ENVIRONMENTAL IMPACT ASSESSMENT PROCESS
DRAFT EIA REPORT

PROPOSED ILANGA SOLAR THERMAL POWER PLANT AS PART OF THE FUTURE KAROSHOEK SOLAR THERMAL PARK, NORTHERN CAPE

(DEA REF No: 12/12/20/2056)

DRAFT FOR PUBLIC REVIEW
15 June 2011 – 15 July 2011

Prepared for

Ilangalethu Solar Power
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2010

ILANGALETHU

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PROJECT DETAILS

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Title	:	Environmental Impact Assessment Process: Draft Environmental Impact Assessment Report Proposed Ilanga Solar Thermal Power Plant as part of the future Karoshoek Solar Thermal Park, Northern Cape
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INVITATION TO COMMENT ON THE DRAFT EIA REPORT

The draft Environmental Impact Assessment (EIA) Report is available for review and comment by Interested and Affected Parties (I&APs) and stakeholders at the following public places within the project area from 15 June 2011 – 15 July 2011:

» Upington Library, Market Street
» Upington Police Station, 114 Schroder Street
» Agrimart Farmers Co-Operation, 20 Swartmodder Road

The report is also made available on:
» www.savannahSA.com

Submit your comments as written submission via fax, post, or e-mail to:
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The due date for comments on the Draft EIA Report is 15 July 2011

EXECUTIVE SUMMARY

Ilangalethu Solar Power (Pty) Ltd, as an independent power producer, is investigating the possible establishment of a 125 MW solar thermal power plant and associated infrastructure for the purpose of commercial electricity generation. This facility is proposed as a first phase of the future proposed 1 GW Karoshoek Solar Valley Site situated approximately 30 km east of Upington in the Northern Cape. Additional phases of this broader development will be the subject of separate EIA processes.

The broader site comprises four including Portion 0 of Karos 959; Portion 3 of Annashoek 41; Portion 2 of Matjiesrivier 41; and Portion 0 of Zandemm 944. Together these farm portions cover an extent of approximately 26 000 ha. Nine potentially suitable areas for the greater Karoshoek facility have been identified within this broader site. Of these nine areas, Site 1.2 has been identified as the most feasible site from a technical and environmental perspective for the development of Project Ilanga.

Project Ilanga will be comprised of the following primary elements:

» *The solar field* - this will comprise multiple loops of parabolic troughs which serve to receive and concentrate the solar radiation.
» *The power block* - comprising a conventional steam turbine generator and a substation into which the electricity can be evacuated.
» *Water related infrastructure* - including an existing abstraction point near Farm Annashoek[1] (i.e. associated with a still basin, a main pump set, a sand filter, and a coffer dam), a water supply pipeline; several water treatment and storage reservoirs, and evaporation ponds.
» *Power evacuation* – two 132kV powerlines will be constructed which will have a loop-in loop-out connection[2] into the existing Gordonia-Garona 132kV line to the north of the site. This will necessitate crossing the Orange River, the N10, and the N14 national roads. Within the site it is proposed that these powerlines follow the same alignment as the main water supply pipeline and access road (along the existing main access road to the farm Annashoek) to reach the on-site substation.
» *Associated infrastructure* – a short internal access road, storerooms, parking facilities, security and administrative buildings, and temporary waste storage facilities.

Parabolic trough technology is proposed for Project Ilanga. The pivotal component of this technology is the solar collector assembly which consists of parabolic troughs (i.e. reflectors) and cylindrical tubes (i.e. receivers) which run in the focal line of the parabola. The reflectors are made of mirrored glass panels which are supported by a truss system. Each solar collector assembly tracks the sun on a one-axis basis

[1] The abstraction point may need to be upgraded.
[2] If a double circuit powerline is proposed then two lines will no longer be necessary.

through an installed drive system thereby allowing for maximum generation capacity as the sun's trajectory changes on a daily and seasonal basis. The reflectors receive the incoming solar radiation and accurately concentrate it onto the receiver tube which is a highly efficient heat collection element. The heat is absorbed by the heat transfer fluid (i.e. oil, salt, or water) which flows within the receivers and transfers the absorbed heat from the solar field to the power block of the solar facility in a closed circuit.

