetlands
- » Alteration of occupancy by terrestrial fauna, possible reduction of available habitat and food availability to terrestrial fauna
- » Spread and establishment of invasive species

» Loss of viable populations of indigenous flora
Residual impacts: » Altered topsoil characteristics » Altered vegetation composition, lower vegetative cover and loss of species diversity

Activity: PV array *components* and their continued maintenance and eventual decommissioning: regular washing: 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: altered runoff and associated vegetation and erosion patterns, contamination of the environment by possible toxic substances and glass		
Environmental impact: localised increase in runoff and accelerated erosion, possible release of toxic substances and/or heavy metals and associated contamination of soil and groundwater		
	Without mitigation	**With mitigation**
Extent	Regional (4)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Low (4)	Small (0)
Probability	Definite (5)	Probable (3)
Significance	**Medium (60)**	**Low (15)**
Status (positive, neutral or negative)	Negative	Neutral
Reversibility	Partially reversible	Reversible
Irreplaceable loss of resources?	Probable	Not likely
Can impacts be mitigated?	Reasonably	
Mitigation: » Where panels need to be washed, no polluting chemicals may be used, and the use of water should be minimal » Where water is used for washing, monitor areas around the PV arrays for signs of accelerated erosion and establishment of weeds or alien invasive species and manage according to the erosion- and invasive species management plan *		
Cumulative impacts: » Possible pollution of surrounding areas Possible increase in and spread of alien invasive species beyond the site		
Residual impacts: » None expected if mitigation measures are implemented		

a) Implications for Project Implementation

» Intact remaining natural vegetation (i.e. vegetation unit 2) should be totally excluded from or avoided by the development as far as possible.

» Excluding intact Carletonville Dolomite Grassland (vegetation unit 2) from the Watershed Phase I development area and limiting the impact on natural grasslands of vegetation unit 1 will prevent the cumulative effect of loss of high biodiversity areas that could arise from the proposed development.
» 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 implemented. The low to medium-low ecological sensitivity of the larger portion of the study area is due to past land-use practices and abiotic limitations on biodiversity persistence.
» 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 impact on fauna is expected to be small or 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 more sensitive areas as recommended.

7.1.3 Potential Impacts on Soils and Agricultural Potential

The natural vegetation on the development site has been transformed by agriculture. The land is in a reasonable condition. There is no evidence of erosion or other significant degradation on the site.

Agricultural potential of the site is limited. As an indication of agricultural potential on the site, the land is classified on AGIS as having a potential maize yield (50 percentile) of mostly between 0.6 and 1.4 tons per hectare. The natural grazing capacity of the site is given as 11-15 hectares per large stock unit.

The major limitation to agriculture is that extremely shallow, rocky soils dominate the site, with only patches of deeper more agriculturally suitable soils interspersed between them. The aridity and lack of access to water are also limitations.

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 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). Caused by: poor topsoil management (burial, erosion, etc.) during construction related soil profile disturbance (levelling, excavations, disposal of spoils from excavations etc.) And 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	**Low (20)**	**Low (4)**
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: Altered soil structure		
Residual impacts: Altered soil structure		

Nature: Loss of agricultural land use: 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). Caused by: direct occupation of land by footprint of solar energy facility infrastructure; And having the effect of: taking affected portions of land out of agricultural production.		
	Without mitigation	**With mitigation**
Extent	Low (1) - Site	Low (1) - Site
Duration	Long term (4)	Long term (4)
Magnitude	Minor (2)	Minor (2)
Probability	Definite (5)	Definite (5)
Significance	**Medium (35)**	**Medium (35)**
Status	Negative	Negative
Reversibility	High	High
Irreplaceable loss of	No	No

resources?		
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 development site.		
Residual impacts*:* No mitigation possible so same as impacts without mitigation		

Nature: Generation of multiple land use income: 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). Caused by: the multiple land use of solar energy facility rental on less agriculturally suitable land combined with agricultural use; 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 stock farming during the operation of the solar energy facility.		
Cumulative impacts: Creation of more sustainable farming practices by affected landowners		
Residual impacts: None		

Nature: Soil Erosion: 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). 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	**Low (16)**	**Low (6)**
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: Altered soil structure		
Residual impacts*:* Altered soil structure		

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 through the provision of an additional income to the affected landowner.
» The significance of agricultural impacts is influenced by the fact that the proposed development area has very limited agricultural potential. The farm has a land capability classification of class 6, non-arable, low to moderate potential grazing land. Soils are predominantly shallow Mispah and Glenrosa soils on underlying rock with interspersed pockets of deeper Hutton soils between them. The patchy nature of the distribution of Hutton soils makes them non-viable for cultivation.
» 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 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 Assessment of Potential Impacts on Heritage Resources

The topography of the area is relatively flat and was historically extensively used for crop farming but is currently used for grazing purposes. An existing power line forms the southern boundary of the study area and will be used for connection into the grid.

The following heritage sites were recorded within the site:

» The sites consist of a low to medium density of artefacts (3 -5 artefacts per m²) with a MSA and possible LSA component. Artefacts consist of un-retouched flakes, blades, radial cores mainly on CCS. The sites are located in close proximity to each other and the artefacts are scattered in varying densities over an area of 20 x 10 meters. It is unsure if this was a manufacturing/ knapping site as there is a lateral distribution of artefacts due to the extensive ploughing activities in the past.
» These sites are already disturbed by the extensive agricultural activities conducted on the farm but fall inside the proposed development footprint and will be impacted on by the proposed solar facility.

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

Nature: *During the construction phase activities resulting in disturbance of surfaces and/or sub-surfaces may destroy, damage, alter, or remove from its original position archaeological and paleontological material or objects*: 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 (2)
Duration	Permanent (5)	Permanent (5)
Magnitude	High (8)	Low (2)
Probability	Probable (5)	Probable (2)
Significance	**High (90)**	**Low (18)**
Status (positive or negative)	Negative	Negative
Reversibility	Not reversible	Not reversible

Irreplaceable loss of resources?	Yes	No
Can impacts be mitigated?	Yes	
Mitigation: It is recommended that the site should be preserved in situ and fenced off with an access gate for family members to protect it during construction with a buffer zone of at least 15 meters from the construction area. (Please refer to section 7 for full details on recommendations).		
Cumulative impacts: Archaeological and cultural sites are non-renewable and impact on any archaeological context or material will be permanent and destructive.		
Residual Impacts: N.A		

d) Implications for Project Implementation

» The grave site is of high social significance **-**Generally Protected A (GP.A). The site is located inside of the development footprint and will be impacted directly. The site should be fenced to minimise any potential impacts during construction.

» The impacts to heritage resources by the proposed development are not considered to be highly significant and the impact on archaeological sites can very easily be mitigated.

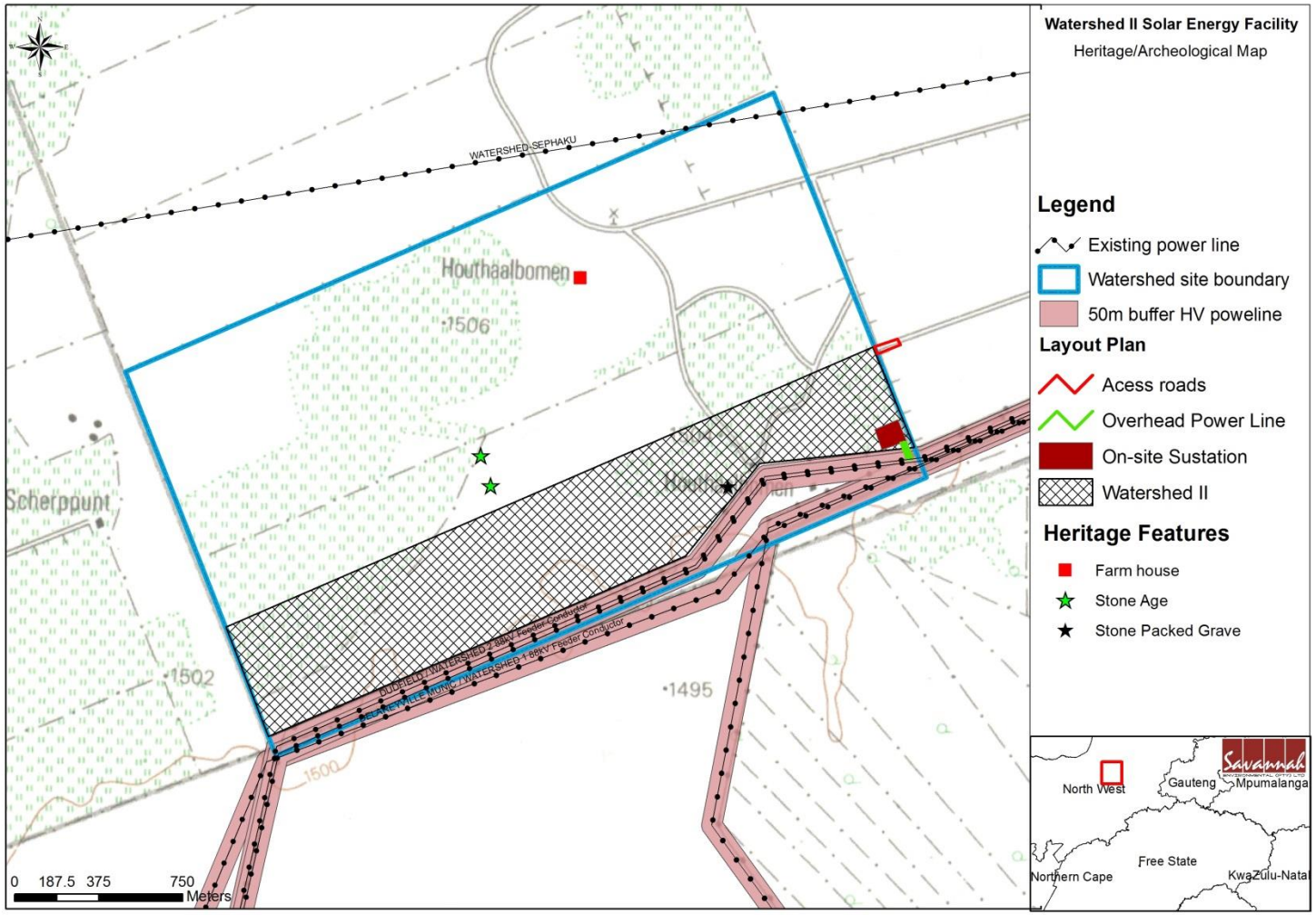

Figure 7.3: Distribution of heritage resources within the proposed Watershed (Phase II) solar energy facility and in relation to the proposed development footprint

7.1.5 Assessment of Potential Visual Impacts

The topography or terrain morphology of the region is broadly described as *Plains and Pans* or *Slightly Undulating Plains* of the *Central Interior Plain*. The slope of the entire study area is extremely even (flat) with a very gradual drop (approximately 50m) from the northern section of the study area (1510m above sea level) to the *Die Vlei* River (1460m) which flows through Lichtenburg. This perennial river, wetlands and farm dams near this town, account for the dominant hydrological features within this region that receives between 500mm to 650mm rainfall per annum.

