ENVIRONMENTAL IMPACT ASSESSMENT PROCESS
DRAFT ENVIRONMENTAL IMPACT REPORT

PROPOSED ALLDAYS PHOTOVOLTAIC (PV)/ CONCENTRATED PHOTOVOLTAIC (CPV) SOLAR ENERGY FACILITY ON GOTHA FARM, PHASE 1 (UP TO 75 MW EXPORTED), LIMPOPO PROVINCE

DEA Ref. No: 14/12/16/3/3/2/329

DRAFT FOR PUBLIC REVIEW
28 November 2012 – 15 January 2013

Prepared for:
BioTherm Energy (Pty) Ltd
3 Eglin Road
Unit B4 The Crescent East
Sunninghill

Prepared by:

Savannah Environmental Pty Ltd

UNIT 10, BLOCK 2
5 WOODLANDS DRIVE OFFICE PARK,
CORNER WOODLANDS DRIVE & WESTERN
SERVICE ROAD, WOODMEAD, GAUTENG
PO BOX 148, SUNNINGHILL, 2157
TEL: +27 (0)11 656 3237
FAX: +27 (0)86 684 0547
E-MAIL: INFO@SAVANNAHSA.COM
WWW.SAVANNAHSA.COM

PROJECT DETAILS

DEA Reference No. : 14/12/16/3/3/2/329

Title : Environmental Impact Assessment Process
Draft Environmental Impact Assessment Report: Proposed Alldays Photovoltaic (PV)/ Concentrated photovoltaic (CPV) Solar Energy Facility on Gotha Farm, Alldays PV/CPV Plant Phase 1 (up to 75MW), Limpopo Province.

Authors : Savannah Environmental (Pty) Ltd
Umeshree Naicker
Jo-Anne Thomas

Sub-consultants : Simon Todd Consulting
Outeniqua Geotechnical Services Cc
G&A Heritage
Tony Barbour Consulting
Zone land Solutions

Client : BioTherm Energy (Pty) Ltd

Report Status : Draft Environmental Impact Assessment Report for public review

When used as a reference this report should be cited as: Savannah Environmental (2012) Environmental Impact Assessment Report: Proposed Alldays Photovoltaic (PV)/ Concentrated Photovoltaic (CPV) Solar Energy Facility on Gotha Farm, Alldays PV/CPV Plant Phase 1 (up to 75MW exported), Limpopo Province.

PURPOSE OF THE ENVIRONMENTAL IMPACT ASSESSMENT REPORT

BioTherm Energy (Pty) Ltd is proposing to establish a commercial photovoltaic solar energy facility (utilising either photovoltaic (PV) or concentrated photovoltaic (CPV) technology) of up to 75 MW exported capacity as well as associated infrastructure on a portion of Farm 102 (Gotha) MS located approximately 70 km west of Musina in the Limpopo Province of South Africa (refer to Figure 1.1). The project is referred to as **Alldays PV/CPV Plant Phase 1**. The solar energy facility is proposed to accommodate either **Photovoltaic (PV) panels or Concentrated Photovoltaic (CPV)** technology.

BioTherm Energy (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 Draft EIA Report consists of eight sections:

Chapter 1: Provides background to the proposed facility and the environmental impact assessment.

Chapter 2: Provides a description of the proposed project.

Chapter 3: Provides an overview of the regulatory and legal context for electricity generation projects and the EIA process.

Chapter 4: Outlines the process which was followed during the EIA Phase, including the consultation program that was undertaken and input received from interested parties.

Chapter 5: Describes the existing biophysical and socio-economic environment.

Chapter 6: Presents the assessment of environmental impacts associated with the proposed facility.

Chapter 7: Presents the conclusions of the EIA, as well as an impact statement on the proposed project.

Chapter 8: Provides a list of references and information sources used in undertaking the studies for this EIA Report.

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

The release of a draft EIA Report provides 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 will incorporate 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 DRAFT EIA REPORT

Members of the public, local communities and stakeholders are invited to comment on the draft EIA Report which has been made available for public review and comment at the following locations from **28 November 2012 to 15 January 2013**

» Alldays Public Library
» Muisna Public Library
» www.savannahsa.com

Please submit your comments to
Shawn Johnston of Sustainable Futures ZA PO Box 749, Rondebosch, Cape Town, 7701 Tel: 083 325 9965 Fax: 086 510 2537 E-mail: swjohnston@mweb.co.za
The due date for comments on the Draft EIA Report is **15 January 2012**

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

EXECUTIVE SUMMARY

BioTherm Energy (Pty) Ltd an Independent Power Producer is proposing the establishment of a commercial solar energy facility for the purpose of electricity generation. Radiant energy from the sun, a renewable form of energy will be used to power the proposed **Alldays PV/CPV Plant Phase 1.**

The facility is proposed on a portion of Farm 102 (Gotha) (MS) located approximately 70km west of Musina in the Limpopo Province of South Africa (refer to Figure 1).

The proposed facility, which will be entirely contained within the identified farm portion, will have a developmental footprint of slightly less than the ~ 175ha extent of the site. The solar energy facility proposes to generate up to 75 MW of electricity and will be comprised of the following infrastructure:

A new on-site substation to connect via a loop in loop out to the Soutpan/Venetia 1 132 kV power line to evacuate the power from the facility into the Eskom grid. The alternative would be to construct a 132kV connection line (up to 2 km), parallel to existing power line to the Venetia substation.

» Mounting structure to be either rammed steel piles or piles with pre-manufactured concrete footings to support the PV/CPV panels.

» Cabling between the project's components, to be lain underground where practical.

» Internal access roads and fencing.

» 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:

» In terms of ecology, the potential significance was rated as having a predominately medium significance.

» In terms of geology, soil, and erosion potential, the potential significance was rated as having a predominately low to medium significance.

» In terms of heritage resources, the potential significance was rated as having a predominately low significance.

» In terms of visual impacts, the potential significance was rated as having a predominately medium to low significance.

» In terms of social impacts, the potential significance was rated as having a predominately medium to low significance.

No environmental fatal flaws were identified with the establishment of the proposed Alldays PV/CPV Plant Phase 1. However a number of issues requiring mitigation have been highlighted. Environmental specifications for the management of potential impacts are detailed within the draft Environmental Management Plan (EMP) included within Appendix I.

OVERALL CONCLUSION (IMPACT STATEMENT)

Internationally there is increasing pressure on countries to increase their share of renewable energy generation due to concerns such as climate change and exploitation of resources. The South African Government has set a 10-year cumulative target for renewable energy of 10 000 GWh renewable energy contribution to final energy consumption by 2013, to be produced mainly from biomass, wind, solar and small-scale hydro. This amounts to approximately 4% (1 667 MW) of the total estimated electricity demand (41 539 MW) by 2013.

The positive implications of establishing a solar energy facility on the identified site within the Limpopo Province include:

» The injection of electricity into the grid, at the proposed point, would serve to strengthen the power supply in the area.
» Solar facilities utilise a renewable source of energy (considered as an international priority) to generate power and is therefore generally perceived in a positive light. It does not emit any harmful by-products or pollutants and is therefore not negatively associated with possible health risks to observers.
» The facility could become a major tourist attraction in its own right and could complement the existing tourism attractions in the area, thereby resulting in promoting a positive image of the area with resultant positive impact on the local tourism industry, economy, and environment.
» The project is anticipated to have positive social and health related impacts through the “greener” technology that will be used (limited noise, no emissions etc).
» On a global scale the project has the potential to assist in reducing carbon dioxide emissions which would thus have an ameliorating impact on global climate change.
» The project will have numerous benefits during both the construction and the operation phase by way of employment opportunities, skills development, and capacity building within the local communities.

The significance levels of the majority of identified negative impacts can generally be reduced by implementing the recommended mitigation measures. 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

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 application for the proposed **Alldays PV/CPV Plant Phase 1** can be mitigated to an acceptable level. In terms of this conclusion, the EIA project team support the decision for environmental authorisation.

Potential sensitive areas have been identified through the environmental scoping study and are listed below. In order to reduce the potential for on-site environmental impacts, these areas should be avoided as far as reasonably possible.

» The baobab trees within the site are considered to be a significant ecological feature given the role these trees play in the ecology of the area. There is one Baobab tree that was noted. A licence would be required to remove the tree.

» The majority of the site consists of woody vegetation and trees. The removal of the vegetation, if not managed properly, would result in soil erosion. The proposed area is classified as being of medium soil sensitivity.

» The visual impacts associated with the proposed facility will be largely contained within the broader region itself. However, the proposed facility is located opposite the Venetia Diamond Mine and the surrounding land consists of farm land (grazing for livestock).

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

» The preferred power evacuation option (i.e. the loop-in/loop-out with the existing power line that crosses the site should be authorised).
» All mitigation measures detailed within this report and the specialist reports contained within Appendices E to I should be implemented to limit the negative impacts and enhance the positives.
» The draft Environmental Management Programme (EMP) as contained within Appendix I of this report should form part of the contract with the Contractors appointed to construct and maintain the proposed facility, and will be used to ensure compliance with environmental specifications and management

measures. The implementation of this EMP for all life cycle phases of the proposed project is considered key in achieving the appropriate environmental management standards as detailed for this project. This EMP should be viewed as a dynamic document that should be updated throughout the life cycle of the facility, as appropriate.

» Alien invasive plants should be controlled on site. Currently, the site contains very little alien vegetation. It is important to maintain this situation and not allow alien species to become established on site.
» A permit is required for removal of protected Baobab that occurs on site.
» A detailed geotechnical investigation should be undertaken before the engineering design phase to provide more detail. Specialist geotechnical input is recommended during the construction of foundations.
» Earthwork related mitigation measures should be included in the EMP and implemented during the construction phase to limit impacts on geology and soil.
» The management plan primarily focuses on the mitigation and management of potential secondary visual impacts, because the primary visual impact has very low mitigation potential. In this regard proper planning should be undertaken regarding the placement of lighting structures.

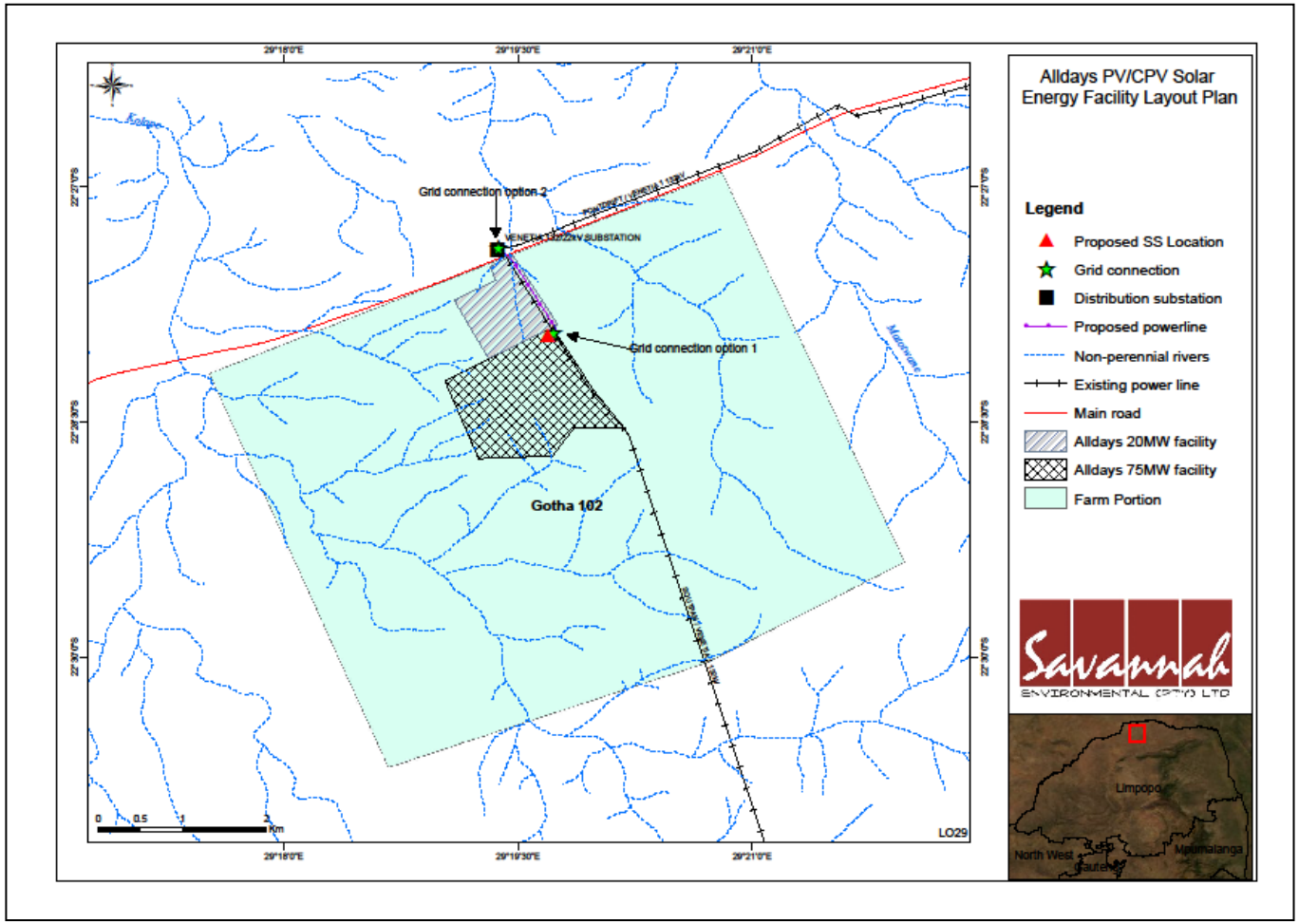

Figure 1: Locality Map

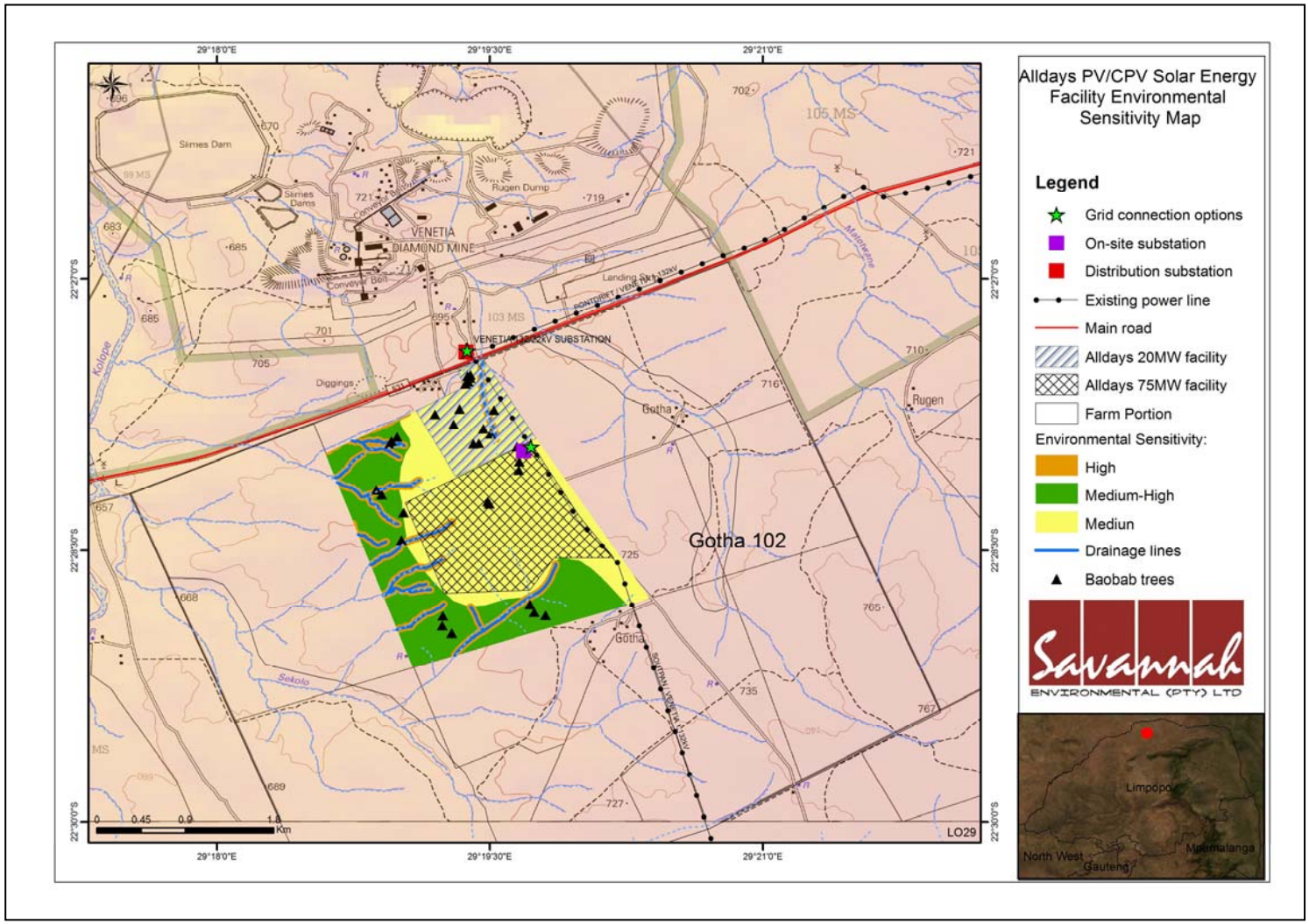

Figure 2: Sensitivity Map

TABLE OF CONTENTS

PAGE

APPENDICES

DEFINITIONS AND TERMINOLOGY

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

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

Cumulative impacts: The impact of an activity that in itself may not be significant, but may become significant when added to the existing and potential impacts eventuating from similar or diverse activities or undertakings in the area.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

ABBREVIATIONS AND ACRONYMS

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

INTRODUCTION CHAPTER 1

BioTherm Energy (Pty) Ltd proposes to establish a commercial solar energy facility with associated infrastructure on a portion of Farm 102 (Gotha) (MS) located approximately 70km west of Musina within the Musina Local Municipality of the Limpopo Province of South Africa (refer to Figure 1.1). The proposed facility and associated infrastructure has an extent of approximately 175 hectares (ha). The larger site covers an area of approximately 450 ha (refer to **Figure 1.1**). The project is referred to as **Alldays PV/CPV Plant Phase 1.**

The proposed development area is preferred 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.
» **Orographic conditions:** The site conditions are optimum for a development of this nature.
» **Extent of the site:** Significant land area is required for the proposed development.
» **Proximity:** This site is in close proximity to an existing electricity grid connection, which minimises the need for a long connection power line.

The nature and extent of this facility, as well as the potential environmental impacts associated with the construction, operation and decommissioning phases are explored in more detail in this Draft Environmental Impact Assessment (EIA) Report. The EIA Report consists of eight chapters, which include:

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

Chapter 8: Provides a list of references and information sources used in undertaking the studies for this EIA Report.

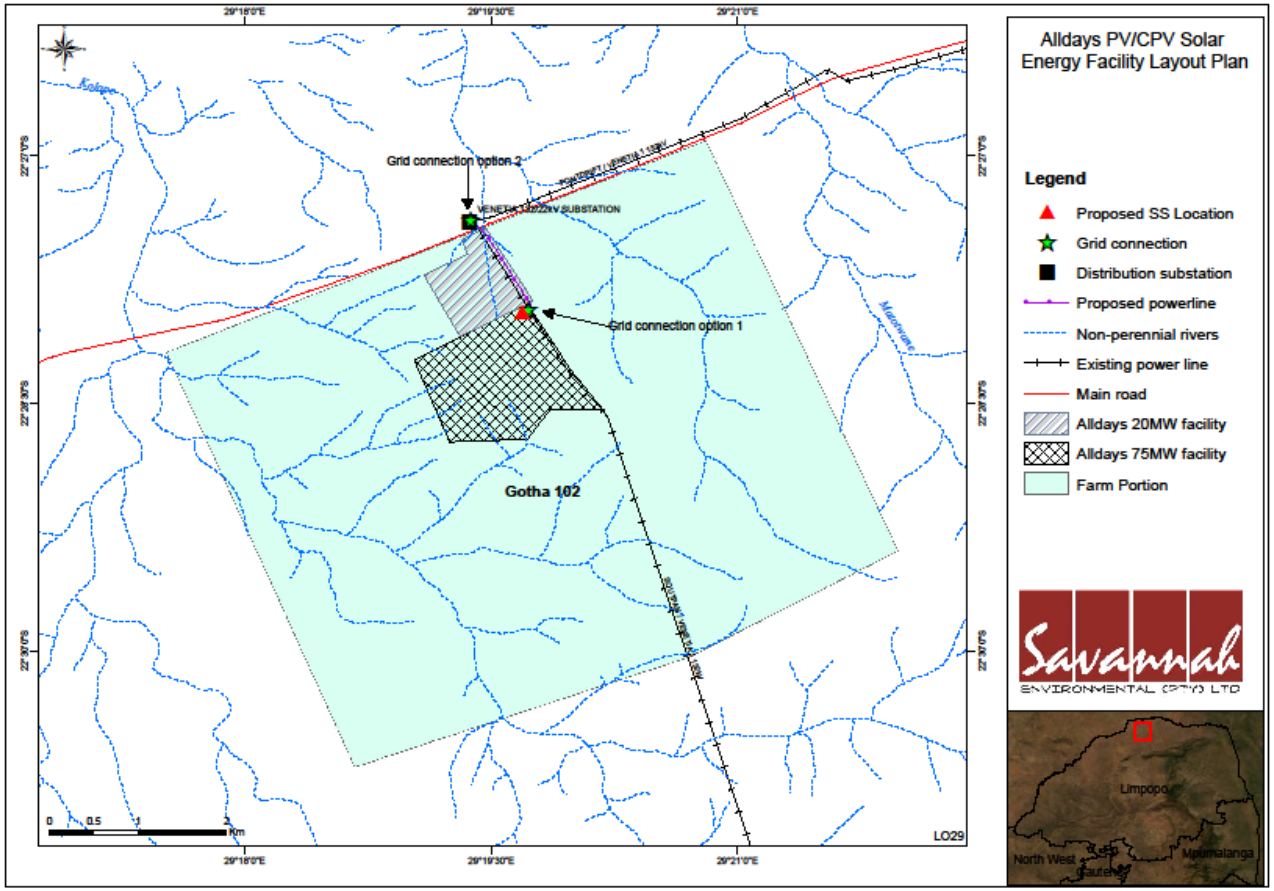

Figure 1.1: Locality map illustrating the location of the assessed development site for the proposed Alldays PV/CPV Plant Phase 1

1.1. Summary of the proposed Development

The BioTherm Energy (Pty) Ltd proposes to establish several arrays of photovoltaic (PV) panels with associated infrastructure in order to generate up to **75 MW** of electricity. The facility will comprise of the following:

» Photovoltaic **(PV)** or Concentrated Photovoltaic **(CPV) panels** with an export capacity of up to 75 MW. Panels are proposed to be up to 20m in height (should CPV technology be utilised).
» A new on-site substation to connect via a loop in loop out to the Soutpan/Venetia 1 132 kV power line to evacuate the power from the facility into the Eskom grid. The alternative would be to construct a 132kV connection line (up to 2 km), parallel to existing power line to the Venetia substation. Mounting structure to be either rammed steel piles or piles with pre-manufactured concrete footings to support the PV/CPV panels.
» Cabling between the project's components, to be lain underground where practical.
» Internal access roads and fencing.
» Workshop area for maintenance, storage, and offices

This **Alldays PV/CPV Plant Phase 1** is located on the same property as the proposed Phase 2 PV/CPV facility with a proposed capacity of up to 20MW. This phase 2 was the subject of a separate Basic Assessment process[1], which has been authorized by the Department of Environmental Affairs.

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

The scope of the proposed **Alldays PV/CPV Plant Phase 1**, 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] This project has been registered with the Department of Environmental Affairs (DEA) under EIA Reference number 14/12/16/3/3/1/551.

1.2. Conclusions from the Scoping Phase

The broader study area (i.e. the farm portion in its entirety) was evaluated within the scoping study. It was found that sections of the study area appear to have Baobab trees within the development footprint, and this was highlighted as an important consideration. The local environmental officials have recommended that any affected trees should be transplanted outside of the development footprint. Avoidance wherever possible is therefore the preferred alternative with regards to these trees.

Erosion risk has also been identified as being a particular risk associated with the development on account of the wooded nature of the site. Site preparation would involve a lot of disturbance, which could leave the site vulnerable to erosion unless appropriate mitigation is implemented. It is therefore recommended that perennial grasses, which occur naturally in the area, be considered for proactive use to stabilise the site after it has been cleared.

From the project point of view, no environmental fatal flaws were identified to be associated with the site. Sensitive areas relating to ecological aspects of the site were however identified (refer to Figure 1.2). It was therefore recommended that infrastructure should be placed with caution in these areas, or mitigation measures must be implemented to minimise impacts in these sensitive areas.

The potentially significant issues related to the **construction** of the **Alldays PV/CPV Plant Phase 1** include, *inter alia*:

» Effects on endangered flora and fauna (local and site specific)
» Socio-economic impacts, both positive and negative (including job creation and business opportunities and impacts associated with construction workers in the area)

The potentially significant issues related to the **operation** of the **Alldays PV/CPV Plant Phase 1** 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
» Increased use of clean, renewable energy (positive)

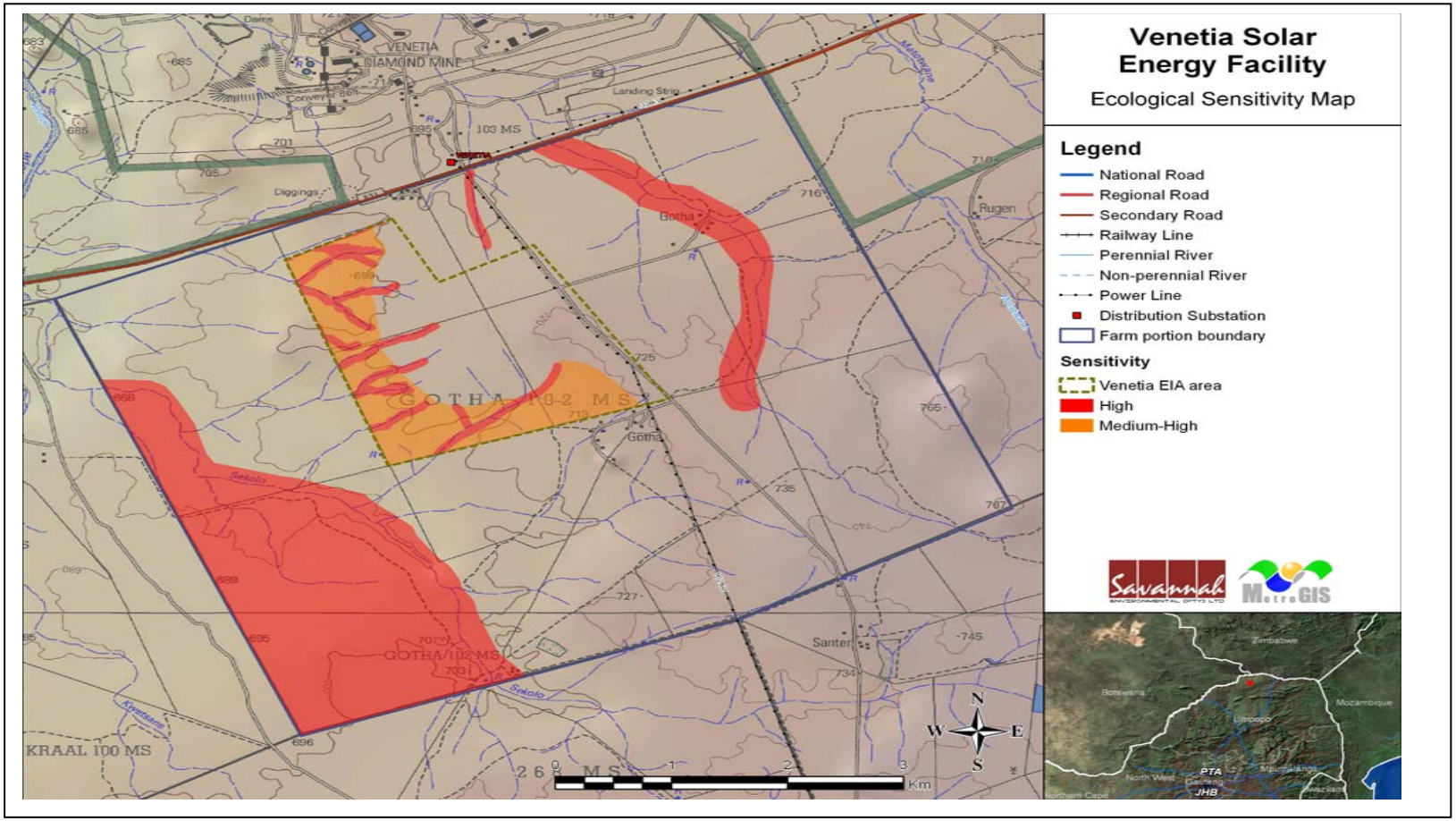

Figure 1.2: Preliminary environmental sensitivity map for the proposed **Alldays PV/CPV Plant Phase 1** indicating ecological sensitivity

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 who 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 Limpopo Department of Economic Development, Environment and Tourism (LDEDET) will act as a commenting authority for the application. An application for authorisation has been accepted by DEA under application reference number 14/12/16/3/3/2/329.

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. BioTherm Energy (Pty) Ltd appointed Savannah Environmental (Pty) Ltd as the independent Environmental Assessment Practitioner (EAP) 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).

Relevant Notice	Activity No	Description of listed activity	Description of relevance
GN544	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 33kV but less than 275kV	***Overhead power line with a capacity of 132kV***.
GN544	11	The construction of: (xi) infrastructure or structures covering 50 square metres or more Where such construction occurs within a watercourse or within 32 metres of a watercourse, measures from the edge of a watercourse, excluding where such construction will occur behind the development setback line.	There may be drainage lines on the development site which could be affected by the proposed development. Infrastructure or structures covering over 50 square metres (PV panels) may be required to be constructed close to watercourses/pans on site.
GN544	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 watercourse	***Small areas of the drainage lines on the development site would be affected by the proposed development***
GN545	1	The construction of facilities or infrastructure, for the generation of electricity where the output is 20 megawatts or more.	***The PV facility would be 75MW in capacity***
GN545	15	Physical alteration of undeveloped, vacant or derelict land for residential, retail, commercial, recreational, industrial or institutional use where the total area to be transformed is 20 hectares or more.	***The development footprint would be in excess of 20ha.***

Relevant Notice	Activity No	Description of listed activity	Description of relevance
GN546	14 (a) (i)	The clearance of an area of 5 hectares or more of vegetation where 75% or more of the vegetative cover constitutes indigenous vegetation	***The site constitutes mainly natural vegetation***

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 November 2012 (i.e. with the acceptance of scoping issued on 06 November 2012) 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) addresses 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 provides stakeholders with an opportunity to verify that issues they have raised through the EIA Process have been captured and adequately considered. The final EIA Report will incorporate 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 to BioTherm Energy (Pty) Ltd as the independent EAP 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 BioTherm Energy (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.