An Environmental Impact Assessment (EIA), as defined in the National Environmental Management Act (NEMA, Act No. 107 of 1998) 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 the developer requires authorisation from the National Department of Environmental Affairs, in consultation with the Northern Cape Department of Agriculture and Nature Conservation, 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 stakeholders 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 Karoshoek site), as well as the extent of studies required within the EIA Phase were identified.
» *EIA Phase* – potentially significant biophysical and social impacts[3] and identified feasible alternatives put forward as parts of the project have been comprehensively assessed. Appropriate mitigation measures have been recommended as part of a draft Environmental Management Programme (EMP).

The following potentially significant environmental impacts have been identified through the EIA Phase.

» Local site specific impacts resulting from the physical modification/disturbance of the site primarily during the construction phase.
» Impacts associated with the power lines.
» Impacts on water resources.

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

» Impacts on the social environment.

Global climate change is widely recognised as being one of the greatest environmental challenges facing the world today. How we source our energy plays a big part in tackling climate change. As a net off-setter of carbon, renewable energy technologies 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. 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 positive implications of establishing a solar energy facility on the identified site within the Northern Cape include:

» The potential to harness and utilise solar energy resources, which are known to be significant within the Northern Cape.
» The project would assist the South African government in reaching their set targets for renewable energy.
» The project would assist the South African government on the implementation of its green growth strategy and job creation targets.
» The National electricity grid in the Northern Cape would benefit from the additional generated power.
» Promotion of clean, renewable energy in South Africa
» Positive impacts on the tourism economy of the area
» 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 from the proposed project conclude that there are **no environmental fatal flaws** that should prevent the proposed facility from proceeding. The majority of impacts identified are of moderate to low significance and can be successfully mitigated to acceptable levels, provided the specifications as detailed within the Environmental Management Programme (EMP) for the project are implemented. 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**.

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 Ilanga Solar Thermal Power Plant can be mitigated to an acceptable level, and therefore that the application for the proposed solar energy facility and associated infrastructure as detailed within this EIA Report be authorised by DEA. The following conditions of this

recommendation must be included within the authorisation issued:

» As far as possible, any component of the facility which could potentially affect sensitive areas (i.e. primary drainage lines) should be shifted in order to avoid these areas of high sensitivity (i.e. best practice is impact avoidance). Where this is not possible, alternative mitigation measures as detailed in this report must be implemented.
» The final alignment of the water supply pipeline and location of the power line towers must be informed by surveys undertaken by an ecological and heritage specialist. The EMP for construction must be updated to include site-specific information and specifications resulting from the final walk-though surveys. This EMP must be submitted to DEA for approval prior to the commencement of construction.
» Following the final design of the facility, a revised layout must be submitted to DEA for review and approval prior to commencing with construction.
» An independent Environmental Control Officer should be appointed to monitor compliance with the specifications of the EMP for the duration of the construction period.
» The Environmental Management Programme as contained within Appendix L of this report should form part of the contract with the EPC Contractor appointed to construct the proposed solar energy facility, and must 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 in this report.
» All relevant practical and reasonable mitigation measures detailed within this report and the specialist reports contained within Appendices F to L must be implemented.
» During construction, unnecessary disturbance to habitats should be strictly controlled and the footprint of the impact should be kept to a minimum.
» Disturbed areas should be rehabilitated as quickly as possible once construction is completed in an area, and an on-going monitoring programme should be established to detect, quantify, and manage any alien species.
» A comprehensive stormwater 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 Ilanga CSP 1 must be submitted to the relevant regulating authorities. This includes permits for the transporting of all components (abnormal loads) to site, disturbance to heritage sites, disturbance of protected vegetation, and disturbance to any drainage lines or riparian vegetation.

INFORMATION TRACKER WITHIN THIS REPORT

The National Environmental Management Act (Act No. 107 of 1998)(NEMA) sets out the requirements for the environmental authorisation process. The table below indicates the requirements for an Environmental Impact Assessment Process, as well as the requirements for undertaking the public participation process.