Potential visual exposure

The visual impact assessments for the Watershed (Phase I & II) Solar Energy Facility were combined because the main visual receptors within a 2 km radius are located around phase II of the project. The result of the viewshed analyses for Phases I and II of the proposed facility is shown on the map below (**refer to Figure 7.4**). The viewshed analyses were undertaken from a number of vantage points within the proposed development areas 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. The visibility analysis map indicates potential visual exposure for each phase individually as well as the combined area potentially visible from both phases (i.e. the area of potential cumulative/collective visual exposure).

No dedicated viewshed analyses were undertaken for the other ancillary infrastructure (i.e. the on-site substation, overhead power line connection, administrative building, internal access roads and workshop). These structures are located within the proposed development site and are not expected to be highly visible amongst the PV panel infrastructure (i.e. the area of potential visual exposure will fall entirely within the viewshed catchment of the PV panels).

It is evident from the preliminary viewshed analyses that the two phases of the proposed facility display very similar viewshed patterns. This is due to the close proximity of the two phases to each other, as well as the flat topography surrounding the development site. Individual exposure is relevant for very limited areas/localities and will be addressed where individual visual receptors are expected to be influenced.

» The facility has a fairly large area of potential visibility (i.e. within a 4km radius of the site), with some additional exposure to the north-east and south-east of the site. The 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 proposed facility includes mainly vacant land or agricultural fields and a number of farmsteads. These include *Scherppunt* (located west of Phase I), *Houthaalbomen* north and a few unnamed (unidentified) residences located east of the site (located between Phase II and the R505). Some of these are located immediately east and south-east of the Phase II PV arrays and the on-site substation and are expected to have a very high level of visual exposure of the project infrastructure.
» Visibility between the 2-4km radii includes sections of the R505 and R503 arterial roads and a number of farm residences, namely *Boskoppie, Elandsfontein, Brakpan* and *Scherppunt* north.
» The intensity of visual exposure is expected to subside beyond a 4km radius with the predominant visibility expected to the north-east and the south-east. This zone includes limited potentially sensitive visual receptors and comprises mainly vacant land, agricultural fields and parts of the cements works west of Lichtenburg. The northern outlying sections of Lichtenburg are also theoretically exposed to the proposed development within this zone.
» 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.

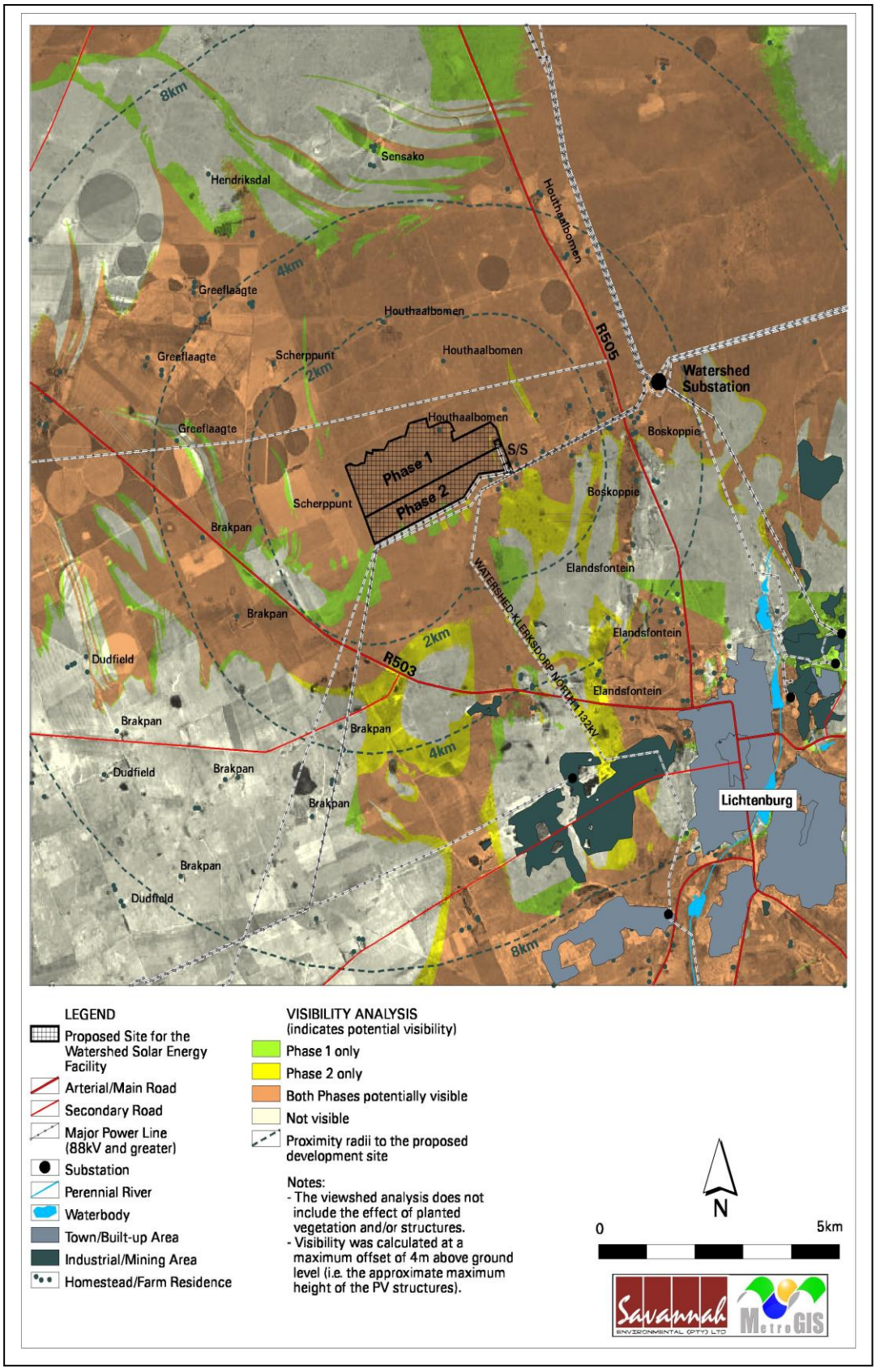

Figure 7.4: Viewshed generated for the proposed Watershed (Phase I & II) Solar Energy Facility

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 7.5**.

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 (both phases), 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.

  Homesteads and residences located within this zone include the residences *Houthaalbomen* south *(*located on the farm earmarked for the development), *Houthaalbomen* north, *Scherppunt* (expected to be influenced by the development of Phase I) and a number of unidentified residences located east of Phase II. It is assumed that the residents of *Houthaalbomen* south are supportive of the proposed PV development and is not expected to be negatively influenced thereby. The other residents within this zone may experience **high** visual impacts.

  At least two residences (and associated buildings and structures) are located immediately south and south-east of the proposed solar energy facility site. The location of these adjacent to, and sharing a common border with the proposed Phase II PV arrays and substation, indicates a potentially **very high** visual impact.

» The potential visual exposure within the 2km to 4km zone from the SEF (both phases) 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: *Brakpan, Elandsfontein, Boskoppie* and *Scherppunt* (north).

