ENVIRONMENTAL IMPACT ASSESSMENT PROCESS
FINAL ENVIRONMENTAL IMPACT REPORT

PROPOSED MERAPI PHOTOVOLTAIC (PV) SOLAR ENERGY FACILITY COMPRISING FOUR DEVELOPMENT PHASES, FREE STATE PROVINCE

DEA Ref. Nos:
14/12/16/3/3/2/361 (Phase 1)
14/12/16/3/3/2/362 (Phase 2)
14/12/16/3/3/2/363 (Phase 3)
14/12/16/3/3/2/364 (Phase 4)

FINAL EIA REPORT
FOR SUBMISSION TO DEPARTMENT OF ENVIRONMENTAL AFFAIRS

Prepared for:
SolaireDirect Southern Africa
1st Floor, Birkdale 1,
River Park, Glouchester Road,
Mowbray, Cape Town

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)11656 3237
FAX: +27 (0)86 684 0547
E-MAIL: INFO@SAVANNAHSA.COM
WWW.SAVANNAHSA.COM

EIA INFORMATION LIST – DEA & LEGAL REQUIREMENTS

According to the requirements of the DEA, site, technical and environmental information on the proposed project is to be included in scoping / EIA reports or to be appended to these reports.

1. General Site

No.	Information	Provided / Reference
1.1	Descriptions of all affected farm portions	Refer to Chapter 1 of this report.
1.2	21 digit Surveyor General codes of all affected farm portions	Refer to Chapter 1 of this report.
1.3	Copies of deeds of all affected farm portions	N/A
1.4	Photos of areas that give a visual perspective of all parts of the site	Various within the report (Chapter 5)
1.5	Photographs from sensitive visual receptors (tourism routes, tourism facilities, etc.)	
1.6	Solar plant design specifications including: * Type of technology * Structure height * Surface area to be covered (including associated infrastructure such as roads) * Structure orientation * Laydown area dimensions (construction period and thereafter) * Generation capacity of the facility as a whole at delivery points	Refer to Chapter 2 of this report.

2. Site maps and GIS information

No.	Information	Provided
2.1	All maps/information layers must also be provided in ESRI Shapefile format	Contained in the CD version of this report
2.2	All affected farm portions must be indicated	Refer to Figure 1.1 of this report – locality map
2.3	The exact site of the application must be indicated (the areas that will be occupied by the application)	Refer to Figure 1.1 of this report – locality map
2.4	A status quo map/layer must be provided that includes the following: Current use of the land on site including:	See Figure 5.4 for land cover/land use map
	2.4.1 Buildings and other structures	Also shown on Figure 5.4
	2.4.2 Agricultural fields	Also shown on Figure 5.4
	2.4.3 Grazing areas	The entire farm portion is

No.	Information	Provided
		used for grazing, and not limited to one area
	2.4.4 Natural vegetation areas (natural veld not cultivated for the preceding 10 years) with an indication of the vegetation quality as well as fine scale mapping in respect of Critical Biodiversity Areas and Ecological Support areas	Appendix E – Ecology Report
	2.4.5 Critically endangered and endangered vegetation areas that occur on the site	Not Applicable
	2.4.6 Bare areas which may be susceptible to soil erosion	Appendix I - Soil Report
	2.4.7 Cultural historical sites and elements	Figure 5.5
	2.4.8 Rivers, streams and water courses	See Figure 7.2
	2.4.9 Ridgelines and 20m continuous contours with height references in the GIS database	See Figure 1.1
	2.4.10 Fountains, boreholes, dams (in-stream as well as off-stream) and reservoirs	Not Applicable to this site
	2.4.11 High potential agricultural areas as defined by the Department of Agriculture, Forestry & Fisheries	Not Applicable to this site
	2.4.12 Buffer zones (also where it is dictated by elements outside the site): 500m from any irrigated agricultural land 1km from residential areas Indicate isolated residential, tourism facilities on or within 1km of the site	The site does not occur within these areas
	2.4.13 A slope analysis map / layer that include the following slope ranges: less than 8% slope between 8% and 12% slope between 12%and 14% slope steeper than 18 %slope	See Figure 5.3
	2.4.14 A map/layer that indicate locations of birds and' bats including roosting and foraging areas (specialist input required)	***These areas do not occur within the site***
2.5	A site development proposal map(s)/layer(s) that indicate:	***Refer to Appendix L***
	2.5.1 Position of solar facility	
	2.5.2 Foundation footprint	
	2.5.3 Permanent laydown area footprint	
	2.5.3 Construction period laydown footprint	
	2.5.4 Internal road indicating width (construction period width and operation period width) and with numbered sections between the other site elements which they serve (to make commenting on sections	

No.	Information	Provided
	possible)	
	2.5.5 River, stream and water crossing of roads and cables indicating the type of bridging structures that will be used	
	Substation (s) and/ transformer (s) sites including their entire footprint	
	2.5.6 Cable routes and trench dimensions (where they are not long internal roads)	
	2.5.7 Connection routes to the distribution / transmission network	
	2.5.8 Cut and fill areas along roads and at substation /transformer sites indicating the expected volume of each cut and fill	
	2.5.9 Borrow pits	
	2.5.10 Spoil heaps (temporary for topsoil & subsoil and permanently for excess material)	
	2.5.11 Buildings including accommodation	

3. Regional map and GIS information

No.	Information	Provided
3.1	All maps/information layers must also be provided in ESRI Shapefile format	Maps contained in the CD version of this report & Appendix L
3.2	The map/layer must cover an area of 20km around the site	Contained in the CD version of this report
3.3	Indicate the following: * roads including their types (tarred or gravel) and category (national, provincial, local or private) * Railway lines and stations * Industrial areas * Harbours and airports * Electricity transmission and distribution lines and substations * Pipelines * Water sources to be utilizes during the construction and operational phases * Critical Biodiversity Areas and Ecological Support Areas * Critically Endangered and Endangered vegetation areas * Agricultural fields * Irrigated areas * An indication of new road or changes and	Refer to Appendix L – Project maps

No.	Information	Provided
	upgrades that must be done to existing roads in order to get equipment onto the site including cut and fill areas and crossings of rivers and streams	

NEMA REGULATIONS 543, SECTION 31 REQUIREMENTS FOR THE CONTENT OF ENVIRONMENTAL IMPACT ASSESSMENT REPORTS	CROSS REFERENCE IN THIS EIA REPORT
(a) details of— (i) the EAP who prepared the report; and (ii) the expertise of the EAP to carry out an environmental impact assessment;	Section 1.5
(b) a detailed description of the proposed activity	Chapter 1
(c) a description of the property on which the activity is to be undertaken and the location of the activity on the property, or if it is— (i) a linear activity, a description of the route of the activity; or (ii) an ocean-based activity, the coordinates where the activity is to be undertaken	Chapter 1
(d) a description of the environment that may be affected by the activity and the manner in which the physical, biological, social, economic and cultural aspects of the environment may be affected by the proposed activity	Chapter 5
(e) details of the public participation process conducted in terms of subregulation (1), including— (i) steps undertaken in accordance with the plan of study; (ii) a list of persons, organisations and organs of state that were registered as interested and affected parties; (iii) a summary of comments received from, and a summary of issues raised by registered interested and affected parties, the date of receipt of these comments and the response of the EAP to those comments; and (iv) copies of any representations and comments received from registered interested and affected parties	Chapter 4 Section 4.1
(f) a description of the need and desirability of the proposed activity;	Section 2.3
(g) a description of identified potential alternatives to the proposed activity, including advantages and disadvantages that the proposed activity or alternatives may have on the environment and the community that may be affected by	Section 2.5

NEMA REGULATIONS 543, SECTION 31 REQUIREMENTS FOR THE CONTENT OF ENVIRONMENTAL IMPACT ASSESSMENT REPORTS	CROSS REFERENCE IN THIS EIA REPORT
the activity	
(h) an indication of the methodology used in determining the significance of potential environmental impacts	Section 6.1
(i) a description and comparative assessment of all alternatives identified during the environmental impact assessment process	Section 2.5, Chapter 6, Section 7.1.5
(j) a summary of the findings and recommendations of any specialist report or report on a specialised process	Section 7.3
(k) a summary of the issues raised by interested and affected parties, the date of receipt of and the response of the EAP to those issues	Appendix D
(i) a description of the need and desirability of the proposed activity	Section 2.3
(j) a description of identified potential alternatives to the proposed activity, including advantages and disadvantages that the proposed activity or alternatives may have on the environment and the community that may be affected by the activity	Section 2.5
(k) a description of all environmental issues that were identified during the environmental impact assessment process, an assessment of the significance of each issue and an indication of the extent to which the issue could be addressed by the adoption of mitigation measures	Chapter 6
(l) an assessment of each identified potentially significant impact, including— (i) cumulative impacts; (ii) the nature of the impact; (iii) the extent and duration of the impact; (iv) the probability of the impact occurring; (v) the degree to which the impact can be reversed; (vi) the degree to which the impact may cause irreplaceable loss of resources; and (vii) the degree to which the impact can be mitigated	Chapter 6
(m) a description of any assumptions, uncertainties and gaps in knowledge	Section 4.3.4
(n) a reasoned opinion as to whether the activity should or should not be authorised, and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation	Section 7.3

NEMA REGULATIONS 543, SECTION 31 REQUIREMENTS FOR THE CONTENT OF ENVIRONMENTAL IMPACT ASSESSMENT REPORTS	CROSS REFERENCE IN THIS EIA REPORT
(o) an environmental impact statement which contains— (i) a summary of the key findings of the environmental impact assessment; and (ii) a comparative assessment of the positive and negative implications of the proposed activity and identified alternatives;	Section 7.2 & 7.3
(p) a draft environmental management programme containing the aspects contemplated in regulation 33	Appendix K
(q) copies of any specialist reports and reports on specialised processes complying with regulation 32	Appendix E-J
(r) any specific information that may be required by the competent authority.	Section 7.3

PROJECT DETAILS

DEA Reference No.	:	14/12/16/3/3/2/361 (Phase 1) 14/12/16/3/3/2/362 (Phase 2) 14/12/16/3/3/2/363 (Phase 3) 14/12/16/3/3/2/364 (Phase 4)
Title	:	Environmental Impact Assessment Process Final Environmental Impact Report: Proposed Merapi Photovoltaic (PV) Solar Energy Facility Comprising Four Development Phases, Free State Province.
Authors	:	Savannah Environmental (Pty) Ltd Sheila Muniongo Jo-Anne Thomas Gabrielle Wood
Sub-consultants	:	» Ecology – Savannah Environmental » Soil and agricultural potential – Viljoen and Associates » Heritage resources – Zone Land Solutions) » Visual – Zone Land Solutions » Social – Tony Barbour Consulting » Palaeontology –Wits University Institute for Human Evolution
Client	:	SolaireDirect Southern Africa (Pty) Ltd
Report Status	:	Final Environmental Impact Assessment Report for submission to DEA

When used as a reference this report should be cited as: Savannah Environmental (2012) Final Environmental Impact Assessment Report: Proposed Merapi Photovoltaic (PV) Solar Energy Facility Comprising Four Development Phases, Free State Province for SolaireDirect Southern Africa (Pty) Ltd

PURPOSE OF THE ENVIRONMENTAL IMPACT ASSESSMENT REPORT

SolaireDirect Southern Africa (Pty) Ltd is currently undertaking an Environmental Impact Assessment (EIA) process to determine the environmental feasibility of a proposed solar energy facility on a near Bloemfontein, in the Free State Province. SolaireDirect Southern Africa (Pty) Ltd has appointed Savannah Environmental, as independent environmental consultants, to undertake the EIA. The EIA process is being undertaken in accordance with the requirements of the National Environmental Management Act (NEMA; Act No. 107 of 1998).

The EIA Report consists of fourteen 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 (phase 1).
Chapter 7: Presents the conclusions of the EIA, as well as an impact statement on the proposed project (phase 1).
Chapter 8: Presents the assessment of environmental impacts associated with the proposed facility (phase 2).
Chapter 9: Presents the conclusions of the EIA, as well as an impact statement on the proposed project (phase 2).
Chapter 10: Presents the assessment of environmental impacts associated with the proposed facility (phase 3).
Chapter 11: Presents the conclusions of the EIA, as well as an impact statement on the proposed project (phase 3).
Chapter 12: Presents the assessment of environmental impacts associated with the proposed facility (phase 4).
Chapter 13: Presents the conclusions of the EIA, as well as an impact statement on the proposed project (phase 4).
Chapter 14: 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 Final 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

The Draft Environmental Impact Assessment (EIA) Report was made available for public review and comment by Interested and Affected Parties (I&APs) and stakeholders from:
21 January 2013 to 20 February 2013 at the:

» Excelsior Public Library
» www.savannahsa.com

PUBLIC FEEDBACK MEETING

In order to further facilitate comments on the Draft EIA report and to provide feedback on the findings of the Draft EIA report, a public feedback meeting was held. All interested and affected parties were invited to attend a public meeting held as follows:

Date: 30 January 2013
Time: 16:00 – 18:00
Venue: Excelsior Public Library

EXECUTIVE SUMMARY

SolaireDirect Southern Africa (Pty) Ltd is proposing to establish a commercial photovoltaic solar energy facility of up to ~130 MW of electricity (155 MW installed capacity) comprising of four development phases, as well as associated infrastructure on a site located approximately 5 km south-east of Excelsior in the Free State Province. The project is referred to as the Merapi Solar PV Facility, and will comprise four development phases. A larger site has been identified for consideration within an Environmental Impact Assessment (EIA). Each of the four development phases will have different electricity generating capacity. Associated infrastructure includes a substation, access roads and power line/s.

As each phase of the project will be constructed and operated by a separate Special Purpose Vehicle (SPV), separate Environmental Authorisations will be required to be obtained for each phase. As such, each project has been registered with the National DEA under following project names and EIA reference numbers:

» Merapi PV - Phase 1 (14/12/16/3/3/2/361)
» Merapi PV - Phase 2 (14/12/16/3/3/2/362)
» Merapi PV - Phase 3 (14/12/16/3/3/2/363)
» Merapi PV - Phase 4 (14/12/16/3/3/2/364)

One consolidated EIA process and public participation process is being undertaken for the four development phases of the project. The nature and extent of this facility (comprising four development phases), as well as potential environmental impacts associated with the construction of a facility of this nature is explored in more detail in this Draft Environmental Impact Report.

The project facility is proposed on Portion 0 of Farm 311 Ceylon, Portion 0 of Farm 566 Moedersgift, Portion 0 of Farm 374 Concordia, and Portion 1 of Farm 1547 De Hoop which falls within the Mantsopa Local Municipality of the Free State Province.

The proposed facility, which will be entirely contained within the identified farm portions, will have a total developmental footprint of ~250 ha; each phase will occupy a footprint as follows:

» Merapi PV - Phase 1 ~55 ha
» Merapi PV - Phase 2 ~30 ha
» Merapi PV - Phase 3 ~85 ha
» Merapi PV - Phase 4 ~70 ha

The solar energy facility proposes to generate ~130 MW of electricity (155 MW installed capacity) and each phase will be comprised of the following infrastructure:

» PV Arrays with the following generating capacity for each phase:

- Merapi PV - Phase 1 ~33 MW
- Merapi PV - Phase 2 ~20 MW
- Merapi PV - Phase 3 ~55 MW
- Merapi PV - Phase 4 ~46 MW

» An on-site substation and 22 kV/132 kV overhead power line to facilitate the connection between the solar energy facility and the Eskom electricity grid.
» Internal access roads.
» Guard house,
» Laydown, Campsite and assembly area.
» Office and Control centre.

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 soil, and agricultural 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-negligible significance.
» In terms of visual impacts, the potential significance was rated as having medium significance. The potential impact on users of arterial and secondary roads and on residents of towns and homesteads in close proximity of the facility will be of high significance.
» In terms of social impacts, the potential significance was rated as having a predominately medium significance.

No environmental fatal flaws were identified with the establishment of the proposed Merapi Solar Energy Facility-Phase 1-4. 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 K-N.

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 viability of establishing a solar plant on a site near Bloemfontein has been established by SolaireDirect (Pty) Ltd. The positive implications of establishing a solar energy facility on the identified site within the Free State 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 Merapi Solar Energy Facility-Phase 1-4 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.

» Rocky outcrops, ridges, and small koppies which are a habitat for several protected species found near the sites. Once these habitats have been physically altered, they cannot be recreated or returned to their former diversity and functionality therefore should be treated as no-go areas i.e. No PV panels, roads, or underground cabling may be placed on these areas. Other sensitive ecological areas include dense vegetation of the riparian areas fringing the drainage channels which is essential in keeping the drainage channel intact and protects it from erosion as well as man-made wetland on site. It is thus imperative that a minimum legal buffer of developments of 32 m from drainage lines be extended in the study area. It is recommended that a buffer of at least 100 m be maintained around riparian areas.

» Potential impacts on heritage sites relate to the five heritage sites that were identified near the site, of the five site two were deemed as important; however these findings were located outside the study area, hence no significant impacts is anticipated.

» The visual impacts associated with the proposed facility is of medium sensitivity, however the impacts will be largely contained within the site itself because the four phases proposed phases for the solar energy facility will be constructed next to each other. (Refer to figure 2).

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

» In order to connect the solar energy facilities to the power grid, 22kV/132kV overhead power line depending on the generating capacity of each phase (i.e. for phases with generating capacity greater than 40MW, a 132kV overhead can be used and if less than 40 MW a 22kV overhead will be used) will be constructed from the on-site substation to connect directly into the existing Excelsior substation or loop-in and loop-out of the existing power line.
» All mitigation measures detailed within this report and the specialist reports contained within Appendices E to J should be implemented to limit the negative impacts and enhance the positives.
» The draft Environmental Management Plan (EMP) as contained within Appendix K-N 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 plant species as a number of protected succulents are present 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.

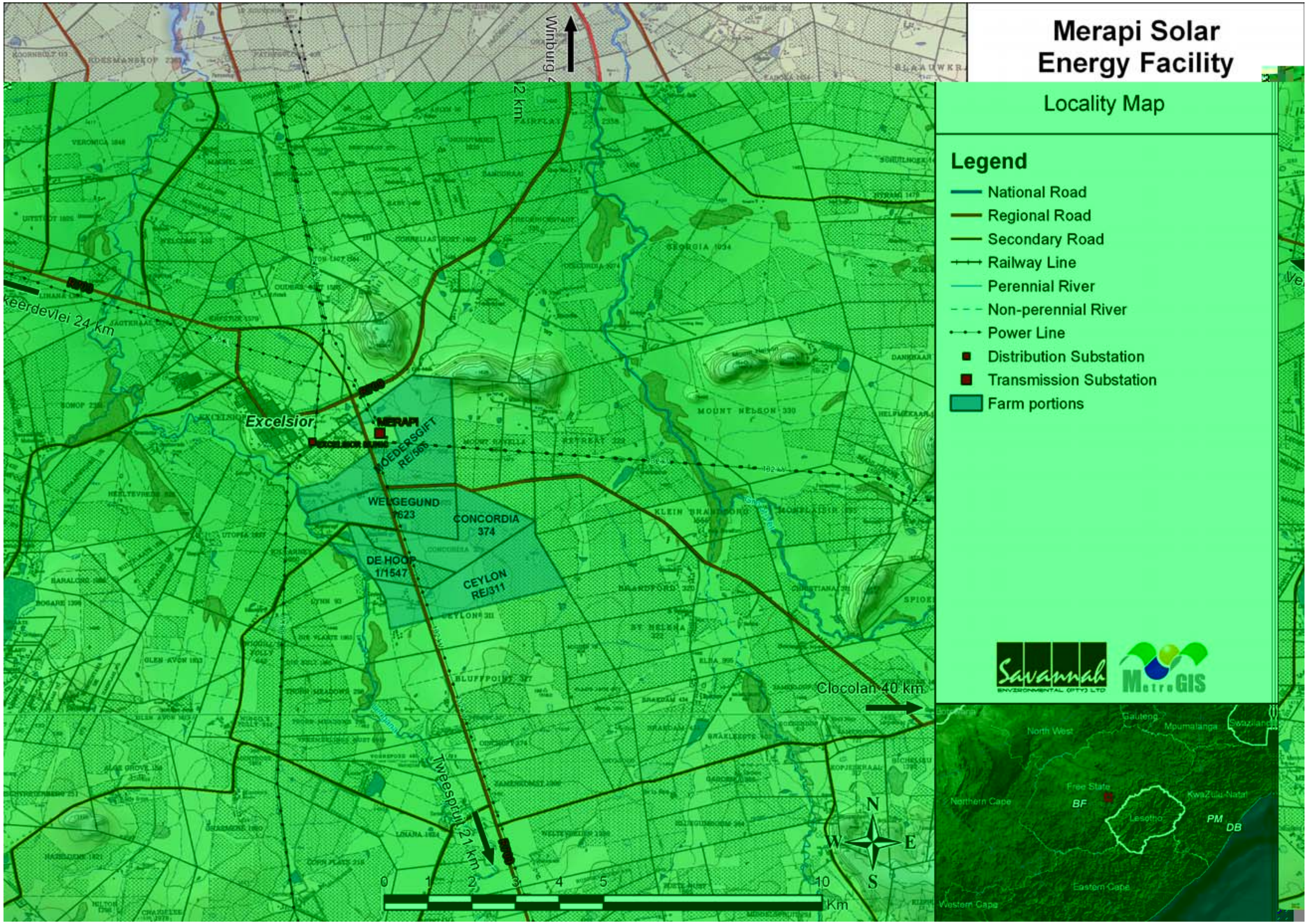

Figure 1: Locality Map

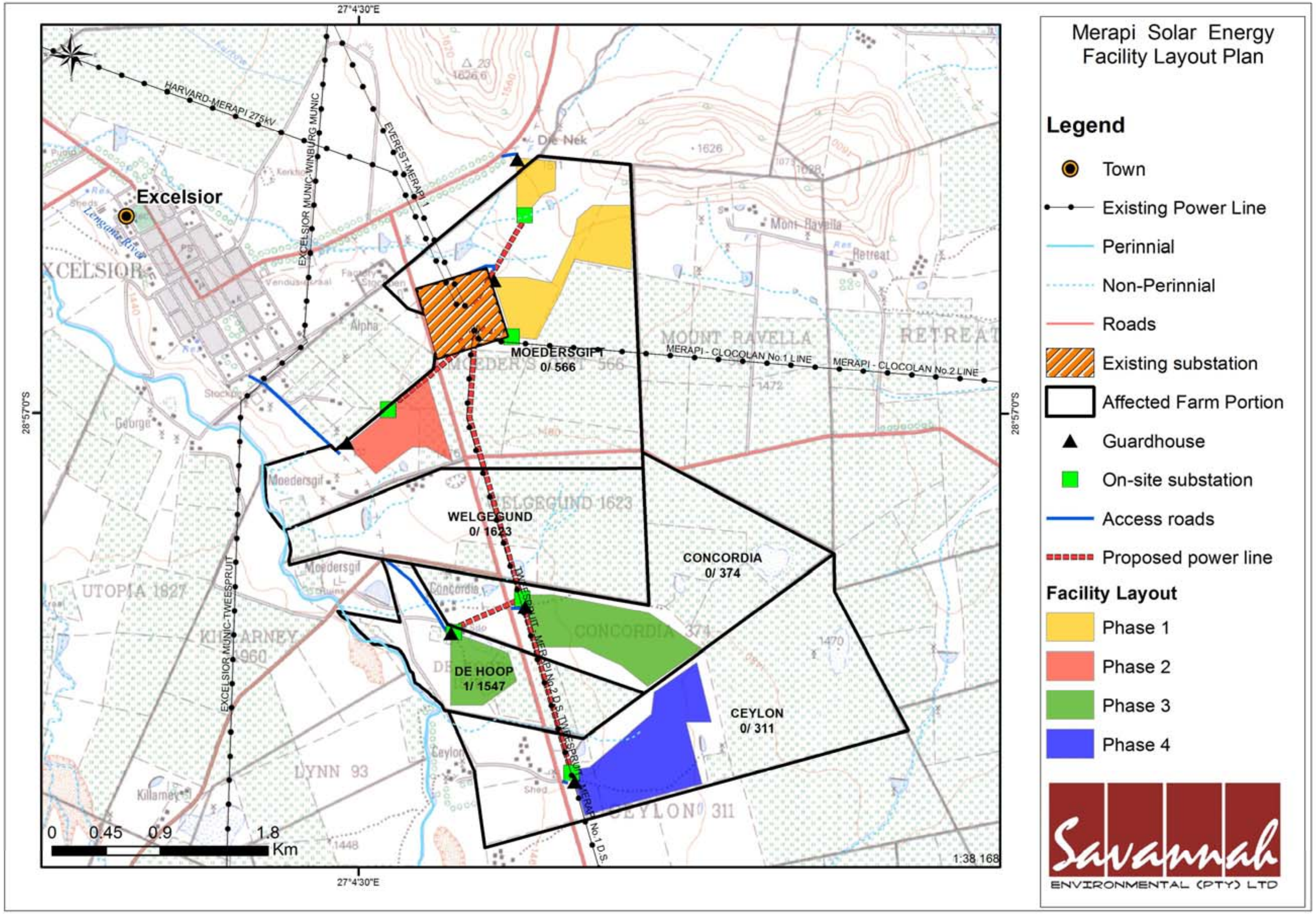

Figure 2: Locality map 2 showing Merapi Solar Energy Facility-Phase 1-4

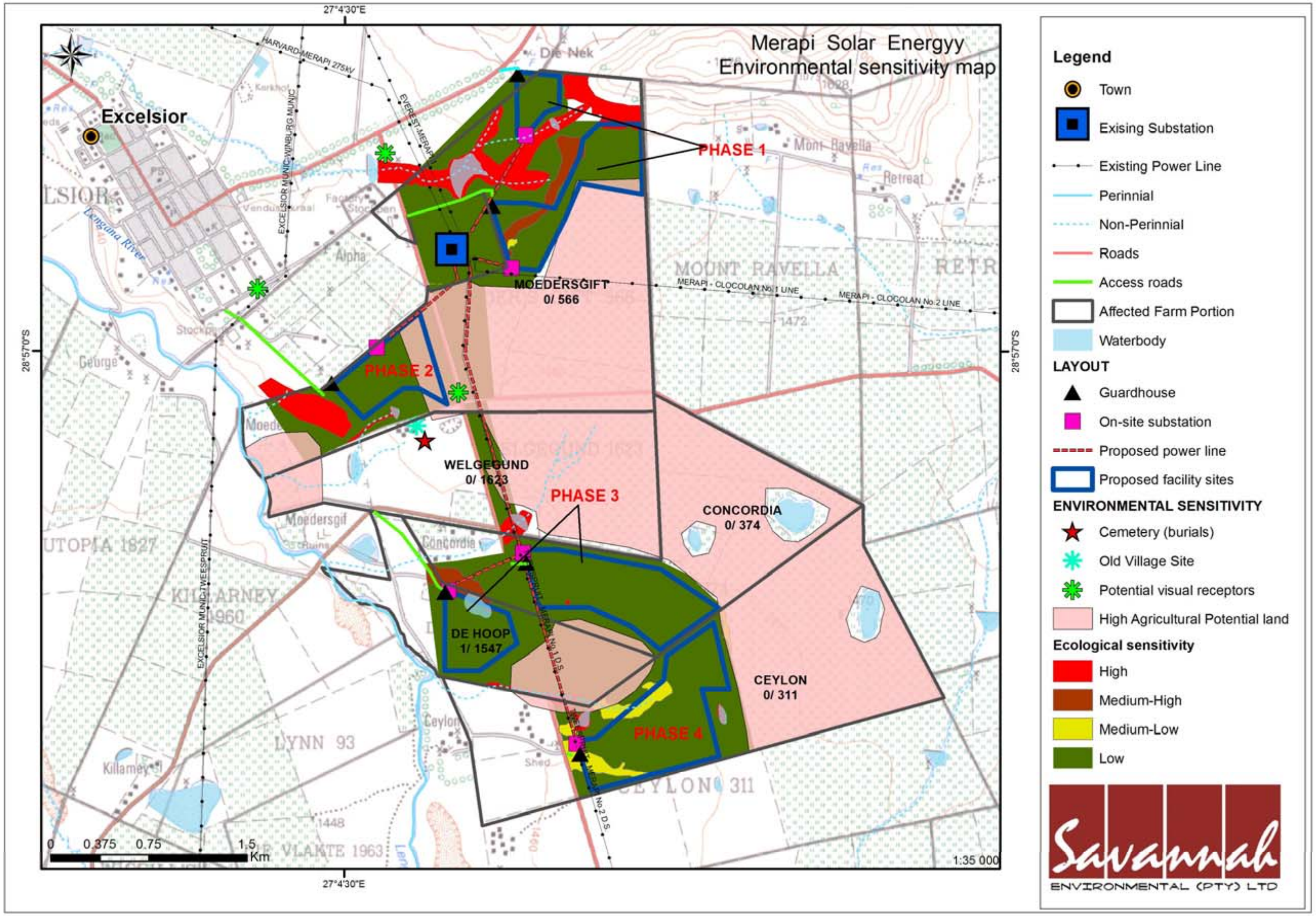

Figure 3: Sensitivity Map for the Merapi Solar Energy Facility-Phase 1-4.

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APPENDICES

DEFINITIONS AND TERMINOLOGY

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

ABBREVIATIONS AND ACRONYMS

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

INTRODUCTION CHAPTER 1

SolaireDirect Southern Africa (Pty) Ltd proposes to establish a commercial solar park and associated infrastructure on Portion 0 of Farm 311 Ceylon, Portion 0 of Farm 566 Moedersgift, Portion 0 of Farm 374 Concordia, and Portion 1 of Farm 1547 De Hoop which falls within the Mantsopa Local Municipality of the Free State Province. The project is proposed to have a generating capacity of up to 300MW which would comprise 4 phases of up to 75MW each. The proposed site lies approximately south-east of Excelsior in the Free State Province. The proposed facility and associated infrastructure (i.e. the development footprint) would be constructed over an area of approximately 250 hectares (ha) in extent. The larger project development site covers an area of approximately 1505 ha. **Figure 1.1** indicates the farm portions that are currently being assessed as part of this Environmental Impact Assessment (EIA) (farm portion shown in blue).

The proposed project development site is considered to be 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. A study of available radiation 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 technology.
» **Orographic conditions:** The site conditions are optimum for a development of this nature. For instance the site slope and aspect for the proposed site is predominantly flat. A level surface area (i.e. with a minimal gradient in the region of 1%) is preferred for the installation of PV panels. The proposed area for the proposed PV plant is generally on a flat location with slopes of less than 5 degrees.
» **Extent of the site:** Significant land area is required for the proposed development. The site is larger than the area required for development.
» **Proximity to grid connection:** This site is in close proximity to an existing electricity grid connection with adequate connection capacity, which minimises the need for a long connection power line.

As each phase of the project will be constructed and operated by a separate Special Purpose Vehicle (SPV), separate Environmental Authorisations will be required to be obtained for each phase. As such, each project has been registered with the National Department of Environmental Affairs (DEA) under following project names and EIA reference numbers:

» Merapi Solar PV Facility - Phase 1 (DEA Ref. No 14/12/16/3/3/2/361)
» Merapi Solar PV Facility - Phase 2 (DEA Ref. No 14/12/16/3/3/2/362)
» Merapi Solar PV Facility - Phase 3 (DEA Ref. No 14/12/16/3/3/2/363)
» Merapi Solar PV Facility - Phase 4 (DEA Ref. No 14/12/16/3/3/2/364)

One consolidated EIA process and public participation process is being undertaken for the four development phases of the project. 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 Final EIA Report . The Final EIA Report consists of fourteen 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 (phase 1).
Chapter 7: Presents the conclusions of the EIA, as well as an impact statement on the proposed project (phase 1).
Chapter 8: Presents the assessment of environmental impacts associated with the proposed facility (phase 2).
Chapter 9: Presents the conclusions of the EIA, as well as an impact statement on the proposed project (phase 2).
Chapter 10: Presents the assessment of environmental impacts associated with the proposed facility (phase 3).
Chapter 11: Presents the conclusions of the EIA, as well as an impact statement on the proposed project (phase 3).
Chapter 12: Presents the assessment of environmental impacts associated with the proposed facility (phase 4).
Chapter 13: Presents the conclusions of the EIA, as well as an impact statement on the proposed project (phase 4).
Chapter 14: Provides a list of references and information sources used in undertaking the studies for this EIA Report.

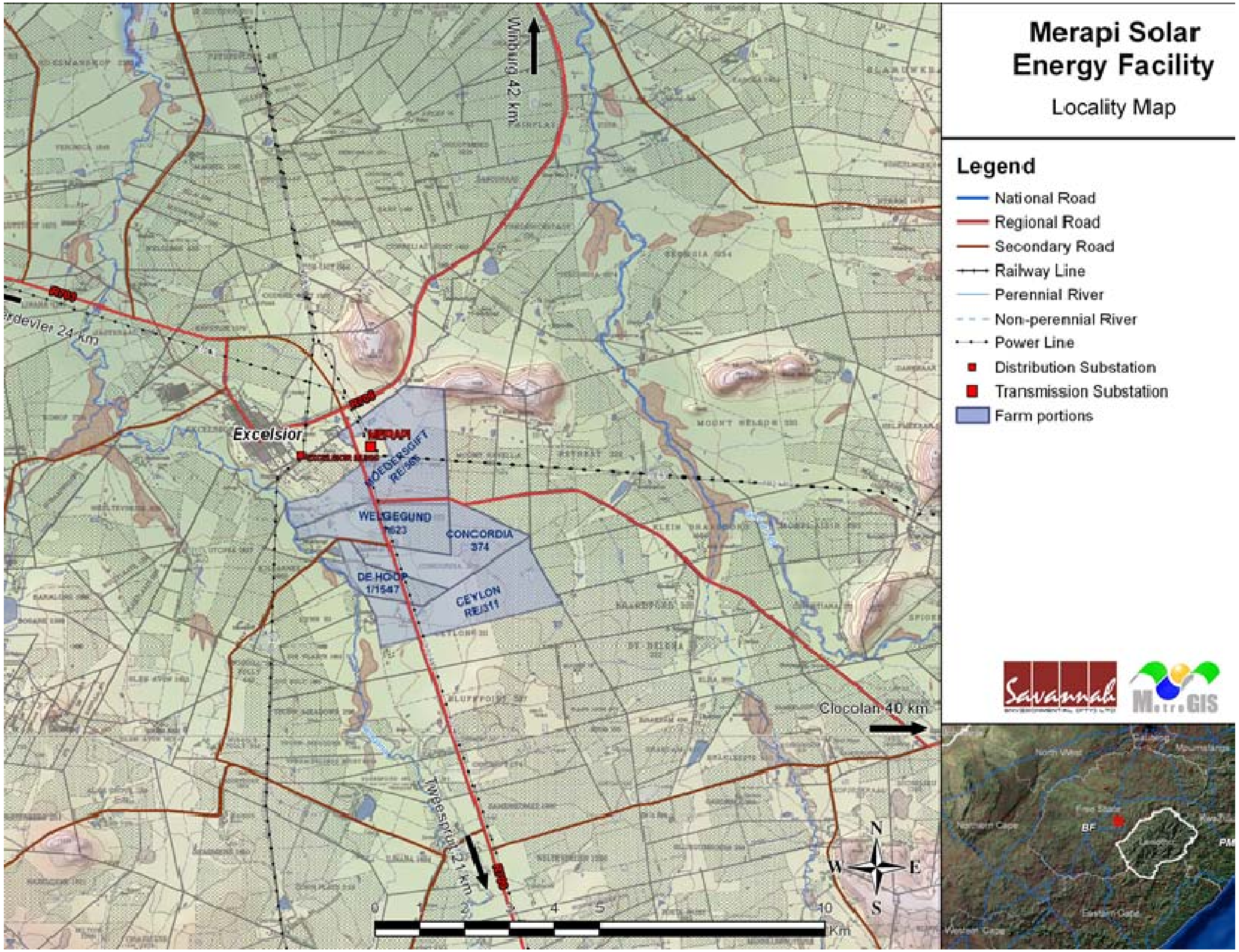


Figure 1.1: Locality map illustrating the location of the assessed development site for the proposed Merapi Solar Energy Facility

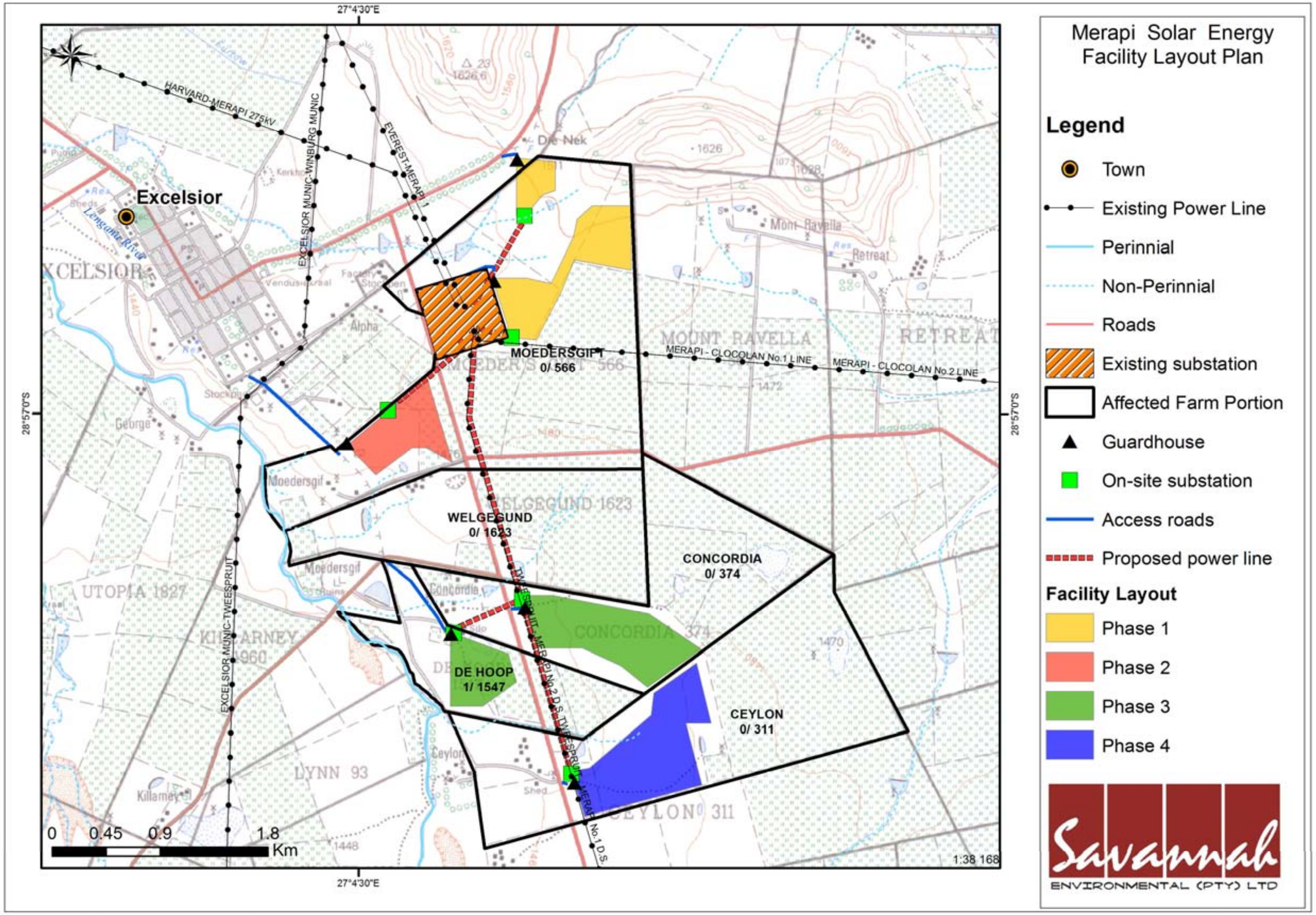


Figure 1.2: Locality map 2 showing the proposed areas for Merapi Solar Energy Facility-Phase 1-4

1.1. Summary of the proposed Development

The Merapi Solar Park is proposed to accommodate several arrays of photovoltaic (PV) panels with associated infrastructure in order to generate up to **~130 MW of electricity** (155 MW installed capacity). Each phase will comprise of PV panels and associated infrastructural requirements which will include:

» An on-site substation and 22 kV/132 kV overhead power line to facilitate the connection between the solar energy facility and the Eskom electricity grid,
» Internal access roads,
» Guard house,
» Laydown, Campsite and assembly area,
Office and Control centre.

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 of which will serve to inform the design of the facility. Potentially suitable areas for development within the broader site were identified through the Scoping Study undertaken for the project. These are illustrated in Figure 1.2 and are the areas which were investigated within this EIA process.

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

1.2. Conclusions from the Scoping Phase

The full extent of the project development site (i.e. the extent of the farm portions) was evaluated within the scoping study. No environmental fatal flaws were identified to be associated with the proposed development at this stage in the process. However, no go areas such as areas of high agricultural potential land, pans and drainage areas have been identified. These areas of potential environmental sensitivity on the site are illustrated on Figure 1.3. From the scoping study, it was concluded that:

» There are pockets of remaining natural vegetation on the farm, which could support habitat for populations of Red List or protected flora and fauna that have been evaluated as having a probability of occurring within natural habitats within the study area. Large areas of the study site, including areas preferred for the proposed development, are part of the remaining extent of the Eastern Free State Clay Grasslands and should thus be regarded as vulnerable.

» The site is in a semi-arid region. There are unlikely to be any wetlands on site, but there are a number of non-perennial streams or drainage lines that occur on the site. According to the National Water Act, dry stream beds and drainage areas (including non-perennial streams) are classified as wetlands or water resources. Drainage lines or non-perennial streams do provide habitat for a number of plant or animal species in the study area, including those with a restricted distribution or species with an elevated conservation status. Drainage lines (water resources) represent particularly vital natural corridors as they function both as wildlife habitat, providing resources needed for survival, reproduction and movement, and as biological corridors, providing for movement between habitat patches.

» The sensitivity map (Figure 1.3) highlighted cemeteries and old village which are deemed to be of high significance from a heritage perspective. If directly affected, it is proposed that the cemetery be relocated into a municipal demarcated cemetery. Alternatively a buffer of 20m needs to be maintained between the site and construction activities during the construction phase of the project – this will require the development of the cemetery management plan which should include a strategy on how the deceased's families should access the graves once the Solar Farm is operational to mitigate security measures for the Solar Farm as well as comply with the need for access by families to the graves or heritage as stipulated in the NHRA, No.25 of 1999.

» The sensitivity map also highlighted areas of potential high agricultural potential. The agricultural potential of the bulk of the site is medium-high due to underlying soils and current land use.

As can be seen from the above conclusion, the majority of potential impacts identified to be associated with the construction of the solar energy facility are anticipated to be localised and restricted to the proposed site itself (apart from social impacts – job creation which could have more of a regional positive impact), while operational phase impacts range from local to regional and national (being the positive impact of contribution of clean energy as part of the energy mix in South Africa and helping to meet the aims of Mantsopa Local Municipality Integrated Development Plan (2010/2011).

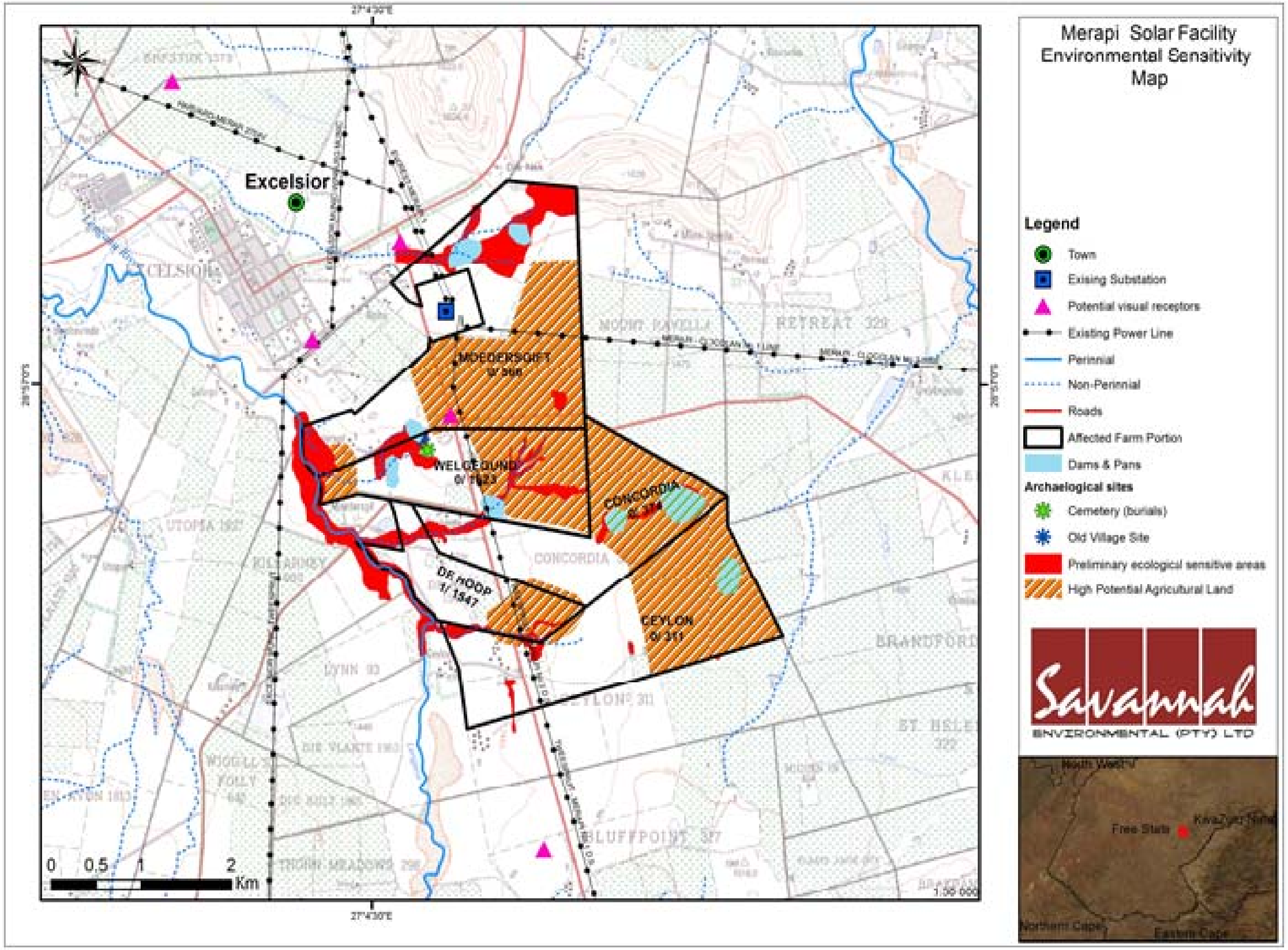


Figure 1.3: Preliminary environmental sensitivity map for the proposed Merapi Solar Energy Facility.

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

» Effects on protected flora and fauna (local and site specific)
» Impacts on agricultural potential and soils
» Impacts on heritage artefacts and graves
» Socio-economic impacts, both positive and negative (including job creation and business opportunities, impacts associated with construction workers in the area)

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

» Visual impacts and impacts on "sense of place" on nearby residential areas and observers travelling on main roads
» Positive socio-economic impacts
» Impacts on agricultural potential and land use of the site
» Increased availability of clean, renewable energy (positive)

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 Free State Department of Economic Development, Tourism and Environmental Affairs (FS DETEA) will act as a commenting authority for the application. Applications for authorisation have been accepted by DEA under application reference numbers:

» Merapi Solar PV Facility - Phase 1 (DEA Ref. No 14/12/16/3/3/2/361)
» Merapi Solar PV Facility - Phase 2 (DEA Ref. No 14/12/16/3/3/2/362)
» Merapi Solar PV Facility - Phase 3 (DEA Ref. No 14/12/16/3/3/2/363)
» Merapi Solar PV Facility - Phase 4 (DEA Ref. No 14/12/16/3/3/2/364)

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. SolaireDirect Southern Africa (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).

Number and date of the relevant notice:	**Activity No (s)**	**Description of each listed activity**	**Description of relevance**
GN544, 18 June 2010	10	The construction of facilities or infrastructure for the transmission and distribution of electricity – i. Outside urban areas or industrial complexes with a capacity of more than 33kv but less than 275kv; or ii. Inside urban areas or industrial complexes with a capacity of 275kv or more.	The substation and distribution line associated with facility will have a capacity of more than 33kV but less than 275kV. ***Proposed distribution line is 22kV/132kV.***
GN544, 18 June 2010	11	The construction of: xi. Infrastructure or structures covering 50 square metres or more.	The construction of the proposed solar facility and associated infrastructure may impede on drainage lines on the site.

Number and date of the relevant notice:	Activity No (s)	Description of each listed activity	Description of relevance
		Where such construction occurs within a watercourse or within 32 metres of a watercourse, measured from the edge of a watercourse, excluding where such construction will occur behind the development setback line.	
GN 544, 18 June 2010	18	The crossing of drainage lines may result in 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 a watercourse	Potential infilling or depositing may occur as a result of the construction of the proposed facility and associated infrastructure.
GN545, 18 June 2010	1	The construction of facilities or infrastructure, for the generation of electricity where the output is 20 megawatts or more.	The PV facility will have a generation capacity of up to 130 MW (155 MW installed capacity).
GN545, 18 June 2010	15	Physical alteration of undeveloped, vacant or derelict land for residential, retail, commercial, recreational, industrial or institutional use where the total area to be transformed is 20 hectares or more; ~~Except where such physical alteration takes place for: Linear development activities. Agriculture or afforestation where activity 16 in this schedule will apply.~~	The proposed solar energy facility would transform an area greater than 20 ha.
GN546, 18 June 2010	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 four phases will occupy an area of approx. 250 ha and the area constitutes natural vegetation which will be cleared.

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 September 2012 with the receipt of the acceptance of scoping from DEA. The scoping phase 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 Final EIA Report provides stakeholders with an opportunity to verify that issues they have raised through the EIA Process have been captured and adequately considered. The final EIA Report 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 SolaireDirect Southern Africa (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 SolaireDirect Southern Africa (Pty). 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.
» Sheila Muniongo - the principle author of this report, holds an Honours Bachelor of Science degree in Environmental Management and 2 years' experience in the environmental field. Her key focus is on environmental impact assessments, public participation, environmental management plans and programmes, as well as mapping different Environmental Projects. She is currently the responsible EAP for several renewable energy project EIAs across the country.
» Gabriele Wood – the public participation consultant for this project, hold an Honours Bachelor degree in Anthropology and has 5 years' experience in Public Participation and Social consultancy including professional execution of public participation consulting for a variety of projects as well as managing and coordinating public participation processes for Environmental Impact Assessments (EIA).

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

» Ecology – Savannah Environmental
» Soil and agricultural potential – Viljoen and Associates
» Heritage resources – Zone Land Solutions
» Visual – Zone Land Solutions
» Social – Tony Barbour Consulting
» Palaeontology – Wits University Institute for Human Evolution

Savannah Environmental has developed a detailed understanding of impacts associated with the construction and operation of renewable energy facilities through their involvement in numerous EIA processes for these projects. 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 Merapi Solar Energy Facility on a site located approximately 5 km south-east of Excelsior in the Free State. 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 several photovoltaic (PV) arrays, to make use of the solar resource on the site. The facility is proposed to have a generating capacity of up to 130 MW (155 MW installed capacity), and will be developed in 4 phases. An area of approximately 250 ha in extent within which the facility is proposed is being investigated within the EIA process.

The following table details the project components

Component	Description
Location of the site	~ 5 km south-east of Bloemfontein
Municipal Jurisdiction	Mantsopa Local Municipality; Motheo District Municipality
Extent of the proposed development footprint (four phases)	±250 ha
Extent of broader site available for development	~1505 ha
Site access	The site can be accessed easily via the R709 main road which crosses through the proposed sites, as well as via farm gravel roads. The farm roads will be upgraded and used to access the facility site during construction and operation.
Generating capacity(four phases)	130 MW (155 MW installed capacity)
Proposed technology	Photovoltaic panels
Associated infrastructure	» An on-site substation and 22kV/132 kV overhead power line to facilitate the connection between the solar energy facility and the Eskom electricity grid. » Internal access roads (~4m wide x 50-1000m in length)

Component	Description
	» Guard house » Laydown, campsite and assembly area. » Office and Control centre.
Water use	» Approximately over 6 million litres/year required during the construction phase and over 1000000 litres/year for operations, Water requirements for the construction phase of the PV power facility which will be supplied by the Local Water Users' Association. Alternatively water will be provided via a rainwater tank. » No effluent will be produced except for the normal sewage from site and operations staff. This will be treated as per normal standards with a septic tank and disposed of at an appropriate licensed facility off-site.

A preliminary layout of the proposed facility has been provided by the project developer, and is included in Figure 2.1. This is the layout which has been assessed within this EIA Report.

2.2. Purpose of the Proposed Project

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

Globally there is 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.

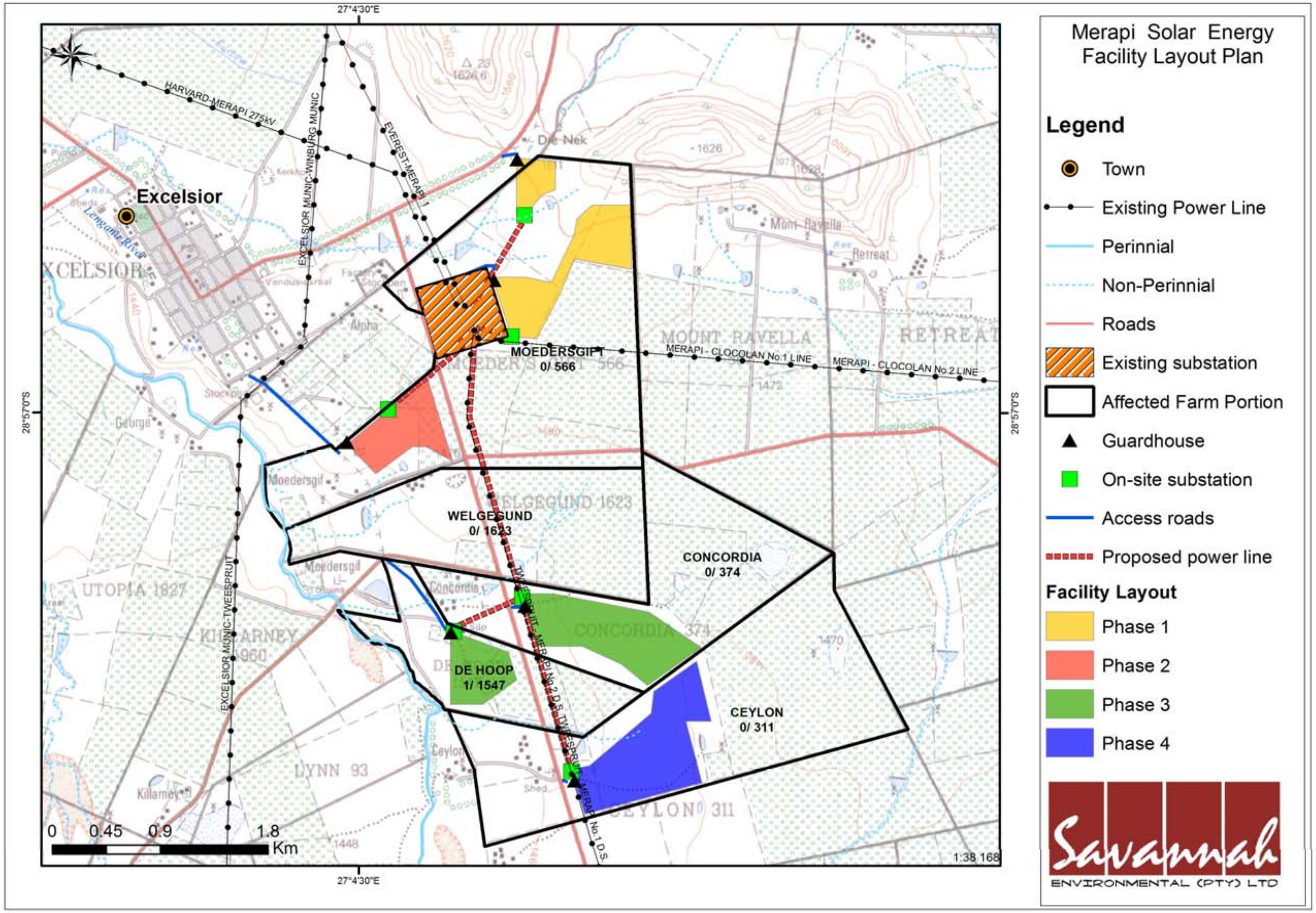


Figure 2.1: Preliminary layout for the proposed Merapi Solar Energy Facility-phase 1.

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, SolaireDirect Southern Africa (Pty) Ltd is proposing the establishment of the Merapi Solar Energy Facility phase 1-4 to add new capacity to the national electricity grid. SolaireDirect Southern Africa (Pty) Ltd will be required to apply for a generation license from the National Energy Regulator of South Africa (NERSA), as well as a power purchase agreement from Eskom (typically for a period of 20 years) in order to build and operate the proposed facility. As part of the agreement, the SolaireDirect Southern Africa (Pty) Ltd will be remunerated per kWh by Eskom who will be financially backed by government. Depending on the economic conditions following the lapse of this period, the facility can either be decommissioned or the power purchase agreement may be renegotiated and extended.

2.3. The Need and Desirability for the Proposed Project

According to the DEA Draft Guideline on Need and Desirability in terms of the Environmental Impact Assessment (EIA) Regulations, 2010 (October 2012) the need and desirability of a development must be measured against the contents of the Integrated Development Plan (IDP), Spatial Development Framework (SDF) and Environmental Management Framework (EMF) for an area, and the sustainable development vision, goals and objectives formulated in, and the desired spatial form and pattern of land use reflected in, the area's IDP and SDF.

2.3.1 Mantsopa Municipality Integrated Development Plan (IDP) (2010-2011)

The vision for the MM as set out in the MM IDP (2010-2011 Review) is "Mantsopa Local Municipality shall be a leading force to achieve an accessible, integrated, sustainable and equitable social and economic development of her community".

The MMs mission is to "To achieve an accessible, integrated, sustainable and equitable social and economic development of the municipality". The IDP identifies 5 focus or key performance areas, namely:

» Provision of sustainable infrastructure and basic services;
» Stimulate socio-economic development and tourism;
» Sustain financial management excellence;
» Improve human resource management excellence (Institutional transformation);

» Improve good governance trough effective leadership.

Of these, the first two are relevant to the proposed Merapi Solar Park.

The priority issues identified in the IDP include: sanitation, electricity, water, roads and stormwater, community facilities, housing and land, local economic development, education, waste management, health, safety and security, social welfare, environmental management and conservation. The construction and operation of the proposed Merapi Solar Park, including the establishment of a Community Trust, can assist the MM in meeting some of these priorities, specifically, the provision of electricity, and establishment of community facilities and promotion of local economic development. The Municipal Strategy outlined in the IDP lists the key developmental objectives of the MM. The following are relevant to the proposed SEF:

» To provide sustainable infrastructure and basic services-
  The IDP indicates that the provision of infrastructure services was identified as a key priority by communities in the MLM. The provision of electricity is listed under the heading of basic services.

» To stimulate sustainable economic development and tourism-
  The IDP notes that local economic development is the most important sector of development in MM. Once the people have escaped the vicious circle of poverty, they can become active generators of income. This income will be spent in Mantsopa towns and will represent a further investment in development. As the economy grows, so the people will be able to provide their own needs and eventually contributes the national economy.

One of the key strategies identified in the IDP is to support small businesses. The key objectives of the national small business strategy that are relevant to the proposed Merapi Solar Park include:

» Creation of an enabling environment for small enterprises;
» Address the legacy of apartheid based disempowerment of black business;
» Support the advancement of women and youth in all business sectors;
» Create long term jobs;
» Stimulate sector focused economic growth;
» Strengthen cohesion between small enterprises; and
» Level the playing fields between bigger and small business as well as between rural and urban business.

The IDP also lists the outcomes of an IDP meeting held on 16 March 2010 at the Ladybrand town hall in which new projects for 2010/2011 were identified. Of specific reference for the proposed Merapi Solar Park the meeting identified the establishment of a “Solar Power Station” and provision of solar panels for all Mantsopa Towns. This clearly indicates that the MLM supports the establishment of renewable energy projects and initiatives in the area, specifically solar energy.

2.3.2. Free State Province Provincial Growth and Development Strategy

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

» The need to effectively use scarce resources within the Province, whilst addressing the real causes of development challenges.
» The need to accelerate service delivery based on a common provincial development agenda as the basis for provincial strategic direction.
» The need to identify investment opportunities and provide an environment of certainty critical for private-sector investment.
» The need to promote intergovernmental coordination between the three spheres of government.
» The need to facilitate facilitates the implementation of the People’s Contract within the Province.
» The need to provide a common vision as the basis for common action amongst all stakeholders, both inside and outside government.
» The need to provide a framework for budgets, implementation, performance management and spatial development.