Legal and Regulatory Requirement:	**Cross Reference:**
(2) An EIA report must contain all information that is necessary for the competent authority to consider the application and to reach a decision contemplated in Regulation 36, and must include –	
Details of:	
(i) The EAP who prepared the report	Section 1.5 and Appendix A
(ii) The expertise of the EAP to carry out an environmental impact assessment	Section 1.5 and Appendix A
(a) Detailed description of the proposed activity	Section 2.3
(b) 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 –	Chapter 1 and Figure 1.1
(i) A linear activity, a description of the route of the activity; or	Section 2.3
(c) 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 6
(d) Details of the public participation process conducted in terms of sub-regulation (1), including –	Chapter 5
(i) Steps undertaken in accordance with the plan of study	Section 4.1
(ii) A list of persons, organisations and organs of state that were registered as interested and affected parties;	Section 5.2.2 and Appendix B and C
(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	Appendix D3
(iv) Copies of any representations, objections and comments received from registered interested and affected parties	Appendix D4
(e) A description of the need and desirability of the proposed activity and identified potential alternatives to the proposed activity, including advantages and disadvantages that the	Section 1.2 and 3.3

proposed activity or alternatives may have on the environment and the community that may be affected by the activity;	
(f) An indication of the methodology used in determining the significance of potential environmental impacts	Section 5.2.5.
(g) A description and comparative assessment of all alternatives identified during the environmental impact assessment process	Section 8.1.1.
(h) A summary of the findings and recommendations of any specialist report or report on a specialised process	Chapter 8 and Appendices E - K
(i) 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 7
(j) An assessment of each identified potentially significant impact, including cumulative impacts, the nature of the impact, the extent and duration of the impact, the probability of the impact occurring, 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.	Chapter 7
(k) A description of any assumptions, uncertainties and gaps in knowledge	Section 5.2.6.
(l) An 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	Chapter 8
(m) An Environmental Impact Statement which contains a summary of the key findings of the environmental impact assessment; and a comparative assessment of the positive and negative implications of the proposed activity and identified alternatives.	Chapter 8
(n) A draft Environmental Management Programme that complies with Regulation 34	Appendix M
(o) Copies of any specialist reports and reports on specialised processes complying with Regulation 33.	Appendix E - K
(p) Any specific information that may be required by the competent authority	As per the specific request for information specified in the acceptance of Scoping - Appendix M

TABLE OF CONTENTS

APPENDICES

Appendix A: EIA project consulting team CVs
Appendix B: Correspondence with Authorities
Appendix C: I&AP database
Appendix D1: Advertisement for the EIA review period
Appendix D2: Stakeholder letters
Appendix D3: Comments and Response report
Appendix E: Ecology study
Appendix F: Geology study
Appendix G: Agricultural Potential study
Appendix H: Heritage study
Appendix I: Water Resources study
Appendix J: Visual study
Appendix K: Social study
Appendix L: Draft Environmental Management Programme
Appendix M: A3 Maps

ABBREVIATIONS AND ACRONYMS

BID	Background Information Document
DEA	National Department of Environmental Affairs
DoE	Department of Energy
EAP	Environmental Assessment Practitioner
EIA	Environmental Impact Assessment
EMP	Environmental Management Programme
EPC	Engineering, Procurement and Construction
FIT	Feed-in Tariffs
GDP	Gross Domestic Profit
GG	Government Gazette
GN	Government Notice
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
LM	Local Municipality
LPG	Liquid Petroleum Gas
LUPO	Land Use Planning Ordinance, Ordinance 15 of 1985
MA	Million years before present
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
NGOs	Non-Governmental Organisations
NT	Not Threatened
NWA	National Water Act (Act No. 36 of 1998)
PES	Present Ecological State
REFIT	Renewable Energy Feed-in Tariffs
SAHRA	South African Heritage Resources Agency
SANBI	South African National Biodiversity Institute
SANRAL	South African National Roads Agency Limited
VAC	Visual Absorption Capacity
VU	Vulnerable

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.

Concentrating solar power: Solar generating facilities use the energy from the sun to generate electricity. Concentrating Solar Power facilities collect the incoming solar radiation and concentrate it (by focusing or combining it) onto a single point, thereby increasing the potential electricity generation capacity.

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.

Early stone age: A very early period of human development dating between 300 000 and 2.6 million years ago.

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.

Feed-in tariffs: Feed-in Tariffs (FIT) have been set to promote socio-economic and environmentally sustainable growth. They are essentially guaranteed prices for electricity supply as opposed to conventional consumer tariffs. The basic economic principle underpinning the FIT is the establishment of a tariff that covers the cost of generation plus a "reasonable profit" to entice independent power producers to invest in generation projects.