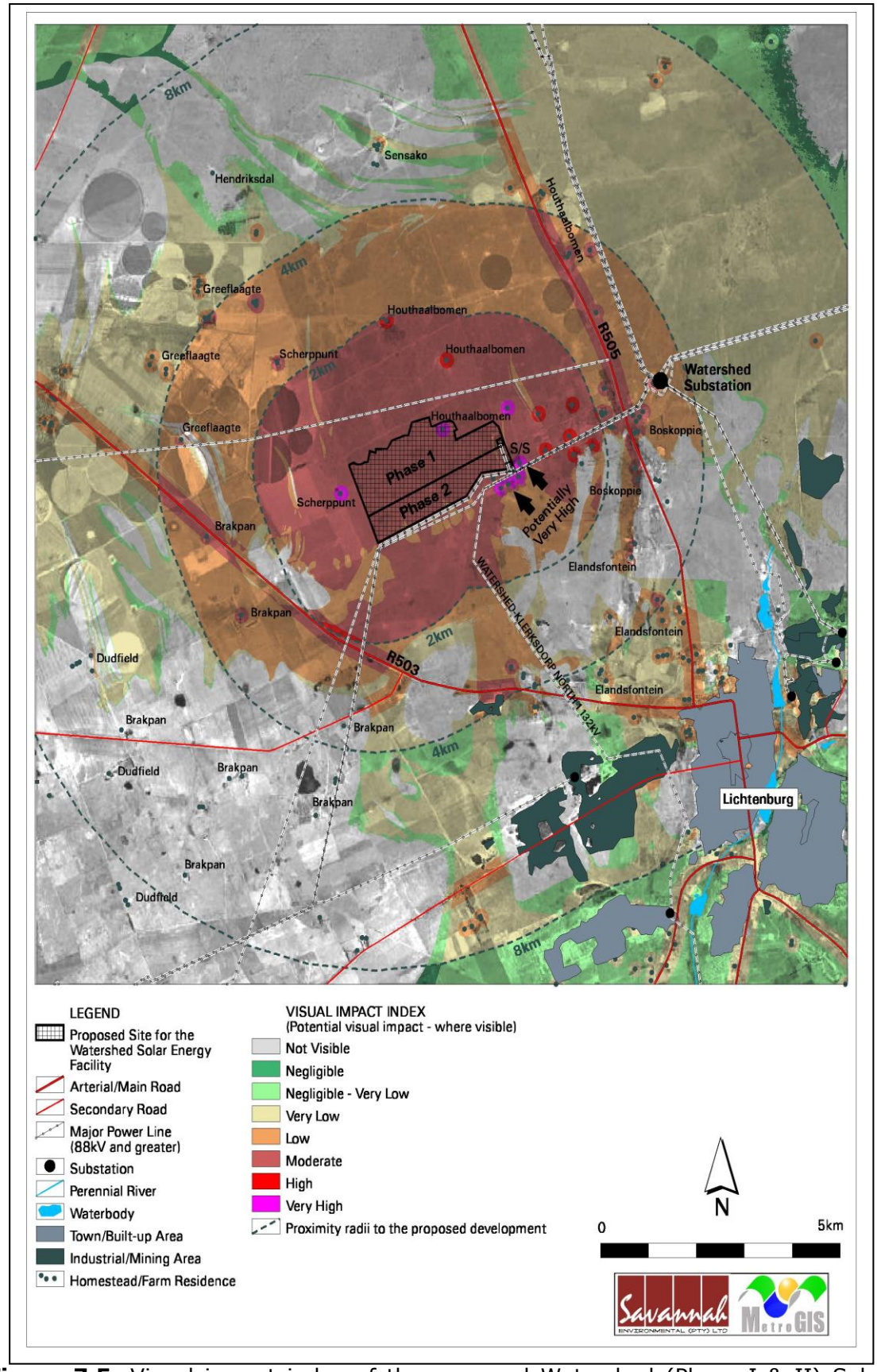

Figure 7.5: Visual impact index of the proposed Watershed (Phase I & II) Solar Energy Facility

Sections of both the R505 and R503 arterial roads are also included in this zone, and are expected to have a **moderate** potential visual impact, where exposed.

» 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 north-western built-up areas of Lichtenburg.

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

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

Nature of Impact: Visual impact of construction on sensitive visual receptors: 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).		
	Without Mitigation	**With Mitigation**
Extent	Local **(4)**	Local **(4)**
Duration	Short Term **(2)**	Short Term **(2)**
Magnitude	Very high **(10)**	High**(8)**
Probability	Highly probable **(4)**	Probable **(3)**
Significance	**High (64)**	**Moderate (42)**
Status (positive, neutral or negative)	Negative	Negative
Reversibility	Recoverable **(3)**	Recoverable **(3)**
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation: » Ensure that vegetation is not unnecessarily cleared or removed during the construction period. » Reduce the construction period through careful logistical planning and productive implementation of resources. » Plan the placement of lay-down areas and temporary construction equipment camps in order to minimise vegetation clearing (i.e. in already disturbed areas) wherever possible. » Restrict the activities and movement of construction workers and vehicles to the immediate construction site and existing access roads. » Ensure that rubble, litter, and disused construction materials are appropriately stored (if not removed daily) and then disposed regularly at licensed waste facilities. » Reduce and control construction dust through the use of approved dust suppression techniques as and when required, especially on the dirt road giving access to the site (i.e. whenever dust becomes apparent).		

» Restrict construction activities to daylight hours in order to negate or reduce the visual impacts associated with lighting. » Rehabilitate all disturbed areas, construction areas, roads, slopes etc. immediately after the completion of construction works.
Cumulative impacts: *None.*
Residual impacts: *None*

Nature of Impact: Visual impact on users of arterial roads in close proximity to the proposed solar energy facility: 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).		
	Without Mitigation	**With Mitigation**
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: 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 south-eastern (Phase II) borders of the solar energy facility in order to shield the structures from observers travelling along these roads.		

Cumulative impacts:
The construction of the solar energy facility (two phases) 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 phases to each other and to the existing visual disturbances (power lines) allows for the effective connection with the power grid without incurring any additional expanded visual impacts (i.e. lengthy overhead power lines).

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 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). .

	Without Mitigation	**With Mitigation**
Extent	Local **(4)**	Local **(4)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Very high **(10)**	Moderate **(6)**
Probability	Highly probable **(4)**	Highly probable **(4)**
Significance	**High (72)**	**Moderate (56)**
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 eastern borders of the Phase II PV plant in order to shield the structures from observers residing at the abovementioned homesteads.
» Engage with landowners in order to inform, plan and execute mitigation measures.

Cumulative impacts:
The construction of the solar energy facility (two phases) 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 phases to each other and to the existing visual disturbances (power lines) allows for the effective connection with the power grid without incurring any additional expanded visual impacts (i.e. lengthy overhead power lines).

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 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).

	Without Mitigation	**With Mitigation**
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 (where required) along the borders of the solar energy facility 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, the substation, mining activities, etc. 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 of lighting on sensitive visual receptors: 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).		
	Without Mitigation	**With Mitigation**
Extent	Local **(4)**	Local **(4)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	High **(8)**	Moderate **(6)**
Probability	Highly probable **(4)**	Probable **(3)**
Significance	**High (64)**	**Moderate (42)**
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 two phases for 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 R503 arterial road traversing south-west 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 **high** to **very high** significance and may be mitigated to **moderate** 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 facilityis likely to be of **high** significance, and may be mitigated to **moderate**.
» The potential visual impact associated with lighting at the facility at night (especially glare) is expected to be of **high** significance and may be mitigated to **moderate**.

7.1.6 Assessment of Potential Social Impacts

b) Impact tables summarising the significance of Social impacts of the PV facility during the construction and operation

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 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).		
	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 :

Employment

» Where reasonable and practical the contractors appointed by the proponent should appoint local contractors and implement a 'locals first' policy, especially for semi and low-skilled job categories. However, due to the low skills levels in the area, the majority of skilled posts are likely to be filled by people from outside the area.
» Where feasible, efforts should be made to employ local contactors that are compliant with Broad Based Black Economic Empowerment (BBBEE) criteria;
» Before the construction phase commences the proponent and its contractors should meet with representatives from the DLM to establish the existence of a skills database for the area. If such as database exists it should be made available to the contractors appointed for the construction phase.
» The local authorities, community representatives, and organisations on the interested and affected party database should be informed of the final decision regarding the project and the potential job opportunities for locals and the employment procedures that the proponent intends following for the construction phase.
» Where feasible, training and skills development programmes for locals should be initiated prior to the initiation of the construction phase.
» The recruitment selection process should seek to promote gender equality and the employment of women wherever possible.

Business

» The proponent should seek to develop a database of local companies, specifically Broad Based Black Economic Empowerment (BBBEE) companies, which qualify as potential service providers (e.g. construction companies, catering companies, waste collection companies, security companies etc.) prior to the commencement of the tender process for construction contractors. These companies should be notified of the tender process and invited to bid for project-related work;
» The proponent, in consultation with the DLM and the local Chamber of Commerce, should identify strategies aimed at maximising the potential benefits associated with the project.

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 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).

	Without Mitigation	**With Mitigation**
Extent	Local (2)	Local (1)

Duration	Medium Term for community as a whole (3)	Medium Term for community as a whole (3)
Magnitude	Low for the community as a whole (4)	Low for community as a whole (4)
Probability	Probable (3)	Probable (3)
Significance	**Low for the community as a whole (27)**	**Low for the community as a whole (24)**
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 projects in the area may exacerbate these impacts.

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

Nature: Potential safety and security risk posed by presence of construction workers on site: 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).

	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	No
Irreplaceable loss of resources?	Yes	Yes
Can impact be mitigated?	Yes	Yes

Mitigation:

» The proponent should liaise with the DLM 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 TLM, 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: Presence of workers may lead to increased security risk.
Residual impacts: Psychological effects associated with attacks or crime related events that may last for many years.

Nature: Potential loss of livestock, poaching and damage to farm infrastructure associated with the presence of construction workers on site: 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).

	Without Mitigation	**With Mitigation**
Extent	Local (2)	Local (1)
Duration	Medium Term (3)	Medium Term (3)
Magnitude	Moderate (6) (Due to reliance on agriculture and livestock for maintaining livelihoods)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	**Medium (33)**	**Low (24)**
Status	Negative	Negative
Reversibility	Yes, compensation paid for stock losses etc.	Yes, compensation paid for stock losses etc.
Irreplaceable loss of resources?	No	No
Can impact be mitigated?	Yes	Yes

Mitigation:

» The proponent should enter into an agreement with the affected landowners whereby the company will compensate for damages to farm property and disruptions to farming activities. This includes losses associated with stock theft and damage to property etc. This agreement should be finalised before the commencement of the construction phase;

» The proponent should investigate the option of establishing a MF (see above) that includes local farmers and develop a Code of Conduct for construction workers. Should such a MF be required it should be established prior to commencement of the construction phase. The Code of Conduct should be signed by the proponent, the neighbouring landowners and the contractors before the contractors move onto site;

» The proponent should hold contractors liable for compensating farmers and communities in full for any stock losses and/or damage to farm infrastructure that can be linked to construction workers. This should be contained in tender documents for contractors and the Code of Conduct to be signed between the proponent, the contractors and neighbouring landowners. The agreement should also cover loses and

costs associated with fires caused by construction workers or construction related activities (see below);

» The EMP must outline procedures for managing and storing waste on site, specifically plastic waste that poses a threat to livestock if ingested;

» Contractors appointed by the proponent should ensure that all workers are informed at the outset of the construction phase of the conditions contained on the Code of Conduct, specifically consequences of stock theft and trespassing on adjacent farms.