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

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

The FSPGDS identifies a number of key provincial priorities. The priorities that are relevant to the proposed Solar Park include:

» Economic development, employment, and investment;

» Human and social development. Economic growth is underpinned by a good socio-economic environment. Future strategies

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

2.3.3. Free State Draft Spatial Development Framework(2007)

The FSSDF in its draft final form was approved by Local Government and housing in July 207, and is used as the key spatial guidance framework for the province. The FSSDF notes that sections of the local communities have limited access to economic and income-generating opportunities in both the formal and informal sectors. Minimal opportunities for small-scale farmers and the uneven spread of the benefits of the tourism industry have limited the impact of the agricultural and tourism sectors on the economic disposition of disadvantaged communities. The SDF further set certain key objectives from priority areas as follows:

» To achieve an economic growth rate of 6%-7% per annum
» To reduce unemployment from 38,9% to 20%
» To reduce the number of households living in poverty by 5% per
» annum
» To provide adequate infrastructure for economic growth and development

The Free State Province Spatial Development Framework SDF does not specifically make reference to renewable energy. However, there are a number of key provincial priorities that are relevant to the proposed PVSEF. These include economic development, employment, and investment. The FSPSDF also emphasises the importance of SMME development and the provision of economic infrastructure, which would include energy related infrastructure. Therefore the Merapi solar energy facility is considered to be compatible with spatial development plans for the province.

2.3.4. Financial Viability and Community Needs

In terms of the energy yield predicted from the facility, the developer considers the Merapi project to be financially viable. The "need and desirability" of the local community as reflected in an IDP, SDF for the area, is also considered in the EIA. In the South African context, developmental needs (community needs) are often determined through the above planning measures (IDP, SDF and/ EMF). The Merapi solar energy facility project is in line with the Matsopa Local Municipality Integrated Development Plan (IDP) (2010-2011), as discussed above. In terms of the needs on the local community, the SDF & SIA identified the need for development, social services, education and employment opportunities in this area. The Merapi project could potentially contribute positively to these community needs. The project will create employment and business opportunities, as well as the opportunity for skills development of for the local community. In addition, indirect benefits and spend in the local area will benefit the local community.

2.3.5. The Need for the Merapi Solar Energy Facility Project

Globally there is increasing pressure on countries to increase their share of renewable energy generation due to concerns such as exploitation of non-renewable resources and the rising cost of fossil fuels. In order to meet the long-term goal of a sustainable renewable energy industry and to diversify the energy-generation mix in South Africa, 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.

In responding to the growing electricity demand within South Africa, as well as the country's targets for renewable energy, SolaireDirect proposes the establishment of the Merapi Solar Energy Facility to add new capacity to the national electricity grid.

The development of the project would benefit the local/regional/national community by developing a renewable energy project. Surrounding communities would also benefit from the development through job creation and spin-offs. In addition, according to Department of Energy (DoE) bidding requirements the developer must plan for a percentage of the profit per annum from the solar energy facility to go back into the community through a social beneficiation scheme. Therefore there is a potential for creation of employment and business opportunities, and the opportunity for skills development of for the local community.

2.3.6. The Desirability for the Merapi Solar Energy Facility Project

Use of solar for electricity generation is essentially a non-consumptive use of a natural resource. A solar energy facility also qualifies as a Clean Development Mechanism (CDM) project (i.e. a financial mechanism developed to encourage the development of renewable technologies) as it meets all international requirements in this regard. The proposed site was selected for the development of a solar energy facility based on its predicted solar radiation, suitable proximity in relation to the existing electricity grid, no completion and minimum technical constraints from a construction and technical point of view. SolaireDirect considers this area, and specifically the demarcated site, to be highly preferred for solar energy facility development.

The current land-use on the site is primarily used for a mixture of livestock farming and crop cultivation. Within a radius of 10 km of the study site, land uses also include formal settlements and game farming. The primary activity in the region is farming. Due to the agricultural activities in the area, the landscape is largely transformed. Therefore the current land-use will be retained, while also generating renewable energy from the sun. This represents a win-win situation of landowners, the site and the developer.

2.3.7. How the principles of environmental management as set out in section 2 of NEMA have been taken into account in the planning for the proposed project

The principles of NEMA have been considered in this assessment through compliance with the requirements of the relevant legislation in undertaking the assessment of potential impacts, as well as through the implementation of the principle of sustainable development where appropriate mitigation measures have been recommended for impacts which cannot be avoided. In addition, the successful implementation and appropriate management of this proposed project will aid in achieving the principles of minimisation of pollution and environmental degradation.

The EIA process has been undertaken in a transparent manner and all effort has been made to involve interested and affected parties, stakeholders and relevant Organs of State such that an informed decision regarding the project can be made by the Regulating Authority.

The general objectives of Integrated Environmental Management have been taken into account for this EIA report by means of identifying, predicting and evaluating the actual and potential impacts on the environment, socio-economic conditions and cultural heritage component. The risks, consequences, alternatives as well as options for mitigation of activities have also been considered with a view to minimise negative impacts, maximise benefits, and promote compliance with the principles of environmental management.

2.4. 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.

2.4.1 How do Grid Connected Photovoltaic Facilities Function?

Solar energy facilities, such as those using PV technology use the energy from the sun to generate electricity through a process known as the Photovoltaic Effect. This effect refers to photons of light colliding with electrons, and therefore placing the electrons into a higher state of energy to create electricity. This is achieved using 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 photovoltaic (PV) panels will be attached to a **support structure approximately 3.5 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

2.5. Project Alternatives

SolaireDirect are proposing the development of a renewable energy project and are therefore not considering any other development options. The proposed site is considered to be most suitable for solar energy power generation due to the local climatic characteristics (i.e. high levels of solar irradiation).

2.5.1. Site 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, available extent and the relief/topography of the site, and available grid connection. These characteristics were considered in determining the feasibility of the proposed site.

Climatic conditions: The efficiency and economic viability of a PV facility is directly dependent on the annual direct solar irradiation values. A study of available radiation 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 technology.

Site extent: Space is a restraining factor for a PV solar facility installation. The PV solar facility of 130 MW will require an area of approximately 250ha. There is therefore sufficient space for the proposed project within the 1505 ha area under consideration. It is expected that within this broader area, any identified environmental or technical constraints can be avoided as necessary.

Site access: The project development site is accessible easily via the R709 main road which crosses through the proposed sites, as well as via existing gravel farm roads. The farm roads will be upgraded and used to access the facility site during construction and operation.

Grid Connection

The proposed facility is in a close proximity (ranging from approx. 100m - 3.5kmfor the different phases) to the Excelsior 132/22kV existing substation or loop-in and loop-out of the existing power line. From initial discussions with Eskom, it has been determined that this existing substation has sufficient capacity to accommodate the electricity generated from the proposed PV Solar plant facility.

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 panels (Fluri, 2009) (refer to Figure 2.3). The proposed area for the proposed PV facility is generally on a flat location with slopes of less than 5 degrees.

In addition to the above, the landowner is willing to enter into a lease agreement for the use of the property. Through this agreement, the landowner will be appropriately compensated.

Based on these considerations, as well as for the fact that they are no competitors/developers located in the immediate area of the proposed facility, SolaireDirect Southern Africa (Pty) Ltd considers the proposed site as their highly preferred site for the development of the Merapi Solar Energy Facility-phase 1-4. No feasible site alternatives have been identified for investigation.

2.5.2. Technology Alternatives

Very few technological options exist in as far as PV technologies are concerned. Those that are available are usually differentiated by weather and temperature conditions that prevail such that optimality is obtained by the final choice. There is no difference in the environmental impacts associated with any of the PV technology choices. Therefore, the choice of technology does not affect the environmental impact of the proposed development. The construction, operation and decommissioning of the facility will also be the same irrespective of the technology chosen. Static or Tracking PV technology is the most two widely used technology. Following detailed investigation and analysis for the proposed project, it was found that tracking technology is a feasible alternative but not preferred as it produces less power and costs more than fixed structures, for the land area under consideration. Therefore, no feasible technology alternatives were identified or assessed in this regard.

Figure 2.3: Illustration of a tracking photovoltaic panel

2.5.3 Electricity Evacuation Infrastructure

Energy generated by the Merapi Solar Energy Facility phase 1-4 will be evacuated to the national grid via a new on-site substation. 22kV/132kV overhead power lines (depending on the generating capacity of the phases) will be constructed from the new substation on each phase to connect directly to the existing substation or loop-in and loop-out of the existing power line closest to the phases.

2.6. 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. These are discussed in more detail below.

2.6.1. Construction Phase

The construction of the facility will be divided into four phases, with a total generating capacity of 130 MW (155 MW installed capacity). The construction phase is expected to extend over a period of 18-24 months and create approximately 291 employment opportunities at peak construction. It is anticipated that approximately 60% (175) of the employment opportunities will be available to low skilled (construction labourers, security staff etc), 15% (43) semi-skilled workers (drivers, equipment operators etc) and 25% (73) 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 Excelsior, Winburg, Ladybrand and Bloemfontein. 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

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 panels, substation and 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 project development site is accessible easily via the R709 main road which crosses through the proposed sites and gravel farm roads. Where possible, existing farm roads will be upgraded and used to access the facility site. Where new roads are required, access track construction would normally comprise of compacted rock-fill with a layer of higher quality surfacing stone on top. A safety firebreak band and roadway will be constructed around the perimeter of the site in order to prevent the spread of external fires entering the park and accommodate light service and maintenance vehicles.

Undertake Site Preparation

Site preparation activities will include clearance of vegetation for most of the proposed area. In addition, site preparation 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. Rocks may also be removed.

Transport of Components and Construction Equipment to Site

The components for the proposed facility will be transported to site by road. 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. Some of the substation components may be defined as abnormal loads in terms of the Road Traffic Act (Act No. 29 of 1989)[1] by virtue of the dimensional limitations (i.e. size and weight).

Establishment of Construction Equipment Camp

Once the required equipment has been transported to site, a construction equipment camp on the site for the workshop 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 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 as to prevent the possibility of leakages and soil contamination.

Establishment of the 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 80 cm below finished ground level. The concrete foundations where necessary will be poured and then left for up to a week to cure. The installation of 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: Workshop, office and a change house. 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 and Power line

An on-site substation of approximately 20 m x 20 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.

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

A new 22 kV/132 kV overhead power line (depending on the generating capacity of the phases) of ~50-1000m in length for each phase will connect the new substation directly to the existing Excelsior substation.

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.

2.6.2. Operational Phase

The proposed operational phase is expected to extend for a period of approximately 20 years with plant maintenance. It is anticipated that during this phase ~ 60 permanent employment opportunities, of this total ~ 30 (50%) will be low skilled (security and maintenance), 10 (17%) semi-skilled and 20 (33%) skilled employees. As indicated above, due the proximity of the site to Excelsior, Winburg, Ladybrand and Bloemfontein, the majority of the work opportunities associated with the operational phase are likely to be taken up by members from the local community. It is expected that during this time, 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 water and/or 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.

During construction phase the primary water use requirement will be for dust control. However, water may also be required to moisture condition the soils for proper compaction at roads and foundations. It is estimated that for dust control and compaction approximately 4,800,000 litres of water will be required. Water will also be required for the concrete foundations. Temporary ablution facilities will be required during construction. Water requirements for the construction phase of the PV power facility will be supplied by the Local Water Users' Association or alternatively water will be provided via a rainwater tank.

It is estimated that PV panel cleaning will require a total of approximately 100 000 litres/year during the operational phase of the project. The PV panels will be cleaned manually with a window washer type device (covered with a specialized cloth material), soft brush, window squeegee or soft cloth. A composting toilet will be installed in the guard house requiring no water. During the operational phase drinking water and process water will also be supplied by existing boreholes and may require treatment for domestic use. It is the intention of SolaireDirect to source the required water from an existing reticulation system, either from the local municipality or the landowner. If this is not feasible, alternative options would be to tanker in the required water and / or amend the existing landowner's water use license to include the activity of the required water use. Water requirements for the operational phase of the PV power facility will also be supplied by the Local Water Users' Association or alternatively water will be provided via a rainwater tank.

2.6.3. 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.

REGULATORY AND LEGAL CONTEXT CHAPTER 3

3.1 Policy and Planning Context

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

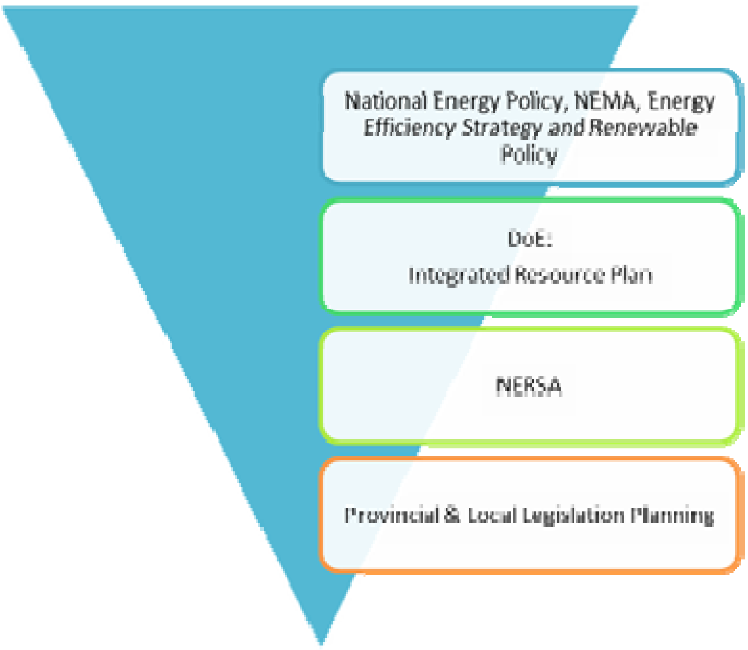


Figure 3.1: Hierarchy of electricity policy and planning documents

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 the same month. 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 awarded electricity generation licences for new generation capacity projects under the IPP procurement programme.

3.1.5. Free State Province Provincial Growth and Development Strategy (2004-2014)

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

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

- The need to provide a common vision as the basis for common action amongst all stakeholders, both inside and outside government.
- The need to provide a framework for budgets, implementation, performance management and spatial development.

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

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

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

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

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

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

The FSPGDS identifies a number of key provincial priorities. The priorities that are relevant to the proposed Solar Park include:

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

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

- To achieve an economic growth rate of 6%-7% per annum;
- To reduce unemployment from 30% to 15%;
- To reduce the number of households living in poverty by 5% per annum;
- To provide adequate infrastructure for economic growth and development.

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

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

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

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

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

Tourism: The emphasis in respect of tourism is to optimise its benefits. More specifically, the weekend tourism market for the north and north-eastern parts of the Province should be explicitly marketed. Emphasis is on nature tourism and heritage tourism. Events tourism should be focused on in the larger urban areas of Bloemfontein and Welkom.

Human resource development and economic growth: Providing the skills for a growing economy will be done by means of the learnerships, providing skills through the FET sector and internships.

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

3.2 Municipal Level Planning and Spatial Policy Context

3.2.1. Mantsopa Municipality Integrated Development Plan (2010-2011 Review)

The vision for the MM as set out in the MM IDP (2010-2011 Review) is “Mantsopa Local Municipality shall be a leading force to achieve an accessible, integrated, sustainable and equitable social and economic development of her community”.

The MMs mission is to “To achieve an accessible, integrated, sustainable and equitable social and economic development of the municipality”

The IDP identifies 5 focus or key performance areas, namely:

» Provision of sustainable infrastructure and basic services;
» Stimulate socio-economic development and tourism;
» Sustain financial management excellence;
» Improve human resource management excellence (Institutional transformation);
» Improve good governance trough effective leadership.

Of these, the first two are relevant to the proposed Merapi Solar Park.

The priority issues identified in the IDP include: sanitation, electricity, water, roads and stormwater, community facilities, housing and land, local economic development, education, waste management, health, safety and security, social welfare, environmental management and conservation.

The construction and operation of the proposed Merapi Solar Park, including the establishment of a Community Trust, can assist the MM in meeting some of these priorities, specifically, the provision of electricity, and establishment of community facilities and promotion of local economic development.

The Municipal Strategy outlined in the IDP lists the key developmental objectives of the MM. The following are relevant to the proposed SEF:

» To provide sustainable infrastructure and basic services
» To stimulate sustainable economic development and tourism

Basic Services
The IDP indicates that the provision of infrastructure services was identified as a key priority by communities in the MLM. The provision of electricity is listed under the heading of basic services.

Local Economic Development

The IDP notes that local economic development is the most important sector of development in MM. Once the people have escaped the vicious circle of poverty, they can become active generators of income. This income will be spent in Mantsopa towns and will represent a further investment in development. As the economy grows, so the people will be able to provide their own needs and eventually contributes the national economy.

One of the key strategies identified in the IDP is to support small businesses. The key objectives of the national small business strategy that are relevant to the proposed Merapi Solar Park include:

» Creation of an enabling environment for small enterprises;
» Address the legacy of apartheid based disempowerment of black business;
» Support the advancement of women and youth in all business sectors;
» Create long term jobs;
» Stimulate sector focused economic growth;
» Strengthen cohesion between small enterprises; and
» Level the playing fields between bigger and small business as well as between rural and urban business.

The IDP also lists the outcomes of an IDP meeting held on 16 March 2010 at the Ladybrand town hall in which new projects for 2010/2011 were identified. Of specific reference for the proposed Merapi Solar Park the meeting identified the establishment of a “Solar Power Station” and provision of solar panels for all Mantsopa Towns. This clearly indicates that the MLM supports the establishment of renewable energy projects and initiatives in the area, specifically solar energy.

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 (MERAPIRAL):* This department is responsible for all national routes.

At the Provincial Level, the main regulatory agencies are:

- *Free State Department of Economic Development, Tourism and Environmental Affairs DETEA - This department is the commenting authority for this project.*
- *Department of Police, 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.
- *The Department of Agriculture:* This Department is responsible for all matters which affect agricultural land.

At the local level, the local and municipal authorities are the principal regulatory authorities responsible for planning, land use and the environment. In the Free State, both the local and district municipalities play a role. The local municipality is the Mantsopa Local Municipality which forms part of the Motheo 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 Environmental Impact Assessment Regulations have been promulgated in terms of Chapter 5 of the Act. Listed activities which may not commence without an environmental authorisation are identified within these Regulations. In terms of S24(1) of NEMA, the potential impact on the environment associated with these listed activities must be assessed and reported on to the competent authority charged by NEMA with granting of the relevant environmental authorisation. In terms of GN R543, R544, R545 and R546 of 18 June 2010, an Environmental Impact Assessment Process is required to be undertaken for the proposed project.	Department of Environmental Affairs – competent authority Free State Department of Economic Development, Tourism and Environmental Affairs (FS DETEA) commenting authority	The listed activities triggered by the proposed solar energy facility have been identified and assessed in the Environmental Impact Assessment Process being undertaken. This Environmental Impact Assessment 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 Environmental Impact Assessment Process through the consideration of potential impacts (cumulative, direct, and

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
			indirect). It will continue to apply throughout the life 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 Free State Department of Economic Development, Tourism and Environmental Affairs (FS DETEA) commenting authority	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.

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
National Water Act (Act No 36 of 1998)	Water uses under S21 of the Act must be licensed, unless such water use falls into one of the categories listed in S22 of the Act or falls under the general authorisation (and then registration of the water use is required). Consumptive water uses may include the taking of water from a water resource - Sections 21a and b. Non-consumptive water uses may include impeding or diverting of flow in a water course - Section 21c; and altering of bed, banks or characteristics of a watercourse - Section 21i.	Department of Water Affairs Provincial Department of Water Affairs	A water use license (WUL) is required to be obtained if wetlands or drainage lines are impacted on, or if infrastructure lies within 500m of such features. Pans occur on the project site, but outside of the development footprint. Should water be abstracted from ground water/ a borehole on site for use within the facility, a water use license may be required.
Minerals and Petroleum Resources Development Act (Act No 28 of 2002)	A mining permit or mining right may be required where a mineral in question is to be mined (e.g. materials from a borrow pit) in accordance with the provisions of the Act. Requirements for Environmental Management Programmes and Environmental Management Plans are set out in S39 of the Act. S53 Department of Mineral Resources: Approval from the Department of Mineral Resources (DMR) may be required to use land surface contrary to the objects of the Act in terms of section 53 of the Mineral and Petroleum Resources Development Act, (Act No 28 of	Department of Mineral Resources	As no borrow pits are expected to be required for the construction of the facility, no mining permit or right is required to be obtained. A Section 53 application will be submitted the Free State DMR office.

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
	2002): In terms of the Act approval from the Minister of Mineral Resources is required to ensure that proposed activities do not sterilise a mineral resources that might occur on site.		
National Environmental Management: Air Quality Act (Act No 39 of 2004)	Measures in respect of dust control (S32) – no regulations promulgated yet. Measures to control noise (S34) - no regulations promulgated yet.	Department of Environmental Affairs	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)	» Stipulates assessment criteria and categories of heritage resources according to their significance (S7). » Provides for the protection of all archaeological and palaeontological sites, and meteorites (S35). » Provides for the conservation and care of cemeteries and graves by SAHRA where this is not the responsibility of any other authority (S36). » Lists activities which require developers any person who intends to undertake to notify the responsible heritage resources authority and furnish it with details regarding the location, nature, and extent of	South African Heritage Resources Agency	An HIA and PIA has been undertaken as part of the Environmental Impact Assessment Process to identify heritage sites.(See Appendix F)

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
	the proposed development (S38). » Requires the compilation of a Conservation Management Plan as well as a permit from SAHRA for the presentation of archaeological sites as part of tourism attraction (S44).		
National Environmental Management: Biodiversity Act (Act No 10 of 2004)	» Provides for the MEC/Minister to identify any process or activity in such a listed ecosystem as a threatening process (S53) » A list of threatened and protected species has been published in terms of S 56(1) - Government Gazette 29657. » Three government notices have been published, i.e. GN R 150 (Commencement of Threatened and Protected Species Regulations, 2007), GN R 151 (Lists of critically endangered, vulnerable and protected species) and GN R 152 (Threatened or Protected Species Regulations). » Provides for listing threatened or protected ecosystems, in one of four categories: critically endangered (CR), endangered (EN), 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	Department of Environmental Affairs	As the applicant will not carry out any restricted activity, as is defined in S1 of the Act, no permit is required to be obtained in this regard. Specialist flora and fauna studies have been undertaken as part of the Environmental Impact Assessment Process (refer to Appendix E). As such the potentially occurrence of critically endangered, endangered, vulnerable, and protected species and the potential for them to be affected has been considered.

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
	threatened and in need of protection, (G 34809, GN 1002), 9 January 2011). » This Act also regulates alien and invader species. » Under this Act, a permit would be required for any activity which is of a nature that may negatively impact on the survival of a listed protected species.		
Conservation of Agricultural Resources Act (Act No 43 of 1983)	» Prohibition of the spreading of weeds (S5) » Classification of categories of weeds & invader plants (Regulation 15 of GN R1048) & restrictions in terms of where these species may occur. » Requirement & methods to implement control measures for alien and invasive plant species (Regulation 15E of GN R1048).	Department of Agriculture	This Act will find application throughout the life cycle of the project. In this regard, soil erosion prevention and soil conservation strategies 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)	According to this act, the Minister may declare a tree, group of trees, woodland or a species of trees as protected. The prohibitions provide that 'no person may	National Department of Forestry	There are no protected trees in the study area.

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
	cut, damage, disturb, destroy or remove any protected tree, or collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree, except under a licence granted by the Minister'.		
National Veld and Forest Fire Act (Act 101 of 1998)	In terms of S12 the applicant must ensure that the firebreak is wide and long enough to have a reasonable chance of preventing the fire from spreading, not causing erosion, and is reasonably free of inflammable material. In terms of S17, the applicant must have such equipment, protective clothing, and trained personnel for extinguishing fires.	Department of Agriculture, Forestry and Fisheries (DAFF)	While no permitting or licensing requirements arise from this legislation, this act will find application during the construction and operational phase of the project.
Hazardous Substances Act (Act No 15 of 1973)	This Act regulates the control of substances that may cause injury, or ill health, or death due to their toxic, corrosive, irritant, strongly sensitising or inflammable nature or the generation of pressure thereby in certain instances and for the control of certain electronic products. To provide for the rating of such substances or products in relation to the degree of danger; to provide for the prohibition and control of the importation, manufacture, sale, use, operation, modification, disposal or dumping of such substances and products. Group I and II: Any substance or mixture of a substance that might by reason of its toxic, corrosive etc, nature or	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
	because it generates pressure through decomposition, heat or other means, cause extreme risk of injury etc., can be declared as Group I or Group II substance Group IV: any electronic product; and Group V: any radioactive material. The use, conveyance, or storage of any hazardous substance (such as distillate fuel) is prohibited without an appropriate license being in force.		
Development Facilitation Act (Act No 67 of 1995)	Provides for the overall framework and administrative structures for planning throughout the Republic. S (2 - 4) provides general principles for land development and conflict resolution.	Local Municipality	The applicant must submit a land development application in the prescribed manner and form as provided for in the Act. A land development applicant who wishes to establish a land development area must comply with procedures set out in the Act.
Subdivision of Agricultural Land Act (Act No 70 of 1970)	Details land subdivision requirements and procedures. Applies for subdivision of all agricultural land in the province	Department of Agriculture	Subdivision 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.	National Department of Water and Environmental Affairs	As no waste disposal site is to be associated with the proposed project, no permit is required in this

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
	The Minister may amend the list by – » Adding other waste management activities to the list. » Removing waste management activities from the list. » Making other changes to the particulars on the list. In terms of the Regulations published in terms of this Act (GN 718), an Environmental Impact 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.	Provincial Department of Environmental Affairs (general waste)	regard. Waste handling, storage and 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-N). 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	» South African National Roads	An abnormal load/vehicle permit may be required to

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
	Permits for the Conveyance of Abnormal Loads and for other Events on Public Roads" outline the rules and conditions which apply to the transport of abnormal loads and vehicles on public roads and the detailed procedures to be followed in applying for exemption permits are described and discussed. » Legal axle load limits and the restrictions imposed on abnormally heavy loads are discussed in relation to the damaging effect on road pavements, bridges, and culverts. » The general conditions, limitations, and escort requirements for abnormally dimensioned loads and vehicles are also discussed and reference is made to speed restrictions, power/mass ratio, mass distribution, and general operating conditions for abnormal loads and vehicles. Provision is also made for the granting of permits for all other exemptions from the requirements of the National Road Traffic Act and the relevant Regulations.	Agency Limited (national roads) » Provincial Department of Transport	transport the various components to site for construction. These include route clearances and permits will be required for vehicles carrying abnormally heavy or abnormally dimensioned loads. Transport vehicles exceeding the dimensional limitations (length) of 22m. Depending on the trailer configuration and height when 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 a right to be heard.	Department of Environmental Affairs	No permitting or licensing requirements.

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
Provincial Legislation			
The Free State Nature Conservation Bill 23 of 2010 (FSNCB)	According to this Bill- Chapter 10, Section 31: Except on authority of a permit issued by the MEC or under environmental authorisation no person may – Drain or mechanically disturb any wetland or portion thereof utilise a wetland or portion thereof in a manner that would damage the hydrological or ecological function thereof engage in activities outside but adjacent to the wetland which would damage the hydrological or ecological functioning of such wetland. Chapter 10, Section 32: No person may undertake any activity involving any species of wild animal or plant which causes or has the potential to cause a degradation in the natural state of the indigenous biodiversity of that area » The Act provides lists of protected species for the Province	Provincial Department of Environmental Affairs	Permitting or licensing requirements arise from this legislation for the proposed activities to be undertaken for the proposed project as there are protected succulent and bulb plant species on the proposed development site. A permit is required to remove these plants.

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 in October 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 Excelsior Public 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 Final Scoping Report was submitted to the National Department of Environmental Affairs in September 2012. The Final Scoping Report and Plan of Study for the EIA were accepted by the DEA, as the competent authority, in October 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[2] 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).

[2] "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 Final 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 Final EIA Report in accordance with the requirements of the Regulation 31 of GN R543 of 2010.

4.2.2 Authority Consultation

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

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

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

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

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

4.2.3. Public Involvement and Consultation

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

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

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

» **Identification of I&APs and establishment of a database**
Identification of I&APs was undertaken by **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	» Free State Department of Economic Development, Tourism and Environmental Affairs (FS DETEA) » Free State - Agriculture and Rural Development » Free State - Police, Roads and Transport » Free State - Water Affairs » South African Heritage Resources Agency National Department of Agriculture, Forestry and Fisheries » South African National Roads Agency » Department of Energy » Civil Aviation Authority.
Municipalities	» Mantsopa Local Municipality » Motheo District Municipality
Public stakeholders	» Farmer's Union
Parastatals & service providers	» Eskom Transmission and Distribution » South African Heritage Resources Agency
NGOs/Business forums	» Birdlife South Africa » Wildlife and Environmental Society of South Africa (WESSA)

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:

- Volksblad (Afrikaans advert placed on 22 June 2012)
- Snuffelblad (Afrikaans advert placed on 22 June 2012)

The advertisements informing the public of the Public meeting were advertised in the following newspapers:

» Volksblad (Afrikaans advert placed on 15 August 2012)
» Bloemnuus (Afrikaans advert placed on 17 August 2012)

During the EIA phase, a third round of newspaper adverts was placed to inform the public on the details of the availability of the Final EIA Report for public review as well as the public meeting in the following newspapers:

- Volksblad (Afrikaans advert placed on 18 January 2013)
- Snuufelblad (Afrikaans advert placed on 18 January 2013)

» **Consultation**

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

- Focus group meetings (stakeholders invited to attend)
- Public meeting (advertised in the local press)
- Written, faxed or e-mail correspondence

In order to further facilitate comments on the Final 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 are invited to attend a public meeting to be on:

* **Date:** Wednesday, 30 January 2013
* **Time:** 16:00 - 18:00
* **Venue:** Excelsior Public Library

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

4.2.4 Identification and Recording of Issues and Concerns

Issues and comments raised by I&APs over the duration of the EIA process have been synthesised into Comments and Response Reports (refer to **Appendix D** 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.

4.2.5 Assessment of Issues Identified through the Scoping Process

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

Table 4.1: Specialist studies undertaken within the EIA Phase

Specialist	Area of Expertise	Refer Appendix
Marianne Strohbach of Savannah Environmental	Ecology	Appendix E
Nkosinathi Tomose of Zone Land Solutions	Heritage	Appendix F
Job Kibii of Wits University Institute for Human Evolution	Palaeontology	Appendix G
Tony Barbour of Tony Barbour Consulting	Social	Appendix H
Chris Viljoen of Viljoen and Associates	Soils and Agricultural potential	Appendix I
Jacques Louis Volschenk of Zone Land Solutions	Visual	Appendix J

Specialist studies considered direct, indirect, cumulative, and residual environmental impacts associated with the development of the proposed Merapi 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 K-N**.

4.2.6. Assumptions and Limitations

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

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

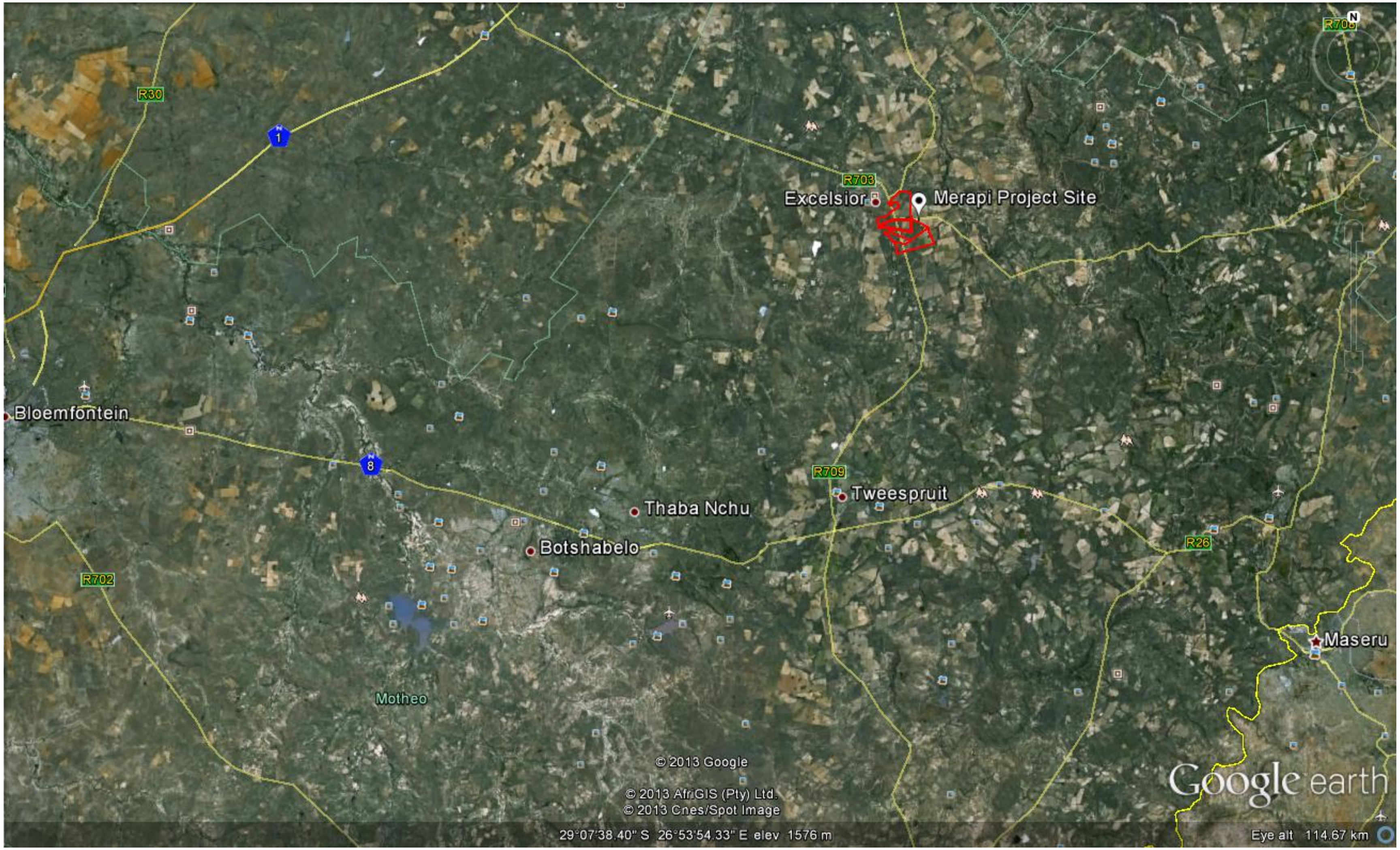
Refer to the specialist studies in **Appendices E – J** for specialist study specific limitations.

DESCRIPTION OF THE RECEIVING ENVIRONMENT CHAPTER 5

This section of the Final EIA Report provides a description of the environment that may be affected by the proposed Merapi Solar facility. 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 – J**.

5.1 Regional Setting: Location of the Study Area

The site is located approximately 5 km south-east of Excelsior and 120 km north-east of Bloemfontein in the Free State Province (Refer to Figure 5.1). Bloemfontein is the capital city of the Free State Province. The four development phases (i.e. Phase 1 - 4) of the Merapi PV Solar Energy Facility is proposed on Portion 0 of Farm 311 Ceylon, Portion 0 of Farm 566 Moedersgift, Portion 0 of Farm 374 Concordia, and Portion 1 of Farm 1547 De Hoop which falls within the Mantsopa Local Municipality of the Free State Province. The region is a farming area. Farms in the area are relatively small, many being smaller than 1000ha. Commercial livestock (cattle) farming is the main form of farming.



5.1: Aerial photo of the site (site shown in red), showing proximity to Bloemfontein and Excelsior

5.2 Climatic Conditions

On average, the area on average receives approximately 450mm of rain per annum (see Figure 5.2), with most of the rainfall occurring during mid-summer. The average midday temperatures range from approximately 16°C in June to 28°C in January. The region is the coldest during June when the mercury drops to 0°C on average during the night.

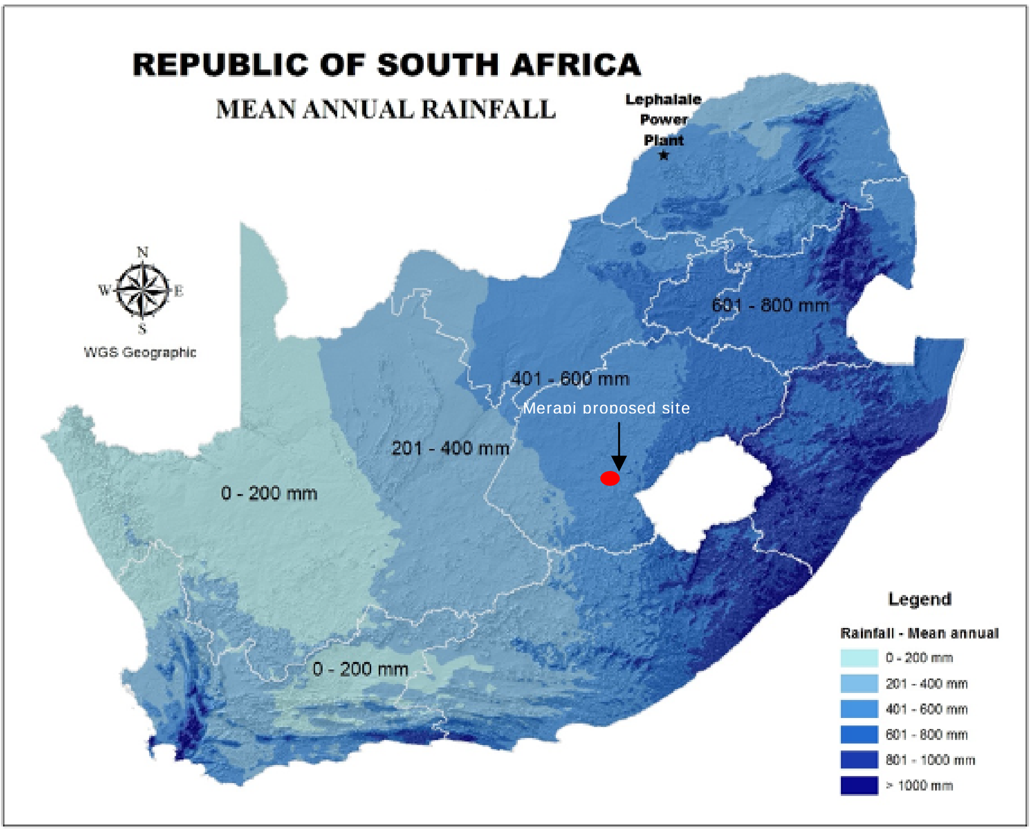


Figure 5.2: Rainfall map of South Africa indicating the survey site

5.3 Biophysical Characteristics of the Study Area

5.3.1. Topographical Profile

A relief map is shown in Figure 5.3. The study area is situated on land that ranges in elevation varying between 1340m and 1410m above mean sea level over a distance of approximately 3.5km. The terrain surrounding the farm is generally flat to gently undulating with a slight downward easterly slope that forms part of the river floodplain of the Modder River.

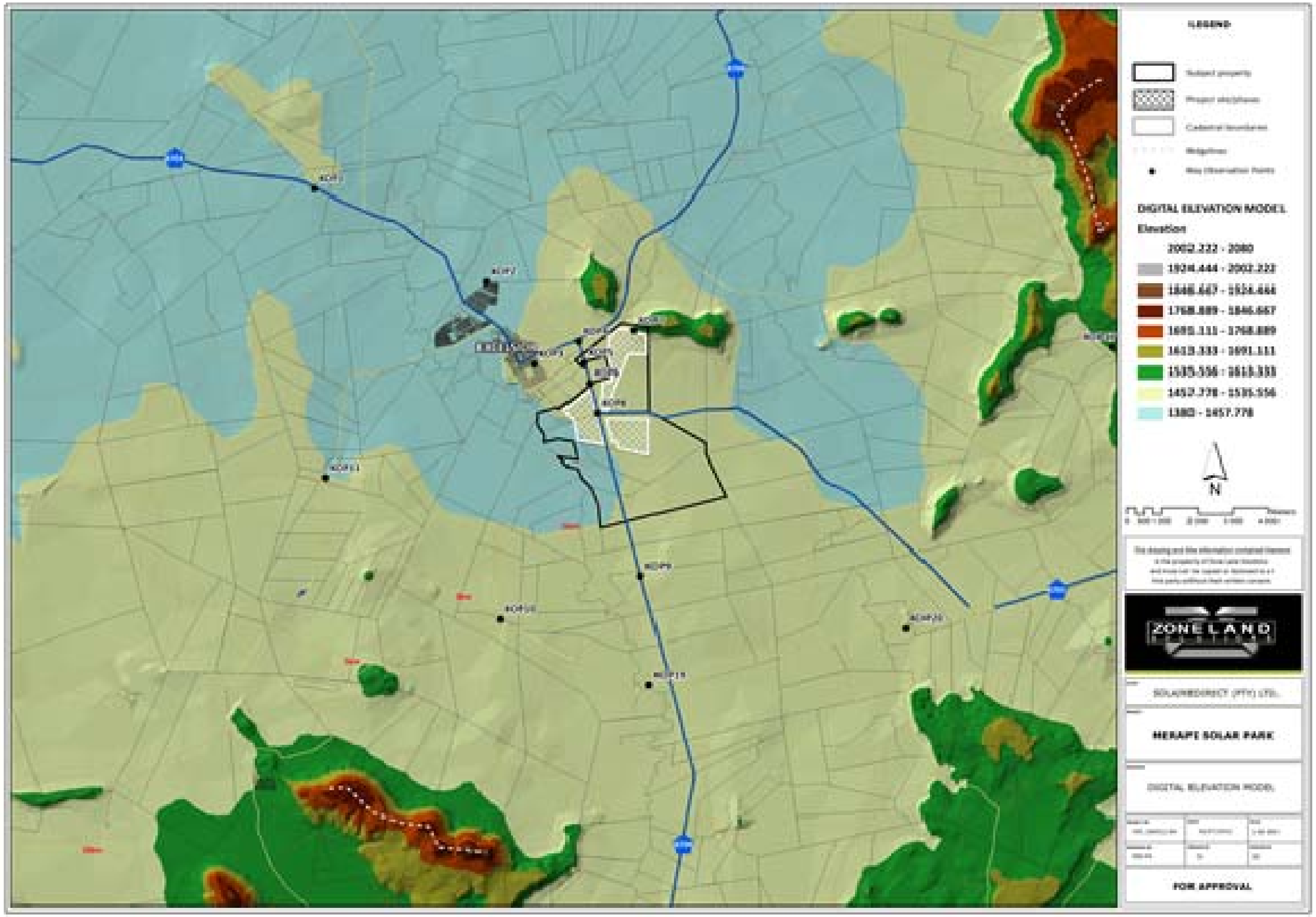


Figure 5.3: Topography / Shaded Relief Map for the study area

The project site has a generally flat terrain, which gently increases in height towards the 'koppies' in the north. Along the western boundary, the Lengana River represents the lowest portion of the subject property. Open grass plains characterise the project site. The Korannaberg Mountains are located further to the east. The height of the project site varies between 1455m and 1530m above mean sea level over a distance of approximately 3.6km between the individual phases.

5.3.2. Landuse and Landcover of the Study Area

The site itself is primarily used for a mixture of livestock farming and crop cultivation. Within a radius of 10 km of the study site, land uses also include formal settlements and game farming. The primary activity in the region is farming. Due to the agricultural activities in the area, the landscape is largely transformed (refer to **Figure 5.4**).

5.3.3. Ecological Profile

The study site falls mostly within the Eastern Free State Clay Grassland as described by Mucina and Rutherford (2006). The remaining extent of this vegetation type has been listed in the threatened terrestrial ecosystems for South Africa (2011) as Vulnerable, as more than half of the original extent of this vegetation type has been irreversibly transformed, and less than 1% of it is protected in the Willem Pretorius Nature Reserve.

The Eastern Free State Clay Grassland occurs on flat to gently rolling landscapes. The grassland is dominated by *Themeda triandra*, *Cymbopogon pospischilii*, *Eragrostis plana*, *Setaria sphacelata*, *Elionurus muticus* and *Aristida congesta* (Mucina and Rutherford 2006). A combination of overgrazing and selective grazing creates further fragmentation and patchiness of the natural vegetation. Large areas of the study site, including sites preferred for the proposed development, are part of the remaining extent of the Eastern Free State Clay Grasslands and should thus be regarded as vulnerable.

Isolated sandstone outcrops within the grassland, as in the north-eastern corner of the study area are covered by Basotho Montane Shrubland. This vegetation occurs on steep talus slopes, kloofs, and mountain slopes support tall, in places dense shrubland dominated by broad-leaved shrubs such as *Olea europaea*, *Euclea crispa*, *Buddleja salviifolia*, and several *Searsia* species.

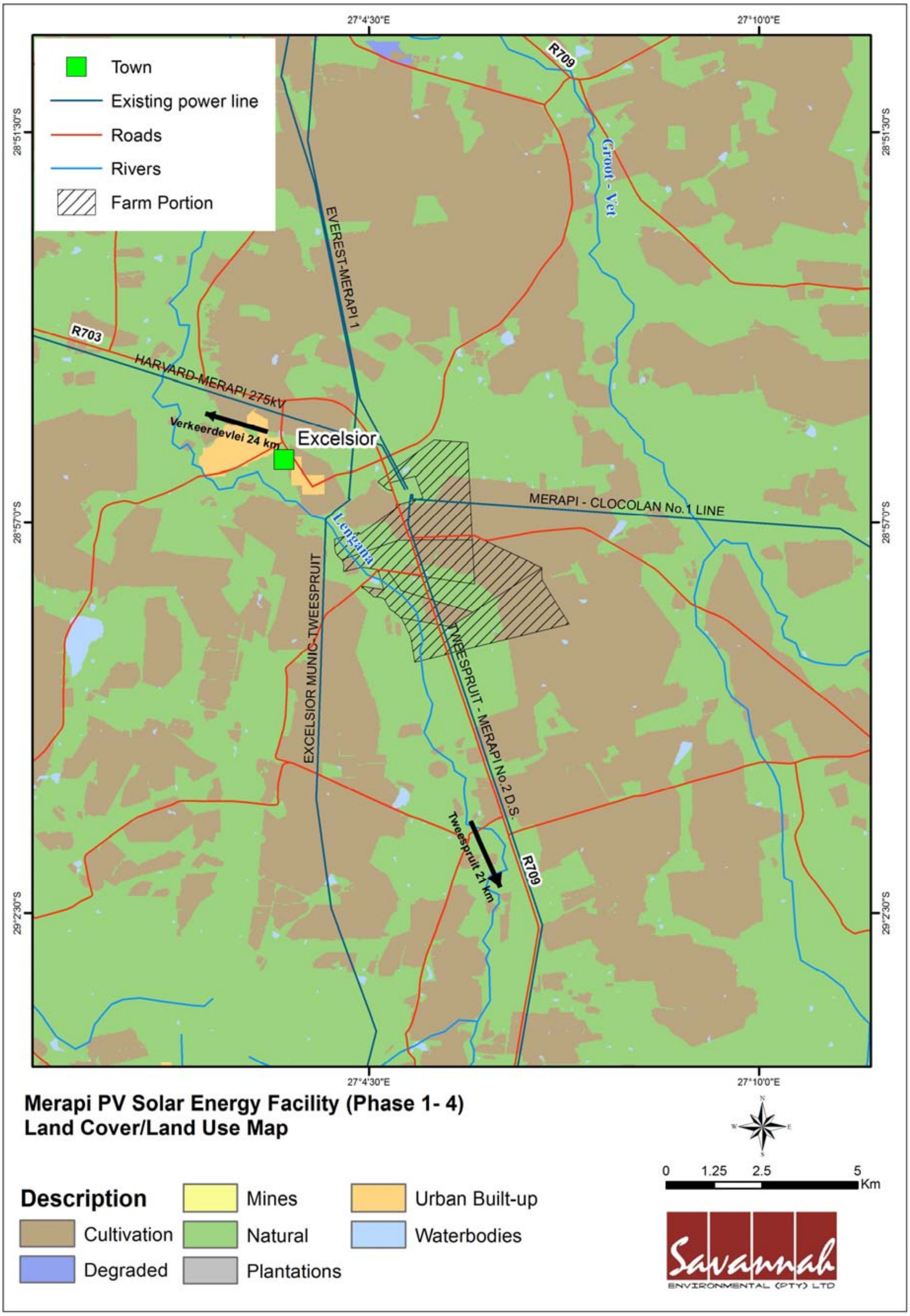


Figure 5.4: Land Cover / Land Use of the Study Area

Currently this vegetation type has not been listed as threatened terrestrial ecosystem, yet it is considered by Mucina and Rutherford (2006) as vulnerable, with only about 2% of it formally protected. One of the main threats to this vegetation type is erosion, with about 33% of the vegetation affected by severe erosion, all a result of vegetation degradation. It is thus not desirable to have any development on this vegetation type that further reduces vegetative cover and thus initiates further erosion.

Further, there is riverine vegetation along the Lengana River and the larger tributaries of it traversing the study site. Several seepage areas and smaller wetlands are scattered throughout the site.

Four vegetation associations could be identified on the proposed development site:

» Association 1: The *Themeda triandra – Helichrysum rugulosum* grasslands are widespread on the gently undulating plains surrounding the outcrops. Within the study area, species composition and plant density of the grasslands is very variable, influenced to a large degree by soil depth, but also grazing. Occasional bare patches do occur within the grasslands, and soils there are highly erodible, with moderate to severe sheet erosion and occasionally slight terracette erosion visible.

» Association 2: *Acacia karroo - Cynodon dactylon* woodlands. This vegetation is relatively restricted within the study area, occurring in small patches on areas with surface rock or, more commonly, along depressions between plains

» Association 3: *Asparagus laricinus - Heteropogon contortus* sparse shrublands are restricted to small rocky outcrops, ridges and footslopes of larger mountains. Most of these areas should be regarded as No Go Areas.

» Association 4: The *Schoenoxiphium - Marsilea* species riparian areas are restricted to the edges of small drainage channels, edges of dams and small natural vleys within the study area (and beyond). Most of the species of this vegetation type, as it is adapted to higher moisture levels, were too poorly developed to identify at the time of the survey. It can also be expected that several additional species, also restricted to these higher-moisture habitats, may occur after sufficient rains, when a more accurate description of the vegetation should be possible. Ideally, such description should form part of a wetland study. The habitat of this association and immediate surrounds must be treated as a **No Go area**.

Few alien invasive species were encountered on the study area, with additional species within surrounding areas and along larger transport routes leading to the study area. Thus, a strong possibility exists that such species may be introduced to the study area during construction. The species of most concern are of the genera *Prosopis, Eucalyptus, Rubus, Cereus, Melia, Verbena, Argemone* and *Opuntia.* These invasives alter ecosystem functionality by displacing indigenous vegetation. Most of these invasives occur around or in the close vicinity of abandoned homesteads or watering points. A detailed alien invasive management and monitoring program will thus have to be implemented throughout the construction and operational phase of the development.

Red Data Species

The following red data plant species have been recorded from the area (2926) according to the new red data species list of SANBI:

Species	RD Status	Suitable Habitat	Possibility of being present	Threat
Isoetes transvaalensis	NT	Wetlands	Slight	Habitat degradation
Calpurnia reflexa	Rare	Rocky footslopes	Slight	Habitat destruction
Dierama dubium	VU	Rocky ridges	Slight	Habitat destruction
Erica maesta var. *longistyla*	DDT	Rocky ridges	Slight	Habitat destruction
Boophone disticha	Declining	Rocky ridges, grasslands	Likely	Harvesting
Hypoxis hemerocallidea	Declining	Rocky ridges, grasslands	Observed	Harvesting
Ilex mitis var. *mitis*	Declining	Rocky footslopes	Slight	Harvesting and habitat destruction
Pelargonium sidoides	Declining	Grasslands	Slight	Harvesting

Protected Species

There are no protected tree species of conservation concern found on the site. However, the following plants species (succulents and bulbs) are encountered on site:

FSNCB Schedule 1 and NCO Schedule 3: Specially Protected Species

Aloe grandidentata
Anacampseros rufescens
Asclepias aurea
Asclepias meyeriana
Euphorbia clavarioides
Helichrysum cerastioides
Helichrysum dregeanum
Helichrysum rugulosum
Helichrysum zeyheri

FSNCB Schedule 2 and NCO Schedule 4: Protected Species

Chasmatophyllum musculinum
Hypoxis angustifolia
Hypoxis hemerocallidea
Moraea elliotii
Moraea species
Ruschia hamata
Tulbaghia acutiloba

5.3.3. Soils and Agricultural Potential

The dominant soils in the study area according to the Taxonomical Soil Classification System of South Africa are Mispah and Sterkspruit soils. The effective depth of the Mispah and Sterkspruit soils is on average 300mm restricted to the Orthic A – Horizon. The Orthic A-horizon is typically characterised by a low dense structure and texture distribution of approximately 65% sand, 20% silt and 15% clay with drainage properties in order of 10mm/h. The dominant clay mineral in the Orthic A – Horizon is kaolinite (1:1 layer silicate), with a low buffer capacity due to the low cation exchange capacity (<10cmol+/kg). The Orthic A soil horizon of the Mispah and Sterkspruit soil types are suitable for rehabilitation purposes.

The agricultural potential of the Mispah and Sterkspruit, soils is considered medium to low under dryland (650mm/y rainfall) and irrigation conditions (>10-15mm/week 33-1,500kPa plant available water). No evidence of soil erosion was observed on any of the soils during the investigation. The current land use includes 129ha natural veld and grazing land capability of 129ha. The Mispah and Sterkspruit soils are characterised by neutral pH values (5,3 and 7,2) and low electrical conductivity values (<250mS/m). Under these conditions plant available nitrogen (15-20mg/kg), phosphorus (10-15mg/kg) and potassium (>50mg/kg) are readily available for plant uptake and sustainable plant growth.

5.4. Social Characteristics of the Study Area and Surrounds

The Free State consists of 4 District Municipalities, namely Xhariep, Thabo Mofutsanyana, Fezile Dabi and Lejweleputswa District Municipalities, and one Metropolitan Municipality, the Manguang Metropolitan Area (MMM). The Motheo DM contains the large population and comprises mainly open grassland, with mountains in the most eastern region. The majority of the Motheo was formal made up of what is now the MMM. The main urban centre is Bloemfontein. The city is the trade and administrative hub of the Province and boasts the provincial government and the seat of the Appeal Court of South Africa. It also has a rich history, which includes the establishment of the ANC in 1912 and the National Party in 1914. Motheo has 26.9% of the Province's population and contributes 32.7% of GDP in the Province.

5.4.1 Demographic Profile

Population

It is estimated that the population increased from 47980 in 1996 to 60 841 in 2001. This is a growth of 5% per annum. The MM IDP indicates that the total population of the MLM is estimated to be the region of 72 000 people. The MM covers an area of 4 290 km^2 and incorporates 5 small towns, which collectively accommodates ~ 66.5% of the total population in the MLM. All of the towns are surrounded by extensive agricultural lands. The rural survey conducted by the MLM found that the rural population in the MLM was ~ 12 329 people.

Of the total population, ~ 86% were African, 9% White, 4% Coloured while the rest of the ethnic groups represent 1% of the total population. In terms of gender, ~ 52% of the total population were female, while 48% were male. This reflects the tendency for males for leave the rural municipal areas and migrate to urban municipal areas in search of work opportunities.

Based on the 2001 Census data the majority of the population in 2001 resided in Ladybrand (34%), while 25.29% resided in the rural areas surrounding Ladybrand. This implies that 59% of the total population resided within the Ladybrand magisterial district. This emphasises the importance of Ladybrand in the MLM. The IDP indicates that Ladybrand will continue to remain the focus of economic growth in the MM, while Tweespruit is also likely to grow due to its central location in relation to the municipal area.

The Census 2001 data also found that ~ 40% of the total population lived on farms in 2001. The rural population has however decreased since 2001. This is due to farm retrenchments and the impact on the Extension of Security of Tenure Legislation. As a result many farm workers have left the rural areas and migrated to the urban areas. A rural survey conducted by the municipality in 2001 confirmed found that the rural population had decreased from 19 425 in 1996 to 12 329 in 2001. The IDP indicates that the total number of households currently living in the rural, farming areas is in the region of 4 430. The number of urban households is estimated to be in the region of 10 627.

Education

According to 2007 Community Survey, 16 % of the total population had no formal schooling. Of this total 55% lived in urban areas. The 2007 data estimated that 31 % of the total population had only primary schooling (grade 0 – 7) as their highest level of education, while 42 % had secondary schooling (grade 8 – 12). Only 9 % of the total population had matric and 2 % had tertiary training. Grade 7 is regarded as the minimum qualification for functional literacy. Therefore it is safe to assume that over 30% of the population of the MM are functionally illiterate. The IDP notes that illiteracy levels in the rural areas are likely to be higher than in the more established urban areas. The low levels of education, specifically the high illiteracy levels, are likely to hamper economic development and growth in the MM.

Income

According to Census 2001, 61 % of the total MM population had no formal income. The IDP notes that although this figure is alarming, it does include people who make a living from informal business activity, children, scholars, disabled people, etc. and are therefore not a true reflection in terms of dependency. The IDP also notes that 63 % of people that had no income stayed in urban areas, which correlates with the higher unemployment rate experienced in the urban areas. In addition, 83% of the total population earned less than R1 500 per month. According to the Municipality's Indigent Policy, indigent or low-income households are classified as households "where the verified total gross monthly income of all occupants do not exceed R1 300 per month or R15 600 per annum". A large percentage of the MM's population is therefore classified as indigent. Based on the 2007 Community Survey, 9% of all households in the MM had no income, while 66% of all households earned less than R1000 per month. This highlights the high levels of poverty experienced in the municipal area. As a result a substantial segment of the municipality's population cannot afford to pay for municipal services.

5.4.2. Heritage

The desktop study yielded information about the existence of heritage resources in the Free State regions. This included archaeological, historical and industrial heritage resources. The south-eastern Free State Province region proved, from a desktop search point of view, to be the most saturated region with known archaeological resources. This study falls directly north-east of the Free State Province capital Bloemfontein and just south-east of Winburg. A number of archaeological resources site have been identified in the area between Winburg and Excelsior by Van Schalkwyk (2011) – these site include Iron Age, cemeteries and a reference to rock art in Cannibal Cave near Merapi. No Stone Age, Iron Age sites, or rock art sites where identified during the physical survey of Merapi proposed development area. The only sites identified include, a grave site in form of cemeteries (none municipal formalised) and historic built environment and landscape features and sites (Figure 21). The built environment and landscape sites were given a relative date of +/- 100 years old based on their existing on the 1909/14 map of Merapi area. The physical survey of the PDA yielded five heritage resources sites, namely: Merap-1, Merap-2, Merap-3, Merap-4 and Merap-5. Based on field rating and significance only two sites are deemed worthy of recording however these sites will not be directly affected by the proposed development – Merap-1 and Merap-2. No mitigation measures proposed for the sites.

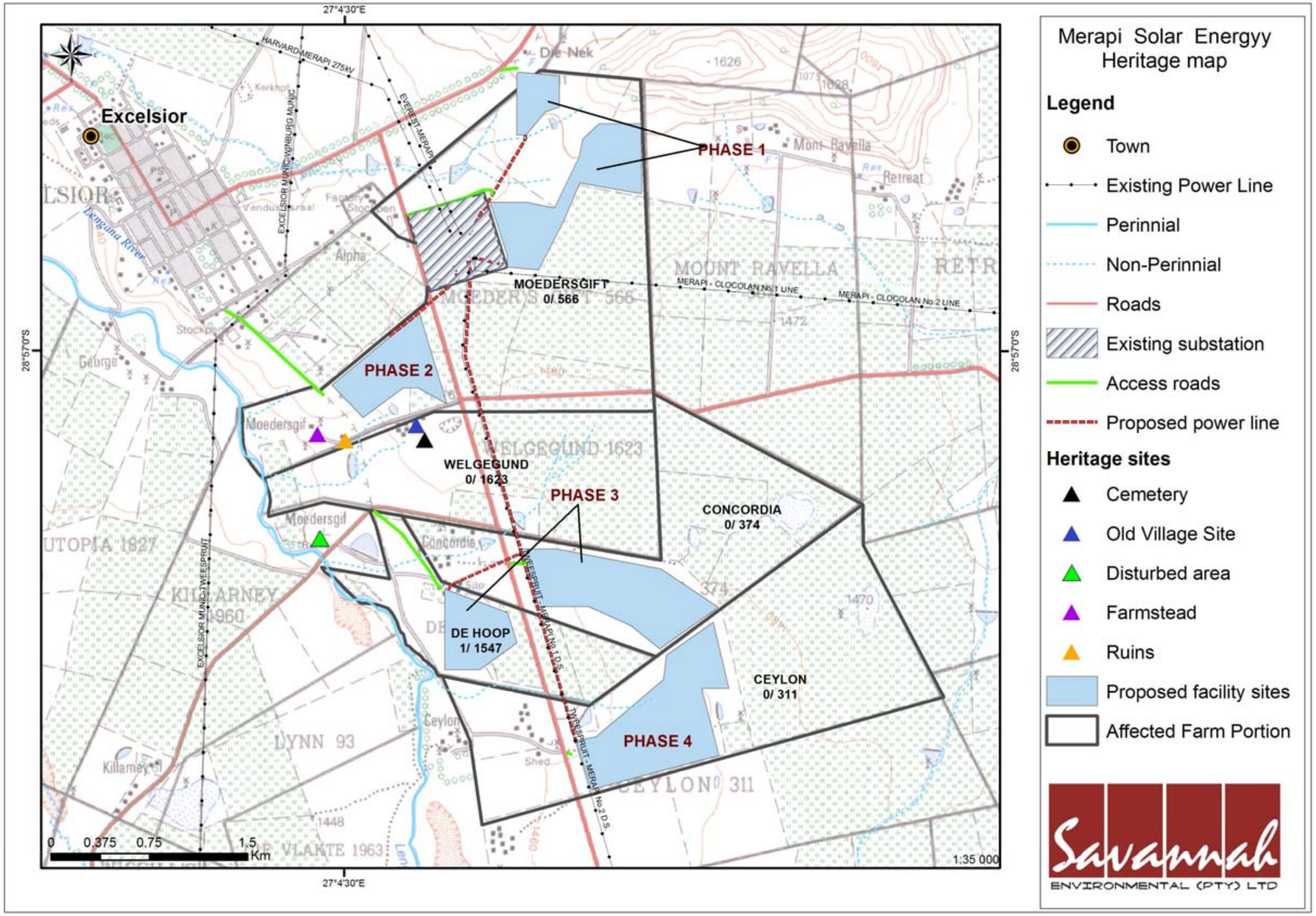


Figure 5.5: Distribution of heritage sites within the Merapi study area

ASSESSMENT OF POTENTIAL IMPACTS: MERAPI PHASE 1 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 SolaireDirect Merapi Solar Facility - Phase 1. This assessment is undertaken for the 33 MW solar facility and for all the facility's components, as detailed in the following table:

Component	Description
Location of the site	~ 5 km south-east of Bloemfontein
Municipal Jurisdiction	Mantsopa Local Municipality; Motheo District Municipality
Extent of the proposed development footprint (four phases)	~55 ha
Extent of broader site available for development	~1505 ha
Site access	The site can be accessed easily via the R709 main road which crosses through the proposed sites, as well as via farm gravel roads. The farm roads will be upgraded and used to access the facility site during construction and operation.
Generating capacity(four phases)	33 MW
Proposed technology	Photovoltaic panels
Associated infrastructure	» An on-site substation and 22kV overhead power line to facilitate the connection between the solar energy facility and the Eskom electricity grid. » Internal access roads (~4m wide x 700m) » Guard house » Laydown, campsite and assembly area. » Office and Control centre.
Water use	» ~2.5 million litres/year required during the construction phase and 330,000 litres/year for operations, » Water requirements for the construction phase of the PV power facility will be supplied by the Local Water Users' Association. Alternatively water will be provided via a rainwater tank.