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.

Integrated energy plan: A plan commissioned by the DME in response to the requirements of the National Energy Policy, in order to provide a framework in which specific energy policies, development decisions and energy supply trade-offs can be made on a project-by-project basis. The framework is intended to create a balance between the energy demand and resource availability to provide low cost electricity for social and economic development, while taking into account health, safety and environmental parameters.

Integrated strategic electricity planning: Eskom's planning process which provides strategic projections of supply-side and demand-side options to be implemented to deal with the energy management issues and meet long-term load forecasts.

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.

Late stone age: In South Africa this time period represents fully modern people who were the ancestors of southern African KhoeKhoen and San groups (40 000 – 300 years ago).

Middle stone age: An early period in human history characterised by the development of early human forms into modern humans capable of abstract though process and cognition 300 000 – 40 000 years ago.

National integrated resource plan: Commissioned by NERSA in response to the National Energy Policy's objective relating to affordable energy services, in order to provide a long-term, cost-effective resource plan for meeting electricity demand, which is consistent with reliable electricity supply and environmental, social and economic policies.

Parabolic trough: Consist of parabolic reflectors and cylindrical tubes (i.e. receivers) which run congruently. The reflectors are made of mirrored glass panels which are supported by a truss system that gives the solar collector assembly its structural

strength. The support structure also allows the parabolic trough to track the sun thereby allowing for maximum generation capacity as the sun's trajectory changes on a daily and seasonal basis. The reflectors receive the incoming solar radiation and accurately concentrate it onto the receiver which is a highly efficient heat collection element which contains a heat transfer fluid (i.e. oil or water) which flows within a closed circuit to the power block of a solar facility.

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).

Renewable energy feed-in tariff: Renewable Energy Feed-In Tariffs (REFITs) are used to promote renewable energy and have been adopted in over 36 countries worldwide. The establishment of the REFIT in South Africa provides the opportunity for an increased contribution towards the sustained growth of the renewable energy sector, and to promote competitiveness between renewable and conventional energies in the medium and long-term. Under the National Energy Regulator Act (Act No. 40 of 2004), the Electricity Regulation Act (Act No. 4 of 2006), and all subsequent relevant amendment acts, the National Energy Regulator of South Africa (NERSA) has the mandate to determine the prices at and conditions under which electricity must be supplied by licence.

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.

Solar thermal power: The generation of electricity can be easily explained as the conversion of energy from one form to another. Solar thermal facilities, like conventional coal-fired power plants operate by heating water for the purpose of steam generation. This steam is used to turn a generator which is a rotating machine that converts mechanical energy into electrical energy by creating relative motion between a magnetic field and a conductor. Where conventional power stations burn fossil fuels (i.e. coal or gas) to generate steam, their solar counterparts extract this energy from the sun. Two types of solar thermal technologies make use of reflectors / mirrors to

concentrate the incoming solar radiation onto a focal point. These are referred to as line and point concentrating solar power (CSP) technologies. The point focus technologies include the tower and dish technologies, the line focus technologies include the parabolic trough and linear fresnel technologies. The parabolic trough is the proposed technology for the Ilanga facility.

INTRODUCTION CHAPTER 1

Ilangalethu Solar Power (Pty) Ltd (Ilanga CSP 1), as an independent power producer (IPP), is investigating the possible establishment of a 125 MW solar thermal power plant (STPP) and associated infrastructure for the purpose of commercial electricity generation. Hereafter referred to as **Project Ilanga**, this facility is proposed as a first phase of the future proposed Karoshoek Solar Valley Site situated approximately 30 km east of Upington in the Northern Cape. The broader site comprises the following farm portions, together which cover an extent of approximately 26 000 ha (refer to Figure 1.1).

» Portion 0 of Karos 959;
» Portion 3 of Annashoek 41;
» Portion 2 of Matjiesrivier 41; and
» Portion 0 of Zandemm 944.

This broader site has been divided into nine potentially suitable areas for the greater Karoshoek facility. Of these 9, Site 1.2 has been selected for Project Ilanga (refer to Chapter 3 for more details in this regard). This site is approximately 4.84 km^2 in extent and is located at 28°28'48.11" S; 21°31'51.46" E (refer to Figure 1.2).