» Contractors appointed by the proponent should ensure that construction workers who are found guilty of stealing livestock, poaching and/or damaging farm infrastructure should be charged as per the conditions contained in the Code of Conduct. All dismissals must be in accordance with South African labour legislation;

» The housing of construction workers on the site should be limited to security personnel.

Cumulative impacts:

No**,** provided losses are compensated for

Residual impacts:

Not applicable if losses are compensated for

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 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).

	Without Mitigation	**With Mitigation**
Extent	Local-Regional (2)	Local-Regional (1)
Duration	Medium Term (3)	Medium Term (3)
Magnitude	Moderate (6)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	**Medium (33)**	**Low (24)**
Status	Negative	Negative
Reversibility	Yes	
Irreplaceable loss of resources?	No	No
Can impact be mitigated?	Yes	

Mitigation:

» Movement of construction vehicles along the Elandsfontein Road should be confined to period between 7h30 and 18h00 on weekdays and 8h00 and 13h00 on Saturdays. No construction related vehicles should be allowed to use the road on Sundays and public holidays.

» Abnormal loads along the R505 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 the Elandsfontein Road 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: » Increased traffic congestion » Increases in dust and noise nuisance
Residual 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 no responsible for the damage. Reduced quality of road surfaces and impact on road users.

Nature: Promotion of clean, renewable energy: 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).		
	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: Reduce carbon emissions via the use of numerous renewable energy developments, and associated benefits in terms of global warming and climate change.		
Residual impacts: » Net reduction in carbon emissions		

b). Implication for project implementation

» The findings of the SIA undertaken for the proposed Watershed (Phase II) Solar Energy Facility indicate that the development will create employment and business opportunities for locals during both the construction and operational phase of the project.
» The establishment of a Community Trust will also 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 Watershed (Phase II) Solar Energy Facility as proposed be supported, subject to the implementation of the recommended enhancement and mitigation measures contained in the SIA report.

7.1.7 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 25-30 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.

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.

In the case of the proposed Watershed (Phase II) Solar Energy Facility, there are other projects proposed around the site and in the broader Lichtenburg area (refer to **Figure 7.6** and **Table 7.1** below).

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

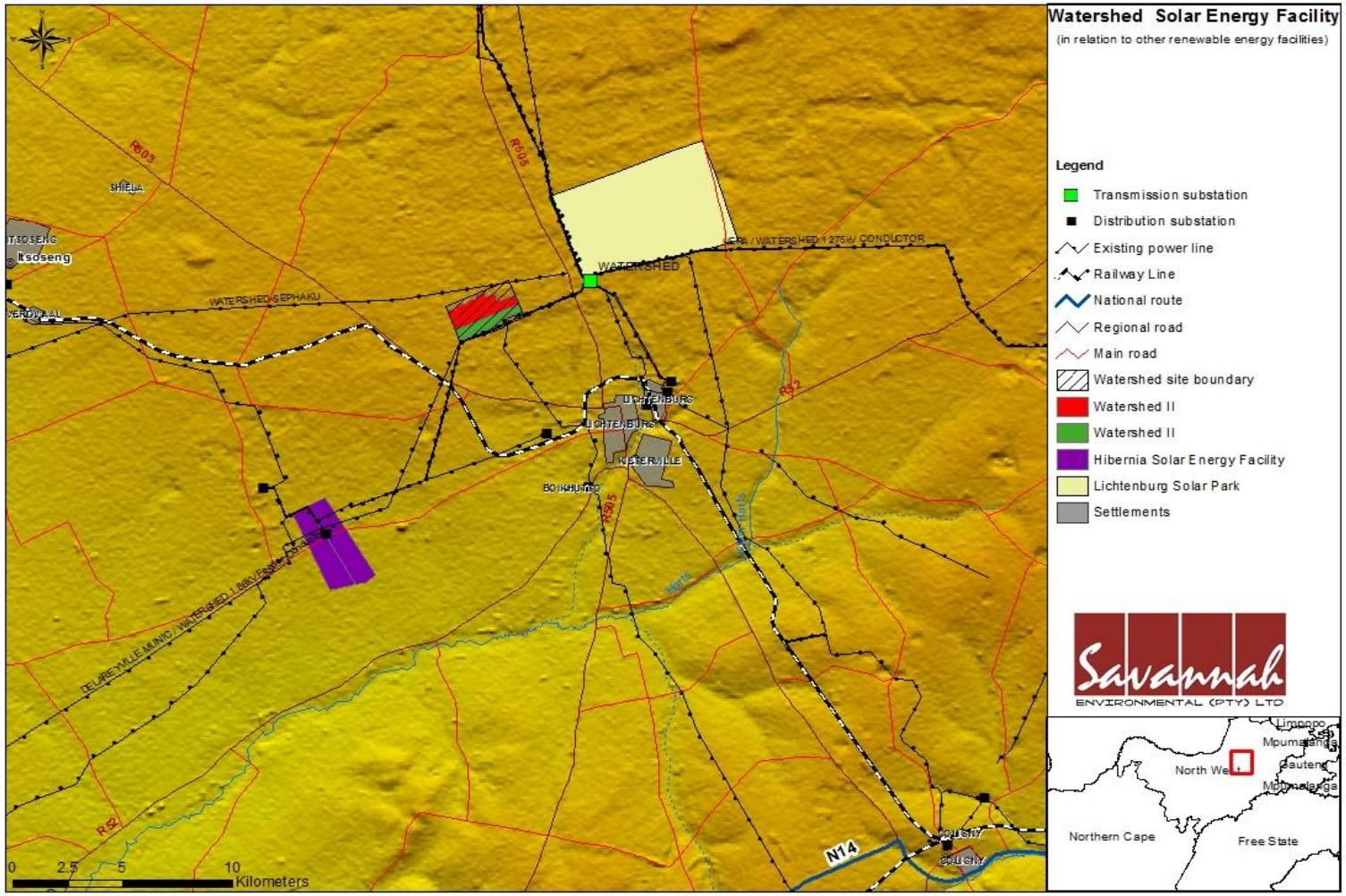

Figure 7.6: Cumulative Impacts map associated with the proposed Watershed (Phase II) Solar Energy Facility

Table 7.1: Proposed solar energy facilities within the Watershed (Phase II) project and surrounding areas

Project	Applicant/ Developer	DEA Ref. No	Location	Status
Lichtenburg Solar Park	Matrigenix (Pty) Ltd	14/12/16/3/3/3/270	portion of portion 10 of the Farm Lichtenburg Town and Townlands 27 IP	EIA process on-going
Watershed (Phase I) Solar Energy Facility	FRV Energy (Pty) Ltd	14/12/16/3/3/2/556	Portion 1,9,10 and 18 of the farm Houthaalbomen 31	EIA process on-going
Hibernia Solar Energy Facility	Megawatt One Photovoltaic (Pty) Ltd	14/12/16/3/31/910	Portion 9 and 32 of the farm Hibernia 52	BA process on-going

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

» **Ecology**: The selected property falls within the Carletonville Dolomite Grassland – as defined by Mucina and Rutherford (2006). This vegetation type is not listed as threatened by legislation, but is considered vulnerable by Mucina and Rutherford (2006) due to high levels of transformation. By excluding intact Carletonville Dolomite Grassland (vegetation unit 2) from the Watershed development and limiting the impact on natural grasslands of vegetation unit 1 will prevent the cumulative effect of loss of high biodiversity areas that could arise from the Watershed development.
» **Soil & Agricultural Potential** - The broader study area is known for agriculture. However, the specific site proposed for the solar facility occurs on an area considered unsuitable for cultivation due to underlying soils. 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 landowners through provision of an additional source of income, thereby contributing to the sustainability of the farming practices on the affected properties.
» **Visual** - The visual integrity of the area has already been impacted by the existing power lines within and around the site. In addition, at a broader level the visual integrity of the area has been negatively impacted by the mining activities and mining related infrastructure. The potential for cumulative impacts on the area's sense of place and landscape character 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 DLM. 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 associated with traffic congestion, spread of diseases and theft.

7.3 Assessment of the Do Nothing Alternative

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

At a local level, the level of unemployment will remain the same and there will not be any transfer of skills to people in terms of the construction and operation of the solar energy facility. The landowners would have lost an opportunity of using his land in a sustainable manner. 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. 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 9th 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 North West power grid will lose an opportunity to benefit from the additional generated power being evacuated directly into the Province's grid at the Watershed Substation. The 'do nothing alternative is, therefore, not a preferred alternative.

7.4 Summary of Impacts

Table 7.2 summarises all potential impacts associated with the proposed Watershed (Phase II) Solar Energy Facility.