Component	Description
	» No effluent will be produced except for the normal sewage from site and operations staff. This will be treated as per normal standards with a septic tank and disposed of at an appropriate licensed facility off-site.

The development of the Merapi Facility – 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 18-24 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 1505 ha (i.e. on Portion 0 of Farm 311 Ceylon, Portion 0 of Farm 566 Moedersgift, Portion 0 of Farm 374 Concordia, and Portion 1 of Farm 1547 De Hoop) was identified by the project developer for the purpose of establishing the proposed Merapi Facility Phase 1-4. The total developmental footprint will cover an extent of <250 ha and can therefore be accommodated within the broader site. Phase 1 of the facility is proposed to be developed on Portion 0 of Farm 566 Moedersgift. An area of 55 ha is required for the development of this phase of the project.

The assessment of potential issues associated with the development of the Merapi Solar Facility - Phase 1 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.

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 ~55 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 as shown on Figure 6.1 below identifies those parts of the study area that have high conservation value or that may be sensitive to disturbance. This sensitivity assessment is based on a desktop study, detailed field evaluation of the site and detailed analysis of aerial photography. A detailed methodology is included within the Ecology report (See Appendix E).

(a) Summary of Ecological Impacts

The majority of impacts on ecology will occur during the construction of the proposed PV facility. A risk assessment was undertaken as part of the ecological impact assessment, which identified the main potential negative impacts on the ecological receiving environment. Potential impacts were identified as follows:

» Loss of vegetation, increase in runoff and erosion;
» Loss of micro-habitat, window of opportunity for the establishment of alien invasive species, altered topsoil characteristics prone to capping;

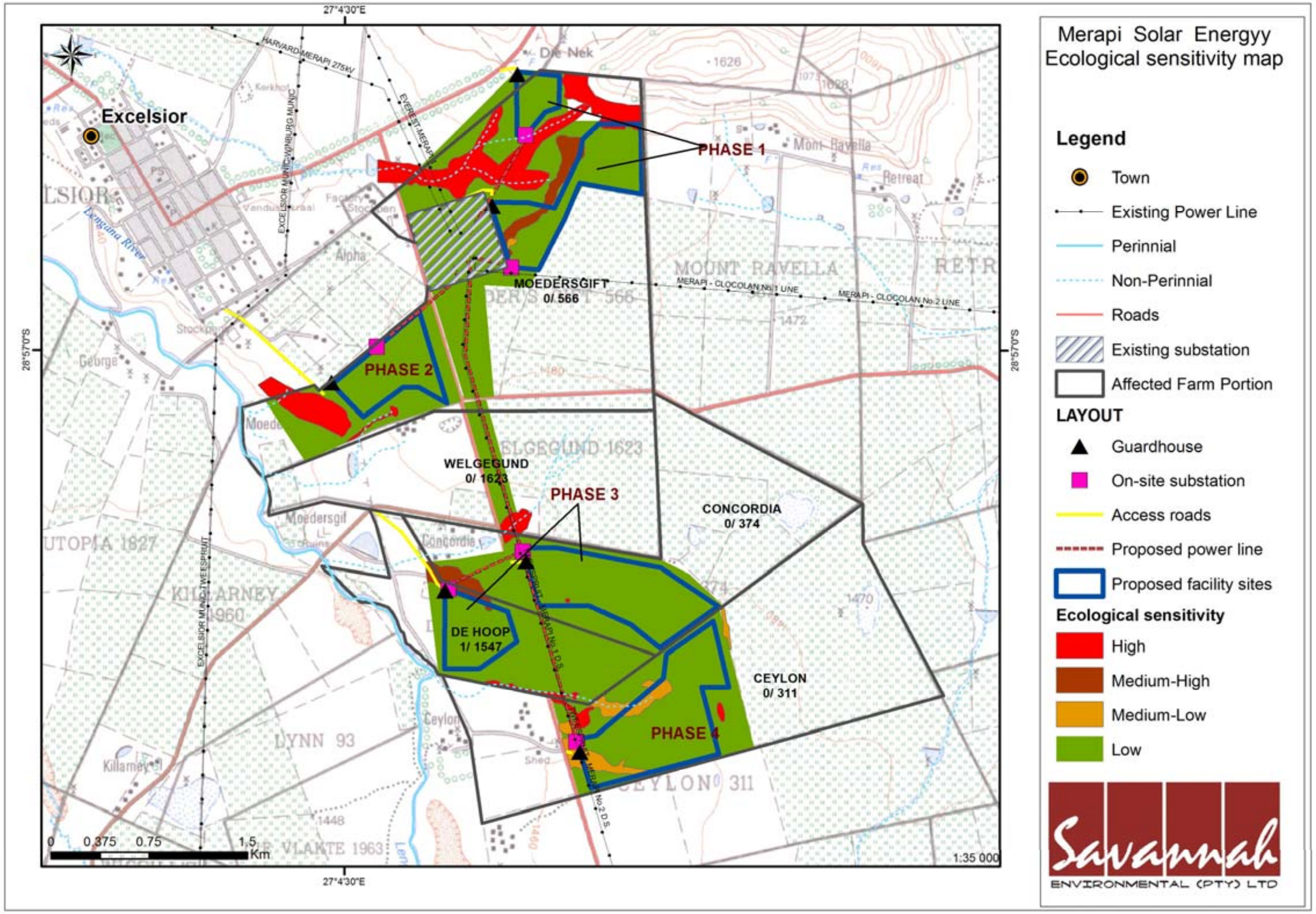


Figure 6.1: Ecology sensitivity map for the study area: Red indicates areas with *High Sensitivity* that should be avoided as far as possible; the remainder of the study area has Medium-High and Low *Sensitivity* where development can take place with certain mitigation measures

» Altered distribution of rainfall and resultant runoff patterns, increase in runoff and accelerated erosion, loss of faunal habitat and resource availability to terrestrial fauna;
» Temporary displacement of terrestrial fauna; and
» Increase in pollution, loss of faunal habitat and resource availability to terrestrial fauna

The following is assumed with regards to the ecological impacts:
» Existing access roads and tracks will be used and upgraded as far as possible, whilst new servitudes or power lines will coincide as far as possible with existing infrastructure;
» The proposed development will be as close as possible to existing electricity infrastructure, thus minimising the need for additional overhead power lines to connect to the grid;
» A thorough ecological investigation be conducted of all footprint areas to detect and relocate all plant species of conservation concern by a suitably qualified botanist prior to a geotechnical survey and construction;
» Development of the PV-footprint area will retain a minimum 50 m (preferably 100 m) buffer from all drainage lines and/or wetlands within the area assessed; and
» Prior to development the footprint area will be entirely cleared of all alien invasive plants.

The tables which follow provide an assessment of the direct, indirect and cumulative impacts on ecology expected to be associated with the construction and operation of the Merapi Solar Facility - Phase 1.

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

Upgrading of Access Road

Nature: Loss of vegetation, increase in runoff and erosion (as the road already exists, no additional impact on terrestrial fauna is expected to arise from the development)		
	Without mitigation	**With mitigation**
Extent	Local (3)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Low (4)	Small (0)
Probability	Definite (5)	Definite (5)
Significance	**Medium (55)**	**Low (25)**
Status (positive or negative)	Negative	Neutral
Reversibility	Not reversible	Partially reversible
Irreplaceable loss of resources?	Probable	Not likely
Can impacts be mitigated?	Reasonably	
Mitigation:		

» Make use of existing tracks as far as possible » Ensure an adequate plant search and rescue program is developed and implemented prior to commencement of activity; especially geophytes may need to be relocated » Reinforce portions of existing access routes that are prone to erosion, create structures or low banks to drain the access road rapidly during rainfall events, yet preventing erosion of the track and surrounding areas » Ensure that runoff from compacted or sealed surfaces is slowed down and dispersed sufficiently to prevent accelerated erosion from being initiated (storm water and erosion management plan required, together with revegetation of adjacent areas) » Prevent leakage of oil or other chemicals or any other form of pollution » Monitor the establishment of alien invasive species and remove as soon as detected, whenever possible before regenerative material can be formed » After decommissioning, if access roads or a portion thereof will not be of further use to the landowner or project, remove all foreign material and rip area to facilitate the establishment of vegetation
Cumulative impacts: » Possible erosion of areas lower than the access road, possible contamination of lower-lying wetlands due to oil or other spillage » Possible spread and establishment of alien invasive species
Residual Impacts: » Altered vegetation composition and structure » Barren areas » Potential for erosion

Creation of Access Roads where existing tracks are insufficient

Nature: Loss of vegetation, increase in runoff and erosion, displacement of fauna, possible alteration of drainage patterns		
	Without mitigation	**With mitigation**
Extent	Local (3)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Moderate (6)	Low (4)
Probability	Definite (5)	Definite (5)
Significance	**High (65)**	**Medium (45)**
Status (positive or negative)	Negative	Neutral
Reversibility	Not reversible	Partially reversible
Irreplaceable loss of resources?	Probable	
Can impacts be mitigated? Reasonably		
Mitigation: » Follow routes of existing tracks or fence lines as far as possible » Ensure adequate drainage and specific erosion control if and where access roads need to cross drainage lines » Ensure an adequate plant search and rescue program prior to commencement of activity, especially geophytes may need to be relocated » Reinforce portions of existing access routes that are prone to erosion, create structures or low banks to drain the access road rapidly during rainfall events, yet preventing erosion of the track and surrounding areas		

» Ensure that runoff from compacted or sealed surfaces is slowed down and dispersed sufficiently to prevent accelerated erosion from being initiated (storm water and erosion management plan required, together with revegetation of adjacent areas) » Prevent leakage of oil or other chemicals or any other form of pollution » Monitor the establishment of alien invasive species and remove as soon as detected, whenever possible before regenerative material can be formed » After decommissioning, if access road or portion thereof will not be of further use to the landowner, remove all foreign material and rip area to facilitate the establishment of vegetation
Cumulative impacts: » Possible erosion of cleared areas and thus also accelerated erosion from surrounding areas » Possible excessive fragmentation and thus reduction of core habitats that may negatively influence species population viability
Residual impacts: » Altered vegetation composition » Compacted topsoils » Possibility for erosion

Fencing area – may also serve as access road to PV panels and fire-break

Nature: Loss of vegetation, loss of micro-habitat, increase in runoff and erosion, window of opportunity for the establishment of alien invasive species, altered topsoil characteristics prone to capping, increased runoff and erosion. As fences already exist, no significant additional impact on terrestrial fauna is expected to arise from the development.		
	Without mitigation	**With mitigation**
Extent	Local (2)	Local (1)
Duration	Long-term (4)	Long term (4)
Magnitude	Moderate (6)	Small (1)
Probability	Definite (5)	Definite (5)
Significance	**Medium (60)**	**Medium (30)**
Status (positive or negative)	Negative	Neutral
Reversibility	Partially reversible	Largely reversible
Irreplaceable loss of resources?	Probable	
Can impacts be mitigated? Reasonably		
Mitigation: » Minimise area affected, especially during construction » Avoid development and disturbance on low rocky ridges or outcrops as well as plains adjacent to and drainage lines themselves » Use topsoils removed for redistribution outside the LOWEST borders of the development to stop erosion off the cleared areas, possibly to construct contour buffer strips to help limit erosion » Remove and collect all bulbous plants from cleared areas and transplant onto the newly redistributed topsoils, together with other species used for revegetation » Prevent leakage of oil or other chemicals » Monitor the establishment of alien invasive species and remove as soon as detected, whenever possible *before* regenerative material can be formed » Should the area along the fence be used for occasional access and fire breaks, regular		

mowing of the grass layer to reduce fire loads is recommended rather than the removal of vegetation
Cumulative impacts: » Possible erosion of cleared areas and thus also accelerated erosion from surrounding areas » Possible excessive fragmentation and thus reduction of core habitats that may negatively influence species population viability
Residual impacts: » Altered vegetation composition » Compacted topsoils » Possibility for erosion

Construction and operation of PV panels

Nature: Loss of vegetation, loss of and alteration of microhabitats, altered vegetation cover, altered distribution of rainfall and resultant runoff patterns, increase in runoff and accelerated erosion, loss of faunal habitat and resource availability to terrestrial fauna.		
	Without mitigation	**With mitigation**
Extent	Local (5)	Local (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	Very High (10)	Moderate (6)
Probability	Definite (5)	Definite (5)
Significance	**High (95)**	**Medium (60)**
Status (positive or negative)	Negative	Negative
Reversibility	Difficult to reverse	Partially reversible
Irreplaceable loss of resources?	Highly Probable	Probable
Can impacts be mitigated?	Reasonably	
Mitigation: » Keep areas affected to a minimum » Utilise area as close as possible to existing infrastructure, keep buffer zone of a minimum of 50m, preferably 100 m, around drainage lines » Keep levelling earthworks and soil disturbance to the minimum practically possible » Develop and implement a comprehensive topsoil management, soil erosion control and rehabilitation plan once layouts have been finalised » Remove as little indigenous vegetation as practically possible » Revegetate areas below/between panels immediately after construction ceases » Relocate all geophytes, or use as far as possible in rehabilitation efforts » No development on drainage lines or other wetlands and low rocky ridges and outcrops, limit development on lower-lying plains adjacent to drainage lines » Monitor the area below the PV panels regularly after larger rainfall events to determine where erosion may be initiated and then mitigate by modifying the soil microtopography and revegetation efforts accordingly » Aim to maintain a reasonable cover of indigenous perennial vegetation throughout the operational phase within and on the periphery of the PV array, preferably low dense perennial grasses that can be mowed as required to reduce fuel loads » Prevent leakage of oil or other chemicals » Monitor the establishment of alien invasive species and remove as soon as detected, whenever possible before regenerative material can be formed		

Cumulative impacts: » possible erosion of areas lower than the panels » possible contamination and siltation of the drainage lines and lower-lying wetlands » possible fragmentation of plant populations » possible alteration of occupancy by terrestrial fauna » possible reduction of available habitat to terrestrial fauna » possible spread and establishment of alien invasive species
Residual Impacts: » altered topsoil characteristics » altered vegetation composition » altered habitat and resource availability to terrestrial fauna

Construction of power lines to substation

Nature: Loss of vegetation, increase in runoff and erosion, temporary displacement of terrestrial fauna		
	Without mitigation	**With mitigation**
Extent	Local (2)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Minor (2)	Small (0)
Probability	Definite (5)	Definite (5)
Significance	**Medium (40)**	**Low (25)**
Status (positive or negative)	Negative	Neutral
Reversibility	Partially reversible	Partially reversible
Irreplaceable loss of resources?	Probable	Not likely
Can impacts be mitigated?	Reasonably	
Mitigation: » Place pylons as far as possible on sites where the slope and erosion risk is minimal or negligible » No pylons may be placed within drainage lines or 32 m of such without the appropriate permits » Riparian areas may not be used as access points to pylon areas » Conduct a search and rescue operation for bulbous plants prior to pylon construction » Prevent spillage of construction material beyond area affected » Monitor the establishment of alien invasive species and remove as soon as detected, whenever possible before regenerative material can be formed		
Cumulative impacts: » Possible erosion of surrounding areas, no major cumulative impact on vegetation expected		
Residual Impacts: » Very localised alteration of soil surface characteristics		

Construction and operation of substation area

Nature: Loss of vegetation, loss of micro-habitats, increased runoff and erosion, possibly altered chemistry of surrounding soils, window of opportunity for the establishment of alien invasive species.

After decommissioning: altered topsoil characteristics with low moisture infiltration capacity, low niche diversity, and increased runoff and slow plant establishment.		
	Without mitigation	**With mitigation**
Extent	Local (3)	Local (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	Moderate (6)	Low (4)
Probability	Definite (5)	Definite (5)
Significance	**High (65)**	**Medium (50)**
Status (positive or negative)	Negative	Negative
Reversibility	Low reversibility	Partially reversible
Irreplaceable loss of resources?	Highly probable	Probable
Can impacts be mitigated?	Reasonably	
Mitigation: » Place pylons as far as possible on sites where the slope and erosion risk is minimal or negligible » No pylons may be placed within drainage lines or 32 m of such without the appropriate permits » Riparian areas may not be used as access points to pylon areas » Conduct a search and rescue operation for bulbous plants prior to pylon construction » Prevent spillage of construction material beyond area affected » Monitor the establishment of alien invasive species and remove as soon as detected, whenever possible before regenerative material can be formed		
Cumulative impacts: » Possible erosion of surrounding areas, no major cumulative impact on vegetation expected		
Residual Impacts: » Very localised alteration of soil surface characteristics		

Construction and operation of workshop area and guard houses

Nature: Loss of vegetation, increase in runoff and erosion, pollution, loss of faunal habitat and resource availability to terrestrial fauna		
	Without mitigation	**With mitigation**
Extent	Local (4)	Local (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	Moderate (6)	Low (4)
Probability	Definite (5)	Definite (5)
Significance	**High (70)**	**Medium (50)**
Status (positive or negative)	Negative	Neutral
Reversibility	Difficult to reverse	Partially reversible
Irreplaceable loss of resources?	Probable	Probable
Can impacts be mitigated?	Reasonably	
Mitigation: » Avoid placing infrastructure on rocky ridges and outcrops, within 100 m of any drainage line or in the lowest sections of the landscape (where no drainage lines have		

developed up to date but where moisture does accumulate seasonally due to the topography), restrict to vegetation Association 2 as far as possible » Limit disturbance to footprint area as far as practically possible – including disturbance to soil » Implement a comprehensive topsoil management plan as soon as layout plans are finalised and site preparation commences » Conduct a search and rescue operation for bulbous plants prior to construction » Prevent spillage of construction material and other pollutants beyond area affected » Implement a comprehensive waste management plan for the operation of the facility » Rehabilitate and revegetate all areas outside footprint area that have been disturbed immediately after construction » Monitor adjacent areas for accelerated erosion and mitigate as required » Monitor the establishment of alien invasive species and remove as soon as detected, whenever possible before regenerative material can be formed
Cumulative impacts: » possible erosion of adjacent or lower-lying areas » possible contamination and siltation of drainage lines and lower-lying wetlands » possible fragmentation of plant populations » possible alteration of occupancy by terrestrial fauna, reduction of available habitat to terrestrial fauna » possible spread and establishment of alien invasive species » Possible erosion of surrounding areas
Residual Impacts: » altered topsoil characteristics » altered vegetation composition » altered habitat and resource availability to terrestrial fauna

Implications for Project Implementation

» The proposed photovoltaic facility development on the site may have significant impacts on the ecology of the site and lower-lying wetlands, if mitigation measures are not strictly adhered to.

» Potentially significant negative impacts on the ecological environment would be soil degradation issues (erosion, depletion of nutrients) as a result of construction activity and the operation of the facility, possible introduction of alien invasive plants and a long-term (more than 8 months) low or absent vegetation cover after construction.

» A loss of niches and specialised habitats for flora and fauna could occur with the removal or significant degradation of large expanses of vegetation or the alteration of rocky habitats. With the ecologically justifiable placement of the different components of the proposed development, coupled with diligent implementation of mitigating measures by the developer, contractors, and operational staff, the severity of impacts can be greatly reduced.

» The impact on fauna is expected to be negligent. Currently minimal presence of wild animals could be detected, possibly due to current land use patterns. Animals that may be present are mobile and will move away during construction, possibly resettling after construction. No restricted or specific habitat of vertebrates will be affected by the proposed development; especially if the proposed development remains outside the more sensitive areas.

» The proposed Merapi Solar Facility - Phase 1 is located largely within an area of low ecological sensitivity. A small area classified as being of Medium-High sensitivity would be affected. Appropriate mitigation is required to be implemented in order to minimise impacts on this area.'
» The proposed facility is considered to be acceptable from an ecological perspective provided appropriate mitigation and management measures are implemented throughout the lifecycle of the project.

6.2.2 Impacts on Soils and Agricultural Potential

The proposed activity could result 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).

The dominant soils in the study area according to the Taxonomical Soil Classification System of South Africa are Mispah and Sterkspruit soils. The effective depth of the Mispah and Sterkspruit soils is on average 300mm restricted to the Orthic A – Horizon. The agricultural potential of the Mispah and Sterkspruit, soils is considered medium to low under dryland (650mm/y rainfall) and irrigation conditions (>10-15mm/week 33-1,500kPa plant available water). The current land use as shown in Figure 6.2 includes 235ha natural veld, 16ha ploughed land and 17ha plantation. The land capability includes 16ha arable (5% of the total development area), 235ha grazing and 17ha wilderness. No evidence of soil erosion was observed on any of the soils during the investigation. It can be seen from the figure below that the proposed layout of the Merapi Solar Energy Facility avoids areas which are currently cultivated.

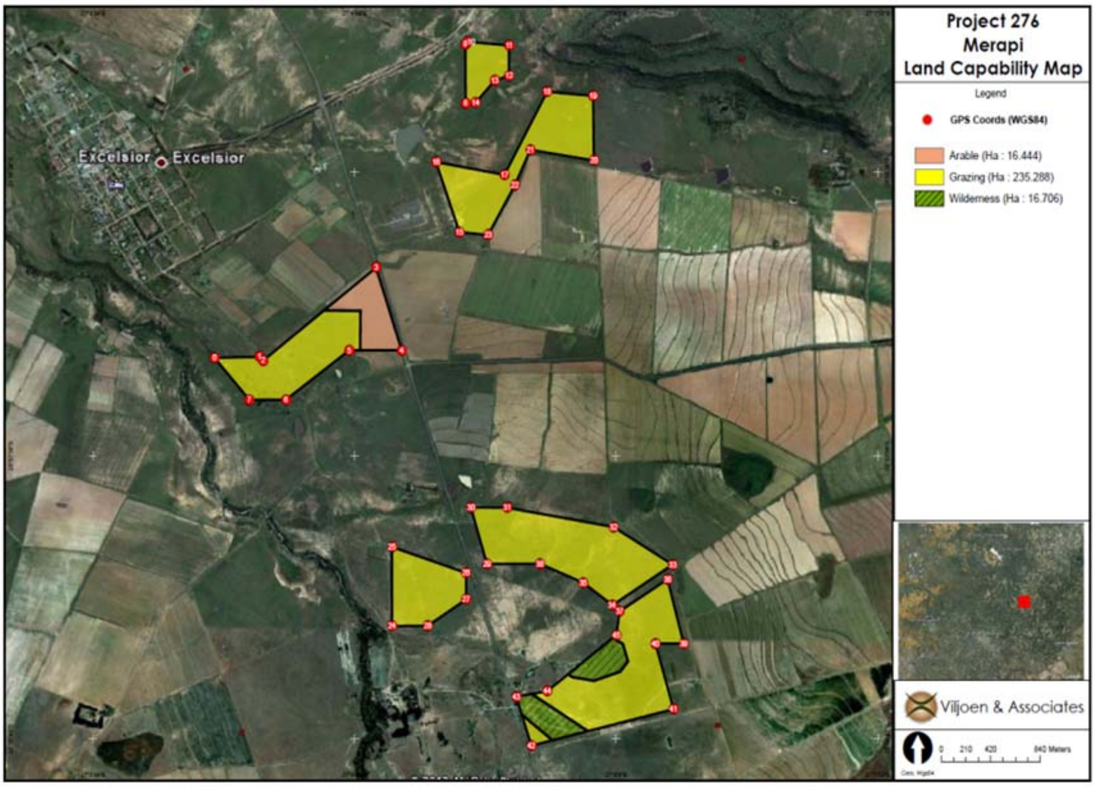


Figure 6.2: Land capability in relation to the proposed Merapi Solar energy facility Phase 1 – 4.

The tables which follow provide an assessment of the direct, indirect and cumulative impacts on soils and agricultural potential expected to be associated with the construction and operation of the Merapi Solar Facility - Phase 1.

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

Nature: Loss of topsoil due to stripping, handling and placement of soil associated with pre construction land clearing and rehabilitation.		
	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	Irreversible	Irreversible
Irreplaceable loss of resources?	Irreplaceable	Irreplaceable
Can impacts be mitigated?	Yes.	
Mitigation: » Strip all usable soil, irrespective of soil depth and store for use during rehabilitation?		
Cumulative impacts: » Cumulative impact of loss of topsoil due to stripping and placement associated with pre		

construction land clearing and rehabilitation is considered low due to the undeveloped nature of the area but further development will increase impact.
Residual impacts: » Minor localised loss of topsoil

Nature: Change of soil's physical, chemical and biological properties due to loss of topsoil due to erosion, stockpiling, mixing of deep and surface soils during handling, stockpiling and subsequent placement.		
	Without mitigation	***With mitigation***
Extent	Local (1)	Local (1)
Duration	Long Term (4)	Short Term (1)
Magnitude	Moderate (8)	Low (4)
Probability	Very Probable (5)	Very Probable (4)
Significance	**Moderate (65)**	**Low (24)**
Status	Negative	Negative
Reversibility	Irreversible	Irreversible
Irreplaceable loss of resources?	Irreplaceable	Irreplaceable
Can impacts be mitigated?	Yes.	
Mitigation: » Implement live placement of soil where possible, improve organic status of soils, maintain fertility levels and curb topsoil loss.		
Cumulative impacts: » Cumulative impact of soil's physical, chemical and biological properties due to loss of topsoil, due to erosion, stockpiling, mixing of deep surface soils during handling, stockpiling and subsequent placement is considered low due to the undeveloped nature of the area but further development will increase impact.		
Residual impacts: » Minor localised degradation of topsoil's chemical, physical and biological properties		

Nature: Change of natural surface topography due to reprofiling of surface after stripping.		
	Without mitigation	***With mitigation***
Extent	Local (1)	Local (1)
Duration	Long Term (4)	Short Term (1)
Magnitude	Moderate (8)	Low (4)
Probability	Very Probable (5)	Very Probable (4)
Significance	**Moderate (65)**	**Low (24)**
Status	Negative	Negative
Reversibility	Irreversible	Irreversible
Irreplaceable loss of resources?	Irreplaceable	Irreplaceable
Can impacts be mitigated?	Yes	
Mitigation: » Implement mapping stormwater control system to ensure surface water control measures are implemented to ensure free draining system with minimal soil erosion.		
Cumulative impacts:		

» Cumulative impact of the change of surface topography due to reprofiling of surface after stripping is considered low due to the undeveloped nature of the area but further development will increase impact.
Residual impacts: » Minor localised degradation of topsoil's chemical, physical and biological properties

Nature: Loss of land with agricultural potential and land capability.		
	Without mitigation	***With mitigation***
Extent	Local (1)	Local (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	Low (4)	Low (4)
Probability	High Probable (4)	High Probable (4)
Significance	**Moderate (40)**	**Low (16)**
Status	Negative	Negative
Reversibility	Medium	Medium
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Direct impacts cannot be mitigated but direct impacts can be minimised and avoided through adequate planning of layout.	
Mitigation: » Loss of agricultural land is a long term loss and no mitigation measures exist. Mitigation is restricted to limitation of extent of impact to the immediate area of impact and minimisation of off-site impacts.		
Cumulative impacts: » The cumulative impact of a loss in the agricultural potential is considered low as areas of high potential and cultivated fields have been avoided by the placement of infrastructure.		
Residual impacts: » Minor loss of grazing land while facility is in use.		

Implications for Project Implementation

- The proposed development of a photovoltaic facility on the site will have minimal significant impacts on the agricultural potential as 95% of the development footprint is proposed on low agricultural potential soils.
- The proposed Merapi Solar Facility - Phase 1 avoids currently cultivated areas.
- The results of the Soil Assessment for the proposed Merapi Solar Park find the proposed activity will have a medium to low impact on the immediate and surrounding soil systems. Implementation and management of proposed mitigation measures will minimise loss of topsoil, prevent contamination of topsoil and stockpiled soil and prevent overall soil erosion.
- It is recommended that the proposed project be approved subject to the mitigation measures stipulated in the Impact Assessment and Environmental Management Programme

6.2.3 Assessment of Potential Impacts on Heritage and Paleontological sites

Five heritage sites were identified near the site (i.e. more than 200m away) and are referred to as: Merap-1, 2, 3, 4 and Merap-5. Of these 5 sites 2 were deemed important as shown on Figure 6.3. None of these sites are located in close proximity to the proposed Merapi Solar facility – Phase 1. No impacts on heritage sites are therefore expected and no mitigation measures are proposed.

In terms of the Paleontological resources in the study area, the site of the proposed Merapi Solar Park is underlain sediments of the Adelaide and Tarkastad subgroups, Beaufort Group (Karoo Supergroup). The Beaufort Group is composed of sandstone and mudrock and ranges in thickness from 5000m to 150m or less (Groenewald 1989). The Beaufort Group (Karoo Supergroup) of formations are rich in Triassic and Permian fossils (Johnson et al., 2006). Vertebrate fossils including retiles, mammal-like reptiles (Therapsids) (Figure 3 in **Appendix G**), amphibians and fish remains occur in the Beaufort Group (Rubidge et al., 1995). Invertebrate fossils, invertebrate burrows and trails, well-preserved leaf impressions, silicified wood and stem impressions have also been recorded from a number of localities in the Beaufort Group (Anderson et al., 1998; McLachlan & Anderson 1973; 1977; Riek, 1973, 1976, Rubidge et al., 1995).

The tables which follow provide an assessment of the direct, indirect and cumulative impacts on heritage and palaeontological sites expected to be associated with the construction and operation of the Merapi Solar Facility - Phase 1.

Figure 6.3: *Heritage sites recorded in close proximity to the study area*

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

Nature: Discovery/destruction of unknown fossil deposits. 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 measures: » Excavation activities should be monitored by a qualified heritage practitioner		
Cumulative impact: » None		
Residual impact: » Loss of heritage related information		

Implications for Project Implementation

» From an archaeological perspective, the only sign of sites of heritage potential were outside the study area.
» The proposed Merapi Solar facility – Phase 1 will not impact on any heritage sites recorded in the study area.
» No mitigation measures are proposed for these sites since they fall outside the development footprint. However, it is advised that the developer avoid these sites as far as possible.
» The proposed project construction phase should pay special attention to previously un-observed resources or “chance-finds” – these are resources that may be unearthed by the construction excavation activities.
» 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

Visual Impact of the PV Facility and power line – Operational Phase

The viewshed[3] analysis for the proposed facility and associated infrastructure was undertaken in accordance with the *Guideline Document for involving Visual Specialists in EIA Processes*. This analysis considers the broader site for development. 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 project site.
» It is calculated at 3.4m above the natural ground level to reflect the highest point of the PV panels.
» 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.
» The viewshed generated from each of the selected observation points referred to in Annexure 2 of the visual impact assessment (refer to Appendix J) is calculated at 1.7m above the natural ground level to reflect the average height of person either walking or sitting in a vehicle.

As illustrated by the generated viewsheds (refer to **Figure 6.4**), the primary *zone of visual influence*[4] is primarily located in a northern direction up to ±10km from the project site. A further zone of visual influence is located intermittently to the east up to 7km.

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 southeast.

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

3 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.

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

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, while structures, textures, styles and forms are often not visible (SRK Consulting, 2007).

The distance radii indicating the various viewing distances from the combined phases are illustrated by Figure 6.4. Also illustrated by the figure is the town of Excelsior in the *foreground* to *middle ground* of the project site. Excelsior represents the area where most of the visual receptors would be located. Also located in the *fore-* and *middle ground* are the two main view corridors, namely the R703 and R709.

The tables which follow provide an assessment of the direct, indirect and cumulative visual impacts expected to be associated with the construction and operation of the Merapi Solar Facility - Phase 1.

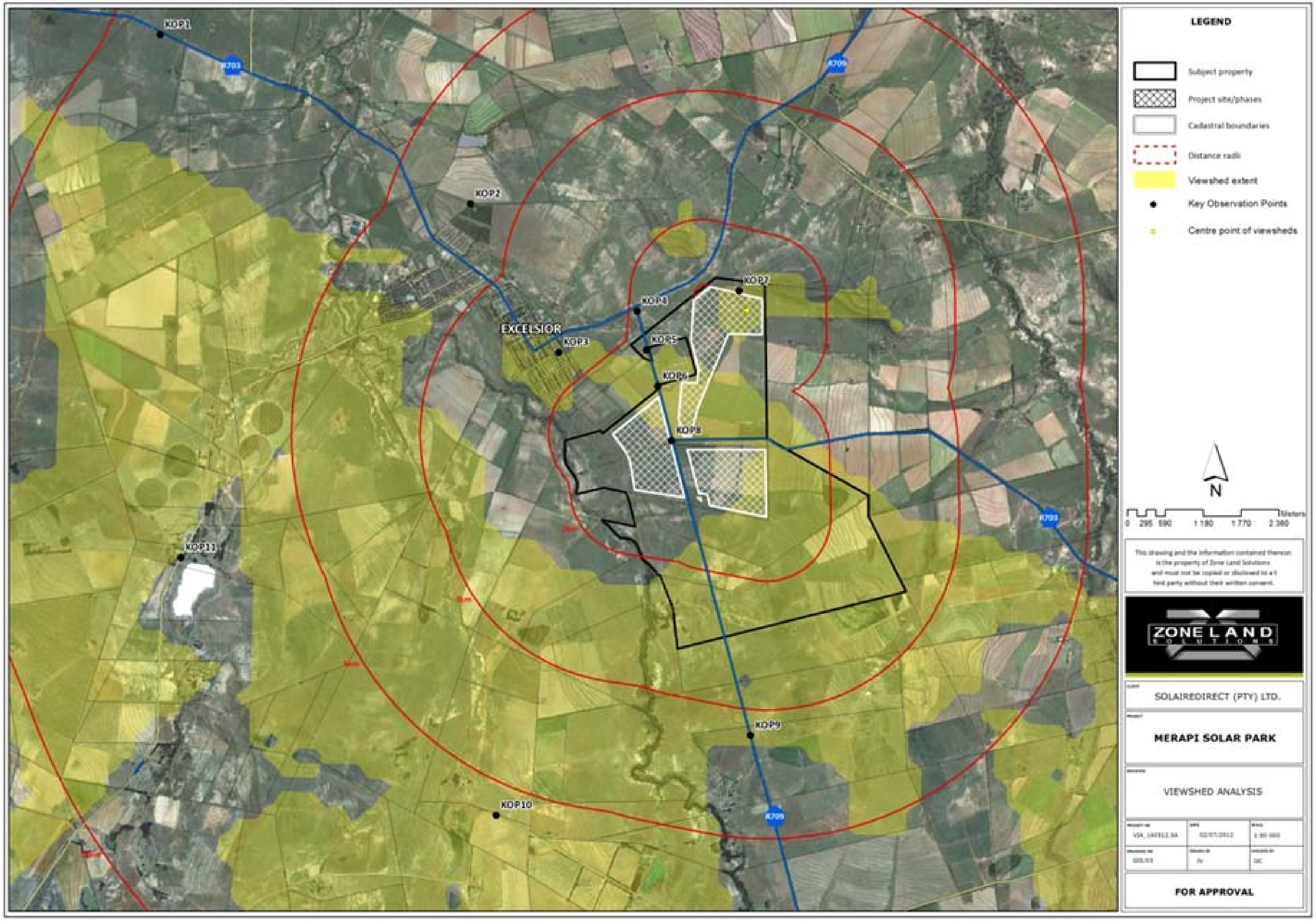


Figure 6.4: Viewshed generated from the highest point of the project site.

Impact tables summarising the significance of visual impacts of the PV facility, power line and proposed substation area (with and without mitigation)

Nature: Potential visual impact on the sensitive receptors in the *foreground* and *middle ground*.		
	Without Mitigation	**With Mitigation**
Extent	Regional (3)	Local (2)
Duration	Long term (4)	Long term (4)
Magnitude	Minor (4)	Low (2)
Probability	Probable (3)	Improbable (2)
Significance	**Medium (33)**	**Low (16)**
Status	Neutral	Neutral
Reversibility	Recoverable (3)	Recoverable (3)
Irreplaceable Loss of Resource?	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 outer boundaries of the individual phases. Only indigenous plant species to be introduced and planted in such a manner and location which would not cast shadows on the PV 'strings'. » 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. » Utilise existing roads and tracks to the extent possible. Where new roads are required, they should be two-track gravel roads, maintained to prevent dust plumes and erosion.		
Cumulative impacts: The existing Merapi Substation and its associated industrial-type infrastructure such as electrical transmission lines and pylons already exist in the immediate surroundings. Therefore, the cumulative impact will be increased with the establishment of the PV plant.		
Residual impacts: The proposed infrastructure is of such a nature that the status quo could be regained after decommissioning of the plant. Providing that the site is rehabilitated to its current state, the visual impact will also be removed.		

Nature: Potential visual impact on the intrinsic value and sense of place of the Excelsior region.		
	Without Mitigation	**With Mitigation**
Extent	Local (2)	Local (2)
Duration	Long term (4)	Long term (4)
Magnitude	Medium (6)	Medium (6)
Probability	Highly probable (4)	Probable (3)
Significance	**Medium (48)**	**Medium (36)**
Status	Negative	Negative

Reversibility	Recoverable (3)	Recoverable (3)
Irreplaceable Loss of Resource?	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 outer boundaries of the individual project phases. Only indigenous plant species to be introduced and planted in such a manner and location which would not cast shadows on the PV 'strings'.

» 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 raising the PV platforms so that cattle can roam underneath the PV 'string'.

» Utilise existing roads and tracks to the extent possible. Where new roads are required, they should be two-track gravel roads, maintained to prevent dust plumes and erosion.

Cumulative impacts:

It is near impossible to distinguish built forms and structures at distances greater than 5km. However, the introduction of a PV plant with four phases of approximately 250 ha in total might have a cumulative effect on the observer.

Residual impacts:

The proposed infrastructure is of such a nature that the status quo could be regained after decommissioning of the plant. Providing that the site is rehabilitated to its current state, the visual impact will also be removed.

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

	Without Mitigation	**With Mitigation**
Extent	Local (2)	Local (2)
Duration	Long term (4)	Long term (4)
Magnitude	Minor (4)	Low (2)
Probability	Probable (3)	Probable (3)
Significance	**Medium (30)**	**Low (24)**
Status	Negative	Negative
Reversibility	Recoverable (3)	Recoverable (3)
Irreplaceable Loss of Resource?	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.

» Only minimum wattage light fixtures must be used.

Cumulative impacts:

The area within which the proposed activity is to be undertaken is relatively low lit. The occurrence of ancillary structures of the PV Plant will contribute to the cumulative lighting effect of the area but it is expected to be negligible in a local context.

Residual impacts:
The proposed infrastructure is of such a nature that the status quo could be regained after decommissioning of the plant. Providing that the site is rehabilitated to its current state, the visual impact will also be removed.

Nature: Potential visual impact of reflection of the PV Panels on sensitive receptors.		
	Without Mitigation	**With Mitigation**
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 Resource?	No	No
Can Impacts Be Mitigated?	Yes	
Mitigation: » Consider installing anti-reflective coating or glass to reduce the sunlight that is reflected and increase the amount of sunlight that is absorbed. » Select the shortest possible route for power lines between individual phases and substation to reduce its visual appearance. » Consider laying electrical cables underground en-route to the substation.		
Cumulative impacts: The introduction of the PV plant, coupled with the power line, proposed and existing substations, contribute to an increased cumulative visual impact.		
Residual impacts: The proposed infrastructure is of such a nature that the status quo could be regained after decommissioning of the plant. Providing that the site is rehabilitated to its current state, the visual impact will also be removed.		

Implications for Project Implementation

» The results of the Visual Impact Assessment for the proposed Merapi Solar Facility – Phase 1 found that the proposed activity will have a medium impact from Key Observer Points identified in the *foreground* and *middle ground*(<3km).
» Cumulative impacts are associated with the other phases of the Merapi Solar Park as well as the existing Merapi Substation and overhead power lines.
» It is herewith recommended that the proposed activity be approved subject to the mitigation measures described in Environmental Management Programme.
» It is furthermore recommended that the proposed project phases be relocated to the south-eastern portions of the subject property (eastern portions of Farms Concordia and Ceylon). The northern phases of the project on the Farm Moedersgift No. 566 presents the area's most visually prominent. A relocation of this particular phase to an area further away from the receptors in Excelsior

would benefit the project from a visual perspective. In addition, it is proposed that the project phases that front onto movement corridors be set back at least 200m from the latter roads in order to establish a proper buffer between the observer and the observed view.

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 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.

The tables which follow provide an assessment of the direct, indirect and cumulative social impacts expected to be associated with the construction and operation of the Merapi Solar Facility - Phase 1.

Impact tables summarising the significance of social impacts associated with the construction phase of the project (with and without mitigation)

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 of each phase of the 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 PVSEF and the associated components, including, access roads, services and power line.

The proposed 33 MW Merapi Solar Park will be developed in 4 phases. The construction phase will therefore extend over a period of ~ 8 years. In terms of employment it is assumed that 70% of the original 291 construction workers employed to construct the first 33MW phase will be employed for the remaining 3 phases. The construction of the remaining 3 phases will therefore create an additional 90 employment opportunities (30% of 291) over and above the initial 291 associated with the construction of the first phase. The total number of employment opportunities created by the construction of all 4 phases will therefore be in the region of 381. Of this total ~ 60% (229) will be available to low-skilled workers (construction labourers, security staff etc.), 15% (57) to semi-skilled workers (drivers, equipment operators etc.) and 25% (95) to skilled personnel (engineers, land surveyors, project managers etc.).

Given the location of the site and its proximity to Excelsior, Winburg, Ladybrand and Bloemfontein, the majority of low and semi-skilled employment opportunities are likely to benefit members from the local community. The majority of the beneficiaries are also likely to be historically disadvantaged (HD) members of the community. The extended duration of the construction phase (8 years) also creates an ideal opportunity for contractor/s to implement an on-site training and skills development programme. This will further enhance to the potential employment opportunities for members from the local community. However, in the absence of specific commitments from the developer to employ local contractors the potential for meaningful skills development and training for members from the local communities are likely to be limited.

	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	Medium Term (3)	Medium Term (3)
Magnitude	Medium (6)	Medium (6)
Probability	Highly probable (4)	Highly probable (4)
Significance	**Medium (44)**	**Medium (48)**
Status (positive or negative)	Positive	Positive
Reversibility	N/A	N/A
Irreplaceable loss of resources?	N/A	N/A
Can impacts be enhanced?	Yes	

***Mitigation*:**

Employment

» Where reasonable and practical, SolaireDirect 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 SolaireDirect should meet with representatives from the MM 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 SolaireDirect 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

- SolaireDirect 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, SolaireDirect 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)

As indicated above, given the proximity of the site to Excelsior, Winburg, Ladybrand and Bloemfontein, including Botshabelo and Thaba Nchu, the majority of the 230 low and semi-skilled employment opportunities associated with the construction phase are likely to be taken up by members from the local community. If these workers are accommodated in their respective home towns then the potential risk posed to local communities will be low. 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. While the significance of the risk to the community as a whole will be low, the significance to individual members of the community who are impacted by the behavior of construction workers would be medium to high.

	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) **Moderate-High** for specific individuals who may be affected by STDs etc. (57)	**Low** for the community as a whole (24) **Moderate-High** for specific individuals who may be affected by STDs etc. (51)
Status (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	Yes, to some degree. However, the risk cannot be eliminated	

enhanced?	

Mitigation:

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

» Where possible, SolaireDirect 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;
» SolaireDirect should consider the need to establish 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;
» SolaireDirect 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;
» SolaireDirect and the contractor should implement an HIV/AIDS awareness programme for all construction workers at the outset of the construction phase;
» The movement of construction workers on and off the site should be closely managed and monitored by the contractors. In this regard the contractors should be responsible for making the necessary arrangements for transporting workers to and from site on a daily basis;
» The contractor should make the necessary arrangements for allowing workers from outside the area to return home over weekends and or on a regular basis during the 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:

» 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 impacts on the affected individuals and/or their families and the community.

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.

Despite the proximity of the farms to the R 709 and R 703, the local farmers interviewed indicated that stock theft was not serious problem in the area. In addition, stock farming was not carried out on a large scale in the area. Sunflowers and maize (corn) are the main crops grown in the area.

	Without enhancement	**With enhancement**
Extent	Local (3)	Local (2)
Duration	Medium Term (3)	Medium Term (3)
Magnitude	Moderate (6) (Due to reliance on agriculture and livestock for maintaining livelihoods)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	**Medium (36)**	**Low (27)**
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:

» SolaireDirect 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.;

» SolaireDirect 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 SolaireDirect and the contractors before the contractors move onto site;

» SolaireDirect 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 SolaireDirect, 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 SolaireDirect 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 SolaireDirect 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 and 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. The local farmers in the area interviewed did however indicate that veld fires were not a major concern. In addition, livestock farming is not the major agricultural activity in the area.		
	Without enhancement	**With enhancement**
Extent	Local (3) (Rated as 3 due to potential severity of impact on local farmers)	Local (2) (Rated as 2 due to potential severity of impact on local farmers)
Duration	Medium Term (3)	Medium Term (3)
Magnitude	Moderate (6) (Due to reliance on agriculture and livestock for maintaining livelihoods)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	**Medium (36)**	**Low (27)**
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: SolaireDirect 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:

» None, provided losses are compensated for.

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. The main access to the site would be via either the R709 and or 703. These two roads link up with the N8, to the south, and N1, to the north-west, respectively. Both the N1 and N8 are important communication routes, specifically the N1. The movement of construction related vehicles along either of these two routes has the potential to cause delays for other road users. However, these impacts will be spread out over the eight year timeframe of the construction phase, and can therefore, be effectively managed and mitigated. The social impacts associated with the movement of construction related traffic are therefore likely to be low.

	Without mitigation	**With mitigation**
Extent	Local (2)	Local (1)
Duration	Medium Term (3)	Medium Term (3)
Magnitude	Low (4)	Minor (2)
Probability	Probable (3)	Probable (3)
Significance	**Low (27)**	**Low (18)**
Status (positive or negative)	Negative	Negative
Reversibility	Yes	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	Yes	

Mitigation:

SolaireDirect 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 heavy vehicles and dust can be effectively mitigated. The aspects that should be covered include:

» The timing of the transport of components to the site should be timed to avoid weekends and holiday times so as to minimise the potential impact on travellers using the N1, N8, R 709 and R 703;
» 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 mitigation measures are implemented.

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 PVSEF and power lines will damage farmlands and result in a loss of farmlands for future farming activities.

The significance of these impacts can 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. In addition, it is standard practice for the affected landowner/s is to enter into a lease agreement that includes monthly rental. The loss of productive farmland would therefore be offset by such an agreement. It may also be possible for livestock and game to graze between the PV panels. The final disturbance footprint can also be reduced by careful site design and placement of components. In addition, the footprint associated with a 10MW solar facility is likely to be relatively small. 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. Recommended mitigation measures are outlined below.

	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)

<table>
<tr><td>Significance</td><td>High, If compensation is not paid or area is not rehabilitated (60)</td><td>Low (20)</td></tr>
<tr><td>Status</td><td>Negative</td><td>Negative</td></tr>
<tr><td>Reversibility</td><td colspan="2">No, in case of footprint associated with solar thermal plant</td></tr>
<tr><td>Irreplaceable loss of resources?</td><td colspan="2">Yes, loss of farmland. However, disturbed areas can be rehabilitated</td></tr>
<tr><td>Can impacts be mitigated?</td><td colspan="2">Yes, loss of farmland. However, disturbed areas can be rehabilitated</td></tr>
<tr><td colspan="3">Mitigation:
The potential impacts associated with damage to and loss of farmland can be effectively mitigated. The aspects that should be covered include:

» 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.</td></tr>
<tr><td colspan="3">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.</td></tr>
<tr><td colspan="3">Residual impacts:
» None provided disturbed areas are rehabilitated.</td></tr>
</table>

Impact tables summarising the significance of social impacts associated with the operation phase of the project (with and without mitigation)

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.

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

Based on the information provided by the proponent, the establishment of the proposed Merapi Solar Facility – Phase 1 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. For the purposes of the assessment it is assumed that there will be some overlap in terms of roles and responsibilities between phases should all 4 phases be implemented. For the purposes of the assessment it is assumed that there will be a 20% overlap for each additional phase. The total number of employment opportunities associated with the additional 3 phases will therefore be 144 (48 x 3).

Due the proximity of the site to Excelsior, Winburg, Ladybrand and Bloemfontein, including Botshabelo and Thaba Nchu, the majority of the work opportunities associated with the operational phase is 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.

	Without mitigation	**With mitigation**
Extent	Local and Regional (2)	Local and Regional (3)
Duration	Long term (4)	Long term (4)
Magnitude	Low (4)	Moderate (6)
Probability	**Probable (3)**	**Highly Probable (4)**
Significance	Medium (30)	Medium (52)
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:

» SolaireDirect 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:

» 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.

<table>
<tr><td colspan="3">Nature of impact: Establishment of a Community Trust funded by revenue generated from the sale of energy.

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 revenue from the proposed solar energy facility plant can be used to support a number of social and economic initiatives in the area, including:

» Creation of jobs;
» Education;
» Support for and provision of basic services;
» School feeding schemes;
» Training and skills development;
» Support for SMMEs.

In addition, the establishment of a solar energy facility plant is not likely to have a significant impact on the current agricultural land uses that underpin the local economic activities in the area. The loss of this relatively small area will not impact on the current and future farming activities.</td></tr>
<tr><td></td><td>Without mitigation</td><td>With mitigation</td></tr>
<tr><td>Extent</td><td>Local (2)</td><td>Local and Regional (4)</td></tr>
<tr><td>Duration</td><td>Long term (4)</td><td>Long term (4)</td></tr>
<tr><td>Magnitude</td><td>Low (4)</td><td>Moderate (6)</td></tr>
<tr><td>Probability</td><td>Probable (3)</td><td>Definite (5)</td></tr>
<tr><td>Significance</td><td>Medium (30)</td><td>High (70)</td></tr>
<tr><td>Status (positive or negative)</td><td>Positive</td><td>Positive</td></tr>
<tr><td>Reversibility</td><td colspan="2">N/A</td></tr>
<tr><td>Irreplaceable loss of resources?</td><td colspan="2">No</td></tr>
<tr><td>Can impacts be mitigated?</td><td colspan="2">Yes</td></tr>
<tr><td colspan="3">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 park.</td></tr>
<tr><td colspan="3">Cumulative impacts:
» Promotion of social and economic development and improvement in the overall well-being of the community. Additional benefits will accrue if all phases of the project are implemented.</td></tr>
<tr><td colspan="3">Residual impacts:
» Social and economic development and improvement in the overall well-being of the community.</td></tr>
</table>

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 4 phases of the Merapi Solar Park relative to South Africa's total energy requirements will be limited. In addition, the current application is not unique. In this regard, a significant number of solar energy projects are currently proposed in other parts of South Africa. The potential contribution of the proposed Merapi Solar Park 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:

- 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:

- Contribution to the government targets for electricity generation from renewable energy.
- Reduced carbon emissions via the use of renewable energy and associated benefits in terms of global warming and climate change.

Residual impacts:

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

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. None of the local farmers, including adjacent farmers, interviewed raised concerns regarding the potential visual impact of the proposed project. Mr A Visagie, the principal of CVO Excelsior School, also indicated that the project was unlikely to have any impact on the school due to the distance of the school from the site. In addition, the Merapi substation is located on the north western boundary of the site, and two power lines associated with the substation traverse the site. The visual integrity of the site and the surrounding area has therefore been impacted by the existing energy related infrastructure on the site.		
	Without mitigation	**With mitigation**
Extent	Local (2)	Local (2)
Duration	Long term (4)	Long term (4)
Magnitude	Medium (4)	Medium (4)
Probability	Probable (3)	Probable (3)
Significance	**Medium (30)**	**Medium (30)**
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 as the impact will be removed after decommissioning.		

Nature of impact: Potential impact of the solar facility on local tourism The FSPGDP identifies tourism as an important economic sector. However, based on the findings of the SIA and 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 project and the areas altered sense of place. 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	Negative

	(Potential to distract from the tourist experience of the area) Positive (Potential to attract people to the area)	(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: » SolaireDirect should liaise with representatives from the MLM and local tourism representatives to raise awareness of the proposed facility. » SolaireDirect 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 impacts on tourism in Mantsopa Local Municipality area.		
Residual impacts: » None as the facility will be removed after decommissioning.		

Nature of impact: Potential visual impact and impact on sense of place associated with power line The social impacts associated with multiple 22kV 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.		
	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 as the impact will be removed after decommissioning

Implications for Project Implementation

» The findings of the SIA indicate that the development of the proposed Merapi Solar facility - Phase 1 will create employment and business opportunities for locals during both the construction and operational phase of the project. The establishment of a Community Trust funded by revenue generated from the sale of energy from the proposed facility also creates an opportunity to support local economic development in the area. This represents a social benefit for an area where there are limited opportunities.

» The proposed development also represents an investment in clean, renewable energy infrastructure, which, given the challenges created by climate change, represents a positive social benefit for society as a whole.

» The establishment of Phase 1 (33MW) of the proposed Merapi solar park is therefore supported by the findings of the SIA.

6.3. 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: Upgrading of Access Road		
Loss of vegetation, increase in runoff and erosion (as the road already exists, no additional impact on terrestrial fauna is expected to arise from the development)	Medium (Negative)	Low (Neutral)
Creation of Access Roads where existing tracks are insufficient		
Loss of vegetation, increase in runoff and erosion, displacement of fauna, possible alteration of drainage patterns	High (Negative)	Medium (Neutral)
Impacts on Ecology: Fencing area		
Loss of vegetation, loss of micro-habitat, increase in runoff and erosion, window of opportunity for	Medium (Negative)	Medium (Neutral)

Nature	***Positive (+) ,Negative (-)or neutral Impact***	***Positive (+) ,Negative (-)or neutral Impact***
	Without mitigation	***With mitigation***
the establishment of alien invasive species, altered topsoil characteristics prone to capping, increased runoff and erosion		
Impacts on Ecology: Construction and operation of PV panels		
Loss of vegetation, loss of and alteration of microhabitats, altered vegetation cover, altered distribution of rainfall and resultant runoff patterns, increase in runoff and accelerated erosion, loss of faunal habitat and resource availability to terrestrial fauna	High (Negative)	Medium (Negative)
Impacts on Ecology: Construction of power lines to substation		
Loss of vegetation, increase in runoff and erosion, temporary displacement of terrestrial fauna. of soils, creation of runoff zone, possible contamination	Medium (Negative)	Low (Neutral)
Construction and operation of substation area		
Loss of vegetation, loss of micro-habitats, increased runoff and erosion, possibly altered chemistry of surrounding soils, window of opportunity for the establishment of alien invasive species	High (Negative)	Medium (Negative)
Impacts on Ecology: Construction and operation of workshop area and guard houses		
Loss of vegetation, increase in runoff and erosion, pollution, loss of faunal habitat and resource availability to terrestrial fauna	High (Negative)	Medium (Neutral)
Impacts on Soils and Agricultural Potential		
Loss of topsoil due to stripping, handling and placement of soil associated with pre construction land clearing and rehabilitation.	Moderate (Negative)	Low (Negative)
Change of soil's physical, chemical and biological properties due to loss of topsoil due to erosion, stockpiling, mixing of deep and surface soils during handling, stockpiling and	Moderate (Negative)	Low (Negative)

Nature	Positive (+) ,Negative (-)or neutral Impact	Positive (+) ,Negative (-)or neutral Impact
	Without mitigation	With mitigation
subsequent placement.		
Change of natural surface topography due to reprofiling of surface after stripping.	Moderate (Negative)	Low (Negative)
Loss of land with high agricultural potential and land capability.	Moderate (Negative)	Low (Negative)
Potential Impacts on Heritage and Paleontological sites		
The disturbance/destruction of the historic farmstead (ruins) may occur (e.g. secondary impact) as a result of construction activities and development of associated infrastructure.	Low (Negative)	Low (Negative)
The disturbance/destruction of the historic farmhouse (ruins) and ‘disturbed area’ may occur (e.g. secondary impact) as a result of construction activities and development of associated infrastructure.	Low (Negative)	Low (Negative)
Discovery/destruction of unknown fossil deposits. Paleontological sites could be affected if bedrock was to be disturbed during the excavation activities associated with the construction	Low (Negative)	Low (Positive)
Potential Visual Impacts		
Potential visual impact of reflection of the PV Panels on the sensitive receptors.	Medium (Neutral)	Low (Neutral)
Potential visual impact on the intrinsic value and sense of place of the Excelsior region.	Medium (Negative)	Medium (Negative)
Potential visual impact of artificial lighting as a result of the activity.	Medium (Negative)	Low (Negative)
Potential visual impact of reflection of the PV Panels on the sensitive receptors	Low (Neutral)	Low (Neutral)
Potential Social Impacts During Construction		
Creation of employment and business opportunities	Medium (Positive)	Medium (Positive)
Potential impacts on family	Low for the community as	Low for the community

Nature	***Positive (+) ,Negative (-)or neutral Impact***	***Positive (+) ,Negative (-)or neutral Impact***
	Without mitigation	***With mitigation***
structures and social networks associated with the presence of construction workers	a whole Moderate-High for specific individuals who may be affected by STDs etc.	as a whole Moderate-High for specific individuals who may be affected by STDs etc.
Increased risk of stock theft, poaching and damage to farm infrastructure	Medium (Negative)	Low (Negative)
Potential increased incidence of veld fires	Medium (Positive)	Medium (Positive)
Potential noise, dust and safety impacts associated with movement of construction related traffic to and from the site	Low (Negative)	Low (Negative)
Loss of farmlands for future farming activities	High (Negative)	Low (Negative)
Potential Social Impacts During Operation		
Creation of employment and business opportunities associated with the operational phase	Low (Positive)	Medium (Positive)
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 (Positive)	High (Positive)
Promotion of clean, renewable energy	Medium (Positive)	Medium (Positive)
Visual impact and impact on sense of place	Medium (Negative)	Medium (Negative)
Potential impact of the solar thermal plant on local tourism	Low (Negative)	Low (Negative)
Potential visual impact and impact on sense of place associated with power lines	Low (Negative)	Low (Negative)

As can be seen from this table, there are no impacts of high significance expected to be associated with the construction and operation of the proposed Merapi Solar Facility – Phase 1, provided that the recommended mitigation measures are implemented. All identified impacts can therefore be mitigated to acceptable levels.

6.4. Assessment of Potential Cumulative Impacts

A cumulative impact, in relation to an activity, refers to the impact of an activity that in itself may not be significant, but may become significant when added to the existing and potential impacts eventuating from similar or diverse undertaking in the area [1].

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 Free State Province is earmarked as a potential solar energy hub for South Africa, considering the vast amounts land available. There are four proposed solar energy facilities proposed in the Motheo District Municipality, the majority of which are located near to the capital city (Bloemfontein). The Merapi Solar Facility – Phase 1 is located ~ 80 km north-east from the proposed Sannaspos Solar Park and ~ 60 km east of the proposed Glen Thorne PV facility. There is therefore sufficient distance between these proposed facilities to result in no cumulative impacts. However, the proximity of the proposed Merapi Solar Facility Phases 2, 3 and 4 to the Merapi Solar Facility Phase 1 result in the potential for localised cumulative impacts (refer to Figure 6.5). Potential cumulative impacts relate to the visual impact, impact on flora and fauna, impact on agricultural potential and impact on the social environment. No impacts on heritage sites are expected as no sites were recorded within the development footprint of any of the proposed phases.