The EAPs from Savannah Environmental who are responsible for this project are:

» **Jo-Anne Thomas** is a registered Professional Natural Scientist and holds a Master of Science degree. She has 14 years' experience consulting in the environmental field. Her key focus is on strategic environmental assessment and advice; management and co-ordination of environmental projects, which includes integration of environmental studies and environmental processes into larger engineering-based projects and ensuring compliance to legislation and guidelines; compliance reporting; the identification of environmental management solutions and mitigation/risk minimising measures; and strategy and guideline development. She is currently involved in undertaking siting processes as well as EIAs for several renewable energy projects across the country.

» **Umeshree Naicker** – The principle author of this report, holds an Honours Bachelor of Science degree in Environmental Science and has 4 years' experience in environmental management.

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

» Ecology: Simon Todd (of Simon Todd Consulting)
» Soil and Agricultural Potential: Iain Paton (of Outeniqua Geotechnical Services Cc)
» Heritage resources: Stephan Gaigher(of G&A Heritage)
» Social: Tony Barbour (of Tony Barbour Consulting)
» Visual: Johan Claassen (of Zone Land Solutions)

Savannah Environmental has developed a detailed understanding of impacts associated with the construction and operation of renewable energy facilities. In order to adequately identify and assess potential environmental impacts, Savannah Environmental has appointed specialist consultants as required. Curricula vitae for

the Savannah Environmental project team and its specialist sub-consultants are included in Appendix A.

DECSRIPTION OF THE PROPOSED PROJECT CHAPTER 2

This chapter provides an overview of the proposed **Alldays PV/CPV Plant Phase 1** on a site located approximately 70km west of Musina in the Limpopo Province. The project scope includes the planning/design, construction, operation and decommissioning phases during which potential impacts will vary in terms of their nature and significance. This chapter also explores the "Do-Nothing" alternative - that is the alternative of not establishing the facility.

2.1. Description of the Proposed Solar Energy Facility

The facility is proposed to accommodate Either photovoltaic (PV) arrays or concentrated photovoltaic (CPV) arrays, to make use of the solar resource on the site. The facility is proposed to have an export capacity of up to 75 MW. Through the EIA process, an area of approximately 175 ha in extent is being investigated within which the facility is proposed to be developed.

The following table details the project components:

Component	Description
Location of the site	~ 70km west of Musina
Municipal Jurisdiction	» Musina Local Municipality » Vhemba District Municipality
Extent of the proposed investigation area	~175 ha
Extent of broader site	450 ha
Site access	Existing access roads from the Bridgewater-Musina gravel road to the south of Venetia mine
Export capacity	Up to 75 MW
Proposed technology	Photovoltaic/ Concentrated Photovoltaic panels
Associated infrastructure	» An on-site generator transformer and a single substation to facilitate the connection between the solar energy facility and the Eskom electricity grid » An overhead power line (132kV) » Internal access roads (<6m wide)) » Workshop area for maintenance, storage, and offices

Component	Description
Water use	» Construction quantity up to 5500m^3 » No effluent will be produced except for the normal sewage from site and operations staff, this will be collected in either conservancy tanks or portable toilets and will be removed from site on a regular basis.
PV Technology	» PV or CPV
Panel Spec	» Up to 350kW DC
Maximum Panel Dimensions	» 2000x1000x50
Number of Panels	» Up to 400 000 panels for PV » Up to 26,250 panels for CPV
Number of inverters	» Up to 150
Distribution Transformers	» Up to 100
Main Transformer capacity	» Up to 100 MW
Final Height of installed panels from ground level	PV – approx. 3m » PVC – approx. 20m
Height of inverters	» Up to 4 meters
Height of Transformers	» Up to 4 meters
Height of Buildings	» Up to 10 meters
Height of Fencing	» Up to 4 meters

A preliminary layout of the proposed facility 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 and was produced by the developer in response to the results of the specialist studies undertaken for the project, with the intention of minimising the impact of the development.

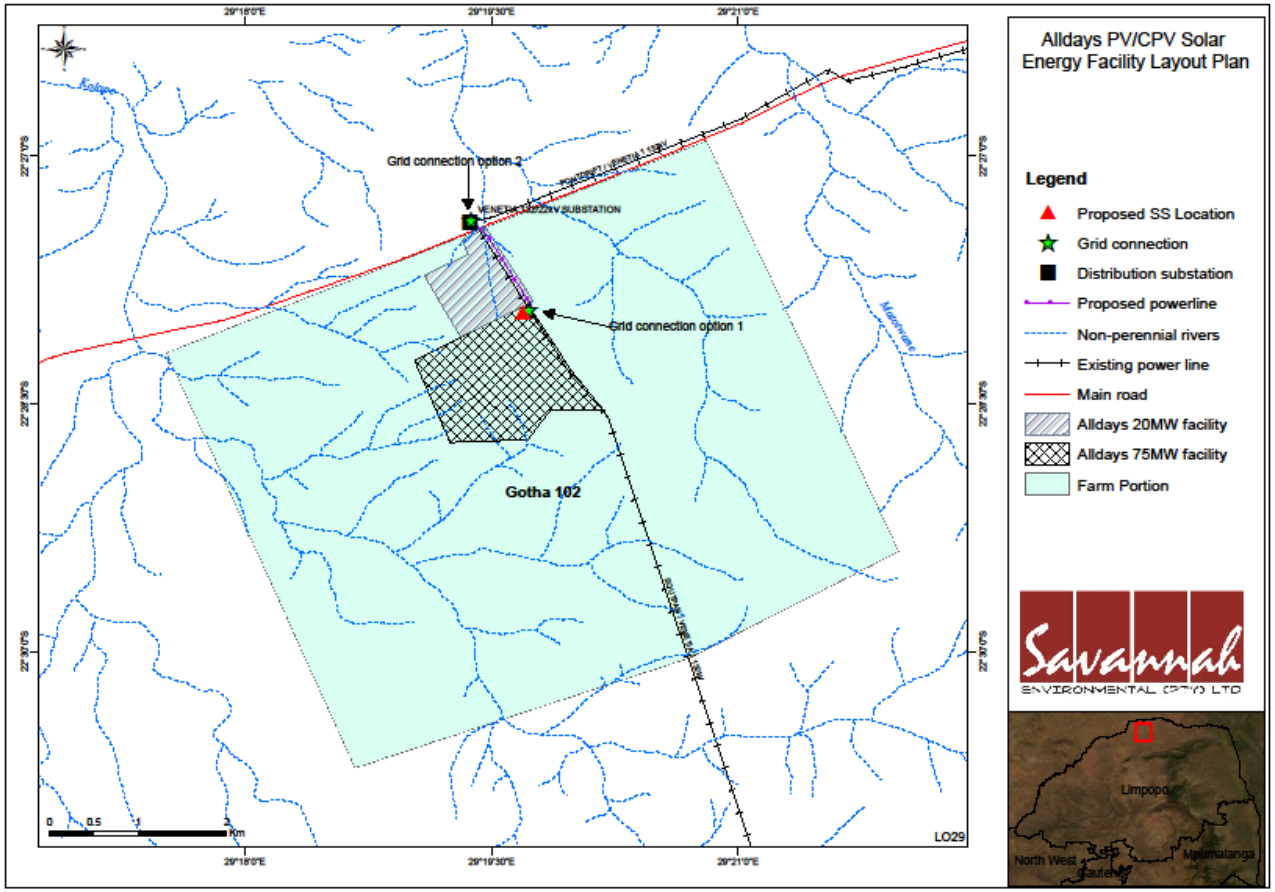

Figure 2.1: Preliminary layout for the proposed **Alldays PV/CPV Plant Phase 1**

2.2. Purpose of the Proposed Project

The **Alldays PV/CPV Plant Phase 1 facility** is proposed to be developed as a commercial energy facility. The purpose of the proposed facility is to add new capacity for the 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 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.

In responding to the growing electricity demand within South Africa, as well as the country's targets for renewable energy, BioTherm Energy (Pty) Ltd is proposing the establishment of the Alldays Solar Energy Facility to add new capacity to the national electricity grid. BioTherm Energy (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 years) in order to build and operate the proposed facility. As part of the agreement, the BioTherm Energy (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 Alldays 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.

2.3. 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?

2.3.1 Photovoltaic (PV) Technology

Solar energy facilities, such as those using PV panels use the energy from the sun to generate electricity through a process known as the **Photovoltaic Effect** (see Figure 2.2). This effect refers to photons of light colliding with electrons, and therefore placing the electrons into a higher state of energy to create electricity. The Solar PV facility will comprise of the following components:

The **Photovoltaic Cell**
Individual PV cells are linked and placed behind a protective glass sheet to form a photovoltaic panel. Other technologies that can be used include thin film.

The **Inverter**
The photovoltaic effect produces electricity in direct current. Therefore an inverter must be used to change it to alternating current.

The **Support Structure**
The tracking photovoltaic (PV) panels will be attached to a **support structure approximately 2 meters off the ground** set at an angle so to receive the maximum amount of solar radiation. The angle of the panel is dependent on the latitude of the proposed facility and the angles may be adjusted to optimise for summer or winter solar radiation characteristics. The PV panels are designed to operate continuously for more than 20 years, unattended and with low maintenance.

Figure 2.2: Illustration of a photovoltaic solar facility

2.3.2. Concentrated Photovoltaic (CPV) Technology

Concentrated photovoltaic (CPV) technology uses optics such as lenses to concentrate a large amount of sunlight onto a small area of solar photovoltaic materials to generate electricity. Unlike traditional, more conventional flat panel systems, CPV systems are more expensive to produce but provide better efficiency.

The **Concentrated Photovoltaic Cell**
The light energy from the sun is concentrated through lenses onto the individual CPV cells. This serves to increase the efficiency of the CPV panels (i.e. up to 39% efficiency), as compared to conventional PV technology (i.e. 8 % – 18% efficiency) (refer to Figure 2.3).

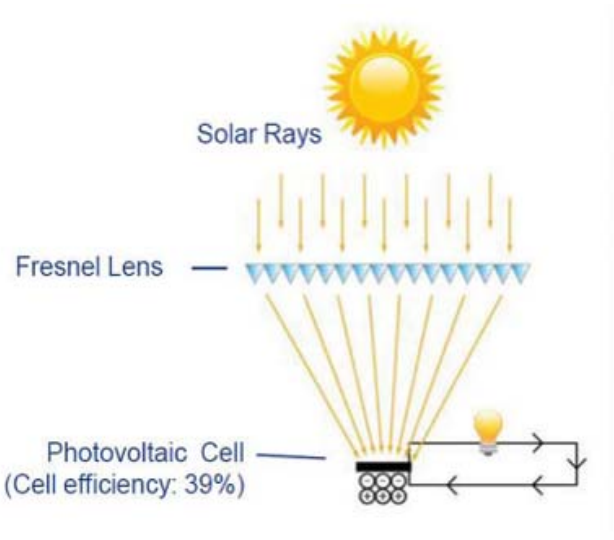

Figure 2.3: The efficiency of the CPV panels is increased through the use of Fresnel Lenses which concentrates the amount of light entering the CPV cells (Source: AmonixTM)

The **Inverter**

An inverter is used to convert the electricity which is produced as direct current into alternating current for the purpose of grid connection. In order to connect a large solar facility to the national grid, numerous inverters will be arranged in several arrays to collect, and convert the produced power.

The **Support Structure**

The CPV Modules will be elevated up to 2m above ground level by a support structure and have a total height of up to 20m. The modules will be able to track the path of the sun during the day, thereby increasing the efficiency of the panels (refer to Figure 2.4).

Figure 2.4: The support structures elevate the panels and allow for dual axis tracking of the sun for increased efficiency (Source: AmonixTM)

Each panel will be approximately 22m wide and 12.5m high. As such when the tracking panel is vertical the structure will be at a maximum height of approximately 20m.

2.4. Project Alternatives

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

The following characteristics were considered in determining the feasibility of the proposed site. Based on these considerations, BioTherm Energy (Pty) Ltd considers the proposed site as their highly preferred site for the development of the **Alldays PV/CPV Plant Phase 1**.

Site extent: Space is a restraining factor in the case of the technology proposed for the present project, for example a PV installation requires an area of up to 2 ha per MW, with CPV requiring a larger area. Therefore an area of approximately 175 ha would be required for a PV facility of up to 75MW. The proposed site, which is approximately 450ha in extent, will therefore be sufficient for the installation of the

proposed facility and will allow space for the avoidance of any identified environmental constraints within the final design of the facility.

Site access: The site can be accessed easily via existing access roads from the Bridgewater-Musina gravel road to the south of Venetia mine. Entrance to the site is opposite the Venetia Mine.

Climatic conditions: The economic viability of a photovoltaic plant is directly dependent on the annual direct solar irradiation levels. A study of available irradiation data shows that the proposed site is uniformly irradiated by the sun. In addition, compared to other areas in the country with similar irradiation, the site experiences moderate temperatures which are suitable for PV/CPV technology.

Site slope and aspect: A level surface area (i.e. with a minimal gradient in the region of 1%) is preferred for the installation of PV/CPV panels and specifically for PV/CPV technologies (Fluri, 2009). This reduces the need for extensive earthworks associated with the levelling of a site, thereby minimising environmental impacts. The proposed area for the proposed PV/CPV plant is located on flat terrain with undulating hills.

2.4.1 Electricity Evacuation Alternatives

Energy generated by the **Alldays PV/CPV Plant Phase 1 facility** will be evacuated to the national grid via a new substation (which will be constructed on the site), to connect directly to the existing power line, which runs along the north eastern boundary of the site, or to the Venetia Substation, located to the north of the site. As the detailed site surveys are concluded within the EIA Phase it may arise that there are other environmentally and technically feasible positions for the substation which are not identified at this stage.

2.4.2 Substation

A new on-site substation to connect via a loop in loop out to the Soutpan/Venetia 1 132 kV power line to evacuate the power from the facility into the Eskom grid. The alternative would be to construct a 132kV connection line (up to 2 km), parallel to existing power line to the Venetia substation.

2.4.3 The 'do-nothing' Alternative

The 'do-nothing' alternative is the option of not constructing the proposed **Alldays PV/CPV Plant Phase 1 facility**.

2.5. Proposed Activities during the Project Development Stages

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

2.5.1. Construction Phase

The construction of the facility will not be phased, the full 75 MW would be installed in one phase. The construction phase is expected to extend over a period of 15 months and create approximately ~300 employment opportunities at peak construction. It is anticipated that approximately ~125 of the employment opportunities will be available to low skilled (construction labourers, security staff etc.), ~150 semi-skilled workers (drivers, equipment operators etc.) and ~25 to skilled personnel (engineers, land surveyors, project managers etc.). The majority of the employment opportunities, specifically the low and semi-skilled opportunities, are likely to be available to local residents in the area, specifically residents from the town of Alldays. The majority of the beneficiaries are likely to be historically disadvantaged (HD) members of the community. This would represent a significant positive social benefit in an area with limited employment opportunities. However, the low education and skills levels in the area will hamper potential opportunities for local communities.

The construction phase will entail a series of activities including:

Conduct Surveys

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

Establishment of Access Roads

The site can be accessed easily via existing access roads from the Bridgewater-Musina gravel road to the south of Venetia mine. Entrance to the site is opposite the Venetia Mine from this road. Within the site itself, access will be required from this existing provincial road to the individual facility components for construction

purposes (and later limited access for maintenance). Access track construction would normally comprise of compacted rock-fill with a layer of higher quality surfacing stone on top.

Undertake Site Preparation

Site preparation activities will include clearance of vegetation at the footprint of each support structure. These activities will require the stripping of topsoil which will need to be stockpiled, backfilled and/or spread on site. If the terrain is undulating, then the ground may have to be levelled to one slope, if the land is not flat enough. Rocks may also be removed as well as trees that may be obstacles.

Transport of Components and Construction Equipment to Site

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

Establishment of Construction Equipment Camps

Once the required equipment has been transported to site, a dedicated construction equipment camp will need to be established. The purpose of this camp is to confine activities and storage of equipment to one designated area to limit the potential ecological impacts associated with this phase of the project. The laydown area(s) will be used for assembly purposes and the general placement/storage of construction equipment. The storage of fuel for the on-site construction vehicles and equipment will need to be secured in a temporary bunded facility so to prevent the possibility of leakages and soil contamination.

Establishment of the CPV/PV Panels

The PV panels will be mounted via steel structures which will be attached to uprights which are stabilised by concrete foundations where necessary. The foundation holes will be mechanically excavated to a depth of approximately 100 - 150 cm for PV and up to 500cm for CPV. The concrete foundations where necessary will be poured and then be left for up to a week to cure. Aggregate and cement to be transported from the closest centre to the development. The

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

installation of the underground cables will require the excavation of trenches of approximately 40 cm – 100 cm deep within which they can then be laid.

Establishment of Ancillary Infrastructure

Ancillary infrastructure for the proposed development includes:

- Internal access roads and fencing.
- Workshop area for maintenance, storage, and offices

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. A laydown area for building materials and equipment associated with these buildings will also be required.

Construct on-site substation

An on-site substation of approximately 80 m x 90 m will be required to be established on the site. The construction of the substation would include the construction of the foundations, erection and installation of equipment (including the transformer) and connection of the necessary conductors.

Undertake Site Rehabilitation

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

2.5.2. Operational Phase

A new on-site substation to connect via a loop in loop out to the Soutpan/Venetia 1 132 kV power line to evacuate the power from the facility into the Eskom grid. The alternative would be to construct a 132kV connection line (up to 2 km), parallel to existing power line to the Venetia substation.

The proposed operational phase is expected to run for a period of approximately 20 years with plant maintenance. It is anticipated that during this time a full time security, maintenance, supervision and monitoring teams will be required on site. Maintenance activities will include *inter alia*, replacement and cleaning of the panels (using pressurised air). The photovoltaic plant will be operational during daylight hours only. However, it will not be operational under circumstances of mechanical breakdown, extreme weather conditions or maintenance activities. No energy

storage mechanisms (i.e. batteries) which would allow for continued generation at night or on cloudy days are proposed.

2.5.3. Decommissioning Phase

Depending on the economics of the development following the operational period, the plant will either be decommissioned or the operational phase will be extended. If it is deemed financially viable to continue, existing components would be dissembled and replaced with more appropriate technology/infrastructure available at that time. However, if the decision is made to decommission the facility the following activities will form part of the project scope.

Site Preparation

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

Disassemble and Remove Existing Components

The components of the plant will be disassembled and removed. Thereafter they will be reused and recycled (where possible) or disposed of in accordance with regulatory requirements.

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 solar energy facility.

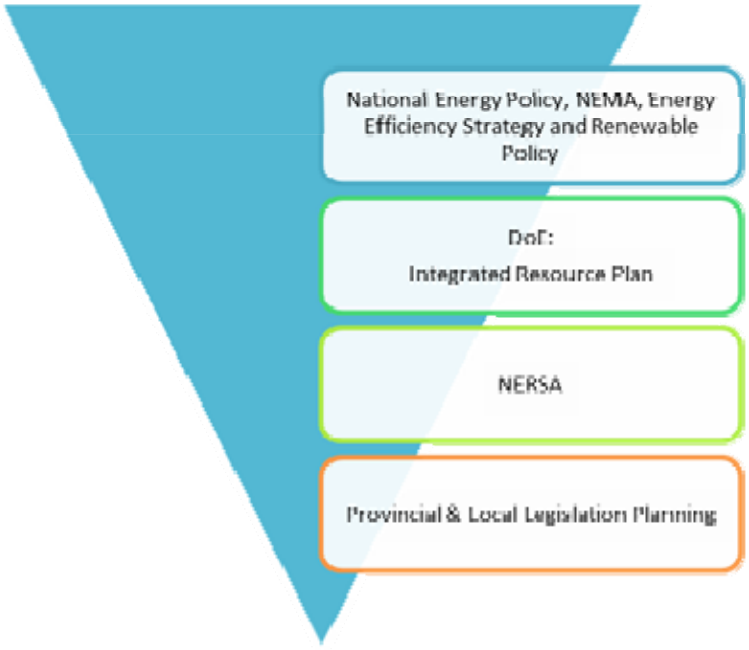

Figure 3.1: Hierarchy of electricity policy and planning documents

3.1.1 White Paper on the Energy Policy of South Africa, 1998

Development within the South African energy sector is governed by the White Paper on a National Energy Policy (DME, 1998). The White Paper identifies key objectives for energy supply, such as increasing access to affordable energy services, managing energy-related environmental impacts and securing energy supply through diversity.

As such, investment in renewable energy initiatives is supported, based on an understanding that renewable energy sources have significant medium - long-term commercial potential and can increasingly contribute towards a long-term sustainable energy future.

3.1.2 Renewable Energy Policy in South Africa, 1998

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

Investment in renewable energy initiatives, such as the proposed solar energy facility, is supported by the National Energy Policy (DME, 1998). This policy recognises that renewable energy applications have specific characteristics which need to be considered. The Energy Policy is "*based on the understanding that renewables are energy sources in their own right, and are not limited to small-scale and remote applications, and have significant medium- and long-term commercial potential*." In addition, the National Energy Policy states that "*Renewable resources generally operate from an unlimited resource base and, as such, can increasingly contribute towards a long-term sustainable energy future*".

The White Paper on Renewable Energy (DME, 2003) supplements the Energy Policy, and sets out Government's vision, policy principles, strategic goals and objectives for promoting and implementing renewable energy in South Africa. It also informs the public and the international community of the Government's vision, and how the Government intends to achieve these objectives; and informs Government agencies and organs of their roles in achieving the objectives.

The support for the Renewable Energy Policy is guided by a rationale that South Africa has a very attractive range of renewable resources, particularly solar and wind, and that renewable applications are, in fact, the least cost energy service in many cases from a fuel resource perspective (i.e. the cost of fuel in generating electricity from such technology); more so when social and environmental costs are taken into account. In spite of this range of resources, the National Energy Policy acknowledges that the development and implementation of renewable energy applications has been neglected in South Africa.

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

» Ensuring that economically feasible technologies and applications are implemented;

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

In order to meet the long-term goal of a sustainable renewable energy industry, the South African Government has set the following 10-year target for renewable energy: "*10 000 GWh (0.8 Mtoe) renewable energy contribution to final energy consumption by 2013 to be produced mainly from biomass, wind, solar and small-scale hydro. The renewable energy is to be utilised for power generation and non-electric technologies such as solar water heating and bio-fuels. This is approximately 4% (1 667 MW) of the estimated electricity demand (41 539 MW) by 2013"* (DME, 2003).

The White Paper on Renewable Energy states "*It is imperative for South Africa to supplement its existing energy supply with renewable energies to combat Global Climate Change which is having profound impacts on our planet*."

3.1.3 Final Integrated Resource Plan, 2010 - 2030

The Energy Act of 2008 obligates the Minister of Energy to develop and publish an integrated resource plan for energy. Therefore, the Department of Energy (DoE), together with the National Energy Regulator of South Africa (NERSA) has compiled the Integrated Resource Plan (IRP) for the period 2010 to 2030. The objective of the IRP is to develop a sustainable electricity investment strategy for generation capacity and transmission infrastructure for South Africa over the next twenty years. The IRP is intended to:

» Improve the long term reliability of electricity supply through meeting adequacy criteria over and above keeping pace with economic growth and development;
» Ascertain South Africa's capacity investment needs for the medium term business planning environment;
» Consider environmental and other externality impacts and the effect of renewable energy technologies; and
» Provide the framework for Ministerial determination of new generation capacity (inclusive of the required feasibility studies).

The objective of the IRP is to evaluate the security of supply, and determine the least-cost supply option by considering various demand side management and supply-side options. The IRP also aims to provide information on the opportunities for investment into new power generating projects.

The outcome of the process confirmed that coal-fired options are still required over the next 20 years and that additional base load plants will be required from 2010. The first and interim IRP was developed in 2009 by the Department of Energy. The initial four years of this plan was promulgated by the Minister of Energy on 31 December 2009, and updated on 29 January 2010. The Department of Energy released the Final IRP in March 2011, which was accepted by Parliament at the end of March. This Policy-Adjusted IRP is recommended for adoption by Cabinet and subsequent promulgation as the final IRP. 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 (including 8,4GW solar); and 8.9 GW of other generation sources.

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 published a request for qualification and proposals for new generation capacity under the IPP procurement programme, and is in the process of updating and developing its process in relation to the awarding of electricity generation licences.

3.2 District and Local Level Planning and Spatial Policy Context

3.2.1 Musina Local Municipality Spatial Development Framework (2011)

The 2011 MLM Spatial Development Framework (SDF) was compiled by BC Gildenhuys and Associates. It is understood that the SDF has been approved by Council in terms of the Municipal Systems Act (2000). Spatial Development Plans contained in the SDF essentially deal with urban areas (Musina town) only. No Spatial Development Categories (SPCs) are provided for the MLM rural area/ Alldays PV/CPV site and study area, and no specific spatial development proposals are made for the study area. The SDF does however provide a broad spatial development framework for the MLM, of which the following aspects are of relevance to the proposed development:

According to the SDF, key aspects of the MLM spatial development context include the following:

» The MLM is dominated by the single urban node of Musina which practically provides access to all available amenities and facilities;

- Land use activities in the rural area are mainly comprised of agriculture, mining, conservation and tourism;
- Agriculture remains the backbone of employment provision in the MLM. The largely extensive agriculture practices are dispersed throughout the municipal area. This, combined with low population densities, makes it very difficult to focus development in specific nodes or to provide general access to opportunities, amenities and resources. Poverty, a lack of access to transport and long distances compounds this problem;
- While the mining sector contributes to general economic activity and job creation, the sector is also responsible for stimulating undesirable in-migration and urbanization in the MLM;
- Tourism forms an important component of the broader development framework, an includes wildlife/ conservation tourism, passing trade associated with the Beitbridge and Pont Drift border posts, and game farming and hunting. Game farming and hunting is also associated with other extensive agricultural practices and are not localised but distributed through the whole municipal area. The SDF notes that the sector could fulfil an import job creation role, and also contribute towards economic stability in the MLM;
- Given the important links with the tourism sector, conservation is identified as one of the highest development priorities for the MLM;
- Various cross border issues influence development and planning in the municipality. The link with Zimbabwe has become one of the busiest roads in Africa. The links and impact is not always through legal and formalised interaction but the impact of black market importers from Zimbabwe and refugees and other people looking for employment in the area;
- Access to water is one of the biggest obstacles to development in the municipality.

3.2.1 Musina Local Municipality Integrated Development Plan 2012-2017

The MLM 5-year Integrated Development Plan (IDP) 2012-2017 is currently in its first year (2012/2013). Key aspects of relevance to the proposed facility are discussed below.

The IDP notes that the MLM has a dualistic economy, with the commercial and services sectors concentrated in the town of Musina, and the remainder of the MLM essentially functioning as agricultural hinterland, or for accommodating other primary sector activities such as mining. The IDP further notes that infrastructure and facilities are mainly concentrated in and around Musina and the eastern part of the MLM, resulting in a spatial imbalance. This imbalance would need to be addressed in order to make optimal use of the significant tourism development potential in the western MLM, mainly associated with the Mapungubwe National

Park/ UNESCO World Heritage Site and the proposed Limpopo-Shashe Transfrontier Park.

In alignment with the National Spatial Development Perspective (2005), the IDP envisages that the bulk of infrastructure investment in the MLM should be focused/prioritised in Musina town as the growth point, while the provision of basic services should be the focus in rural settlement clusters and lower-order service centres.

Key development issues and constraints

A number of socio-economic development challenges are identified for the MLM, including:

» The MLM's natural resource base and economy do not have the capacity to absorb the total MLM workforce population, forcing a large percentage of the labour force to seek employment outside of the MLM, or opportunities within the local informal sector;
» Low income levels and poverty are pervasive, affecting the bulk of the MLM population. Low income levels have a negative knock-on effect on the local economy in terms of low spending power, which in turn negatively effects local business development, and ultimately the MLM's ability to retain what spending power it does have;
» Land claims are a major factor influencing development. Approximately 36% of the MLM area is currently subject to land claims;
» The economic relationship between the settlements in the municipality and Musina CBD are not yet strong;
» There is a shortage of job opportunities and job creation in the area. It is essential that job opportunities are spread to also include people from the settlements in the rural eastern parts of the municipality;
» Established businesses and farmers still prefer to employ immigrants at lower wages;
» SMMEs need financial assistance to expand their businesses and to promote/advertise their products;
» There is a lack of finance to pursue farming projects.

Key opportunities are identified as the MLM's large, relatively young workforce, and its comparative advantages in the agriculture, mining, manufacturing and transport sectors, compared to the Vhembe District Municipality (VDM). The MLM development strategy should therefore focus on capitalising on identified advantages to further strengthen its position in the District.

The agricultural sector of MLM contributes to approximately half of the employment created in the VDM sector. This high degree of concentration of employment in a

single sector is noted as a cause for concern, as the MLM does not have any other source of income to cushion the impacts of any negative changes that could occur in the agricultural sector, therefore creating a strong need to diversify employment. The IDP therefore indicates that the MLM should focus on a dual strategy of retaining existing opportunities, and on labour creation in other sectors to decrease the MLM's reliance on the sector. With regard to the important mining sector (~27% of MLM GDP), the IDP notes inconsistent electricity provision as the key development constraint.

Development priorities and objectives

Economic cluster strategies and objectives aimed at employment creation and poverty alleviation focus on development of the key tourism and mining sectors, micro-enterprise development (SSMEs), multi-sector skills development, and the growth of a green economy. With regards to the growth of a green economy, a number of intervention areas are identified, including promoting the use of renewable energy. Solar energy is not specifically mentioned (MLM, 2012 – Table 39). With regard to rural economic development, focus is on land reform and agricultural support, including to small-scale and subsistence farmers.

Social cluster strategies and objectives focus on the provision of social services, including with regard to HIV/ Aids (mainly with regard to the provision of care facilities), education and multi-sector skills development, and plans to support vulnerable groups such as women, the youth and senior citizens.

Annexure 1 of the IDP indicates that the MLM has a Tourism Strategy and an Integrated HIV/ Aids Plan and HIV/ Aids Council in place, but that an SMME Strategy still needs to be compiled. The MLM HIV/Aids strategy is aligned with the Limpopo Provincial and National strategies, and addresses amongst others, the following aspects:

» Social mobilization and communication with the community;
» Prevention services rendered by all relevant departments;
» Care and support services for people living with HIV/AIDS including awareness programme for living positive programmes;
» Involvement of all stakeholders in integration and implementation of various programmes;
» Sourcing of external funding;
» Promotions of partnerships and referral networks

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).
» *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.
» *National Department of Agriculture, Forestry, and Fisheries (DAFF):* This department is responsible for activities pertaining to subdivision and rezoning of agricultural land. The forestry section is responsible for the protection of tree species under the National Forests Act (Act No 84 of 1998).
» *South African National Roads Agency (SANRAL):* This department is responsible for all national routes.
» *Department of Water Affairs:* This department is responsible for water use licensing and permits.
»

At the Provincial Level, the main regulatory agencies are:

» *Limpopo Department of Economic Development, Environment and Tourism*: This department is the commenting authority for this project.