Table 7.2: Summary of impacts associated with the proposed Watershed (Phase II) Solar Energy Facility

Construction / Decommissioning Impacts	Significance of Impact		
	Without mitigation	**With mitigation**	**Listed Activities (18 June 2010)**
Upgrading and/or creation of site access and internal maintenance roads	H (50)	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)
Construction and operation of PV panels on semi-natural or degraded vegetation and disturbed areas (**tracking or Fixed panel option**)	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)
Activity: Construction and operation of PV panels on remaining natural vegetation of CBA 2 ecosystems (**tracking or fixed panel option**)	H (80)	H (70)	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 of agricultural land use	M (35)	M (35)	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 (16)	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)
Generation of multiple land use income	L (27)	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)
Loss and disturbance of heritage structures	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)
Loss and disturbance of archaeological and palaeontological material or objects	M (45)	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)
Visual impact of construction on sensitive visual receptors.	H (64)	M (42)	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	L (27)	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)
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)
Potential loss of livestock, poaching and damage to farm infrastructure associated with the presence of construction workers on site	M (33)	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)

Potential noise, dust and safety impacts associated with movement of construction related traffic to and from the site	M (33)	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)

Operational Impacts	**Significance of Impact**		
	Without mitigation	**With mitigation**	**Listed Activities (18 June 2010)**
Spread of alien invasive species	H (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)
Increase in runoff and erosion	M (38)	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 on users of arterial and secondary roads in close proximity to the proposed SEF	M (42)	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 SEF.	H (72)	M (56)	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 of lighting on sensitive visual receptors.	H (64)	M (42)	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: PHASE I CHAPTER 8

The Watershed (Phase I) Solar Energy Facility is proposed to be developed as a commercial solar energy facility to be located on portion 1, 9, 10 and 18 of the farm Houthaalbomen, which falls within the Ditsobotla Local Municipality, North West Province (refer to Figure 8.1). The purpose of the proposed facility is proposed to have an export capacity of up to 75MW and 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 a development area of approximately 180 ha and will be comprised of the following primary elements (refer to Chapter 2 for more details):

» Arrays of photovoltaic (PV) panels
» Mounting structure to be either rammed steel piles or piles with pre-manufactured concrete footings to support the PV panels.
» Cabling between project components, to be lain underground where practical.
» Underground cabling to transmit electricity generated from the panels to the proposed on-site substation which will be located within the Watershed (Phase II) solar energy facility site
» Internal access roads (4 – 8 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, and offices.

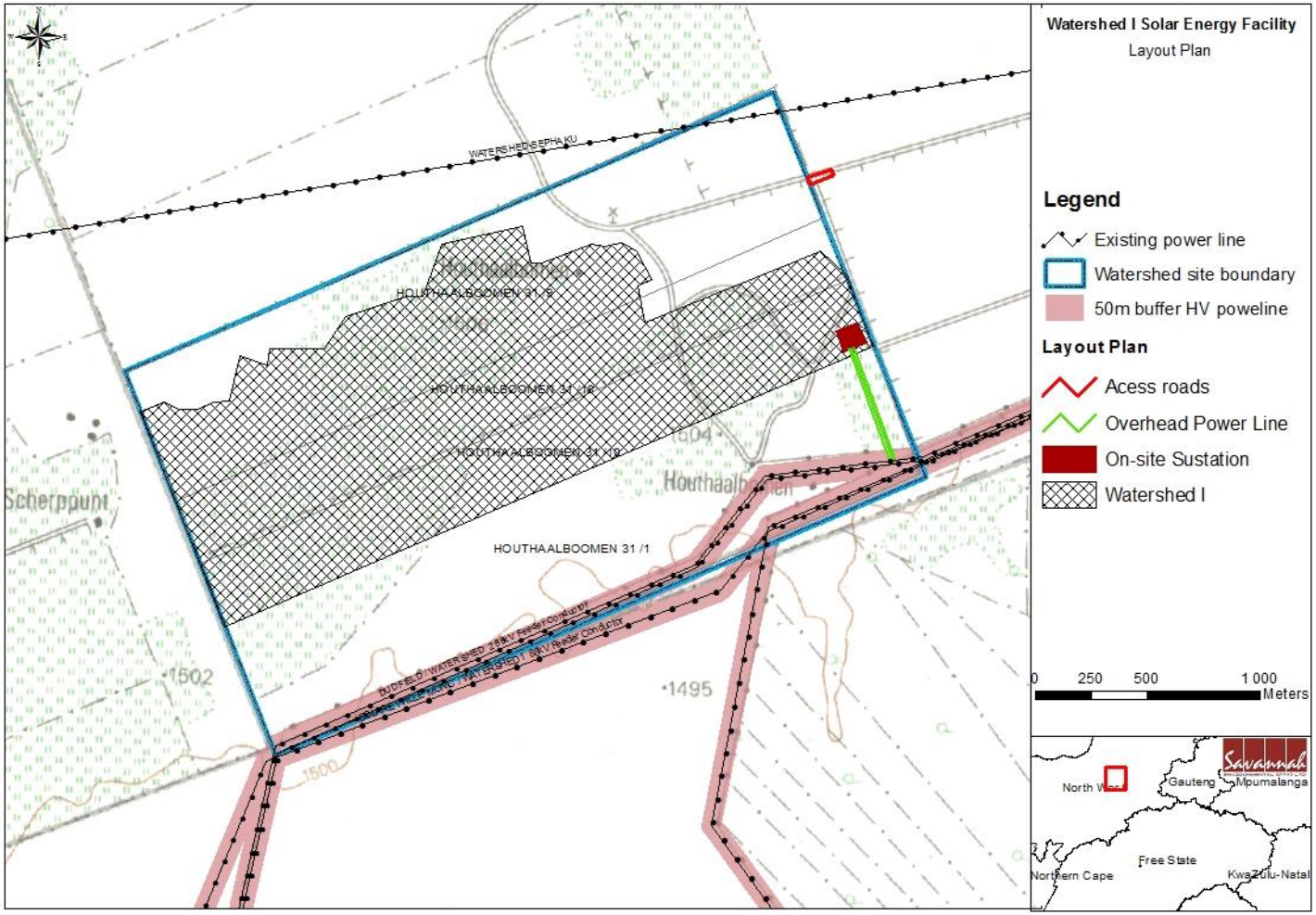

Figure 8.1: Layout map illustrating the location of the development site for the proposed Watershed (Phase I) Solar Energy Facility and preliminary layout of the proposed facility

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 North West Department of Economic Development, Environment, Conservation and Tourism (DEDECT)) 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[9] 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 J**).

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.

8.1 Evaluation of Watershed (Phase I) Solar Energy Facility

The preceding chapters of this report together with the specialist studies contained within **Appendices E –I** provide a detailed assessment of the potential impacts that may result from the proposed project. This chapter concludes the EIA Report for

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

Watershed (Phase I) Solar Energy Facility by providing a summary of the conclusions of the assessment of the proposed site for the development of the PV solar energy facility. In so doing, it draws on the information gathered as part of the EIA process and the knowledge gained by the environmental specialist consultants and presents an informed opinion of the environmental impacts associated with the proposed project.

From the conclusions of the detailed EIA studies undertaken, it has been concluded that the proposed development area has **sensitive areas** within the development footprint. Potential impacts which could occur as a result of the proposed project are summarised in the sections which follow.

8.1.1. Impacts on Ecology

The study area falls within the Carletonville Dolomite Grassland – as defined by Mucina and Rutherford (2006). This vegetation type is not listed as threatened by legislation, but is considered vulnerable by Mucina and Rutherford (2006) due to high levels of transformation. According to the North West Biodiversity Conservation Assessment, the entire farm portion has been mapped as CBA 2 area.

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 the diversity of geophytic and annual species within the study area will be higher than could be determined during the survey.

Relatively intact grasslands of vegetation unit 2 should be entirely excluded from the development, whilst vegetation unit 1, especially the more rocky areas, should be avoided. Access roads to the development should follow existing tracks. Where new access routes will be necessary, suitable erosion control measures must be taken.

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

It is not expected that the development will compromise the survival of any specific flora or terrestrial vertebrate species on the study area or beyond if mitigation measure are fully implemented. The most significant impacts are expected to be on ecosystem health and functionality, which should remain relatively intact if all

mitigation recommendations are implemented. Possible cumulative impacts are thus expected to be fully avoidable.

The largest concerns are:

- Areas with relatively intact natural grasslands and/or high amounts of surface rockiness should be excluded from the development where possible to maintain the local high species diversity
- Trees of the protected *Acacia erioloba* are present, despite the area not being their optimal habitat. The overall density is relatively low and it can be expected that several specimens can be avoided by the development
- Bulbous and succulent protected species that do occur on the site can be successfully relocated.
- All indigenous and alien invasives and potential invasives within the development area will have to be entirely cleared prior to development
    - There is a risk of several alien and indigenous weed species being introduced to the site from transport routes by machinery or clothing due to the nature of the seeds of these species
- Newly cleared soils will have to be revegetated as soon as construction has been completed
    - Soils are prone to capping and erosion and need to be stabilised by a permanent grass layer.
    - If soil disturbance can be kept to a minimum during the construction process, it is expected that revegetation of the area after construction by grasses and some forbs will be relatively spontaneous from existing soil seed banks as well as numerous low-growing plant species with tuberous root stocks. The vigour of the herbaceous layer will need to be monitored and maintained for the duration of the operational phase of the proposed development.
    - To maintain a low-growing grass layer in a vigorous state and reduce the fire risk, intermittent grazing by sheep is recommended. This will ensure that there is no build-up of excessive dead biomass on the grass which creates a fire-risk and suffocates new growth of the grasses. Alternatively, a regular mowing program will need to be implemented.
- Naturally occurring high shrub species are ideal to be used for visually screening the proposed development from surrounding residential (small holding) areas

Wetland issues:

- No natural river or surface wetland exists on the site selected
- Use of water from the existing watering point will have to be arranged with the land-owner and relevant authorities if needed
- The dolomite rock prominent on parts of the farm is usually associated with strong and/or shallow underground water reserves.

- Contamination risk of underground water does exist from accidental spills of chemicals or oils, and such spill must be prevented

8.1.2. Soil and Agricultural Potential Impacts

» The development will have low to medium negative impact on agricultural resources and productivity as the land is being utilised for grazing.
» The grazing of cattle will be able to continue unaffected on all other parts of the farm for the duration of the project.
» The significance of agricultural impacts is influenced by the fact that the solar panel sites have very limited agricultural potential. The farm has a land capability classification of class 6, non-arable, low to moderate potential grazing land. Soils are predominantly shallow Mispah and Glenrosa soils on underlying rock with interspersed pockets of deeper Hutton soils between them. The patchy nature of the distribution of Hutton soils makes them non-viable for cultivation.
» 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 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).