6.4.1. Visual Impacts

The Merapi Solar Facility site is located within a remote area within the Mantsopa Local Municipality. Considering the low population density in the District Municipality the visual impacts of multiple solar energy facilities will be low. In addition, the Merapi substation is located on the north western boundary of the site, and two power lines associated with the substation traverse the site. The visual integrity of the site and the surrounding area has therefore been impacted by the existing energy related infrastructure on the site.

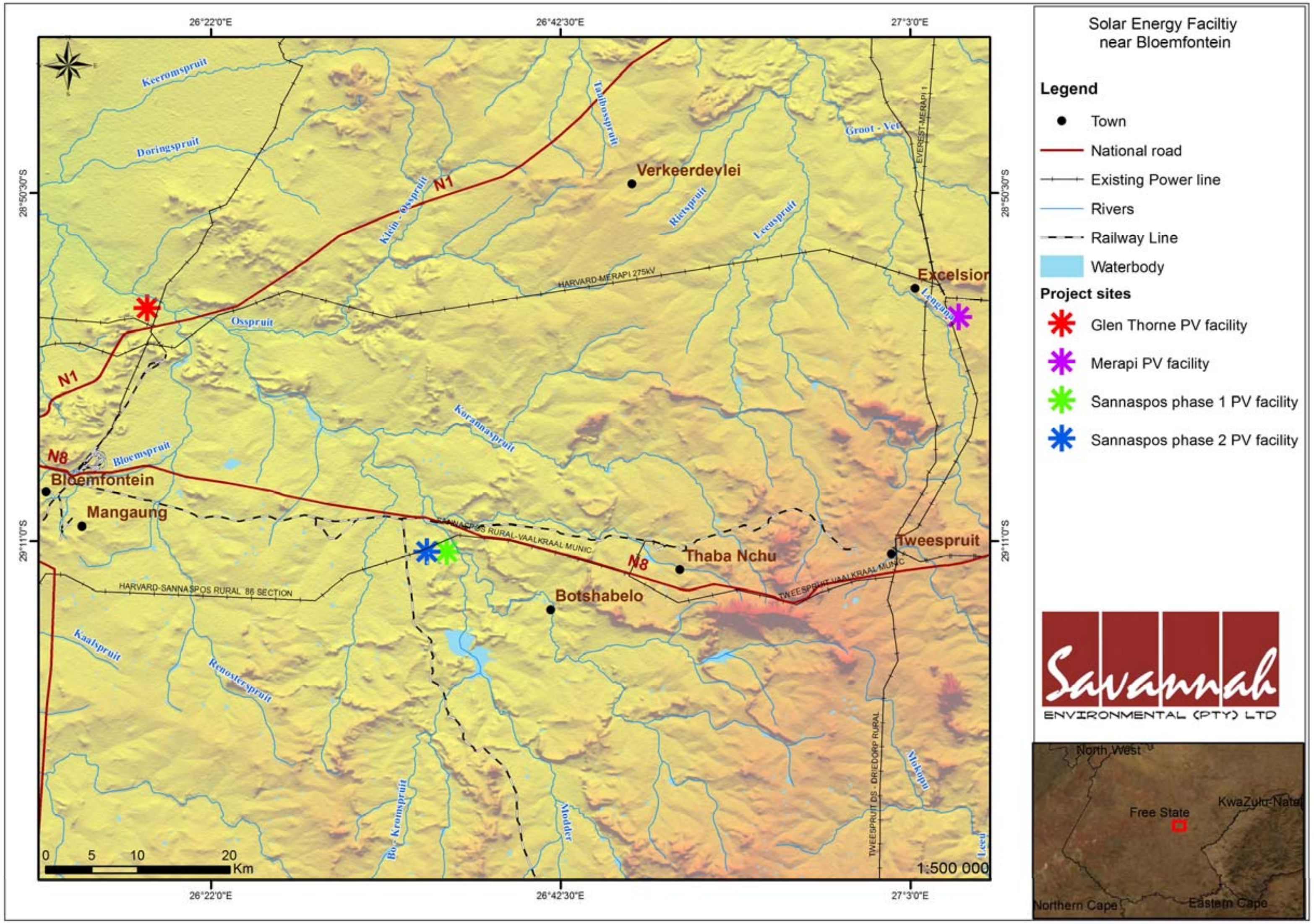


Figure 6.5: The location of the proposed Merapi Solar Energy Facility relative to the proposed Glen Thorne and Sannaspos solar energy facilities.

The table below assesses the potential visual impact for the establishment of a number of solar energy facilities in the Free State Province.

Nature: Visual impacts associated with the establishment of more than one solar 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	Negative	Negative
Reversibility	Yes. Solar energy plant components and other infrastructure can be removed.	
Irreplaceable loss of resources?	No	
Can impact be mitigated?	Yes	
Mitigation: Implement mitigation measures as proposed for each facility to minimise impacts.		
Residual impacts: None as the impact would be removed after decommissioning.		

6.4.2. Ecology Impacts

Negative cumulative ecological impacts include habitat loss and disturbance, and soil erosion. Individual projects will require proper management of environmental impacts during construction and operation. Cumulative ecological impacts relate to:

- » possible erosion of areas lower than the panels
- » possible contamination and siltation of the drainage lines and lower-lying wetlands
- » possible fragmentation of plant populations
- » possible alteration of occupancy by terrestrial fauna
- » possible reduction of available habitat to terrestrial fauna
- » possible spread and establishment of alien invasive species

Nature: Loss of vegetation, loss of and alteration of microhabitats, altered vegetation cover, altered distribution of rainfall and resultant runoff patterns, increase in runoff and accelerated erosion, loss of faunal habitat and resource availability to terrestrial fauna.		
	Without mitigation	**With mitigation**
Extent	Local (5)	Local (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	Very High (10)	Moderate (6)
Probability	Definite (5)	Definite (5)

Significance	**High (95)**	**Medium (60)**
Status (positive or negative)	Negative	Negative
Reversibility	Difficult to reverse	Partially reversible
Irreplaceable loss of resources?	Highly Probable	Probable
Can impacts be mitigated?	Reasonably	
Mitigation: » Implement mitigation measures as proposed for each facility to minimise impacts.		
Residual Impacts: » altered topsoil characteristics » altered vegetation composition » altered habitat and resource availability to terrestrial fauna		

6.4.3. Impacts on Agricultural Potential

Cumulative impacts on agricultural potential would be associated with impacts on cultivated lands and/or areas of high potential. The cumulative impact of a loss in the agricultural potential associated with the establishment of Phases 1 – 4 of the Merapi Solar Facility is considered low as areas of high potential and cultivated fields have been avoided by the placement of infrastructure.

Nature: Loss of land with agricultural potential and land capability.		
	Without mitigation	***With mitigation***
Extent	Local (1)	Local (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	Low (4)	Low (4)
Probability	High Probable (4)	High Probable (4)
Significance	**Moderate (40)**	**Low (16)**
Status	Negative	Negative
Reversibility	Medium	Medium
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Direct impacts cannot be mitigated but direct impacts can be minimised and avoided through adequate planning of layout.	
Mitigation: » Implement mitigation measures recommended for each phase of development in order to minimise impacts.		
Residual impacts: » Minor loss of grazing land while facility is in use.		

6.4.4. Social Impacts

Cumulative social impacts would be of medium (positive), regional significance as there would be creation of employment and business opportunities and would include the benefits associated with the establishment of Community Trusts in the municipal area. There would also be an increase in job opportunities and skills development due to these projects. The negative cumulative impacts could be

related an influx of job seekers to the area but localised for each site, and if managed well it can be of low negative impact. The overall cumulative impacts are acceptable. In terms of land use, the dominate land use in the district municipality will not be compromised due to the vast amounts of land available in the Free State. The table below assesses the potential social impact for the establishment of a number of solar energy facilities in the Free State Province.

Nature: The establishment of a number of solar energy facilities in the Free State Province will create employment, skills development and training opportunities, creation of downstream business opportunities and stimulation of the local property market.		
	Without Enhancement	**With Enhancement**
Extent	Local and regional (3)	Local and regional (4)
Duration	Long term (4)	Long term (4)
Magnitude	Low (4)	Moderate (6)
Probability	Highly Probable (4)	Definite (5)
Significance	**Medium (44)**	**High (70)**
Status	Positive	Positive
Reversibility	Yes. Solar energy plant components and other infrastructure can be removed.	
Irreplaceable loss of resources?	No	
Can impact be enhanced?	Yes	
Mitigations: » SolaireDirect 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; » SolaireDirect 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 20-25 year operational life of the facility. The rationale for the establishment of a Rehabilitation Trust Fund is linked to the experiences with the mining sector in South Africa and failure of many mining companies to allocate sufficient funds during the operational phase to cover the costs of rehabilitation and closure. SolaireDirect have indicated that the rehabilitation programme will be funded by sale of scrap metal etc. on closure of the facility.		
***Residual impacts*:** Positive impact on the local and regional economy through the creation of downstream opportunities and wage spend in the local economy		

6.5. Assessment of the Do Nothing Alternative

The 'do-nothing' alternative is the option of not constructing the proposed Merapi Solar Energy Facility - Phase 1. Should this alternative be selected, there would be no impacts on the site due to the construction and operation activities of a solar energy facility. However, there will be impacts at a local and a broader scale.

The primary considerations pertaining to the do-nothing alternative relate to:

1. The current land-use regime of the site; and
2. The need to diversify the energy mix in South Africa.

These are discussed in further detail below.

1. The agricultural potential of the site is mainly determined by climatic parameters such as rainfall distribution and frequency as well as wind prevalence. The site is considered to have low agricultural potential. The current land-use on the site is agriculture (livestock and game farming). The "do nothing" alternative would retain the current land-use, with a resultant lost opportunity to generate renewable energy from the wind and at the same time continue current agricultural activities on areas that fall outside of the proposed solar energy facility infrastructure. The development of the solar energy facility would allow current agricultural activities on areas of the farm portions which will not be occupied by solar panels and associated infrastructure. Therefore the current land-use will be retained, while also generating renewable energy from the sun. In addition, the landowner would obtain an income from the facility (as the developer would pay a percentage of the revenue generated to the landowner in accordance with the lease agreement for the use of the land). This would contribute towards the financial stability of the landowner which would in turn contribute to the financial viability of the farming practices on the property. The do nothing alternative would result in a lost opportunity for the landowner (in terms of revenue) and the country (in terms of renewable energy).

2. At a broader scale, the benefits of additional capacity to the electricity grid and those associated with the introduction of renewable energy would not be realised. Although the facility is only proposed to contribute approximately 33MW to the grid capacity, this would assist in meeting the growing electricity demand throughout the country and would also assist in meeting the government's goal for renewable energy.

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

» **Increased energy security:** The current electricity crisis in South Africa highlights the significant role that renewable energy can play in terms of power supplementation. In addition, given that renewables can often be deployed in a decentralised manner close to consumers, they offer the opportunity for

improving grid strength and supply quality, while reducing expensive transmission and distribution losses.

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

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

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

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

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

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

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

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

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

The table below provides an assessment of the potential impacts associated with the no-development alternative.

Nature: 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 Enhancement[5]**
Extent	Local-Regional (3)	Local-Regional (4)
Duration	Long term (4)	Long term (4)
Magnitude	Medium (6)	Medium (6)
Probability	Definite (5)	Definite (5)
Significance	High (65	High (70)
Status	Negative	Positive
Reversibility	Yes	
Irreplaceable loss of resources?	Yes, impact of climate change on ecosystems	
Can impact 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.		
***Cumulative impacts*:** Reduce carbon emissions via the use of renewable energy and associated benefits in terms of global warming and climate change.		
***Residual impacts*:** Reduce carbon emissions via the use of renewable energy and associated benefits in terms of global warming and climate change.		

[5] Enhancement assumes development of the proposed PVSEF and establishment of Community Trust

CONCLUSIONS AND RECOMMENDATIONS: PHASE 1 CHAPTER 7

The Merapi Solar Energy Facility – Phase 1 is proposed to be developed as a commercial solar energy facility located on Portion 0 of Farm 566 Moedersgift which falls within the Mantsopa Local Municipality of the Free State Province (refer to Figure 7.1). The purpose of the proposed facility is to add new capacity for generation of power from renewable energy to the national electricity supply (which is short of generation capacity to meet current and expected demand), and to aid in achieving the goal of a 30% share of all new power generation being derived from independent power producers (IPPs), as targeted by the Department of Energy (DoE).

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

As such SolaireDirect Southern Africa (Pty) Ltd, as an IPP, is investigating the establishment of a 130 MW (155 installed capacity) photovoltaic solar park for the purpose of commercial electricity generation. The proposed Merapi Solar Facility – Phase 1 facility is proposed to be approximately 33MW in capacity and forms part of this larger solar park. The proposed facility will require approximately 55 ha and will be comprised of the following primary elements (refer to Chapter 2 for more details):

» An array of PV panels.
» An on-site substation and 22kV overhead power line to facilitate the connection between the solar energy facility and the Eskom electricity grid.
» Internal access roads.
» Guard house,
» Laydown, Campsite and assembly area.
» Office and Control centre.

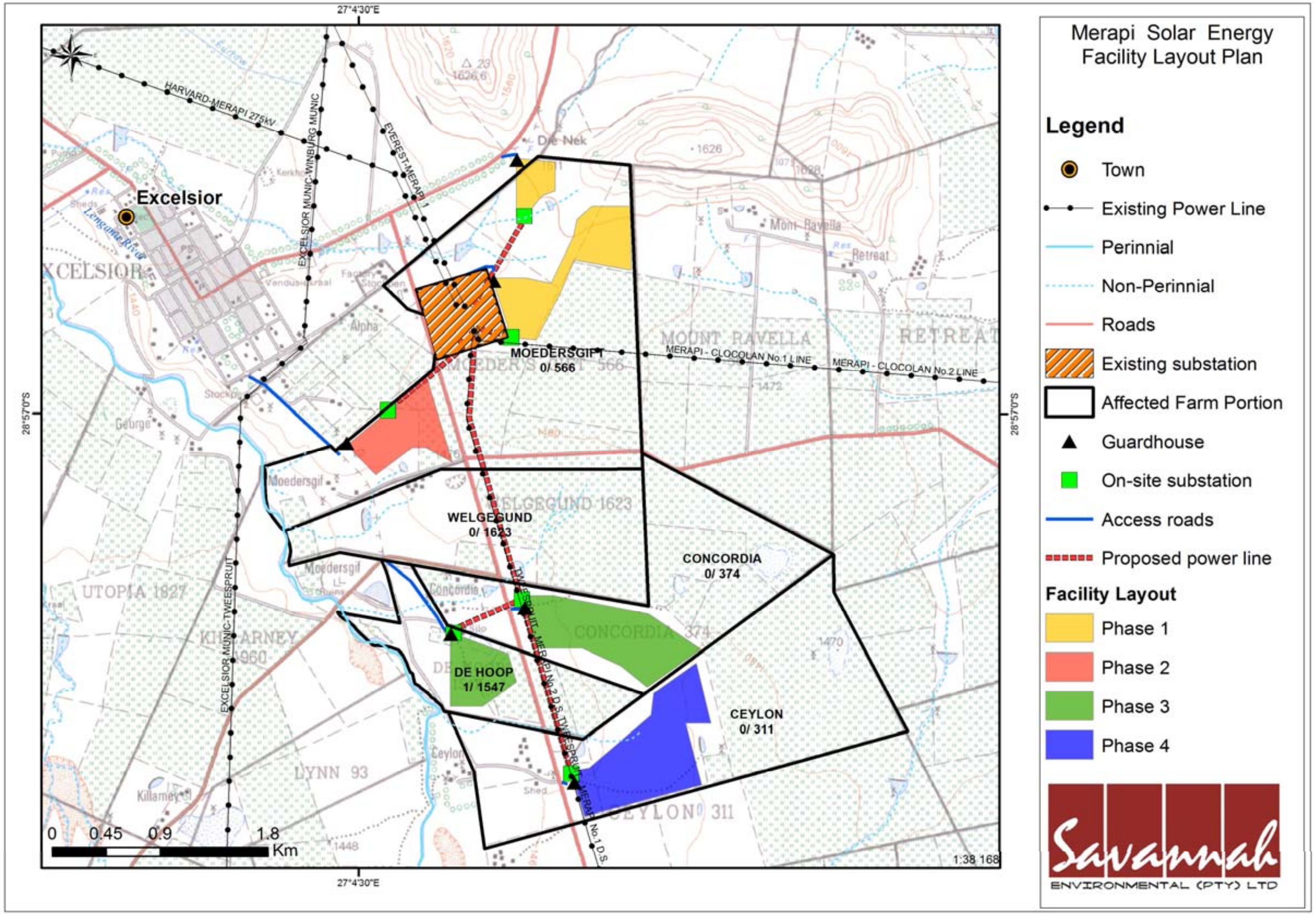


Figure 7.1: Locality map illustrating the location of the assessed development site for the proposed Merapi Solar Park and preliminary layout of the proposed facility, indicating the location proposed for the 4 project phases

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), SolaireDirect Southern Africa (Pty) Ltd requires authorisation from the National Department of Environmental Affairs (DEA) (in consultation with the Free State DETEA 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[6] 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 K).

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

7.1. Evaluation of Merapi Solar Energy Facility – 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 Merapi Solar Energy Facility – Phase 1 by providing a summary of the conclusions of the assessment of the proposed site for the development of the PV solar energy

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

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 environmental fatal flaws which were identified to be associated with the site. No go areas identified include areas of high ecological sensitivity (small rocky outcrops, ridges, footslopes of larger mountains and riparian areas). In summary, the most significant environmental impacts associated with the Merapi Solar Energy Facility – 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 agricultural potential,
» Impacts on the social environment.

7.1.1. Local Site-specific Impacts

The construction of the Merapi Solar Energy Facility – Phase 1 will lead to permanent disturbance of an area of ~55ha in extent. Permanently affected areas include the area for the PV panels and associated infrastructure, as well as the internal 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, but degraded due to continued heavy grazing. Areas of sensitivity within the proposed development site were identified through the EIA process. These relate to the local ecology (sensitive and protected vegetation, habitat for fauna, several small drainage lines, man-made dams and natural vleys occur within the project area). (Refer to the sensitivity map – Figure 7.2).

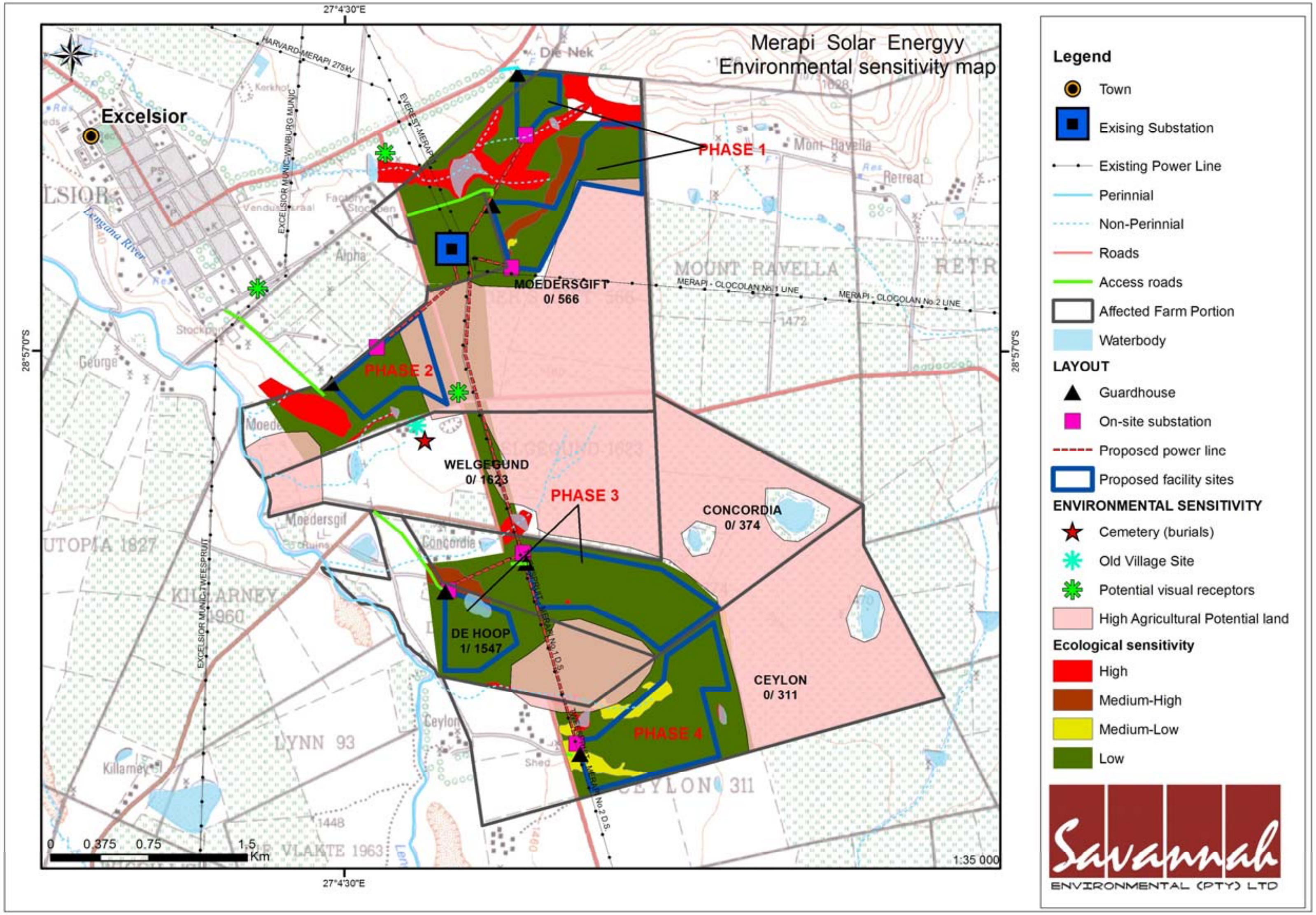


Figure 7.2: Sensitivity map for the Merapi Solar Energy Facility.

Areas of high sensitivity include rocky outcrops, ridges, and small koppies which are a habitat for several protected species found near the sites. Once these habitats have been physically altered, they cannot be recreated or returned to their former diversity and functionality therefore should be treated as no-go areas. Other sensitive ecological areas include dense vegetation of the riparian areas fringing the drainage channels which is essential in keeping the drainage channel intact and protects it from erosion as well as footslopes of larger mountains and riparian areas. These areas have been avoided through the careful placement of infrastructure. The proposed facility is located within areas of low and medium-high sensitivity. It is concluded through the specialist investigations undertaken that impacts on ecology associated with the proposed development can be mitigated to acceptable levels.

No impacts on heritage sites are expected to occur as no heritage sites were recorded within the proposed development footprint.

7.1.2. Visual Impacts

Most of the potential impacts associated with the proposed facility relate to the foreground and middle ground zone of visual influence (i.e. within 3km of the proposed facility). The visual analysis and assessment from all selected observation points found that the proposed activity is potentially visible and recognisable from Key Observation Points along the R703 and R709 as well as from Excelsior itself. The results of the Visual Impact Assessment for the proposed Merapi Solar Park therefore found that the proposed activity will have a **medium** impact from KOPs identified in the *foreground* and *middle ground* (<3km). This impact is partially mitigated by the presence of the Merapi substation is located on the north western boundary of the site, and two power lines associated with the substation traverse the site. The visual integrity of the site and the surrounding area has therefore been impacted by the existing energy related infrastructure on the site.

Other solar energy facilities are located in the same district as the proposed Merapi Solar Energy Facility (Refer to Figure 7.3). Based on the findings of the specialist studies undertaken, the potential cumulative visual impacts are expected to be low. This is due to the distance between facilities as well as the sparsely populated nature of the region.

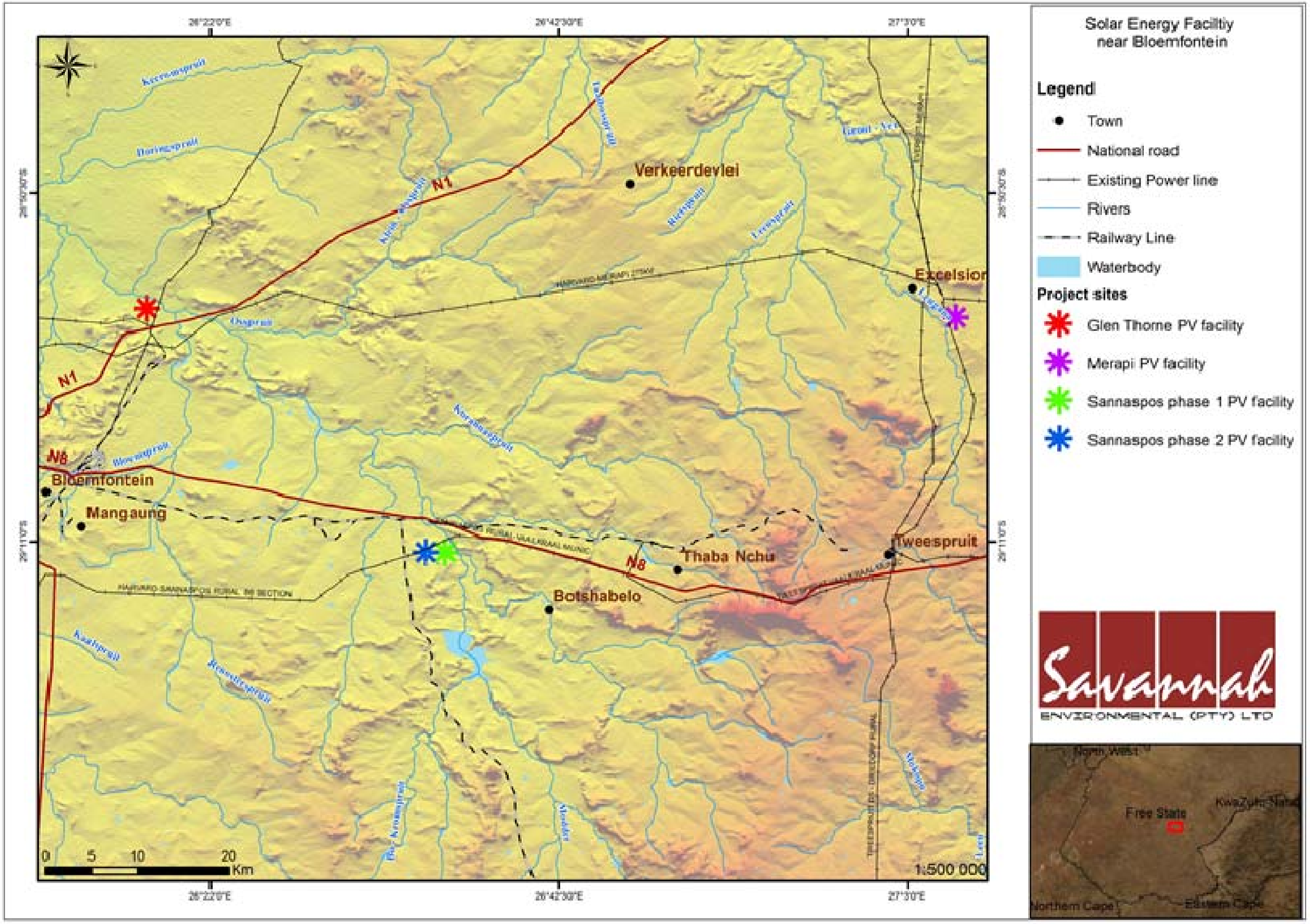


Figure 7.3: Locality map showing the Solar Energy Facility proposed in close proximity to the Merapi Solar Energy Facility.

7.1.3. Impacts on Agricultural potential

The majority of the site (95%) is proposed on Mispah and Sterkspruit soils. These soils type have low-medium agricultural potential. However a small portion of the facility will occupy the Clovelly soil of type and these soils are known to be of medium-high agricultural potential. As the majority of the development footprint is located outside of areas of high agricultural potential and cultivated fields, the impact on agricultural potential is considered acceptable. It is recommended that the proposed project be approved subjected to the mitigation measures stipulated in the Environmental Management Programme since these soils type are suitable for rehabilitation purposes.

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 largely restricted to daylight hours, and the construction phase is anticipated to extend for a minimum period of 18-months. Negative impacts during construction relate mainly to impacts due to the presence of construction workers and visual impact imposed by the facility on the local environment. 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. This will be a positive impact due to the high unemployment levels in the area. The positive impact due to employment creation will be lower during operation as there will be a limited number of staff required compared to the construction phase.

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 generating capacity of 33MW on a site located on Portion 0 of Farm 566 Moedersgift has been established by SolaireDirect Southern Africa (Pty) Ltd. The positive implications of establishing a solar energy facility on the identified site within the Free State include the following:

» The potential to harness and utilise solar energy resources within the Free State Province.
» The consolidation of solar facility infrastructure within an area (specifically considering the proximity to Phases 2, 3 and 4 of the Merapi Solar park, as well as to the proposed Sannaspos and Glen Thorne solar facilities to be developed).
» 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 Free State Province would benefit from the additional generated power.
» Promotion of clean, renewable energy in South Africa
» Creation of local employment, business opportunities and skills development for the area.

The findings of the specialist studies undertaken within this EIA to assess both the benefits and potential negative impacts anticipated as a result of the proposed project conclude that 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 the majority of identified negative impacts can be reduced by implementing the recommended mitigation measures. The project is therefore considered to meet the requirements of sustainable development. Environmental specifications for the management of potential impacts are detailed within the draft Environmental Management Programme (EMP) included within Appendix K.

With reference to the information available at this planning approval stage in the project cycle, the **confidence** in the environmental assessment undertaken is regarded as **acceptable**.

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 Merapi Solar Energy Facility – Phase 1 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:

» A minimum legal buffer of development of 32 m from drainage lines should be observed. It is recommended that a buffer of at least 100 m be maintained around riparian areas. Where this is not possible, alternative mitigation measures as detailed in this report must be implemented and relevant permits must be obtained.
» Following the final design of the facility, a final 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 K 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 throughout the construction and operation of the facility.
» 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.
» Existing access roads on site should be used as far as possible.
» 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 SolaireDirect Southern Africa (Pty) Ltd must be submitted to the relevant regulating authorities.

ASSESSMENT OF POTENTIAL IMPACTS: MERAPI PHASE 2 CHAPTER 8

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 SolaireDirect Merapi Solar Facility - Phase 2. This assessment is undertaken for the 20 MW solar facility and for all the facility's components, as detailed in the following table:

Component	Description
Location of the site	~ 5 km south-east of Bloemfontein
Municipal Jurisdiction	Mantsopa Local Municipality; Motheo District Municipality
Extent of the proposed development footprint (four phases)	~30 ha
Extent of broader site available for development	~1505 ha
Site access	The site can be accessed easily via the R709 main road which crosses through the proposed sites, as well as via farm gravel roads. The farm roads will be upgraded and used to access the facility site during construction and operation.
Generating capacity(four phases)	20 MW
Proposed technology	Photovoltaic panels
Associated infrastructure	» An on-site substation and 22kV overhead power line to facilitate the connection between the solar energy facility and the Eskom electricity grid. » Internal access roads (~4m wide x 1000m in length) » Guard house » Laydown, campsite and assembly area. » Office and Control centre.
Water use	» ~2 million litres/year required during the construction phase and 200,000 litres/year for operations,, » Water requirements for the construction phase of the PV power facility will be supplied by the Local Water Users' Association. Alternatively water will be provided

Component	Description
	via a rainwater tank. » No effluent will be produced except for the normal sewage from site and operations staff. This will be treated as per normal standards with a septic tank and disposed of at an appropriate licensed facility off-site.

The development of the Merapi Facility – Phase 2 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 18-24 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.

8.1. Methodology for the assessment of Potentially Significant Impacts

A broader site of 1505 ha (i.e. on Portion 0 of Farm 311 Ceylon, Portion 0 of Farm 566 Moedersgift, Portion 0 of Farm 374 Concordia, and Portion 1 of Farm 1547 De Hoop) was identified by the project developer for the purpose of establishing the proposed Merapi Facility Phase 1-4. The total developmental footprint will cover an extent of <250 ha and can therefore be accommodated within the broader site. Phase 2 of the facility is proposed to be developed on Portion 0 of Farm 566 Moedersgift. An area of 30ha is required for the development of this phase of the project.

The assessment of potential issues associated with the development of the Merapi Solar Facility - Phase 2 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.

8.2. 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.

8.2.1 Potential Impacts on Ecology

Solar energy facilities require relatively large areas of land for placement of infrastructure. This PV facility requires ~150 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 as shown on Figure 8.1 below identifies those parts of the study area that have high conservation value or that may be sensitive to disturbance. This sensitivity assessment is based on a desktop study, detailed field evaluation of the site and detailed analysis of aerial photography. A detailed methodology is included within the Ecology report (See Appendix E).

(a) Summary of Ecological Impacts

The majority of impacts on ecology will occur during the construction of the proposed PV facility. A risk assessment was undertaken as part of the ecological impact assessment, which identified the main potential negative impacts on the ecological receiving environment. Potential impacts were identified as follows:

» Loss of vegetation, increase in runoff and erosion;
» Loss of micro-habitat, window of opportunity for the establishment of alien invasive species, altered topsoil characteristics prone to capping;
» Altered distribution of rainfall and resultant runoff patterns, increase in runoff and accelerated erosion, loss of faunal habitat and resource availability to terrestrial fauna;
» Temporary displacement of terrestrial fauna; and
» Increase in pollution, loss of faunal habitat and resource availability to terrestrial fauna

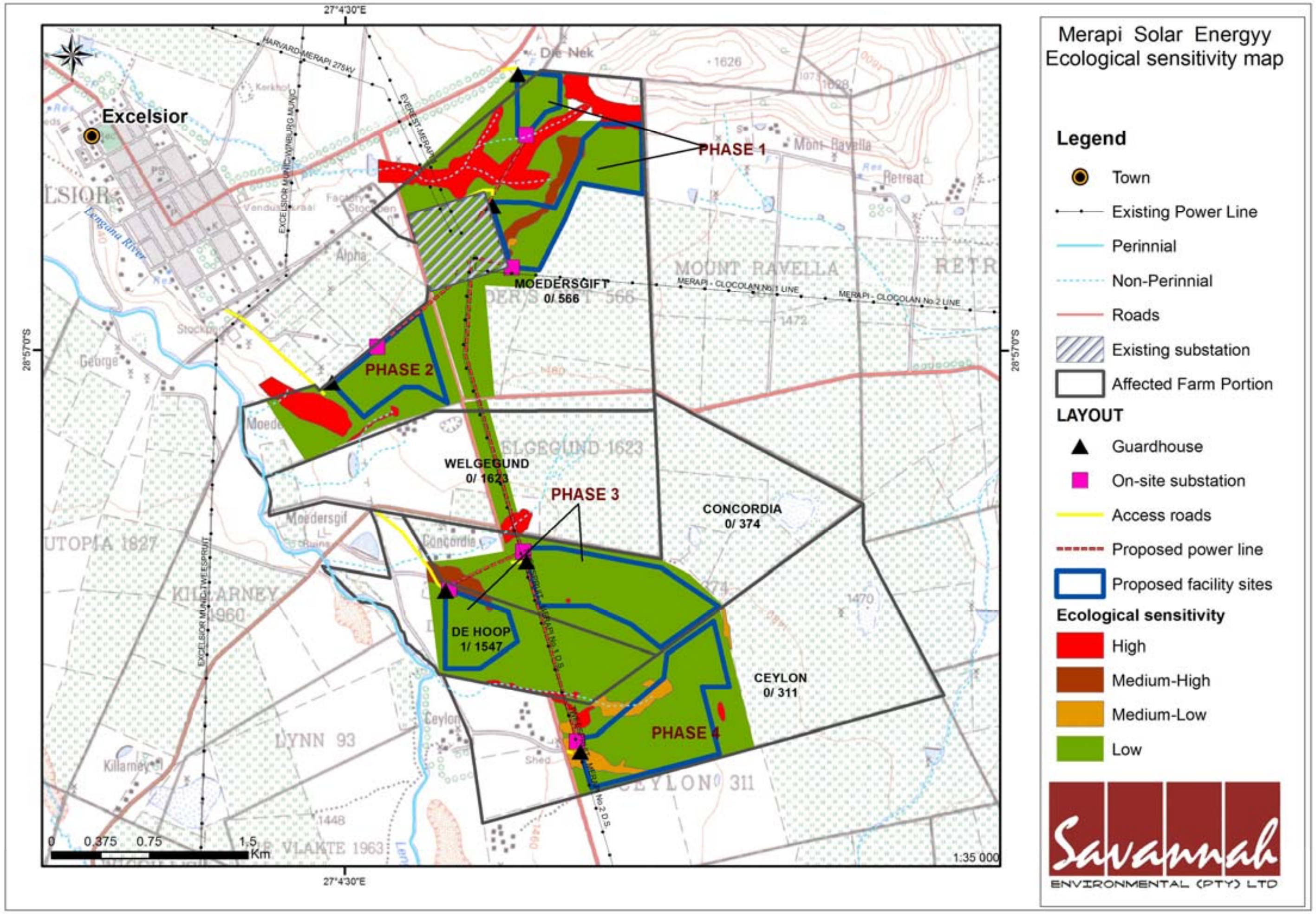


Figure 8.1: Ecology sensitivity map for the study area: Red indicates areas with *High Sensitivity* that should be avoided as far as possible; the remainder of the study area has Medium-High and Low *Sensitivity* where development can take place with certain mitigation measures

The following is assumed with regards to the ecological impacts:

» Existing access roads and tracks will be used and upgraded as far as possible, whilst new servitudes or power lines will coincide as far as possible with existing infrastructure;
» The proposed development will be as close as possible to existing electricity infrastructure, thus minimising the need for additional overhead power lines to connect to the grid;
» A thorough ecological investigation be conducted of all footprint areas to detect and relocate all plant species of conservation concern by a suitably qualified botanist prior to a geotechnical survey and construction;
» Development of the PV-footprint area will retain a minimum 50 m (preferably 100 m) buffer from all drainage lines and/or wetlands within the area assessed; and
» Prior to development the footprint area will be entirely cleared of all alien invasive plants.

The tables which follow provide an assessment of the direct, indirect and cumulative impacts on ecology expected to be associated with the construction and operation of the Merapi Solar Facility - Phase 2.

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

Upgrading of Access Road

Nature: Loss of vegetation, increase in runoff and erosion (as the road already exists, no additional impact on terrestrial fauna is expected to arise from the development)		
	Without mitigation	**With mitigation**
Extent	Local (3)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Low (4)	Small (0)
Probability	Definite (5)	Definite (5)
Significance	**Medium (55)**	**Low (25)**
Status (positive or negative)	Negative	Neutral
Reversibility	Not reversible	Partially reversible
Irreplaceable loss of resources?	Probable	Not likely
Can impacts be mitigated?	Reasonably	
Mitigation: » Make use of existing tracks as far as possible » Ensure an adequate plant search and rescue program is developed and implemented prior to commencement of activity; especially geophytes may need to be relocated » Reinforce portions of existing access routes that are prone to erosion, create structures or low banks to drain the access road rapidly during rainfall events, yet preventing erosion of the track and surrounding areas » Ensure that runoff from compacted or sealed surfaces is slowed down and dispersed		

sufficiently to prevent accelerated erosion from being initiated (storm water and erosion management plan required, together with revegetation of adjacent areas) » Prevent leakage of oil or other chemicals or any other form of pollution » Monitor the establishment of alien invasive species and remove as soon as detected, whenever possible before regenerative material can be formed » After decommissioning, if access roads or a portion thereof will not be of further use to the landowner or project, remove all foreign material and rip area to facilitate the establishment of vegetation
Cumulative impacts: » Possible erosion of areas lower than the access road, possible contamination of lower-lying wetlands due to oil or other spillage » Possible spread and establishment of alien invasive species
Residual Impacts: » Altered vegetation composition and structure » Barren areas » Potential for erosion

Creation of Access Roads where existing tracks are insufficient

Nature: Loss of vegetation, increase in runoff and erosion, displacement of fauna, possible alteration of drainage patterns		
	Without mitigation	**With mitigation**
Extent	Local (3)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Moderate (6)	Low (4)
Probability	Definite (5)	Definite (5)
Significance	**High (65)**	**Medium (45)**
Status (positive or negative)	Negative	Neutral
Reversibility	Not reversible	Partially reversible
Irreplaceable loss of resources?	Probable	
Can impacts be mitigated? Reasonably		
Mitigation: » Follow routes of existing tracks or fence lines as far as possible » Ensure adequate drainage and specific erosion control if and where access roads need to cross drainage lines » Ensure an adequate plant search and rescue program prior to commencement of activity, especially geophytes may need to be relocated » Reinforce portions of existing access routes that are prone to erosion, create structures or low banks to drain the access road rapidly during rainfall events, yet preventing erosion of the track and surrounding areas » Ensure that runoff from compacted or sealed surfaces is slowed down and dispersed sufficiently to prevent accelerated erosion from being initiated (storm water and erosion management plan required, together with revegetation of adjacent areas) » Prevent leakage of oil or other chemicals or any other form of pollution » Monitor the establishment of alien invasive species and remove as soon as detected, whenever possible before regenerative material can be formed » After decommissioning, if access road or portion thereof will not be of further use to the		

landowner, remove all foreign material and rip area to facilitate the establishment of vegetation
Cumulative impacts:
» Possible erosion of cleared areas and thus also accelerated erosion from surrounding areas » Possible excessive fragmentation and thus reduction of core habitats that may negatively influence species population viability
Residual impacts:
» Altered vegetation composition » Compacted topsoils » Possibility for erosion

Fencing area – may also serve as access road to PV panels and fire-break

Nature: Loss of vegetation, loss of micro-habitat, increase in runoff and erosion, window of opportunity for the establishment of alien invasive species, altered topsoil characteristics prone to capping, increased runoff and erosion. As fences already exist, no significant additional impact on terrestrial fauna is expected to arise from the development.		
	Without mitigation	**With mitigation**
Extent	Local (2)	Local (1)
Duration	Long-term (4)	Long term (4)
Magnitude	Moderate (6)	Small (1)
Probability	Definite (5)	Definite (5)
Significance	**Medium (60)**	**Medium (30)**
Status (positive or negative)	Negative	Neutral
Reversibility	Partially reversible	Largely reversible
Irreplaceable loss of resources?	Probable	
Can impacts be mitigated? Reasonably		
Mitigation: » Minimise area affected, especially during construction » Avoid development and disturbance on low rocky ridges or outcrops as well as plains adjacent to and drainage lines themselves » Use topsoils removed for redistribution outside the LOWEST borders of the development to stop erosion off the cleared areas, possibly to construct contour buffer strips to help limit erosion » Remove and collect all bulbous plants from cleared areas and transplant onto the newly redistributed topsoils, together with other species used for revegetation » Prevent leakage of oil or other chemicals » Monitor the establishment of alien invasive species and remove as soon as detected, whenever possible *before* regenerative material can be formed » Should the area along the fence be used for occasional access and fire breaks, regular mowing of the grass layer to reduce fire loads is recommended rather than the removal of vegetation		
Cumulative impacts: » Possible erosion of cleared areas and thus also accelerated erosion from surrounding areas » Possible excessive fragmentation and thus reduction of core habitats that may negatively influence species population viability		

Residual impacts:

- Altered vegetation composition
- Compacted topsoils
- Possibility for erosion

Construction and operation of PV panels

Nature: Loss of vegetation, loss of and alteration of microhabitats, altered vegetation cover, altered distribution of rainfall and resultant runoff patterns, increase in runoff and accelerated erosion, loss of faunal habitat and resource availability to terrestrial fauna.		
	Without mitigation	**With mitigation**
Extent	Local (5)	Local (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	Very High (10)	Moderate (6)
Probability	Definite (5)	Definite (5)
Significance	**High (95)**	**Medium (60)**
Status (positive or negative)	Negative	Negative
Reversibility	Difficult to reverse	Partially reversible
Irreplaceable loss of resources?	Highly Probable	Probable
Can impacts be mitigated?	Reasonably	

Mitigation:

- Keep areas affected to a minimum
- Utilise area as close as possible to existing infrastructure, keep buffer zone of a minimum of 50m, preferably 100 m, around drainage lines
- Keep levelling earthworks and soil disturbance to the minimum practically possible
- Develop and implement a comprehensive topsoil management, soil erosion control and rehabilitation plan once layouts have been finalised
- Remove as little indigenous vegetation as practically possible
- Revegetate areas below/between panels immediately after construction ceases
- Relocate all geophytes, or use as far as possible in rehabilitation efforts
- No development on drainage lines or other wetlands and low rocky ridges and outcrops, limit development on lower-lying plains adjacent to drainage lines
- Monitor the area below the PV panels regularly after larger rainfall events to determine where erosion may be initiated and then mitigate by modifying the soil microtopography and revegetation efforts accordingly
- Aim to maintain a reasonable cover of indigenous perennial vegetation throughout the operational phase within and on the periphery of the PV array, preferably low dense perennial grasses that can be mowed as required to reduce fuel loads
- Prevent leakage of oil or other chemicals
- Monitor the establishment of alien invasive species and remove as soon as detected, whenever possible before regenerative material can be formed

Cumulative impacts:

- possible erosion of areas lower than the panels
- possible contamination and siltation of the drainage lines and lower-lying wetlands
- possible fragmentation of plant populations
- possible alteration of occupancy by terrestrial fauna
- possible reduction of available habitat to terrestrial fauna
- possible spread and establishment of alien invasive species

Residual Impacts:
» altered topsoil characteristics
» altered vegetation composition
» altered habitat and resource availability to terrestrial fauna

Construction of power lines to substation

Nature: Loss of vegetation, increase in runoff and erosion, temporary displacement of terrestrial fauna		
	Without mitigation	**With mitigation**
Extent	Local (2)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Minor (2)	Small (0)
Probability	Definite (5)	Definite (5)
Significance	**Medium (40)**	**Low (25)**
Status (positive or negative)	Negative	Neutral
Reversibility	Partially reversible	Partially reversible
Irreplaceable loss of resources?	Probable	Not likely
Can impacts be mitigated?	Reasonably	
Mitigation: » Place pylons as far as possible on sites where the slope and erosion risk is minimal or negligible » No pylons may be placed within drainage lines or 32 m of such without the appropriate permits » Riparian areas may not be used as access points to pylon areas » Conduct a search and rescue operation for bulbous plants prior to pylon construction » Prevent spillage of construction material beyond area affected » Monitor the establishment of alien invasive species and remove as soon as detected, whenever possible before regenerative material can be formed		
Cumulative impacts: » Possible erosion of surrounding areas, no major cumulative impact on vegetation expected		
Residual Impacts: » Very localised alteration of soil surface characteristics		

Construction and operation of substation area

Nature: Loss of vegetation, loss of micro-habitats, increased runoff and erosion, possibly altered chemistry of surrounding soils, window of opportunity for the establishment of alien invasive species. After decommissioning: altered topsoil characteristics with low moisture infiltration capacity, low niche diversity, and increased runoff and slow plant establishment.		
	Without mitigation	**With mitigation**
Extent	Local (3)	Local (2)
Duration	Long-term (4)	Long-term (4)

Magnitude	Moderate (6)	Low (4)
Probability	Definite (5)	Definite (5)
Significance	**High (65)**	**Medium (50)**
Status (positive or negative)	Negative	Negative
Reversibility	Low reversibility	Partially reversible
Irreplaceable loss of resources?	Highly probable	Probable
Can impacts be mitigated?	Reasonably	

Mitigation:

- Place pylons as far as possible on sites where the slope and erosion risk is minimal or negligible
- No pylons may be placed within drainage lines or 32 m of such without the appropriate permits
- Riparian areas may not be used as access points to pylon areas
- Conduct a search and rescue operation for bulbous plants prior to pylon construction
- Prevent spillage of construction material beyond area affected
- Monitor the establishment of alien invasive species and remove as soon as detected, whenever possible before regenerative material can be formed

Cumulative impacts:

- Possible erosion of surrounding areas, no major cumulative impact on vegetation expected

Residual Impacts:

- Very localised alteration of soil surface characteristics

Construction and operation of workshop area and guard houses

Nature: Loss of vegetation, increase in runoff and erosion, pollution, loss of faunal habitat and resource availability to terrestrial fauna

	Without mitigation	**With mitigation**
Extent	Local (4)	Local (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	Moderate (6)	Low (4)
Probability	Definite (5)	Definite (5)
Significance	**High (70)**	**Medium (50)**
Status (positive or negative)	Negative	Neutral
Reversibility	Difficult to reverse	Partially reversible
Irreplaceable loss of resources?	Probable	Probable
Can impacts be mitigated?	Reasonably	

Mitigation:

- Avoid placing infrastructure on rocky ridges and outcrops, within 100 m of any drainage line or in the lowest sections of the landscape (where no drainage lines have developed up to date but where moisture does accumulate seasonally due to the topography), restrict to vegetation Association 2 as far as possible
- Limit disturbance to footprint area as far as practically possible – including disturbance to soil
- Implement a comprehensive topsoil management plan as soon as layout plans are finalised and site preparation commences

» Conduct a search and rescue operation for bulbous plants prior to construction » Prevent spillage of construction material and other pollutants beyond area affected » Implement a comprehensive waste management plan for the operation of the facility » Rehabilitate and revegetate all areas outside footprint area that have been disturbed immediately after construction » Monitor adjacent areas for accelerated erosion and mitigate as required » Monitor the establishment of alien invasive species and remove as soon as detected, whenever possible before regenerative material can be formed
Cumulative impacts: » possible erosion of adjacent or lower-lying areas » possible contamination and siltation of drainage lines and lower-lying wetlands » possible fragmentation of plant populations » possible alteration of occupancy by terrestrial fauna, reduction of available habitat to terrestrial fauna » possible spread and establishment of alien invasive species » Possible erosion of surrounding areas
Residual Impacts: » altered topsoil characteristics » altered vegetation composition » altered habitat and resource availability to terrestrial fauna

Implications for Project Implementation

» The proposed photovoltaic facility development on the site may have significant impacts on the ecology of the site and lower-lying wetlands, if mitigation measures are not strictly adhered to.

» Potentially significant negative impacts on the ecological environment would be soil degradation issues (erosion, depletion of nutrients) as a result of construction activity and the operation of the facility, possible introduction of alien invasive plants and a long-term (more than 8 months) low or absent vegetation cover after construction.

» A loss of niches and specialised habitats for flora and fauna could occur with the removal or significant degradation of large expanses of vegetation or the alteration of rocky habitats. With the ecologically justifiable placement of the different components of the proposed development, coupled with diligent implementation of mitigating measures by the developer, contractors, and operational staff, the severity of impacts can be greatly reduced.

» The impact on fauna is expected to be negligent. Currently minimal presence of wild animals could be detected, possibly due to current land use patterns. Animals that may be present are mobile and will move away during construction, possibly resettling after construction. No restricted or specific habitat of vertebrates will be affected by the proposed development; especially if the proposed development remains outside the more sensitive areas.

» The proposed Merapi Solar Facility - Phase 2 is located largely within an area of low ecological sensitivity. A small area classified as being of High sensitivity would be affected. Appropriate mitigation is required to be implemented in order to minimise impacts on this area.

» The proposed facility is considered to be acceptable from an ecological perspective provided appropriate mitigation and management measures are implemented throughout the lifecycle of the project.

8.2.2 Impacts on Soils and Agricultural Potential

The proposed activity could result 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).

The dominant soils in the study area according to the Taxonomical Soil Classification System of South Africa are Mispah and Sterkspruit soils. The effective depth of the Mispah and Sterkspruit soils is on average 300mm restricted to the Orthic A – Horizon. The agricultural potential of the Mispah and Sterkspruit, soils is considered medium to low under dryland (650mm/y rainfall) and irrigation conditions (>10-15mm/week 33-1,500kPa plant available water). The current land use as shown in Figure 8.2 includes 235ha natural veld, 16ha ploughed land and 17ha plantation. The land capability includes 16ha arable (5% of the total development area), 235ha grazing and 17ha wilderness. No evidence of soil erosion was observed on any of the soils during the investigation. It can be seen from the figure below that the proposed layout of the Merapi Solar Energy Facility avoids areas which are currently cultivated.

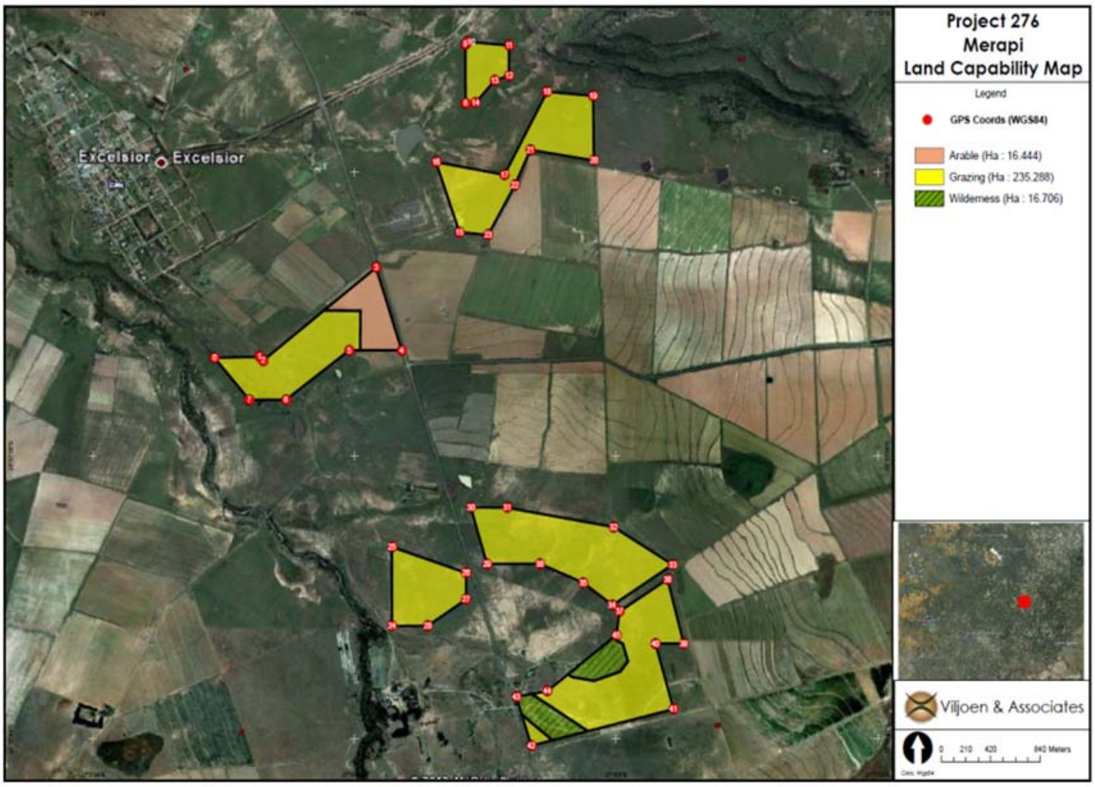


Figure 8.2: Land capability in relation to the proposed Merapi Solar energy facility Phase 1 – 4.

The tables which follow provide an assessment of the direct, indirect and cumulative impacts on soils and agricultural potential expected to be associated with the construction and operation of the Merapi Solar Facility - Phase 2.

<u>Impact tables summarising the significance of impacts on soils and agricultural potential (with and without mitigation)</u>

Nature: Loss of topsoil due to stripping, handling and placement of soil associated with pre construction land clearing and rehabilitation.		
	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	Irreversible	Irreversible
Irreplaceable loss of resources?	Irreplaceable	Irreplaceable
Can impacts be mitigated?	Yes.	
Mitigation: » Strip all usable soil, irrespective of soil depth and store for use during rehabilitation?		
Cumulative impacts: » Cumulative impact of loss of topsoil due to stripping and placement associated with pre		

construction land clearing and rehabilitation is considered low due to the undeveloped nature of the area but further development will increase impact.
Residual impacts:
» Minor localised loss of topsoil

Nature: Change of soil's physical, chemical and biological properties due to loss of topsoil due to erosion, stockpiling, mixing of deep and surface soils during handling, stockpiling and subsequent placement.		
	Without mitigation	***With mitigation***
Extent	Local (1)	Local (1)
Duration	Long Term (4)	Short Term (1)
Magnitude	Moderate (8)	Low (4)
Probability	Very Probable (5)	Very Probable (4)
Significance	**Moderate (65)**	**Low (24)**
Status	Negative	Negative
Reversibility	Irreversible	Irreversible
Irreplaceable loss of resources?	Irreplaceable	Irreplaceable
Can impacts be mitigated?	Yes.	
Mitigation:		
» Implement live placement of soil where possible, improve organic status of soils, maintain fertility levels and curb topsoil loss.		
Cumulative impacts:		
» Cumulative impact of soil's physical, chemical and biological properties due to loss of topsoil, due to erosion, stockpiling, mixing of deep surface soils during handling, stockpiling and subsequent placement is considered low due to the undeveloped nature of the area but further development will increase impact.		
Residual impacts:		
» Minor localised degradation of topsoil's chemical, physical and biological properties		

Nature: Change of natural surface topography due to reprofiling of surface after stripping.		
	Without mitigation	***With mitigation***
Extent	Local (1)	Local (1)
Duration	Long Term (4)	Short Term (1)
Magnitude	Moderate (8)	Low (4)
Probability	Very Probable (5)	Very Probable (4)
Significance	**Moderate (65)**	**Low (24)**
Status	Negative	Negative
Reversibility	Irreversible	Irreversible
Irreplaceable loss of resources?	Irreplaceable	Irreplaceable
Can impacts be mitigated?	Yes	
Mitigation:		
» Implement mapping stormwater control system to ensure surface water control measures are implemented to ensure free draining system with minimal soil erosion.		
Cumulative impacts:		

» Cumulative impact of the change of surface topography due to reprofiling of surface after stripping is considered low due to the undeveloped nature of the area but further development will increase impact.
Residual impacts: » Minor localised degradation of topsoil's chemical, physical and biological properties

Nature: Loss of land with agricultural potential and land capability.		
	Without mitigation	***With mitigation***
Extent	Local (1)	Local (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	Low (4)	Low (4)
Probability	High Probable (4)	High Probable (4)
Significance	**Moderate (40)**	**Low (16)**
Status	Negative	Negative
Reversibility	Medium	Medium
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Direct impacts cannot be mitigated but direct impacts can be minimised and avoided through adequate planning of layout.	
Mitigation: » Loss of agricultural land is a long term loss and no mitigation measures exist. Mitigation is restricted to limitation of extent of impact to the immediate area of impact and minimisation of off-site impacts.		
Cumulative impacts: » The cumulative impact of a loss in the agricultural potential is considered low as areas of high potential and cultivated fields have been avoided by the placement of infrastructure.		
Residual impacts: » Minor loss of grazing land while facility is in use.		

Implications for Project Implementation

- The proposed development of a photovoltaic facility on the site will have minimal significant impacts on the agricultural potential as 95% of the development footprint is proposed on low agricultural potential soils.
- The proposed Merapi Solar Facility - Phase 2 avoids currently cultivated areas.
- The results of the Soil Assessment for the proposed Merapi Solar Park find the proposed activity will have a medium to low impact on the immediate and surrounding soil systems. Implementation and management of proposed mitigation measures will minimise loss of topsoil, prevent contamination of topsoil and stockpiled soil and prevent overall soil erosion.
- It is recommended that the proposed project be approved subject to the mitigation measures stipulated in the Impact Assessment and Environmental Management Programme

8.2.3 Assessment of Potential Impacts on Heritage and Paleontological sites

Five heritage sites were identified near the site (i.e. more than 200m away) and are referred to as: Merap-1, 2, 3, 4 and Merap-5. Of these 5 sites 2 were deemed important as shown on Figure 8.3. These sites are located in close proximity to the proposed Merapi Solar facility – Phase 2. No impacts on heritage sites are however expected as these sites fall outside of the development footprint. No mitigation measures are therefore required to be implemented.

In terms of the Paleontological resources in the study area, the site of the proposed Merapi Solar Park is underlain sediments of the Adelaide and Tarkastad subgroups, Beaufort Group (Karoo Supergroup). The Beaufort Group is composed of sandstone and mudrock and ranges in thickness from 5000m to 150m or less (Groenewald 1989). The Beaufort Group (Karoo Supergroup) of formations are rich in Triassic and Permian fossils (Johnson et al., 2006). Vertebrate fossils including retiles, mammal-like reptiles (Therapsids) (Figure 3 in **Appendix G**), amphibians and fish remains occur in the Beaufort Group (Rubidge et al., 1995). Invertebrate fossils, invertebrate burrows and trails, well-preserved leaf impressions, silicified wood and stem impressions have also been recorded from a number of localities in the Beaufort Group (Anderson et al., 1998; McLachlan & Anderson 1973; 1977; Riek, 1973, 1976, Rubidge et al., 1995).

The tables which follow provide an assessment of the direct, indirect and cumulative impacts on heritage and palaeontological sites expected to be associated with the construction and operation of the Merapi Solar Facility - Phase 2.

Figure 8.3: *Heritage sites recorded in close proximity to the study area*

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

Nature: Discovery/destruction of unknown fossil deposits. 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 measures: » Excavation activities should be monitored by a qualified heritage practitioner		
Cumulative impact: » None		
Residual impact: » Loss of heritage related information		

Implications for Project Implementation

» From an archaeological perspective, the only sign of sites of heritage potential were outside the study area.