» *Department of Transport and Public Works:* This department is responsible for roads and the granting of exemption permits for the conveyance of abnormal loads on public roads.
» *Provincial Department of Water Affairs:* This department is responsible for water use licensing and permits.
» *Provincial Department of Agriculture, Forestry and Fisheries* – This department is responsible for activities pertaining to subdivision and rezoning of agricultural land. The forestry section is responsible for the protection of tree species under the National Forests Act (Act No 84 of 1998).
» Limpopo Heritage Resources Authority (LIHRA) – LIHRA is responsible for the identification, conservation and management of heritage resources throughout the province.

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

3.3.2 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 EIA Report:

» National Environmental Management Act (Act No 107 of 1998).
» EIA Regulations, published under Chapter 5 of the NEMA (GNR543, GNR544, GNR545, and GNR546 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 addressed and assessed in the EIA Report. A review of legislative requirements applicable to the proposed project is provided in the **Table 3.1.**

Table 3.1: Relevant legislative permitting requirements applicable to the proposed solar energy facility

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
National Legislation			
National Environmental Management Act (Act No 107 of 1998)	The EIA Regulations have been promulgated in terms of Chapter 5 of the Act. Listed activities which may not commence without an environmental authorisation are identified within these Regulations. In terms of S24(1) of NEMA, the potential impact on the environment associated with these listed activities must be assessed and reported on to the competent authority charged by NEMA with granting of the relevant environmental authorisation. In terms of GNR 544 - 546 of June 2010 a Scoping and EIA Process is required to be undertaken for the proposed project.	Department of Environmental Affairs – competent authority Limpopo Department of Economic Development, Environment and Tourism - commenting authority	The listed activities triggered by the proposed solar energy facility have been identified and assessed in the EIA process being undertaken (i.e. Scoping and EIA). This EIA Report will be submitted to the competent and commenting authority in support of the application for authorisation.
National Environmental Management Act (Act No 107 of 1998)	In terms of the Duty of Care Provision in S28(1) the project proponent must ensure that reasonable measures are taken throughout the life cycle of this project to ensure that any pollution or degradation of the environment associated with this project is avoided, stopped or minimised. In terms of NEMA, it has become the legal duty of a project proponent to consider a project holistically, and to consider the cumulative effect of a variety of impacts.	Department of Environmental Affairs	While no permitting or licensing requirements arise directly by virtue of the proposed project, this section has found application during the EIA Phase through the consideration of potential impacts (cumulative, direct, and indirect). It will continue to apply throughout the life

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
			cycle of the project.
Environment Conservation Act (Act No 73 of 1989)	National Noise Control Regulations (GN R154 dated 10 January 1992)	Department of Environmental Affairs Limpopo Department of Economic Development, Environment and Tourism - 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. On-site activities should be limited to 6:00am - 6:00pm, Monday – Saturday (excluding public holidays). Should activities need to be undertaken outside of these times, the surrounding communities will need to be notified and appropriate approval will be obtained from DEA and the Local Municipality.
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	Department of Water Affairs Provincial Department of Water	A water use license (WUL) is required to be obtained if drainage lines are impacts

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
	authorisation.	Affairs	on. Should water be abstracted from the borehole on site for use within the facility, a water use license may be required.
National Water Act (Act No 36 of 1998)	In terms of S19, the project proponent must ensure that reasonable measures are taken throughout the life cycle of this project to prevent and remedy the effects of pollution to water resources from occurring, continuing, or recurring.	Department of Water Affairs Provincial Department of Water Affairs	This section of the Act will apply with respect to the potential impact on drainage lines, primarily during the construction phase (i.e. pollution from construction vehicles).
Minerals and Petroleum Resources Development Act (Act No 28 of 2002)	A mining permit or mining right may be required where a mineral in question is to be mined (e.g. materials from a borrow pit) in accordance with the provisions of the Act. Requirements for Environmental Management Programmes and Environmental Management Plans are set out in S39 of the Act.	Department of Mineral Resources	As no borrow pits are expected to be required for the construction of the facility, no mining permit or right is required to be obtained.
Minerals and Petroleum Resources Development Act (Act No 28 of 2002)	In terms of subsection (2) of Section 53(1) of the Mineral and Petroleum Resources Development Act (MPRDA), 2002 (Act 28 of 2002) any person who intends to use the surface of any land in any way which may be contrary to any object of the Act or which is likely to impede any such object must apply to the Minister for approval.	Department of Mineral Resources	The developer must apply to the Minister for approval to use the surface of the property for the proposed development.

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
National Environmental Management: Air Quality Act (Act No 39 of 2004)	S18, S19, and S20 of the Act allow certain areas to be declared and managed as "priority areas." Declaration of controlled emitters (Part 3 of Act) and controlled fuels (Part 4 of Act) with relevant emission standards.	Department of Environmental Affairs Provincial/local air emissions licensing authority	No permitting or licensing requirements arise from this legislation. The Act provides that an air quality officer may require any person to submit an atmospheric impact report if there is reasonable suspicion that the person has failed to comply with the Act.
National Heritage Resources Act (Act No 25 of 1999)	S38 states that Heritage Impact Assessments (HIAs) are required for certain kinds of development including: » The construction of a road, power line, pipeline, canal or other similar linear development or barrier exceeding 300 m in length; and » Any development or other activity which will change the character of a site exceeding 5 000 m^2 in extent. Stand alone HIAs are not required where an EIA Process is carried out as long as the EIA contains an adequate HIA component that fulfils the provisions of S38. In such cases only those components not addressed by the EIA should be covered by the heritage component.	South African Heritage Resources Agency Limpopo Heritage Authority (LIHRA)	A permit may be required should identified cultural/heritage sites on site be required to be disturbed or destroyed as a result of the proposed development. A HIA has been undertaken as part of the EIA Process to identify heritage sites. See Appendix I.
National Environmental	In terms of S57, the Minister of Environmental Affairs	Department of Environmental	As the applicant will not

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
Management: Biodiversity Act (Act No 10 of 2004)	has published a list of critically endangered, endangered, vulnerable, and protected species in GNR 151 in Government Gazette 29657 of 23 February 2007 and the regulations associated therewith in GNR 152 in GG29657 of 23 February 2007, which came into effect on 1 June 2007. In terms of GNR 152 of 23 February 2007: Regulations relating to listed threatened and protected species, the relevant specialists must be employed during the EIA Phase of the project to incorporate the legal provisions as well as the regulations associated with listed threatened and protected species (GNR 152) into specialist reports in order to identify permitting requirements at an early stage of the EIA Phase. The Act provides for listing threatened or protected ecosystems, in one of four categories: critically endangered (CR), endangered (EN), vulnerable (VU) or protected. The first national list of threatened terrestrial ecosystems has been gazetted, together with supporting information on the listing process including the purpose and rationale for listing ecosystems, the criteria used to identify listed ecosystems, the implications of listing ecosystems, and summary statistics and national maps of listed ecosystems (National Environmental Management: Biodiversity Act: National list of ecosystems that are threatened and in need of protection, (G 34809, GoN	Affairs	carry out any restricted activity, as is defined in S1 of the Act, no permit is required to be obtained in this regard. Specialist flora and fauna studies have been undertaken as part of the EIA Phase. As such the potentially occurrence of critically endangered, endangered, vulnerable, and protected species and the potential for them to be affected has been considered, this report is contained in Appendix F

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
	1002), 9 December 2011).		
Conservation of Agricultural Resources Act (Act No 43 of 1983)	» Provides for the regulation of control over the utilisation of the natural agricultural resources in order to promote the conservation of soil, water and vegetation and provides for combating weeds and invader plant species Regulation 15 of GNR1048 provides for the declaration of weeds and invader plants, and these are set out in Table 3 of GNR1048. Weeds are described as Category 1 plants, while invader plants are described as Category 2 and Category 3 plants. These regulations provide that Category 1, 2 and 3 plants must not occur on land and that such plants must be controlled by the methods set out in Regulation 15E.	Department of Agriculture	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. The permission of agricultural authorities will be required if the Project requires the draining of vleis, marshes or water sponges on land outside urban areas.
National Forests Act (Act No. 84 of 1998)	In terms of S5 (1) no person may cut, disturb, damage or destroy any protected tree or possess, collect, remove, transport, export, purchase, sell donate or in any other manner acquire or dispose of any protected tree or any forest product derived from a protected tree, except under a license granted by the Minister to an (applicant and subject to such period and conditions as may be stipulated". GN 1042 provides a list of protected tree species.	National Department of Forestry	There are a few protected trees (Baobab & Marula) on the proposed development site.

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
National Veld and Forest Fire Act (Act 101 of 1998)	In terms of S21 the applicant would be obliged to burn firebreaks to ensure that should a veldfire occur on the property, that it does not spread to adjoining land. In terms of S12 the applicant must ensure that the firebreak is wide and long enough to have a reasonable chance of preventing the fire from spreading, not causing erosion, and is reasonably free of inflammable material. In terms of S17, the applicant must have such equipment, protective clothing, and trained personnel for extinguishing fires.	Department of Agriculture, Forestry and Fisheries (DAFF)	Permitting or licensing requirements arise from this legislation, and this Act will find application during the construction and operational phase of the project.
Hazardous Substances Act (Act No 15 of 1973)	This Act regulates the control of substances that may cause injury, or ill health, or death due to their toxic, corrosive, irritant, strongly sensitising or inflammable nature or the generation of pressure thereby in certain instances and for the control of certain electronic products. To provide for the rating of such substances or products in relation to the degree of danger; to provide for the prohibition and control of the importation, manufacture, sale, use, operation, modification, disposal or dumping of such substances and products. 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	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
	risk of injury etc., can be declared as Group I or Group II substance Group IV: any electronic product; and Group V: any radioactive material. The use, conveyance, or storage of any hazardous substance (such as distillate fuel) is prohibited without an appropriate license being in force.		
Development Facilitation Act (Act No 67 of 1995)	Provides for the overall framework and administrative structures for planning throughout the Republic. S (2 - 4) provide general principles for land development and conflict resolution.	Local Municipality District Municipality	The applicant must submit a land development application in the prescribed manner and form as provided for in the Act. A land development applicant who wishes to establish a land development area must comply with procedures set out in the Act.
Subdivision of Agricultural Land Act (Act No 70 of 1970)	Details land subdivision requirements and procedures. Applies for subdivision of all agricultural land in the province	Department of Agriculture	Subdivision 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 –	National Department of Water and Environmental Affairs Provincial 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

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
	» Adding other waste management activities to the list. » Removing waste management activities from the list. » Making other changes to the particulars on the list. In terms of the Regulations published in terms of this Act (GN 718), A Basic Assessment or Environmental Impact Assessment is required to be undertaken for identified listed activities. Any person who stores waste must at least take steps, unless otherwise provided by this Act, to ensure that: » The containers in which any waste is stored, are intact and not corroded or in » any other way rendered unlit for the safe storage of waste. » Adequate measures are taken to prevent accidental spillage or leaking. » The waste cannot be blown away. » Nuisances such as odour, visual impacts and breeding of vectors do not arise; and » Pollution of the environment and harm to health are prevented.		disposal during construction and operation is required to be undertaken in accordance with the requirements of the Act, as detailed in the EMP (refer to Appendix K). The volumes of waste to be generated and stored on the site during construction and operation of the facility will not require a waste license (provided these remain below the prescribed thresholds).
National Road Traffic Act (Act No 93 of 1996)	» The technical recommendations for highways (TRH 11): "Draft Guidelines for Granting of Exemption Permits for the Conveyance of Abnormal Loads and for other Events on Public Roads" outline the rules	» South African National Roads Agency Limited (national roads) » Provincial Department of	An abnormal load/vehicle permit may be required to transport the various components to site for

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
	and conditions which apply to the transport of abnormal loads and vehicles on public roads and the detailed procedures to be followed in applying for exemption permits are described and discussed. » Legal axle load limits and the restrictions imposed on abnormally heavy loads are discussed in relation to the damaging effect on road pavements, bridges, and culverts. » The general conditions, limitations, and escort requirements for abnormally dimensioned loads and vehicles are also discussed and reference is made to speed restrictions, power/mass ratio, mass distribution, and general operating conditions for abnormal loads and vehicles. Provision is also made for the granting of permits for all other exemptions from the requirements of the National Road Traffic Act and the relevant Regulations.	Transport	construction. These include route clearances and permits will be required for vehicles carrying abnormally heavy or abnormally dimensioned loads. Transport vehicles exceeding the dimensional limitations (length) of 22m. Depending on the trailer configuration and height when loaded, some of the power station components may not meet specified dimensional limitations (height and width).
Promotion of Access to Information Act (Act No 2 of 2000)	All requests for access to information held by state or private body are provided for in the Act under S11.	Department of Environmental Affairs	No permitting or licensing requirements.
Promotion of Administrative Justice Act (Act No 3 of 2000)	In terms of S3 the government is required to act lawfully and take procedurally fair, reasonable, and rational decisions. Interested and affected parties have right to be heard.	Department of Environmental Affairs	No permitting or licensing requirements.
Guideline Documents			

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
Draft Guidelines for Granting of Exemption Permits for the Conveyance of Abnormal Loads and for other Events on Public Roads	Outlines 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.		
Policies and White Papers			
The White Paper on the Energy Policy of the Republic of South Africa (December 1998)	» Investment in renewable energy initiatives, such as the proposed solar energy facility, is supported by this white Paper.		
The White Paper on Renewable Energy (November 2003)	» This Paper sets out Government's vision, policy principles, strategic goals and objectives for promoting and implementing renewable energy in South Africa.		

APPROACH TO UNDERTAKING THE EIA PHASE CHAPTER 4

An EIA process is dictated 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 GNR543 - 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 on 6 November 2012 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 the Musina Municipal Library (21 Irwin Street, Musina) and Alldays Library and on the Savannah Environmental website for I&AP review and comment for a 30-day period. All the comments, concerns, and suggestions received during the Scoping Phase and the review period were included in the Final Scoping Report

The Scoping Report was submitted to the National Department of Environmental Affairs in July 2012. The Final Scoping Report and Plan of Study for the EIA were accepted by the DEA, as the competent authority, in 06 November 2012. In terms of this acceptance, an EIA was required to be undertaken for the proposed project.

4.2. Phase 2: Environmental Impact Assessment Phase

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

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

The EIA Report addresses potential direct, indirect, and cumulative[3] impacts (both positive and negative) associated with all phases of the project including design, construction, operation and decommissioning. In this regard the EIA Report aims to provide the relevant authorities with sufficient information to make an informed decision regarding the proposed project.

4.2.1. Tasks completed during the EIA Phase

The EIA Phase 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).

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

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

4.2.2 Authority Consultation

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

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

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

» Submission of a final EIA Report following the 30-day public review period.
» An opportunity for DEA and LDEDET 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, LIHRA, Department of Water Affairs, South African National Roads Agency Limited, Department of Agriculture, etc.).
    * Government Structures (including the Department of Public Works, Roads and Transport, etc)

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

4.3.1 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 **Sustainable Futures** (specialist public participation consultants) 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	» Limpopo – Limpopo Department of Economic Development, Environment and Tourism (LDEDET) » Limpopo – Department of Agriculture » Limpopo - Public Works, Roads and Transport » Limpopo - Water Affairs » South African Heritage Resources Agency » Limpopo Heritage Resources Agency » National Department of Agriculture, Forestry and Fisheries » South African National Roads Agency » Department of Energy
Municipalities	» Musina Local Municipality » Vhembe District Municipality
Public stakeholders	» Adjacent and surrounding landowners (see attached landowner map – Appendix E)
Parastatals & service providers	» Eskom Distribution
NGOs/Business forums	» Wildlife Environment Society of South Africa

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, 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, a first round of adverts were placed as follows:

* Northern Review (28 June 2012)
* Zoutpansberger (6 July 2012)

During the EIA phase, a second round of newspaper adverts was placed to inform the public on the details of the public meeting in the following newspapers:

* Northern Review (2 November 2012)
* Zoutpansberger (2 November 2012)

» **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)
* Public meeting (advertised in the local press)
* Written, faxed or e-mail correspondence

In order to further facilitate comments on the Draft EIA report and to provide feedback on the findings of the specialist scoping studies, a public feedback meeting will be held during the public review period. All interested and affected parties were invited to attend a public meeting ;

* **Date: 15 November 2012**
* **Time: 17.00pm – 18.30pm**
* **Venue: Abend Rube Gotha Guest Lodge**

Records of all consultation undertaken are included within **Appendix E**.

4.3.2 Identification and Recording of Issues and Concerns

Issues and comments raised by I&APs over the duration of the EIA process have been synthesised into Comments and Response Reports (refer to **Appendix E** for the Comments and Response Reports compiled from the EIA Process to date).

The Comments and Response Report includes responses from members of the EIA project team and/or the project proponent. Where issues are raised that the EIA team considers beyond the scope and purpose of this EIA process, clear reasoning for this view is provided.

4.3.3 Assessment of Issues Identified through the Scoping Process

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

Table 4.1: Specialist studies undertaken within the EIA Phase

Specialist	Area of Expertise	Refer Appendix
Simon Todd (of Simon Todd Consulting)	Ecology	Appendix F
Iain Paton (of Outeniqua Geotechnical Services Cc)	Soils and Agricultural potential	Appendix G
Stephan Gaigher(of G&A Heritage)	Heritage	Appendix H
Tony Barbour (of Tony Barbour Consulting)	Social	Appendix I
Johan Claassen (of Zone Land Solutions)	Visual	Appendix J

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

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

- The lifetime of the impact will be of a very short duration (0–1 years) – assigned a score of 1
- The lifetime of the impact will be of a short duration (2-5 years) - assigned a score of 2
- Medium-term (5–15 years) – assigned a score of 3
- Long term (> 15 years) - assigned a score of 4
- Permanent - assigned a score of 5

» The **magnitude**, quantified on a scale from 0-10, where a score is assigned:
- 0 is small and will have no effect on the environment
- 2 is minor and will not result in an impact on processes
- 4 is low and will cause a slight impact on processes
- 6 is moderate and will result in processes continuing but in a modified way
- 8 is high (processes are altered to the extent that they temporarily cease)
- 10 is very high and results in complete destruction of patterns and permanent cessation of processes

» The **probability of occurrence**, which describes the likelihood of the impact actually occurring. Probability is estimated on a scale, and a score assigned:
- Assigned a score of 1–5, where 1 is very improbable (probably will not happen)
- Assigned a score of 2 is improbable (some possibility, but low likelihood)
- Assigned a score of 3 is probable (distinct possibility)
- Assigned a score of 4 is highly probable (most likely)
- Assigned a score of 5 is definite (impact will occur regardless of any prevention measures)

» The **significance**, which is determined through a synthesis of the characteristics described above (refer formula below) and can be assessed as low, medium or high

» The **status**, which is described as either positive, negative or neutral

» The degree to which the impact can be reversed

» The degree to which the impact may cause irreplaceable loss of resources

» The degree to which the impact can be mitigated

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

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

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

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

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

As 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**.

4.3.4 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 F – J** for specialist study specific limitations.

This section of the Draft EIA Report provides a description of the environment that may be affected by the proposed **Alldays PV/CPV Plant Phase 1** project. 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 environmental and social specialist reports contained within **Appendices E – I**.

5.1 Regional Setting: Location of the Study Area

The project site is located in the Musina Local Municipality (LIM341) in the Limpopo Province and is some 75km due west of Musina and 35km from Alldays (refer to Figure 5.1). The site does not fall within any designated urban edge. A local airstrip and an electrical substation, known as the Venetia 132/22kV Substation, and the Venetia Diamond Mine are on the adjoining property. The latter is in close proximity to the proposed PV/CPV plant. The electricity generated from this facility would therefore easily be fed into the electrical grid via the Venetia Substation or existing power line infrastructure.

The site is located in close proximity to the R521, which connects to the R572 north en-route to Zimbabwe, and therefore the site is readily accessible. Even though the project site has a generally flat terrain, the terrain gently slopes downwards in an east-west direction. The site is located at an altitude of between 694m and 735m above mean sea level.

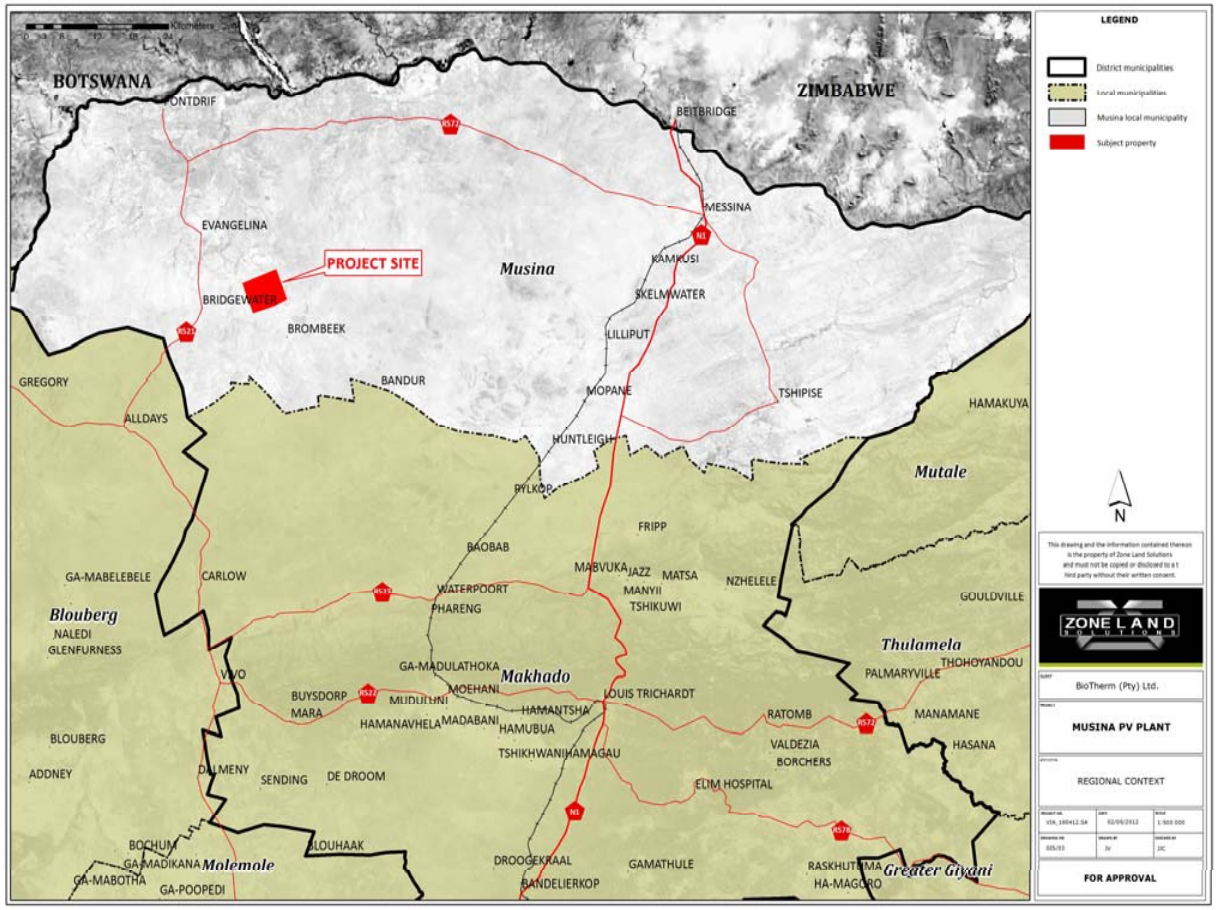

Figure 5.1: Regional context of the project site

5.2 Climatic Conditions

The climate of the area is generally dry (Wienert No. 5-10) with an average annual rainfall of less than 400mm. Most rainfall occurs in the hot summer months between November and March. Rain occurs approximately 10 days per annum and most of the rain falls during thunderstorms over a short period of time. Mean summer temperatures vary between 24 and 28°C with a maximum of 42°C. Minimum temperatures for the winter can be as low as -3.5°C. Evapotranspiration is high during the summer months.

5.3 Access and Transport Routes in the region

The proposed Alldays PV/CPV solar energy facility site is located along the Bridgewater-Musina gravel road to the south of the Venetia mine. This road is currently proposed as a potential public transport development route in the 2011 Musina Spatial Development Framework (SDF).

Higher-order public roads in the local study area are comprised of the R521 (tarred) and R572 (partially tarred). The east-west aligned R572, located ~20 km to the north of the proposed development site, provides direct access to the Mapungubwe National Park (MNP) as well as the Venetia Limpopo Nature Reserve (VLNR) from Musina and the N1. The north-south aligned R521 links the Pontdrift border post to the provincial capital of Polokwane (and the N1), via the small towns of Vivo and Alldays (Capricorn DM).

5.4 Biophysical Characteristics of the Study Area

5.4.1 Topography

The proposed site is situated in the northern central portion of the farm on slightly undulating plains of low relief (see **Figure 5.2**). The study area drains to the west and east into minor ephemeral tributaries of the Kolope River which flows northwards through the Mapungubwe National Park into the Limpopo River 30km to the north of the site.

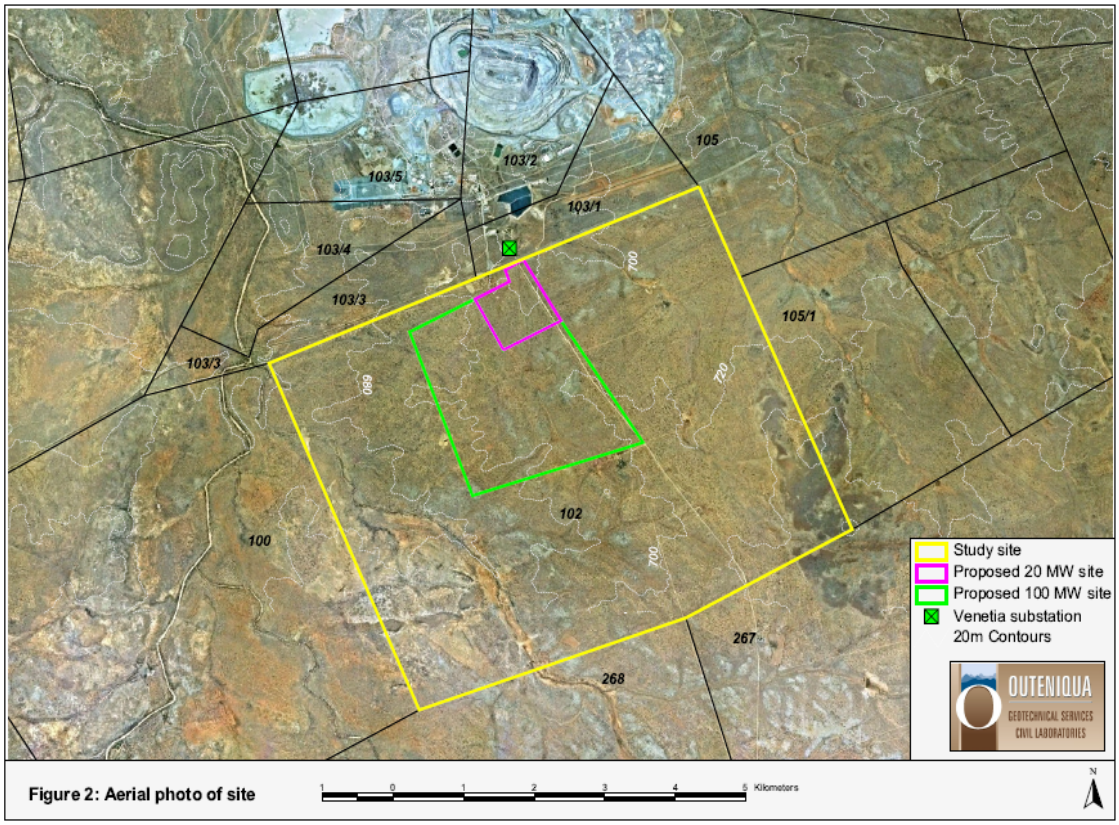

Figure 5.2: Overhead view of the site

5.4.2 Geology

The study area is situated within the Limpopo metamorphic belt which joins the Kaapvaal craton to the south with the Zimbabwe craton to the north. The belt consists of high-grade metamorphic rocks that have undergone a long cycle of high temperature and pressure deformation that ended approximately 2 billion years ago, after the stabilisation of the adjacent cratons.

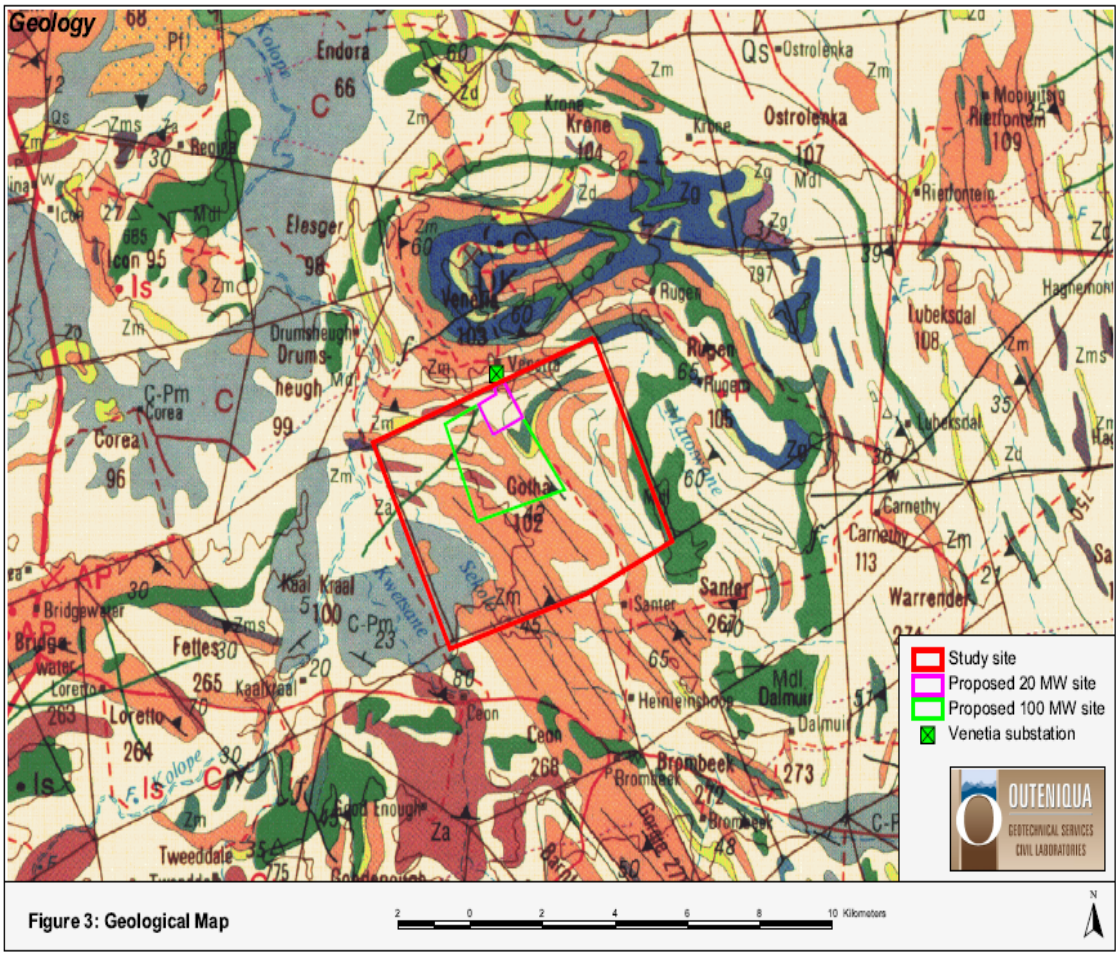

Figure 5.3: Geological map of the study area

The majority of the farm Gotha is underlain by gneiss, quartzite and granulite of the Malala Drift Group of the Beit Bridge Complex which forms part of the Limpopo belt. These rocks have been intruded locally by younger diabase dykes. The south western portion of the farm is underlain by significantly younger sedimentary rocks (mudstone, shale) of the Karoo Supergroup.