8.1.3 Heritage Impacts

The impacts to heritage resources by the proposed development are not considered to be highly significant and the impact on archaeological sites can very easily be mitigated. Other studies (e.g. Hutton 2012) did not record any Stone Age finds adjacent to the current study area. The proposed Watershed footprint is however not devoid of archaeological material. Two Stone Age sites (**Site 1 and 2**) were recorded within the development footprint. Most of the Stone Age archaeology recorded in the development area consists of low densities of scattered (and possibly mixed) MSA and LSA artefacts. These sites will be affected by the proposed development as they are located within the development footprint.

The entire development footprint was extensively utilised for crop farming and ploughing through the years resulting in a lateral and downward migration of artefacts making it virtually impossible to identify knapping or manufacturing sites and site extent. Burrowing animals exposed a thick sand cover (in some places a meter and half deep) on the site, bringing MSA flakes to the surface giving the impression that artefacts occur deeper down from the present surface level, possibly undisturbed by the intensive ploughing. It is however recommended that earth works must be monitored during construction to determine if any stratigraphy exists that was not disturbed by ploughing.

8.1.4. Visual Impacts

The findings of the Visual Impact Assessment undertaken for the Proposed Watershed Solar Energy Facility is that the visual environment surrounding the site, especially within a 2 to 4km radius, will be visually impacted upon for the anticipated operational lifespan of the facility (i.e. 20 - 30 years).

The proposed facility would be visible within an area that includes certain sensitive visual receptors. These include users of roads and residents of homesteads. The following is a summary of impacts remaining, assuming mitigation as recommended is exercised:

» The solar energy facility could potentially have a **moderate** visual impact on road users travelling along the R503 arterial road traversing south-west 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 **high** to **very high** significance and may be mitigated to **moderate** 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 **high** significance, and may be mitigated to **moderate**.
» The potential visual impact associated with lighting at the facility at night (especially glare) is expected to be of **high** significance and may be mitigated to **moderate**.

The anticipated visual impacts listed above (post mitigation measures) are on average expected to be of **moderate** significance. The solar energy facility development is not considered to be fatally flawed from a visual perspective,

provided that landowners adjacent to the facility are consulted and reasonably compensated/accommodated.

8.1.5. Impacts on the Social Environment

» The findings of the SIA indicate that the development of the proposed Watershed (Phase I) 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 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.
» The establishment of the proposed (Phase I) Solar Energy Facility is supported by the findings of the SIA.

8.2 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[10]. 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:

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

» **Ecology**: The selected property falls within the Carletonville Dolomite Grassland – as defined by Mucina and Rutherford (2006). This vegetation type is not listed as threatened by legislation, but is considered vulnerable by Mucina and Rutherford (2006) due to high levels of transformation. By excluding intact Carletonville Dolomite Grassland (vegetation unit 2) from the Watershed development and limiting the impact on natural grasslands of vegetation unit 1 will prevent the cumulative effect of loss of high biodiversity areas that could arise from the Watershed development.
» **Soil & Agricultural Potential** - The study area is known for agriculture. However, the specific site proposed for the solar facility occurs on an area considered unsuitable for cultivation due to underlying soils. 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 landowners through provision of an additional source of income, thereby contributing to the sustainability of the farming practices on the affected properties.
» **Visual** - The visual integrity of the area has already been impacted by the existing power lines within and around the site. In addition, at a broader level the visual integrity of the area has been negatively impacted by the mining activities and mining related infrastructure. The potential for cumulative impacts on the area's sense of place and landscape character 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 DLM. 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.

8.3. 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 portion 1, 9, 10 and 18 of the farm Houthaalbomen 31 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 North West include the following:

» The potential to harness and utilise solar energy resources within the North West 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 North West 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.

Based on findings of the specialist studies undertaken within this EIA and the sensitivity map below (**Figure 8.2**), the Watershed (Phase I) Solar Energy Facility does not have environmental flaws that may prevent the proposed project from being develop neither does it pose a threat to the ecological sensitive areas. The layout has been designed to avoid all environmental sensitive area with the proposed site.

The significance levels of the majority of identified negative impacts can be reduced by implementing the recommended mitigation measures. The project is therefore considered to meet the requirements of sustainable development. Environmental specifications for the management of potential impacts are detailed within the draft Environmental Management Programme (EMPr) included within **Appendix J**.

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**.

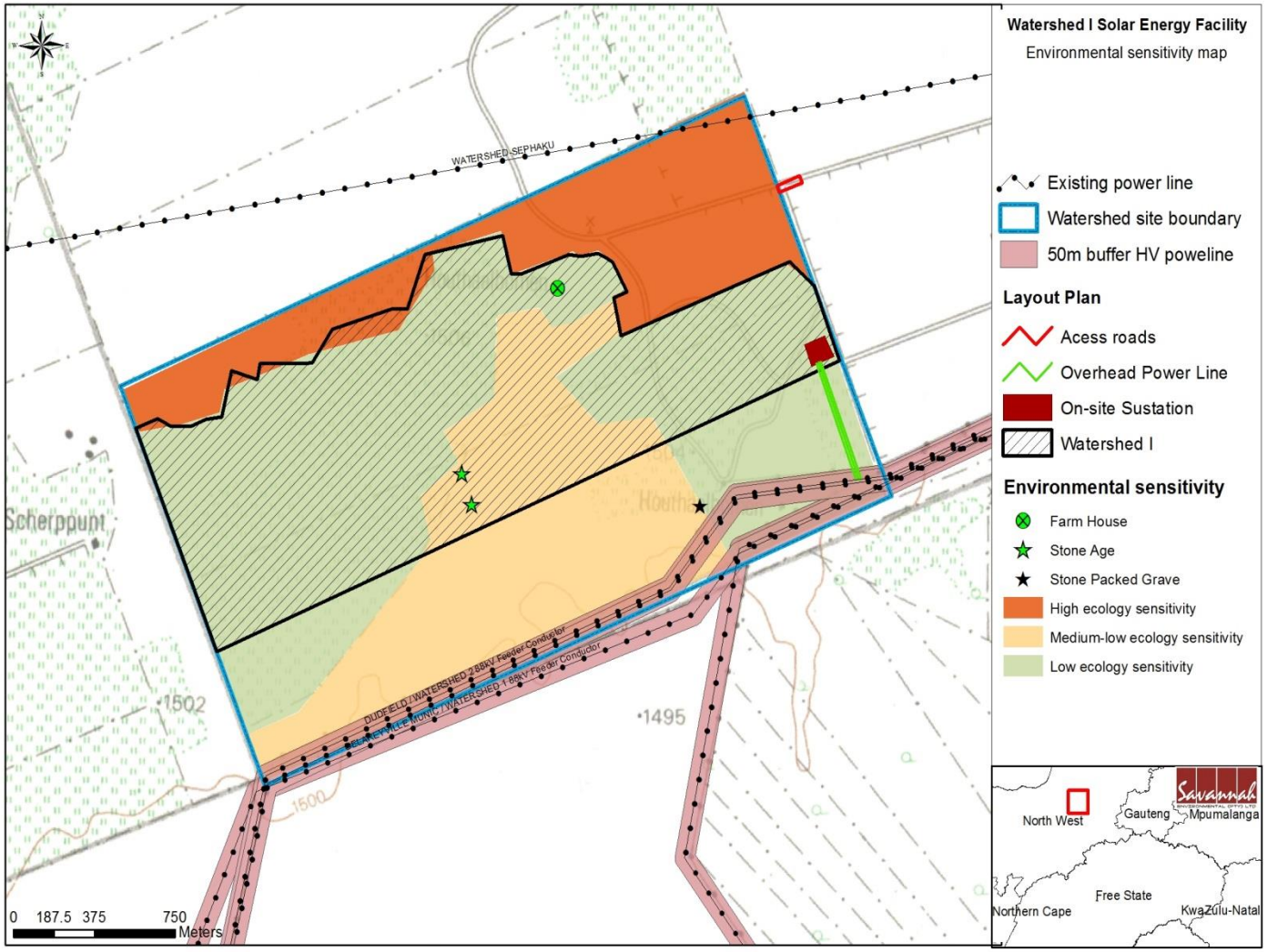

Figure 8.1: Environmental Sensitivity map of the proposed Watershed (Phase I) Solar Energy Facility

8.4. 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 developmental impacts of the Watershed (Phase I) Solar Energy Facility project can be mitigated to an acceptable level. In terms of this conclusion, the EIA project team support the decision for environmental authorisation.

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 J 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.
» Clear as little grassland vegetation as possible. Aim to maintain vegetation where it will not interfere with the construction or operation of the development. Rehabilitate an acceptable vegetation layer according to rehabilitation recommendations of the relevant EMP.
» The high biodiversity and conservation value and associated classification as CBA 2 area should be excluded from the development as far as possible. Any alteration of or disturbance to the habitat should be avoided.
» 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.
» It is recommended that weeds and invasives in the remaining natural grassland on the western portion of the study area be eradicated and controlled, but that the area is excluded as much as possible from the development.

- All declared alien plants must be identified and managed in accordance with the Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983), the implementation of a monitoring programme in this regard is recommended.
- Develop emergency maintenance operational plan to deal with any event of contamination, pollution, or spillages.
- Access roads to the development should follow existing tracks as far as possible. Where new access routes will be necessary, suitable erosion control measures must be implemented.
- No Archaeological mitigation is necessary prior to the start of construction (based on approval by SAHRA).
- 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.
- In terms of ancillary infrastructure, it is recommended that access roads and other on-site infrastructure be planned so that the clearing of vegetation is minimised.
- Consolidate infrastructure as far as possible and make use of already disturbed areas rather than pristine sites, wherever possible.
- 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.
- Compile a comprehensive storm water management method statement, as part of the final design of the project and implement during construction and operation.
- All rehabilitated areas should be monitored for at least a year following decommissioning, and remedial actions implemented as and when required.
- An independent **Environmental Control Officer** (ECO) must be appointed by FRV Energy South Africa (Pty) Ltd prior to the commencement of any authorised activities.