» The proposed Merapi Solar Facility – Phase 2 will not impact on any heritage sites recorded in the study area.

» No mitigation measures are proposed for these sites since they fall outside the development footprint. However, it is advised that the developer avoid these sites as far as possible.

» The proposed project construction phase should pay special attention to previously un-observed resources or "chance-finds" – these are resources that may be unearthed by the construction excavation activities.

» 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.

8.2.4 Assessment of Potential Visual Impacts

Visual Impact of the PV Facility and power line – Operational Phase

The viewshed[7] analysis for the proposed facility and associated infrastructure was undertaken in accordance with the *Guideline Document for involving Visual Specialists in EIA Processes*. This analysis considers the broader site for development. 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 project site.
» It is calculated at 3.4m above the natural ground level to reflect the highest point of the PV panels.
» 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.
» The viewshed generated from each of the selected observation points referred to in Annexure 2 of the visual impact assessment (refer to Appendix J) is calculated at 1.7m above the natural ground level to reflect the average height of person either walking or sitting in a vehicle.

As illustrated by the generated viewsheds (refer to **Figure 8.4**), the primary *zone of visual influence*[8] is primarily located in a northern direction up to ±10km from the project site. A further zone of visual influence is located intermittently to the east up to 7km.

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 southeast.

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

7 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.

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

of an activity diminishing as the distance between the viewer and the activity increases. Viewsheds are categorised into three broad categories of significance, namely:

d) 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.
e) 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.
f) Background: the background stretches from approximately 3km onwards. Background views are only distinguishable by colour and lines, while structures, textures, styles and forms are often not visible (SRK Consulting, 2007).

The distance radii indicating the various viewing distances from the combined phases are illustrated by Figure 8.4. Also illustrated by the figure is the town of Excelsior in the *foreground* to *middle ground* of the project site. Excelsior represents the area where most of the visual receptors would be located. Also located in the *fore-* and *middle ground* are the two main view corridors, namely the R703 and R709.

The tables which follow provide an assessment of the direct, indirect and cumulative visual impacts expected to be associated with the construction and operation of the Merapi Solar Facility - Phase 2.

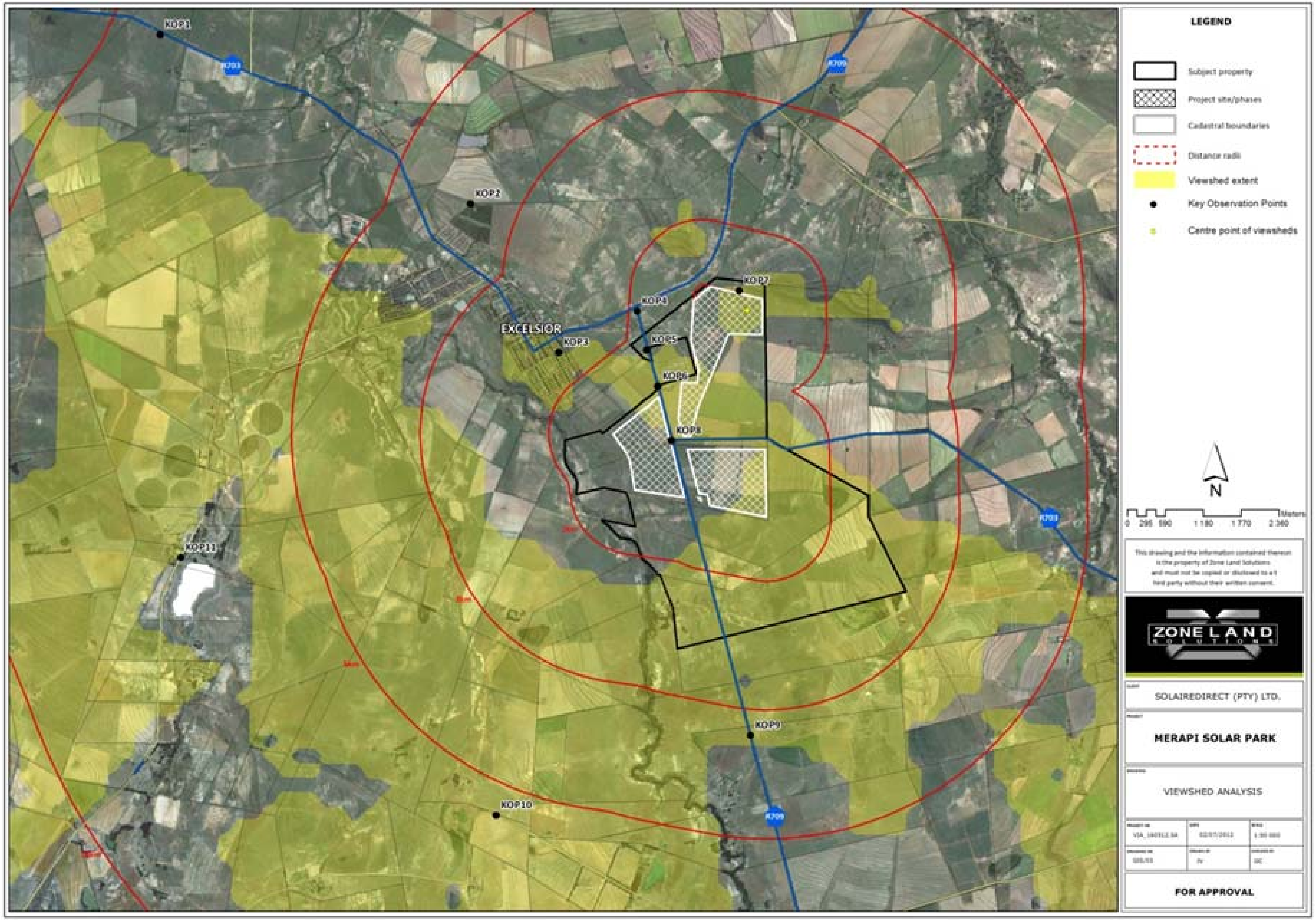


Figure 8.4: Viewshed generated from the highest point of the project site.

Impact tables summarising the significance of visual impacts of the PV facility, power line and proposed substation area (with and without mitigation)

Nature: Potential visual impact on the sensitive receptors in the *foreground* and *middle ground*.		
	Without Mitigation	**With Mitigation**
Extent	Regional (3)	Local (2)
Duration	Long term (4)	Long term (4)
Magnitude	Minor (4)	Low (2)
Probability	Probable (3)	Improbable (2)
Significance	**Medium (33)**	**Low (16)**
Status	Neutral	Neutral
Reversibility	Recoverable (3)	Recoverable (3)
Irreplaceable Loss of Resource?	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 outer boundaries of the individual phases. Only indigenous plant species to be introduced and planted in such a manner and location which would not cast shadows on the PV 'strings'. » 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. » Utilise existing roads and tracks to the extent possible. Where new roads are required, they should be two-track gravel roads, maintained to prevent dust plumes and erosion.		
Cumulative impacts: The existing Merapi Substation and its associated industrial-type infrastructure such as electrical transmission lines and pylons already exist in the immediate surroundings. Therefore, the cumulative impact will be increased with the establishment of the PV plant.		
Residual impacts: The proposed infrastructure is of such a nature that the status quo could be regained after decommissioning of the plant. Providing that the site is rehabilitated to its current state, the visual impact will also be removed.		

Nature: Potential visual impact on the intrinsic value and sense of place of the Excelsior region.		
	Without Mitigation	**With Mitigation**
Extent	Local (2)	Local (2)
Duration	Long term (4)	Long term (4)
Magnitude	Medium (6)	Medium (6)
Probability	Highly probable (4)	Probable (3)
Significance	**Medium (48)**	**Medium (36)**
Status	Negative	Negative

Reversibility	Recoverable (3)	Recoverable (3)
Irreplaceable Loss of Resource?	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 outer boundaries of the individual project phases. Only indigenous plant species to be introduced and planted in such a manner and location which would not cast shadows on the PV 'strings'. » 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 raising the PV platforms so that cattle can roam underneath the PV 'string'. » Utilise existing roads and tracks to the extent possible. Where new roads are required, they should be two-track gravel roads, maintained to prevent dust plumes and erosion.		
Cumulative impacts: It is near impossible to distinguish built forms and structures at distances greater than 5km. However, the introduction of a PV plant with four phases of approximately 250 ha in total might have a cumulative effect on the observer.		
Residual impacts: The proposed infrastructure is of such a nature that the status quo could be regained after decommissioning of the plant. Providing that the site is rehabilitated to its current state, the visual impact will also be removed.		

Nature: Potential visual impact of artificial lighting as a result of the activity.		
	Without Mitigation	**With Mitigation**
Extent	Local (2)	Local (2)
Duration	Long term (4)	Long term (4)
Magnitude	Minor (4)	Low (2)
Probability	Probable (3)	Probable (3)
Significance	**Medium (30)**	**Low (24)**
Status	Negative	Negative
Reversibility	Recoverable (3)	Recoverable (3)
Irreplaceable Loss of Resource?	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. » Only minimum wattage light fixtures must be used.		
Cumulative impacts: The area within which the proposed activity is to be undertaken is relatively low lit. The occurrence of ancillary structures of the PV Plant will contribute to the cumulative lighting effect of the area but it is expected to be negligible in a local context.		

Residual impacts: The proposed infrastructure is of such a nature that the status quo could be regained after decommissioning of the plant. Providing that the site is rehabilitated to its current state, the visual impact will also be removed.

Nature: Potential visual impact of reflection of the PV Panels on sensitive receptors.		
	Without Mitigation	**With Mitigation**
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 Resource?	No	No
Can Impacts Be Mitigated?	Yes	
Mitigation: » Consider installing anti-reflective coating or glass to reduce the sunlight that is reflected and increase the amount of sunlight that is absorbed. » Select the shortest possible route for power lines between individual phases and substation to reduce its visual appearance. » Consider laying electrical cables underground en-route to the substation.		
Cumulative impacts: The introduction of the PV plant, coupled with the power line, proposed and existing substations, contribute to an increased cumulative visual impact.		
Residual impacts: The proposed infrastructure is of such a nature that the status quo could be regained after decommissioning of the plant. Providing that the site is rehabilitated to its current state, the visual impact will also be removed.		

Implications for Project Implementation

» The results of the Visual Impact Assessment for the proposed Merapi Solar Facility – Phase 2 found that the proposed activity will have a medium impact from Key Observer Points identified in the *foreground* and *middle ground*(<3km).
» Cumulative impacts are associated with the other phases of the Merapi Solar Park as well as the existing Merapi Substation and overhead power lines.
» It is herewith recommended that the proposed activity be approved subject to the mitigation measures described in Environmental Management Programme.
» It is furthermore recommended that the proposed project phases be relocated to the south-eastern portions of the subject property (eastern portions of Farms Concordia and Ceylon). The northern phases of the project on the Farm Moedersgift No. 566 (i.e. Phases 1 and 2) present the areas most visually prominent. A relocation of this particular phase to an area further away from

the receptors in Excelsior would benefit the project from a visual perspective. In addition, it is proposed that the project phases that front onto movement corridors be set back at least 200m from the latter roads in order to establish a proper buffer between the observer and the observed view.

8.2.5 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 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.

The tables which follow provide an assessment of the direct, indirect and cumulative social impacts expected to be associated with the construction and operation of the Merapi Solar Facility - Phase 2.

Impact tables summarising the significance of social impacts associated with the construction phase of the project (with and without mitigation)

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 of each phase of the 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 PVSEF and the associated components, including, access roads, services and power line.

The proposed 130 MW Merapi Solar Park will be developed in 4 phases. The construction phase will therefore extend over a period of ~ 8 years. In terms of employment it is assumed that 70% of the original 291 construction workers employed to construct the 20MW phase will be employed for the remaining 3 phases. The construction of the remaining 3 phases will therefore create an additional 90 employment opportunities (30% of 291) over and above the initial 291 associated with the construction of the first phase. The total number of employment opportunities created by the construction of all 4 phases will therefore be in the region of 381. Of this total ~ 60% (229) will be available to low-skilled workers (construction labourers, security staff etc.), 15% (57) to semi-skilled workers (drivers, equipment operators etc.) and 25% (95) to skilled personnel (engineers, land surveyors, project managers etc.).

Given the location of the site and its proximity to Excelsior, Winburg, Ladybrand and Bloemfontein, the majority of low and semi-skilled employment opportunities are likely to benefit members from the local community. The majority of the beneficiaries are also likely to be historically disadvantaged (HD) members of the community. The extended duration of the construction phase (8 years) also creates an ideal opportunity for contractor/s to implement an on-site training and skills development programme. This will further enhance to the potential employment opportunities for members from the local community. However, in the absence of specific commitments from the developer to employ local contractors the potential for meaningful skills development and training for members from the local communities are likely to be limited.

	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	Medium Term (3)	Medium Term (3)
Magnitude	Medium (6)	Medium (6)
Probability	Highly probable (4)	Highly probable (4)
Significance	**Medium (44)**	**Medium (48)**
Status (positive or negative)	Positive	Positive
Reversibility	N/A	N/A
Irreplaceable loss of resources?	N/A	N/A
Can impacts be enhanced?	Yes	

***Mitigation*:**

Employment

- Where reasonable and practical, SolaireDirect 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 SolaireDirect should meet with representatives from the MM 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 SolaireDirect 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

- SolaireDirect 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, SolaireDirect 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)

As indicated above, given the proximity of the site to Excelsior, Winburg, Ladybrand and Bloemfontein, including Botshabelo and Thaba Nchu, the majority of the 230 low and semi-skilled employment opportunities associated with the construction phase are likely to be taken up by members from the local community. If these workers are accommodated in their respective home towns then the potential risk posed to local communities will be low. 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. While the significance of the risk to the community as a whole will be low, the significance to individual members of the community who are impacted by the behavior of construction workers would be medium to high.

	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) **Moderate-High** for specific individuals who may be affected by STDs etc. (57)	**Low** for the community as a whole (24) **Moderate-High** for specific individuals who may be affected by STDs etc. (51)
Status (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, SolaireDirect 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;
- SolaireDirect should consider the need to establish 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;
- SolaireDirect 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;
- SolaireDirect and the contractor should implement an HIV/AIDS awareness programme for all construction workers at the outset of the construction phase;
- The movement of construction workers on and off the site should be closely managed and monitored by the contractors. In this regard the contractors should be responsible for making the necessary arrangements for transporting workers to and from site on a daily basis;
- The contractor should make the necessary arrangements for allowing workers from outside the area to return home over weekends and or on a regular basis during the 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:

- 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 impacts on the affected individuals and/or their families and the community.

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. Despite the proximity of the farms to the R 709 and R 703, the local farmers interviewed indicated that stock theft was not serious problem in the area. In addition, stock farming was not carried out on a large scale in the area. Sunflowers and maize (corn) are the main crops grown in the area.		
	Without enhancement	**With enhancement**
Extent	Local (3)	Local (2)
Duration	Medium Term (3)	Medium Term (3)
Magnitude	Moderate (6) (Due to reliance on agriculture and livestock for maintaining livelihoods)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	**Medium (36)**	**Low (27)**
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: » SolaireDirect 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.; » SolaireDirect 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 SolaireDirect and the contractors before the contractors move onto site; » SolaireDirect 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 SolaireDirect, 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 SolaireDirect 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 SolaireDirect 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 and 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. The local farmers in the area interviewed did however indicate that veld fires were not a major concern. In addition, livestock farming is not the major agricultural activity in the area.

	Without enhancement	**With enhancement**
Extent	Local (3) (Rated as 3 due to potential severity of impact on local farmers)	Local (2) (Rated as 2 due to potential severity of impact on local farmers)
Duration	Medium Term (3)	Medium Term (3)
Magnitude	Moderate (6) (Due to reliance on agriculture and livestock for maintaining livelihoods)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	**Medium (36)**	**Low (27)**
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:

SolaireDirect 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:

» None, provided losses are compensated for.

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. The main access to the site would be via either the R709 and or 703. These two roads link up with the N8, to the south, and N1, to the north-west, respectively. Both the N1 and N8 are important communication routes, specifically the N1. The movement of construction related vehicles along either of these two routes has the potential to cause delays for other road users. However, these impacts will be spread out over the eight year timeframe of the construction phase, and can therefore, be effectively managed and mitigated. The social impacts associated with the movement of construction related traffic are therefore likely to be low.

	Without mitigation	**With mitigation**
Extent	Local (2)	Local (1)
Duration	Medium Term (3)	Medium Term (3)
Magnitude	Low (4)	Minor (2)
Probability	Probable (3)	Probable (3)
Significance	**Low (27)**	**Low (18)**
Status (positive or negative)	Negative	Negative
Reversibility	Yes	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	Yes	

Mitigation:

SolaireDirect 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 heavy vehicles and dust can be effectively mitigated. The aspects that should be covered include:

- » The timing of the transport of components to the site should be timed to avoid weekends and holiday times so as to minimise the potential impact on travellers using the N1, N8, R 709 and R 703;
- » 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 mitigation measures are implemented.

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 PVSEF and power lines will damage farmlands and result in a loss of farmlands for future farming activities.

The significance of these impacts can 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. In addition, it is standard practice for the affected landowner/s is to enter into a lease agreement that includes monthly rental. The loss of productive farmland would therefore be offset by such an agreement. It may also be possible for livestock and game to graze between the PV panels. The final disturbance footprint can also be reduced by careful site design and placement of components. In addition, the footprint associated with a 10MW solar facility is likely to be relatively small. 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. Recommended mitigation measures are outlined below.

	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, If compensation is not paid or area is not rehabilitated (60)**	**Low (20)**
Status	Negative	Negative
Reversibility	No, in case of footprint associated with solar thermal plant	
Irreplaceable loss of resources?	Yes, loss of farmland. However, disturbed areas can be rehabilitated	
Can impacts be mitigated?	Yes, loss of farmland. However, disturbed areas can be rehabilitated	

***Mitigation*:**

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

- » 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 provided disturbed areas are rehabilitated.

<u>Impact tables summarising the significance of social impacts associated with the operation phase of the project (with and without mitigation)</u>

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.

Nature of impact: Creation of employment and business opportunities associated with the operational phase Based on the information provided by the proponent, the establishment of the proposed Merapi Solar Facility – Phase 2 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. For the purposes of the assessment it is assumed that there will be some overlap in terms of roles and responsibilities between phases should all 4 phases be implemented. For the purposes of the assessment it is assumed that there will be a 20% overlap for each additional phase. The total number of employment opportunities associated with the additional 3 phases will therefore be 144 (48 x 3). Due the proximity of the site to Excelsior, Winburg, Ladybrand and Bloemfontein, including Botshabelo and Thaba Nchu, the majority of the work opportunities associated with the operational phase is 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.		
	Without mitigation	**With mitigation**
Extent	Local and Regional (2)	Local and Regional (3)
Duration	Long term (4)	Long term (4)
Magnitude	Low (4)	Moderate (6)
Probability	**Probable (3)**	**Highly Probable (4)**
Significance	Medium (30)	Medium (52)
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: » SolaireDirect 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:		

» 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: Establishment of a Community Trust funded by revenue generated from the sale of energy.

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 revenue from the proposed solar energy facility plant can be used to support a number of social and economic initiatives in the area, including:

- Creation of jobs;
- Education;
- Support for and provision of basic services;
- School feeding schemes;
- Training and skills development;
- Support for SMMEs.

In addition, the establishment of a solar energy facility plant is not likely to have a significant impact on the current agricultural land uses that underpin the local economic activities in the area. The loss of this relatively small area will not impact on the current and future farming activities.

	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 park.

Cumulative impacts:

- Promotion of social and economic development and improvement in the overall well-being of the community. Additional benefits will accrue if all phases of the project are implemented.

Residual impacts:
» Social and economic development and improvement in the overall well-being of the community.

<table>
<tr><td colspan="3">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 4 phases of the Merapi Solar Park relative to South Africa’s total energy requirements will be limited. In addition, the current application is not unique. In this regard, a significant number of solar energy projects are currently proposed in other parts of South Africa. The potential contribution of the proposed Merapi Solar Park should therefore be regarded as valuable, but should not be overestimated.</td></tr>
<tr><td></td><td>Without Mitigation</td><td>With Mitigation
(The provision of renewable energy infrastructure is in itself a mitigation measure)</td></tr>
<tr><td>Extent</td><td>Local, Regional and National (4)</td><td>Local, Regional and National (4)</td></tr>
<tr><td>Duration</td><td>Long term (4)</td><td>Long term (4)</td></tr>
<tr><td>Magnitude</td><td>Minor (2)</td><td>Low (4)</td></tr>
<tr><td>Probability</td><td>Highly Probable (4)</td><td>Highly Probable (4)</td></tr>
<tr><td>Significance</td><td>Medium (40)</td><td>Medium (48)</td></tr>
<tr><td>Status (positive or negative)</td><td>Positive</td><td>Positive</td></tr>
<tr><td>Reversibility</td><td colspan="2">Yes</td></tr>
<tr><td>Irreplaceable loss of resources?</td><td colspan="2">Yes, impact of climate change on ecosystems</td></tr>
<tr><td>Can impacts be mitigated?</td><td colspan="2">Yes</td></tr>
<tr><td colspan="3">Mitigation:
» 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.</td></tr>
<tr><td colspan="3">Cumulative impacts:
» Contribution to the government targets for electricity generation from renewable energy.
» Reduced carbon emissions via the use of renewable energy and associated benefits in terms of global warming and climate change.</td></tr>
<tr><td colspan="3">Residual impacts:
» Reduced carbon emissions via the use of renewable energy and associated benefits in terms of global warming and climate change.</td></tr>
</table>

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. None of the local farmers, including adjacent farmers, interviewed raised concerns regarding the potential visual impact of the proposed project. Mr A Visagie, the principal of CVO Excelsior School, also indicated that the project was unlikely to have any impact on the school due to the distance of the school from the site. In addition, the Merapi substation is located on the north western boundary of the site, and two power lines associated with the substation traverse the site. The visual integrity of the site and the surrounding area has therefore been impacted by the existing energy related infrastructure on the site.		
	Without mitigation	**With mitigation**
Extent	Local (2)	Local (2)
Duration	Long term (4)	Long term (4)
Magnitude	Medium (4)	Medium (4)
Probability	Probable (3)	Probable (3)
Significance	**Medium (30)**	**Medium (30)**
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 as the impact will be removed after decommissioning.		

Nature of impact: Potential impact of the solar facility on local tourism The FSPGDP identifies tourism as an important economic sector. However, based on the findings of the SIA and 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 project and the areas altered sense of place. 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:

» SolaireDirect should liaise with representatives from the MLM and local tourism representatives to raise awareness of the proposed facility.
» SolaireDirect 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 impacts on tourism in Mantsopa Local Municipality area.

Residual impacts:

» None as the facility will be removed after decommissioning.

Nature of impact: Potential visual impact and impact on sense of place associated with power line

The social impacts associated with multiple 22kV 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.

	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 as the impact will be removed after decommissioning	

Implications for Project Implementation

» The findings of the SIA indicate that the development of the proposed Merapi Solar facility - Phase 2 will create employment and business opportunities for locals during both the construction and operational phase of the project. The establishment of a Community Trust funded by revenue generated from the sale of energy from the proposed facility also creates an opportunity to support local economic development in the area. This represents a social benefit for an area where there are limited opportunities.

» The proposed development also represents an investment in clean, renewable energy infrastructure, which, given the challenges created by climate change, represents a positive social benefit for society as a whole.

» The establishment of Phase 2 (20MW) of the proposed Merapi solar park is therefore supported by the findings of the SIA.

8.3. 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: Upgrading of Access Road		
Loss of vegetation, increase in runoff and erosion (as the road already exists, no additional impact on terrestrial fauna is expected to arise from the development)	Medium (Negative)	Low (Neutral)
Creation of Access Roads where existing tracks are insufficient		
Loss of vegetation, increase in runoff and erosion, displacement of fauna, possible alteration of drainage patterns	High (Negative)	Medium (Neutral)

Nature	Positive (+) ,Negative (-)or neutral Impact	Positive (+) ,Negative (-)or neutral Impact
	Without mitigation	With mitigation
Impacts on Ecology: Fencing area		
Loss of vegetation, loss of micro-habitat, increase in runoff and erosion, window of opportunity for the establishment of alien invasive species, altered topsoil characteristics prone to capping, increased runoff and erosion	Medium (Negative)	Medium (Neutral)
Impacts on Ecology: Construction and operation of PV panels		
Loss of vegetation, loss of and alteration of microhabitats, altered vegetation cover, altered distribution of rainfall and resultant runoff patterns, increase in runoff and accelerated erosion, loss of faunal habitat and resource availability to terrestrial fauna	High (Negative)	Medium (Negative)
Impacts on Ecology: Construction of power lines to substation		
Loss of vegetation, increase in runoff and erosion, temporary displacement of terrestrial fauna. of soils, creation of runoff zone, possible contamination	Medium (Negative)	Low (Neutral)
Construction and operation of substation area		
Loss of vegetation, loss of micro-habitats, increased runoff and erosion, possibly altered chemistry of surrounding soils, window of opportunity for the establishment of alien invasive species	High (Negative)	Medium (Negative)
Impacts on Ecology: Construction and operation of workshop area and guard houses		
Loss of vegetation, increase in runoff and erosion, pollution, loss of faunal habitat and resource availability to terrestrial fauna	High (Negative)	Medium (Neutral)
Impacts on Soils and Agricultural Potential		
Loss of topsoil due to stripping, handling and placement of soil associated with pre construction land clearing and rehabilitation.	Moderate (Negative)	Low (Negative)
Change of soil's physical, chemical	Moderate (Negative)	Low (Negative)

Nature	Positive (+) ,Negative (-)or neutral Impact	Positive (+) ,Negative (-)or neutral Impact
	Without mitigation	With mitigation
and biological properties due to loss of topsoil due to erosion, stockpiling, mixing of deep and surface soils during handling, stockpiling and subsequent placement.		
Change of natural surface topography due to reprofiling of surface after stripping.	Moderate (Negative)	Low (Negative)
Loss of land with high agricultural potential and land capability.	Moderate (Negative)	Low (Negative)
Potential Impacts on Heritage and Paleontological sites		
The disturbance/destruction of the historic farmstead (ruins) may occur (e.g. secondary impact) as a result of construction activities and development of associated infrastructure.	Low (Negative)	Low (Negative)
The disturbance/destruction of the historic farmhouse (ruins) and 'disturbed area' may occur (e.g. secondary impact) as a result of construction activities and development of associated infrastructure.	Low (Negative)	Low (Negative)
Discovery/destruction of unknown fossil deposits. Paleontological sites could be affected if bedrock was to be disturbed during the excavation activities associated with the construction	Low (Negative)	Low (Positive)
Potential Visual Impacts		
Potential visual impact of reflection of the PV Panels on the sensitive receptors.	Medium (Neutral)	Low (Neutral)
Potential visual impact on the intrinsic value and sense of place of the Excelsior region.	Medium (Negative)	Medium (Negative)
Potential visual impact of artificial lighting as a result of the activity.	Medium (Negative)	Low (Negative)
Potential visual impact of reflection of the PV Panels on the sensitive receptors	Low (Neutral)	Low (Neutral)

Nature	***Positive (+) ,Negative (-)or neutral Impact***	***Positive (+) ,Negative (-)or neutral Impact***
	Without mitigation	***With mitigation***
Potential Social Impacts During Construction		
Creation of employment and business opportunities	Medium (Positive)	Medium (Positive)
Potential impacts on family structures and social networks associated with the presence of construction workers	Low for the community as a whole Moderate-High for specific individuals who may be affected by STDs etc.	Low for the community as a whole Moderate-High for specific individuals who may be affected by STDs etc.
Increased risk of stock theft, poaching and damage to farm infrastructure	Medium (Negative)	Low (Negative)
Potential increased incidence of veld fires	Medium (Positive)	Medium (Positive)
Potential noise, dust and safety impacts associated with movement of construction related traffic to and from the site	Low (Negative)	Low (Negative)
Loss of farmlands for future farming activities	High (Negative)	Low (Negative)
Potential Social Impacts During Operation		
Creation of employment and business opportunities associated with the operational phase	Low (Positive)	Medium (Positive)
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 (Positive)	High (Positive)
Promotion of clean, renewable energy	Medium (Positive)	Medium (Positive)
Visual impact and impact on sense of place	Medium (Negative)	Medium (Negative)
Potential impact of the solar thermal plant on local tourism	Low (Negative)	Low (Negative)
Potential visual impact and impact on sense of place associated with power lines	Low (Negative)	Low (Negative)

As can be seen from this table, there are no impacts of high significance expected to be associated with the construction and operation of the proposed Merapi Solar

Facility – Phase 2, provided that the recommended mitigation measures are implemented. All identified impacts can therefore be mitigated to acceptable levels.

8.4. Assessment of Potential Cumulative Impacts

A cumulative impact, in relation to an activity, refers to the impact of an activity that in itself may not be significant, but may become significant when added to the existing and potential impacts eventuating from similar or diverse undertaking in the area [1].

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 Free State Province is earmarked as a potential solar energy hub for South Africa, considering the vast amounts land available. There are four proposed solar energy facilities proposed in the Motheo District Municipality, the majority of which are located near to the capital city (Bloemfontein). The Merapi Solar Facility – Phase 2 is located ~ 80 km north-east from the proposed Sannaspos Solar Park and ~ 60 km east of the proposed Glen Thorne PV facility. There is therefore sufficient distance between these proposed facilities to result in no cumulative impacts. However, the proximity of the proposed Merapi Solar Facility Phases 1, 3 and 4 to the Merapi Solar Facility Phase 2 result in the potential for localised cumulative impacts (refer to Figure 8.5). Potential cumulative impacts relate to the visual impact, impact on flora and fauna, impact on agricultural potential and impact on the social environment. No impacts on heritage sites are expected as no sites were recorded within the development footprint of any of the proposed phases.

8.4.1. Visual Impacts

The Merapi Solar Facility site is located within a remote area within the Mantsopa Local Municipality. Considering the low population density in the District Municipality the visual impacts of multiple solar energy facilities will be low. In addition, the Merapi substation is located on the north western boundary of the site, and two power lines associated with the substation traverse the site. The visual integrity of the site and the surrounding area has therefore been impacted by the existing energy related infrastructure on the site.

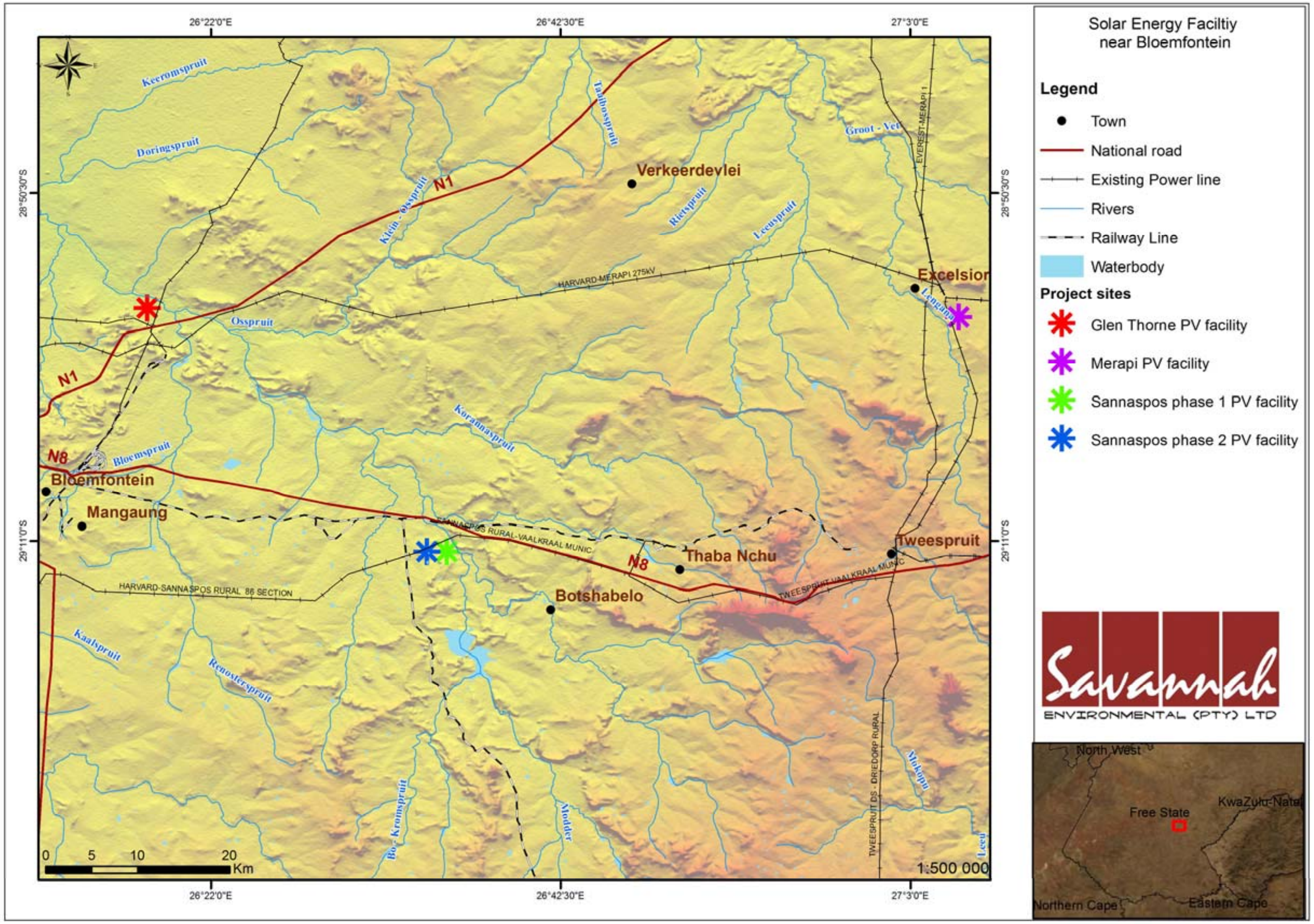


Figure 8.5: The location of the proposed Merapi Solar Energy Facility relative to the proposed Glen Thorne and Sannaspos solar energy facilities.

The table below assesses the potential visual impact for the establishment of a number of solar energy facilities in the Free State Province.

Nature: Visual impacts associated with the establishment of more than one solar 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	Negative	Negative
Reversibility	Yes. Solar energy plant components and other infrastructure can be removed.	
Irreplaceable loss of resources?	No	
Can impact be mitigated?	Yes	
Mitigation: Implement mitigation measures as proposed for each facility to minimise impacts.		
Residual impacts: None as the impact would be removed after decommissioning.		

8.4.2. Ecology Impacts

Negative cumulative ecological impacts include habitat loss and disturbance, and soil erosion. Individual projects will require proper management of environmental impacts during construction and operation. Cumulative ecological impacts relate to:

» possible erosion of areas lower than the panels
» possible contamination and siltation of the drainage lines and lower-lying wetlands
» possible fragmentation of plant populations
» possible alteration of occupancy by terrestrial fauna
» possible reduction of available habitat to terrestrial fauna
» possible spread and establishment of alien invasive species

Nature: Loss of vegetation, loss of and alteration of microhabitats, altered vegetation cover, altered distribution of rainfall and resultant runoff patterns, increase in runoff and accelerated erosion, loss of faunal habitat and resource availability to terrestrial fauna.		
	Without mitigation	**With mitigation**
Extent	Local (5)	Local (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	Very High (10)	Moderate (6)
Probability	Definite (5)	Definite (5)

Significance	**High (95)**	**Medium (60)**
Status (positive or negative)	Negative	Negative
Reversibility	Difficult to reverse	Partially reversible
Irreplaceable loss of resources?	Highly Probable	Probable
Can impacts be mitigated?	Reasonably	
Mitigation: » Implement mitigation measures as proposed for each facility to minimise impacts.		
Residual Impacts: » altered topsoil characteristics » altered vegetation composition » altered habitat and resource availability to terrestrial fauna		

8.4.3. Impacts on Agricultural Potential

Cumulative impacts on agricultural potential would be associated with impacts on cultivated lands and/or areas of high potential. The cumulative impact of a loss in the agricultural potential associated with the establishment of Phases 1 – 4 of the Merapi Solar Facility is considered low as areas of high potential and cultivated fields have been avoided by the placement of infrastructure.

Nature: Loss of land with agricultural potential and land capability.		
	Without mitigation	***With mitigation***
Extent	Local (1)	Local (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	Low (4)	Low (4)
Probability	High Probable (4)	High Probable (4)
Significance	**Moderate (40)**	**Low (16)**
Status	Negative	Negative
Reversibility	Medium	Medium
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Direct impacts cannot be mitigated but direct impacts can be minimised and avoided through adequate planning of layout.	
Mitigation: » Implement mitigation measures recommended for each phase of development in order to minimise impacts.		
Residual impacts: » Minor loss of grazing land while facility is in use.		

8.4.4. Social Impacts

Cumulative social impacts would be of medium (positive), regional significance as there would be creation of employment and business opportunities and would include the benefits associated with the establishment of Community Trusts in the municipal area. There would also be an increase in job opportunities and skills development due to these projects. The negative cumulative impacts could be

related an influx of job seekers to the area but localised for each site, and if managed well it can be of low negative impact. The overall cumulative impacts are acceptable. In terms of land use, the dominate land use in the district municipality will not be compromised due to the vast amounts of land available in the Free State. The table below assesses the potential social impact for the establishment of a number of solar energy facilities in the Free State Province.

Nature: The establishment of a number of solar energy facilities in the Free State Province will create employment, skills development and training opportunities, creation of downstream business opportunities and stimulation of the local property market.		
	Without Enhancement	**With Enhancement**
Extent	Local and regional (3)	Local and regional (4)
Duration	Long term (4)	Long term (4)
Magnitude	Low (4)	Moderate (6)
Probability	Highly Probable (4)	Definite (5)
Significance	**Medium (44)**	**High (70)**
Status	Positive	Positive
Reversibility	Yes. Solar energy plant components and other infrastructure can be removed.	
Irreplaceable loss of resources?	No	
Can impact be enhanced?	Yes	
Mitigations: » SolaireDirect 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; » SolaireDirect 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 20-25 year operational life of the facility. The rationale for the establishment of a Rehabilitation Trust Fund is linked to the experiences with the mining sector in South Africa and failure of many mining companies to allocate sufficient funds during the operational phase to cover the costs of rehabilitation and closure. SolaireDirect have indicated that the rehabilitation programme will be funded by sale of scrap metal etc. on closure of the facility.		
***Residual impacts*:** Positive impact on the local and regional economy through the creation of downstream opportunities and wage spend in the local economy		

8.5. Assessment of the Do Nothing Alternative

The 'do-nothing' alternative is the option of not constructing the proposed Merapi Solar Energy Facility - Phase 2. Should this alternative be selected, there would be no impacts on the site due to the construction and operation activities of a solar energy facility. However, there will be impacts at a local and a broader scale.

The primary considerations pertaining to the do-nothing alternative relate to:

3. The current land-use regime of the site; and
4. The need to diversify the energy mix in South Africa.

These are discussed in further detail below.

3. The agricultural potential of the site is mainly determined by climatic parameters such as rainfall distribution and frequency as well as wind prevalence. The site is considered to have low agricultural potential. The current land-use on the site is agriculture (livestock and game farming). The "do nothing" alternative would retain the current land-use, with a resultant lost opportunity to generate renewable energy from the wind and at the same time continue current agricultural activities on areas that fall outside of the proposed solar energy facility infrastructure. The development of the solar energy facility would allow current agricultural activities on areas of the farm portions which will not be occupied by solar panels and associated infrastructure. Therefore the current land-use will be retained, while also generating renewable energy from the sun. In addition, the landowner would obtain an income from the facility (as the developer would pay a percentage of the revenue generated to the landowner in accordance with the lease agreement for the use of the land). This would contribute towards the financial stability of the landowner which would in turn contribute to the financial viability of the farming practices on the property. The do nothing alternative would result in a lost opportunity for the landowner (in terms of revenue) and the country (in terms of renewable energy).

4. At a broader scale, the benefits of additional capacity to the electricity grid and those associated with the introduction of renewable energy would not be realised. Although the facility is only proposed to contribute approximately 20MW to the grid capacity, this would assist in meeting the growing electricity demand throughout the country and would also assist in meeting the government's goal for renewable energy.

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

» **Increased energy security:** The current electricity crisis in South Africa highlights the significant role that renewable energy can play in terms of power supplementation. In addition, given that renewables can often be deployed in a decentralised manner close to consumers, they offer the opportunity for

improving grid strength and supply quality, while reducing expensive transmission and distribution losses.

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

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

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

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

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

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

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

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

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

The table below provides an assessment of the potential impacts associated with the no-development alternative.

Nature: 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 Enhancement**[9]
Extent	Local-Regional (3)	Local-Regional (4)
Duration	Long term (4)	Long term (4)
Magnitude	Medium (6)	Medium (6)
Probability	Definite (5)	Definite (5)
Significance	High (65	High (70)
Status	Negative	Positive
Reversibility	Yes	
Irreplaceable loss of resources?	Yes, impact of climate change on ecosystems	
Can impact 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.		
***Cumulative impacts*:** Reduce carbon emissions via the use of renewable energy and associated benefits in terms of global warming and climate change.		
***Residual impacts*:** Reduce carbon emissions via the use of renewable energy and associated benefits in terms of global warming and climate change.		

[9] Enhancement assumes development of the proposed PVSEF and establishment of Community Trust

CONCLUSIONS AND RECOMMENDATIONS: PHASE 2 CHAPTER 9

The Merapi Solar Energy Facility – Phase 2 is proposed to be developed as a commercial solar energy facility located on Portion 0 of Farm 566 Moedersgift which falls within the Mantsopa Local Municipality of the Free State Province (refer to Figure 9.1). 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 SolaireDirect Southern Africa (Pty) Ltd, as an IPP, is investigating the establishment of a 130 MW (155 installed capacity) photovoltaic solar park for the purpose of commercial electricity generation. The proposed Merapi Solar Facility – Phase 2 facility is proposed to be approximately 20MW in capacity and forms part of this larger solar park. The proposed facility will require approximately 30 ha and will be comprised of the following primary elements (refer to Chapter 2 for more details):

» An array of PV panels.
» An on-site substation and 22kV overhead power line to facilitate the connection between the solar energy facility and the Eskom electricity grid.
» Internal access roads.
» Guard house,
» Laydown, Campsite and assembly area.
» Office and Control centre.

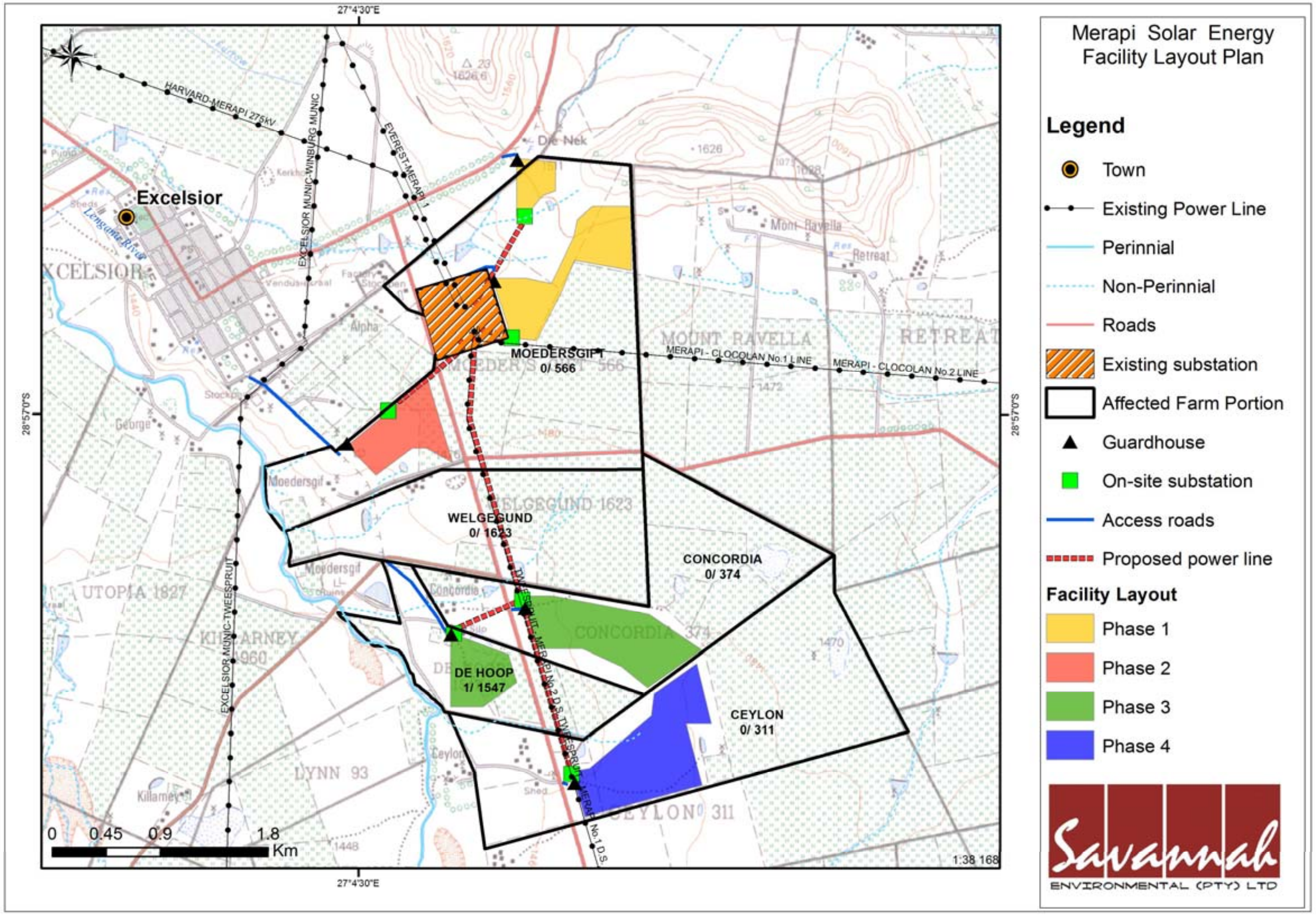


Figure 9.1: Locality map illustrating the location of the assessed development site for the proposed Merapi Solar Park and preliminary layout of the proposed facility, indicating the location proposed for the 4 project phases

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), SolaireDirect Southern Africa (Pty) Ltd requires authorisation from the National Department of Environmental Affairs (DEA) (in consultation with the Free State DETEA 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[10] 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 L).

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

9.1. Evaluation of Merapi Solar Energy Facility – Phase 2

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 Merapi Solar Energy Facility – Phase 2 by providing a summary of the conclusions of the assessment of the proposed site for the development of the PV solar energy

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

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 environmental fatal flaws which were identified to be associated with the site. No go areas identified include areas of high ecological sensitivity (small rocky outcrops, ridges, footslopes of larger mountains and riparian areas). In summary, the most significant environmental impacts associated with the Merapi Solar Energy Facility – Phase 2, 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 agricultural potential,
» Impacts on the social environment.

9.1.1. Local Site-specific Impacts

The construction of the Merapi Solar Energy Facility – Phase 2 will lead to permanent disturbance of an area of ~30ha in extent. Permanently affected areas include the area for the PV panels and associated infrastructure, as well as the internal 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, but degraded due to continued heavy grazing. Areas of sensitivity within the proposed development site were identified through the EIA process. These relate to the local ecology (sensitive and protected vegetation, habitat for fauna, several small drainage lines, man-made dams and natural vleys occur within the project area). (Refer to the sensitivity map – Figure 9.2).

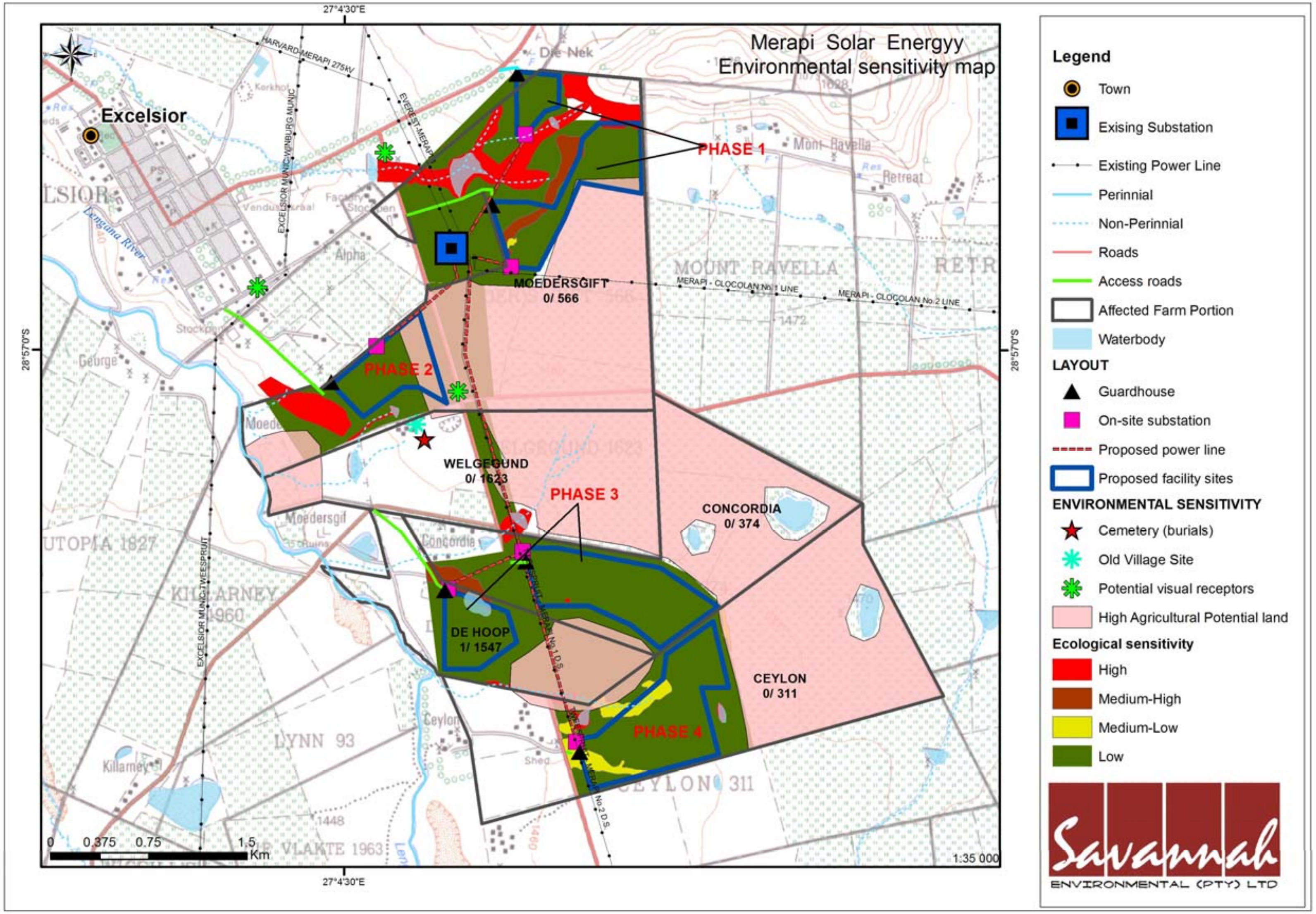


Figure 9.2: Sensitivity map for the Merapi Solar Energy Facility.

Areas of high sensitivity include rocky outcrops, ridges, and small koppies which are a habitat for several protected species found near the sites. Once these habitats have been physically altered, they cannot be recreated or returned to their former diversity and functionality therefore should be treated as no-go areas. Other sensitive ecological areas include dense vegetation of the riparian areas fringing the drainage channels which is essential in keeping the drainage channel intact and protects it from erosion as well as footslopes of larger mountains and riparian areas. The proposed facility is located within areas of low sensitivity. A small area classified as being of High sensitivity would be affected. Appropriate mitigation is required to be implemented in order to minimise impacts on this area. It is concluded through the specialist investigations undertaken that impacts on ecology associated with the proposed development can be mitigated to acceptable levels.

No impacts on heritage sites are expected to occur as no heritage sites were recorded within the proposed development footprint.

9.1.2. Visual Impacts

Most of the potential impacts associated with the proposed facility relate to the foreground and middle ground zone of visual influence (i.e. within 3km of the proposed facility). The visual analysis and assessment from all selected observation points found that the proposed activity is potentially visible and recognisable from Key Observation Points along the R703 and R709 as well as from Excelsior itself. The results of the Visual Impact Assessment for the proposed Merapi Solar Park therefore found that the proposed activity will have a **medium** impact from KOPs identified in the *foreground* and *middle ground* (<3km). This impact is partially mitigated by the presence of the Merapi substation is located on the north western boundary of the site, and two power lines associated with the substation traverse the site. The visual integrity of the site and the surrounding area has therefore been impacted by the existing energy related infrastructure on the site.

Other solar energy facilities are located in the same district as the proposed Merapi Solar Energy Facility (Refer to Figure 9.3). Based on the findings of the specialist studies undertaken, the potential cumulative visual impacts are expected to be low. This is due to the distance between facilities as well as the sparsely populated nature of the region.

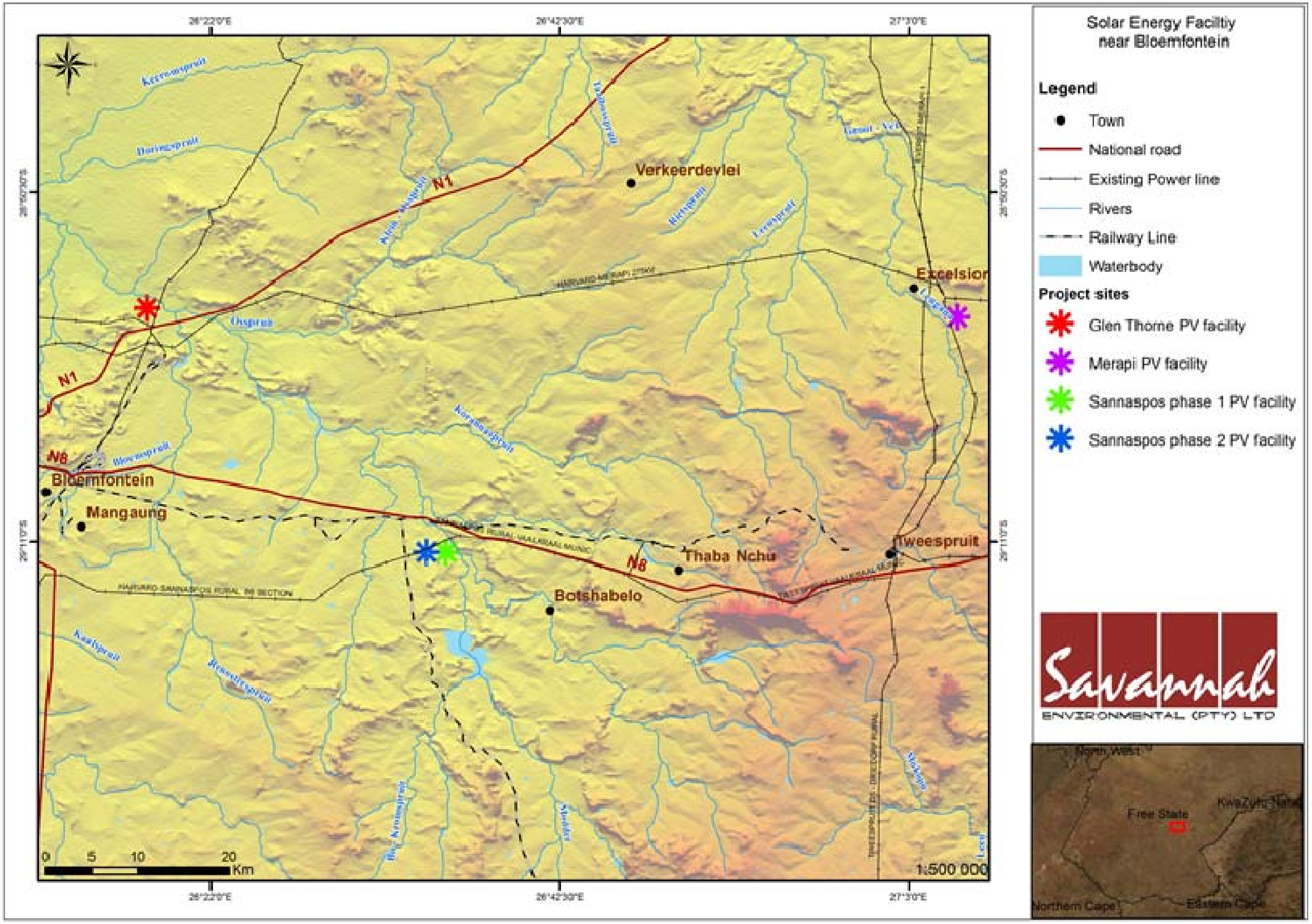


Figure 9.3: Locality map showing the Solar Energy Facility proposed in close proximity to the Merapi Solar Energy Facility.

9.1.3. Impacts on Agricultural potential

The majority of the site (95%) is proposed on Mispah and Sterkspruit soils. These soils type have low-medium agricultural potential. However a small portion of the facility will occupy the Clovelly soil of type, and these soils are known to be of medium-high agricultural potential. As the majority of the development footprint is located outside of areas of high agricultural potential and cultivated fields, the impact on agricultural potential is considered acceptable. It is recommended that the proposed project be approved subjected to the mitigation measures stipulated in the Environmental Management Programme since these soils type are suitable for rehabilitation purposes.

9.1.4. 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 largely restricted to daylight hours, and the construction phase is anticipated to extend for a minimum period of 18-months. Negative impacts during construction relate mainly to impacts due to the presence of construction workers and visual impact imposed by the facility on the local environment. 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. This will be a positive impact due to the high unemployment levels in the area. The positive impact due to employment creation will be lower during operation as there will be a limited number of staff required compared to the construction phase.

9.2. 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 generating capacity of 20MW on a site located on Portion 0 of Farm 566 Moedersgift has been established by SolaireDirect Southern Africa (Pty) Ltd. The positive implications of establishing a solar energy facility on the identified site within the Free State include the following:

» The potential to harness and utilise solar energy resources within the Free State Province.
» The consolidation of solar facility infrastructure within an area (specifically considering the proximity to Phases 1, 3 and 4 of the Merapi Solar park, as well as to the proposed Sannaspos and Glen Thorne solar facilities to be developed).
» 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 Free State Province would benefit from the additional generated power.
» Promotion of clean, renewable energy in South Africa
» Creation of local employment, business opportunities and skills development for the area.

The findings of the specialist studies undertaken within this EIA to assess both the benefits and potential negative impacts anticipated as a result of the proposed project conclude that 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 the majority of identified negative impacts can be reduced by implementing the recommended mitigation measures. The project is therefore considered to meet the requirements of sustainable development. Environmental specifications for the management of potential impacts are detailed within the draft Environmental Management Programme (EMP) included within Appendix L.

With reference to the information available at this planning approval stage in the project cycle, the **confidence** in the environmental assessment undertaken is regarded as **acceptable**.

9.3. 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 Merapi Solar Energy Facility – Phase 2 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:

» A small area classified as being of High sensitivity would be affected by the proposed development. Appropriate mitigation as recommended within this EIA Report is required to be implemented in order to minimise impacts on this area.
» A minimum legal buffer of development of 32 m from drainage lines should be observed. It is recommended that a buffer of at least 100 m be maintained around riparian areas. Where this is not possible, alternative mitigation measures as detailed in this report must be implemented and relevant permits must be obtained.
» Following the final design of the facility, a final 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 L 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 throughout the construction and operation of the facility.
» 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.
» Existing access roads on site should be used as far as possible.

» 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 SolaireDirect Southern Africa (Pty) Ltd must be submitted to the relevant regulating authorities.

ASSESSMENT OF POTENTIAL IMPACTS: MERAPI PHASE 3 CHAPTER 10

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 SolaireDirect Merapi Solar Facility - Phase 3. This assessment is undertaken for the 55 MW solar facility and for all the facility's components, as detailed in the following table:

Component	Description
Location of the site	~ 5 km south-east of Bloemfontein
Municipal Jurisdiction	Mantsopa Local Municipality; Motheo District Municipality
Extent of the proposed development footprint (four phases)	~85 ha
Extent of broader site available for development	~1505 ha
Site access	The site can be accessed easily via the R709 main road which crosses through the proposed sites, as well as via farm gravel roads. The farm roads will be upgraded and used to access the facility site during construction and operation.
Generating capacity(four phases)	55 MW
Proposed technology	Photovoltaic panels
Associated infrastructure	» An on-site substation and 22kV/132kV overhead power line to facilitate the connection between the solar energy facility and the Eskom electricity grid. » Internal access roads (~4m wide x 800m in length) » Guard house » Laydown, campsite and assembly area. » Office and Control centre.
Water use	» ~3 million litres/year required during the construction phase and 550,000 litres/year for operations, » Water requirements for the construction phase of the PV power facility will be supplied by the Local Water Users' Association. Alternatively water will be provided

Component	Description
	via a rainwater tank. » No effluent will be produced except for the normal sewage from site and operations staff. This will be treated as per normal standards with a septic tank and disposed of at an appropriate licensed facility off-site.

The development of the Merapi Facility – Phase 3 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 18-24 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.