The bedrock is sporadically overlain by Quaternary soil cover which typically has a coarse gravelly or sandy texture as mechanical weathering processes are dominant in the dry climate. The soil types are broadly classified according to the Universal Soil Classification as SM and GM types (poorly graded silty sands and poorly graded silty gravels with non-plastic fines, respectively). The thickness of the soil cover is generally less than 0.5m thick and outcrops of the underlying basement rock are common. Thicker deposits of sandy soil are located along dry river channels

5.4.3 Soil Types

The dominant soils are shallow (100 – 300mm) and consists of sand to sandy loam Glenrosa soils (± 40%) and Hutton and Clovelly soils (35%) with depths up to 800mm with similar textures. Limestone (Coega soils) occurs frequently within the landscape on the low ridges with low growing Mopani shrub on it. All the above soils are of apedal nature. In the low lying floodplains, Oakleaf soils with a sandy loam texture and depths up to 1200mm are found. Rock outcrops frequently occur over the site which would hamper tilling. Soil depth and texture, together with effective rainfall determine the production of fodder for a particular situation. The low seasonal rainfall, high transpiration rates, shallow depth on a dominant portion of the area (± 40 – 50%) contribute to the relatively low fodder production potential of the area.

5.4.4 Agricultural Potential

Agricultural potential is primarily determined by the suitability of the soil profile to support crop production. The soil needs to be adequately thick to support root development and the drainage characteristics needs to be good to prevent chemical crusting on the surface. In addition to the soil characteristics, climatic factors are also important because the annual rainfall needs to be adequate to sustain a viable crop production. The combined effect of shallow soils, low rainfall and high evaporation rates associated with the proposed development site result in a serious limitation to agricultural potential and therefore the agricultural potential is limited to livestock and game production on natural vegetation.

5.4.5 Hydrology

The farm is located within the A63E Quaternary catchment of the Limpopo water management area (WMA). The mean annual precipitation is 300-400mm and the mean annual evaporation (S-Pan) is 2000-2200mm.[3]

Water erosion potential is directly related to the hydrology of the site which is largely controlled by the geology and soil types. Infiltration of rainfall into the ground is largely determined by the soil thickness and permeability. Infiltration is inversely proportional to run-off, and therefore in areas where infiltration into the ground is high, run-off is generally low, up to a point where the amount of rainfall exceeds the infiltration rate, and beyond that point excess rainfall ends up as run-off. Run-off is the primary trigger of erosion.

The soil cover over the study area is typically thin with good drainage characteristics but saturation will be reached quickly during peak rainfall periods, resulting in overland flow. The soils are also highly erodible and significant erosion can be expected along natural drainage lines where run-off is concentrated. Elsewhere moderate levels of erosion can be expected during peak rainfall events.

5.5 Land use and Land capability of the Study Area

The current land use on the proposed site is grazing livestock only (cattle, sheep, goats and game). There is no crop production. There is no irrigation water available in the area and dry land crop/pasture production under low rainfall and high transpiration rates, is a high risk and therefore not sustainable.

The land capability classification, which is an indication of agricultural potential and includes both soil capability and climate factors, is: non-arable, moderate potential grazing land. The natural vegetation on this property is utilised by beef cattle, a few small stock units (SSU) and by a large proportion of game. The game consists of a minimum of 400 impala, 150 kudu and other species. Based on the figures presented to the author by the farmer, a carrying capacity of approximately 4 hectares per large stock unit (LSU) is viable during normal years. Some supplementary fodder is fed during the winter months.

The landscape of the study area consists of mixed western Mopane veld on open flat terrain interspersed with sandstone and conglomerate formations. Mopane veld is characterised by mopane trees (*Colophospermum mopane*), which range in size from scrub to medium sized trees, depending on moisture availability. Stands of Baobab (*Adansonia digitata*) and Ilala palm (*Hyphaene coriacea*)[4] occur in places. The Limpopo valley is dominated by thorny *Acacia* spp. such as Fever trees (*A. Xantephloea*), but also includes specimen of *Ficus* spp., Jackalberry and others. The veld carrying capacity is generally low, and mainly suited to raising beef cattle, and to big game farming (including all of the "big five") or conservation management, all typically on extensive land parcels. The area around the Limpopo valley is conspicuously rich in bird life, with more than 350 species having been recorded[5]. Animals such as warthog are still frequently encountered along public roads in the study area. The sense of place is that of arid African bushveld.

With regard to the immediate landscape context around the proposed site, it should be noted that the large Venetia open cast mine is located directly adjacent to the proposed site The proposed PV/CPV site would therefore not be established in a pristine bushveld context lacking in pre-existing industrial landscape references.

[4] www.environment.gov.za/projprog/tfcas/limpopo_shashe.htm; www.sanparks.org
[5] www.environment.gov.za/projprog/tfcas/limpopo_shashe.htm. This figure represents more than a third of the national Roberts bird list (~920 species).

Figure 5.4: The typical terrain and vegetation on the study area

5.5 Ecological Profile

5.5.1 Vegetation

The vegetation of the site is fairly homogenous and is dominated to varying degrees by Mopane trees. In some parts of the site the density of mopane trees is high and there are few other species present. However, in other parts, the vegetation consists of a more diverse mixed woodland which included other tree species such as *Sclerocarya birrea*, *Adansonia digitata*, *Commiphora glandulosa*, *C. pyracanthoides*, *Dichrostachys cinerea*, *Acacia nigrescens*, *A. senegal*, *A. tortillis*, *Sterculia rogersii*, *Terminalia prunioides*, *Ehretia rigida* and *Grewia bicolor*. The understorey is also better developed within the areas of lower mopane density and consisted of species such as *Asparagus exuvialis*, *Asparagus nelsii*, *Blepharis pruinosa*, *Abutilon pycnodon*, *Barleria senensis*, *Cenchrus ciliaris*, *Aristida adscensionis*, *Sansevieria aethiopica* and *Lycium cinereum*.

A number of protected species occur at the site, including Marula and Baobab trees. The Boabab trees are of particular significance as these trees are keystone species which provide key resources for birds, bats and mammals. The Baobab is a nationally protected species under the Forests Act and a permit is required to impact on these species. At least ten Baobab trees occur within the areas earmarked for development, six within the 20MW development area (assessed within a separate process) and four within the broader area for the 75 MW development area, although only one occurs within the proposed development

footprint. The dense tree cover at the site generally restricts visibility to less than 75 m and so it may be possible that additional trees that were not observed occur within the 75 MW development area. The Baobab trees are however considerably taller than the surrounding vegetation and if any were not observed, it would not be very many.

There are no perennial rivers or water bodies within the site, a number of ephemeral river courses occur within the site, primarily along the southern and western boundaries of the proposed 75 MW development area. As most of these drainage lines are within very rocky soils and are not very well developed, there is very little riparian vegetation associated with the drainage lines. There is also some evidence of erosion in this area, suggesting that unmitigated disturbance at the site could significantly increase the risk of soil erosion.

Figure 5.5: Typical vegetation of the site. In the above image, an area highly dominated by Mopane trees, while in the belowt image a number of other tree species are also present including *Grewia*, *Commiphora*, *Terminalia* and *Sclerocarya birrea*. In both cases, the vegetation of the ground layer is very poorly developed, which was typical of the site.

Figure 5.6: Examples of the Baobab *Adansonia digitata* trees which occur within the study area. The large nests on the right hand tree were built by the Red-billed Buffalo-Weaver *Bubalornis niger*. The Baobab is a nationally protected species under the Forests Act.

Conservation status of broad vegetation types

The site lies within the planning domain of the Limpopo Conservation Plan (2011). This biodiversity assessment identifies Critical Biodiversity Areas (CBAs) which represent biodiversity priority areas which should be maintained in a natural to near natural state. The CBA maps indicate the most efficient selection and classification of land portions requiring safeguarding in order to maintain ecosystem functioning and meet national biodiversity objectives. **The site does not lie within a CBA and there are no CBAs within the site**. The nearest CBA areas are about 10 km east of the site, suggesting that the development would not have a significant impact on any CBAs (Figure 5.7). In terms of other broader-scale processes, the development is not likely to disrupt any faunal movement corridors or upland-lowland gradients in the area.

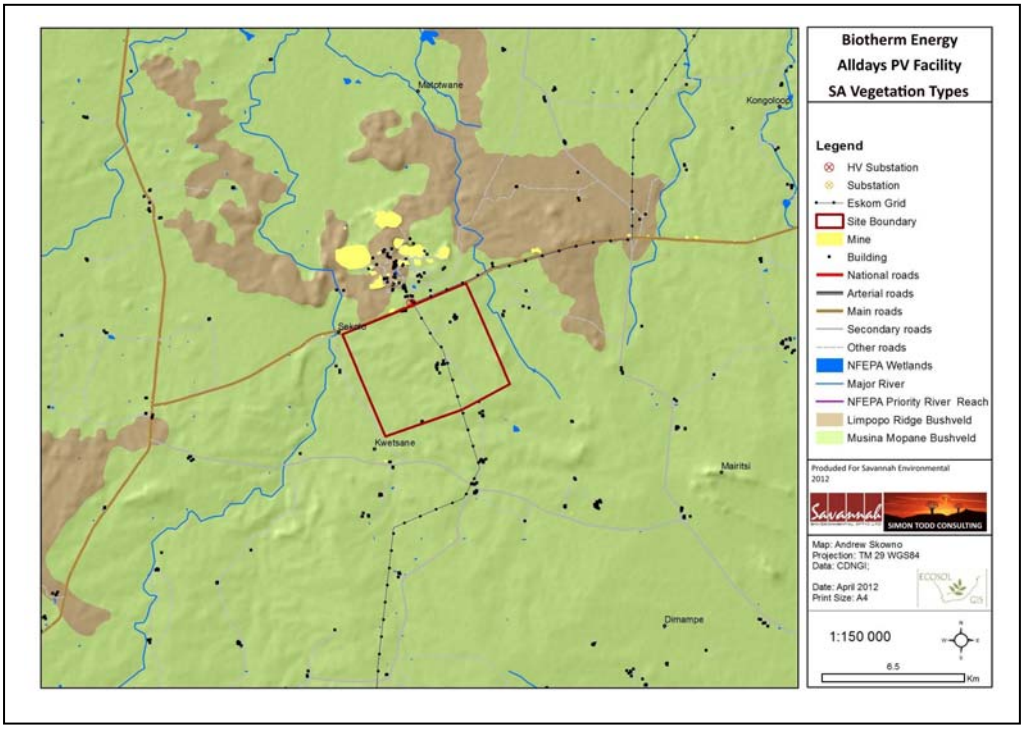

Figure 5.7: Critical Biodiversity Areas map of the BioTherm Venetia site and surrounding area. The only CBAs in the area are some distance from the site and would not be impacted by the development.

5.5.2 Red List Animal Species

The site falls within the distribution range of as many as 70 terrestrial mammals, indicating that the mammalian diversity at the site is potentially very high. However, the low diversity of habitats present at the site means that significantly less species than this will actually occur at the site. Four listed terrestrial mammals may occur at the site, the Honey Badger (Endangered), Leopard (Near Threatened), Brown Hyaena (Near Threatened) and Black-footed cat (Vulnerable). Given the preponderance of game farming in the area, predators may be tolerated to a greater degree than in livestock farming areas and so it is possible that all of the listed species may occur in the area. The proximity of the site to the Venetia mine may deter shy species such as the Black-footed Cat from the area, but the other three species are naturally secretive and their presence and activity in close proximity to humans can easily go unnoticed. For the listed species, it is likely that the development would result in a small amount of habitat loss. This would not be highly significant within context as these species all have a large home-range and the development would not be likely to actually displace any individuals of these species.

There are no reptile species of conservation concern that have a distribution that includes the study area.

The site lies within the distribution range of as many as 25 bat species, indicating that the richness of bats at the site is potentially very high. The lack of wetlands and large drainage lines at the site, as well as the unlikelihood of any cave roosts in the vicinity suggests that the site is not likely to contain an abundance of species associated with these habitats. Nevertheless, a lot of chewed fruit was observed beneath some of the Baobab trees, indicating that fruit-eating species such as Wahlberg's Epauletted Fruit Bat are likely to be common at the site.

5.5.3 Reptiles

Species observed at the site include the Variable Skink, Striped Skink, Common Rough-scaled Lizard and Peter's Ground *Agama*. It is unlikely that any listed or highly localised reptile species occur at the site as it lacks specialised habitat for such species. Similarly, given the homogenous nature of the site, there were specific habitats present at the site which are likely to be of greater significance for reptiles.

As no listed reptile species are likely to occur at the site and given the small extent of the development, the impact on reptiles is likely to local in extent and of a generally low significance.

5.5.4 Amphibians

The only listed species which may occur at the site is the Giant Bullfrog which is listed as Near Threatened. As there is no suitable breeding habitat for this species within or near the site, the site is not likely to be an important habitat for this species. Given that there are no pans, rivers or permanent water sources within the proposed development area, the impact on amphibians is likely to be local in nature and of low magnitude.

5.5.5 Avifauna

According to the bird data sets which are available on the South African National Biodiversity Institute, 360 bird species are known from the broad area surrounding the proposed development site. This includes 26 IUCN listed species. A large proportion of the listed species are susceptible to electrocution or collision from power-line infrastructure. The larger raptors are susceptible to both collision and electrocution, while the storks, bustards and flamingos are all vulnerable to collision with power lines. This is a potentially significant source of impact for these species.

Listed bird species observed at the site include the Southern Ground Hornbill and the Red-billed Oxpecker, but a large proportion of the other species are also likely to frequent the site or pass through the area occasionally. Overall the development is likely to result in some habitat loss for resident bird species, which is to some extent mitigated by the proximity of the site to the tar road and the mine.

5.6 Social Characteristics of the Study Area and Surrounds

5.6.1 Population

Ethnically, the Limpopo population is the most homogenous in South Africa, with the Black African group comprising ~97.5% of the population. The Black African group consists of several ethnic groups distinguished by culture, language and race. 97.3% of the population is Black, 2.4% is White, 0.2% is Coloured, and 0.1% is Indian/Asian. The province has the smallest percentage and second smallest by number of white South Africans in the country. It also has the highest Black percentage out of all the provinces. Vhembe district has the smallest share of White people in Limpopo.

According to the 2007 Community Survey, the Musina Local Municipality (MSM) has an estimated population of 57 195 (14203 households) – a substantial increase since Census 2001, which counted 39 310 people for the MLM[6]. Approximately 94% of the MLM population is Black African. The White group forms the most significant minority, and accounts for 5.9% of the population share (MLM, 2012). According to the SDF, the vast majority (~63%) of the MLM population lives in the town of Musina (MLM, 2011).

5.6.2 Age Structure

The MLM has a youthful population with ~40% under the age of 18. The largest cohort is accounted for by young adults (35.4%), with adults and the elderly only making up 24.2%. According to the 2011 SDF, there are relatively fewer children, but more young adults in the farming areas than in urban Musina. The situation with regard to young adult suggests employment seeking out-migration from Musina elsewhere, while the rural farming area still provides job opportunities.

[6] The 2011 MLM SDF indicates a projected 2009 MLM total of 38 748 – i.e. roughly the same as the Census 2001 total.

5.6.3 Education levels

MLM educational levels are very low. Approximately 19% of the population has had no formal education, 33% only partial or a full Primary education, and only 4.1% hold a tertiary qualification. With the exception of Musina town and other small urban areas which have a higher concentration of skilled people, the profile is fairly even across the MLM. As noted in the 2011 SDF, the bulk of the population is therefore only equipped for low and elementary skilled jobs (58% of the population) in the primary sector, mainly in Agriculture (MLM, 2011; MLM, 2012).

5.6.4 Employment

According to the 2007 Community Survey, the MLM had an unemployment rate of 25%, and a labour force participation rate of 81%. The highest unemployment is amongst the 15-19 year age cohort (36%), and generally declines with age (MSM; 2012). The extent to which the municipal agricultural sector is able to absorb labour is a key factor in un/employment levels in the MLM (MLM; 2011).

Primary sector activities accounted for the bulk of employment in 2007, with Agriculture providing 54% of opportunities, and Mining 18%. The Services sector (including government services) was the third most significant, providing an estimated 23%. Wholesale (6%) and Manufacturing (5%) were other significant employment providers (MLM; 2012).

5.6.5 Household income and poverty levels

MLM poverty levels are very high. An estimated 85% of household heads earn less than R3200 per month – of which 65% has either no formal income, or earn less than R800/ month. Only an estimated 14.3% of breadwinners earn more than R3500/ month (MLM, 2011). The vast majority of poor are Black (99% according to a 2006 estimate). In 2011 the MLM provided -indigent support to 2459 households in the municipality (MLM; 2012).

5.6.6 Economic context

The MLM accounts for 11% of the Vhembe District Municipality's GDP. Key economic activities are related to primary sector activities, mainly agriculture and mining, with limited local beneficiation. Thanks to the MLM's strategic location along the N1 south of Beitbridge, the transport sector also plays an important role in the MLM economy. Conservation-based tourism and game farming (including for hunting) are further significant established and growing land uses. Broken down by sector, the three main contributors to the MLM economy are Agriculture, Forestry and Fishing (35%), Mining (30%), and Transport and communication (15%).

Manufacturing accounts for a further 11%, and Finance and business services for 9% (MLM, 2012).

The GDP generated by the MLM agricultural sector currently contributes up to three times more to the Musina municipality's economy than this sector does to the VDM economy. The MLM agricultural sector also contributes to more than a third of the GDP generated by this sector in the VDM. The MLM agricultural sector also provides the bulk of agricultural employment opportunities in the VDM (MLM, 2012).

The MLM manufacturing sector is not currently performing well. However, given the MLM's strong agricultural base, opportunities for expansion of the manufacturing industry exists through agro-processing and other activities.

With regard to tourism, at least two designated provincial tourism routes are located within the western MLM, both focusing on the Mapungubwe National Park (MNP) and Cultural Landscape. These are the Mapungubwe Route (R521 and R572) and the Limpopo Valley Route (including portions of the R572). Apart from MNP, no other national or provincial parks are located within the MLM. A number of private reserves and game farms are however located in the MLM. The MNP currently offers ~100 beds in a number of small rest camps.

5.7 Heritage

5.7.1 Stone Age

The Stone Age sites of this area fit within the later Earlier Stone Age and the Middle Stone Age periods, and this section therefore discusses the relevant industries, beginning with the Acheulean. The rate of change seen in the lithics of the Acheulean is slow (Klein 2000), but by the later Acheulean, knappers were familiar with a more extensive range of options which become more refined in the MSA, such as the prepared core technique and blade production (Barham 2000a, Beaumont & Vogel 2006). The transition from the end of the Acheulean to the MSA is complex and controversial and has been described as the most important event to occur in the later Middle Pleistocene (Tryon 2006). Traditionally the disappearance of handaxes and cleavers has defined the MSA in South Africa. In other words, when the large cutting tools of the Acheulean seem to be replaced with points of bone or stone, industries are attributed to the MSA. However, early MSA sites are very rare and this paucity of information tends to exaggerate the differences between the Acheulean and the MSA.

In the past, a number of researchers have recognized industries that are 'transitional' between the ESA and MSA. At the 1955 Panafrican Congress the term

'First Intermediate Period' was adopted to describe this transition period between the ESA and MSA (McBrearty 1988). The term was then dropped at the Burg Wartenstein symposium of 1965 due to insufficient field evidence. However, a number of researchers still support the argument for transitional industries, and these are discussed in the sections below.

Therefore while the ESA with bifaces generally gives way to an MSA without bifaces, in some areas 'transitional' industries' defined as the Sangoan and Fauresmith have been recognised. This 'transitional' status has meant that the Sangoan is frequently referred to as a final ESA industry (Clark 1959), but some researchers consider it to represent the early MSA (Davies 1976, Van Peer *et al.* 2003). Van Riet Lowe (1947) placed the Fauresmith at the end of the ESA, while Beaumont & Vogel (2006) define the Fauresmith as the MSA, arguing that it is older than 500,000 years old. More recently a number of researchers have again been researching these industries (e.g., M. Chazan, F. Rheinhardt), and they argue that while they are problematic, they do in fact exist (McBrearty 1988). Although no good dates are available for the Sangoan, it seems to appear at approximately 300,000 years ago and is associated with the appearance of more evolved hominids (McBrearty 1988, White *et al.* 2003). The variation seen in artefacts at this time is complex and although the terms Sangoan and Fauresmith are the traditional industry names for this period, actually pigeonholing assemblages within these industries is difficult.

5.7.2 Iron Age

The Early Iron Age is the best represented in this area with several Late Iron Age to be found as well. The Mapungubwe and K2 sites are the best known of the Early Iron Age sites (around 25km north of the study area). Sites that are culturally related to K2 and Mapungubwe have been observed on Hamilton 41 MS (23km north of study area), Samaria 28 MS (27km north of study area) and Den Staat 27 MS (31km northwest of study area). Another site related to Mapungubwe was excavated by Van Ewyk (1987) on Skutwater approximately 28km to the east of Greefswald. Small Iron Age sites postdating Mapungubwe and K2 have been recorded on Greefswald (25km north of study area), including some stone-walled sites on hilltops.

Figure 5.8: Mapungubwe Hill

Some of these sites have been identified by T.N. Huffman as Khami type ruins. According to oraltradition, communities belonging to the Lea and Twamamba tribes, related to the Venda and the Shona-speaking people, settled in the Greefswald region in historical times.

They were followed, after c. AD 1700, by Sotho-speaking people. The seasonal presence of tsetse fly in the Lowveld during the 19th century made cattle herding difficult for the Iron Age communities (Fuller 1923). Malaria made living conditions still worse. As a result, the Greefswald area was used only for hunting from around 1900 until after the 1920s. When gold was discovered in stone-walled sites north of the Limpopo River, prospectors and treasure hunters began to search for similar sites south of the Limpopo River.

5.7.3 Historic Era

Mapungubwe was the largest settlement in the subcontinent in the 13th century AD before it was abandoned. Various communities settled in the vicinity over the next 600 years. Legends and rumours about the place were passed on from generation to generation. Karel Moerschell, a local German farmer, knew about the gold by 1911, but it was not until the 1930s that the significance of Mapungubwe became more widely known.

On 31 December 1932, a local informant, Mowena, led E.S.J. van Graan, and four others to Greefswald farm on Mapungubwe Hill where they saw stone walls and recovered gold and iron artefacts, pottery and glass beads. The finds, which received wide publicity in the media, were reported to the head of the Department

of History at the University of Pretoria, Professor Leo Fouché. As a result of his intervention, the University negotiated with the owner of the property, E.E. Collins.

In a legal agreement the University took ownership of the gold and other artefacts and secured an option and contract for excavation rights. The University also successfully requested a postponement of prospecting, mining and related activities on Greefswald. In June 1933, Greefswald was bought by the Government and excavation rights were granted to the University of Pretoria.

The University established an Archaeological Committee, which from 1933 to 1947 oversaw research and excavations. Rev. Neville Jones from Zimbabwe and J.F. Schofield were appointed to undertake the first fieldwork in 1934 and 1935 and they were advised by Professor C van Riet Lowe, Director of the Bureau of Archaeology. Their work focused on Mapungubwe Hill, the southern terrace and the midden there. They briefly surveyed other similar sites in the vicinity.

From 1935-1940 six excavation seasons at K2 and Mapungubwe Hill were directed by Guy A. Gardner. The results of his work were published nearly 25 years later. Meyer (1998) describes the excavations on Greefswald between 1933 and 1940 as ‘rapid, large scale excavations resulting in the recovery of valuable artefacts'. Research was hampered by ‘the lack of professional archaeologists in South Africa, the lack of full-time supervision of the excavations by efficient, trained staff, the fact that adequate scientific methods for Iron Age research had not yet been developed and that the Iron Age in South Africa was virtually unknown to archaeologists. Consequently, many of the deposits on the sites were removed without the meticulous excavation and recording required. These problems inevitably resulted in a loss of irreplaceable deposits and eventually also of excavated materials [and] a lack of scientific data.'

The next phase of archaeological investigation, in 1953- 1954 and in 1968-1970, under the direction initially of the Department of Anthropology, and then of Professor J F Eloff who was appointed as Head of the newly-formed Department of Archaeology at the University of Pretoria in 1970, was more systematic and focused mainly on the southern terrace.

Over the next 25 years from 1970 to 1995, the Department of Archaeology at the University of Pretoria recognised that their first priority was to establish a firm data base by testing, correcting and supplementing the earlier research, and concentrating on reconstructing the way of life of the site inhabitants. Between 1979 and 2002 reports have been published on the human and faunal remains, Chinese porcelain, gold objects, glass beads and radiocarbon dating.

In addition, sites on neighbouring farms have been investigated by students of the University of Pretoria during the 1970s and 1980s.

Greefswald has remained the property of the State since the 1930s. Management of the farm was taken over by the provincial Department of Nature Conservation in 1992, and control was transferred to SANParks in 1999.

The proposed boundaries of the world heritage site coincide with the boundaries of the proposed Vhembe- Dongala National Park - which is still in the process of formation. It is being inscribed sequentially - with three areas properties already gazetted. These are Den Staat, Geefswald and Reidal which are areas of 'natural' landscape in which are many of the principal archaeological sites.

The aim is for SANParks eventually to acquire all the land within the proposed park or to have contractual agreement with the owners. This will allow the land to be taken out of agriculture and revert to 'natural' landscape. A chart of the current progress with land negotiations is included in the nomination. Currently there are 'in principle' agreements for 11 of the remaining 29 land units, but the timetable is missing. These are currently used for different purposes: some are being cultivated using irrigation agricultural techniques based on water extracted from the Limpopo river, some are managed as game reserves, and others are owned by the De Beers Corporation and are used to ensure water extraction, storage, and provision for that organisation's diamond mining activities, which are estimated to have a maximum working life of twenty years (*Source – Advisory Body Evaluation*).

ASSESSMENT OF POTENTIAL IMPACTS CHAPTER 6

This chapter serves to assess the significance of the positive and negative environmental impacts (direct, indirect, and cumulative) expected to be associated with the development of the proposed **Alldays PV/CPV Plant Phase 1** for all the facility's components which will comprise:

» A single substation and overhead power line to facilitate the connection between the solar energy facility and the Eskom electricity grid.
» Internal access roads.
» Gate house and security.
» Warehouse.
» Canteen and change rooms.
» Office and Control centre.

The development of the **Alldays PV/CPV Plant Phase 1** 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 15 months.
» *Operation* – will include operation of the facility and the generation of electricity. The operational phase is expected to extend in excess of 20 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. Methodology for the assessment of Potentially Significant Impacts

A broader site of 450 ha (i.e. on a portion of Farm 102 (Gotha) (MS)) was identified by the project developer for the purpose of establishing the proposed San Solar Energy Facility. However, the developmental footprint will cover an extent of ~175ha.

The assessment of potential issues has involved key input from specialist consultants, the project developer, key stakeholders, and interested and affected

parties (I&APs). The Comments and Response Report included within Appendix D lists these issues and the responses given by the EAP during the Scoping Phase.

In order to assess the potential impacts associated with the proposed facility, it was necessary to quantify the extent of the permanently and temporarily affected areas (i.e. both area and linear infrastructure).

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

The sections which follow provide a summary of the findings of the assessment undertaken for potential impacts associated with the construction and operation of the proposed solar energy facility on the identified site. Issues were assessed in terms of the criteria detailed in Chapter 4 (Section 4.3.4). 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.

6.2.1 Potential Impacts on Ecology

Solar energy facilities require relatively large areas of land for placement of infrastructure; this PV facility requires ~175 hectares. The main expected negative impact will be due to 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).

The ecological sensitivity assessment identifies those parts of the study area that have high conservation value or that may be sensitive to disturbance. From this assessment, it has been concluded that there are a number of features that need to be taken into account in order to evaluate sensitivity in the study area.

(a) Summary of Ecological Impacts – PV/CPV Panels

The majority of impacts on ecology will occur during the construction of the proposed PV/CPV facility. Potential ecological impacts resulting from the development would stem from a variety of different activities and risk factors associated with the construction and operational phases of the project including the following:

Construction Phase

» Vegetation clearing
» Presence and operation of heavy machinery

» Human presence and disturbance

Operational Phase

» Maintenance activities
» Human presence
» Presence of the facility & associated infrastructure

The above activities are likely to manifest themselves as the following impacts, which are assessed in the next section of the report:

» Impacts on vegetation and protected plant species
» Increased Alien Plant Invasion Risk
» Increased Soil Erosion Risk
» Faunal Impacts
» Avifaunal Impacts
» Reduced Landscape Connectivity

A draft ecological sensitivity map of the site was produced by integrating the information collected on-site with the available ecological and biodiversity information. The ecological sensitivity of the different units identified in the mapping procedure was rated according to the following scale:

» **Low** – Units with a low sensitivity where there is likely to be a negligible impact on ecological processes and terrestrial biodiversity. This category is reserved specifically for areas where the natural vegetation has already been transformed, usually for intensive agricultural purposes such as cropping. Most types of development can proceed within these areas with little ecological impact. There were however no transformed areas with Low Sensitivity within the study area.
» **Medium**- Areas of natural or previously transformed land where the impacts are likely to be largely local and the risk of secondary impact such as erosion low. Development within these areas can proceed with relatively little ecological impact provided that appropriate mitigation measures are taken.
» **High** – Areas of natural or transformed land where a high impact is anticipated due to the high biodiversity value, sensitivity or important ecological role of the area. Development within these areas is highly undesirable and should only proceed with caution as it may not be possible to mitigate all impacts appropriately.
» **Very High** – Critical and unique habitats that serve as habitat for rare/endangered species or perform critical ecological roles. These areas are essentially no-go areas from a developmental perspective and should be avoided at all costs.