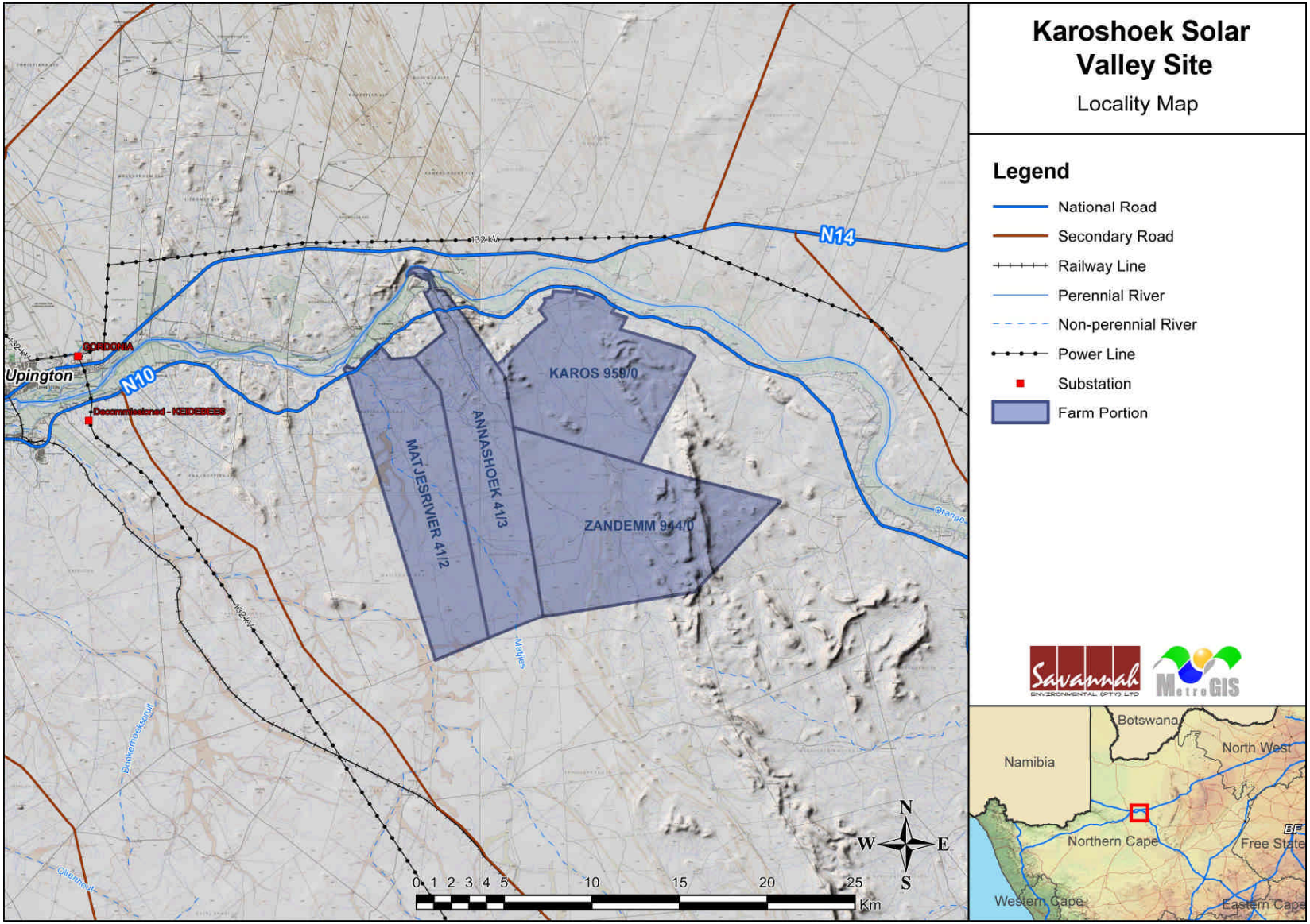

Figure 1.1: Locality map showing the broader Karoshoek Solar Valley site east of Upington.