10.1. Methodology for the assessment of Potentially Significant Impacts

A broader site of 1505 ha (i.e. on Portion 0 of Farm 311 Ceylon, Portion 0 of Farm 566 Moedersgift, Portion 0 of Farm 374 Concordia, and Portion 1 of Farm 1547 De Hoop) was identified by the project developer for the purpose of establishing the proposed Merapi Facility Phase 1-4. The total developmental footprint will cover an extent of <250 ha and can therefore be accommodated within the broader site. Phase 3 of the facility is proposed to be developed on Portion 0 of Farm 374 Concordia, and Portion 1 of Farm 1547 De Hoop. An area of 85ha is required for the development of this phase of the project.

The assessment of potential issues associated with the development of the Merapi Solar Facility - Phase 3 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.

10.2. 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.

10.2.1Potential Impacts on Ecology

Solar energy facilities require relatively large areas of land for placement of infrastructure. This PV facility requires ~85 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 as shown on Figure 10.1 below identifies those parts of the study area that have high conservation value or that may be sensitive to disturbance. This sensitivity assessment is based on a desktop study, detailed field evaluation of the site and detailed analysis of aerial photography. A detailed methodology is included within the Ecology report (See Appendix E).

(a) Summary of Ecological Impacts

The majority of impacts on ecology will occur during the construction of the proposed PV facility. A risk assessment was undertaken as part of the ecological impact assessment, which identified the main potential negative impacts on the ecological receiving environment. Potential impacts were identified as follows:

» Loss of vegetation, increase in runoff and erosion;
» Loss of micro-habitat, window of opportunity for the establishment of alien invasive species, altered topsoil characteristics prone to capping;

- Altered distribution of rainfall and resultant runoff patterns, increase in runoff and accelerated erosion, loss of faunal habitat and resource availability to terrestrial fauna;
- Temporary displacement of terrestrial fauna; and
- Increase in pollution, loss of faunal habitat and resource availability to terrestrial fauna

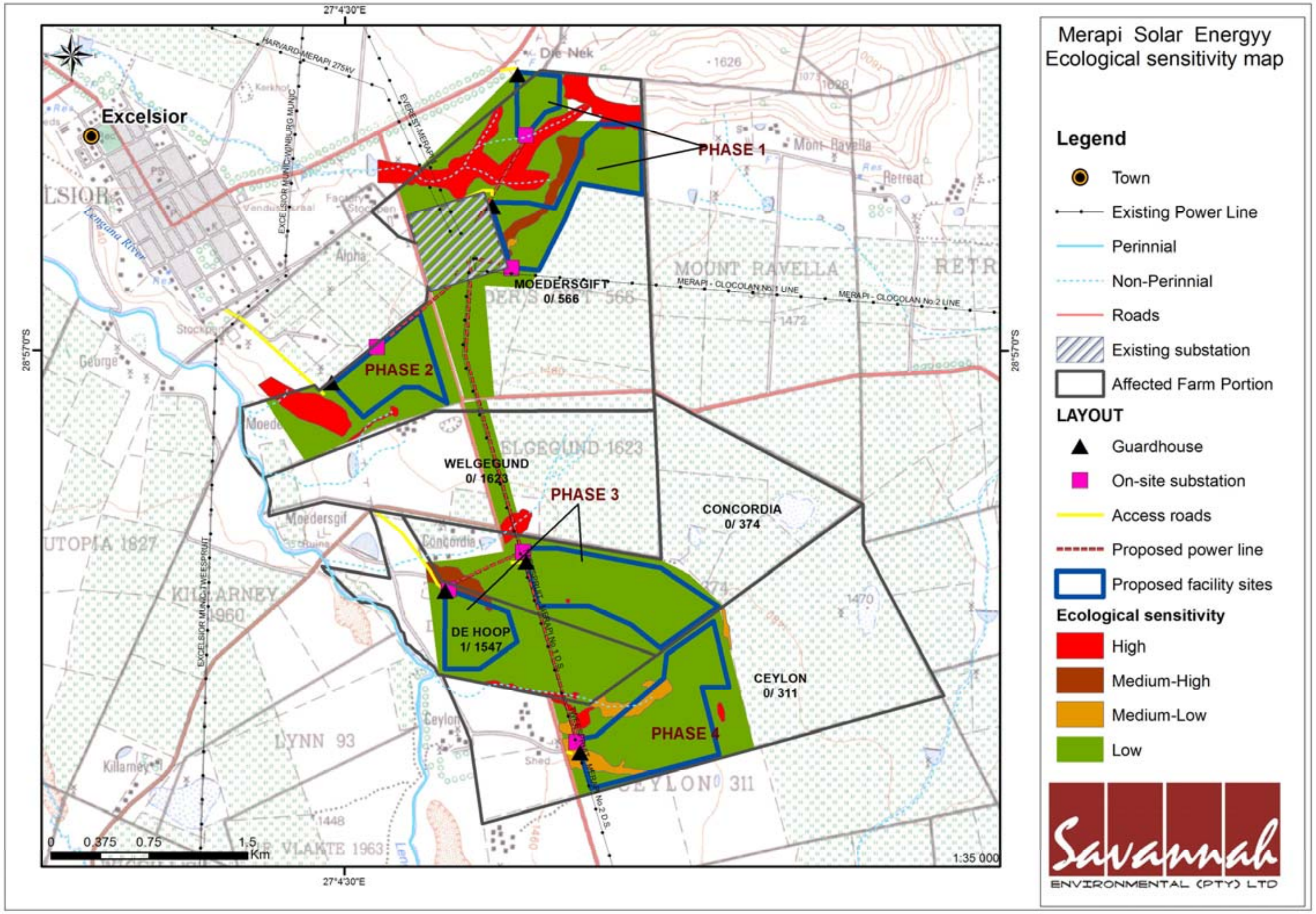


Figure 10.1: Ecology sensitivity map for the study area: Red indicates areas with *High Sensitivity* that should be avoided as far as possible; the remainder of the study area has Medium-High and Low *Sensitivity* where development can take place with certain mitigation measures

The following is assumed with regards to the ecological impacts:

- » Existing access roads and tracks will be used and upgraded as far as possible, whilst new servitudes or power lines will coincide as far as possible with existing infrastructure;
- » The proposed development will be as close as possible to existing electricity infrastructure, thus minimising the need for additional overhead power lines to connect to the grid;
- » A thorough ecological investigation be conducted of all footprint areas to detect and relocate all plant species of conservation concern by a suitably qualified botanist prior to a geotechnical survey and construction;
- » Development of the PV-footprint area will retain a minimum 50 m (preferably 100 m) buffer from all drainage lines and/or wetlands within the area assessed; and
- » Prior to development the footprint area will be entirely cleared of all alien invasive plants.

The tables which follow provide an assessment of the direct, indirect and cumulative impacts on ecology expected to be associated with the construction and operation of the Merapi Solar Facility - Phase 3.

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

Upgrading of Access Road

Nature: Loss of vegetation, increase in runoff and erosion (as the road already exists, no additional impact on terrestrial fauna is expected to arise from the development)		
	Without mitigation	**With mitigation**
Extent	Local (3)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Low (4)	Small (0)
Probability	Definite (5)	Definite (5)
Significance	**Medium (55)**	**Low (25)**
Status (positive or negative)	Negative	Neutral
Reversibility	Not reversible	Partially reversible
Irreplaceable loss of resources?	Probable	Not likely
Can impacts be mitigated?	Reasonably	
Mitigation: » Make use of existing tracks as far as possible » Ensure an adequate plant search and rescue program is developed and implemented prior to commencement of activity; especially geophytes may need to be relocated » Reinforce portions of existing access routes that are prone to erosion, create structures or low banks to drain the access road rapidly during rainfall events, yet preventing erosion of the track and surrounding areas » Ensure that runoff from compacted or sealed surfaces is slowed down and dispersed		

sufficiently to prevent accelerated erosion from being initiated (storm water and erosion management plan required, together with revegetation of adjacent areas) » Prevent leakage of oil or other chemicals or any other form of pollution » Monitor the establishment of alien invasive species and remove as soon as detected, whenever possible before regenerative material can be formed » After decommissioning, if access roads or a portion thereof will not be of further use to the landowner or project, remove all foreign material and rip area to facilitate the establishment of vegetation
Cumulative impacts: » Possible erosion of areas lower than the access road, possible contamination of lower-lying wetlands due to oil or other spillage » Possible spread and establishment of alien invasive species
Residual Impacts: » Altered vegetation composition and structure » Barren areas » Potential for erosion

Creation of Access Roads where existing tracks are insufficient

Nature: Loss of vegetation, increase in runoff and erosion, displacement of fauna, possible alteration of drainage patterns		
	Without mitigation	**With mitigation**
Extent	Local (3)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Moderate (6)	Low (4)
Probability	Definite (5)	Definite (5)
Significance	**High (65)**	**Medium (45)**
Status (positive or negative)	Negative	Neutral
Reversibility	Not reversible	Partially reversible
Irreplaceable loss of resources?	Probable	
Can impacts be mitigated? Reasonably		
Mitigation: » Follow routes of existing tracks or fence lines as far as possible » Ensure adequate drainage and specific erosion control if and where access roads need to cross drainage lines » Ensure an adequate plant search and rescue program prior to commencement of activity, especially geophytes may need to be relocated » Reinforce portions of existing access routes that are prone to erosion, create structures or low banks to drain the access road rapidly during rainfall events, yet preventing erosion of the track and surrounding areas » Ensure that runoff from compacted or sealed surfaces is slowed down and dispersed sufficiently to prevent accelerated erosion from being initiated (storm water and erosion management plan required, together with revegetation of adjacent areas) » Prevent leakage of oil or other chemicals or any other form of pollution » Monitor the establishment of alien invasive species and remove as soon as detected, whenever possible before regenerative material can be formed » After decommissioning, if access road or portion thereof will not be of further use to the		

landowner, remove all foreign material and rip area to facilitate the establishment of vegetation
Cumulative impacts: » Possible erosion of cleared areas and thus also accelerated erosion from surrounding areas » Possible excessive fragmentation and thus reduction of core habitats that may negatively influence species population viability
Residual impacts: » Altered vegetation composition » Compacted topsoils » Possibility for erosion

Fencing area – may also serve as access road to PV panels and fire-break

Nature: Loss of vegetation, loss of micro-habitat, increase in runoff and erosion, window of opportunity for the establishment of alien invasive species, altered topsoil characteristics prone to capping, increased runoff and erosion. As fences already exist, no significant additional impact on terrestrial fauna is expected to arise from the development.		
	Without mitigation	**With mitigation**
Extent	Local (2)	Local (1)
Duration	Long-term (4)	Long term (4)
Magnitude	Moderate (6)	Small (1)
Probability	Definite (5)	Definite (5)
Significance	**Medium (60)**	**Medium (30)**
Status (positive or negative)	Negative	Neutral
Reversibility	Partially reversible	Largely reversible
Irreplaceable loss of resources?	Probable	
Can impacts be mitigated? Reasonably		
Mitigation: » Minimise area affected, especially during construction » Avoid development and disturbance on low rocky ridges or outcrops as well as plains adjacent to and drainage lines themselves » Use topsoils removed for redistribution outside the LOWEST borders of the development to stop erosion off the cleared areas, possibly to construct contour buffer strips to help limit erosion » Remove and collect all bulbous plants from cleared areas and transplant onto the newly redistributed topsoils, together with other species used for revegetation » Prevent leakage of oil or other chemicals » Monitor the establishment of alien invasive species and remove as soon as detected, whenever possible *before* regenerative material can be formed » Should the area along the fence be used for occasional access and fire breaks, regular mowing of the grass layer to reduce fire loads is recommended rather than the removal of vegetation		
Cumulative impacts: » Possible erosion of cleared areas and thus also accelerated erosion from surrounding areas » Possible excessive fragmentation and thus reduction of core habitats that may negatively influence species population viability		

Residual impacts:

- Altered vegetation composition
- Compacted topsoils
- Possibility for erosion

Construction and operation of PV panels

Nature: Loss of vegetation, loss of and alteration of microhabitats, altered vegetation cover, altered distribution of rainfall and resultant runoff patterns, increase in runoff and accelerated erosion, loss of faunal habitat and resource availability to terrestrial fauna.		
	Without mitigation	**With mitigation**
Extent	Local (5)	Local (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	Very High (10)	Moderate (6)
Probability	Definite (5)	Definite (5)
Significance	**High (95)**	**Medium (60)**
Status (positive or negative)	Negative	Negative
Reversibility	Difficult to reverse	Partially reversible
Irreplaceable loss of resources?	Highly Probable	Probable
Can impacts be mitigated?	Reasonably	

Mitigation:

- Keep areas affected to a minimum
- Utilise area as close as possible to existing infrastructure, keep buffer zone of a minimum of 50m, preferably 100 m, around drainage lines
- Keep levelling earthworks and soil disturbance to the minimum practically possible
- Develop and implement a comprehensive topsoil management, soil erosion control and rehabilitation plan once layouts have been finalised
- Remove as little indigenous vegetation as practically possible
- Revegetate areas below/between panels immediately after construction ceases
- Relocate all geophytes, or use as far as possible in rehabilitation efforts
- No development on drainage lines or other wetlands and low rocky ridges and outcrops, limit development on lower-lying plains adjacent to drainage lines
- Monitor the area below the PV panels regularly after larger rainfall events to determine where erosion may be initiated and then mitigate by modifying the soil microtopography and revegetation efforts accordingly
- Aim to maintain a reasonable cover of indigenous perennial vegetation throughout the operational phase within and on the periphery of the PV array, preferably low dense perennial grasses that can be mowed as required to reduce fuel loads
- Prevent leakage of oil or other chemicals
- Monitor the establishment of alien invasive species and remove as soon as detected, whenever possible before regenerative material can be formed

Cumulative impacts:

- possible erosion of areas lower than the panels
- possible contamination and siltation of the drainage lines and lower-lying wetlands
- possible fragmentation of plant populations
- possible alteration of occupancy by terrestrial fauna
- possible reduction of available habitat to terrestrial fauna
- possible spread and establishment of alien invasive species

Residual Impacts: » altered topsoil characteristics » altered vegetation composition » altered habitat and resource availability to terrestrial fauna

Construction of power lines to substation

Nature: Loss of vegetation, increase in runoff and erosion, temporary displacement of terrestrial fauna		
	Without mitigation	**With mitigation**
Extent	Local (2)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Minor (2)	Small (0)
Probability	Definite (5)	Definite (5)
Significance	**Medium (40)**	**Low (25)**
Status (positive or negative)	Negative	Neutral
Reversibility	Partially reversible	Partially reversible
Irreplaceable loss of resources?	Probable	Not likely
Can impacts be mitigated?	Reasonably	
Mitigation: » Place pylons as far as possible on sites where the slope and erosion risk is minimal or negligible » No pylons may be placed within drainage lines or 32 m of such without the appropriate permits » Riparian areas may not be used as access points to pylon areas » Conduct a search and rescue operation for bulbous plants prior to pylon construction » Prevent spillage of construction material beyond area affected » Monitor the establishment of alien invasive species and remove as soon as detected, whenever possible before regenerative material can be formed		
Cumulative impacts: » Possible erosion of surrounding areas, no major cumulative impact on vegetation expected		
Residual Impacts: » Very localised alteration of soil surface characteristics		

Construction and operation of substation area

Nature: Loss of vegetation, loss of micro-habitats, increased runoff and erosion, possibly altered chemistry of surrounding soils, window of opportunity for the establishment of alien invasive species. After decommissioning: altered topsoil characteristics with low moisture infiltration capacity, low niche diversity, and increased runoff and slow plant establishment.		
	Without mitigation	**With mitigation**
Extent	Local (3)	Local (2)
Duration	Long-term (4)	Long-term (4)

Magnitude	Moderate (6)	Low (4)
Probability	Definite (5)	Definite (5)
Significance	**High (65)**	**Medium (50)**
Status (positive or negative)	Negative	Negative
Reversibility	Low reversibility	Partially reversible
Irreplaceable loss of resources?	Highly probable	Probable
Can impacts be mitigated?	Reasonably	

Mitigation:
» Place pylons as far as possible on sites where the slope and erosion risk is minimal or negligible
» No pylons may be placed within drainage lines or 32 m of such without the appropriate permits
» Riparian areas may not be used as access points to pylon areas
» Conduct a search and rescue operation for bulbous plants prior to pylon construction
» Prevent spillage of construction material beyond area affected
» Monitor the establishment of alien invasive species and remove as soon as detected, whenever possible before regenerative material can be formed

Cumulative impacts:
» Possible erosion of surrounding areas, no major cumulative impact on vegetation expected

Residual Impacts:
» Very localised alteration of soil surface characteristics

Construction and operation of workshop area and guard houses

Nature: Loss of vegetation, increase in runoff and erosion, pollution, loss of faunal habitat and resource availability to terrestrial fauna

	Without mitigation	**With mitigation**
Extent	Local (4)	Local (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	Moderate (6)	Low (4)
Probability	Definite (5)	Definite (5)
Significance	**High (70)**	**Medium (50)**
Status (positive or negative)	Negative	Neutral
Reversibility	Difficult to reverse	Partially reversible
Irreplaceable loss of resources?	Probable	Probable
Can impacts be mitigated?	Reasonably	

Mitigation:
» Avoid placing infrastructure on rocky ridges and outcrops, within 100 m of any drainage line or in the lowest sections of the landscape (where no drainage lines have developed up to date but where moisture does accumulate seasonally due to the topography), restrict to vegetation Association 2 as far as possible
» Limit disturbance to footprint area as far as practically possible – including disturbance to soil
» Implement a comprehensive topsoil management plan as soon as layout plans are finalised and site preparation commences

» Conduct a search and rescue operation for bulbous plants prior to construction » Prevent spillage of construction material and other pollutants beyond area affected » Implement a comprehensive waste management plan for the operation of the facility » Rehabilitate and revegetate all areas outside footprint area that have been disturbed immediately after construction » Monitor adjacent areas for accelerated erosion and mitigate as required » Monitor the establishment of alien invasive species and remove as soon as detected, whenever possible before regenerative material can be formed
Cumulative impacts: » possible erosion of adjacent or lower-lying areas » possible contamination and siltation of drainage lines and lower-lying wetlands » possible fragmentation of plant populations » possible alteration of occupancy by terrestrial fauna, reduction of available habitat to terrestrial fauna » possible spread and establishment of alien invasive species » Possible erosion of surrounding areas
Residual Impacts: » altered topsoil characteristics » altered vegetation composition » altered habitat and resource availability to terrestrial fauna

Implications for Project Implementation

» The proposed photovoltaic facility development on the site may have significant impacts on the ecology of the site and lower-lying wetlands, if mitigation measures are not strictly adhered to.

» Potentially significant negative impacts on the ecological environment would be soil degradation issues (erosion, depletion of nutrients) as a result of construction activity and the operation of the facility, possible introduction of alien invasive plants and a long-term (more than 8 months) low or absent vegetation cover after construction.

» A loss of niches and specialised habitats for flora and fauna could occur with the removal or significant degradation of large expanses of vegetation or the alteration of rocky habitats. With the ecologically justifiable placement of the different components of the proposed development, coupled with diligent implementation of mitigating measures by the developer, contractors, and operational staff, the severity of impacts can be greatly reduced.

» The impact on fauna is expected to be negligent. Currently minimal presence of wild animals could be detected, possibly due to current land use patterns. Animals that may be present are mobile and will move away during construction, possibly resettling after construction. No restricted or specific habitat of vertebrates will be affected by the proposed development; especially if the proposed development remains outside the more sensitive areas.

» The proposed Merapi Solar Facility - Phase 3 is located largely within an area of low ecological sensitivity. An area classified as being of Medium-High sensitivity is located in close proximity to a portion of this proposed development.

Appropriate mitigation is required to be implemented in order to minimise impacts on this area.

» The proposed facility is considered to be acceptable from an ecological perspective provided appropriate mitigation and management measures are implemented throughout the lifecycle of the project.

10.2.2 Impacts on Soils and Agricultural Potential

The proposed activity could result 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).

The dominant soils in the study area according to the Taxonomical Soil Classification System of South Africa are Mispah and Sterkspruit soils. The effective depth of the Mispah and Sterkspruit soils is on average 300mm restricted to the Orthic A – Horizon. The agricultural potential of the Mispah and Sterkspruit, soils is considered medium to low under dryland (650mm/y rainfall) and irrigation conditions (>10-15mm/week 33-1,500kPa plant available water). The current land use as shown in Figure 10.2 includes 235ha natural veld, 16ha ploughed land and 17ha plantation. The land capability includes 16ha arable (5% of the total development area), 235ha grazing and 17ha wilderness. No evidence of soil erosion was observed on any of the soils during the investigation. It can be seen from the figure below that the proposed layout of the Merapi Solar Energy Facility avoids areas which are currently cultivated.

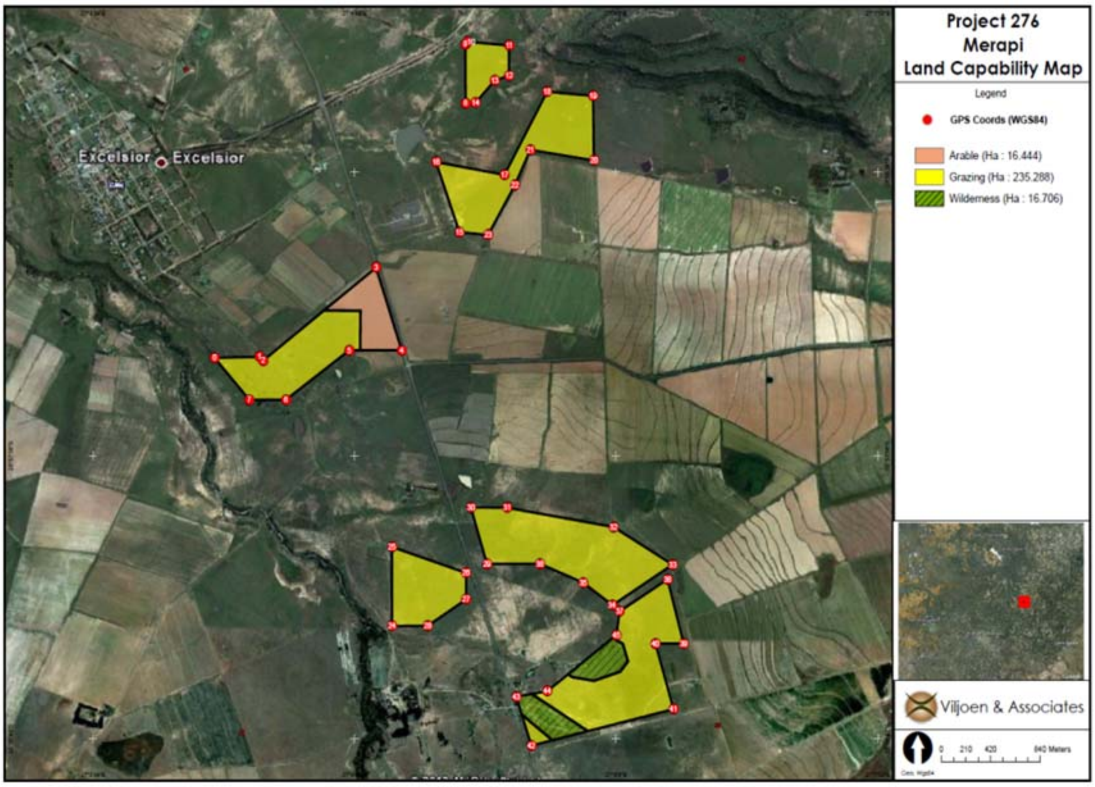


Figure 10.2: Land capability in relation to the proposed Merapi Solar energy facility Phase 1 – 4.

The tables which follow provide an assessment of the direct, indirect and cumulative impacts on soils and agricultural potential expected to be associated with the construction and operation of the Merapi Solar Facility - Phase 3.

<u>Impact tables summarising the significance of impacts on soils and agricultural potential (with and without mitigation)</u>

Nature: Loss of topsoil due to stripping, handling and placement of soil associated with pre construction land clearing and rehabilitation.		
	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	Irreversible	Irreversible
Irreplaceable loss of resources?	Irreplaceable	Irreplaceable
Can impacts be mitigated?	Yes.	
Mitigation: » Strip all usable soil, irrespective of soil depth and store for use during rehabilitation?		
Cumulative impacts: » Cumulative impact of loss of topsoil due to stripping and placement associated with pre		

construction land clearing and rehabilitation is considered low due to the undeveloped nature of the area but further development will increase impact.
Residual impacts:
» Minor localised loss of topsoil

Nature: Change of soil's physical, chemical and biological properties due to loss of topsoil due to erosion, stockpiling, mixing of deep and surface soils during handling, stockpiling and subsequent placement.		
	Without mitigation	***With mitigation***
Extent	Local (1)	Local (1)
Duration	Long Term (4)	Short Term (1)
Magnitude	Moderate (8)	Low (4)
Probability	Very Probable (5)	Very Probable (4)
Significance	**Moderate (65)**	**Low (24)**
Status	Negative	Negative
Reversibility	Irreversible	Irreversible
Irreplaceable loss of resources?	Irreplaceable	Irreplaceable
Can impacts be mitigated?	Yes.	
Mitigation:		
» Implement live placement of soil where possible, improve organic status of soils, maintain fertility levels and curb topsoil loss.		
Cumulative impacts:		
» Cumulative impact of soil's physical, chemical and biological properties due to loss of topsoil, due to erosion, stockpiling, mixing of deep surface soils during handling, stockpiling and subsequent placement is considered low due to the undeveloped nature of the area but further development will increase impact.		
Residual impacts:		
» Minor localised degradation of topsoil's chemical, physical and biological properties		

Nature: Change of natural surface topography due to reprofiling of surface after stripping.		
	Without mitigation	***With mitigation***
Extent	Local (1)	Local (1)
Duration	Long Term (4)	Short Term (1)
Magnitude	Moderate (8)	Low (4)
Probability	Very Probable (5)	Very Probable (4)
Significance	**Moderate (65)**	**Low (24)**
Status	Negative	Negative
Reversibility	Irreversible	Irreversible
Irreplaceable loss of resources?	Irreplaceable	Irreplaceable
Can impacts be mitigated?	Yes	
Mitigation:		
» Implement mapping stormwater control system to ensure surface water control measures are implemented to ensure free draining system with minimal soil erosion.		
Cumulative impacts:		

» Cumulative impact of the change of surface topography due to reprofiling of surface after stripping is considered low due to the undeveloped nature of the area but further development will increase impact.
Residual impacts: » Minor localised degradation of topsoil's chemical, physical and biological properties

Nature: Loss of land with agricultural potential and land capability.		
	Without mitigation	***With mitigation***
Extent	Local (1)	Local (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	Low (4)	Low (4)
Probability	High Probable (4)	High Probable (4)
Significance	**Moderate (40)**	**Low (16)**
Status	Negative	Negative
Reversibility	Medium	Medium
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Direct impacts cannot be mitigated but direct impacts can be minimised and avoided through adequate planning of layout.	
Mitigation: » Loss of agricultural land is a long term loss and no mitigation measures exist. Mitigation is restricted to limitation of extent of impact to the immediate area of impact and minimisation of off-site impacts.		
Cumulative impacts: » The cumulative impact of a loss in the agricultural potential is considered low as areas of high potential and cultivated fields have been avoided by the placement of infrastructure.		
Residual impacts: » Minor loss of grazing land while facility is in use.		

Implications for Project Implementation

- The proposed development of a photovoltaic facility on the site will have minimal significant impacts on the agricultural potential as 95% of the development footprint is proposed on low agricultural potential soils.
- The proposed Merapi Solar Facility - Phase 3 avoids currently cultivated areas.
- The results of the Soil Assessment for the proposed Merapi Solar Park find the proposed activity will have a medium to low impact on the immediate and surrounding soil systems. Implementation and management of proposed mitigation measures will minimise loss of topsoil, prevent contamination of topsoil and stockpiled soil and prevent overall soil erosion.
- It is recommended that the proposed project be approved subject to the mitigation measures stipulated in the Impact Assessment and Environmental Management Programme

10.2.3 Assessment of Potential Impacts on Heritage and Paleontological sites

Five heritage sites were identified near the site (i.e. more than 200m away) and are referred to as: Merap-1, 2, 3, 4 and Merap-5. Of these 5 sites 2 were deemed important as shown on Figure 10.3. None of these sites are located in close proximity to the proposed Merapi Solar facility – Phase 3. No impacts on heritage sites are therefore expected and no mitigation measures are proposed.

In terms of the Paleontological resources in the study area, the site of the proposed Merapi Solar Park is underlain sediments of the Adelaide and Tarkastad subgroups, Beaufort Group (Karoo Supergroup). The Beaufort Group is composed of sandstone and mudrock and ranges in thickness from 5000m to 150m or less (Groenewald 1989). The Beaufort Group (Karoo Supergroup) of formations are rich in Triassic and Permian fossils (Johnson et al., 2006). Vertebrate fossils including retiles, mammal-like reptiles (Therapsids) (Figure 3 in **Appendix G**), amphibians and fish remains occur in the Beaufort Group (Rubidge et al., 1995). Invertebrate fossils, invertebrate burrows and trails, well-preserved leaf impressions, silicified wood and stem impressions have also been recorded from a number of localities in the Beaufort Group (Anderson et al., 1998; McLachlan & Anderson 1973; 1977; Riek, 1973, 1976, Rubidge et al., 1995).

The tables which follow provide an assessment of the direct, indirect and cumulative impacts on heritage and palaeontological sites expected to be associated with the construction and operation of the Merapi Solar Facility - Phase 3.

Figure 10.3: *Heritage sites recorded in close proximity to the study area*

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

Nature: Discovery/destruction of unknown fossil deposits. 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 measures: » Excavation activities should be monitored by a qualified heritage practitioner		
Cumulative impact: » None		
Residual impact: » Loss of heritage related information		

Implications for Project Implementation

» From an archaeological perspective, the only sign of sites of heritage potential were outside the study area.
» The proposed Merapi Solar facility – Phase 3 will not impact on any heritage sites recorded in the study area.
» No mitigation measures are proposed for these sites since they fall outside the development footprint. However, it is advised that the developer avoid these sites as far as possible.
» The proposed project construction phase should pay special attention to previously un-observed resources or “chance-finds” – these are resources that may be unearthed by the construction excavation activities.
» 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.

10.2.4 Assessment of Potential Visual Impacts

Visual Impact of the PV Facility and power line – Operational Phase

The viewshed[11] analysis for the proposed facility and associated infrastructure was undertaken in accordance with the *Guideline Document for involving Visual Specialists in EIA Processes*. This analysis considers the broader site for development. 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 project site.
» It is calculated at 3.4m above the natural ground level to reflect the highest point of the PV panels.
» 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.
» The viewshed generated from each of the selected observation points referred to in Annexure 2 of the visual impact assessment (refer to Appendix J) is calculated at 1.7m above the natural ground level to reflect the average height of person either walking or sitting in a vehicle.

As illustrated by the generated viewsheds (refer to **Figure 10.4**), the primary *zone of visual influence*[12] is primarily located in a northern direction up to ±10km from the project site. A further zone of visual influence is located intermittently to the east up to 7km.

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 southeast.

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

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11 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.

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

of an activity diminishing as the distance between the viewer and the activity increases. Viewsheds are categorised into three broad categories of significance, namely:

g) 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.

h) 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.

i) Background: the background stretches from approximately 3km onwards. Background views are only distinguishable by colour and lines, while structures, textures, styles and forms are often not visible (SRK Consulting, 2007).

The distance radii indicating the various viewing distances from the combined phases are illustrated by Figure 6.4. Also illustrated by the figure is the town of Excelsior in the *foreground* to *middle ground* of the project site. Excelsior represents the area where most of the visual receptors would be located. Also located in the *fore-* and *middle ground* are the two main view corridors, namely the R703 and R709.

The tables which follow provide an assessment of the direct, indirect and cumulative visual impacts expected to be associated with the construction and operation of the Merapi Solar Facility - Phase 3.

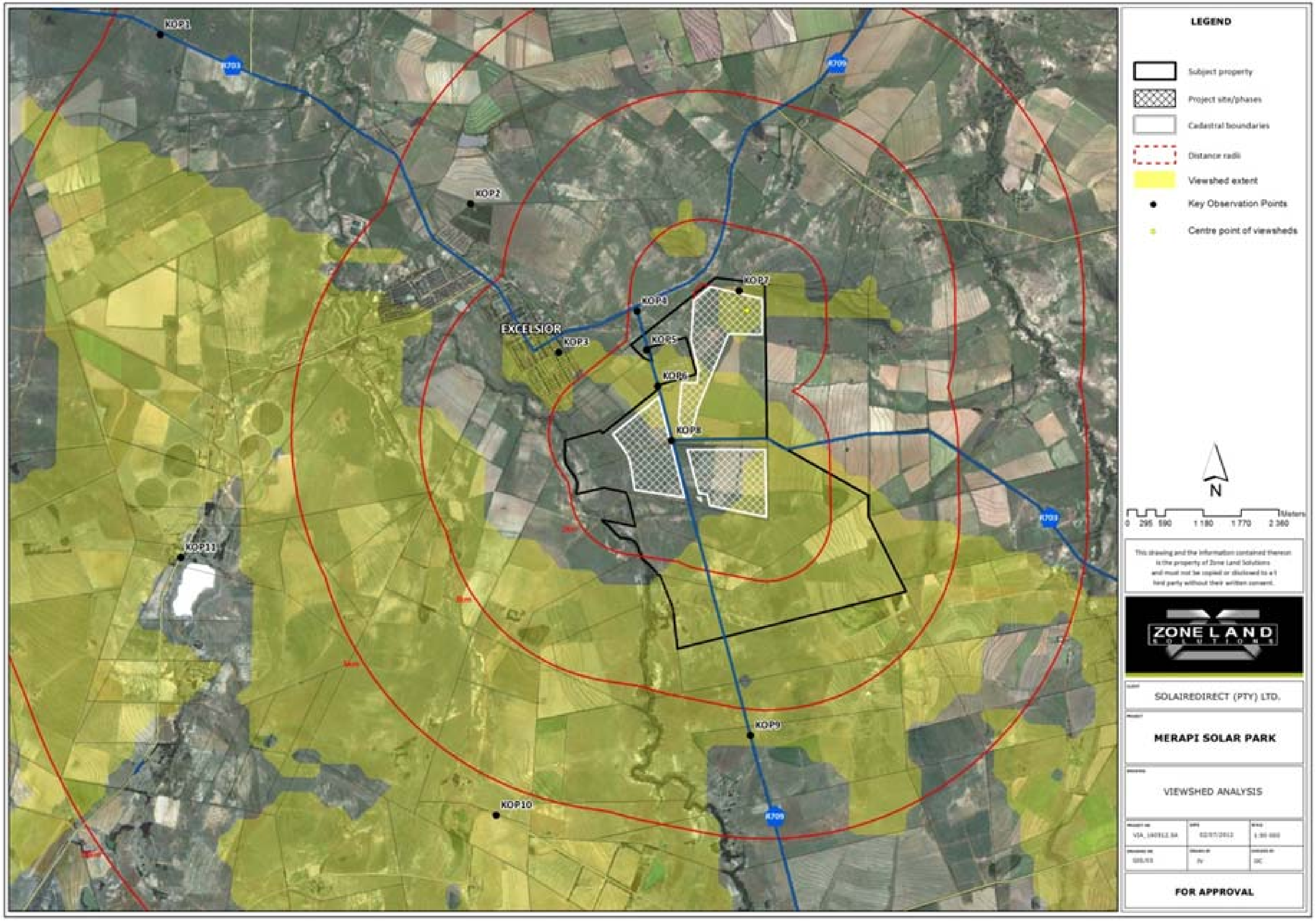

Figure 10.4: Viewshed generated from the highest point of the project site.

Impact tables summarising the significance of visual impacts of the PV facility, power line and proposed substation area (with and without mitigation)

Nature: Potential visual impact on the sensitive receptors in the *foreground* and *middle ground*.		
	Without Mitigation	**With Mitigation**
Extent	Regional (3)	Local (2)
Duration	Long term (4)	Long term (4)
Magnitude	Minor (4)	Low (2)
Probability	Probable (3)	Improbable (2)
Significance	**Medium (33)**	**Low (16)**
Status	Neutral	Neutral
Reversibility	Recoverable (3)	Recoverable (3)
Irreplaceable Loss of Resource?	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 outer boundaries of the individual phases. Only indigenous plant species to be introduced and planted in such a manner and location which would not cast shadows on the PV 'strings'. » 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. » Utilise existing roads and tracks to the extent possible. Where new roads are required, they should be two-track gravel roads, maintained to prevent dust plumes and erosion.		
Cumulative impacts: The existing Merapi Substation and its associated industrial-type infrastructure such as electrical transmission lines and pylons already exist in the immediate surroundings. Therefore, the cumulative impact will be increased with the establishment of the PV plant.		
Residual impacts: The proposed infrastructure is of such a nature that the status quo could be regained after decommissioning of the plant. Providing that the site is rehabilitated to its current state, the visual impact will also be removed.		

Nature: Potential visual impact on the intrinsic value and sense of place of the Excelsior region.		
	Without Mitigation	**With Mitigation**
Extent	Local (2)	Local (2)
Duration	Long term (4)	Long term (4)
Magnitude	Medium (6)	Medium (6)
Probability	Highly probable (4)	Probable (3)
Significance	**Medium (48)**	**Medium (36)**
Status	Negative	Negative

Reversibility	Recoverable (3)	Recoverable (3)
Irreplaceable Loss of Resource?	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 outer boundaries of the individual project phases. Only indigenous plant species to be introduced and planted in such a manner and location which would not cast shadows on the PV 'strings'.
- 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 raising the PV platforms so that cattle can roam underneath the PV 'string'.
- Utilise existing roads and tracks to the extent possible. Where new roads are required, they should be two-track gravel roads, maintained to prevent dust plumes and erosion.

Cumulative impacts:

It is near impossible to distinguish built forms and structures at distances greater than 5km. However, the introduction of a PV plant with four phases of approximately 250 ha in total might have a cumulative effect on the observer.

Residual impacts:

The proposed infrastructure is of such a nature that the status quo could be regained after decommissioning of the plant. Providing that the site is rehabilitated to its current state, the visual impact will also be removed.

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

	Without Mitigation	**With Mitigation**
Extent	Local (2)	Local (2)
Duration	Long term (4)	Long term (4)
Magnitude	Minor (4)	Low (2)
Probability	Probable (3)	Probable (3)
Significance	**Medium (30)**	**Low (24)**
Status	Negative	Negative
Reversibility	Recoverable (3)	Recoverable (3)
Irreplaceable Loss of Resource?	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.
- Only minimum wattage light fixtures must be used.

Cumulative impacts:

The area within which the proposed activity is to be undertaken is relatively low lit. The occurrence of ancillary structures of the PV Plant will contribute to the cumulative lighting effect of the area but it is expected to be negligible in a local context.

Residual impacts: The proposed infrastructure is of such a nature that the status quo could be regained after decommissioning of the plant. Providing that the site is rehabilitated to its current state, the visual impact will also be removed.

Nature: Potential visual impact of reflection of the PV Panels on sensitive receptors.		
	Without Mitigation	**With Mitigation**
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 Resource?	No	No
Can Impacts Be Mitigated?	Yes	
Mitigation: » Consider installing anti-reflective coating or glass to reduce the sunlight that is reflected and increase the amount of sunlight that is absorbed. » Select the shortest possible route for power lines between individual phases and substation to reduce its visual appearance. » Consider laying electrical cables underground en-route to the substation.		
Cumulative impacts: The introduction of the PV plant, coupled with the power line, proposed and existing substations, contribute to an increased cumulative visual impact.		
Residual impacts: The proposed infrastructure is of such a nature that the status quo could be regained after decommissioning of the plant. Providing that the site is rehabilitated to its current state, the visual impact will also be removed.		

Implications for Project Implementation

» The results of the Visual Impact Assessment for the proposed Merapi Solar Facility – Phase 3 found that the proposed activity will have a medium impact from Key Observer Points identified in the *foreground* and *middle ground*(<3km).

» Cumulative impacts are associated with the other phases of the Merapi Solar Park as well as the existing Merapi Substation and overhead power lines.

» It is herewith recommended that the proposed activity be approved subject to the mitigation measures described in Environmental Management Programme.

» It is furthermore recommended that the proposed project phases be relocated to the south-eastern portions of the subject property (eastern portions of Farms Concordia and Ceylon). The northern phases of the project on the Farm Moedersgift No. 566 (i.e. Phases 1 and 2) present the areas which are most visually prominent. A relocation of this particular phase to an area further away from the receptors in Excelsior would benefit the project from a visual perspective. In addition, it is proposed that the project phases that front onto movement corridors be set back at least 200m from the latter roads in order to establish a proper buffer between the observer and the observed view.

10.3.5 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 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.

The tables which follow provide an assessment of the direct, indirect and cumulative social impacts expected to be associated with the construction and operation of the Merapi Solar Facility - Phase 3.

Impact tables summarising the significance of social impacts associated with the construction phase of the project (with and without mitigation)

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 of each phase of the 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 PVSEF and the associated components, including, access roads, services and power line.

The proposed 130MW Merapi Solar Park will be developed in 4 phases. The construction phase will therefore extend over a period of ~ 8 years. In terms of employment it is assumed that 70% of the original 291 construction workers employed to construct the 55 MW phase will be employed for the remaining 3 phases. The construction of the remaining 3 phases will therefore create an additional 90 employment opportunities (30% of 291) over and above the initial 291 associated with the construction of the first phase. The total number of employment opportunities created by the construction of all 4 phases will therefore be in the region of 381. Of this total ~ 60% (229) will be available to low-skilled workers (construction labourers, security staff etc.), 15% (57) to semi-skilled workers (drivers, equipment operators etc.) and 25% (95) to skilled personnel (engineers, land surveyors, project managers etc.).

Given the location of the site and its proximity to Excelsior, Winburg, Ladybrand and Bloemfontein, the majority of low and semi-skilled employment opportunities are likely to benefit members from the local community. The majority of the beneficiaries are also likely to be historically disadvantaged (HD) members of the community. The extended duration of the construction phase (8 years) also creates an ideal opportunity for contractor/s to implement an on-site training and skills development programme. This will further enhance to the potential employment opportunities for members from the local community. However, in the absence of specific commitments from the developer to employ local contractors the potential for meaningful skills development and training for members from the local communities are likely to be limited.

	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	Medium Term (3)	Medium Term (3)
Magnitude	Medium (6)	Medium (6)
Probability	Highly probable (4)	Highly probable (4)
Significance	**Medium (44)**	**Medium (48)**
Status (positive or negative)	Positive	Positive
Reversibility	N/A	N/A
Irreplaceable loss of resources?	N/A	N/A
Can impacts be enhanced?	Yes	

***Mitigation*:**

Employment

» Where reasonable and practical, SolaireDirect 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 SolaireDirect should meet with representatives from the MM 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 SolaireDirect 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

» SolaireDirect 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, SolaireDirect 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)

As indicated above, given the proximity of the site to Excelsior, Winburg, Ladybrand and Bloemfontein, including Botshabelo and Thaba Nchu, the majority of the 230 low and semi-skilled employment opportunities associated with the construction phase are likely to be taken up by members from the local community. If these workers are accommodated in their respective home towns then the potential risk posed to local communities will be low. 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. While the significance of the risk to the community as a whole will be low, the significance to individual members of the community who are impacted by the behavior of construction workers would be medium to high.

	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) **Moderate-High** for specific individuals who may be affected by STDs etc. (57)	**Low** for the community as a whole (24) **Moderate-High** for specific individuals who may be affected by STDs etc. (51)
Status (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	Yes, to some degree. However, the risk cannot be eliminated	

enhanced?	

Mitigation:

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

- Where possible, SolaireDirect 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;
- SolaireDirect should consider the need to establish 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;
- SolaireDirect 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;
- SolaireDirect and the contractor should implement an HIV/AIDS awareness programme for all construction workers at the outset of the construction phase;
- The movement of construction workers on and off the site should be closely managed and monitored by the contractors. In this regard the contractors should be responsible for making the necessary arrangements for transporting workers to and from site on a daily basis;
- The contractor should make the necessary arrangements for allowing workers from outside the area to return home over weekends and or on a regular basis during the 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:

- 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 impacts on the affected individuals and/or their families and the community.

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.

Despite the proximity of the farms to the R 709 and R 703, the local farmers interviewed indicated that stock theft was not serious problem in the area. In addition, stock farming was not carried out on a large scale in the area. Sunflowers and maize (corn) are the main crops grown in the area.

	Without enhancement	**With enhancement**
Extent	Local (3)	Local (2)
Duration	Medium Term (3)	Medium Term (3)
Magnitude	Moderate (6) (Due to reliance on agriculture and livestock for maintaining livelihoods)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	**Medium (36)**	**Low (27)**
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:

» SolaireDirect 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.;

» SolaireDirect 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 SolaireDirect and the contractors before the contractors move onto site;

» SolaireDirect 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 SolaireDirect, 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 SolaireDirect 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 SolaireDirect 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 and 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. The local farmers in the area interviewed did however indicate that veld fires were not a major concern. In addition, livestock farming is not the major agricultural activity in the area.		
	Without enhancement	**With enhancement**
Extent	Local (3) (Rated as 3 due to potential severity of impact on local farmers)	Local (2) (Rated as 2 due to potential severity of impact on local farmers)
Duration	Medium Term (3)	Medium Term (3)
Magnitude	Moderate (6) (Due to reliance on agriculture and livestock for maintaining livelihoods)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	**Medium (36)**	**Low (27)**
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: SolaireDirect 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:

- None, provided losses are compensated for.

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. The main access to the site would be via either the R709 and or 703. These two roads link up with the N8, to the south, and N1, to the north-west, respectively. Both the N1 and N8 are important communication routes, specifically the N1. The movement of construction related vehicles along either of these two routes has the potential to cause delays for other road users. However, these impacts will be spread out over the eight year timeframe of the construction phase, and can therefore, be effectively managed and mitigated. The social impacts associated with the movement of construction related traffic are therefore likely to be low.

	Without mitigation	**With mitigation**
Extent	Local (2)	Local (1)
Duration	Medium Term (3)	Medium Term (3)
Magnitude	Low (4)	Minor (2)
Probability	Probable (3)	Probable (3)
Significance	**Low (27)**	**Low (18)**
Status (positive or negative)	Negative	Negative
Reversibility	Yes	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	Yes	

Mitigation:

SolaireDirect 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 heavy vehicles and dust can be effectively mitigated. The aspects that should be covered include:

- The timing of the transport of components to the site should be timed to avoid weekends and holiday times so as to minimise the potential impact on travellers using the N1, N8, R 709 and R 703;
- 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 mitigation measures are implemented.

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 PVSEF and power lines will damage farmlands and result in a loss of farmlands for future farming activities.

The significance of these impacts can 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. In addition, it is standard practice for the affected landowner/s is to enter into a lease agreement that includes monthly rental. The loss of productive farmland would therefore be offset by such an agreement. It may also be possible for livestock and game to graze between the PV panels. The final disturbance footprint can also be reduced by careful site design and placement of components. In addition, the footprint associated with a 10MW solar facility is likely to be relatively small. 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. Recommended mitigation measures are outlined below.

	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, If compensation is not paid or area is not rehabilitated (60)**	**Low (20)**
Status	Negative	Negative
Reversibility	No, in case of footprint associated with solar thermal plant	
Irreplaceable loss of resources?	Yes, loss of farmland. However, disturbed areas can be rehabilitated	
Can impacts be mitigated?	Yes, loss of farmland. However, disturbed areas can be rehabilitated	
***Mitigation*:** The potential impacts associated with damage to and loss of farmland can be effectively mitigated. The aspects that should be covered include: » 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 provided disturbed areas are rehabilitated.		

Impact tables summarising the significance of social impacts associated with the operation phase of the project (with and without mitigation)

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.

<table>
<tr><td colspan="3">Nature of impact: Creation of employment and business opportunities associated with the operational phase

Based on the information provided by the proponent, the establishment of the proposed Merapi Solar Facility – Phase 3 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. For the purposes of the assessment it is assumed that there will be some overlap in terms of roles and responsibilities between phases should all 4 phases be implemented. For the purposes of the assessment it is assumed that there will be a 20% overlap for each additional phase. The total number of employment opportunities associated with the additional 3 phases will therefore be 144 (48 x 3).

Due the proximity of the site to Excelsior, Winburg, Ladybrand and Bloemfontein, including Botshabelo and Thaba Nchu, the majority of the work opportunities associated with the operational phase is 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.</td></tr>
<tr><td></td><td>Without mitigation</td><td>With mitigation</td></tr>
<tr><td>Extent</td><td>Local and Regional (2)</td><td>Local and Regional (3)</td></tr>
<tr><td>Duration</td><td>Long term (4)</td><td>Long term (4)</td></tr>
<tr><td>Magnitude</td><td>Low (4)</td><td>Moderate (6)</td></tr>
<tr><td>Probability</td><td>Probable (3)</td><td>Highly Probable (4)</td></tr>
<tr><td>Significance</td><td>Medium (30)</td><td>Medium (52)</td></tr>
<tr><td>Status (positive or negative)</td><td>Positive</td><td>Positive</td></tr>
<tr><td>Reversibility</td><td colspan="2">N/A</td></tr>
<tr><td>Irreplaceable loss of resources?</td><td colspan="2">No</td></tr>
<tr><td>Can impacts be mitigated?</td><td colspan="2">Yes</td></tr>
<tr><td colspan="3">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:
» SolaireDirect 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.</td></tr>
<tr><td colspan="3">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</td></tr>
<tr><td colspan="3">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.</td></tr>
</table>

Nature of impact: Establishment of a Community Trust funded by revenue generated from the sale of energy.

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 revenue from the proposed solar energy facility plant can be used to support a number of social and economic initiatives in the area, including:

» Creation of jobs;
» Education;
» Support for and provision of basic services;
» School feeding schemes;
» Training and skills development;
» Support for SMMEs.

In addition, the establishment of a solar energy facility plant is not likely to have a significant impact on the current agricultural land uses that underpin the local economic activities in the area. The loss of this relatively small area will not impact on the current and future farming activities.

	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 park.

Cumulative impacts:

» Promotion of social and economic development and improvement in the overall well-being of the community. Additional benefits will accrue if all phases of the project are implemented.

Residual impacts:

» Social and economic development and improvement in the overall well-being of the community.

<table>
<tr><td colspan="3">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 4 phases of the Merapi Solar Park relative to South Africa's total energy requirements will be limited. In addition, the current application is not unique. In this regard, a significant number of solar energy projects are currently proposed in other parts of South Africa. The potential contribution of the proposed Merapi Solar Park should therefore be regarded as valuable, but should not be overestimated.</td></tr>
<tr><td></td><td>Without Mitigation</td><td>With Mitigation
(The provision of renewable energy infrastructure is in itself a mitigation measure)</td></tr>
<tr><td>Extent</td><td>Local, Regional and National (4)</td><td>Local, Regional and National (4)</td></tr>
<tr><td>Duration</td><td>Long term (4)</td><td>Long term (4)</td></tr>
<tr><td>Magnitude</td><td>Minor (2)</td><td>Low (4)</td></tr>
<tr><td>Probability</td><td>Highly Probable (4)</td><td>Highly Probable (4)</td></tr>
<tr><td>Significance</td><td>Medium (40)</td><td>Medium (48)</td></tr>
<tr><td>Status (positive or negative)</td><td>Positive</td><td>Positive</td></tr>
<tr><td>Reversibility</td><td colspan="2">Yes</td></tr>
<tr><td>Irreplaceable loss of resources?</td><td colspan="2">Yes, impact of climate change on ecosystems</td></tr>
<tr><td>Can impacts be mitigated?</td><td colspan="2">Yes</td></tr>
<tr><td colspan="3">Mitigation:
» 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.</td></tr>
<tr><td colspan="3">Cumulative impacts:
» Contribution to the government targets for electricity generation from renewable energy.
» Reduced carbon emissions via the use of renewable energy and associated benefits in terms of global warming and climate change.</td></tr>
<tr><td colspan="3">Residual impacts:
» Reduced carbon emissions via the use of renewable energy and associated benefits in terms of global warming and climate change.</td></tr>
</table>

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. None of the local farmers, including adjacent farmers, interviewed raised concerns regarding the potential visual impact of the proposed project. Mr A Visagie, the principal of CVO Excelsior School, also indicated that the project was unlikely to have any impact on the school due to the distance of the school from the site. In addition, the Merapi substation is located on the north western boundary of the site, and two power lines associated with the substation traverse the site. The visual integrity of the site and the surrounding area has therefore been impacted by the existing energy related infrastructure on the site.		
	Without mitigation	**With mitigation**
Extent	Local (2)	Local (2)
Duration	Long term (4)	Long term (4)
Magnitude	Medium (4)	Medium (4)
Probability	Probable (3)	Probable (3)
Significance	**Medium (30)**	**Medium (30)**
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 as the impact will be removed after decommissioning.		

Nature of impact: Potential impact of the solar facility on local tourism The FSPGDP identifies tourism as an important economic sector. However, based on the findings of the SIA and 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 project and the areas altered sense of place. 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	Negative

	(Potential to distract from the tourist experience of the area) Positive (Potential to attract people to the area)	(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:

- » SolaireDirect should liaise with representatives from the MLM and local tourism representatives to raise awareness of the proposed facility.
- » SolaireDirect 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 impacts on tourism in Mantsopa Local Municipality area.

Residual impacts:

- » None as the facility will be removed after decommissioning.

Nature of impact: Potential visual impact and impact on sense of place associated with power line

The social impacts associated with multiple 22kV/132kV 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.

	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 as the impact will be removed after decommissioning

Implications for Project Implementation

- The findings of the SIA indicate that the development of the proposed Merapi Solar facility - Phase 3 will create employment and business opportunities for locals during both the construction and operational phase of the project. The establishment of a Community Trust funded by revenue generated from the sale of energy from the proposed facility also creates an opportunity to support local economic development in the area. This represents a social benefit for an area where there are limited opportunities.
- The proposed development also represents an investment in clean, renewable energy infrastructure, which, given the challenges created by climate change, represents a positive social benefit for society as a whole.
- The establishment of Phase 3 (55MW) of the proposed Merapi solar park is therefore supported by the findings of the SIA.

10.3. 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: Upgrading of Access Road		
Loss of vegetation, increase in runoff and erosion (as the road already exists, no additional impact on terrestrial fauna is expected to arise from the development)	Medium (Negative)	Low (Neutral)
Creation of Access Roads where existing tracks are insufficient		
Loss of vegetation, increase in runoff and erosion, displacement of fauna, possible alteration of drainage patterns	High (Negative)	Medium (Neutral)
Impacts on Ecology: Fencing area		
Loss of vegetation, loss of micro-habitat, increase in runoff and erosion, window of opportunity for	Medium (Negative)	Medium (Neutral)

Nature	Positive (+) ,Negative (-)or neutral Impact Without mitigation	Positive (+) ,Negative (-)or neutral Impact With mitigation
the establishment of alien invasive species, altered topsoil characteristics prone to capping, increased runoff and erosion		
Impacts on Ecology: Construction and operation of PV panels		
Loss of vegetation, loss of and alteration of microhabitats, altered vegetation cover, altered distribution of rainfall and resultant runoff patterns, increase in runoff and accelerated erosion, loss of faunal habitat and resource availability to terrestrial fauna	High (Negative)	Medium (Negative)
Impacts on Ecology: Construction of power lines to substation		
Loss of vegetation, increase in runoff and erosion, temporary displacement of terrestrial fauna. of soils, creation of runoff zone, possible contamination	Medium (Negative)	Low (Neutral)
Construction and operation of substation area		
Loss of vegetation, loss of micro-habitats, increased runoff and erosion, possibly altered chemistry of surrounding soils, window of opportunity for the establishment of alien invasive species	High (Negative)	Medium (Negative)
Impacts on Ecology: Construction and operation of workshop area and guard houses		
Loss of vegetation, increase in runoff and erosion, pollution, loss of faunal habitat and resource availability to terrestrial fauna	High (Negative)	Medium (Neutral)
Impacts on Soils and Agricultural Potential		
Loss of topsoil due to stripping, handling and placement of soil associated with pre construction land clearing and rehabilitation.	Moderate (Negative)	Low (Negative)
Change of soil's physical, chemical and biological properties due to loss of topsoil due to erosion, stockpiling, mixing of deep and surface soils during handling, stockpiling and	Moderate (Negative)	Low (Negative)

Nature	Positive (+) ,Negative (-)or neutral Impact Without mitigation	Positive (+) ,Negative (-)or neutral Impact With mitigation
subsequent placement.		
Change of natural surface topography due to reprofiling of surface after stripping.	Moderate (Negative)	Low (Negative)
Loss of land with high agricultural potential and land capability.	Moderate (Negative)	Low (Negative)
Potential Impacts on Heritage and Paleontological sites		
The disturbance/destruction of the historic farmstead (ruins) may occur (e.g. secondary impact) as a result of construction activities and development of associated infrastructure.	Low (Negative)	Low (Negative)
The disturbance/destruction of the historic farmhouse (ruins) and ‘disturbed area’ may occur (e.g. secondary impact) as a result of construction activities and development of associated infrastructure.	Low (Negative)	Low (Negative)
Discovery/destruction of unknown fossil deposits. Paleontological sites could be affected if bedrock was to be disturbed during the excavation activities associated with the construction	Low (Negative)	Low (Positive)
Potential Visual Impacts		
Potential visual impact of reflection of the PV Panels on the sensitive receptors.	Medium (Neutral)	Low (Neutral)
Potential visual impact on the intrinsic value and sense of place of the Excelsior region.	Medium (Negative)	Medium (Negative)
Potential visual impact of artificial lighting as a result of the activity.	Medium (Negative)	Low (Negative)
Potential visual impact of reflection of the PV Panels on the sensitive receptors	Low (Neutral)	Low (Neutral)
Potential Social Impacts During Construction		
Creation of employment and business opportunities	Medium (Positive)	Medium (Positive)
Potential impacts on family	Low for the community as	Low for the community

Nature	Positive (+) ,Negative (-)or neutral Impact	Positive (+) ,Negative (-)or neutral Impact
	Without mitigation	With mitigation
structures and social networks associated with the presence of construction workers	a whole Moderate-High for specific individuals who may be affected by STDs etc.	as a whole Moderate-High for specific individuals who may be affected by STDs etc.
Increased risk of stock theft, poaching and damage to farm infrastructure	Medium (Negative)	Low (Negative)
Potential increased incidence of veld fires	Medium (Positive)	Medium (Positive)
Potential noise, dust and safety impacts associated with movement of construction related traffic to and from the site	Low (Negative)	Low (Negative)
Loss of farmlands for future farming activities	High (Negative)	Low (Negative)
Potential Social Impacts During Operation		
Creation of employment and business opportunities associated with the operational phase	Low (Positive)	Medium (Positive)
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 (Positive)	High (Positive)
Promotion of clean, renewable energy	Medium (Positive)	Medium (Positive)
Visual impact and impact on sense of place	Medium (Negative)	Medium (Negative)
Potential impact of the solar thermal plant on local tourism	Low (Negative)	Low (Negative)
Potential visual impact and impact on sense of place associated with power lines	Low (Negative)	Low (Negative)

As can be seen from this table, there are no impacts of high significance expected to be associated with the construction and operation of the proposed Merapi Solar Facility – Phase 3, provided that the recommended mitigation measures are implemented. All identified impacts can therefore be mitigated to acceptable levels.

10.4. Assessment of Potential Cumulative Impacts

A cumulative impact, in relation to an activity, refers to the impact of an activity that in itself may not be significant, but may become significant when added to the existing and potential impacts eventuating from similar or diverse undertaking in the area [1].

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 Mpumalanga Province is earmarked as a potential solar energy hub for South Africa, considering the vast amounts land available. There are two proposed solar energy facilities proposed in the Nkangala District Municipality, the Machadodorp1 Solar Facility is located ~ 155 km north-east of the Kendal PV Solar facility. There is therefore sufficient distance between these proposed facilities to result in no cumulative impacts. Potential cumulative impacts relate to the visual impact, impact on flora and fauna, impact on agricultural potential and impact on the social environment. No impacts on heritage sites are expected as no sites were recorded within the development footprint of any of the proposed phases.

10.4.1. Visual Impacts

The Merapi Solar Facility site is located within a remote area within the Mantsopa Local Municipality. Considering the low population density in the District Municipality the visual impacts of multiple solar energy facilities will be low. In addition, the Merapi substation is located on the north western boundary of the site, and two power lines associated with the substation traverse the site. The visual integrity of the site and the surrounding area has therefore been impacted by the existing energy related infrastructure on the site.