The ecological sensitivity map of the solar facility is depicted in Figure 6.1 below. Apart from the some relatively minor drainage lines, there are no highly significant biodiversity features within the study area. The southern and western margins of the study area have been assessed as being of somewhat higher sensitivity than the rest of the site, on account of the steep slope of this area as well as the high density of drainage features present. The baobab trees within the site are considered to be a significant ecological feature given the role these trees play in the ecology of the area. Although there are quite a number of baobabs within the study area, there is only one tree which was identified as occurring within the proposed development area for the 75MW facility.

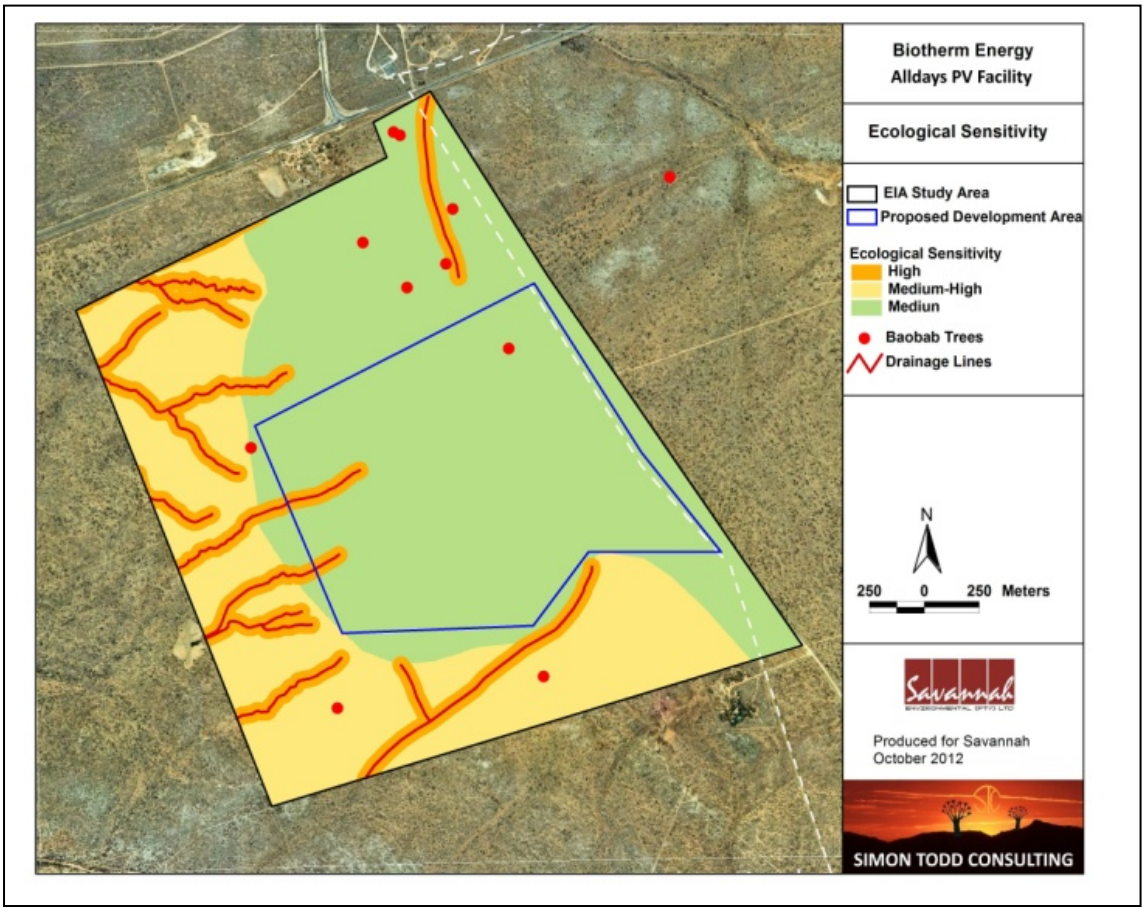

Figure 6.1: Ecological Sensitivity map of the proposed Venetia Solar Facility site, illustrating the proposed development area within the study area. Note the minor drainage lines at the south and western portion of the proposed site. There is only one Baobab tree located in the proposed site for the development of the facility.

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

Nature: Impacts on vegetation and protected plant species

Impacts on vegetation and protected plant species would occur due to the construction of the facility, which will require extensive site clearing. Some loss of vegetation is an inevitable consequence of the development. In addition, the abundance of Marula trees at the site was high and a relatively large number of these trees are likely to be affected as well as potentially some Baobab trees.

	Without mitigation	**With mitigation**
Extent	Local (2)	Local (2)
Duration	Long-term (4)	Long-term (3)
Magnitude	Medium-High (7)	Medium (5)
Probability	Definite (5)	Definite (5)
Significance	**High (65)**	**Medium (50)**

Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	N/A
Can impacts be mitigated?	Largely Not, as all the woody vegetation present will need to be cleared.	

Mitigation:

» Vegetation clearing to be kept to a minimum. No unnecessary vegetation to be cleared.
» Where roads and other infrastructure cross sensitive features such as drainage lines, caution should be exercised to ensure that impact to these features are minimised.
» The final development area should be surveyed for species suitable for search and rescue, which should be translocated prior to the commencement of construction. This would include any baobab trees present within the development footprint.
» Development would be likely to encourage alien plant invasion and measures to prevent and limit alien plant invasion should be implemented as part of the EMPr for the development.

Cumulative impacts:

» The potential for cumulative impacts is quite high on account of the presence of the adjacent 20MW facility as well as the Venetia mine. These developments would result in a significant cumulative impact at a local level, but the significance at the landscape level is likely to be fairly low

Residual Impacts:

» The development requires that all the woody vegetation within the development footprint is cleared, which cannot be avoided or fully mitigated.

Nature: Increased alien plant invasion

Alien plants are likely to invade the site as a result of disturbance created during construction***.*** Disturbance created at the site during construction would leave the site vulnerable to alien plant invasion. Clearing the site would result in a large amount of disturbance and as the grass layer is poorly developed, it is not likely that an indigenous plant cover would rapidly colonise the cleared areas to limit the invasion potential of the area.

	Without mitigation	**With mitigation**
Extent	Local (2)	Local (2)
Duration	Long-term (4)	Short-term (2)
Magnitude	Medium (5)	Low (3)
Probability	Highly Probable (4)	Improbable (3)
Significance	**Medium (44)**	**Low (21)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	High
Irreplaceable loss of resources?	Yes	No
Can impacts be mitigated? Yes		
Mitigation:		

- Cleared areas which are not surfaced or required for construction should be revegetated with seed or plants of locally occurring species.
- Regular monitoring for alien plants within the development footprint.
- Regular alien clearing should be conducted using the best-practice methods for the species concerned. The use of herbicides should be avoided as far as possible.

» An alien plant management plan should be developed as part of the EMPr for the development.

Cumulative impacts:

» If alien plant abundance in the area increases to a large degree then some cumulative impacts would result and invasion is likely to spill over into adjacent intact areas.

Residual impacts:

» If alien species at the site are controlled, then there will be very little residual impact

Nature: Increased erosion risk as a result of soil disturbance and loss of vegetation cover.

The development of the site would create a high level of soil disturbance, which would leave the site susceptible to erosion. This may be a particular concern at the site on account of the poorly developed grass layer, which probably does not have sufficient soil seedbanks present to quickly colonise cleared areas and limit erosion potential. In addition, the panels and hardened surfaces of the roads and other infrastructure would generate a lot of runoff, which will further increase erosion risk.

	Without mitigation	**With mitigation**
Extent	Local (2)	Local (2)
Duration	Long-term (4)	Short-term (2)
Magnitude	Medium-High (7)	Low (4)
Probability	Highly Probable (4)	Probable (3)
Significance	**Medium (52)**	**Low (24)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	High
Irreplaceable loss of resources?	Yes	No
Can impacts be mitigated?	Yes	

Mitigation:

» The development will require the clearing of all woody species present, which will create a lot of disturbance at the site. Seeding of cleared areas with locally occurring grass species should occur as soon after vegetation clearing as possible, even if construction activities are going to commence thereafter. Suitable species would include *Cenchrus ciliaris* and *Cynodon dactylon*.

» All roads and other hardened surfaces should have runoff control features which redirect water flow and dissipate any energy in the water which may pose an erosion risk.

» Regular monitoring for erosion during and after construction to ensure that no erosion problems have developed as result of the disturbance.

» All erosion problems observed should be rectified as soon as possible, using the appropriate erosion control structures and revegetation techniques.

Cumulative impacts:

» Higher sediment loads in rivers and streams will affect in-stream vegetation and biota

Residual Impacts:

» If erosion at the site is controlled, then there will be no residual impact

Nature: Disturbance, transformation and loss of habitat will have a negative effect on resident fauna.

During the construction phase, there will be a lot of disturbance and noise at the site which will drive many species away from the area. The presence of large number of construction personnel will also lead to increased risk to species such as snakes, tortoises and mammals which would be vulnerable to poaching for food, trade or killed out of fear and superstition. During the operational phase, the large change in vegetation structure will render the area unsuitable for many species which will consequently experience long-term habitat loss as a result.

	Without mitigation	**With mitigation**
Extent	Local (2)	Local (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	Medium (5)	Low (3)
Probability	Definite (5)	Highly Probable (4)
Significance	**Medium (55)**	**Medium (36)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Some aspects such as those relating to human activity can be mitigated, but habitat loss cannot be mitigated.	

Mitigation:

» Any fauna directly threatened by the construction activities should be removed to a safe location by the ECO or other suitably qualified person.
» The collection, hunting or harvesting of any plants or animals at the site should be strictly forbidden. Personnel should not be allowed to wander off the construction site.
» Fires should only be allowed within fire-safe demarcated areas.
» No fuelwood collection should be allowed on-site.
» No dogs should be allowed on site.
» If the site must be lit at night for security purposes, this should be done with low-UV type lights (such as most LEDs), which do not attract insects.
» All hazardous materials should be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel and oil spills that occur at the site should be cleaned up in the appropriate manner as related to the nature of the spill.
» No unauthorised persons should be allowed onto the site.
» All construction vehicles should adhere to a low speed limit to avoid collisions with susceptible species such as snakes and tortoises.

Cumulative impacts:

» The other PV facility on the same site and the mine will result in some cumulative

impact, which is likely to be locally significant, but given the total expected extent of habitat loss, this is not likely to be of broader significance

Residual Impacts:

» Some habitat loss is an inevitable consequence of the development and cannot be fully mitigated.

Nature: Avifaunal Impacts

Avifauna will experience some habitat loss as a result of the development as well as a potentially increased risk of collisions and electrocution with the power line infrastructure. Direct and indirect impacts of the development on avifauna would result from habitat loss as well as the risk of electrocution and collisions with transmission lines. This includes potential impact on 26 listed bird species.

	Without mitigation	**With mitigation**
Extent	Local (2)	Local (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	Medium (6)	Low (4)
Probability	Highly Probable (4)	Probable (3)
Significance	**Medium (48)**	**Medium (30)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Moderate
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	To some degree	

Mitigation:

- The grid connection option that does not require a transmission line, would be preferable for avifauna.
- Ensure that if new lines are required, they are marked with bird flight diverters along their entire length. If the new line was to run parallel to existing unmarked line this would potentially create a net benefit as this could reduce the collision risk posed by the older line.
- All new power line infrastructure should be bird-friendly in configuration and adequately insulated. These activities should be supervised by someone with experience in this field.

» Any electrocution and collision events that occur should be recorded, including the species affected and the date. If repeated collisions occur within the same area, then further mitigation and avoidance measures may need to be implemented.

Cumulative impacts:

» The current development in conjunction with the adjacent 20MW facility and the mine would create a significant amount of transformation in area. Given the mobility of birds and the large extent of available intact habitat in the area, this would not amount to a highly significant impact for most avifauna. In addition, there do not appear to be any features present that would suggest that the area is particularly important for birds and vulnerable to cumulative impacts.

Residual Impacts:

» The large change in vegetation structure resulting from the development would amount to long-term habitat loss for most species.

Nature: Reduced landscape connectivity

The development would result in a large change in vegetation structure within the site, which would render it unsuitable for many species, while others would be excluded by the security fencing around the facility. This would make it difficult for affected fauna to move through the area.

The development of the site will require the clearing of all woody species present and the remaining vegetation will be restricted to the grass layer. This will impact the connectivity of the landscape as many species will avoid the development due to the change in vegetation structure as well as human presence and fencing around the site.

	Without mitigation	**With mitigation**
Extent	Local (2)	Local (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	Medium (5)	Medium(4)
Probability	Highly Probable (4)	Probable (3)
Significance	Medium (44)	Medium (30)
Status (positive or negative)	Negative	Negative
Reversibility	Moderate	Moderate
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	No. The impact will remain in place for as long as the facility is present.	

Mitigation:

» Shrubs and a grass layer should be encouraged within the facility, especially in those areas not required for regular operational and maintenance use.
» Only the taller woody vegetation should be cleared.
» Woody vegetation should be cleared by hand and herbicides should not be used.

Cumulative impacts:

» The current development would contribute to cumulative habitat loss and disruption of landscape connectivity in the area.

Residual Impacts:

» The change in vegetation structure will be permanent and for those species which require such habitat, mitigation will not be possible. If a ground layer of grass and shrubs can be maintained within parts of the facility, many smaller species will benefit and the residual impact on such species will be low.

Implications for Project Implementation:

» Erosion risk is identified as being a particular risk associated with the development on account of the wooded nature of the site. It is therefore recommended that perennial grasses which occur naturally in the area are considered for proactive use to stabilize the site after it has been cleared. A mix of fast growing annual and perennial grass species could be used, which could

include species such as *Cynodon dactylon* and *Cenchrus ciliaris*, which are readily available and easily established.

» The local environmental officials have recommended that any affected Baobab trees should be transplanted outside of the development footprint. There is one Baobab tree within the proposed area.
» Ensure that if new power lines are required, they are marked with bird flight diverters along their entire length.

6.2.2 Potential Impacts on Geology and Soils and Agricultural Potential

The proposed activity could carry potentially negative direct impacts in terms of soil degradation (erosion, soil removal, loosening, compaction, contamination/pollution, etc.) and agricultural potential. The activity may also lead to indirect impacts such as dust pollution and siltation away from the site. Negative impacts on soil would mainly occur during the construction phase. During the post construction and decommissioning phases the potential impacts are likely to be insignificant.

Potential positive impacts could potentially include a reduction in soil erosion in areas where new engineering solutions are put in place to rectify certain existing problems, such as improved drainage along poorly constructed and maintained roads. Other positive impacts relating to the geological environment on a regional/national scale could include a reduction in the demand for non-renewable energy sources (such as coal or uranium).

Erosion sensitivity can be broadly mapped according to the potential severity of erosion if land disturbing activities occur and this is generally affected by the geology, soil types and topography.

Specifically relating to the site, the geological map indicates that the study area is partially underlain by unconsolidated Quaternary sandy soils. Certain parts of the site have been identified as being sensitive in terms of erosion, however the site is classified as medium sensitivity (figure 6.2 below).

Table 6.1 broadly outlines the erosion sensitivity as a function of topography and geology.

Table 6.1: Water erosion sensitivity

Sensitivity Level	Topography/Geology	Comments/Recommendations
High	Natural drainage lines/ watercourses, steep slopes (high relief areas)	No-go areas without special mitigating measures. Erosion presently taking place.
Medium	Moderately to gently undulating hills and plains (low relief areas) where unconsolidated sediment occurs	Moderate levels of erosion will occur if land-disturbing activities take place (construction). Mitigating measures to be applied to minimise impact.
Low	Areas where rock outcrops at surface	Minor erosion will naturally occur. Normal mitigating measures apply.

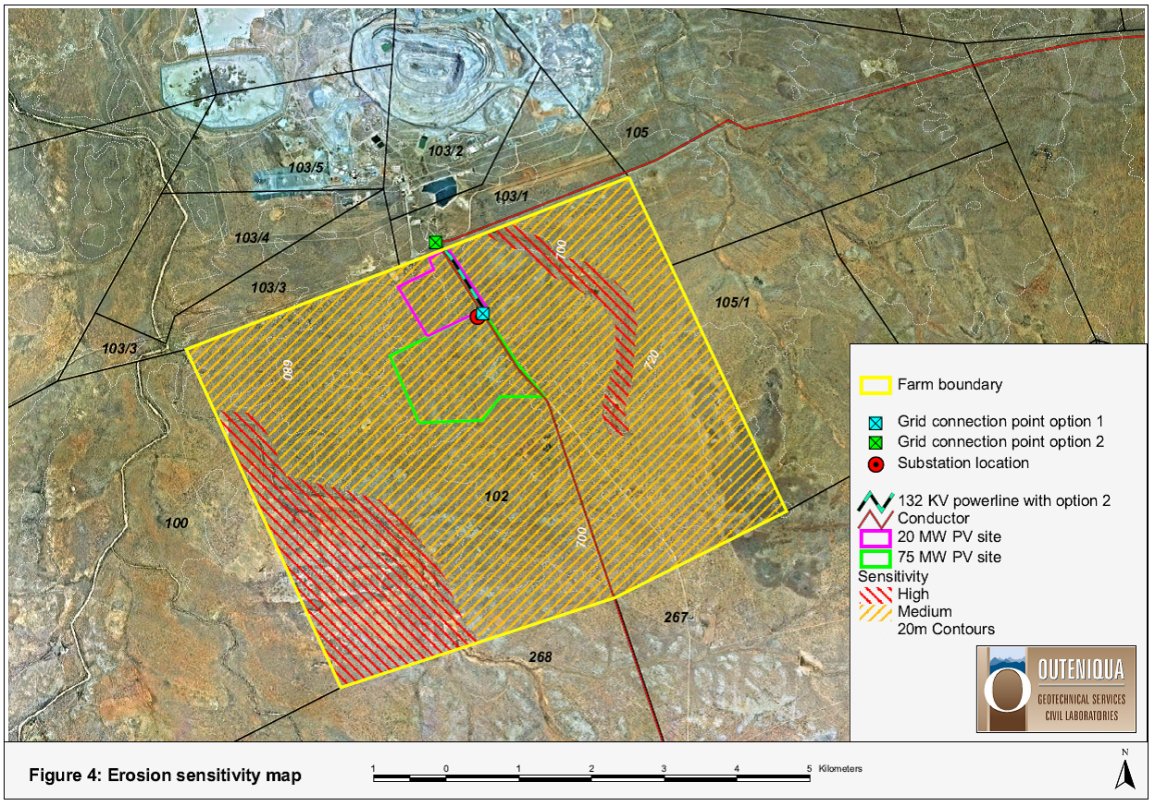

Figure 6.2: Erosion sensitivity map

The agricultural potential of the site is considered to be low and the proposed activity will not have any significant effect on this status. Some relocation of agricultural infrastructure (fences, camps, water points, etc.) and stock may be required to accommodate the proposed development, but this is not considered to have a significant impact on production apart from minor loss of grazing land.

Impact tables summarising the significance of impacts on geology and soils (with and without mitigation)

Nature: Soil degradation (soil removal, mixing, compaction, etc.) due to the construction of foundations for structures (PV panels, buildings, substations, power lines).		
	Without mitigation	***With mitigation***
Extent	Local (1)	Local (1)
Duration	Short term (2)	Very Short term (1)
Magnitude	Minor (2)	Minor (2)
Probability	Definite (5)	Definite (5)
Significance	**Low (25)**	**Low (20)**
Status	Negative	Negative
Reversibility	Partially reversible	Partially reversible
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes.	
Mitigation: » Rehabilitate topsoil & vegetation site after construction is completed.		
Cumulative impacts: » The cumulative impact of earthworks in the area is considered low at this stage due to the low density of development in the area. However, there Venetia Mine located north of the proposed solar energy site, contributes to soil degradation is the area. Further development of the area may have increasing impact on the natural soil.		
Residual impacts: » Minor loss of soil under structures.		

Nature: Soil degradation (soil removal, mixing, compaction, etc.) due to the construction of access roads.		
	Without mitigation	***With mitigation***
Extent	Local (1)	Local (1)
Duration	Long term (4)	Long term (4)
Magnitude	Low (4)	Minor (2)
Probability	Definite (5)	Definite (5)
Significance	**Moderate (45)**	**Moderate (35)**
Status	Negative	Negative
Reversibility	Irreversible	Reversible
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes.	
Mitigation: » Use existing roads if possible/practical. » Minimise the length and width of new access roads (preferably just gravel tracks). » Maintain access roads in good condition, preventing detours due to bad road conditions		
Cumulative impacts: » The cumulative impact of earthworks in the area is considered low at this stage due to the low density of development in the area. Further development of the area may have an increasing impact on the natural soil.		

Residual impacts:
» Minor loss of structures under roads.

Nature: Soil degradation due to pollution of soil by contaminants used on site during construction (e.g. fuel, oil, chemicals, cement).		
	Without mitigation	***With mitigation***
Extent	Local (1)	Local (1)
Duration	Medium term (3)	Very short term (1)
Magnitude	Minor (2)	Minor (2)
Probability	Probable (3)	Probable (3)
Significance	**Low (18)**	**Low (12)**
Status	Negative	Negative
Reversibility	Partially reversible	Partially reversible
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation:		
» Control use and disposal of potential contaminants or hazardous materials.		
» Remove contaminants and contaminated topsoil and replace topsoil in affected areas..		
Cumulative impacts:		
» The cumulative impact of soil pollution is considered low at present due to the undeveloped nature of the area but further development may have an increasing impact.		
Residual impacts:		
» Minor loss of soil potential		

Nature: Soil degradation due to increased soil erosion by wind and/or water on construction areas.		
	Without mitigation	***With mitigation***
Extent	Local (1)	Local (1)
Duration	Long term (4)	Short term (1)
Magnitude	Moderate (6)	Low (4)
Probability	Very probable (4)	Very probable (4)
Significance	**Moderate (44)**	**Low (24)**
Status	Negative	Negative
Reversibility	Practically irreversible	Practically irreversible
Irreplaceable loss of resources?	Practically irreplaceable	Practically irreplaceable
Can impacts be mitigated?	Yes.	
Mitigation:		
» Minimise size of the construction footprint/camp.		
» Restrict activity outside of construction camp areas.		
» Implement effective erosion control measures around site.		
» Carry out earthworks in phases across site to reduce the area of exposed ground at any one time.		
» Protect and maintain denuded areas and material stockpiles to minimise erosion and instability		

Cumulative impacts:
» The cumulative impact of soil erosion is considered low at present due to the undeveloped nature of the area but further development may have an increasing impact on soil erosion.
Residual impacts:
» Minor localised erosion.

Nature: Impact on existing land-use.	
	Without mitigation
Extent	Local (1)
Duration	Long term (4)
Magnitude	Minor (2)
Probability	Probable (4)
Significance	Low (28)
Status	Negative
Reversibility	Reversible
Irreplaceable loss of resources?	No
Can impacts be mitigated?	No
Mitigation:	
» Not possible	
Cumulative impacts:	
» The cumulative impact on land use is considered low at present due to the low intensity land-use practised on the site.	
Residual impacts:	
» Insignificant temporary loss of grazing land while facility is in use.	

Nature: Reduction in agricultural potential.		
	Without mitigation	***With mitigation***
Extent	Local (1)	Local (1)
Duration	Long term (4)	Long term (4)
Magnitude	Minor (2)	Minor (2)
Probability	Probable (4)	Probable (4)
Significance	**Low (28)**	**Low (28)**
Status	Negative	Negative
Reversibility	Reversible	Reversible
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	No	
Mitigation:		
» Not possible		
Cumulative impacts:		
» The cumulative impact of a reduction in the agricultural potential is considered low at present due to the low potential of the area.		
Residual impacts:		
» Minor loss of grazing land while facility is in use.		

An assessment of the potential indirect impacts associated with the proposed development is provided below.

Nature: Degradation of waterways due to increased siltation downstream from site.		
	Without mitigation	***With mitigation***
Extent	Regional (3)	Local (1)
Duration	Long term (4)	Long term (4)
Magnitude	Low (4)	Minor (2)
Probability	Probable (3)	Probable (3)
Significance	**Moderate (33)**	**Low (21)**
Status	Negative	Negative
Reversibility	Irreversible	Irreversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	
Mitigation: » Install anti-erosion measures such as silt fences, geosynthetic erosion protection, and/or flow attenuation along watercourses below construction sites. » Strictly control activity near water courses/natural drainage lines as sediment transport is higher in these areas. » Minimise increased run-off from hard surfaces (PV panels) by channelising and capturing rainwater for re-use (rainwater harvesting)		
Cumulative impacts: » The cumulative impact of siltation in the area is considered low at present but further development may have an increasing impact on siltation of waterways.		
Residual impacts: » Minor localised movement of soil across site		

Nature: Increased dust pollution from construction sites affecting surroundings.		
	Without mitigation	***With mitigation***
Extent	Regional (2)	Local (1)
Duration	Very short term (1)	Very short term (1)
Magnitude	Low (4)	Minor (2)
Probability	Highly probable (4)	Highly probable (4)
Significance	**Low (28)**	**Low (16)**
Status	Negative	Negative
Reversibility	Irreversible	Irreversible
Irreplaceable loss of resources?	Yes, minor	Yes, insignificant
Can impacts be mitigated?	Yes	
Mitigation: » Apply dust control measures such as straw bales or dampen dusty denuded areas.		
Cumulative impacts: » The cumulative impact of dust in the area is considered low.		
Residual impacts:		

» Minor localised dust pollution

Nature: Reduction in demand for non-renewable energy sources.	
	Without mitigation
Extent	National (3)
Duration	Long term (4)
Magnitude	Moderate (6)
Probability	Very probable (4)
Significance	**Moderate (52)**
Status	Positive
Reversibility	N/A
Irreplaceable loss of resources?	N/A
Can impacts be mitigated?	N/A
Mitigation: N/A	
Cumulative impacts: » The cumulative positive impact on a national scale is considered very high	
Residual impacts: N/A	

Implications for Project Implementation

» The proposed development of a PV/CPV facility on the site will not have large impacts due to the low agricultural potential of the site.
» The only significant potential negative impacts on the geological environment are soil degradation issues as a result of construction activity and its effect on soil stability and soil-forming processes. However, with effective implementation of mitigating measures, these impacts are considered to have a low to moderate significance, requiring diligent attention from the engineers, environmental officers and contractors, but not posing a threat to the status-quo or the feasibility of the development.
» The potential positive impacts on the geological environment are considered to have a moderate significance on a local scale but the cumulative impact of a reduction in demand and extraction/mining of non-renewable energy sources on a national scale is very significant.
» The Venetia Mine is a significant contributor to cumulative soil degradation in the broader study area. In comparison, the proposed solar energy development is considered to be a relatively small contributor to the cumulative impact of the degradation of the local soil resource.

6.2.3 Assessment of Potential Impacts on Heritage Sites

Potential impacts on heritage sites relate to the direct loss of these features during construction or an indirect impact in terms of visual impacts during operation.

The up to 75 MW site could be constructed in any part of the study area as no culturally sensitive sites were identified. The site lies on the southern boundary of the Mapungubwe World Heritage Site (WHS) and Cultural Landscape. However no impacts on this aspect are anticipated due to the distance between this site and the proposed development area.

Impact tables summarising the significance of impacts on heritage sites, or objects (with and without mitigation)

Archaeological Sites - Pre-Contact Heritage (Stone Age Sites)

Nature: Localised damage to the sites Possible post-contact site could be damaged locally by excavation activities and associated activities		
	Without Mitigation	**With Mitigation**
Extent	Local (2)	Local (2)
Duration	Long term (5)	Long term (5)
Magnitude	Medium (4)	Low (1)
Probability	Probable (3)	Improbable (1)
Significance	**Medium (33)**	**Low (8)**
Status	Negative	Positive
Reversibility	Irreversible	Irreversible
Irreplaceable loss of resources?	Yes	No
Can impacts be mitigated?	No	Yes
Mitigation » Excavation activities should be monitored by a qualified heritage practitioner » Should archaeological sites be uncovered during construction, the relevant heritage authority should be consulted and a permit obtained if required.		
Cumulative impacts: » None.		
Residual impacts: » Loss of heritage related information		

Paleontological sites

No paleontological sites of high value could be identified. Paleontological sites could be affected if bedrock was to be disturbed during the excavation activities associated with the construction of foundations. It was however determined that the ground intrusion of the development would be limited and that base rock would not be affected.

Nature: : Paleontological sites could be affected if bedrock was to be disturbed during the excavation activities associated with the construction		
	Without Mitigation	**With Mitigation**
Extent	Local (2)	Local (2)

Duration	Short term (2)	Long term (5)
Magnitude	Low (2)	Low (1)
Probability	Improbable (2)	Improbable (1)
Significance	**Low (12)**	**Low (8)**
Status	Negative	Positive
Reversibility	Irreversible	Reversible
Irreplaceable loss of resources?	Yes	No
Can impacts be mitigated?	No	Yes
Mitigation		
» No further mitigation is recommended provided bedrock is not to be disturbed.		
» Paleontological monitoring during excavation activities if bedrock is to be disturbed.		
Cumulative impacts:		
» None		
Residual impacts:		
» None		

Built Environment

Although some built structures were noted, none will be affected by the proposed development.

Nature: No sites falling within the Built Environment were identified within the study.		
	Without Mitigation	**With Mitigation**
Extent	Local (1)	Local (1)
Duration	Short term (1)	Long term (1)
Magnitude	Low (1)	Low (1)
Probability	Improbable (1)	Improbable (1)
Significance	**Low (3)**	**Low (3)**
Status	Positive	Positive
Reversibility	Reversible	Reversible
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	Yes
Mitigation		
» No sites were identified as being affected by the proposed development, and therefore no mitigation is recommended.		
Cumulative impacts:		
» None		
Residual impacts:		
» None		

Implications for Project Implementation

» Should archaeological sites or graves be exposed during construction work, work in the area must be stopped and the find must immediately be reported to

a suitably qualified heritage practitioner such that an investigation and evaluation of the finds can be made.

6.2.4 Assessment of Potential Visual Impacts

The topography and the major ridgelines of the area were determined and mapped by using a *Digital Elevation Model*[7] (DEM). The project site is located at a mean elevation of approximately 715 m above sea level on a slight westerly slope. The DEM shows that there are no prominent topographical manifestations in close proximity to the project site from which the proposed activity is particularly visually exposed. Furthermore, the project site is located below any ridgeline. The proposed activity will therefore not impact on the skyline.

In order to quantify and assess the visibility and potential impact of the proposed activity and to provide a basis for selecting appropriate observation points outside of the project site, a photographic study and analysis was undertaken from the project site. A selection of Key Observation Points is therefore included under Annexure 1 of the Visual Impact Assessment Report in Appendix G) The figure below illustrate the nature of the landscape in the vicinity of the project site.

[7] A Digital Elevation Model (DEM) is a geographic information system-based outcome generated from contours for a specific area. In this instance, 20m contour intervals for reference sheet nos. 2228bd, 2228db, 2229ac, 2229ad, 2229ca, 2229cb, 2229bc and 2229da were used to calculate the DEM for the region.