CONCLUSIONS AND RECOMMENDATIONS: PHASE II CHAPTER 9

The Watershed (Phase II) Solar Energy Facility is proposed to be developed as a commercial solar energy facility to be located on portion 1, 9, 10 and 18 of the farm Houthaalbomen, which falls within the Ditsobotla Local Municipality, North West Province (refer to Figure 9.1). The purpose of the proposed facility is proposed to have an export capacity of up to 75MW and 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 a development area of approximately 200 ha and will be comprised of the following primary elements (refer to Chapter 2 for more details):

» Arrays of photovoltaic (PV) panels
» Mounting structure to be either rammed steel piles or piles with pre-manufactured concrete footings to support the PV panels.
» Cabling between project components, to be lain underground where practical.
» Underground cabling to transmit electricity generated from the panels to the proposed on-site substation which will be located within the Watershed (Phase II) solar energy facility site
» Internal access roads (4 – 8 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, and offices.

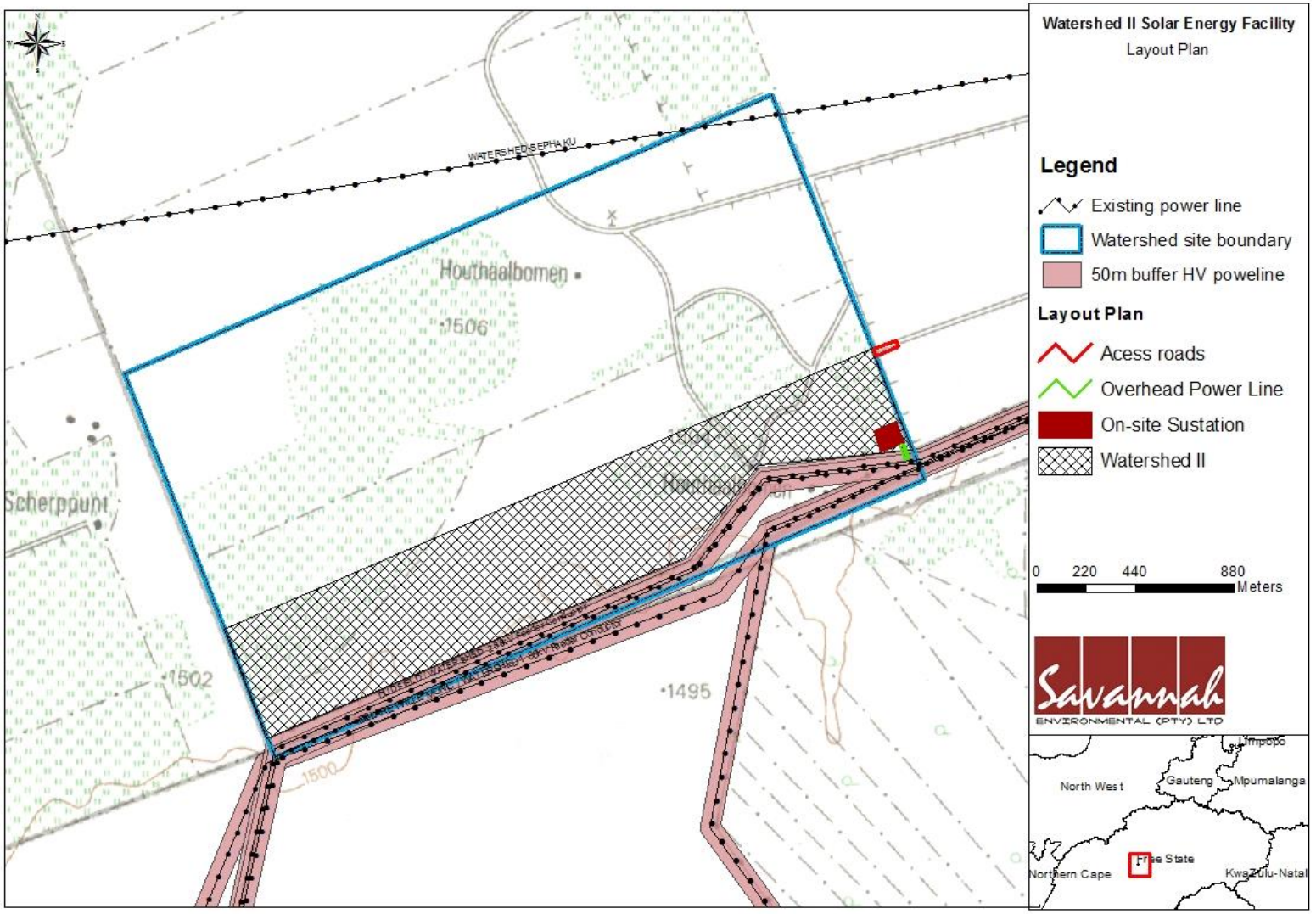

Figure 9.1: Layout map illustrating the location of the development site for the proposed Watershed (Phase II) Solar Energy Facility and preliminary layout of the proposed facility

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 North West Department of Economic Development, Environment, Conservation and Tourism (DEDECT)) 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[11] 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.

9.1 Evaluation of Watershed (Phase II) Solar Energy Facility

The preceding chapters of this report together with the specialist studies contained within **Appendices E -I** provide a detailed assessment of the potential impacts that may result from the proposed project. This chapter concludes the EIA Report for

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

Watershed (Phase II) Solar Energy Facility by providing a summary of the conclusions of the assessment of the proposed site for the development of the PV solar energy facility. In so doing, it draws on the information gathered as part of the EIA process and the knowledge gained by the environmental specialist consultants and presents an informed opinion of the environmental impacts associated with the proposed project.

From the conclusions of the detailed EIA studies undertaken, it has been concluded that the proposed development area has **sensitive areas** within the development footprint. Potential impacts which could occur as a result of the proposed project are summarised in the sections which follow.

9.1.1. Impacts on Ecology

The study area falls within the Carletonville Dolomite Grassland – as defined by Mucina and Rutherford (2006). This vegetation type is not listed as threatened by legislation, but is considered vulnerable by Mucina and Rutherford (2006) due to high levels of transformation. According to the North West Biodiversity Conservation Assessment, the entire farm portion has been mapped as CBA 2 area.

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 the diversity of geophytic and annual species within the study area will be higher than could be determined during the survey.

Relatively intact grasslands of vegetation unit 2 should be entirely excluded from the development, whilst vegetation unit 1, especially the more rocky areas, should be avoided. Access roads to the development should follow existing tracks. Where new access routes will be necessary, suitable erosion control measures must be taken.

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

It is not expected that the development will compromise the survival of any specific flora or terrestrial vertebrate species on the study area or beyond if mitigation measure are fully implemented. The most significant impacts are expected to be on ecosystem health and functionality, which should remain relatively intact if all

mitigation recommendations are implemented. Possible cumulative impacts are thus expected to be fully avoidable.

The largest concerns are:

- Areas with relatively intact natural grasslands and/or high amounts of surface rockiness should be excluded from the development where possible to maintain the local high species diversity
- Trees of the protected *Acacia erioloba* are present, despite the area not being their optimal habitat. The overall density is relatively low and it can be expected that several specimens can be avoided by the development
- Bulbous and succulent protected species that do occur on the site can be successfully relocated.
- All indigenous and alien invasives and potential invasives within the development area will have to be entirely cleared prior to development
    - There is a risk of several alien and indigenous weed species being introduced to the site from transport routes by machinery or clothing due to the nature of the seeds of these species
- Newly cleared soils will have to be revegetated as soon as construction has been completed
    - Soils are prone to capping and erosion and need to be stabilised by a permanent grass layer.
    - If soil disturbance can be kept to a minimum during the construction process, it is expected that revegetation of the area after construction by grasses and some forbs will be relatively spontaneous from existing soil seed banks as well as numerous low-growing plant species with tuberous root stocks. The vigour of the herbaceous layer will need to be monitored and maintained for the duration of the operational phase of the proposed development.
    - To maintain a low-growing grass layer in a vigorous state and reduce the fire risk, intermittent grazing by sheep is recommended. This will ensure that there is no build-up of excessive dead biomass on the grass which creates a fire-risk and suffocates new growth of the grasses. Alternatively, a regular mowing program will need to be implemented.
- Naturally occurring high shrub species are ideal to be used for visually screening the proposed development from surrounding residential (small holding) areas

Wetland issues:

- No natural river or surface wetland exists on the site selected
- Use of water from the existing watering point will have to be arranged with the land-owner and relevant authorities if needed
- The dolomite rock prominent on parts of the farm is usually associated with strong and/or shallow underground water reserves.

- Contamination risk of underground water does exist from accidental spills of chemicals or oils, and such spill must be prevented

9.1.2. Soil and Agricultural Potential Impacts

» The development will have low to medium negative impact on agricultural resources and productivity as the land is being utilised for grazing.
» The grazing of cattle will be able to continue unaffected on all other parts of the farm for the duration of the project.
» The significance of agricultural impacts is influenced by the fact that the solar panel sites have very limited agricultural potential. The farm has a land capability classification of class 6, non-arable, low to moderate potential grazing land. Soils are predominantly shallow Mispah and Glenrosa soils on underlying rock with interspersed pockets of deeper Hutton soils between them. The patchy nature of the distribution of Hutton soils makes them non-viable for cultivation.
» 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 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).