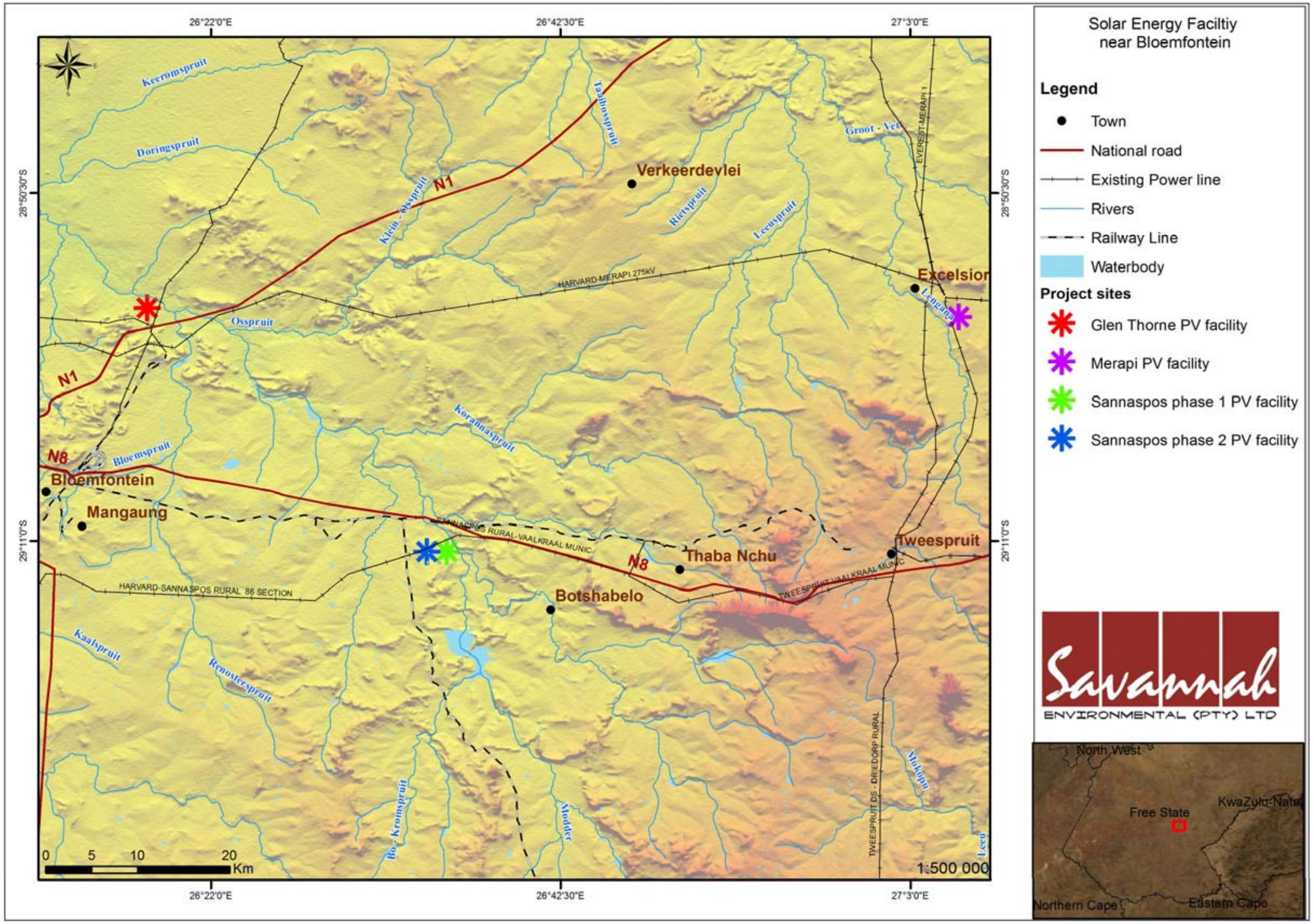

Figure 10.5: The location of the proposed Merapi Solar Energy Facility relative to the proposed Glen Thorne and Sannaspos solar energy facilities.

The table below assesses the potential visual impact for the establishment of a number of solar energy facilities in the Free State Province.

Nature: Visual impacts associated with the establishment of more than one solar 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	Negative	Negative
Reversibility	Yes. Solar energy plant components and other infrastructure can be removed.	
Irreplaceable loss of resources?	No	
Can impact be mitigated?	Yes	
Mitigation: Implement mitigation measures as proposed for each facility to minimise impacts.		
Residual impacts: None as the impact would be removed after decommissioning.		

10.4.2. Ecology Impacts

Negative cumulative ecological impacts include habitat loss and disturbance, and soil erosion. Individual projects will require proper management of environmental impacts during construction and operation. Cumulative ecological impacts relate to:

» possible erosion of areas lower than the panels
» possible contamination and siltation of the drainage lines and lower-lying wetlands
» possible fragmentation of plant populations
» possible alteration of occupancy by terrestrial fauna
» possible reduction of available habitat to terrestrial fauna
» possible spread and establishment of alien invasive species

Nature: Loss of vegetation, loss of and alteration of microhabitats, altered vegetation cover, altered distribution of rainfall and resultant runoff patterns, increase in runoff and accelerated erosion, loss of faunal habitat and resource availability to terrestrial fauna.		
	Without mitigation	**With mitigation**
Extent	Local (5)	Local (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	Very High (10)	Moderate (6)
Probability	Definite (5)	Definite (5)

Significance	**High (95)**	**Medium (60)**
Status (positive or negative)	Negative	Negative
Reversibility	Difficult to reverse	Partially reversible
Irreplaceable loss of resources?	Highly Probable	Probable
Can impacts be mitigated?	Reasonably	
Mitigation: » Implement mitigation measures as proposed for each facility to minimise impacts.		
Residual Impacts: » altered topsoil characteristics » altered vegetation composition » altered habitat and resource availability to terrestrial fauna		

10.4.3. Impacts on Agricultural Potential

Cumulative impacts on agricultural potential would be associated with impacts on cultivated lands and/or areas of high potential. The cumulative impact of a loss in the agricultural potential associated with the establishment of Phases 1 – 4 of the Merapi Solar Facility is considered low as areas of high potential and cultivated fields have been avoided by the placement of infrastructure.

Nature: Loss of land with agricultural potential and land capability.		
	Without mitigation	***With mitigation***
Extent	Local (1)	Local (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	Low (4)	Low (4)
Probability	High Probable (4)	High Probable (4)
Significance	**Moderate (40)**	**Low (16)**
Status	Negative	Negative
Reversibility	Medium	Medium
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Direct impacts cannot be mitigated but direct impacts can be minimised and avoided through adequate planning of layout.	
Mitigation: » Implement mitigation measures recommended for each phase of development in order to minimise impacts.		
Residual impacts: » Minor loss of grazing land while facility is in use.		

10.4.4. Social Impacts

Cumulative social impacts would be of medium (positive), regional significance as there would be creation of employment and business opportunities and would include the benefits associated with the establishment of Community Trusts in the municipal area. There would also be an increase in job opportunities and skills development due to these projects. The negative cumulative impacts could be

related an influx of job seekers to the area but localised for each site, and if managed well it can be of low negative impact. The overall cumulative impacts are acceptable. In terms of land use, the dominate land use in the district municipality will not be compromised due to the vast amounts of land available in the Free State. The table below assesses the potential social impact for the establishment of a number of solar energy facilities in the Free State Province.

Nature: The establishment of a number of solar energy facilities in the Free State Province will create employment, skills development and training opportunities, creation of downstream business opportunities and stimulation of the local property market.		
	Without Enhancement	**With Enhancement**
Extent	Local and regional (3)	Local and regional (4)
Duration	Long term (4)	Long term (4)
Magnitude	Low (4)	Moderate (6)
Probability	Highly Probable (4)	Definite (5)
Significance	**Medium (44)**	**High (70)**
Status	Positive	Positive
Reversibility	Yes. Solar energy plant components and other infrastructure can be removed.	
Irreplaceable loss of resources?	No	
Can impact be enhanced?	Yes	
Mitigations: » SolaireDirect 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; » SolaireDirect 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 20-25 year operational life of the facility. The rationale for the establishment of a Rehabilitation Trust Fund is linked to the experiences with the mining sector in South Africa and failure of many mining companies to allocate sufficient funds during the operational phase to cover the costs of rehabilitation and closure. SolaireDirect have indicated that the rehabilitation programme will be funded by sale of scrap metal etc. on closure of the facility.		
***Residual impacts*:** Positive impact on the local and regional economy through the creation of downstream opportunities and wage spend in the local economy		

10.5. Assessment of the Do Nothing Alternative

The 'do-nothing' alternative is the option of not constructing the proposed Merapi Solar Energy Facility - Phase 3. Should this alternative be selected, there would be no impacts on the site due to the construction and operation activities of a solar energy facility. However, there will be impacts at a local and a broader scale.

The primary considerations pertaining to the do-nothing alternative relate to:

5. The current land-use regime of the site; and
6. The need to diversify the energy mix in South Africa.

These are discussed in further detail below.

5. The agricultural potential of the site is mainly determined by climatic parameters such as rainfall distribution and frequency as well as wind prevalence. The site is considered to have low agricultural potential. The current land-use on the site is agriculture (livestock and game farming). The "do nothing" alternative would retain the current land-use, with a resultant lost opportunity to generate renewable energy from the wind and at the same time continue current agricultural activities on areas that fall outside of the proposed solar energy facility infrastructure. The development of the solar energy facility would allow current agricultural activities on areas of the farm portions which will not be occupied by solar panels and associated infrastructure. Therefore the current land-use will be retained, while also generating renewable energy from the sun. In addition, the landowner would obtain an income from the facility (as the developer would pay a percentage of the revenue generated to the landowner in accordance with the lease agreement for the use of the land). This would contribute towards the financial stability of the landowner which would in turn contribute to the financial viability of the farming practices on the property. The do nothing alternative would result in a lost opportunity for the landowner (in terms of revenue) and the country (in terms of renewable energy).

6. At a broader scale, the benefits of additional capacity to the electricity grid and those associated with the introduction of renewable energy would not be realised. Although the facility is only proposed to contribute approximately 55MW to the grid capacity, this would assist in meeting the growing electricity demand throughout the country and would also assist in meeting the government's goal for renewable energy.

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

» **Increased energy security:** The current electricity crisis in South Africa highlights the significant role that renewable energy can play in terms of power supplementation. In addition, given that renewables can often be deployed in a decentralised manner close to consumers, they offer the opportunity for

improving grid strength and supply quality, while reducing expensive transmission and distribution losses.

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

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

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

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

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

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

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

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

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

The table below provides an assessment of the potential impacts associated with the no-development alternative.

Nature: 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 Enhancement**[13]
Extent	Local-Regional (3)	Local-Regional (4)
Duration	Long term (4)	Long term (4)
Magnitude	Medium (6)	Medium (6)
Probability	Definite (5)	Definite (5)
Significance	High (65	High (70)
Status	Negative	Positive
Reversibility	Yes	
Irreplaceable loss of resources?	Yes, impact of climate change on ecosystems	
Can impact 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.		
***Cumulative impacts*:** Reduce carbon emissions via the use of renewable energy and associated benefits in terms of global warming and climate change.		
***Residual impacts*:** Reduce carbon emissions via the use of renewable energy and associated benefits in terms of global warming and climate change.		

[13] Enhancement assumes development of the proposed PVSEF and establishment of Community Trust

CONCLUSIONS AND RECOMMENDATIONS: PHASE 3 CHAPTER 11

The Merapi Solar Energy Facility – Phase 3 is proposed to be developed as a commercial solar energy facility located on Portion 0 of Farm 374 Concordia, and Portion 1 of Farm 1547 De Hoop which falls within the Mantsopa Local Municipality of the Free State Province (refer to Figure 11.1). 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 SolaireDirect Southern Africa (Pty) Ltd, as an IPP, is investigating the establishment of a 130 MW (155 installed capacity) photovoltaic solar park for the purpose of commercial electricity generation. The proposed Merapi Solar Facility – Phase 3 facility is proposed to be approximately 55MW in capacity and forms part of this larger solar park. The proposed facility will require approximately 85 ha and will be comprised of the following primary elements (refer to Chapter 2 for more details):

» An array of PV panels.
» An on-site substation and 22kV/132kV overhead power line to facilitate the connection between the solar energy facility and the Eskom electricity grid.
» Internal access roads.
» Guard house,
» Laydown, Campsite and assembly area.
» Office and Control centre.

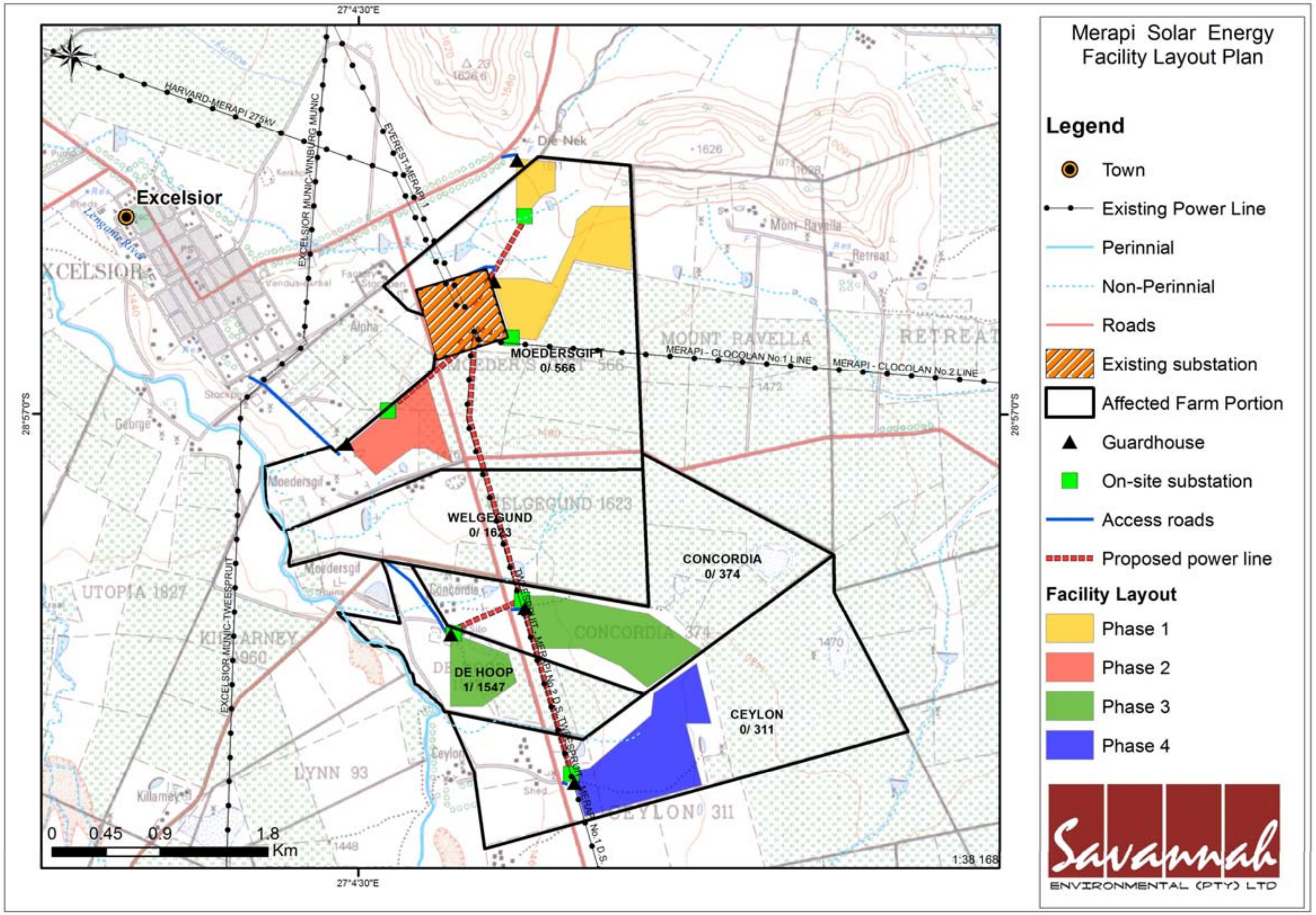

Figure 11.1: Locality map illustrating the location of the assessed development site for the proposed Merapi Solar Park and preliminary layout of the proposed facility, indicating the location proposed for the 4 project phases

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), SolaireDirect Southern Africa (Pty) Ltd requires authorisation from the National Department of Environmental Affairs (DEA) (in consultation with the Free State DETEA 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[14] 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 M).

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

11.1. Evaluation of Merapi Solar Energy Facility – Phase 3

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 Merapi Solar Energy Facility – Phase 3 by providing a summary of the conclusions of the assessment of the proposed site for the development of the PV solar energy

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

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 environmental fatal flaws which were identified to be associated with the site. No go areas identified include areas of high ecological sensitivity (small rocky outcrops, ridges, footslopes of larger mountains and riparian areas). In summary, the most significant environmental impacts associated with the Merapi Solar Energy Facility – Phase 3, 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 agricultural potential,
» Impacts on the social environment.

11.1.1. Local Site-specific Impacts

The construction of the Merapi Solar Energy Facility – Phase 3 will lead to permanent disturbance of an area of ~55ha in extent. Permanently affected areas include the area for the PV panels and associated infrastructure, as well as the internal 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, but degraded due to continued heavy grazing. Areas of sensitivity within the proposed development site were identified through the EIA process. These relate to the local ecology (sensitive and protected vegetation, habitat for fauna, several small drainage lines, man-made dams and natural vleys occur within the project area). (Refer to the sensitivity map – Figure 11.2).

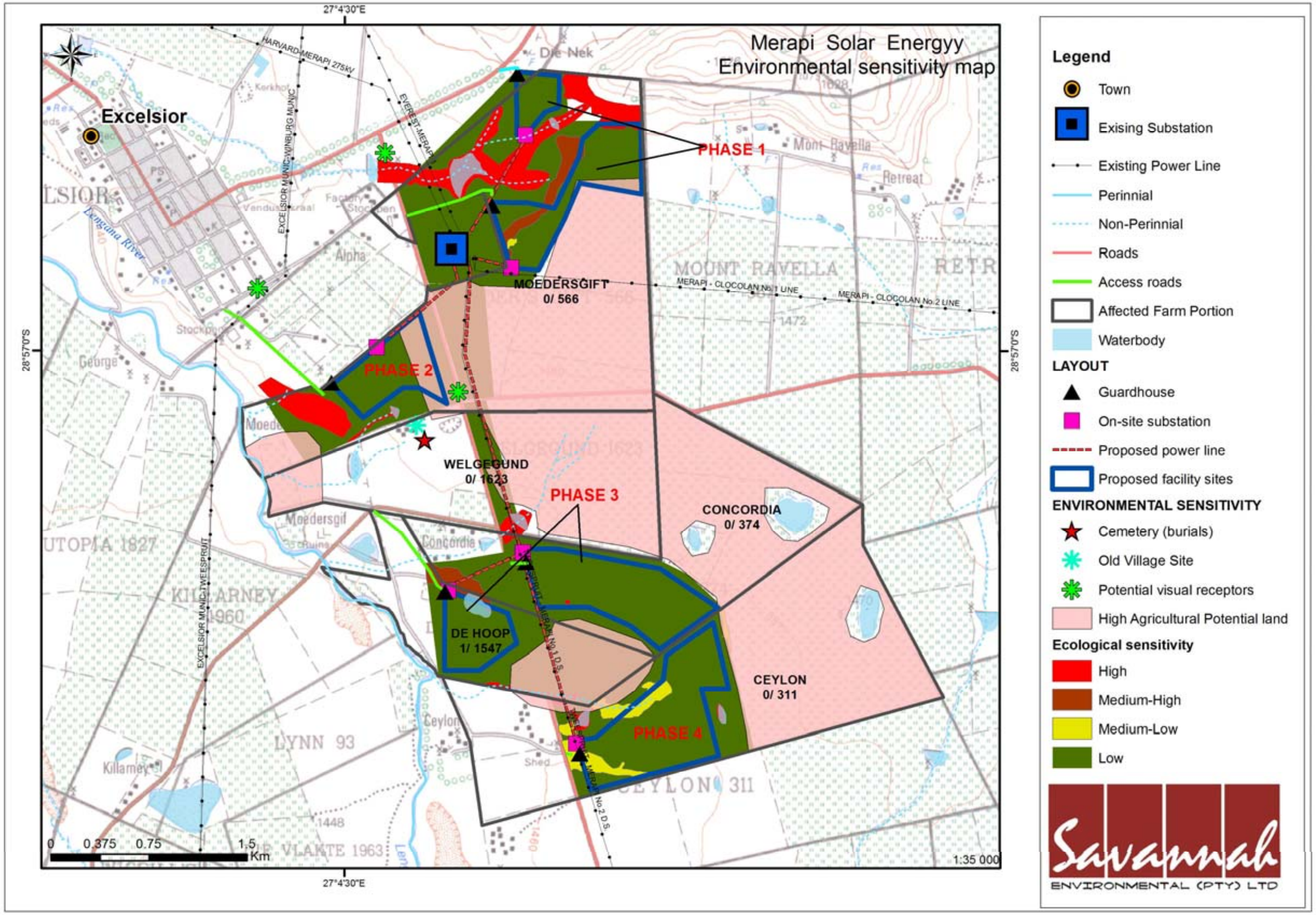

Figure 11.2: Sensitivity map for the Merapi Solar Energy Facility.

Areas of high sensitivity include rocky outcrops, ridges, and small koppies which are a habitat for several protected species found near the sites. Once these habitats have been physically altered, they cannot be recreated or returned to their former diversity and functionality therefore should be treated as no-go areas. Other sensitive ecological areas include dense vegetation of the riparian areas fringing the drainage channels which is essential in keeping the drainage channel intact and protects it from erosion as well as footslopes of larger mountains and riparian areas. These areas have been avoided through the careful placement of infrastructure. The proposed facility is located within areas of low sensitivity. An area classified as being of Medium-High sensitivity is located in close proximity to a portion of this proposed development. Appropriate mitigation is required to be implemented in order to minimise impacts on this area. It is concluded through the specialist investigations undertaken that impacts on ecology associated with the proposed development can be mitigated to acceptable levels.

No impacts on heritage sites are expected to occur as no heritage sites were recorded within the proposed development footprint.

11.1.2. Visual Impacts

Most of the potential impacts associated with the proposed facility relate to the foreground and middle ground zone of visual influence (i.e. within 3km of the proposed facility). The visual analysis and assessment from all selected observation points found that the proposed activity is potentially visible and recognisable from Key Observation Points along the R703 and R709 as well as from Excelsior itself. The results of the Visual Impact Assessment for the proposed Merapi Solar Park therefore found that the proposed activity will have a **medium** impact from KOPs identified in the *foreground* and *middle ground* (<3km). This impact is partially mitigated by the presence of the Merapi substation is located on the north western boundary of the site, and two power lines associated with the substation traverse the site. The visual integrity of the site and the surrounding area has therefore been impacted by the existing energy related infrastructure on the site.

Other solar energy facilities are located in the same district as the proposed Merapi Solar Energy Facility (Refer to Figure 11.3). Based on the findings of the specialist studies undertaken, the potential cumulative visual impacts are expected to be low. This is due to the distance between facilities as well as the sparsely populated nature of the region.

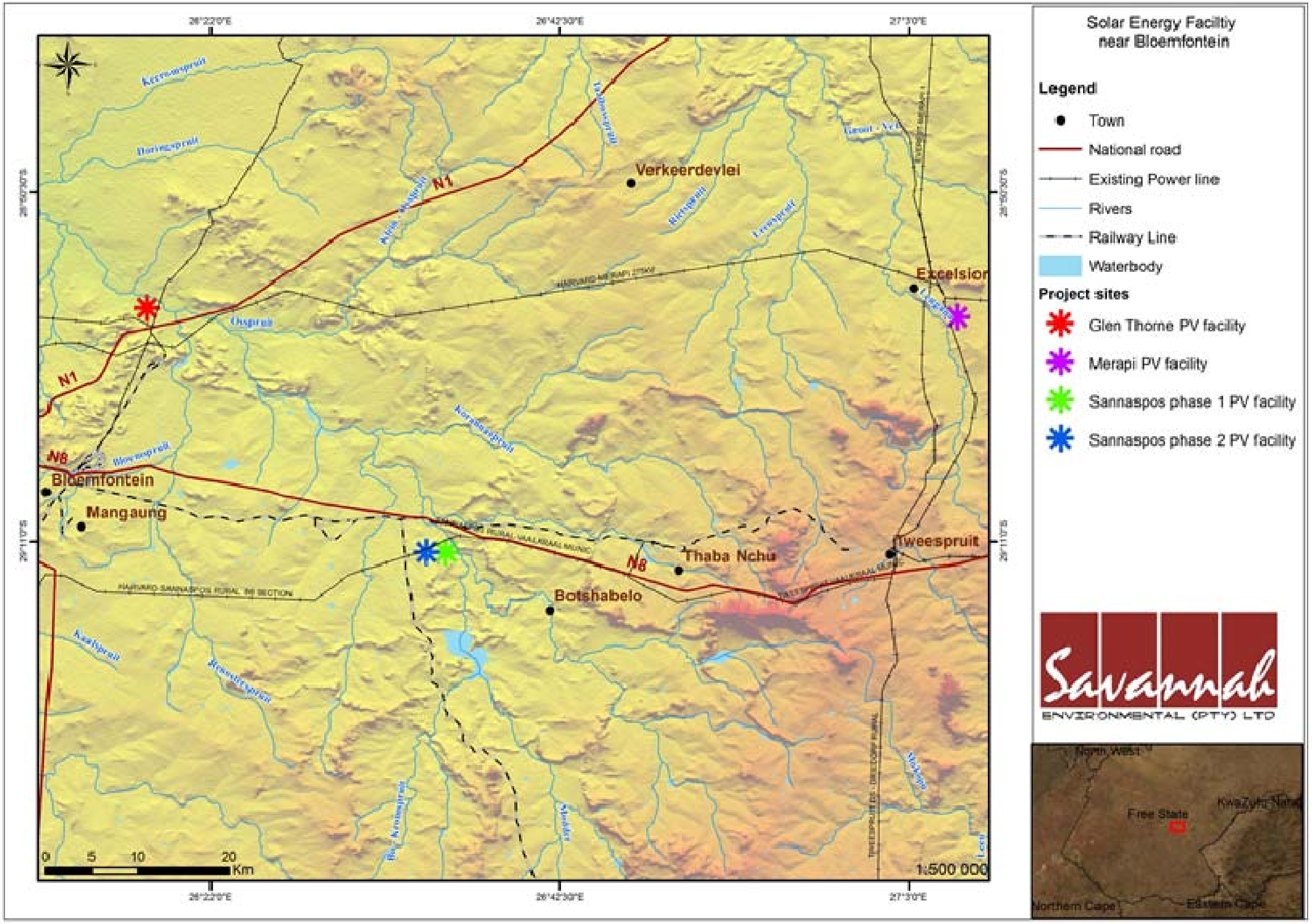

Figure 11.3: Locality map showing the Solar Energy Facility proposed in close proximity to the Merapi Solar Energy Facility.

11.1.3. Impacts on Agricultural potential

The majority of the site (95%) is proposed on Mispah and Sterkspruit soils. These soils type have low-medium agricultural potential. However a small portion of the facility will occupy the Clovelly soil of type, and these soils are known to be of medium-high agricultural potential. As the majority of the development footprint is located outside of areas of high agricultural potential and cultivated fields, the impact on agricultural potential is considered acceptable. It is recommended that the proposed project be approved subjected to the mitigation measures stipulated in the Environmental Management Programme since these soils type are suitable for rehabilitation purposes.

11.1.4. 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 largely restricted to daylight hours, and the construction phase is anticipated to extend for a minimum period of 18-months. Negative impacts during construction relate mainly to impacts due to the presence of construction workers and visual impact imposed by the facility on the local environment. 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. This will be a positive impact due to the high unemployment levels in the area. The positive impact due to employment creation will be lower during operation as there will be a limited number of staff required compared to the construction phase.

11.2. 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 generating capacity of 55MW on a site located on Portion 0 of Farm 374 Concordia, and Portion 1 of Farm 1547 De Hoop has been established by SolaireDirect Southern Africa (Pty) Ltd. The positive implications of establishing a solar energy facility on the identified site within the Free State include the following:

» The potential to harness and utilise solar energy resources within the Free State Province.
» The consolidation of solar facility infrastructure within an area (specifically considering the proximity to Phases 1, 2, and 4 of the Merapi Solar park, as well as to the proposed Sannaspos and Glen Thorne solar facilities to be developed).
» 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 Free State Province would benefit from the additional generated power.
» Promotion of clean, renewable energy in South Africa
» Creation of local employment, business opportunities and skills development for the area.

The findings of the specialist studies undertaken within this EIA to assess both the benefits and potential negative impacts anticipated as a result of the proposed project conclude that 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 the majority of identified negative impacts can be reduced by implementing the recommended mitigation measures. The project is therefore considered to meet the requirements of sustainable development. Environmental specifications for the management of potential impacts are detailed within the draft Environmental Management Programme (EMP) included within Appendix M.

With reference to the information available at this planning approval stage in the project cycle, the **confidence** in the environmental assessment undertaken is regarded as **acceptable**.

11.3. 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 Merapi Solar Energy Facility – Phase 3 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:

» A minimum legal buffer of development of 32 m from drainage lines should be observed. It is recommended that a buffer of at least 100 m be maintained around riparian areas. Where this is not possible, alternative mitigation measures as detailed in this report must be implemented and relevant permits must be obtained.
» Following the final design of the facility, a final 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 M 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 throughout the construction and operation of the facility.
» 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.
» Existing access roads on site should be used as far as possible.
» 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 SolaireDirect Southern Africa (Pty) Ltd must be submitted to the relevant regulating authorities.

ASSESSMENT OF POTENTIAL IMPACTS: MERAPI PHASE 4 CHAPTER 12

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 SolaireDirect Merapi Solar Facility - Phase 4. This assessment is undertaken for the 46 MW solar facility and for all the facility's components, as detailed in the following table:

Component	Description
Location of the site	~ 5 km south-east of Bloemfontein
Municipal Jurisdiction	Mantsopa Local Municipality; Motheo District Municipality
Extent of the proposed development footprint (four phases)	~70 ha
Extent of broader site available for development	~1505 ha
Site access	The site can be accessed easily via the R709 main road which crosses through the proposed sites, as well as via farm gravel roads. The farm roads will be upgraded and used to access the facility site during construction and operation.
Generating capacity(four phases)	46 MW
Proposed technology	Photovoltaic panels
Associated infrastructure	» An on-site substation and 22kV/132kV overhead power line to facilitate the connection between the solar energy facility and the Eskom electricity grid. » Internal access roads (~4m wide x 50m in length) » Guard house » Laydown, campsite and assembly area. » Office and Control centre.
Water use	» ~3 million litres/year required during the construction phase and 460,000 litres/year for operations, » Water requirements for the construction phase of the PV power facility will be supplied by the Local Water Users' Association. Alternatively water will be provided

Component	Description
	via a rainwater tank. » No effluent will be produced except for the normal sewage from site and operations staff. This will be treated as per normal standards with a septic tank and disposed of at an appropriate licensed facility off-site.

The development of the Merapi Facility – Phase 4 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 18-24 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.

12.1. Methodology for the assessment of Potentially Significant Impacts

A broader site of 1505 ha (i.e. on Portion 0 of Farm 311 Ceylon, Portion 0 of Farm 566 Moedersgift, Portion 0 of Farm 374 Concordia, and Portion 1 of Farm 1547 De Hoop) was identified by the project developer for the purpose of establishing the proposed Merapi Facility Phase 1-4. The total developmental footprint will cover an extent of <250 ha and can therefore be accommodated within the broader site. Phase 4 of the facility is proposed to be developed on Portion 0 of Farm 311 Ceylon. An area of 70ha is required for the development of this phase of the project.

The assessment of potential issues associated with the development of the Merapi Solar Facility - Phase 4 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.

12.2. 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.

12.2.1Potential Impacts on Ecology

Solar energy facilities require relatively large areas of land for placement of infrastructure. This PV facility requires ~150 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 as shown on Figure 12.1 below identifies those parts of the study area that have high conservation value or that may be sensitive to disturbance. This sensitivity assessment is based on a desktop study, detailed field evaluation of the site and detailed analysis of aerial photography. A detailed methodology is included within the Ecology report (See Appendix E).

(a) Summary of Ecological Impacts

The majority of impacts on ecology will occur during the construction of the proposed PV facility. A risk assessment was undertaken as part of the ecological impact assessment, which identified the main potential negative impacts on the ecological receiving environment. Potential impacts were identified as follows:

» Loss of vegetation, increase in runoff and erosion;
» Loss of micro-habitat, window of opportunity for the establishment of alien invasive species, altered topsoil characteristics prone to capping;

» Altered distribution of rainfall and resultant runoff patterns, increase in runoff and accelerated erosion, loss of faunal habitat and resource availability to terrestrial fauna;
» Temporary displacement of terrestrial fauna; and
» Increase in pollution, loss of faunal habitat and resource availability to terrestrial fauna

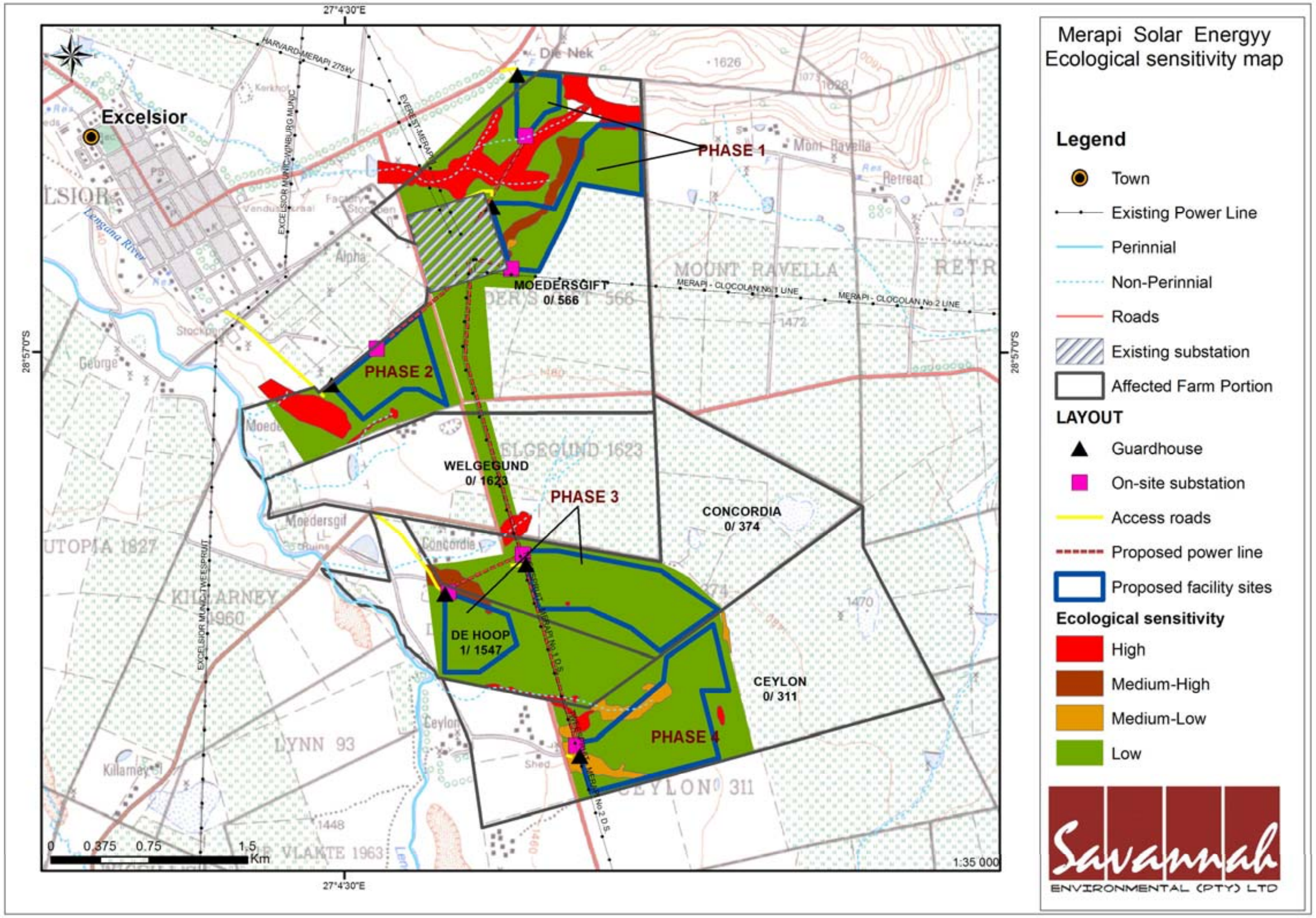

Figure 12.1: Ecology sensitivity map for the study area: Red indicates areas with *High Sensitivity* that should be avoided as far as possible; the remainder of the study area has Medium-High and Low *Sensitivity* where development can take place with certain mitigation measures

The following is assumed with regards to the ecological impacts:

» Existing access roads and tracks will be used and upgraded as far as possible, whilst new servitudes or power lines will coincide as far as possible with existing infrastructure;
» The proposed development will be as close as possible to existing electricity infrastructure, thus minimising the need for additional overhead power lines to connect to the grid;
» A thorough ecological investigation be conducted of all footprint areas to detect and relocate all plant species of conservation concern by a suitably qualified botanist prior to a geotechnical survey and construction;
» Development of the PV-footprint area will retain a minimum 50 m (preferably 100 m) buffer from all drainage lines and/or wetlands within the area assessed; and
» Prior to development the footprint area will be entirely cleared of all alien invasive plants.

The tables which follow provide an assessment of the direct, indirect and cumulative impacts on ecology expected to be associated with the construction and operation of the Merapi Solar Facility - Phase 4.

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

Upgrading of Access Road

Nature: Loss of vegetation, increase in runoff and erosion (as the road already exists, no additional impact on terrestrial fauna is expected to arise from the development)		
	Without mitigation	**With mitigation**
Extent	Local (3)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Low (4)	Small (0)
Probability	Definite (5)	Definite (5)
Significance	**Medium (55)**	**Low (25)**
Status (positive or negative)	Negative	Neutral
Reversibility	Not reversible	Partially reversible
Irreplaceable loss of resources?	Probable	Not likely
Can impacts be mitigated?	Reasonably	
Mitigation: » Make use of existing tracks as far as possible » Ensure an adequate plant search and rescue program is developed and implemented prior to commencement of activity; especially geophytes may need to be relocated » Reinforce portions of existing access routes that are prone to erosion, create structures or low banks to drain the access road rapidly during rainfall events, yet preventing erosion of the track and surrounding areas » Ensure that runoff from compacted or sealed surfaces is slowed down and dispersed		

sufficiently to prevent accelerated erosion from being initiated (storm water and erosion management plan required, together with revegetation of adjacent areas) » Prevent leakage of oil or other chemicals or any other form of pollution » Monitor the establishment of alien invasive species and remove as soon as detected, whenever possible before regenerative material can be formed » After decommissioning, if access roads or a portion thereof will not be of further use to the landowner or project, remove all foreign material and rip area to facilitate the establishment of vegetation
Cumulative impacts: » Possible erosion of areas lower than the access road, possible contamination of lower-lying wetlands due to oil or other spillage » Possible spread and establishment of alien invasive species
Residual Impacts: » Altered vegetation composition and structure » Barren areas » Potential for erosion

Creation of Access Roads where existing tracks are insufficient

Nature: Loss of vegetation, increase in runoff and erosion, displacement of fauna, possible alteration of drainage patterns		
	Without mitigation	**With mitigation**
Extent	Local (3)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Moderate (6)	Low (4)
Probability	Definite (5)	Definite (5)
Significance	**High (65)**	**Medium (45)**
Status (positive or negative)	Negative	Neutral
Reversibility	Not reversible	Partially reversible
Irreplaceable loss of resources?	Probable	
Can impacts be mitigated? Reasonably		
Mitigation: » Follow routes of existing tracks or fence lines as far as possible » Ensure adequate drainage and specific erosion control if and where access roads need to cross drainage lines » Ensure an adequate plant search and rescue program prior to commencement of activity, especially geophytes may need to be relocated » Reinforce portions of existing access routes that are prone to erosion, create structures or low banks to drain the access road rapidly during rainfall events, yet preventing erosion of the track and surrounding areas » Ensure that runoff from compacted or sealed surfaces is slowed down and dispersed sufficiently to prevent accelerated erosion from being initiated (storm water and erosion management plan required, together with revegetation of adjacent areas) » Prevent leakage of oil or other chemicals or any other form of pollution » Monitor the establishment of alien invasive species and remove as soon as detected, whenever possible before regenerative material can be formed » After decommissioning, if access road or portion thereof will not be of further use to the		

landowner, remove all foreign material and rip area to facilitate the establishment of vegetation
Cumulative impacts: » Possible erosion of cleared areas and thus also accelerated erosion from surrounding areas » Possible excessive fragmentation and thus reduction of core habitats that may negatively influence species population viability
Residual impacts: » Altered vegetation composition » Compacted topsoils » Possibility for erosion

Fencing area – may also serve as access road to PV panels and fire-break

Nature: Loss of vegetation, loss of micro-habitat, increase in runoff and erosion, window of opportunity for the establishment of alien invasive species, altered topsoil characteristics prone to capping, increased runoff and erosion. As fences already exist, no significant additional impact on terrestrial fauna is expected to arise from the development.		
	Without mitigation	**With mitigation**
Extent	Local (2)	Local (1)
Duration	Long-term (4)	Long term (4)
Magnitude	Moderate (6)	Small (1)
Probability	Definite (5)	Definite (5)
Significance	**Medium (60)**	**Medium (30)**
Status (positive or negative)	Negative	Neutral
Reversibility	Partially reversible	Largely reversible
Irreplaceable loss of resources?	Probable	
Can impacts be mitigated? Reasonably		
Mitigation: » Minimise area affected, especially during construction » Avoid development and disturbance on low rocky ridges or outcrops as well as plains adjacent to and drainage lines themselves » Use topsoils removed for redistribution outside the LOWEST borders of the development to stop erosion off the cleared areas, possibly to construct contour buffer strips to help limit erosion » Remove and collect all bulbous plants from cleared areas and transplant onto the newly redistributed topsoils, together with other species used for revegetation » Prevent leakage of oil or other chemicals » Monitor the establishment of alien invasive species and remove as soon as detected, whenever possible *before* regenerative material can be formed » Should the area along the fence be used for occasional access and fire breaks, regular mowing of the grass layer to reduce fire loads is recommended rather than the removal of vegetation		
Cumulative impacts: » Possible erosion of cleared areas and thus also accelerated erosion from surrounding areas » Possible excessive fragmentation and thus reduction of core habitats that may negatively influence species population viability		

Residual impacts:

» Altered vegetation composition
» Compacted topsoils
» Possibility for erosion

Construction and operation of PV panels

Nature: Loss of vegetation, loss of and alteration of microhabitats, altered vegetation cover, altered distribution of rainfall and resultant runoff patterns, increase in runoff and accelerated erosion, loss of faunal habitat and resource availability to terrestrial fauna.		
	Without mitigation	**With mitigation**
Extent	Local (5)	Local (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	Very High (10)	Moderate (6)
Probability	Definite (5)	Definite (5)
Significance	**High (95)**	**Medium (60)**
Status (positive or negative)	Negative	Negative
Reversibility	Difficult to reverse	Partially reversible
Irreplaceable loss of resources?	Highly Probable	Probable
Can impacts be mitigated?	Reasonably	

Mitigation:

» Keep areas affected to a minimum
» Utilise area as close as possible to existing infrastructure, keep buffer zone of a minimum of 50m, preferably 100 m, around drainage lines
» Keep levelling earthworks and soil disturbance to the minimum practically possible
» Develop and implement a comprehensive topsoil management, soil erosion control and rehabilitation plan once layouts have been finalised
» Remove as little indigenous vegetation as practically possible
» Revegetate areas below/between panels immediately after construction ceases
» Relocate all geophytes, or use as far as possible in rehabilitation efforts
» No development on drainage lines or other wetlands and low rocky ridges and outcrops, limit development on lower-lying plains adjacent to drainage lines
» Monitor the area below the PV panels regularly after larger rainfall events to determine where erosion may be initiated and then mitigate by modifying the soil microtopography and revegetation efforts accordingly
» Aim to maintain a reasonable cover of indigenous perennial vegetation throughout the operational phase within and on the periphery of the PV array, preferably low dense perennial grasses that can be mowed as required to reduce fuel loads
» Prevent leakage of oil or other chemicals
» Monitor the establishment of alien invasive species and remove as soon as detected, whenever possible before regenerative material can be formed

Cumulative impacts:

» possible erosion of areas lower than the panels
» possible contamination and siltation of the drainage lines and lower-lying wetlands
» possible fragmentation of plant populations
» possible alteration of occupancy by terrestrial fauna
» possible reduction of available habitat to terrestrial fauna
» possible spread and establishment of alien invasive species

Residual Impacts:
» altered topsoil characteristics
» altered vegetation composition
» altered habitat and resource availability to terrestrial fauna

Construction of power lines to substation

Nature: Loss of vegetation, increase in runoff and erosion, temporary displacement of terrestrial fauna		
	Without mitigation	**With mitigation**
Extent	Local (2)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Minor (2)	Small (0)
Probability	Definite (5)	Definite (5)
Significance	**Medium (40)**	**Low (25)**
Status (positive or negative)	Negative	Neutral
Reversibility	Partially reversible	Partially reversible
Irreplaceable loss of resources?	Probable	Not likely
Can impacts be mitigated?	Reasonably	
Mitigation: » Place pylons as far as possible on sites where the slope and erosion risk is minimal or negligible » No pylons may be placed within drainage lines or 32 m of such without the appropriate permits » Riparian areas may not be used as access points to pylon areas » Conduct a search and rescue operation for bulbous plants prior to pylon construction » Prevent spillage of construction material beyond area affected » Monitor the establishment of alien invasive species and remove as soon as detected, whenever possible before regenerative material can be formed		
Cumulative impacts: » Possible erosion of surrounding areas, no major cumulative impact on vegetation expected		
Residual Impacts: » Very localised alteration of soil surface characteristics		

Construction and operation of substation area

Nature: Loss of vegetation, loss of micro-habitats, increased runoff and erosion, possibly altered chemistry of surrounding soils, window of opportunity for the establishment of alien invasive species. After decommissioning: altered topsoil characteristics with low moisture infiltration capacity, low niche diversity, and increased runoff and slow plant establishment.		
	Without mitigation	**With mitigation**
Extent	Local (3)	Local (2)
Duration	Long-term (4)	Long-term (4)

Magnitude	Moderate (6)	Low (4)
Probability	Definite (5)	Definite (5)
Significance	**High (65)**	**Medium (50)**
Status (positive or negative)	Negative	Negative
Reversibility	Low reversibility	Partially reversible
Irreplaceable loss of resources?	Highly probable	Probable
Can impacts be mitigated?	Reasonably	

Mitigation:

» Place pylons as far as possible on sites where the slope and erosion risk is minimal or negligible
» No pylons may be placed within drainage lines or 32 m of such without the appropriate permits
» Riparian areas may not be used as access points to pylon areas
» Conduct a search and rescue operation for bulbous plants prior to pylon construction
» Prevent spillage of construction material beyond area affected
» Monitor the establishment of alien invasive species and remove as soon as detected, whenever possible before regenerative material can be formed

Cumulative impacts:

» Possible erosion of surrounding areas, no major cumulative impact on vegetation expected

Residual Impacts:

» Very localised alteration of soil surface characteristics

Construction and operation of workshop area and guard houses

Nature: Loss of vegetation, increase in runoff and erosion, pollution, loss of faunal habitat and resource availability to terrestrial fauna

	Without mitigation	**With mitigation**
Extent	Local (4)	Local (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	Moderate (6)	Low (4)
Probability	Definite (5)	Definite (5)
Significance	**High (70)**	**Medium (50)**
Status (positive or negative)	Negative	Neutral
Reversibility	Difficult to reverse	Partially reversible
Irreplaceable loss of resources?	Probable	Probable
Can impacts be mitigated?	Reasonably	

Mitigation:

» Avoid placing infrastructure on rocky ridges and outcrops, within 100 m of any drainage line or in the lowest sections of the landscape (where no drainage lines have developed up to date but where moisture does accumulate seasonally due to the topography), restrict to vegetation Association 2 as far as possible
» Limit disturbance to footprint area as far as practically possible – including disturbance to soil
» Implement a comprehensive topsoil management plan as soon as layout plans are finalised and site preparation commences

» Conduct a search and rescue operation for bulbous plants prior to construction » Prevent spillage of construction material and other pollutants beyond area affected » Implement a comprehensive waste management plan for the operation of the facility » Rehabilitate and revegetate all areas outside footprint area that have been disturbed immediately after construction » Monitor adjacent areas for accelerated erosion and mitigate as required » Monitor the establishment of alien invasive species and remove as soon as detected, whenever possible before regenerative material can be formed
Cumulative impacts: » possible erosion of adjacent or lower-lying areas » possible contamination and siltation of drainage lines and lower-lying wetlands » possible fragmentation of plant populations » possible alteration of occupancy by terrestrial fauna, reduction of available habitat to terrestrial fauna » possible spread and establishment of alien invasive species » Possible erosion of surrounding areas
Residual Impacts: » altered topsoil characteristics » altered vegetation composition » altered habitat and resource availability to terrestrial fauna

Implications for Project Implementation

» The proposed photovoltaic facility development on the site may have significant impacts on the ecology of the site and lower-lying wetlands, if mitigation measures are not strictly adhered to.

» Potentially significant negative impacts on the ecological environment would be soil degradation issues (erosion, depletion of nutrients) as a result of construction activity and the operation of the facility, possible introduction of alien invasive plants and a long-term (more than 8 months) low or absent vegetation cover after construction.

» A loss of niches and specialised habitats for flora and fauna could occur with the removal or significant degradation of large expanses of vegetation or the alteration of rocky habitats. With the ecologically justifiable placement of the different components of the proposed development, coupled with diligent implementation of mitigating measures by the developer, contractors, and operational staff, the severity of impacts can be greatly reduced.

» The impact on fauna is expected to be negligent. Currently minimal presence of wild animals could be detected, possibly due to current land use patterns. Animals that may be present are mobile and will move away during construction, possibly resettling after construction. No restricted or specific habitat of vertebrates will be affected by the proposed development; especially if the proposed development remains outside the more sensitive areas.

» The proposed Merapi Solar Facility - Phase 4 is located largely within an area of low ecological sensitivity. A small area classified as being of Medium-Low sensitivity would be affected. Appropriate mitigation is required to be implemented in order to minimise impacts on this area.'

» The proposed facility is considered to be acceptable from an ecological perspective provided appropriate mitigation and management measures are implemented throughout the lifecycle of the project.

12.2.2 Impacts on Soils and Agricultural Potential

The proposed activity could result 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).

The dominant soils in the study area according to the Taxonomical Soil Classification System of South Africa are Mispah and Sterkspruit soils. The effective depth of the Mispah and Sterkspruit soils is on average 300mm restricted to the Orthic A – Horizon. The agricultural potential of the Mispah and Sterkspruit, soils is considered medium to low under dryland (650mm/y rainfall) and irrigation conditions (>10-15mm/week 33-1,500kPa plant available water). The current land use as shown in Figure 12.2 includes 235ha natural veld, 16ha ploughed land and 17ha plantation. The land capability includes 16ha arable (5% of the total development area), 235ha grazing and 17ha wilderness. No evidence of soil erosion was observed on any of the soils during the investigation. It can be seen from the figure below that the proposed layout of the Merapi Solar Energy Facility avoids areas which are currently cultivated.

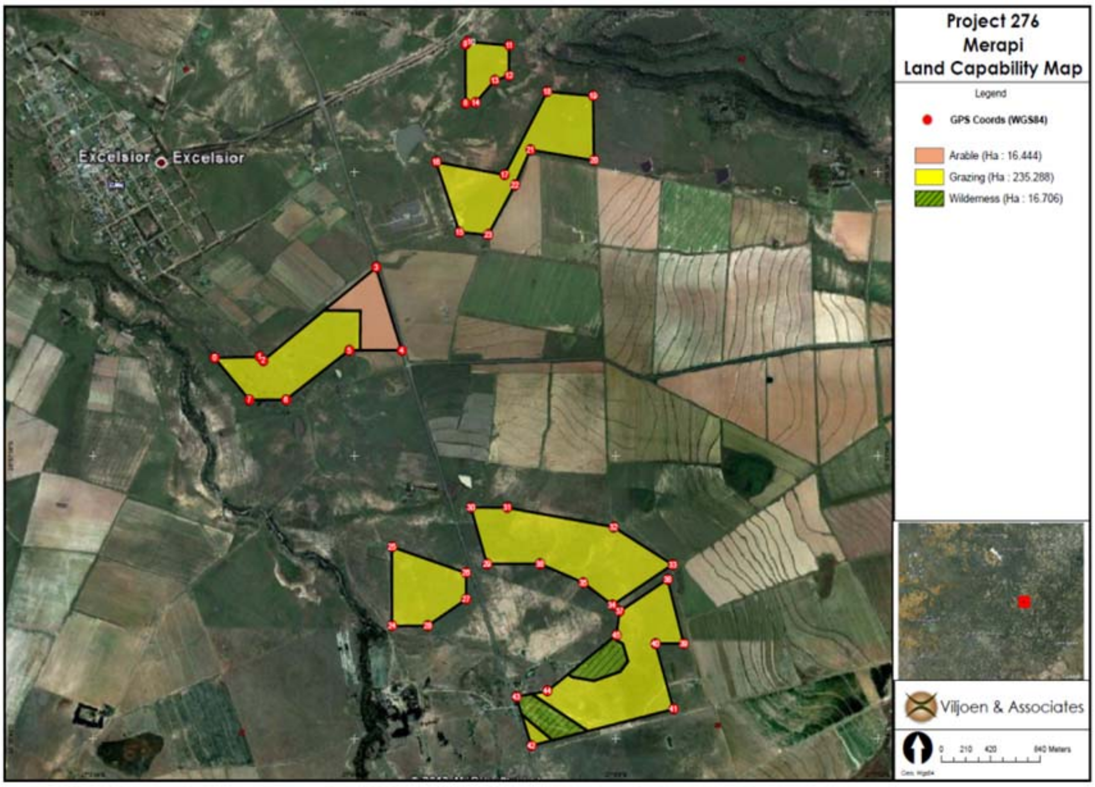

Figure 12.2: Land capability in relation to the proposed Merapi Solar energy facility Phase 1 – 4.

The tables which follow provide an assessment of the direct, indirect and cumulative impacts on soils and agricultural potential expected to be associated with the construction and operation of the Merapi Solar Facility - Phase 4.

<u>Impact tables summarising the significance of impacts on soils and agricultural potential (with and without mitigation)</u>

Nature: Loss of topsoil due to stripping, handling and placement of soil associated with pre construction land clearing and rehabilitation.		
	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	Irreversible	Irreversible
Irreplaceable loss of resources?	Irreplaceable	Irreplaceable
Can impacts be mitigated?	Yes.	
Mitigation: » Strip all usable soil, irrespective of soil depth and store for use during rehabilitation?		
Cumulative impacts: » Cumulative impact of loss of topsoil due to stripping and placement associated with pre		

construction land clearing and rehabilitation is considered low due to the undeveloped nature of the area but further development will increase impact.
Residual impacts:
» Minor localised loss of topsoil

Nature: Change of soil's physical, chemical and biological properties due to loss of topsoil due to erosion, stockpiling, mixing of deep and surface soils during handling, stockpiling and subsequent placement.		
	Without mitigation	***With mitigation***
Extent	Local (1)	Local (1)
Duration	Long Term (4)	Short Term (1)
Magnitude	Moderate (8)	Low (4)
Probability	Very Probable (5)	Very Probable (4)
Significance	**Moderate (65)**	**Low (24)**
Status	Negative	Negative
Reversibility	Irreversible	Irreversible
Irreplaceable loss of resources?	Irreplaceable	Irreplaceable
Can impacts be mitigated?	Yes.	
Mitigation:		
» Implement live placement of soil where possible, improve organic status of soils, maintain fertility levels and curb topsoil loss.		
Cumulative impacts:		
» Cumulative impact of soil's physical, chemical and biological properties due to loss of topsoil, due to erosion, stockpiling, mixing of deep surface soils during handling, stockpiling and subsequent placement is considered low due to the undeveloped nature of the area but further development will increase impact.		
Residual impacts:		
» Minor localised degradation of topsoil's chemical, physical and biological properties		

Nature: Change of natural surface topography due to reprofiling of surface after stripping.		
	Without mitigation	***With mitigation***
Extent	Local (1)	Local (1)
Duration	Long Term (4)	Short Term (1)
Magnitude	Moderate (8)	Low (4)
Probability	Very Probable (5)	Very Probable (4)
Significance	**Moderate (65)**	**Low (24)**
Status	Negative	Negative
Reversibility	Irreversible	Irreversible
Irreplaceable loss of resources?	Irreplaceable	Irreplaceable
Can impacts be mitigated?	Yes	
Mitigation:		
» Implement mapping stormwater control system to ensure surface water control measures are implemented to ensure free draining system with minimal soil erosion.		
Cumulative impacts:		

» Cumulative impact of the change of surface topography due to reprofiling of surface after stripping is considered low due to the undeveloped nature of the area but further development will increase impact.
Residual impacts: » Minor localised degradation of topsoil's chemical, physical and biological properties

Nature: Loss of land with agricultural potential and land capability.		
	Without mitigation	***With mitigation***
Extent	Local (1)	Local (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	Low (4)	Low (4)
Probability	High Probable (4)	High Probable (4)
Significance	**Moderate (40)**	**Low (16)**
Status	Negative	Negative
Reversibility	Medium	Medium
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Direct impacts cannot be mitigated but direct impacts can be minimised and avoided through adequate planning of layout.	
Mitigation: » Loss of agricultural land is a long term loss and no mitigation measures exist. Mitigation is restricted to limitation of extent of impact to the immediate area of impact and minimisation of off-site impacts.		
Cumulative impacts: » The cumulative impact of a loss in the agricultural potential is considered low as areas of high potential and cultivated fields have been avoided by the placement of infrastructure.		
Residual impacts: » Minor loss of grazing land while facility is in use.		

Implications for Project Implementation

» The proposed development of a photovoltaic facility on the site will have minimal significant impacts on the agricultural potential as 95% of the development footprint is proposed on low agricultural potential soils.

» The proposed Merapi Solar Facility - Phase 4 avoids currently cultivated areas.

» The results of the Soil Assessment for the proposed Merapi Solar Park find the proposed activity will have a medium to low impact on the immediate and surrounding soil systems. Implementation and management of proposed mitigation measures will minimise loss of topsoil, prevent contamination of topsoil and stockpiled soil and prevent overall soil erosion.

» It is recommended that the proposed project be approved subject to the mitigation measures stipulated in the Impact Assessment and Environmental Management Programme

12.2.3 Assessment of Potential Impacts on Heritage and Paleontological sites

Five heritage sites were identified near the site (i.e. more than 200m away) and are referred to as: Merap-1, 2, 3, 4 and Merap-5. Of these 5 sites 2 were deemed important as shown on Figure 12.3. None of these sites are located in close proximity to the proposed Merapi Solar facility – Phase 4. No impacts on heritage sites are therefore expected and no mitigation measures are proposed.

In terms of the Paleontological resources in the study area, the site of the proposed Merapi Solar Park is underlain sediments of the Adelaide and Tarkastad subgroups, Beaufort Group (Karoo Supergroup). The Beaufort Group is composed of sandstone and mudrock and ranges in thickness from 5000m to 150m or less (Groenewald 1989). The Beaufort Group (Karoo Supergroup) of formations are rich in Triassic and Permian fossils (Johnson et al., 2006). Vertebrate fossils including retiles, mammal-like reptiles (Therapsids) (Figure 3 in **Appendix G**), amphibians and fish remains occur in the Beaufort Group (Rubidge et al., 1995). Invertebrate fossils, invertebrate burrows and trails, well-preserved leaf impressions, silicified wood and stem impressions have also been recorded from a number of localities in the Beaufort Group (Anderson et al., 1998; McLachlan & Anderson 1973; 1977; Riek, 1973, 1976, Rubidge et al., 1995).

The tables which follow provide an assessment of the direct, indirect and cumulative impacts on heritage and palaeontological sites expected to be associated with the construction and operation of the Merapi Solar Facility - Phase 4.

***Figure 12.3:** Heritage sites recorded in close proximity to the study area*

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

Nature: Discovery/destruction of unknown fossil deposits. 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 measures: » Excavation activities should be monitored by a qualified heritage practitioner		
Cumulative impact: » None		
Residual impact: » Loss of heritage related information		

Implications for Project Implementation

» From an archaeological perspective, the only sign of sites of heritage potential were outside the study area.
» The proposed Merapi Solar facility – Phase 4 will not impact on any heritage sites recorded in the study area.
» No mitigation measures are proposed for these sites since they fall outside the development footprint. However, it is advised that the developer avoid these sites as far as possible.
» The proposed project construction phase should pay special attention to previously un-observed resources or "chance-finds" – these are resources that may be unearthed by the construction excavation activities.
» 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.

12.2.4. Assessment of Potential Visual Impacts

Visual Impact of the PV Facility and power line – Operational Phase

The viewshed[15] analysis for the proposed facility and associated infrastructure was undertaken in accordance with the *Guideline Document for involving Visual Specialists in EIA Processes*. This analysis considers the broader site for development. 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 project site.
- » It is calculated at 3.4m above the natural ground level to reflect the highest point of the PV panels.
- » 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.
- » The viewshed generated from each of the selected observation points referred to in Annexure 2 of the visual impact assessment (refer to Appendix J) is calculated at 1.7m above the natural ground level to reflect the average height of person either walking or sitting in a vehicle.

As illustrated by the generated viewsheds (refer to **Figure 12.4**), the primary *zone of visual influence*[16] is primarily located in a northern direction up to ±10km from the project site. A further zone of visual influence is located intermittently to the east up to 7km.

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 southeast.

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

[15] 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.

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

of an activity diminishing as the distance between the viewer and the activity increases. Viewsheds are categorised into three broad categories of significance, namely:

j) 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.

k) 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.

l) Background: the background stretches from approximately 3km onwards. Background views are only distinguishable by colour and lines, while structures, textures, styles and forms are often not visible (SRK Consulting, 2007).