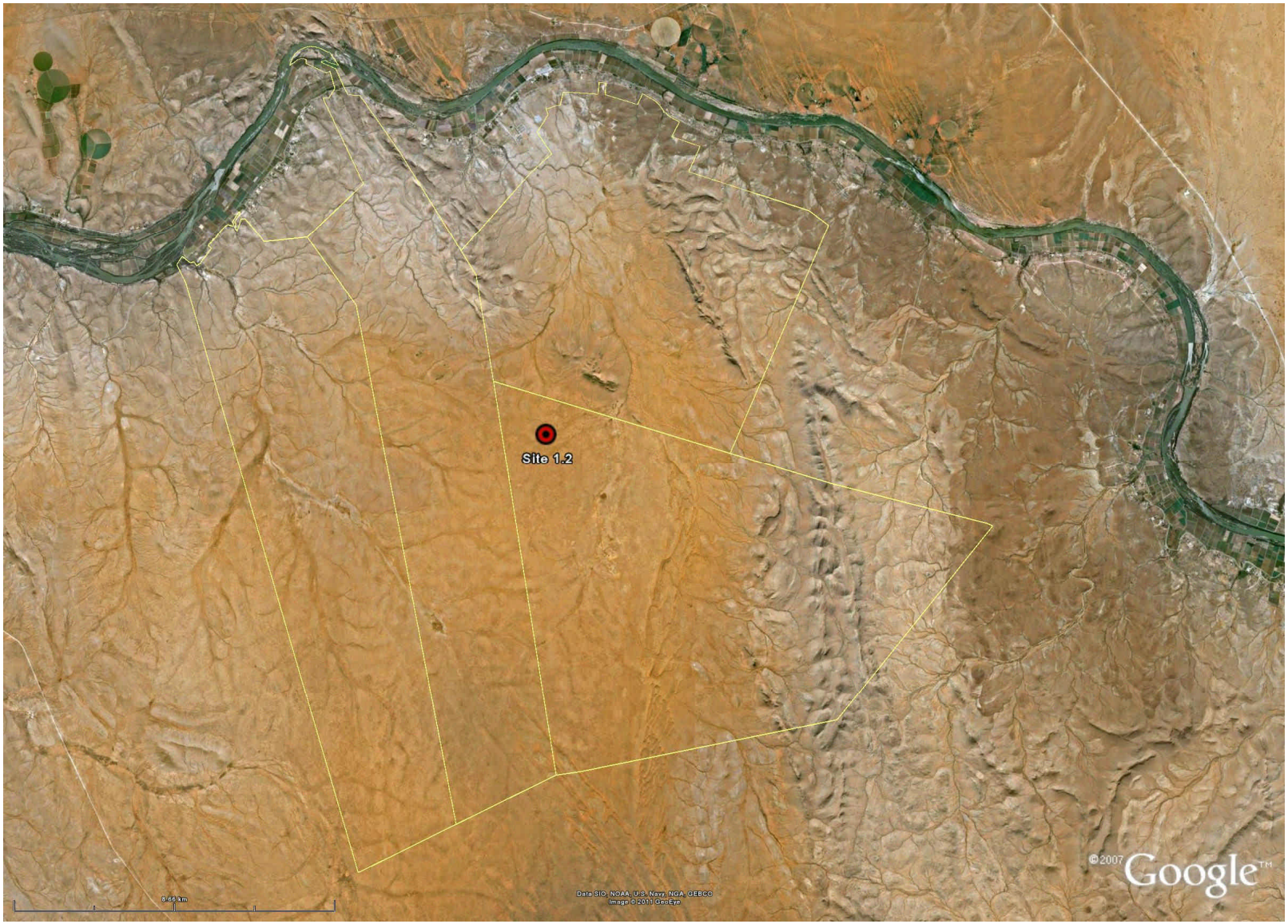

Figure 1.2: Google Earth Image illustrating the location of Site 1.2 within the broader Karoshoek site.

The area infrastructure (i.e. solar field (i.e. parabolic troughs), power block etc.) will be entirely contained within this identified site and will have a developmental footprint of approximately 4.84 km^2. The associated infrastructure will extend beyond this boundary across the Karoshoek site (i.e. the powerline will extend to its connection point with the existing 132 kV line, and the water pipeline will extend to the abstraction point along the Orange River. Project Ilanga is proposed as the first phase of the larger Karoshoek facility, which is proposed to have a maximum generating capacity of 1 GW. Additional phases of this broader development will be the subject of separate EIA processes.