9.1.3 Heritage Impacts

The impacts to heritage resources by the proposed development are considered to be moderate significant and the impact on archaeological sites can very easily be mitigated. Other studies (e.g. Hutton 2012) did not record any Stone Age finds adjacent to the current study area. The proposed Watershed footprint is however not devoid of archaeological material. Apart from the Stone Age component a single unmarked grave (**Site 3**) was documented within the study area and it will be directly impacted upon by the proposed development. However some recommendations are made to protect the site from accidental damage during the construction phase of the project. Most of the Stone Age archaeology recorded in

the development area consists of low densities of scattered (and possibly mixed) MSA and LSA artefacts. This site will be affected by the proposed development as it is located within the development footprint.

The entire development footprint was extensively utilised for crop farming and ploughing through the years resulting in a lateral and downward migration of artefacts making it virtually impossible to identify knapping or manufacturing sites and site extent. Burrowing animals exposed a thick sand cover (in some places a meter and half deep) on the site, bringing MSA flakes to the surface giving the impression that artefacts occur deeper down from the present surface level, possibly undisturbed by the intensive ploughing. It is recommended that a heritage walkthrough survey be undertaken prior construction.

9.1.4. Visual Impacts

The findings of the Visual Impact Assessment undertaken for the Proposed Watershed Solar Energy Facility is that the visual environment surrounding the site, especially within a 2 to 4km radius, will be visually impacted upon for the anticipated operational lifespan of the facility (i.e. 20 - 30 years).

The proposed facility would be visible within an area that includes certain sensitive visual receptors. These include users of roads and residents of homesteads. The following is a summary of impacts remaining, assuming mitigation as recommended is exercised:

» The solar energy facility could potentially have a **moderate** visual impact on road users travelling along the R503 arterial road traversing south-west 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 **high** to **very high** significance and may be mitigated to **moderate** 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 **high** significance, and may be mitigated to **moderate**.
» The potential visual impact associated with lighting at the facility at night (especially glare) is expected to be of **high** significance and may be mitigated to **moderate**.

The anticipated visual impacts listed above (post mitigation measures) are on average expected to be of **moderate** significance. The solar energy facility development is not considered to be fatally flawed from a visual perspective, provided that landowners adjacent to the facility are consulted and reasonably compensated/accommodated.

9.1.5. Impacts on the Social Environment

» The findings of the SIA indicate that the development of the proposed Watershed (Phase II) 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 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.
» The establishment of the proposed (Phase II) Solar Energy Facility is supported by the findings of the SIA.

9.2 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[12]. 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.

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

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

» **Ecology**: The selected property falls within the Carletonville Dolomite Grassland – as defined by Mucina and Rutherford (2006). This vegetation type is not listed as threatened by legislation, but is considered vulnerable by Mucina and Rutherford (2006) due to high levels of transformation. By excluding intact Carletonville Dolomite Grassland (vegetation unit 2) from the Watershed development and limiting the impact on natural grasslands of vegetation unit 1 will prevent the cumulative effect of loss of high biodiversity areas that could arise from the Watershed development.
» **Soil & Agricultural Potential** - The study area is known for agriculture. However, the specific site proposed for the solar facility occurs on an area considered unsuitable for cultivation due to underlying soils. 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 landowners through provision of an additional source of income, thereby contributing to the sustainability of the farming practices on the affected properties.
» **Visual** - The visual integrity of the area has already been impacted by the existing power lines within and around the site. In addition, at a broader level the visual integrity of the area has been negatively impacted by the mining activities and mining related infrastructure. The potential for cumulative impacts on the area's sense of place and landscape character 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 DLM. 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.

9.3. 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 portion 1, 9, 10 and 18 of the farm Houthaalbomen 31 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 North West include the following:

» The potential to harness and utilise solar energy resources within the North West 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 North West 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.

Based on findings of the specialist studies undertaken within this EIA and the sensitivity map below (**Figure 9.2**), the Watershed (Phase II) Solar Energy Facility does not have environmental flaws that may prevent the proposed project from being develop neither does it pose a threat to the ecological sensitive areas. The layout has been designed to avoid all environmental sensitive area with the proposed site.

The significance levels of the majority of identified negative impacts can be reduced by implementing the recommended mitigation measures. The project is therefore considered to meet the requirements of sustainable development. Environmental specifications for the management of potential impacts are detailed within the draft Environmental Management Programme (EMPr) included within **Appendix K**.

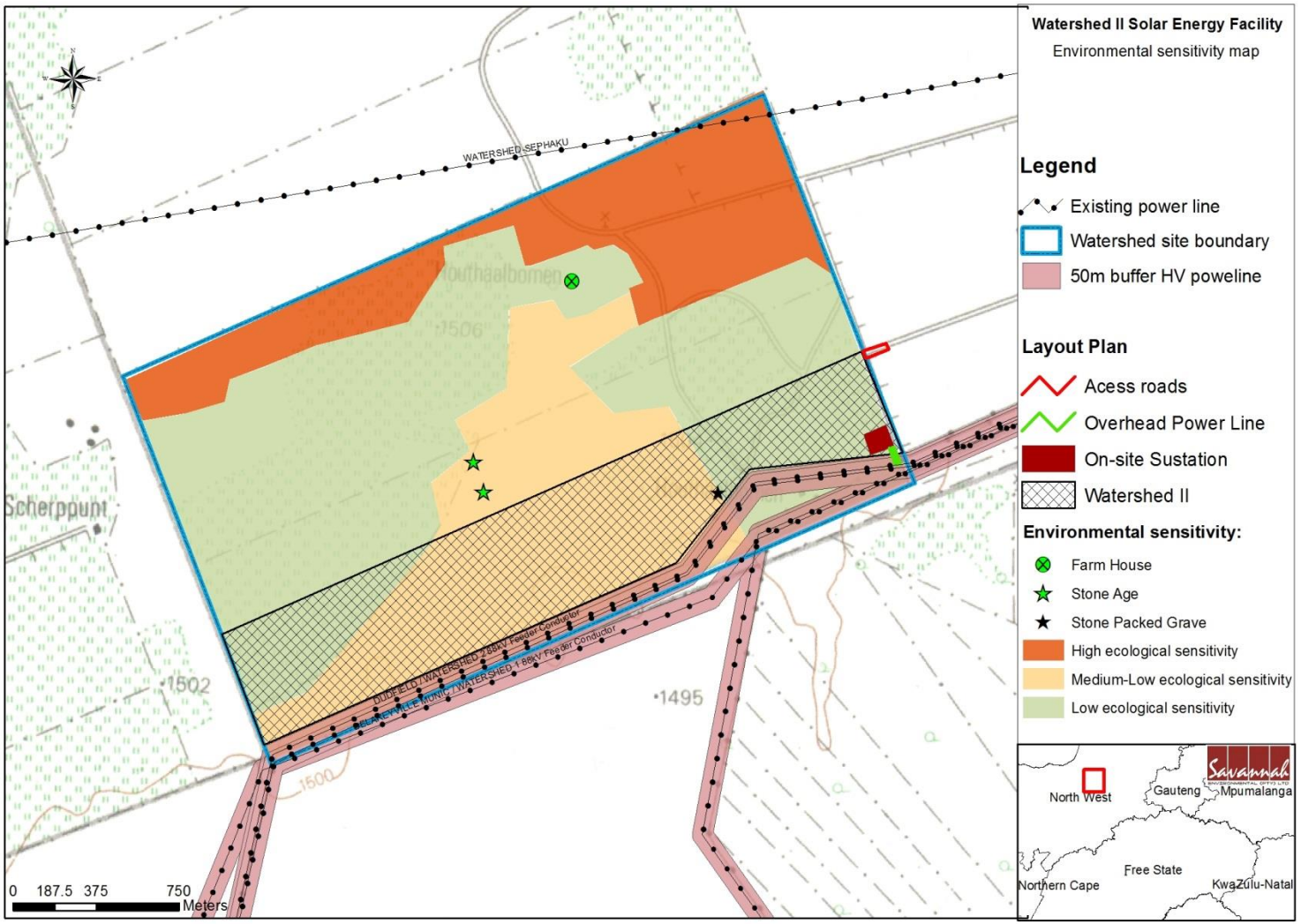

Figure 9.1: Environmental Sensitivity map of the proposed Watershed (Phase II) Solar Energy Facility

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**.

9.4. 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 developmental impacts of the Watershed (Phase II) Solar Energy Facility project can be mitigated to an acceptable level. In terms of this conclusion, the EIA project team support the decision for environmental authorisation.

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.
- Clear as little grassland vegetation as possible. Aim to maintain vegetation where it will not interfere with the construction or operation of the development. Rehabilitate an acceptable vegetation layer according to rehabilitation recommendations of the relevant EMP.
- The high biodiversity and conservation value and associated classification as CBA 2 area should be excluded from the development as far as possible. Any alteration of or disturbance to the habitat should be avoided.
- 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.

- It is recommended that weeds and invasives in the remaining natural grassland on the western portion of the study area be eradicated and controlled, but that the area is excluded as much as possible from the development.
- All declared alien plants must be identified and managed in accordance with the Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983), the implementation of a monitoring programme in this regard is recommended.
- Develop emergency maintenance operational plan to deal with any event of contamination, pollution, or spillages.
- Access roads to the development should follow existing tracks as far as possible. Where new access routes will be necessary, suitable erosion control measures must be implemented.
- No Archaeological mitigation is necessary prior to the start of construction (based on approval by SAHRA).
- 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.
- In terms of ancillary infrastructure, it is recommended that access roads and other on-site infrastructure be planned so that the clearing of vegetation is minimised.
- Consolidate infrastructure as far as possible and make use of already disturbed areas rather than pristine sites, wherever possible.
- 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.
- It is recommended that a heritage walkthrough survey be undertaken prior construction
- Compile a comprehensive storm water management method statement, as part of the final design of the project and implement during construction and operation.
- All rehabilitated areas should be monitored for at least a year following decommissioning, and remedial actions implemented as and when required.
- An independent **Environmental Control Officer** (ECO) must be appointed by FRV Energy South Africa (Pty) Ltd prior to the commencement of any authorised activities.

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