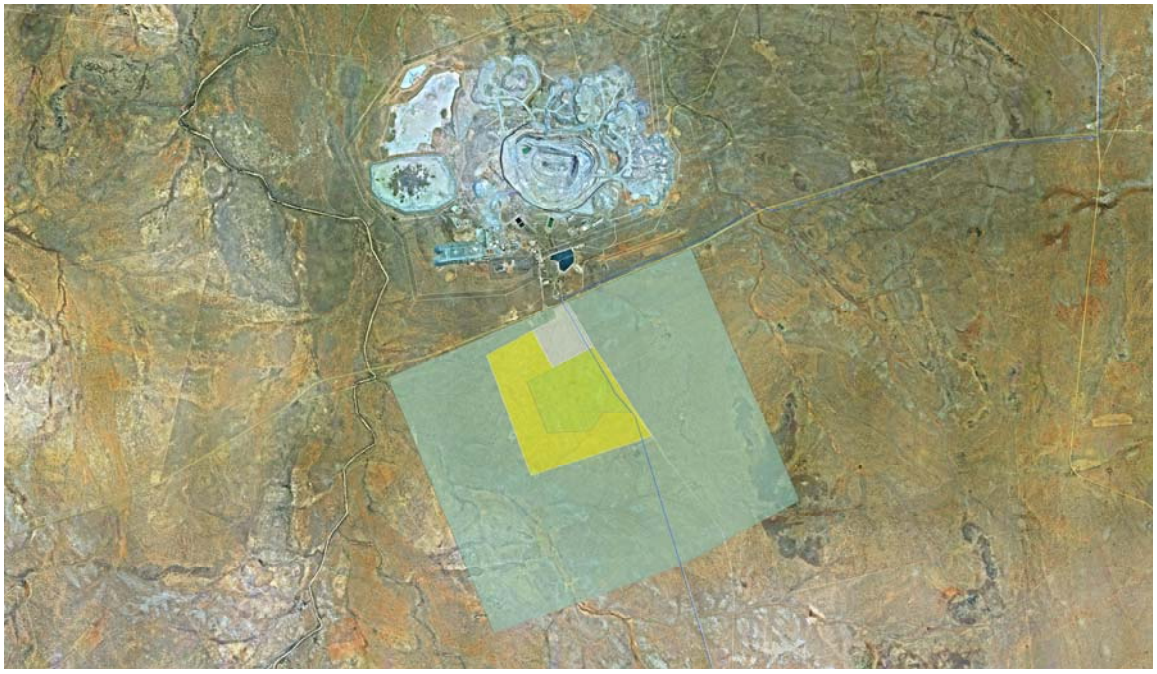

Figure 6.3: Aerial photograph illustrating the nature of the landscape of the project site. The white hatch illustrates the position of the 20MW PV/CPV plant while the yellow indicate the 75MW PV/CPV plant. The green portion polygon on the yellow portion indicated the proposed location of the PV/CPV plant

Digital Viewshed Analysis

A viewshed[8] analysis was undertaken in accordance with the *Guideline Document for involving Visual Specialists in EIA Processes*. Geographic Information Systems (GIS) technology was used to analyse and map information in order to understand the relationships that exist between the observer and the observed view. Key aspects of the viewshed are as follows:

» It is based on a *single viewpoint* from the highest point of the combined 20MW and 75MW sites.
» It is calculated from 20m above natural ground level (i.e. maximum height of the proposed development).
» It represents a '*broad-brush' designation*, which implies that the zone of visual influence may include portions that are located in a view of shadow and it is therefore not visible from the project site and vice versa. This may be as a result of landscape features such as vegetation, buildings and infrastructure not taken into consideration by the DEM.

[8] A viewshed is defined as '*the outer boundary defining a view catchment area, usually along crests and ridgelines. Similar to a watershed*'. A Viewshed Analysis is therefore the study into the extent to which a defined area is visible to its surroundings.

» As illustrated by the viewshed (refer to Figure 6.4 below), the primary *zone of visual influence*[9] is located in an easterly and north-easterly direction up to 30km from the project site. The GIS-generated viewshed illustrates a theoretical *zone of visual influence*. This does not mean that the proposed activity would be visible from all observation points in this area. The *zone of visual influence* is closely associated with the most prominent topographical features to the northeast.

Key Aspects of the Viewshed

The distance between the observer and the observed activity is an important determinant of the magnitude of the visual impact. This is due to the visual impact of an activity diminishing as the distance between the viewer and the activity increases. Viewsheds are categorised into three broad categories of significance, namely:

a) Foreground: The foreground is defined as the area within 1km from the observer within which details such as colour, texture, styles, forms and structure can be recognised. Objects in this zone are highly visible unless obscured by other landscape features, existing structures or vegetation.
b) Middle ground: The middle ground is the area between 1km and 3km from the observer where the type of detail which is clearly visible in the foreground becomes indistinguishable. Objects in the middle ground can be classified as visible to moderately visible, unless obscured by other elements within the landscape.
c) Background: the background stretches from approximately 3km onwards. Background views are only distinguishable by colour and lines, structures, textures, styles and forms are often not visible (SRK Consulting, 2007).

As is illustrated by the figure 6.4 below, no large settlement areas are within a 30km radius from the project site. The identified receptors are likely to be residents and farm workers on the farms in the region as well as the Venetia mine itself and residents of the Venetia mine settlement on a portion of the Farm Gotha 102-MS next to the Venetia access road. The latter is considered to be in the *foreground* while all other receptors are located in the *middle* to *background.*

However, the main view corridor, namely the Venetia access road falls within the *foreground*, *middle ground* and *background*, while the proposed activity will theoretically only be visible from the *middle* and *background*.

[9] Zone of visual influence is defined as *'An area subject to the direct visual influence of a particular project'.*

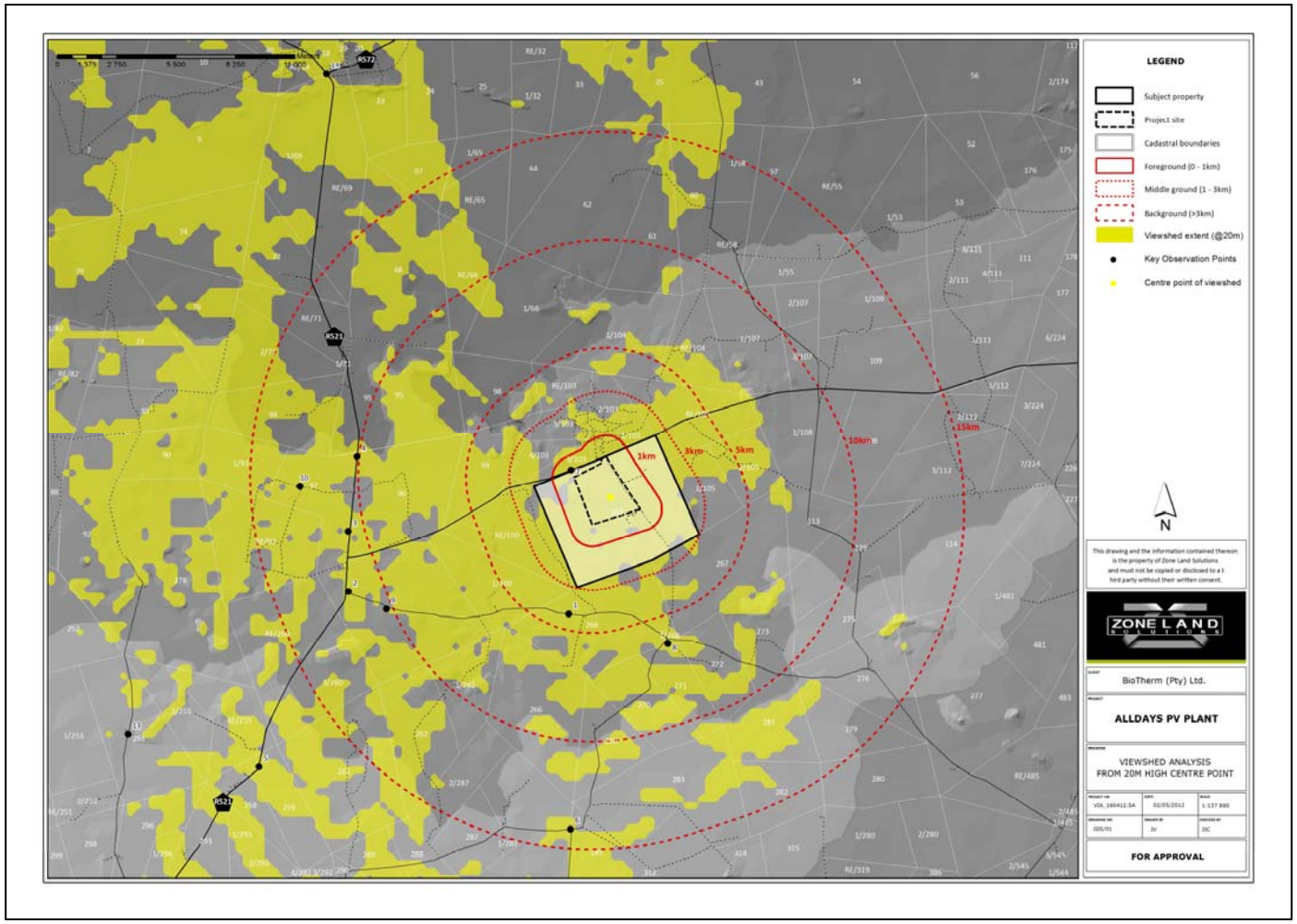

Figure 6.4: Viewshed generated from the project site.

Selection of Observation Points

A total of 15 Key Observation Points (KOPs) were provisionally identified and selected within the defined viewshed for the visual assessment in accordance with the selection criteria stipulated in the Visual Guidelines. As a result of the similarity in the assessment results of the KOPs, the description and assessment of only four KOPs are included in Annexure 1 of the VIA contained in Appendix G.

Impact tables summarising the significance of visual impacts of the PV facility (with and without mitigation)

Nature: Potential visual impact on the sensitive receptors in the foreground and the middle ground.

The sensitive receptors in the *foreground* and *middle ground* of the generated viewshed represents the Venetia access road, the Venetia mine and a secondary road south of the proposed project site. The latter road does not serve as a mobility route but only to provide access to adjacent farms. It is therefore not likely that many observers will travel along this route.

The proposed activity will represent a change in land use and land form to what is currently the status quo on the project site. The introduction of foreign structures and forms in the bushveld landscape will have a potentially significant impact on sensitive receptors as described in the table below.

	No mitigation	***Mitigation considered***
Extent	Local (2)	Local (2)
Duration	Long term (4)	Long term (4)
Magnitude	Medium (6)	Minor (4)
Probability	Probable (3)	Probable (3)
Significance	**Medium (36)**	**Medium (30)**
Status	Negative	Negative
Reversibility	Recoverable (3)	Recoverable (3)
Irreplaceable loss of resources?	No	No
Can impacts be mitigated	Yes	

Mitigation:

» Keep disturbed areas to a minimum.

» No clearing of land to take place outside the demarcated footprint.

» Institute a rigorous planting regime along the boundaries of the site. Only indigenous plant species to be introduced. Attend especially to the northern boundary of the proposed activity.

» Buildings and similar structures must be in keeping with regional planning policy documents, especially the principles of critical regionalism, namely sense of place, sense of history, sense of nature, sense of craft and sense of limits.

» Consider establishing a private nature reserve on the remaining land (outside the development footprint).

Cumulative impacts:

The Venetia mine, airfield, substation and associated industrial-type infrastructure already afford the area a sense of disturbance. The proposed activity will therefore add to the cumulative impact of the area in a negligible manner.

Residual impacts:

» It is very possible that the status quo could be regained after decommissioning of the plant. Providing that the site is completely rehabilitated. The visual impact will therefore also be removed.

Nature: Potential visual impact on the sensitive receptors in the background.

Visual receptors in the *background* represent a mix of farmsteads, game ranges and mobility routes. The envisaged development components are constant and similar to the aspects described above, the likelihood of these structures being visible from a greater distance is however the only variable.

Various photographs taken from key observation points in the background illustrate the extent to which the site is visible from a greater distance (refer to Annexure 1 of the VIA contained in Appendix G).

	No mitigation	***Mitigation considered***
Extent	Local (2)	Local (2)
Duration	Long term (4)	Long term (4)
Magnitude	Low (2)	Low (2)
Probability	Improbable (2)	Improbable (2)
Significance	**Low (16)**	**Low (16)**
Status	Neutral	Neutral
Reversibility	Recoverable (3)	Recoverable (3)
Irreplaceable loss of resources?	No	No
Can impacts be mitigated	Yes	

Mitigation:

» Keep disturbed areas to a minimum.

» No clearing of land to take place outside the demarcated footprint.

» Institute a rigorous planting regime along the boundaries of the site. Only indigenous plant species to be introduced. Attend especially to the northern boundary of the proposed activity.

» Buildings and similar structures must be in keeping with regional planning policy documents, especially the principles of critical regionalism, namely sense of place, sense of history, sense of nature, sense of craft and sense of limits.

Cumulative impacts:

It is near impossible to distinguish built forms and structures such as the proposed PV/CPV structures at distances greater than 5km. A tower structure of 20m in height might add to the cumulative impact although visual studies have confirmed that such as structure would not be visible at great distances (measured against the existing neighbouring mining structures).

Residual impacts:

» It is very possible that the status quo could be regained after decommissioning of the plant. Providing that the site is completely rehabilitated. The visual impact will therefore also be removed.

Nature: Potential visual impact on the sense of place of the Musina region.

The sense of place of the wider region is very much one of Bushveld game farms. However, as the observer approach the project site, the increase in infrastructure becomes apparent and the character changes to an industrialised area. The project site has to a large degree lost much of its sense of place attributes due to the mining activities.

	No mitigation	***Mitigation considered***
Extent	Local (2)	Site related (1)
Duration	Long term (4)	Long term (4)
Magnitude	Minor (4)	Low (2)
Probability	Probable (3)	Probable (3)
Significance	**Medium (30)**	**Low (21)**
Status	Negative	Negative
Reversibility	Recoverable (3)	Recoverable (3)
Irreplaceable loss of resources?	No	No
Can impacts be mitigated	Yes	

Mitigation:

» Keep disturbed areas to a minimum.

» No clearing of land to take place outside the demarcated footprint.

» Institute a rigorous planting regime along the boundaries of the site. Only indigenous plant species to be introduced. Attend especially to the northern boundary of the proposed activity.

» Buildings and similar structures must be in keeping with regional planning policy documents, especially the principles of critical regionalism, namely sense of place, sense of history, sense of nature, sense of craft and sense of limits.

» Consider establishing a private nature reserve on the remaining land (outside the development footprint).

» Encourage grasses to establish underneath the PV 'string' to provide a more natural character.

Cumulative impacts:

It is near impossible to distinguish built forms and structures at distances greater than 5km. A tower structure of 20m in height might therefore only add to the cumulative impact of sense of place in the *foreground* and *middle ground*.

Residual impacts:

» It is very possible that the status quo could be regained after decommissioning of the plant. Providing that the site is completely rehabilitated. The visual impact will therefore also be removed.

Nature: Potential visual impact of the construction period on visual receptors.

Construction periods are often characterised by an increase in construction vehicles and personnel and their associated impacts such as dust clouds, noise, potential pollution, safety considerations, etc.

	No mitigation	***Mitigation considered***
Extent	Regional (3)	Local (2)
Duration	Very short term (1)	Very short term (1)
Magnitude	Medium (6)	Medium (6)
Probability	Probable (3)	Improbable (2)
Significance	**Medium (30)**	**Low (18)**
Status	Negative	Negative
Reversibility	Recoverable (3)	Recoverable (3)
Irreplaceable loss of resources?	No	No
Can impacts be mitigated	Yes	

Mitigation:

» A *Construction Phase* and *Operational Phase* Environmental Management Programme must be prepared which would guide and control all aspects of the activity, including visual aspects.

» An Environmental Control Officer (ECO) must be appointed to oversee the construction process and ensure compliance with conditions of approval.

» An Environmental Management Specifications document (Specs) must be prepared to form part of the Basic Assessment Report and be adhered to. The document is to describe specifications for the pre-construction and construction phase of the project and include *inter alia* the following:

- o Details on aspects such as scope, interpretation, materials, the plant, tolerances, etc.
- o method statements for all identified aspects such as access routes, plant clearing, anchors, bunding, environmental awareness, fuel spills, rehabilitation, sensitive habitat , traffic, etc.

» Reduce and control dust through the use of approved dust suspension techniques as and when required (Venetia enforces a strict dust control policy which could be enforced on site).

» Rehabilitate all disturbed areas (construction sites and roads) immediately after completion of construction works

Cumulative impacts:

» None

Residual impacts:

» None.

Nature: Potential visual impact of artificial lighting as a result of the activity during operational phase.

The project site has a very low incidence of light sources. A slight sky glow effect is however visible at night at the Venetia mine. Direct, open light sources are also visible at night. The PV 'string' of the proposed activity will not include lights of any kind, however, the associated ancillary buildings and infrastructure may include some degree of lighting.

Apart from the tower structure, it is not expected that the proposed activity will contribute to the effects of sky glow or artificial lighting of the area. In order to ensure this, the proposed mitigation measures will have to be complied with.

	No mitigation	***Mitigation considered***
Extent	Regional (3)	Regional (3)
Duration	Long term (4)	Long term (4)
Magnitude	Minor (4)	Minor (4)
Probability	Probable (3)	Probable (3)
Significance	**Medium (33)**	**Medium (33)**
Status	Negative	Negative
Reversibility	Recoverable (3)	Recoverable (3)
Irreplaceable loss of resources?	No	No
Can impacts be mitigated	Yes	

Mitigation:

» Outdoor lighting must be strictly controlled so as to prevent light pollution.

» All lighting must be installed at downward angles.

» Sources of light must as far as possible be shielded by physical barriers.

» Consider the application of motion detectors to allow the application of lighting only where and when it is required.

Cumulative impacts:

The immediate surrounding area to the project site is already impacted by lighting. The proposed will contribute to the cumulative lighting effect although it is expected to be negligible in a regional context.

Residual impacts:

» It is very possible that the status quo could be regained after decommissioning of the plant.

Nature: Potential visual impact of reflection of the PV/CPV Panels on the sensitive receptors.

Photovoltaic solar panels are designed to absorb sunlight in order to convert it into electricity. The more sunlight that is absorbed, the more energy that can be produced. A monocrystalline silicon solar cell absorbs two-thirds of the sunlight reaching the panel's surface. This effectively means that only one-third of the sunlight reaching the surface of a solar panel has a chance to be reflected.

In addition, the PV panels have a reflectivity of around 30%, while surface materials such as dry sand has a reflectivity of around 45% and grass-type vegetation at 25%. Moreover, PV panels are installed at a fixed angle of around 30°.

Concentrated solar plants, on the other hand, are designed to reflect as much as possible light to a defined point. This type of plant, therefore, has the potential to impact on receptors, if not properly managed and maintained.

As the majority of receptors in the region are located at more or less the similar height of the project site (±40m variation), the solar panels will therefore not noticeably alter the site's current amount of reflected, indirect sunlight. Nor will a CPV reflect light into or in the direction of any receptors.		
	No mitigation	***Mitigation considered***
Extent	Regional (3)	Regional (3)
Duration	Long term (4)	Long term (4)
Magnitude	Medium (6)	Medium (6)
Probability	Improbable (2)	Improbable (2)
Significance	**Low (26)**	**Low (26)**
Status	Neutral	Neutral
Reversibility	Recoverable (3)	Recoverable (3)
Irreplaceable loss of resources?	No	No
Can impacts be mitigated	Yes	
Mitigation: » Consider installing anti-reflective coating or glass to reduce the sunlight that is reflected from PV panels and increase the amount of sunlight that is absorbed.		
Cumulative impacts: The introduction of all kinds of solar panels, coupled with the existing substation on site and the adjacent industrial buildings, contribute to an increased cumulative visual impact.		
Residual impacts: » The status quo could be regained after decommissioning of the plant, providing that the site is rehabilitated to its current state		

Implications for Project Implementation

» The anticipated visual impacts identified are expected to be of moderate to low significance following the implementation of mitigation measures as recommended.
» A lighting engineer should be consulted to assist in the planning and placement of light fixtures in order to reduce visual impacts associated with glare and light trespass.

6.3.5 Assessment of Potential Social Impacts

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/CPV 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.

Social Impacts associated with the Construction Phase

The key social issues associated with the construction phase include:

Potential positive impacts

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

Potential negative impacts

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

Nature of Impact: Creation of employment and business opportunities during the construction phase

Based on the information provided by the proponent the construction phase for a 75MW solar PV/CPV facility is expected to extend over a period of 18-24 months and create approximately 291 employment opportunities, depending on the final design. Of this total ~ 60% (175) will be available to low-skilled workers (construction labourers, security staff etc.), 15% (43) to semi-skilled workers (drivers, equipment operators etc.) and 25% (73) to skilled personnel (engineers, land surveyors, project managers etc.). The work associated with the construction phase will be undertaken by contractors and will include the establishment of the solar facility and the associated components, including, access roads, services and power line.

The majority of the low-skilled employment opportunities associated with the project are likely to benefit members from the local community. In this regard the majority of the beneficiaries are likely to be historically disadvantaged (HD) members of the community. The low education and skills levels in the area may however hamper potential opportunities for local communities. The majority of the skilled and semi-skilled opportunities are likely to be associated with the contactors appointed to construct the proposed solar facility and the associated infrastructure. The majority of contractors also tend to use their own staff and this may limit the potential for direct employment opportunities for locals during the construction phase. In the absence of specific commitments by the developer to set local employment targets the potential benefits for local communities are likely to be limited.

The hospitality industry in Musina and local guest farms and B&Bs are also likely to benefit from the provision of accommodation and meals for professionals (engineers, quantity surveyors, project managers, product representatives etc.) and other (non-construction) personnel involved on the project. Experience from other large construction projects indicates that the potential opportunities are not limited to on-site construction workers but

also to consultants and product representatives associated with the project.		
	Without enhancement	**With enhancement**
Extent	Local – Regional (2) (Rated as 2 due to potential opportunities for local communities and businesses)	Local – Regional (3) (Rated as 3 due to potential opportunities for local communities and businesses)
Duration	Short Term (2)	Short Term (2)
Magnitude	Low (4)	Low (4)
Probability	Probable (3)	Highly probable (4)
Significance	Low (24)	Medium (36)
Status (positive or negative)	Positive	Positive
Reversibility	N/A	
Irreplaceable loss of resources?	N/A	
Can impacts be enhanced?	Yes	

***Mitigation*:**

Employment

» Where reasonable and practical, BioTherm 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 Black Economic Empowerment (BEE) criteria.

» Before the construction phase commences BioTherm should meet with representatives from the MLM 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 BioTherm intends following for the construction phase of the project.

» 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

» BioTherm should seek to develop a database of local companies, specifically BEE 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;

» Where possible, BioTherm should assist local BEE companies to complete and submit the required tender forms and associated information.

» The MLM, in conjunction with the local Chamber of Commerce and representatives from the local hospitality industry, should identify strategies aimed at maximising the potential

benefits associated with the project. Note that while preference to local employees and companies is recommended, it is recognised that a competitive tender process may not guarantee the employment of local labour for the construction phase.
Cumulative impacts: » Opportunity to up-grade and improve skills levels in the area. However, due to relatively small number of local employment opportunities this benefit is likely to be limited.
Residual impacts: » Improved pool of skills and experience in the local area. However, due to relatively small number of local employment opportunities this benefit is likely to be limited.

Nature of Impact: ***Potential impacts on family structures and social networks associated with the presence of construction workers***

The presence of construction workers poses a potential risk to family structures and social networks in the area. In addition there are a number of potentially vulnerable farming activities, such as livestock farming. The potential threat to farming activities is discussed below.

While the presence of construction workers does not in itself constitute a social impact, the manner in which construction workers conduct themselves can impact on the local community. In this regard the most significant negative impact is associated with the disruption of existing family structures and social networks. This risk is linked to the potential behaviour of male construction workers, including:

» An increase in alcohol and drug use;
» An increase in crime levels;
» The loss of girlfriends and or wives to construction workers;
» An increase in teenage and unwanted pregnancies;
» An increase in prostitution;
» An increase in sexually transmitted diseases (STDs).

Employing members from the local community to fill the low-skilled job categories can help to reduce the risk and mitigate the potential impacts on the local communities. These workers will be from the local community and form part of the local family and social network and, as such, the potential impact will be low. The use of local residents to fill the low skilled job categories will also reduce the need to house construction workers on the site.

Phase: Construction phase		
	Without enhancement	**With enhancement**
Extent	Local (3) (Rated as 3 due to potential severity of impact on local communities)	Local (2) (Rated as 1 due to potential severity of impact on local communities)
Duration	Short term for community as a whole (2) Long term-permanent for individuals who may be affected by STDs etc. (5)	Short term for community as a whole (2) Long term-permanent for individuals who may be affected by STDs etc. (5)
Magnitude	Low for the community as a whole (4) High-Very High for specific individuals who may be affected by STDs etc. (10)	Low for community as a whole (4) High-Very High for specific individuals who may be affected by STDs etc. (10)
Probability	Probable (3)	Probable (3)
Significance	Low for the community as a whole (27)	Low for the community as a whole (24)

	Moderate-High for specific individuals who may be affected by STDs etc. (57)	Moderate-High for specific individuals who may be affected by STDs etc. (51)
Status (positive or negative)	Negative	Negative
Reversibility	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 impacts be enhanced?	Yes, to some degree. However, the risk cannot be eliminated	

***Mitigation*:**

The potential risks associated with construction workers can be mitigated. The aspects that should be covered include:

- Where possible, BioTherm 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.
- BioTherm should consider the establishment of a Monitoring Forum (MF) for the construction phase which 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.
- BioTherm and the contractor 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.
- BioTherm 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 the site on a daily basis.
- The contractor should make the necessary arrangements for allowing workers from outside the area to return home over weekends and or on a regular basis during the 18-24 month construction phase. This would reduce the risk posed by construction workers to local family structures and social networks.
- It is recommended that no construction workers, with the exception of security personnel, should be permitted to stay overnight on the site. This will make it possible to manage the potential impacts effectively.

Cumulative impacts:

- Impacts on family and community relations that may, in some cases, persist for a long period of time. 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.

Residual impacts:

» See cumulative impacts.

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

The presence of construction workers on the site increases the potential risk of stock theft and poaching. The movement of construction workers on and off the site also poses a potential threat to farm infrastructure, such as fences and gates, which may be damaged. Stock and game losses may also result from gates being left open and/or fences being damaged.

The representative from De Beers indicated that the presence of a large number of construction workers in the area was a concern for the mine (Davies – pers. comm). The manager of Ceon Farm also indicated that theft (diesel, equipment etc.) was an issue in the area (Daneel – pers. com). Concerns were also raised regarding potential poaching for bush meat. Small stock (limited sheep and goats on a number of properties) are also at risk, but are far less valuable than game which may be killed or injured by wire snares (Maree – pers. comm). The increased number of construction workers in the area may result in an increase in poaching etc. However, with effective controls the potential risks can be reduced.

	Without enhancement	**With enhancement**
Extent	Local (4) (Rated as 4 due to potential severity of impact on local farmers)	Local (2)
Duration	Short Term (2)	Short Term (2)
Magnitude	Moderate (6) (Due to reliance on agriculture and livestock for maintaining livelihoods)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	Medium (36)	Low (24)
Status (positive or negative)	Negative	Negative
Reversibility	Yes, compensation paid for stock losses etc.	
Irreplaceable loss of resources?	No	
Can impacts be enhanced?	Yes	

***Mitigation*:**

The mitigation measures that can be considered to address the potential impact on livestock, game, and farm infrastructure include:

» BioTherm should enter into an agreement with the affected landowner/s 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.;

- » BioTherm 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 BioTherm and the contractors before the contractors move onto site.
- » BioTherm 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 the Code of Conduct to be signed between BioTherm, 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 BioTherm 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 BioTherm should ensure that construction workers who are found guilty of stealing livestock, poaching and/or damaging farm infrastructure are dismissed and charged. This should be 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:

- » None, provided losses are compensated for.

Residual impacts:

- » None, provided losses are compensated for.

Nature of impact: ***Potential loss of livestock, crops and houses, damage to farm infrastructure and threat to human life associated with increased incidence of veld fires***

The presence of construction workers and construction-related activities on the site poses an increased risk of veld fires that in turn pose a threat to the livestock, wildlife, and farmsteads in the area. In the process, farm infrastructure may also be damaged or destroyed and human lives threatened. The farms in the area are dependent on grazing for their game and livestock. Any loss of grazing due to a fire would therefore impact negatively on the livelihoods of the affected farmers. The potential risk of veld fires is likely to be higher during the dry, winter months.

	Without enhancement	**With enhancement**
Extent	Local (4) (Rated as 4 due to potential severity of impact on local farmers)	Local (2) (Rated as 2 due to potential severity of impact on local farmers)
Duration	Short Term (2)	Short Term (2)

Magnitude	Moderate-High due to reliance on livestock for maintaining livelihoods (8)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	Medium (42)	Low (24)
Status (positive or negative)	Negative	Negative
Reversibility	Yes, compensation paid for stock and crop losses etc.	
Irreplaceable loss of resources?	No	
Can impacts be enhanced?	Yes	

***Mitigation*:**

BioTherm should enter into an agreement with the affected landowners whereby the company will compensate for damages. This includes losses associated veld fires. In addition, the potential increased risk of veld fires can be effectively mitigated. The detailed mitigation measures are outlined in the EMP for the construction and operation phases. The aspects that should be covered include:

- Contractor to ensure that open fires on the site for cooking or heating are not allowed except in designated areas.
- Contractor to ensure that construction related activities that pose a potential fire risk, such as welding, are properly managed and are confined to areas where the risk of fires has been reduced. Measures to reduce the risk of fires include clearing working areas and avoiding working in high wind conditions when the risk of fires is greater. In this regard special care should be taken during the high risk dry, windy winter months.
- Contractor to provide adequate fire fighting equipment on-site.
- Contractor to provide fire-fighting training to selected construction staff.
- As per the conditions of the Code of Conduct, in the advent of a fire being caused by construction workers and or construction activities, the appointed contractors must compensate farmers for any damage caused to their farms. The contractor should also compensate the fire fighting costs borne by farmers and local authorities.

In addition, the landowner should ensure that they join the local fire protection agency.

Cumulative impacts:

- No, provided losses are compensated for.

Residual impacts:

- See cumulative impacts.

Nature of impact: Potential noise, dust and safety impacts associated with movement of construction related traffic to and from the site

The movement of heavy construction vehicles during the construction phase has the potential to damage roads and create noise, dust, and safety impacts for other road users and local communities in the area. However, the current road-use frequency along the Bridgewater-Musina gravel road to the south of Venetia mine is low.