The distance radii indicating the various viewing distances from the combined phases are illustrated by Figure 6.4. Also illustrated by the figure is the town of Excelsior in the *foreground* to *middle ground* of the project site. Excelsior represents the area where most of the visual receptors would be located. Also located in the *fore-* and *middle ground* are the two main view corridors, namely the R703 and R709.

The tables which follow provide an assessment of the direct, indirect and cumulative visual impacts expected to be associated with the construction and operation of the Merapi Solar Facility - Phase 4.

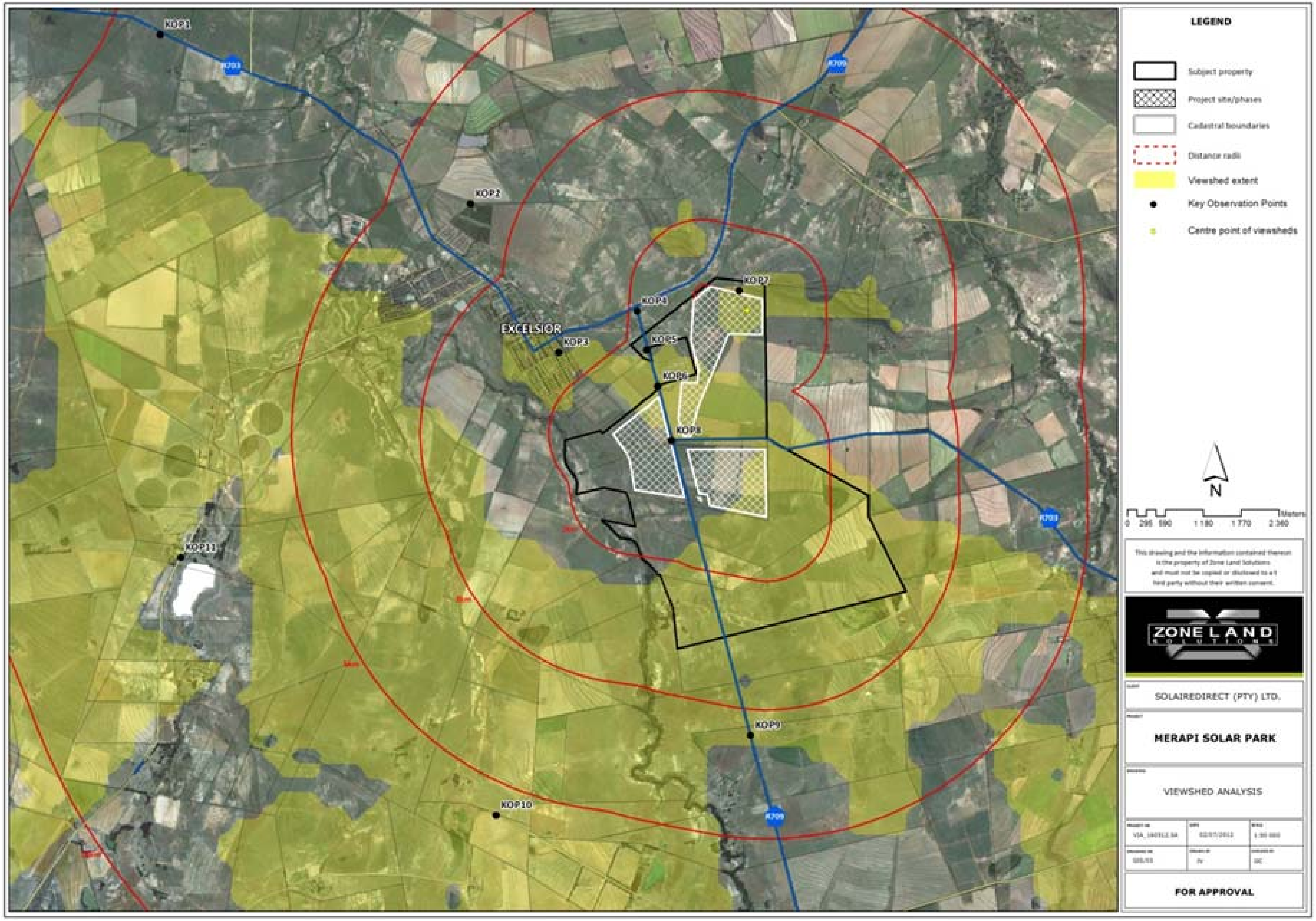

Figure 12.4: Viewshed generated from the highest point of the project site.

Impact tables summarising the significance of visual impacts of the PV facility, power line and proposed substation area (with and without mitigation)

Nature: Potential visual impact on the sensitive receptors in the *foreground* and *middle ground*.		
	Without Mitigation	**With Mitigation**
Extent	Regional (3)	Local (2)
Duration	Long term (4)	Long term (4)
Magnitude	Minor (4)	Low (2)
Probability	Probable (3)	Improbable (2)
Significance	**Medium (33)**	**Low (16)**
Status	Neutral	Neutral
Reversibility	Recoverable (3)	Recoverable (3)
Irreplaceable Loss of Resource?	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 outer boundaries of the individual phases. Only indigenous plant species to be introduced and planted in such a manner and location which would not cast shadows on the PV 'strings'. » 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. » Utilise existing roads and tracks to the extent possible. Where new roads are required, they should be two-track gravel roads, maintained to prevent dust plumes and erosion.		
Cumulative impacts: The existing Merapi Substation and its associated industrial-type infrastructure such as electrical transmission lines and pylons already exist in the immediate surroundings. Therefore, the cumulative impact will be increased with the establishment of the PV plant.		
Residual impacts: The proposed infrastructure is of such a nature that the status quo could be regained after decommissioning of the plant. Providing that the site is rehabilitated to its current state, the visual impact will also be removed.		

Nature: Potential visual impact on the intrinsic value and sense of place of the Excelsior region.		
	Without Mitigation	**With Mitigation**
Extent	Local (2)	Local (2)
Duration	Long term (4)	Long term (4)
Magnitude	Medium (6)	Medium (6)
Probability	Highly probable (4)	Probable (3)
Significance	**Medium (48)**	**Medium (36)**
Status	Negative	Negative

Reversibility	Recoverable (3)	Recoverable (3)
Irreplaceable Loss of Resource?	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 outer boundaries of the individual project phases. Only indigenous plant species to be introduced and planted in such a manner and location which would not cast shadows on the PV ‘strings’.
» 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 raising the PV platforms so that cattle can roam underneath the PV ‘string’.
» Utilise existing roads and tracks to the extent possible. Where new roads are required, they should be two-track gravel roads, maintained to prevent dust plumes and erosion.

Cumulative impacts:

It is near impossible to distinguish built forms and structures at distances greater than 5km. However, the introduction of a PV plant with four phases of approximately 250 ha in total might have a cumulative effect on the observer.

Residual impacts:

The proposed infrastructure is of such a nature that the status quo could be regained after decommissioning of the plant. Providing that the site is rehabilitated to its current state, the visual impact will also be removed.

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

	Without Mitigation	**With Mitigation**
Extent	Local (2)	Local (2)
Duration	Long term (4)	Long term (4)
Magnitude	Minor (4)	Low (2)
Probability	Probable (3)	Probable (3)
Significance	**Medium (30)**	**Low (24)**
Status	Negative	Negative
Reversibility	Recoverable (3)	Recoverable (3)
Irreplaceable Loss of Resource?	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.
» Only minimum wattage light fixtures must be used.

Cumulative impacts:

The area within which the proposed activity is to be undertaken is relatively low lit. The occurrence of ancillary structures of the PV Plant will contribute to the cumulative lighting effect of the area but it is expected to be negligible in a local context.

Residual impacts:
The proposed infrastructure is of such a nature that the status quo could be regained after decommissioning of the plant. Providing that the site is rehabilitated to its current state, the visual impact will also be removed.

Nature: Potential visual impact of reflection of the PV Panels on sensitive receptors.		
	Without Mitigation	**With Mitigation**
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 Resource?	No	No
Can Impacts Be Mitigated?	Yes	
Mitigation: » Consider installing anti-reflective coating or glass to reduce the sunlight that is reflected and increase the amount of sunlight that is absorbed. » Select the shortest possible route for power lines between individual phases and substation to reduce its visual appearance. » Consider laying electrical cables underground en-route to the substation.		
Cumulative impacts: The introduction of the PV plant, coupled with the power line, proposed and existing substations, contribute to an increased cumulative visual impact.		
Residual impacts: The proposed infrastructure is of such a nature that the status quo could be regained after decommissioning of the plant. Providing that the site is rehabilitated to its current state, the visual impact will also be removed.		

Implications for Project Implementation

» The results of the Visual Impact Assessment for the proposed Merapi Solar Facility – Phase 4 found that the proposed activity will have a medium impact from Key Observer Points identified in the *foreground* and *middle ground*(<3km).
» Cumulative impacts are associated with the other phases of the Merapi Solar Park as well as the existing Merapi Substation and overhead power lines.
» It is herewith recommended that the proposed activity be approved subject to the mitigation measures described in Environmental Management Programme.
» It is furthermore recommended that the proposed project phases be relocated to the south-eastern portions of the subject property (eastern portions of Farms Concordia and Ceylon). The northern phases of the project on the Farm Moedersgift No. 566 presents the area's most visually prominent. A relocation of this particular phase to an area further away from the receptors in Excelsior

would benefit the project from a visual perspective. In addition, it is proposed that the project phases that front onto movement corridors be set back at least 200m from the latter roads in order to establish a proper buffer between the observer and the observed view.

12.2.5. 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 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.

The tables which follow provide an assessment of the direct, indirect and cumulative social impacts expected to be associated with the construction and operation of the Merapi Solar Facility - Phase 4.

Impact tables summarising the significance of social impacts associated with the construction phase of the project (with and without mitigation)

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 of each phase of the 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 PVSEF and the associated components, including, access roads, services and power line.

The proposed 130MW Merapi Solar Park will be developed in 4 phases. The construction phase will therefore extend over a period of ~ 8 years. In terms of employment it is assumed that 70% of the original 291 construction workers employed to construct the 46MW phase will be employed for the remaining 3 phases. The construction of the remaining 3 phases will therefore create an additional 90 employment opportunities (30% of 291) over and above the initial 291 associated with the construction of the first phase. The total number of employment opportunities created by the construction of all 4 phases will therefore be in the region of 381. Of this total ~ 60% (229) will be available to low-skilled workers (construction labourers, security staff etc.), 15% (57) to semi-skilled workers (drivers, equipment operators etc.) and 25% (95) to skilled personnel (engineers, land surveyors, project managers etc.).

Given the location of the site and its proximity to Excelsior, Winburg, Ladybrand and Bloemfontein, the majority of low and semi-skilled employment opportunities are likely to benefit members from the local community. The majority of the beneficiaries are also likely to be historically disadvantaged (HD) members of the community. The extended duration of the construction phase (8 years) also creates an ideal opportunity for contractor/s to implement an on-site training and skills development programme. This will further enhance to the potential employment opportunities for members from the local community. However, in the absence of specific commitments from the developer to employ local contractors the potential for meaningful skills development and training for members from the local communities are likely to be limited.

	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	Medium Term (3)	Medium Term (3)
Magnitude	Medium (6)	Medium (6)
Probability	Highly probable (4)	Highly probable (4)
Significance	**Medium (44)**	**Medium (48)**
Status (positive or negative)	Positive	Positive
Reversibility	N/A	N/A
Irreplaceable loss of resources?	N/A	N/A
Can impacts be enhanced?	Yes	

***Mitigation*:**

Employment

» Where reasonable and practical, SolaireDirect 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 SolaireDirect should meet with representatives from the MM 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 SolaireDirect 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

» SolaireDirect 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, SolaireDirect 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)

As indicated above, given the proximity of the site to Excelsior, Winburg, Ladybrand and Bloemfontein, including Botshabelo and Thaba Nchu, the majority of the 230 low and semi-skilled employment opportunities associated with the construction phase are likely to be taken up by members from the local community. If these workers are accommodated in their respective home towns then the potential risk posed to local communities will be low. 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. While the significance of the risk to the community as a whole will be low, the significance to individual members of the community who are impacted by the behavior of construction workers would be medium to high.

	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) **Moderate-High** for specific individuals who may be affected by STDs etc. (57)	**Low** for the community as a whole (24) **Moderate-High** for specific individuals who may be affected by STDs etc. (51)
Status (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	Yes, to some degree. However, the risk cannot be eliminated	

enhanced?	

Mitigation:

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

» Where possible, SolaireDirect 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;
» SolaireDirect should consider the need to establish 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;
» SolaireDirect 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;
» SolaireDirect and the contractor should implement an HIV/AIDS awareness programme for all construction workers at the outset of the construction phase;
» The movement of construction workers on and off the site should be closely managed and monitored by the contractors. In this regard the contractors should be responsible for making the necessary arrangements for transporting workers to and from site on a daily basis;
» The contractor should make the necessary arrangements for allowing workers from outside the area to return home over weekends and or on a regular basis during the 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:

» 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 impacts on the affected individuals and/or their families and the community.

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.

Despite the proximity of the farms to the R 709 and R 703, the local farmers interviewed indicated that stock theft was not serious problem in the area. In addition, stock farming was not carried out on a large scale in the area. Sunflowers and maize (corn) are the main crops grown in the area.

	Without enhancement	**With enhancement**
Extent	Local (3)	Local (2)
Duration	Medium Term (3)	Medium Term (3)
Magnitude	Moderate (6) (Due to reliance on agriculture and livestock for maintaining livelihoods)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	**Medium (36)**	**Low (27)**
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:

- SolaireDirect 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.;
- SolaireDirect 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 SolaireDirect and the contractors before the contractors move onto site;
- SolaireDirect 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 SolaireDirect, 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 SolaireDirect 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 SolaireDirect 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 and 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. The local farmers in the area interviewed did however indicate that veld fires were not a major concern. In addition, livestock farming is not the major agricultural activity in the area.		
	Without enhancement	**With enhancement**
Extent	Local (3) (Rated as 3 due to potential severity of impact on local farmers)	Local (2) (Rated as 2 due to potential severity of impact on local farmers)
Duration	Medium Term (3)	Medium Term (3)
Magnitude	Moderate (6) (Due to reliance on agriculture and livestock for maintaining livelihoods)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	**Medium (36)**	**Low (27)**
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: SolaireDirect 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:

» None, provided losses are compensated for.

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. The main access to the site would be via either the R709 and or 703. These two roads link up with the N8, to the south, and N1, to the north-west, respectively. Both the N1 and N8 are important communication routes, specifically the N1. The movement of construction related vehicles along either of these two routes has the potential to cause delays for other road users. However, these impacts will be spread out over the eight year timeframe of the construction phase, and can therefore, be effectively managed and mitigated. The social impacts associated with the movement of construction related traffic are therefore likely to be low.

	Without mitigation	**With mitigation**
Extent	Local (2)	Local (1)
Duration	Medium Term (3)	Medium Term (3)
Magnitude	Low (4)	Minor (2)
Probability	Probable (3)	Probable (3)
Significance	**Low (27)**	**Low (18)**
Status (positive or negative)	Negative	Negative
Reversibility	Yes	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	Yes	

Mitigation:

SolaireDirect 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 heavy vehicles and dust can be effectively mitigated. The aspects that should be covered include:

» The timing of the transport of components to the site should be timed to avoid weekends and holiday times so as to minimise the potential impact on travellers using the N1, N8, R 709 and R 703;
» 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 mitigation measures are implemented.

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 PVSEF and power lines will damage farmlands and result in a loss of farmlands for future farming activities.

The significance of these impacts can 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. In addition, it is standard practice for the affected landowner/s is to enter into a lease agreement that includes monthly rental. The loss of productive farmland would therefore be offset by such an agreement. It may also be possible for livestock and game to graze between the PV panels. The final disturbance footprint can also be reduced by careful site design and placement of components. In addition, the footprint associated with a 10MW solar facility is likely to be relatively small. 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. Recommended mitigation measures are outlined below.

	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)

<table>
<tr><td>Significance</td><td>High, If compensation is not paid or area is not rehabilitated (60)</td><td>Low (20)</td></tr>
<tr><td>Status</td><td>Negative</td><td>Negative</td></tr>
<tr><td>Reversibility</td><td colspan="2">No, in case of footprint associated with solar thermal plant</td></tr>
<tr><td>Irreplaceable loss of resources?</td><td colspan="2">Yes, loss of farmland. However, disturbed areas can be rehabilitated</td></tr>
<tr><td>Can impacts be mitigated?</td><td colspan="2">Yes, loss of farmland. However, disturbed areas can be rehabilitated</td></tr>
<tr><td colspan="3">Mitigation:
The potential impacts associated with damage to and loss of farmland can be effectively mitigated. The aspects that should be covered include:

» 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.</td></tr>
<tr><td colspan="3">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.</td></tr>
<tr><td colspan="3">Residual impacts:
» None provided disturbed areas are rehabilitated.</td></tr>
</table>

<u>Impact tables summarising the significance of social impacts associated with the operation phase of the project (with and without mitigation)</u>

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.

<table>
<tr><td colspan="3">Nature of impact: Creation of employment and business opportunities associated with the operational phase

Based on the information provided by the proponent, the establishment of the proposed Merapi Solar Facility – Phase 4 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. For the purposes of the assessment it is assumed that there will be some overlap in terms of roles and responsibilities between phases should all 4 phases be implemented. For the purposes of the assessment it is assumed that there will be a 20% overlap for each additional phase. The total number of employment opportunities associated with the additional 3 phases will therefore be 144 (48 x 3).

Due the proximity of the site to Excelsior, Winburg, Ladybrand and Bloemfontein, including Botshabelo and Thaba Nchu, the majority of the work opportunities associated with the operational phase is 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.</td></tr>
<tr><td></td><td>Without mitigation</td><td>With mitigation</td></tr>
<tr><td>Extent</td><td>Local and Regional (2)</td><td>Local and Regional (3)</td></tr>
<tr><td>Duration</td><td>Long term (4)</td><td>Long term (4)</td></tr>
<tr><td>Magnitude</td><td>Low (4)</td><td>Moderate (6)</td></tr>
<tr><td>Probability</td><td>Probable (3)</td><td>Highly Probable (4)</td></tr>
<tr><td>Significance</td><td>Medium (30)</td><td>Medium (52)</td></tr>
<tr><td>Status (positive or negative)</td><td>Positive</td><td>Positive</td></tr>
<tr><td>Reversibility</td><td colspan="2">N/A</td></tr>
<tr><td>Irreplaceable loss of resources?</td><td colspan="2">No</td></tr>
<tr><td>Can impacts be mitigated?</td><td colspan="2">Yes</td></tr>
<tr><td colspan="3">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:
» SolaireDirect 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.</td></tr>
<tr><td colspan="3">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</td></tr>
<tr><td colspan="3">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.</td></tr>
</table>

<table>
<tr><td colspan="3">Nature of impact: Establishment of a Community Trust funded by revenue generated from the sale of energy.

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 revenue from the proposed solar energy facility plant can be used to support a number of social and economic initiatives in the area, including:

» Creation of jobs;
» Education;
» Support for and provision of basic services;
» School feeding schemes;
» Training and skills development;
» Support for SMMEs.

In addition, the establishment of a solar energy facility plant is not likely to have a significant impact on the current agricultural land uses that underpin the local economic activities in the area. The loss of this relatively small area will not impact on the current and future farming activities.</td></tr>
<tr><td></td><td>Without mitigation</td><td>With mitigation</td></tr>
<tr><td>Extent</td><td>Local (2)</td><td>Local and Regional (4)</td></tr>
<tr><td>Duration</td><td>Long term (4)</td><td>Long term (4)</td></tr>
<tr><td>Magnitude</td><td>Low (4)</td><td>Moderate (6)</td></tr>
<tr><td>Probability</td><td>Probable (3)</td><td>Definite (5)</td></tr>
<tr><td>Significance</td><td>Medium (30)</td><td>High (70)</td></tr>
<tr><td>Status (positive or negative)</td><td>Positive</td><td>Positive</td></tr>
<tr><td>Reversibility</td><td colspan="2">N/A</td></tr>
<tr><td>Irreplaceable loss of resources?</td><td colspan="2">No</td></tr>
<tr><td>Can impacts be mitigated?</td><td colspan="2">Yes</td></tr>
<tr><td colspan="3">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 park.</td></tr>
<tr><td colspan="3">Cumulative impacts:
» Promotion of social and economic development and improvement in the overall well-being of the community. Additional benefits will accrue if all phases of the project are implemented.</td></tr>
<tr><td colspan="3">Residual impacts:
» Social and economic development and improvement in the overall well-being of the community.</td></tr>
</table>

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 4 phases of the Merapi Solar Park relative to South Africa's total energy requirements will be limited. In addition, the current application is not unique. In this regard, a significant number of solar energy projects are currently proposed in other parts of South Africa. The potential contribution of the proposed Merapi Solar Park 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: » 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: » Contribution to the government targets for electricity generation from renewable energy. » Reduced carbon emissions via the use of renewable energy and associated benefits in terms of global warming and climate change.		
Residual impacts: » Reduced carbon emissions via the use of renewable energy and associated benefits in terms of global warming and climate change.		

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

<table>
<tr><td colspan="3">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.

None of the local farmers, including adjacent farmers, interviewed raised concerns regarding the potential visual impact of the proposed project. Mr A Visagie, the principal of CVO Excelsior School, also indicated that the project was unlikely to have any impact on the school due to the distance of the school from the site. In addition, the Merapi substation is located on the north western boundary of the site, and two power lines associated with the substation traverse the site. The visual integrity of the site and the surrounding area has therefore been impacted by the existing energy related infrastructure on the site.</td></tr>
<tr><td></td><td>Without mitigation</td><td>With mitigation</td></tr>
<tr><td>Extent</td><td>Local (2)</td><td>Local (2)</td></tr>
<tr><td>Duration</td><td>Long term (4)</td><td>Long term (4)</td></tr>
<tr><td>Magnitude</td><td>Medium (4)</td><td>Medium (4)</td></tr>
<tr><td>Probability</td><td>Probable (3)</td><td>Probable (3)</td></tr>
<tr><td>Significance</td><td>Medium (30)</td><td>Medium (30)</td></tr>
<tr><td>Status (positive or negative)</td><td>Negative</td><td>Negative</td></tr>
<tr><td>Reversibility</td><td colspan="2">Yes, solar facility can be removed.</td></tr>
<tr><td>Irreplaceable loss of resources?</td><td colspan="2">No</td></tr>
<tr><td>Can impacts be enhanced or mitigated?</td><td colspan="2">Yes</td></tr>
<tr><td colspan="3">Mitigation:
» The recommendations contained in the VIA should be implemented.</td></tr>
<tr><td colspan="3">Cumulative impacts:
» Potential impact on current rural sense of place</td></tr>
<tr><td colspan="3">Residual impacts:
» None as the impact will be removed after decommissioning.</td></tr>
</table>

<table>
<tr><td colspan="3">Nature of impact: Potential impact of the solar facility on local tourism

The FSPGDP identifies tourism as an important economic sector. However, based on the findings of the SIA and 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 project and the areas altered sense of place. 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.</td></tr>
<tr><td></td><td>Without mitigation</td><td>With mitigation</td></tr>
<tr><td>Extent</td><td>Local (2)</td><td>Local (3)</td></tr>
<tr><td>Duration</td><td>Long term (4)</td><td>Long term (4)</td></tr>
<tr><td>Magnitude</td><td>Low (2)</td><td>Low (2)</td></tr>
<tr><td>Probability</td><td>Probable (3)</td><td>Probable (3)</td></tr>
<tr><td>Significance</td><td>Low (24) (Applies to both – and +)</td><td>Low (27) (Applies to both – and +)</td></tr>
<tr><td>Status (positive or negative)</td><td>Negative</td><td>Negative</td></tr>
</table>

	(Potential to distract from the tourist experience of the area) Positive (Potential to attract people to the area)	(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: » SolaireDirect should liaise with representatives from the MLM and local tourism representatives to raise awareness of the proposed facility. » SolaireDirect 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 impacts on tourism in Mantsopa Local Municipality area.		
Residual impacts: » None as the facility will be removed after decommissioning.		

Nature of impact: Potential visual impact and impact on sense of place associated with power line The social impacts associated with multiple 22kV/132kV 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.		
	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 as the impact will be removed after decommissioning

Implications for Project Implementation

- The findings of the SIA indicate that the development of the proposed Merapi Solar facility - Phase 4 will create employment and business opportunities for locals during both the construction and operational phase of the project. The establishment of a Community Trust funded by revenue generated from the sale of energy from the proposed facility also creates an opportunity to support local economic development in the area. This represents a social benefit for an area where there are limited opportunities.
- The proposed development also represents an investment in clean, renewable energy infrastructure, which, given the challenges created by climate change, represents a positive social benefit for society as a whole.
- The establishment of Phase 4 (46MW) of the proposed Merapi solar park is therefore supported by the findings of the SIA.

12.3. 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: Upgrading of Access Road		
Loss of vegetation, increase in runoff and erosion (as the road already exists, no additional impact on terrestrial fauna is expected to arise from the development)	Medium (Negative)	Low (Neutral)
Creation of Access Roads where existing tracks are insufficient		
Loss of vegetation, increase in runoff and erosion, displacement of fauna, possible alteration of drainage patterns	High (Negative)	Medium (Neutral)
Impacts on Ecology: Fencing area		
Loss of vegetation, loss of micro-habitat, increase in runoff and erosion, window of opportunity for	Medium (Negative)	Medium (Neutral)

Nature	Positive (+) ,Negative (-)or neutral Impact Without mitigation	Positive (+) ,Negative (-)or neutral Impact With mitigation
the establishment of alien invasive species, altered topsoil characteristics prone to capping, increased runoff and erosion		
Impacts on Ecology: Construction and operation of PV panels		
Loss of vegetation, loss of and alteration of microhabitats, altered vegetation cover, altered distribution of rainfall and resultant runoff patterns, increase in runoff and accelerated erosion, loss of faunal habitat and resource availability to terrestrial fauna	High (Negative)	Medium (Negative)
Impacts on Ecology: Construction of power lines to substation		
Loss of vegetation, increase in runoff and erosion, temporary displacement of terrestrial fauna. of soils, creation of runoff zone, possible contamination	Medium (Negative)	Low (Neutral)
Construction and operation of substation area		
Loss of vegetation, loss of micro-habitats, increased runoff and erosion, possibly altered chemistry of surrounding soils, window of opportunity for the establishment of alien invasive species	High (Negative)	Medium (Negative)
Impacts on Ecology: Construction and operation of workshop area and guard houses		
Loss of vegetation, increase in runoff and erosion, pollution, loss of faunal habitat and resource availability to terrestrial fauna	High (Negative)	Medium (Neutral)
Impacts on Soils and Agricultural Potential		
Loss of topsoil due to stripping, handling and placement of soil associated with pre construction land clearing and rehabilitation.	Moderate (Negative)	Low (Negative)
Change of soil's physical, chemical and biological properties due to loss of topsoil due to erosion, stockpiling, mixing of deep and surface soils during handling, stockpiling and	Moderate (Negative)	Low (Negative)

Nature	Positive (+) ,Negative (-)or neutral Impact	Positive (+) ,Negative (-)or neutral Impact
	Without mitigation	With mitigation
subsequent placement.		
Change of natural surface topography due to reprofiling of surface after stripping.	Moderate (Negative)	Low (Negative)
Loss of land with high agricultural potential and land capability.	Moderate (Negative)	Low (Negative)
Potential Impacts on Heritage and Paleontological sites		
The disturbance/destruction of the historic farmstead (ruins) may occur (e.g. secondary impact) as a result of construction activities and development of associated infrastructure.	Low (Negative)	Low (Negative)
The disturbance/destruction of the historic farmhouse (ruins) and 'disturbed area' may occur (e.g. secondary impact) as a result of construction activities and development of associated infrastructure.	Low (Negative)	Low (Negative)
Discovery/destruction of unknown fossil deposits. Paleontological sites could be affected if bedrock was to be disturbed during the excavation activities associated with the construction	Low (Negative)	Low (Positive)
Potential Visual Impacts		
Potential visual impact of reflection of the PV Panels on the sensitive receptors.	Medium (Neutral)	Low (Neutral)
Potential visual impact on the intrinsic value and sense of place of the Excelsior region.	Medium (Negative)	Medium (Negative)
Potential visual impact of artificial lighting as a result of the activity.	Medium (Negative)	Low (Negative)
Potential visual impact of reflection of the PV Panels on the sensitive receptors	Low (Neutral)	Low (Neutral)
Potential Social Impacts During Construction		
Creation of employment and business opportunities	Medium (Positive)	Medium (Positive)
Potential impacts on family	Low for the community as	Low for the community

Nature	Positive (+) ,Negative (-)or neutral Impact	Positive (+) ,Negative (-)or neutral Impact
	Without mitigation	With mitigation
structures and social networks associated with the presence of construction workers	a whole Moderate-High for specific individuals who may be affected by STDs etc.	as a whole Moderate-High for specific individuals who may be affected by STDs etc.
Increased risk of stock theft, poaching and damage to farm infrastructure	Medium (Negative)	Low (Negative)
Potential increased incidence of veld fires	Medium (Positive)	Medium (Positive)
Potential noise, dust and safety impacts associated with movement of construction related traffic to and from the site	Low (Negative)	Low (Negative)
Loss of farmlands for future farming activities	High (Negative)	Low (Negative)
Potential Social Impacts During Operation		
Creation of employment and business opportunities associated with the operational phase	Low (Positive)	Medium (Positive)
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 (Positive)	High (Positive)
Promotion of clean, renewable energy	Medium (Positive)	Medium (Positive)
Visual impact and impact on sense of place	Medium (Negative)	Medium (Negative)
Potential impact of the solar thermal plant on local tourism	Low (Negative)	Low (Negative)
Potential visual impact and impact on sense of place associated with power lines	Low (Negative)	Low (Negative)

As can be seen from this table, there are no impacts of high significance expected to be associated with the construction and operation of the proposed Merapi Solar Facility – Phase 4, provided that the recommended mitigation measures are implemented. All identified impacts can therefore be mitigated to acceptable levels.

12.4. Assessment of Potential Cumulative Impacts

A cumulative impact, in relation to an activity, refers to the impact of an activity that in itself may not be significant, but may become significant when added to the existing and potential impacts eventuating from similar or diverse undertaking in the area [1].

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 Free State Province is earmarked as a potential solar energy hub for South Africa, considering the vast amounts land available. There are four proposed solar energy facilities proposed in the Motheo District Municipality, the majority of which are located near to the capital city (Bloemfontein). The Merapi Solar Facility – Phase 4 is located ~ 80 km north-east from the proposed Sannaspos Solar Park and ~ 60 km east of the proposed Glen Thorne PV facility. There is therefore sufficient distance between these proposed facilities to result in no cumulative impacts. However, the proximity of the proposed Merapi Solar Facility Phases 2, 3 and 4 to the Merapi Solar Facility Phase 4 result in the potential for localised cumulative impacts (refer to Figure 12.5). Potential cumulative impacts relate to the visual impact, impact on flora and fauna, impact on agricultural potential and impact on the social environment. No impacts on heritage sites are expected as no sites were recorded within the development footprint of any of the proposed phases.

12.4.1. Visual Impacts

The Merapi Solar Facility site is located within a remote area within the Mantsopa Local Municipality. Considering the low population density in the District Municipality the visual impacts of multiple solar energy facilities will be low. In addition, the Merapi substation is located on the north western boundary of the site, and two power lines associated with the substation traverse the site. The visual integrity of the site and the surrounding area has therefore been impacted by the existing energy related infrastructure on the site.

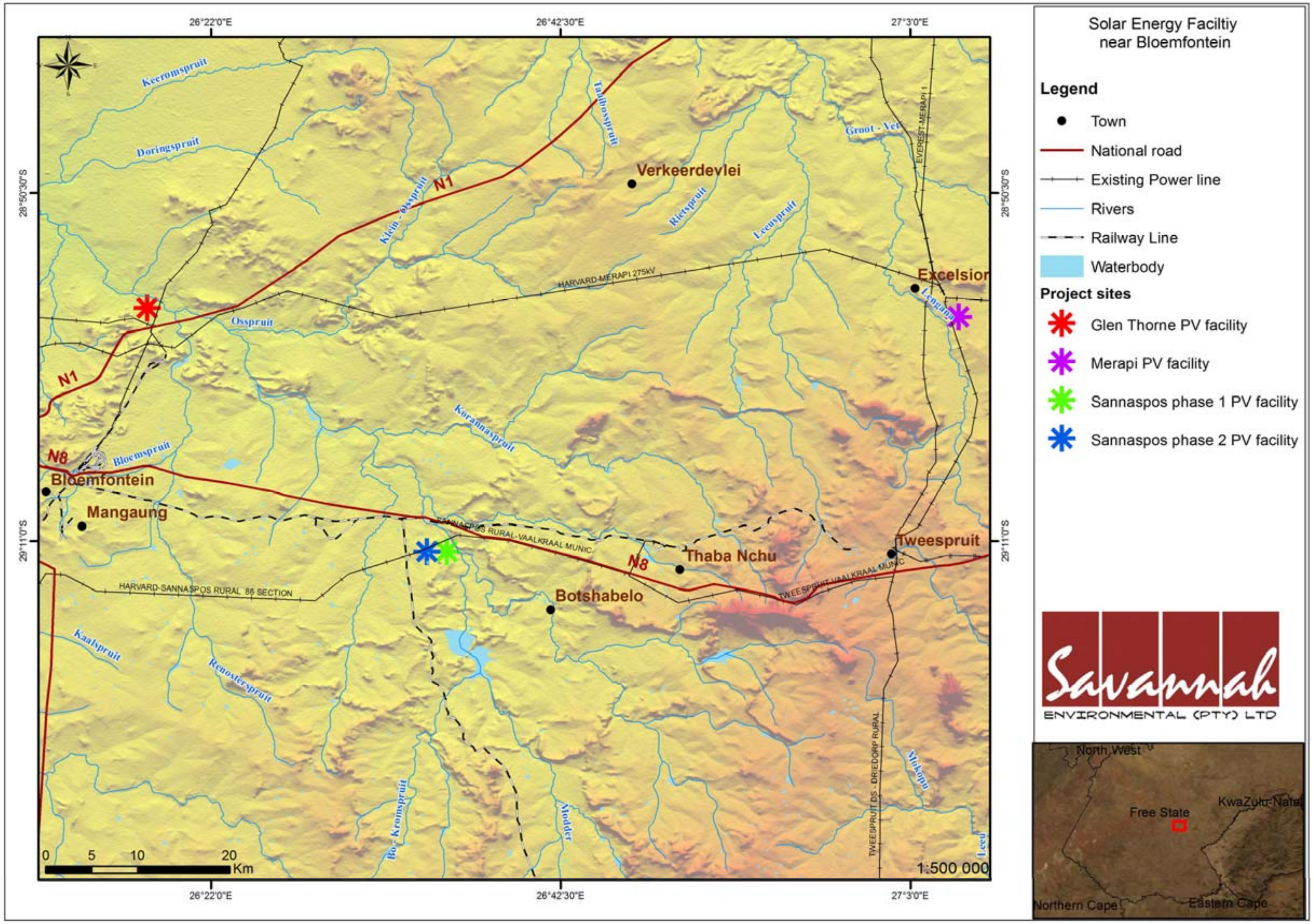

Figure 12.5: The location of the proposed Merapi Solar Energy Facility relative to the proposed Glen Thorne and Sannaspos solar energy facilities.

The table below assesses the potential visual impact for the establishment of a number of solar energy facilities in the Free State Province.

Nature: Visual impacts associated with the establishment of more than one solar 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	Negative	Negative
Reversibility	Yes. Solar energy plant components and other infrastructure can be removed.	
Irreplaceable loss of resources?	No	
Can impact be mitigated?	Yes	
Mitigation: Implement mitigation measures as proposed for each facility to minimise impacts.		
Residual impacts: None as the impact would be removed after decommissioning.		

12.4.2. Ecology Impacts

Negative cumulative ecological impacts include habitat loss and disturbance, and soil erosion. Individual projects will require proper management of environmental impacts during construction and operation. Cumulative ecological impacts relate to:

» possible erosion of areas lower than the panels
» possible contamination and siltation of the drainage lines and lower-lying wetlands
» possible fragmentation of plant populations
» possible alteration of occupancy by terrestrial fauna
» possible reduction of available habitat to terrestrial fauna
» possible spread and establishment of alien invasive species

Nature: Loss of vegetation, loss of and alteration of microhabitats, altered vegetation cover, altered distribution of rainfall and resultant runoff patterns, increase in runoff and accelerated erosion, loss of faunal habitat and resource availability to terrestrial fauna.		
	Without mitigation	**With mitigation**
Extent	Local (5)	Local (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	Very High (10)	Moderate (6)
Probability	Definite (5)	Definite (5)

Significance	**High (95)**	**Medium (60)**
Status (positive or negative)	Negative	Negative
Reversibility	Difficult to reverse	Partially reversible
Irreplaceable loss of resources?	Highly Probable	Probable
Can impacts be mitigated?	Reasonably	
Mitigation: » Implement mitigation measures as proposed for each facility to minimise impacts.		
Residual Impacts: » altered topsoil characteristics » altered vegetation composition » altered habitat and resource availability to terrestrial fauna		

12.4.3. Impacts on Agricultural Potential

Cumulative impacts on agricultural potential would be associated with impacts on cultivated lands and/or areas of high potential. The cumulative impact of a loss in the agricultural potential associated with the establishment of Phases 1 – 4 of the Merapi Solar Facility is considered low as areas of high potential and cultivated fields have been avoided by the placement of infrastructure.

Nature: Loss of land with agricultural potential and land capability.		
	Without mitigation	***With mitigation***
Extent	Local (1)	Local (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	Low (4)	Low (4)
Probability	High Probable (4)	High Probable (4)
Significance	**Moderate (40)**	**Low (16)**
Status	Negative	Negative
Reversibility	Medium	Medium
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Direct impacts cannot be mitigated but direct impacts can be minimised and avoided through adequate planning of layout.	
Mitigation: » Implement mitigation measures recommended for each phase of development in order to minimise impacts.		
Residual impacts: » Minor loss of grazing land while facility is in use.		

12.4.4. Social Impacts

Cumulative social impacts would be of medium (positive), regional significance as there would be creation of employment and business opportunities and would include the benefits associated with the establishment of Community Trusts in the municipal area. There would also be an increase in job opportunities and skills development due to these projects. The negative cumulative impacts could be

related an influx of job seekers to the area but localised for each site, and if managed well it can be of low negative impact. The overall cumulative impacts are acceptable. In terms of land use, the dominate land use in the district municipality will not be compromised due to the vast amounts of land available in the Free State. The table below assesses the potential social impact for the establishment of a number of solar energy facilities in the Free State Province.

<table>
<tr><td colspan="3">Nature: The establishment of a number of solar energy facilities in the Free State Province will create employment, skills development and training opportunities, creation of downstream business opportunities and stimulation of the local property market.</td></tr>
<tr><td></td><td>Without Enhancement</td><td>With Enhancement</td></tr>
<tr><td>Extent</td><td>Local and regional (3)</td><td>Local and regional (4)</td></tr>
<tr><td>Duration</td><td>Long term (4)</td><td>Long term (4)</td></tr>
<tr><td>Magnitude</td><td>Low (4)</td><td>Moderate (6)</td></tr>
<tr><td>Probability</td><td>Highly Probable (4)</td><td>Definite (5)</td></tr>
<tr><td>Significance</td><td>Medium (44)</td><td>High (70)</td></tr>
<tr><td>Status</td><td>Positive</td><td>Positive</td></tr>
<tr><td>Reversibility</td><td colspan="2">Yes. Solar energy plant components and other infrastructure can be removed.</td></tr>
<tr><td>Irreplaceable loss of resources?</td><td>No</td><td></td></tr>
<tr><td>Can impact be enhanced?</td><td>Yes</td><td></td></tr>
<tr><td colspan="3">Mitigations:
» SolaireDirect 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;
» SolaireDirect 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 20-25 year operational life of the facility. The rationale for the establishment of a Rehabilitation Trust Fund is linked to the experiences with the mining sector in South Africa and failure of many mining companies to allocate sufficient funds during the operational phase to cover the costs of rehabilitation and closure. SolaireDirect have indicated that the rehabilitation programme will be funded by sale of scrap metal etc. on closure of the facility.</td></tr>
<tr><td colspan="3">Residual impacts:
Positive impact on the local and regional economy through the creation of downstream opportunities and wage spend in the local economy</td></tr>
</table>

12.5. Assessment of the Do Nothing Alternative

The ‘do-nothing’ alternative is the option of not constructing the proposed Merapi Solar Energy Facility - Phase 4. Should this alternative be selected, there would be no impacts on the site due to the construction and operation activities of a solar energy facility. However, there will be impacts at a local and a broader scale.

The primary considerations pertaining to the do-nothing alternative relate to:

7. The current land-use regime of the site; and
8. The need to diversify the energy mix in South Africa.

These are discussed in further detail below.

7. The agricultural potential of the site is mainly determined by climatic parameters such as rainfall distribution and frequency as well as wind prevalence. The site is considered to have low agricultural potential. The current land-use on the site is agriculture (livestock and game farming). The "do nothing" alternative would retain the current land-use, with a resultant lost opportunity to generate renewable energy from the wind and at the same time continue current agricultural activities on areas that fall outside of the proposed solar energy facility infrastructure. The development of the solar energy facility would allow current agricultural activities on areas of the farm portions which will not be occupied by solar panels and associated infrastructure. Therefore the current land-use will be retained, while also generating renewable energy from the sun. In addition, the landowner would obtain an income from the facility (as the developer would pay a percentage of the revenue generated to the landowner in accordance with the lease agreement for the use of the land). This would contribute towards the financial stability of the landowner which would in turn contribute to the financial viability of the farming practices on the property. The do nothing alternative would result in a lost opportunity for the landowner (in terms of revenue) and the country (in terms of renewable energy).

8. At a broader scale, the benefits of additional capacity to the electricity grid and those associated with the introduction of renewable energy would not be realised. Although the facility is only proposed to contribute approximately 46MW to the grid capacity, this would assist in meeting the growing electricity demand throughout the country and would also assist in meeting the government's goal for renewable energy.

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

» **Increased energy security:** The current electricity crisis in South Africa highlights the significant role that renewable energy can play in terms of power supplementation. In addition, given that renewables can often be deployed in a decentralised manner close to consumers, they offer the opportunity for

improving grid strength and supply quality, while reducing expensive transmission and distribution losses.

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

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

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

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

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

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

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

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

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

The table below provides an assessment of the potential impacts associated with the no-development alternative.

Nature: 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 Enhancement**[17]
Extent	Local-Regional (3)	Local-Regional (4)
Duration	Long term (4)	Long term (4)
Magnitude	Medium (6)	Medium (6)
Probability	Definite (5)	Definite (5)
Significance	High (65	High (70)
Status	Negative	Positive
Reversibility	Yes	
Irreplaceable loss of resources?	Yes, impact of climate change on ecosystems	
Can impact 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.		
***Cumulative impacts*:** Reduce carbon emissions via the use of renewable energy and associated benefits in terms of global warming and climate change.		
***Residual impacts*:** Reduce carbon emissions via the use of renewable energy and associated benefits in terms of global warming and climate change.		

[17] Enhancement assumes development of the proposed PVSEF and establishment of Community Trust

CONCLUSIONS AND RECOMMENDATIONS: PHASE 4 CHAPTER 13

The Merapi Solar Energy Facility – Phase 4 is proposed to be developed as a commercial solar energy facility located on Portion 0 of Farm 311 Ceylon which falls within the Mantsopa Local Municipality of the Free State Province (refer to Figure 13.1). 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 SolaireDirect Southern Africa (Pty) Ltd, as an IPP, is investigating the establishment of a 130 MW (155MW installed capacity) photovoltaic solar park for the purpose of commercial electricity generation. The proposed Merapi Solar Facility – Phase 4 facility is proposed to be approximately 46MW in capacity and forms part of this larger solar park. The proposed facility will require approximately 70 ha and will be comprised of the following primary elements (refer to Chapter 2 for more details):

» An array of PV panels.
» An on-site substation and 22kV/132kV overhead power line to facilitate the connection between the solar energy facility and the Eskom electricity grid.
» Internal access roads.
» Guard house,
» Laydown, Campsite and assembly area.
» Office and Control centre.

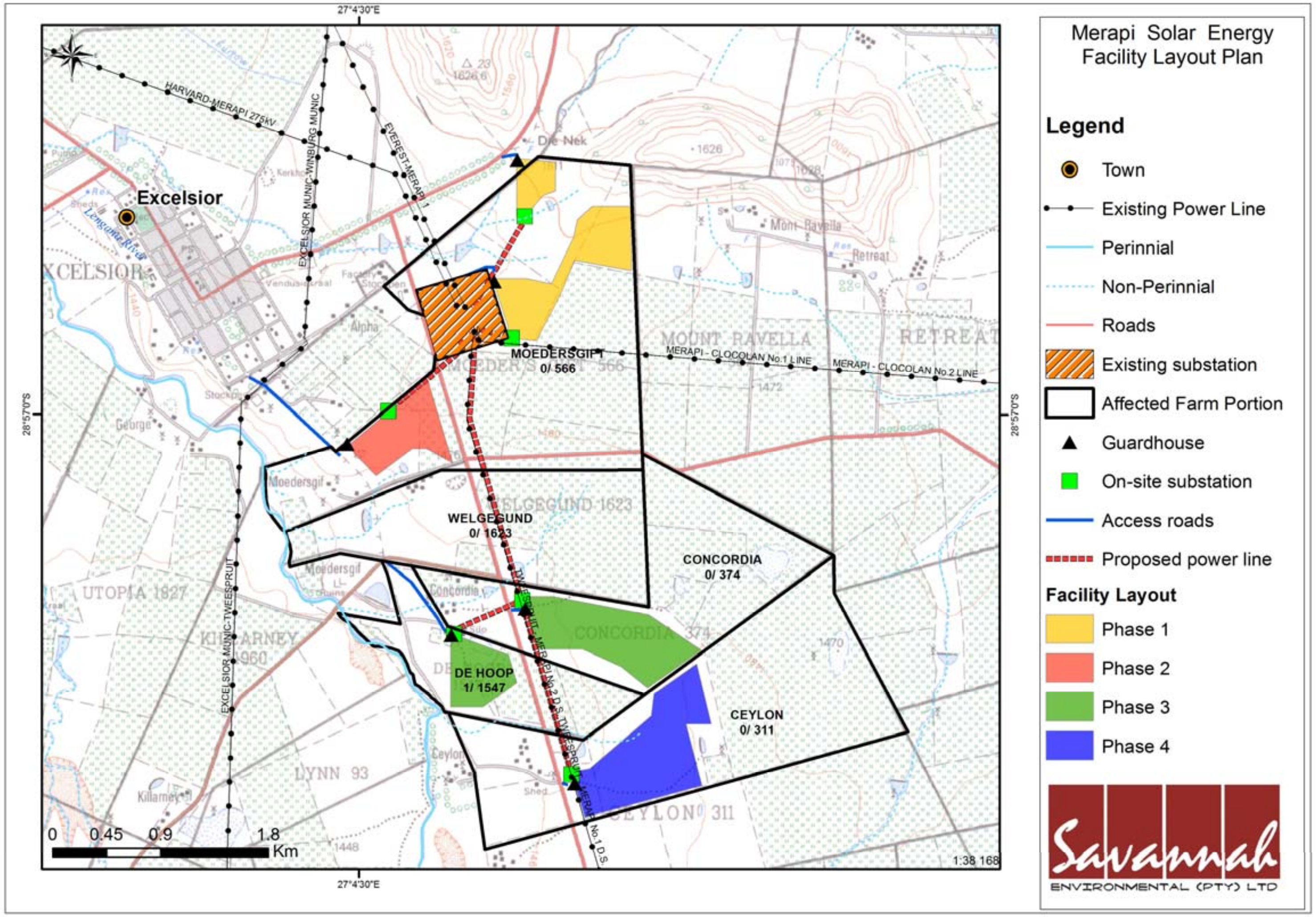

Figure 13.1: Locality map illustrating the location of the assessed development site for the proposed Merapi Solar Park and preliminary layout of the proposed facility, indicating the location proposed for the 4 project phases

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), SolaireDirect Southern Africa (Pty) Ltd requires authorisation from the National Department of Environmental Affairs (DEA) (in consultation with the Free State DETEA 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[18] 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 N).

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

13.1. Evaluation of Merapi Solar Energy Facility – Phase 4

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 Merapi Solar Energy Facility – Phase 4 by providing a summary of the conclusions of the assessment of the proposed site for the development of the PV solar energy

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

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 environmental fatal flaws which were identified to be associated with the site. No go areas identified include areas of high ecological sensitivity (small rocky outcrops, ridges, footslopes of larger mountains and riparian areas). In summary, the most significant environmental impacts associated with the Merapi Solar Energy Facility – Phase 4, 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 agricultural potential,
» Impacts on the social environment.

13.1.1. Local Site-specific Impacts

The construction of the Merapi Solar Energy Facility – Phase 4 will lead to permanent disturbance of an area of ~70ha in extent. Permanently affected areas include the area for the PV panels and associated infrastructure, as well as the internal 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, but degraded due to continued heavy grazing. Areas of sensitivity within the proposed development site were identified through the EIA process. These relate to the local ecology (sensitive and protected vegetation, habitat for fauna, several small drainage lines, man-made dams and natural vleys occur within the project area). (Refer to the sensitivity map – Figure 13.2).

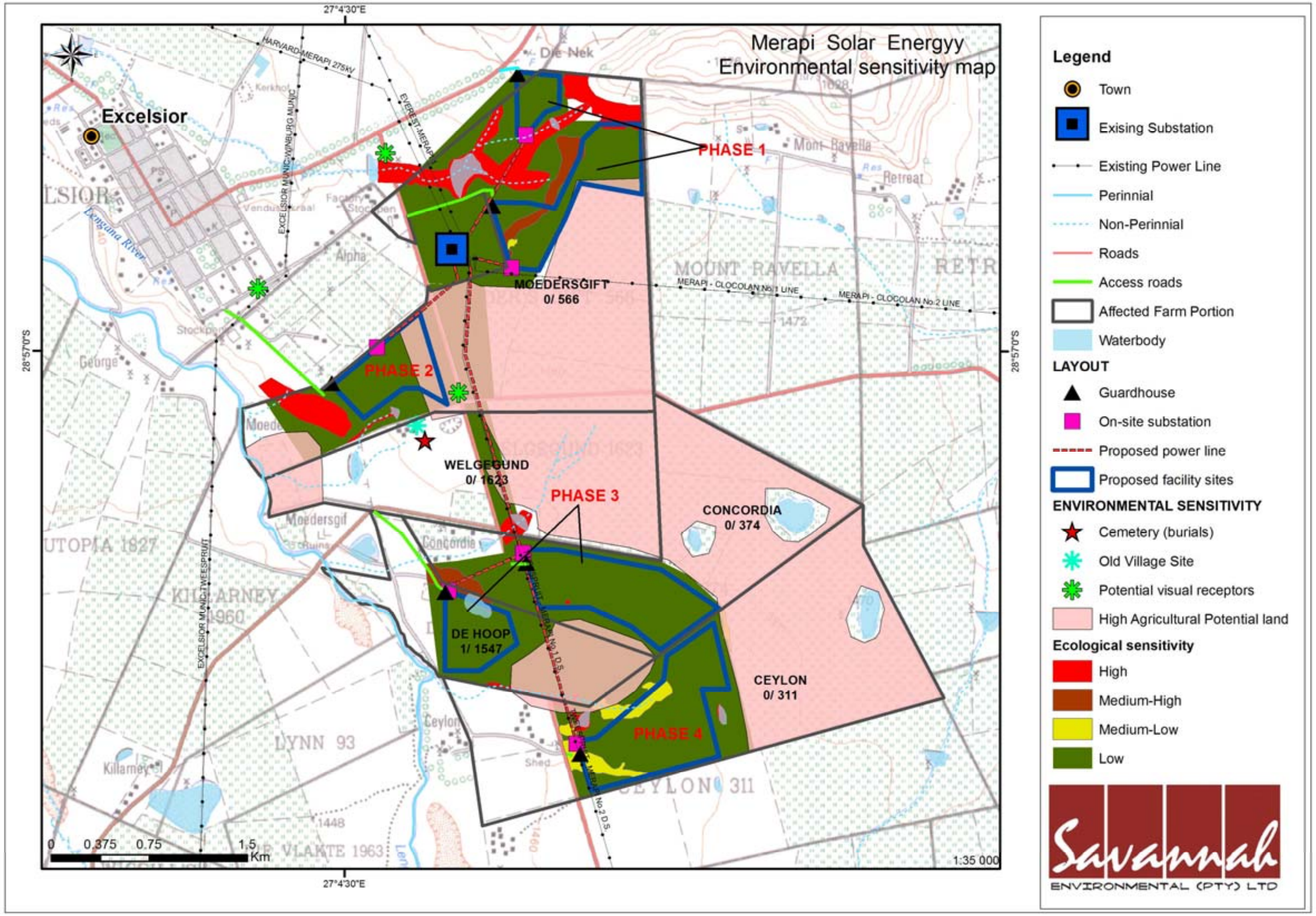

Figure 13.2: Sensitivity map for the Merapi Solar Energy Facility.

Areas of high sensitivity include rocky outcrops, ridges, and small koppies which are a habitat for several protected species found near the sites. Once these habitats have been physically altered, they cannot be recreated or returned to their former diversity and functionality therefore should be treated as no-go areas. Other sensitive ecological areas include dense vegetation of the riparian areas fringing the drainage channels which is essential in keeping the drainage channel intact and protects it from erosion as well as footslopes of larger mountains and riparian areas. These areas have been avoided through the careful placement of infrastructure. The proposed facility is located within areas of low and medium-low sensitivity. It is concluded through the specialist investigations undertaken that impacts on ecology associated with the proposed development can be mitigated to acceptable levels.

No impacts on heritage sites are expected to occur as no heritage sites were recorded within the proposed development footprint.

13.1.2. Visual Impacts

Most of the potential impacts associated with the proposed facility relate to the foreground and middle ground zone of visual influence (i.e. within 3km of the proposed facility). The visual analysis and assessment from all selected observation points found that the proposed activity is potentially visible and recognisable from Key Observation Points along the R703 and R709 as well as from Excelsior itself. The results of the Visual Impact Assessment for the proposed Merapi Solar Park therefore found that the proposed activity will have a **medium** impact from KOPs identified in the *foreground* and *middle ground* (<3km). This impact is partially mitigated by the presence of the Merapi substation is located on the north western boundary of the site, and two power lines associated with the substation traverse the site. The visual integrity of the site and the surrounding area has therefore been impacted by the existing energy related infrastructure on the site.

Other solar energy facilities are located in the same district as the proposed Merapi Solar Energy Facility (Refer to Figure 13.3). Based on the findings of the specialist studies undertaken, the potential cumulative visual impacts are expected to be low. This is due to the distance between facilities as well as the sparsely populated nature of the region.

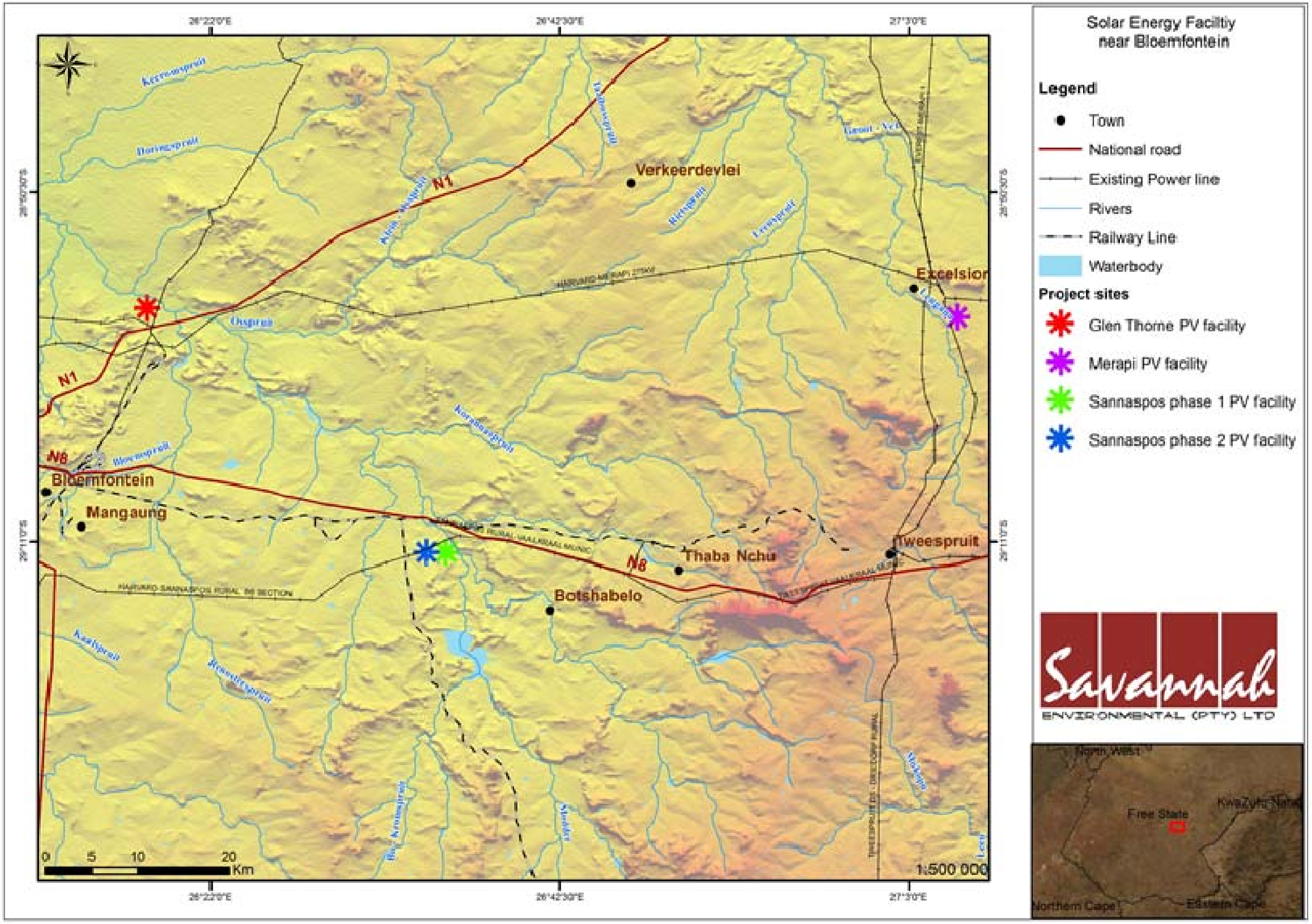

Figure 13.3: Locality map showing the Solar Energy Facility proposed in close proximity to the Merapi Solar Energy Facility.

13.1.3. Impacts on Agricultural potential

The majority of the site (95%) is proposed on Mispah and Sterkspruit soils. These soils type have low-medium agricultural potential. However a small portion of the facility will occupy the Clovelly soil of type and these soils are known to be of medium-high agricultural potential. As the majority of the development footprint is located outside of areas of high agricultural potential and cultivated fields, the impact on agricultural potential is considered acceptable. It is recommended that the proposed project be approved subjected to the mitigation measures stipulated in the Environmental Management Programme since these soils type are suitable for rehabilitation purposes.

13.1.4. 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 largely restricted to daylight hours, and the construction phase is anticipated to extend for a minimum period of 18-months. Negative impacts during construction relate mainly to impacts due to the presence of construction workers and visual impact imposed by the facility on the local environment. 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. This will be a positive impact due to the high unemployment levels in the area. The positive impact due to employment creation will be lower during operation as there will be a limited number of staff required compared to the construction phase.

13.2. 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 generating capacity of 33MW on a site located on Portion 0 of Farm 566 Moedersgift has been established by SolaireDirect Southern Africa (Pty) Ltd. The positive implications of establishing a solar energy facility on the identified site within the Free State include the following:

» The potential to harness and utilise solar energy resources within the Free State Province.
» The consolidation of solar facility infrastructure within an area (specifically considering the proximity to Phases 2, 3 and 4 of the Merapi Solar park, as well as to the proposed Sannaspos and Glen Thorne solar facilities to be developed).
» 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 Free State Province would benefit from the additional generated power.
» Promotion of clean, renewable energy in South Africa
» Creation of local employment, business opportunities and skills development for the area.

The findings of the specialist studies undertaken within this EIA to assess both the benefits and potential negative impacts anticipated as a result of the proposed project conclude that 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 the majority of identified negative impacts can be reduced by implementing the recommended mitigation measures. The project is therefore considered to meet the requirements of sustainable development. Environmental specifications for the management of potential impacts are detailed within the draft Environmental Management Programme (EMP) included within Appendix N.

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**.

13.3. 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 Merapi Solar Energy Facility – Phase 4 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:

» A minimum legal buffer of development of 32 m from drainage lines should be observed. It is recommended that a buffer of at least 100 m be maintained around riparian areas. Where this is not possible, alternative mitigation measures as detailed in this report must be implemented and relevant permits must be obtained.
» Following the final design of the facility, a final 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 N 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 throughout the construction and operation of the facility.
» 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.
» Existing access roads on site should be used as far as possible.
» 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 SolaireDirect Southern Africa (Pty) Ltd must be submitted to the relevant regulating authorities.

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