The potential impacts associated with the construction phase, specifically dust and

generation of waste water, and the potential to impact on the environmental monitoring programme at Venetia Mine was raised as a key issue by De Beers. The generation of dust and waste water during the construction phase has the potential to compromise the dust and groundwater monitoring programme at the Venetia Mine. In addition, concerns were raised that the Venetia substation may need to shut down when the solar facility is connected to the grid. This is a potentially key issue and would impact on daily operations at the mine. In this regard the representative from Be Beers indicated that the potential impact on the mine associated with commissioning needed to be better understood (Davies, pers com.).

The potential social impacts associated with the construction related activities and the movement of construction related traffic can be effectively mitigated. As a result the significance with mitigation is rated to be Low Negative. However, BioTherm and De Beers should meet to discuss the timing of the construction phase and necessary mitigation measures that need to be put in place.

	Without mitigation	**With mitigation**
Extent	Local (2)	Local (1)
Duration	Short Term (2)	Short Term (2)
Magnitude	Low (4)	Minor (2)
Probability	Probable (3)	Probable (3)
Significance	Low (24)	Low (15)
Status (positive or negative)	Negative	Negative
Reversibility	Yes	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	Yes	

***Mitigation*:**

BioTherm should enter into an agreement with the affected landowners whereby the company will compensate for damages. This includes losses associated with damage to local internal farm roads that are affected by the site. In addition, the potential impacts associated with the construction phase and the movement of heavy vehicles can be effectively mitigated. The aspects that should be covered include:

- BioTherm and De Beers should make the necessary arrangements to meet and discuss the timing of the construction phase and necessary mitigation measures that need to be put in place.
- The contractor must ensure that damage caused to roads by the construction related activities, including heavy vehicles, is repaired before the completion of the construction phase. The costs associated with the repair must be borne by the contractor.
- Dust suppression measures must be implemented for heavy vehicles such as wetting of gravel roads on a regular basis and ensuring that vehicles used to transport sand and building materials are fitted with tarpaulins or covers.
- All vehicles must be road-worthy and drivers must be qualified and made aware of the potential road safety issues and need for strict speed limits.

Cumulative impacts:

- If damage to roads is not repaired then this will affect the farming activities in the area and result in higher maintenance costs for vehicles of local farmers and other road users. The costs will be borne by road users who were no responsible for the damage.

Residual impacts:

» None provided roads affected by construction activities are repaired

Nature of impact: The activities associated with the construction phase, such as establishment of access roads and the construction camp, movement of heavy vehicles and preparation of foundations for the solar facility and power lines will damage farmlands and result in a loss of farmlands for future farming activities.

The activities associated with the construction phase have the potential to damage farmlands and result in a loss of land available for grazing. The significance of the impacts is to some extent mitigated by the fact that the farming activities on the site are confined to sheep and cattle farming as opposed to crops. The impact on farmland associated with the construction phase can therefore be mitigated by minimising the footprint of the construction related activities and ensuring that disturbed areas are fully rehabilitated on completion of the construction phase.

The owner of Gotha Farm on whose land the current 75 MW site is largely located, coincided with an established cattle camp on Gotha. Due to its location the camp is centrally located and accessible by road. Gotha has a herd of 200 beef cows, with three calving periods per year (Heinlein – pers. comm). The owner indicated that the camp cannot be relocated to another part of the farm due to its location. The area is also the only portion on Gotha with suitable grass cover during normal rainfall years and where no significant poisonous plants grow. The fencing, watering points, etc. have all been developed for the present use. Based on this owner would prefer an alternative site to be considered (yellow area in Figure 6.5 below). At the same time, the owner of Ceon, located just to the south of Gotha and adjacent to the existing 132 kV line, also indicated he would be interested in a solar facility on his farm, should BioTherm need to identify an alternative site.

Figure 6.5: Location of proposed (pink) area and alternative (yellow) area on Gotha Farm

	Without mitigation	With mitigation
Extent	Local (3)	Local (1)
Duration	Long term-permanent if disturbed areas are not effectively rehabilitated (5)	Short term if damaged areas are rehabilitated (2)
Magnitude	Moderate, due to importance of farming in terms of local livelihoods (4)	Minor (2)
Probability	Definite (5)	Highly Probable (4)
Significance	High (60)	Low (20)
Status	Negative	Negative
Reversibility	No, in case of footprint associated with solar plant	
Irreplaceable loss of resources?	Yes, loss of farmland. However, disturbed areas can be rehabilitated	
Can impacts be mitigated?	Yes, however, loss of farmland cannot be avoided	

***Mitigation*:**

The potential impacts associated with damage to and loss of farmland can be effectively mitigated. The aspects that should be covered include:

» The option of considering an alternative site (yellow area in Figure below) should be investigated by BioTherm and discussed with the owner of Gotha Farm.

» The footprint associated with the construction related activities (access roads, construction platforms, workshop etc.) should be minimised.

» An Environmental Control Officer (ECO) should be appointed to monitor the establishment phase of the construction phase.

» All areas disturbed by construction related activities, such as access roads on the site, construction platforms, workshop area etc., should be rehabilitated at the end of the construction phase.

» The implementation of a rehabilitation programme should be included in the terms of reference for the contractor/s appointed. The specifications for the rehabilitation programme should be drawn up the Environmental Consultants appointed to undertake the EIA.

» The implementation of the Rehabilitation Programme should be monitored by the ECO.

Cumulative impacts:

» Overall loss of farmland could affect the livelihoods of the affected farmers, their families, and the workers on the farms and their families. However, disturbed areas can be rehabilitated. .

Residual impacts:

» None. Once facility is decommissioned, current land use can be restored.

Social Impacts Associated With the Operational Phase

The key social issues affecting the operational phase include:

Potential positive impacts

» Creation of employment and business opportunities. The operational phase will also create opportunities for skills development and training;
» Benefits associated with the establishment of a community trust;
» The establishment of renewable energy infrastructure.

Potential negative impacts

» The visual impacts and associated impact on sense of place;
» Potential impact on tourism;
» Potential impacts on operations at Venetia Mine.

Nature of impact:
Creation of employment and business opportunities associated with the operational phase

Based on the information from other Solar Facility projects the establishment of a 75MW facility will create ~ 60 permanent employment opportunities during the 20 year operational phase. Of this total ~ 30 (50%) will be low skilled (security and maintenance), 10 (17%) semi-skilled and 20 (33%) skilled employees. The majority of the low and semi-skilled work opportunities associated with the operational phase are likely to be taken up by members from the local community. It will be possible to increase the number of local employment opportunities through the implementation of a skills development and training programme linked to the operational phase. Such a programme would support the strategic goals of promoting local employment and skills development contained in the MLM IDP. The LED Manager for the MLM indicated that the project was supported by the MLM and that the opportunities for creating local employment opportunities should be maximised.

Given the location of the proposed facility the majority of permanent staff is likely to reside in Musina. In terms of accommodation options, a percentage of the permanent employees may purchase houses in the town, while others may decide to rent. Both options would represent a positive economic benefit for the region. In addition, a percentage of the monthly wage bill earned by permanent staff would be spent in the regional and local economy, which will benefit local businesses in these towns. The benefits to the local economy will extend over the 20-year operational lifespan of the project.

The local hospitality industry in Musina is also likely to benefit from the operational phase. These benefits are associated with site visits by company staff members and other professionals (engineers, technicians etc.) who are involved in the company and the project but who are not linked to the day-to-day operations.

	Without mitigation	**With mitigation**
Extent	Local and Regional (2)	Local and Regional (3)
Duration	Long term (4)	Long term (4)

Magnitude	Low (4)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	Medium (30)	Medium (33)
Status (positive or negative)	Positive	Positive
Reversibility	N/A	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	Yes	

***Mitigation*:**

The enhancement measures listed in Section 4.4.1, i.e. to enhance local employment and business opportunities during the construction phase, also apply to the operational phase. In addition:

» BioTherm should implement a training and skills development programme for locals during the first 5 years of the operational phase. The aim of the programme should be to maximise the number of South African's and locals employed during the operational phase of the project.

Cumulative impacts:

» Creation of permanent employment and skills and development opportunities for members from the local community and creation of additional business and economic opportunities in the area

Residual impacts

» Skills development

Nature of impact: Establishment of a community trust funded by revenue generated from the sale of energy. The revenue can be used to fund local community development.

In terms of the Request for Proposal document prepared by the Department of Energy all bidders for operating licences for renewable energy projects must demonstrate how the proposed development will benefit the local community. This can be achieved by establishing a Community Trust which is funded by revenue generated from the sale for energy. BioTherm has indicated that they are committed to establishment of a community trust. Community Trusts provide an opportunity to generate a steady revenue stream that is guaranteed for a 20 year period. This revenue can be used to fund development initiatives in the area and support the local community. The long term duration of the revenue stream also allows local municipalities and communities to undertake long term planning for the area. The revenue from the proposed solar facility can be used to support a number of social and economic initiatives in the area, including:

» Education;
» School feeding schemes;
» Training and skills development;
» Support for SMMEs.

In addition, the establishment of a solar facility is unlikely to have a significantly impact on the agricultural land uses that underpin the local economic activities in the area. The loss of this relatively small area is therefore unlikely to impact on the current and future farming activities. Experience has however also shown that Community Trusts can be mismanaged. This issue will need to be addressed in order to maximise the potential benefits associated with the establishment of a community trust.

	Without mitigation	**With mitigation**
Extent	Local (2)	Local and Regional (4)
Duration	Long term (4)	Long term (4)
Magnitude	Low (4)	Moderate (6)
Probability	Probable (3)	Definite (5)
Significance	Medium (30)	High (70)
Status (positive or negative)	Positive	Positive
Reversibility	N/A	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	Yes	

***Mitigation*:**

In order to maximise the benefits and minimise the potential for corruption and misappropriation of funds the following measures should be implemented:

» Clear criteria for identifying and funding community projects and initiatives in the area should be identified. The criteria should be aimed at maximising the benefits for the community as a whole and not individuals within the community;

» Strict financial management controls, including annual audits, should be instituted to manage the funds generated for the Community Trust from the solar facility.

Cumulative impacts:

» Promotion of social and economic development and improvement in the overall well-being of the community

Residual impacts:

» Overall improvement of social infrastructure & community services.

Nature of impact: Promotion of clean, renewable energy

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 carbon emissions. The establishment of a clean, renewable energy facility will therefore reduce, albeit minimally, South Africa's reliance on coal-generated energy and the generation of carbon emissions into the atmosphere.

However, the overall contribution of the proposed BioTherm Alldays solar facility to South Africa's total energy requirements will be small. In addition, the current application is not unique. In this regard, a significant number of solar developments are currently proposed in other parts of South Africa. The potential contribution of the proposed BioTherm Alldays solar facility should therefore be regarded as valuable, but should not be overestimated.

	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	Minor (2)	Low (4)
Probability	Highly Probable (4)	Highly Probable (4)
Significance	Medium (40)	Medium (48)
Status (positive or negative)	Positive	Positive
Reversibility	Yes	
Irreplaceable loss of resources?	Yes, impact of climate change on ecosystems	
Can impacts be mitigated?	Yes	

***Mitigation*:**

The establishment of the proposed facility is a mitigation measure in itself. In order to maximise the benefits of the proposed project BioTherm should:

» Implement a training and skills development programme for locals during the first 5 years of the operational phase. The aim of the programme should be to maximise the number of South African's employed during the operational phase of the project.

Cumulative impacts:

» Reduce carbon emissions via the use of renewable energy and associated benefits in terms of global warming and climate change.

Residual impacts:

» See cumulative impacts

Nature of impact: Visual impact associated with the proposed solar facility and the potential impact on the areas rural sense of place.

The components associated with the proposed facility will have a visual impact and, in so doing, impact on the landscape and rural sense of the place of the area. Care therefore needs to be taken to ensure that the development of large renewable energy projects not impact on visual character and sense of place of the landscape.

The findings of the Visual Impact Assessment (VIA) for the proposed Alldays solar facility (Phase 1 and 2) found that the proposed activity will have a **negligible** impact from the *middle* and *background* and a **low** impact from the *foreground* (<1km) (VIA, Zone Land Solutions, April, 2012). In addition, the VIA found that users of the Venetia access road would not see the proposed 100MW (Phase 1 and 2) plant directly from the road as the facility will be set back some 250m. A dense vegetated buffer will also be created around the boundary of the site, especially the 20MW (Phase 2) project site, as this facility will be located closer to the mentioned road. The VIA also found that the area's sense of place has already been impacted due to the adjacent activities, which include the Venetia diamond

mine and its associated infrastructure. Based on the findings of the assessment the VIA recommends that the proposed activity be approved subject to the conditions described Environmental Management Programme.

	Without mitigation	**With mitigation**
Extent	Local (2)	Local (1)
Duration	Long term (4)	Long term (4)
Magnitude	Minor (2)	Minor (2)
Probability	Probable (3)	Probable (3)
Significance	Low (24)	Low (21)
Status (positive or negative)	Negative	Negative
Reversibility	Yes, solar facility can be removed.	
Irreplaceable loss of resources?	No	
Can impacts be enhanced or mitigated?	Yes	

***Mitigation*:**

» The recommendations contained in the VIA should be implemented.

Cumulative impacts:

» Potential impact on current rural sense of place

Residual impacts:

» None, once facility is decommissioned the visual impact will be removed.

Nature of impact: ***Potential impact of the solar plant on local tourism***

The LPGDP identifies tourism as an important economic sector. However, based on the findings of the VIA the proposed facility is not likely to impact on the tourism sector in the area or the Province. This is due to the location of the proposed solar facility and the existence of the Venetia Mine and Venetia substation.

In addition, the game farms located to the south and west of Gotha (Ceon, Kaalkraal) obtain access from (and are orientated towards) the Brombeek Road, and, as such, are unlikely to be affected by the project. The site will be screened from these areas by the natural vegetation and topography. The two Rugen properties to the east of Gotha (De Korter, Delport) are not inhabited by the owners, and do not accommodate any tourism or commercial hunting related activities. The provisionally identified scenic roads (Alldays and Pontdrift Roads) and Mapungubwe are both located at a distance from the site and would be screened by the natural vegetation and topography in the area. Mapungubwe, which is the key tourist attraction in the region, would not be affected. The LED manager also indicated that the proposed site would not impact on tourism in the area (Dzebu – pers. comm). The significance of this issue is therefore rated as low negative. In some instances the plant may also attract tourists to the area. However, the significance of this potential benefit is also rated as low positive.

	Without mitigation	**With mitigation**
Extent	Local (2)	Local (3)
Duration	Long term (4)	Long term (4)
Magnitude	Low (2)	Low (2)
Probability	Probable (3)	Probable (3)

Significance	Low (24) (Applies to both – and +)	Low (27) (Applies to both – and +)
Status (positive or negative)	Negative (Potential to distract from the tourist experience of the area) Positive (Potential to attract people to the area)	Negative (Potential to distract from the tourist experience of the area) Positive (Potential to attract people to the area)
Reversibility	Yes	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	Yes	

***Mitigation*:**

In terms of mitigating the visual impacts, it is virtually impossible to hide the facility. The impact on the sense of place of the area cannot therefore be effectively mitigated. In terms of efforts to enhance the proposed benefits to tourism:

» BioTherm should liaise with representatives from the MLM and local tourism representatives to raise awareness of the proposed facility;
» BioTherm should investigate the option of establishing a renewable energy interpretation centre at entrance to the site. The centre should include a viewing area where passing visitors can stop and view the site.

Cumulative impacts:

» Potential negative and or positive impact on tourism in the Local Municipality Area.

Residual impacts:

» See cumulative impacts

Assessment Power Line Options

» This Would entail linking directly into the existing Soutpan/Venetia 1 132 kV line traversing Gotha from the proposed onsite substation;

The social impacts associated with an overhead power lines are linked to the visual impact and associated impact on the sense of place and landscape character of the area. An existing substation is located adjacent to the site and therefore only a short power line would be required to connect the facility to the electricity grid. The significance of the impact is therefore rated as low negative. This is due to the short length of the line and presence of an existing substation and power lines that traverse the site.

There is very little difference between Alternative 1 and 2. However, Alternative 1 is the preferred alternative due to the potential for reduced impact on movement of vehicles associated with Venetia Mine.

Nature of impact: Potential visual impact and impact on sense of place associated

with power lines		
	Without mitigation	**With mitigation**
Extent	Local (2)	Local (1)
Duration	Long term (4)	Long term (4)
Magnitude	Minor (2)	Minor (2)
Probability	Probable (3)	Probable (3)
Significance	Low (24)	Low (21)
Status (positive or negative)	Negative	Negative
Reversibility	Yes	
Irreplaceable loss of resources?	No	
Can impacts be mitigated or enhanced?	Yes	
***Mitigation*:** » The recommendations contained in the VIA should be implemented. The measures listed above to address the potential impacts associated with the construction phase also apply to the construction of the power line.		
Cumulative impacts: » Limited visual and impact on sense of place		
Residual impacts: » None, impact would be removed when infrastructure is decommissioned.		

Social Impacts Associated With the Decommissioning Phase

The social impacts associated with final decommissioned are likely to be limited due to the relatively small number of permanent employees (60) affected. The potential impacts associated with the decommissioning phase can also be effectively managed with the implementation of a retrenchment and downscaling programme. With mitigation, the impacts are assessed to be Low (negative).

The decommissioning phase will also involve the disassembly of the solar facility rehabilitation of the site. The decommissioning phase will therefore also create additional, construction type jobs. Based on experience on other solar projects ~ 50 people will be employed during the decommissioning phase.

Nature of impact: Social impacts associated with retrenchment including loss of jobs, and source of income		
	Without mitigation	**With mitigation**
Extent	Local and regional (3)	Local and regional (3)
Duration	Medium Term (2)	Medium Term (2)
Magnitude	Moderate (6)	Moderate (6)
Probability	Highly Probable (4)	Highly Probable (4)
Significance	Medium (44)	Medium (44)
Status (positive or negative)	Negative	Negative
Reversibility	Yes, assumes retrenchment packages are paid to all affected employees	

Irreplaceable loss of resources?	No
Can impacts be mitigated or enhanced?	Yes
Mitigation: The following mitigation measures are recommended: » BioTherm should ensure that retrenchment packages are provided for all staff who stand to lose their jobs when the plant is decommissioned; » All structures and infrastructure associated with the proposed facility should be dismantled and transported off-site on decommissioning; » BioTherm should 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 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. BioTherm have indicated that the rehabilitation programme will be funded by sale of scrap metal etc. on closure of the facility.	
Cumulative impacts: » Loss of jobs and associated loss of income etc. can impact on the local economy and other businesses. However, decommissioning can also create short term, temporary employment opportunities associated with dismantling etc.	
Residual impacts: » None	

6.3. 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 area10.

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 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. With regard to the area, there do not appear to any other solar projects proposed in the immediate vicinity of the site, apart from the 20MW facility proposed by BioTherm on the same farm. The

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

potential for significant cumulative impacts is therefore likely to be low. In addition, the site is located adjacent to De Beers Venetia diamond mine. The area's sense of place has therefore already been negatively impacted. However, the Environmental Authorities should be aware of the potential cumulative impacts associated with the establishment of renewable energy facilities in the area when evaluating applications.

Representatives from Venetia Mine have indicated that the potential exists for potential cumulative light and visual impacts associated with the solar facility and the Venetia Mine. These impacts would affect game farms in the general area and the Vhembe Biosphere Reserve. Based on the observations during the site visit it would appear that the potential for cumulative visual impacts is limited.

Nature of impact: Visual impacts associated with the establishment of more than one solar energy facility and the potential impact on the areas rural sense of place and character of the landscape.		
	Without mitigation	**With mitigation**
Extent	Local and regional (2)	Local and regional (2)
Duration	Long term (4)	Long term (4)
Magnitude	Minor (2)	Minor (2)
Probability	Probable (3)	Probable (3)
Significance	Low (24)	Low (24)
Status (positive or negative)	Negative	Negative
Reversibility	Yes. Solar energy plant components and other infrastructure can be removed.	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	Yes	
Mitigation: » The establishment of a number of large renewable energy facilities in the area does have the potential to have a negative cumulative impact on the areas sense of place and the landscape. The environmental authorities should consider the overall cumulative impact on the rural character and the areas sense of place before a final decision is taken with regard to the optimal number of such plants in an area.		
Cumulative impacts: » Impact on other activities whose existence is linked to linked to rural sense of place and character of the area, such as tourism, bird watching, and hunting		
Residual impacts: » None, impact would be removed when infrastructure is decommissioned.		

6.4. Assessment of the Do Nothing Alternative

The 'Do-Nothing' alternative is the option of not constructing the proposed San solar Energy project. Should this alternative be selected, the predicted environmental impacts will not result. However, the local and regional socio-

economic and environmental benefits of this renewable energy facility will not be realised. These benefits are explored in further detail in the South Africa REFIT Regulatory Guideline published by NERSA (March 2009), and 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.
» **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 ~1 % of global GHG emissions and is currently ranked 9th worldwide in terms of per capita CO2 emissions.
» **Support for international agreements:** The effective deployment of renewable energy provides a tangible means for South Africa to demonstrate its commitment to its international agreements under the Kyoto Protocol, and for cementing its status as a leading player within the international community.
» **Employment creation:** The sale, development, installation, maintenance and management of 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.

» **Protecting the natural foundations of life for future generations:** Actions to reduce our disproportionate carbon footprint can play an important part in ensuring our role in preventing dangerous anthropogenic climate change; thereby securing the natural foundations of life for generations to come.

As indicated above, 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 carbon emissions.

The No-Development option would represent a lost opportunity for South Africa to supplement is current energy needs with clean, renewable energy. Given South Africa's position as one of the highest per capita producer of carbon emissions in the world, this would represent a negative social cost. However, as indicated above, the overall contribution of Phase 1 (75MW) of BioTherm Alldays Solar Facility to South Africa's total energy requirements will be relatively small. In addition, the current application is not unique. The potential contribution of the proposed BioTherm Alldays Solar Facility should therefore be regarded as valuable, but should not be over-estimated.

The No-Development option would also result in a loss in employment opportunities associated with both the construction and operational phase. In addition, the benefits for the local community in the area associated with the establishment of a Community Trust funded by revenue generated from the sale of energy from the solar facility would be forfeited. The revenue from the proposed solar facility can be used to support a number of social and economic initiatives in the area. These benefits would be forgone if the proposed solar facility is not developed. Given the limited economic opportunities in the area this would represent a negative social cost for the local community.

Nature of impact: The no-development option would result in the lost opportunity for South Africa to supplement is current energy needs with clean, renewable energy. The No-Development option would also result in the loss of the benefits to the local community and economy associated with the creation of employment opportunities and the establishment of a Community Trust		
	Without mitigation	**With mitigation**
Extent	Local-International (3)	Local-International (4)
Duration	Long term (4)	Long term (4)
Magnitude	Low (4)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	Medium(33)	Medium (36)
Status (positive or negative)	Negative	Positive
Reversibility	Yes	
Irreplaceable loss of resources?	Yes, increased impact of climate change on	

	ecosystems due to continued reliance on fossil fuels
Can impacts be mitigated?	Yes
Mitigation: » The proposed facility should be developed and the mitigation and enhancement measures identified in the SIA and other specialist studies should be implemented. However, the impact of large solar facilities on the sense of place and landscape are issues need to be addressed in the location, design and layout of the proposed plant.	
Cumulative impacts: » Reduce carbon emissions via the use of renewable energy and associated benefits in terms of global warming and climate change.	
Residual impacts: » None	

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

6.5. Summary of All Impacts

The following table provides a summary of the impact rating of the potential impacts identified and assessed through the EIA.

Nature	***Positive (+) ,Negative (-)or neutral Impact***	***Positive (+) ,Negative (-)or neutral Impact***
	Without mitigation	***With mitigation***
Impacts on Ecology: Construction and operation of PV panels		
Impacts on vegetation and protected plant species would occur due to the construction of the facility, which will require extensive site clearing	Medium (-)	Medium (-)
Alien plants are likely to invade the site as a result of disturbance created during construction	Medium (-)	Low (-)
Increased erosion risk would occur as a result of soil disturbance and loss of vegetation cover.	Medium (-)	Low (-)
Disturbance, transformation and loss of habitat will have a negative effect on resident fauna.	Medium (-)	Medium (-)
Avifauna will experience some habitat loss as a result of the development as well as a potentially increased risk of collisions and electrocution with the power line infrastructure.	Medium (-)	Medium (-)

Nature	***Positive (+) ,Negative (-)or neutral Impact***	***Positive (+) ,Negative (-)or neutral Impact***
	Without mitigation	***With mitigation***
Reduced landscape connectivity.	Medium (-)	Medium (-)
Impacts on Geology and Soils and Agricultural Potential		
Soil degradation (soil removal, mixing, compaction, etc) due to the construction of foundations for structures (PV panels, buildings, substations, power lines).	Low (-)	Low (-)
Soil degradation (soil removal, mixing, compaction, etc) due to the construction of access roads	Medium (-)	Medium (-)
Soil degradation due to pollution of soil by contaminants used on site during construction (e.g. fuel, oil, chemicals, cement).	Low (-)	Low (-)
Soil degradation due to increased soil erosion by wind and/or water on construction areas.	Medium (-)	Low (-)
Degradation of waterways due to increased siltation downstream from site	Medium (-)	Low (-)
Increased dust pollution from construction sites affecting surroundings..	Low (-)	Low (-)
Impact on existing land-use.	Low (-)	N/A
Reduction in agricultural potential.	Low (-)	Low (-)
Reduction in demand for non-renewable energy sources.	Medium (+)	N/A
Potential Heritage Impacts		
Possible post-contact site could be damaged locally by excavation activities and associated activities	Medium (-)	Low (+)
Potential Paleontological Impacts		
Paleontological sites could be affected if bedrock was to be disturbed during the excavation activities associated with the construction	Low (-)	Low (+)
Built Environment		
No sites falling within the Built Environment were identified within the study.	Low (+)	Low (+)

Nature	***Positive (+) ,Negative (-)or neutral Impact***	***Positive (+) ,Negative (-)or neutral Impact***
	Without mitigation	***With mitigation***
Potential Visual Impacts		
Potential visual impact on the sensitive receptors in the foreground and the middle ground.	Medium (-)	Medium (-)
Potential visual impact on the sensitive receptors in the background**.**	Low (neutral)	Low (neutral)
Potential visual impact on the sense of place of the Musina region.	Medium (-)	Low (-)
Potential visual impact of the construction period on visual receptors.	Medium (-)	Low (-)
Potential visual impact of artificial lighting as a result of the activity during operational phase.	Medium (-)	Medium (-)
Potential visual impact of reflection of the PV Panels on the sensitive receptors.	Low (neutral)	Low (neutral)
Potential visual impact on the sensitive receptors in the foreground and the middle ground.	Medium (-)	Medium (-)
Potential Social Impacts During Construction		
Creation of employment and business opportunities during the construction phase	Low (+)	Medium (+)
Potential impacts on family structures and social networks associated with the presence of construction workers	Community - Low (-) Individuals – Medium – High (-)	Community - Low (-) Individuals – Medium – High (-)
Potential loss of livestock, poaching and damage to farm infrastructure associated with the presence of construction workers on site	Medium (-)	Low (-)
Potential loss of livestock, crops and houses, damage to farm infrastructure and threat to human life associated with increased incidence of veld fires	Medium (-)	Low (-)
Potential noise, dust and safety impacts associated with movement of construction related traffic to and	Low (-)	Low (-)

Nature	***Positive (+) ,Negative (-)or neutral Impact***	***Positive (+) ,Negative (-)or neutral Impact***
	Without mitigation	***With mitigation***
from the site		
Damage to and loss of farmland	High (-)	Low (-)
Potential Social Impacts During Operation		
Creation of employment and business opportunities associated with the operational phase	Medium (+)	Medium (+)
Establishment of a community trust funded by revenue generated from the sale of energy. The revenue can be used to fund local community development	Medium (+)	Medium (+)
Promotion of clean, renewable energy	Medium (+)	Medium (+)
Visual impact associated with the proposed solar facility and the potential impact on the areas rural sense of place	Low (-)	Low (-)
Potential impact of the solar plant on local tourism	Low (-&+)	Low (-&+)
Potential visual impact and impact on sense of place associated with power lines	Low (-)	Low (-)
Potential visual impact and impact on sense of place associated with power lines	Low (-)	Low (-)
Social impacts associated with retrenchment including loss of jobs, and source of income	Medium (-)	Medium (-)
Assessment of Cumulative Impacts		
Visual impacts associated with the establishment of more than one solar plant and the potential impact on the areas rural sense of place and character of the landscape.	Low (-)	Low (-)
Assessment of the Do Nothing Alternative		
The no-development option would result in the lost opportunity for South Africa to supplement is current energy needs	Medium (+)	Medium (+)

As can be seen from this table, there are no impacts of high significance expected to be associated with the proposed facility, provided that the recommended

mitigation measures are implemented. All identified impacts can be mitigated to acceptable levels.

CONCLUSIONS AND RECOMMENDATIONS CHAPTER 7

The **Alldays PV/CPV Plant Phase 1** is proposed to be developed as a commercial solar energy facility located on a portion of Farm 102 (Gotha) (MS), approximately 70km west of Musina in the Limpopo Province (refer to Figure 7.1) The purpose of the proposed facility is to add new capacity for generation of power from renewable energy to the national electricity supply (which is short of generation capacity to meet current and expected demand), and to aid in achieving the goal of a 30% share of all new power generation being derived from independent power producers (IPPs), as targeted by the Department of Energy (DoE).

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

As such BioTherm Energy (Pty) Ltd, as an IPP, is investigating the establishment of up to 75 MW photovoltaic solar energy facility and associated infrastructure for the purpose of commercial electricity generation. The proposed facility will require approximately ~175 ha that will be utilized for the installation of the PV/CPV panels and associated infrastructural requirements which will include:

» Photovoltaic **(PV)** or Concentrated Photovoltaic **(CPV) panels** with an export capacity of up to 75 MW. Panels are proposed to be up to 20m in height (should CPV technology be utilised).
» A new on-site substation to connect via a loop in loop out to the Soutpan/Venetia 1 132 kV power line to evacuate the power from the facility into the Eskom grid. The alternative would be to construct a 132kV connection line (up to 2 km), parallel to existing power line to the Venetia substation. Mounting structure to be either rammed steel piles or piles with pre-manufactured concrete footings to support the PV/CPV panels. Mounting structure to be either rammed steel piles or piles with pre-manufactured concrete footings to support the PV/CPV panels.
» Cabling between the project components, to be lain underground where practical.

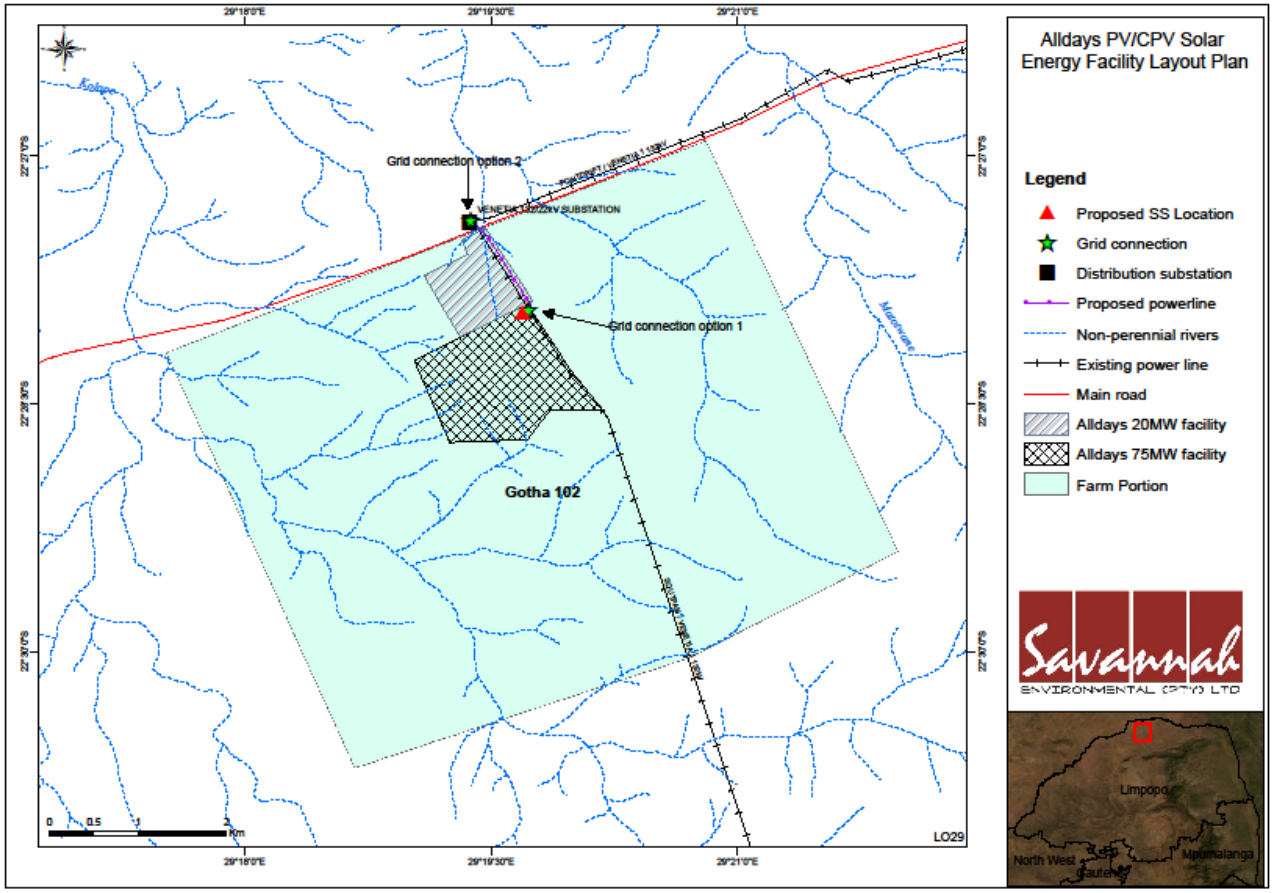

Figure 7.1: Locality map illustrating the location of the assessed development site for the proposed **Alldays PV/CPV Plant Phase 1.**

» Internal access roads and fencing.
» Workshop area for maintenance, storage, and offices

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), BioTherm Energy (Pty) Ltd requires authorisation from the National Department of Environmental Affairs (DEA) (in consultation with the Limpopo Department of Economic Development, Environment and Tourism (LDEDET), 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 parts of the project have been comprehensively assessed through specialist investigations. Appropriate mitigation measures have been recommended as part of a draft Environmental Management Programme (EMP) (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 recommendation and conclusion are provided in this Chapter.

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

7.1. Evaluation of Alldays PV/CPV Plant Phase 1

The preceding chapters of this report together with the specialist studies contained within Appendices E -J provide a detailed assessment of the potential impacts that may result from the proposed project. This chapter concludes the EIA Report for **Alldays PV/CPV Plant Phase 1** 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 assessment of potential impacts undertaken within this EIA, it is concluded that there are no fatal flaws to be associated with the site, and no absolute 'no-go' areas were identified for the larger site. In summary, the most significant environmental impacts associated with the **Alldays PV/CPV Plant Phase 1**, as identified through the EIA, include:

» Local site-specific biophysical (flora, fauna and soils) impacts as a result of physical disturbance/modification to the site with the establishment of the facility.
» Visual impacts.
» Impacts on the social environment.

7.1.1. Local Site-specific Impacts

The construction of the **Alldays PV/CPV Plant Phase 1** will lead to permanent disturbance of an area of ~ 175 ha in extent. Permanently affected areas include the area for the PV/CPV panels and associated infrastructure, as well as the power line route. From the specialist investigations undertaken for the proposed solar energy facility development site, it was determined that the majority of the site is in a natural state. Areas of sensitivity within the proposed development site were identified through the EIA process. These relate to the local ecology (vegetation, habitat for fauna, minor drainage lines that occur on the site (refer to the sensitivity map – Figure 7.2).

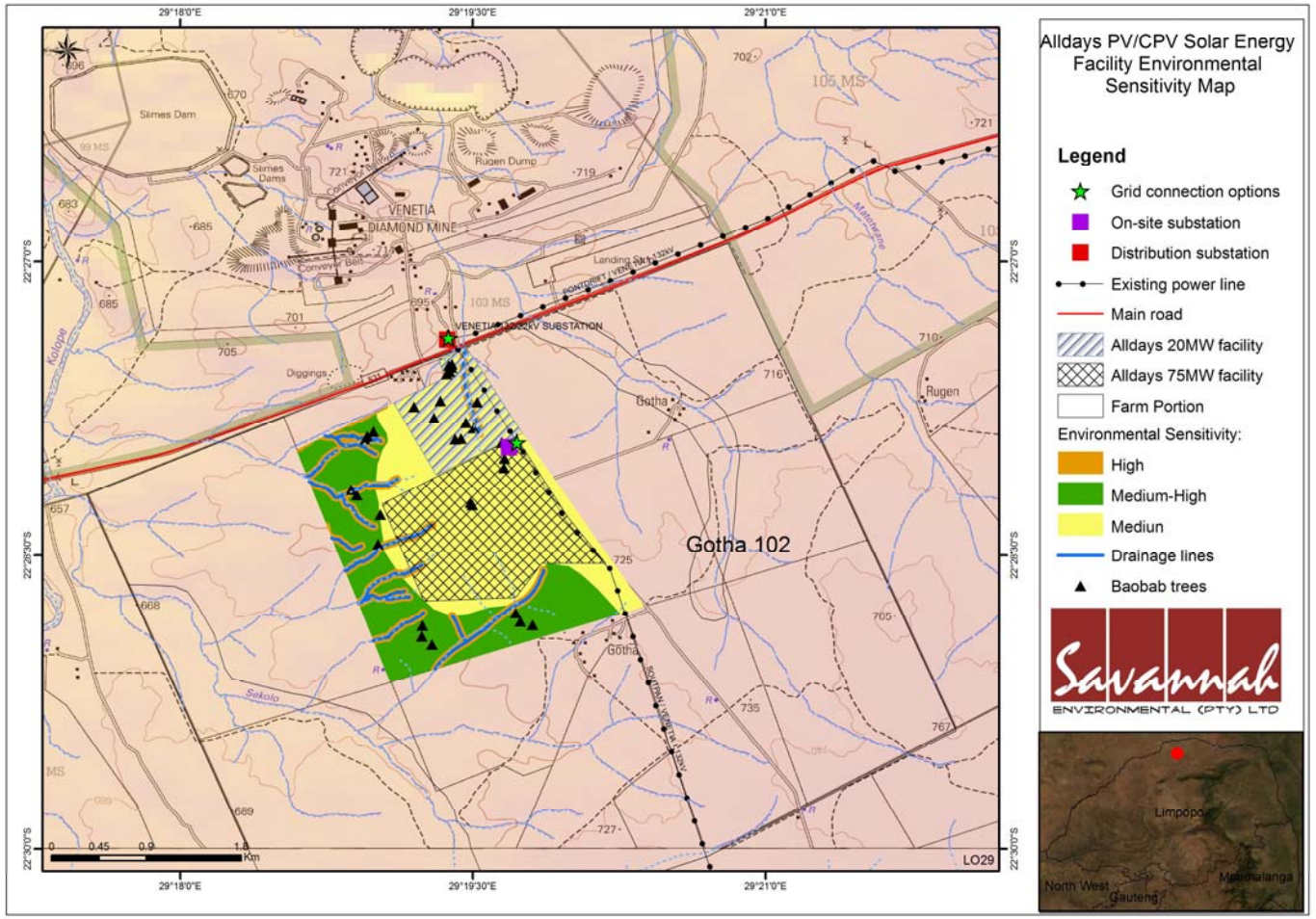

Figure 7.2: Sensitivity map for the **Alldays PV/CPV Plant Phase 1.**

The Baobab trees within the site are considered to be a significant ecological feature given the role these trees play in the ecology of the area. There is one Baobab tree that was noted within the proposed development footprint. A licence would be required to move the tree, as is required by the Limpopo Environmental Authorities.

The majority of the site consists of woody vegetation and trees. The removal of the vegetation, if not managed properly, would result in soil erosion. The proposed development area is classified as being of medium soil sensitivity.

Apart from some relatively minor drainage lines, there are no highly significant biodiversity features within the study area. The southern and western margins of the broader study area have been assessed as being of somewhat higher sensitivity than the rest of the site, on account of the steep slope of this area as well as the high density of drainage features present. These areas have however been avoided by BioTherm in determining the placement of the proposed infrastructure (refer to Figure 7.2).

In order to minimise potential impacts on these sensitive areas within the site, no development is to take place within the sensitive areas as far as possible. Where this is unavoidable, the relevant permits (biodiversity permits for impacts on threatened and/or protected plant and animal species) must be obtained prior to undertaking construction.

7.1.2. Visual Impacts

It has been concluded that the visual impacts associated with the proposed facility will be largely contained within the broader region itself. None of the potential visual impacts identified are considered to be fatal flaws for the proposed solar energy facility. In addition, the proposed facility is located opposite the Venetia Diamond Mine. The sense of place of the local area has been largely altered by the mining activities and power line and substation infrastructure. The surrounding land consists of farm land (grazing for livestock). Access to the site for the proposed development is from the existing access roads, including the Bridgewater-Musina gravel road to the south of Venetia mine. Visual impacts can be mitigated to some extent through the retention of a buffer of 30 – 50m of natural vegetation along the boundary of the development site.

7.1.4. Impacts on the Social Environment

Impacts on the social environment are expected during both the construction phase and the operational phase of the solar energy facility. Impacts are expected at both a local and regional scale. Impacts on the social environment as a result of the construction of the solar energy facility can be mitigated to impacts of low significance or can be enhanced to be of positive significance to the region. Construction crew camps may be established on the site, and if required construction workers may also be housed in the nearest towns or other available/existing accommodation. Construction activities on the site will be restricted to daylight hours, and the construction phase is anticipated to extend for a minimum period of 8-months.

Negative impacts during construction relate mainly to impacts due to presence of construction workers and visual impact imposed by the facility on the local environment. There will be a positive impact due to employment creation, which is a much needed due to the high unemployment levels in the area. The positive impact due to employment creation will be lower than during operation as there will be a limited number of staff required compared to the construction phase. The findings of the SIA undertaken for the proposed project indicate that the development will create employment and business opportunities for locals during both the construction and operational phase of the project. The concerns raised by neighbouring landowners, have been included in this EIA report and with implementation of an EMP, these social risks from the PV plant can be managed to an acceptable level.

From a heritage perspective, the 75 MW site could be constructed in any part of the study area as no culturally sensitive sites were identified. The site lies on the southern boundary of the Mapungubwe WHS and Cultural Landscape. No impacts on this aspect is anticipated due to the distance between these areas and the proposed development.

7.2. 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 a export capacity of up to 75 MW on a portion of Farm 102 (Gotha) (MS) located approximately 70km west of Musina in the Limpopo Province established **Alldays PV/CPV Plant Phase 1**. The positive implications of establishing a solar energy facility on the identified site within the Limpopo Province include the following:

» The potential to harness and utilise solar energy resources within the Limpopo 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 National electricity grid in the Limpopo Province would benefit from the additional generated power.
» Promotion of clean, renewable energy in South Africa
» Creation of local employment, business opportunities and skills development for the area.

The findings of the specialist studies undertaken within this EIA to assess both the benefits and potential negative impacts anticipated as a result of the proposed project conclude that there are **no environmental fatal flaws** that should prevent the proposed project from proceeding, provided that the recommended mitigation and management measures are implemented. The significance levels of identified negative impacts are expected to be medium to low with the implementation of the recommended mitigation measures. The project is therefore considered to be environmentally acceptable and to meet the requirements of sustainable development. Environmental specifications for the management of potential impacts are detailed within the draft Environmental Management Programme (EMP) 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**.

7.3. 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 **Alldays PV/CPV Plant Phase 1** 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:

» As the grass layer at the site is poorly developed, it is not likely that the natural vegetation would colonise the bare soil very quickly, which would leave the site vulnerable to erosion as well as alien plant invasion. It is therefore recommended that perennial grass species which occur naturally in the area are considered for proactive use to stabilize the site after it has been cleared. Species such as *Cynodon dactylon* and *Cenchrus ciliaris*, which are readily available and easily established are recommended for the purpose.
» Although only one baobab tree is within the proposed development area, an additional six trees are within the adjacent 20MW facility, raising the potential for cumulative impact on this keystone species. The local environmental officials have recommended that any affected trees should be transplanted outside of the development footprint. Given the size of the trees, this would involve some cost as well as present some technical challenges. The input and supervision of someone who has experience in this task should be sought to assist with this task.
» As far as possible, any component of the facility which could potentially affect sensitive areas (i.e. minor drainage lines) should be relocated.
» Use existing infrastructure where possible to minimise potential ecological impacts from disturbance of vegetation.
» proper planning should be undertaken regarding the placement of lighting structures.
» Following the final design of the facility, a revised layout must be submitted to DEA for review and approval prior to commencing with construction.
» An independent Environmental Control Officer (ECO) should be appointed to monitor compliance with the specifications of the EMP for the duration of the construction period.
» The draft Environmental Management Programme (EMP) as contained within Appendix J of this report should form part of the contract with the Contractors appointed to construct and maintain the proposed facility, and will be used to ensure compliance with environmental specifications and management measures. The implementation of this EMP for all life cycle phases of the proposed project is considered key in achieving the appropriate environmental

management standards as detailed for this project. This EMP should be viewed as a dynamic document that should be updated throughout the life cycle of the facility, as appropriate.

» Alien invasive plants should be controlled on site during construction and operation of the facility. An appropriate alien plant management plan should be developed and implemented.
» Disturbed areas should be rehabilitated as quickly as possible once construction is completed in an area.
» Implement appropriate erosion control measures, specifically in potentially sensitive areas identified within the EIA Report.
» A walk-though survey of final infrastructure positions should be undertaken by a specialist ecologist prior to the commencement of construction in order to confirm the presence/absence of protected plant and animal species. The EMP for construction must be updated to include site-specific information and specifications resulting from the final walk-though surveys. This EMP must be submitted to DEA for approval prior to the commencement of construction.
» All relevant practical and reasonable mitigation measures detailed within this report and the specialist reports contained within Appendices E to J must be implemented.
» 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 quickly as possible once construction is completed in an area, and an on-going monitoring programme should be established to detect, quantify, and manage any alien species.
» A comprehensive storm water management plan should be compiled and implemented for the developmental footprint prior to construction.
» Applications for all other relevant and required permits required to be obtained by BioTherm Energy (Pty) Ltd must be submitted to the relevant regulating authorities.

REFERENCES CHAPTER 8

8.1. References for Ecology.

Alexander, G. & Marais, J. 2007. *A Guide to the Reptiles of Southern Africa*. Struik Nature, Cape Town.

Branch W.R. 1998. *Field guide to snakes and other reptiles of southern Africa*. Struik, Cape Town.

Department of Environmental Affairs and Tourism, 2007. National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004): Publication of lists of Critically Endangered, Endangered, Vulnerable and Protected Species. Government Gazette, Republic of South Africa.

Du Preez, L. & Carruthers, V. 2009. *A Complete Guide to the Frogs of Southern Africa*. Struik Nature., Cape Town.

IUCN 2012. IUCN Red List of Threatened Species. Version 2010.2. <www.iucnredlist.org>. Downloaded on 19 January 2012.

Lehman, R.N., Kennedy, P.L. & Savidge, J.A. 2007. The state of the art in raptor electrocution research: a global review. *Biological Conservation* 136: 159-174.

Limpopo Conservation Plan (2011) Limpopo Provincial Government Report and GIS dataset 2011.

Nel, J.L., Murray, K.M., Maherry, A.M., Petersen, C.P., Roux, D.J., Driver, A., Hill, L., Van Deventer, H., Funke, N., Swartz, E.R., Smith-Adao, L.B., Mbona, N., Downsborough, L. and Nienaber, S. (2011). Technical Report for the National Freshwater Ecosystem Priority Areas project. WRC Report No. K5/1801.

Mucina L. & Rutherford M.C. (eds) 2006. *The Vegetation of South Africa, Lesotho and Swaziland*. Strelitzia 19. South African National Biodiversity Institute, Pretoria.

Skinner, J.D. & Chimimba, C.T. 2005. The mammals of the Southern African Subregion. Cambridge University Press, Cambridge.

8.2. References for Soils and Agricultural potential

South African National Biodiversity website (www.sanbi.org).

South African Weather Service website (www.weathersa.co.za).

Department of Water Affairs website (www.dwaf.gov.za).

Department of Environmental Affairs website (www.environment.gov.za)

Brink, A.B.A. 1979. Engineering Geology of South Africa (Series 1-4). Building Publications, Pretoria.

Identification of Problematic Soils in Southern Africa. 2007. Technical notes for civil and structural engineers. Published by the Department of Public Works.

Mucina, L., Rutherford, M.C. & Powrie, L.W. (eds) 2005. Vegetation map of South Africa, Lesotho and Swaziland, 1:1 000 000 scale sheet maps. South African National Biodiversity Institute, Pretoria.

Garland, G., Hoffman, T. And Todd, S. Soil degradation (in Hoffman, T., Todd, S., Ntshona, Z. And Turner, S. (eds)) 1999. Land degradation in SA, Chapter 6, NBRI, Kistenbosch.

Geological map of the Alldays area. Geological Survey, Government Printer, Pretoria.

Wienert, H. H. 1980. The Natural Road Construction Materials of Southern Africa. H&R Academia Publ., Pretoria, 298pp.

Macvicar, C. N. et. al. 1991. Soil Classification. A taxonomic system for South Africa. Mem. Agric. Nat. Res. S.Afr. No 15. Pretoria.

8.3. References for Visual impact and GIS mapping

Acocks, J.P.H. (1988). *Vegetation Map of SouthAfrica, Lesotho and Swaziland*. SANBI, Pretoria.

BC Gildenhuys & Associates. (2011). *Musina Spatial Development Framework:* Final draft SDF for comments and inputs by stakeholders.

Chief Director of Surveys and Mapping, varying dates. *1:50 000 Topo-cadastral Maps and Data*.

Dennis Moss Partnership (2010). *Visual Impact Assessment for portions of the Farm Hartenbosch No. 217.*

MetroGIS (Pty) Ltd. (2012). *Proposed Middelburg Solar Park: Visual Impact Assessment*

Oberholzer, B. (2005). *Guideline for involving visual and aesthetic specialists in EIA processes*: Edition 1.

SRK Consulting. (2007). *Visual Impact Assessment Report for the Proposed Sibaya Precinct Development.* Report Prepared for Moreland (Pty) Ltd.

Venetia Diamond Mine - Mining Technology. 2012. Venetia Diamond Mine - Mining Technology. [ONLINE] Available at: http://www.mining-technology.com/projects/de_beers/. [Accessed 24 April 2012].

Venitia Diamond Mine. 22°28''31.09' S and 29°20''01.69' E. Google Earth. 1 January 2008. 24 April 2012.

8.4. References for Heritage Impact Assessment

Acocks, J.P.H. 1988. (3rd Edition). Veld types of South Africa. Pretoria: Botanical Research Institute, Department of Agriculture and Water Supply.

Beck, H.C. 1937. The beads ofthe Mapungubwe District. In: Fouche, L. (ed.) Mapungubwe: ancient Bantu civilization on the Limpopo: 104-113. Cambridge: Cambridge University Press.

Becker 1979. Metallurgiese waarnemings. In: Eloff, J. F. Die kulture van Greefswald. Vol. 2, Bylae 5/2. University of Pretoria: Unpublished report for the Human Sciences Council.

Bonsma, J. 1976. Bosveldbome en weistreke. Pretoria: J.L. van Schaik.

Caton-Thompson, G. 1931. The Zimbabwe culture. Oxford: Clarendon Press.

Caton-Thompson, G. 1939. Mapungubwe. Antiquity 13: 324-355.

Davison, CC. 1979. Three chemical groups of glass beads at the Greefswald sites. In: Eloff, J.F. (ed.) Die culture van Greefswald: Vol. 2, Bylae 5/3:1-39. University of Pretoria: Unpublished report for the Human Sciences Council.

De Villiers, H. 1979. Verslag oor menslike skeletmateriaal. In: Eloff, J. F. Die kulture van Greefswald. Vol. 3, Bylae 8/2. University of Pretoria: Unpublished report for the Human Sciences Council.

Eastwood, E.B. & Fish, W.S. 1995. Hunters and herders of the far north. Die Rooi Olifant. Newsletter of the Soutpansberg Rock Art Conservation Group 13:6-10.

Eloff, J.F. 1979. Die kulture van Greefswald. Vols 1-4. University of Pretoria: Unpublished report for the Human Sciences Council.

Eloff, J.F. 1981. Verslag oor opgrawingswerk op die plaas Greefswald gedurende April 1981. University of Pretoria: Unpublished report.

Eloff, J.F. 1982. Verslag oor argeologiese navorsing op Greefswald gedurende April 1982. University of Pretoria: Unpublished report.

Eloff, J.F. 1983. Verslag oor argeologiese navorsing op Greefswald gedurende April 1983. University of Pretoria: Unpublished report.

Eloff, J.F. & Meyer, A. 1981. The Greefswald sites. In: Voigt, E.A. (ed.) Guide to archaeological sites in the northern and eastern Transvaal: 7?22. Pretoria: Transvaal Museum.

Fagan, B.M. 1970. The Greefswald sequence: Bambandyanalo and Mapungubwe. In: Fage, J.D. & Oliver, R. (ed.) Papers in African prehistory: 173-199. Cambridge: Cambridge University Press.

Fouche, L. (ed.) 1937. Mapungubwe: ancient Bantu civilisation on the Limpopo. Cambridge: Cambridge University Press.

Fuller, C. 1923. Tsetse in the Transvaal and surrounding territories. an historical review. Entomological Memoirs 5:8-68.

Galloway, A. 1937. The skeletal remains of Mapungubwe. In: Fouche, L. (ed) Mapungubwe: ancient Bantu civilisation on the Limpopo: 127-174. Cambridge: Cambridge University Press.

Galloway, A. 1959. The skeletal remains of Bambandyanalo. Johannesburg: Witwatersrand University Press.

Gardner, G.A. 1955. Mapungubwe 1935-1940. South African Archaeological Bulletin 10: 73-77.

Gardner, G.A. 1956. Mapungubwe and Bambandyanalo. South African Archaeological Bulletin 11: 55-56.

Gardner, G.A. 1963. Mapungubwe. Vol. 2. Pretoria: J.L. van Schaik.

Jones, N. 1937. The 1934 expedition. In: Fouche, L. (ed.) Mapungubwe: ancient Bantu civilisation on the Limpopo: 9-28. Cambridge: Cambridge University Press.

Lestrade, G.P. 1937. Report on certain ethnological investigations in connection with the archaeological discoveries at Mapungubwe. In: Fouche, L. (ed.) Mapungubwe: Ancient Bantu civilisation on the Limpopo: 119-124. Cambridge: Cambridge University Press.

Meyer, A. 1980. 'n Interpretasie van die Greefswaldpotwerk. University of Pretoria: MA thesis.

Meyer, A. 1992. Die argeologiese terreine van Greefswald. Pretoria: University van Pretoria.

Meyer, A. 1994. Stratigrafie van die ystertydperkterreine op Greefswald. South African Journal of Ethnology 17(4): 137-160.

Meyer, A. 1995. From hunting grounds to digging fields: observations on aspects of cultural heritage management in some national parks. South African Journal of Archaeology.

Meyer, A. 1996. The Iron Age sites of Greefswald: stratigraphy and chronology of the sites and a history of investigations. Pretoria: University of Pretoria.

Meyer, A. 1998. The archaeological sites of Greefswald.Pretoria: University of Pretoria.

Meyer, A. & Esterhuizen, V. 1994. Skerwe uit die verlede: handel tussen Mapungubwe en China. South African Journal ofEthnology 17(3): 103-108.

Morant, G.M. 1939. Mapungubwe. Antiquity 13:335-341.

Oddy, A. 1983. On the trail of Iron Age gold. Transvaal Museum Bulletin 19, November 1983.

Oddy, A. 1984. Gold in the southern African Iron Age: a technological investigation of the Mapungubwe and other finds. Gold Bulletin 17(2):70-78.

Paver, F.R. 1933. Mysterious grave on Mapungubwe Hill. The Illustrated London News, 8 April 1933:494^95.

Pearson, R. 1937. Gold from Mapungubwe. In: Fouche, L. (ed.) Mapungubwe: ancient Bantu civilisation on the Limpopo: 116-117. Cambridge: Cambridge University Press.

Pole-Evans, LB. 1937. Report on vegetable remains from Mapungubwe. In: Fouche, L. (ed.) Mapungubwe: ancient Bantu civilisation on the Limpopo: 31. Cambridge: Cambridge University Press.

Rightmire, G.P. 1970. Iron Age skulls from southern Africa re-assessed by multiple discriminant analysis. African Journal of Physical Anthropology 33(2): 147-168.

Robertson, T.C. 1946. The hill of the jackals. Libertas, March 1946:21-32.

Saitowitz, S.J. 1996. Glass beads as indicators of contact and trade in southern Africa c. AD 900-1250. University of Cape Town: PhD thesis.

Saitowitz, S.J, Reid, D.L. & Van der Merwe, NJ. 1995. Glass bead trade from Islamic Egypt to South Africa c. AD 900-1250. South African Journal of Science 92:101-104.

Schofield, J.F. 1937. The pottery ofthe Mapungubwe District. In: Fouche, L. 1937 (ed.) Mapungubwe: ancient Bantu civilisation on the Limpopo: 32-102. Cambridge: Cambridge University Press.

Schofield, J.F. 1948. Primitive pottery: an introduction to the South African ceramics, prehistoric and protohistoric. Cape Town: The South African Archaeological Society Handbook Series, No 3.

Sentker, H.F. 1969. Mapungubwe 1953-1954. University of Pretoria: Unpublished report.

Stanley, G.H. 1937a. Report on slag. In: Fouche, L. (ed.) Mapungubwe: ancient Bantu civilisation on the Limpopo: 30. Cambridge: Cambridge University Press.

Stanley, G.H. 1937b. Mapungubwe metallurgical material. In: Fouche, L. (ed.) 1937. Mapungubwe: ancient Bantu civilisation on the Limpopo: 117-118. Cambridge: Cambridge University Press.

Steyn, M. 1994. An assessment of the health status and physical characteristics of the prehistoric population from Mapungubwe. University of the Witwatersrand:PhD thesis.

Steyn, M. 1995. Human pot burial from Greefswald. South African Journal ofEthnology 18:87-90.

Steyn, M. & Henneberg, M. 1994. Cranial and postcranial growth reconstructed from skeletal material from the Iron Age site of K2. Journal of Anatomy 185(3):692.

Tobias, P.V. 1959. Note on Carbon-14 dates. In: Galloway, A. (ed.) The skeletal remains of Bambandyanalo:xi-xii. Johannesburg: Witwatersrand University Press.

Van Ewyk, J.F. 1987. The prehistory of an Iron Age site on Skutwater. University of Pretoria: MA thesis.

Van Riet Lowe, C. 1955. The glass beads of Mapungubwe. Archaeological Survey, Series No. 9: Pretoria.

Voigt, E.A. 1978. The faunal remains from Greefswald as a reflection of Iron Age economic and cultural activities. University of Pretoria: MA thesis.
Voigt, E.A. 1979. Fauna from Greefswald. In: Eloff, J.F. (ed.) Die kulture van Greefswald. Vol. 3: 1-315. University of Pretoria: Unpublished report for the Human Sciences Council.
Voigt, E.A. 1983. Mapungubwe: an archaeozoological interpretation of an Iron Age community. Monograph No. 1. Pretoria: Transvaal Museum.

8.5. References for Social Impact Assessment

Erasmus, BJP (1995). Oppad in Suid-Afrika (Johannesburg, Jonathan Ball).
IDC of SA, DBSA, TIP (2011). Green Jobs. An Estimate of the Direct Employment Potential of a Greening South African Economy.
Limpopo Provincial Government (2009-2014). Limpopo Growth and Development Strategy.
Musina Local Municipality (2012). Integrated Development Plan – 2012/ 2013-2017.
Musina Local Municipality (2011). Musina Local Municipality Spatial Development Framework.
Musina Local Municipality (2007). Local Economic Development Strategy.
Republic of South Africa (2011). White Paper on National Climate Change Repsonse Strategy.
Republic of South Africa (2008). National Energy Act, Act nr. 34 of 2008);
Republic of South Africa (2003). White Paper on Renewable Energy;
Republic of South Africa (December 1998). White Paper on Energy Policy;
Savannah Environmental (Pty) Ltd (August 2012). Proposed Alldays Photovoltaic (PV)/ Concentrated Photovoltaic (CPV) Solar Energy Facility on Gotha Farm, Phase 1, Limpopo Province.
University of the Free State: Centre for Development Support (2007). The Arid Areas Programme – Volume 1: District Socio-Economic Profile and Development Plans.
Zone Land Solutions (April, 2012). Visual Impact Assessment for Alldays PVSEF

Internet sources
www.debeersgroup.com/Operations/Mining/Mining-Operations/De-Beers-Consolidated-Mines/Venetia/
www.dehoopdam.co.za
www.environment.gov.za/projprog/tfcas/limpopo_shashe.htm
www.golimpopo.com
www.krugerpark.co.za/africa_venda.html
www.limpopobusiness.co.za
www.Limpopo.gov.za
www.mining-technology.com/projects/de_beers/

www.safarinow.com/destinations/musina(messina)/NatureReserves/Venetia-Limpopo-Nature-Reserve.aspx
www.sanparks.org/parks/mapungubwe/
www.saexplorer.co.za/south-africa/distance/travel_distance_calculator
www.sa-venues.com/attractionslm/musina.php
www.southafrica.info/about/geography/limpopo.htm
http://www.til.co.za/doing_busi.php
www.unesco.org
www.vhembe.gov.za
www.en.wiki.org
Google Earth 2012.