Project Ilanga will be comprised of the following primary elements (refer to Chapter 3 for more details):

» *The solar field* - this will comprise multiple loops of parabolic troughs which serve to receive and concentrate the solar radiation. They will be directly associated with pipelines which will convey the heat transfer fluid between the troughs and the steam cycle.
» *The power block* - comprising a conventional steam turbine generator and a substation into which the electricity can be evacuated.
» *Water related infrastructure* - including an existing abstraction point at the Farm Annashoek[4] (i.e. associated with a still basin, a main pump set, a sand filter, and a coffer dam), a water supply pipeline; several water treatment and storage reservoirs, and evaporation ponds.
» *Power evacuation* – two 132 kV powerlines will be constructed which will have a loop-in loop-out connection[5] into the existing Gordonia-Garona 132 kV line to the north of the site. This will necessitate crossing the Orange River, the N10, and the N14 national roads. Within the site it is proposed that these powerlines follow the same alignment as the main water supply pipeline and access road (along the existing main access road to the farm Annashoek) to reach the on-site substation.
» *Associated infrastructure* – a short internal access road, storerooms, parking facilities, security and administrative buildings, and temporary waste storage facilities.

The nature and extent of the proposed facility is evaluated further within this Draft EIA Report. This EIA Report consists of the following sections:

» *Chapter 1: Introduction* - provides background to the proposed facility, the environmental impact assessment process; and the environmental assessment practitioner.
» *Chapter 2: - Technology Description* - provides an overview of the proposed solar technology.

[4] The abstraction point may need to be upgraded.
[5] If a double circuit powerline is proposed then two lines will no longer be necessary.

» *Chapter 3: - Project Overview* - provides an overview of the consideration of alternatives, and the proposed activities during the different phases in the project timeline.
» *Chapter 4: - Regulatory and Legal Context* - provides an overview of the regulatory and legal context for electricity generation projects.
» *Chapter 5 – EIA Process* - outlines the process followed during the EIA Phase, including the public participation process.
» *Chapter 6 – Description of the Affected Environment* - describes the baseline biophysical and socio-economic conditions.
» *Chapter 7 – Impact Assessment* - presents the assessment of impacts, both positive, negative, direct, indirect, and cumulative associated with the facility and its associated infrastructure.
» *Chapter 8 – Conclusions and Recommendations* - presents the conclusions of the EIA Phase, as well as an impact statement (i.e. conclusions) and recommendations for the implementation of the proposed project.
» *Chapter 9* - provides a list of references and information sources used in compiling the EIA Report.

1.1. Conclusions from the Scoping Phase

The broader Karoshoek site was evaluated within the Scoping Study (Savannah Environmental, November 2010). No environmental fatal flaws were identified to be associated with the site. However, from the preliminary sensitivity analysis undertaken, potentially sensitive areas within the broader 26 000 ha were identified (refer to Figure 1.3). These sensitive areas included areas of ecological sensitivity, areas of visual exposure, areas of high agricultural potential, and areas with potentially sensitive noise receptors. The sensitivities are expanded on below.

» *Areas of high ecological sensitivity* - there are high concentrations of dunes primarily in the south-western quarter and in some northern parts of the site, which are potentially sensitive to disturbance, and several non-perennial drainage lines and pans.
» *Areas of visual exposure* - the construction and operation of the proposed facility may have a negative visual impact on a limited number of potentially sensitive visual receptors within, but not restricted to, those receptors within an 8 km radius of the facility.
» *Areas of high agricultural potential* – the agricultural potential of the soils on the proposed development site range from low to high. The low rainfall, however, inhibits dry-land crop production and therefore production relies on irrigation from the Orange River. Construction of the proposed facility will result in the loss of land affected by the infrastructure for agricultural activities particularly for those areas in close proximity to the Orange River.

» *Areas with sensitive noise receptors* - there are a number of rural settlements near the Orange River and the N10. No potential noise sensitive receptors are located in the immediate vicinity of the proposed site however any receptor located within 2 km of the proposed development site may be affected.

As a result of the above, the recommendations of the Scoping Phase were that these areas of sensitivity be avoided as far as possible through an effective design process of the different components of the facility.

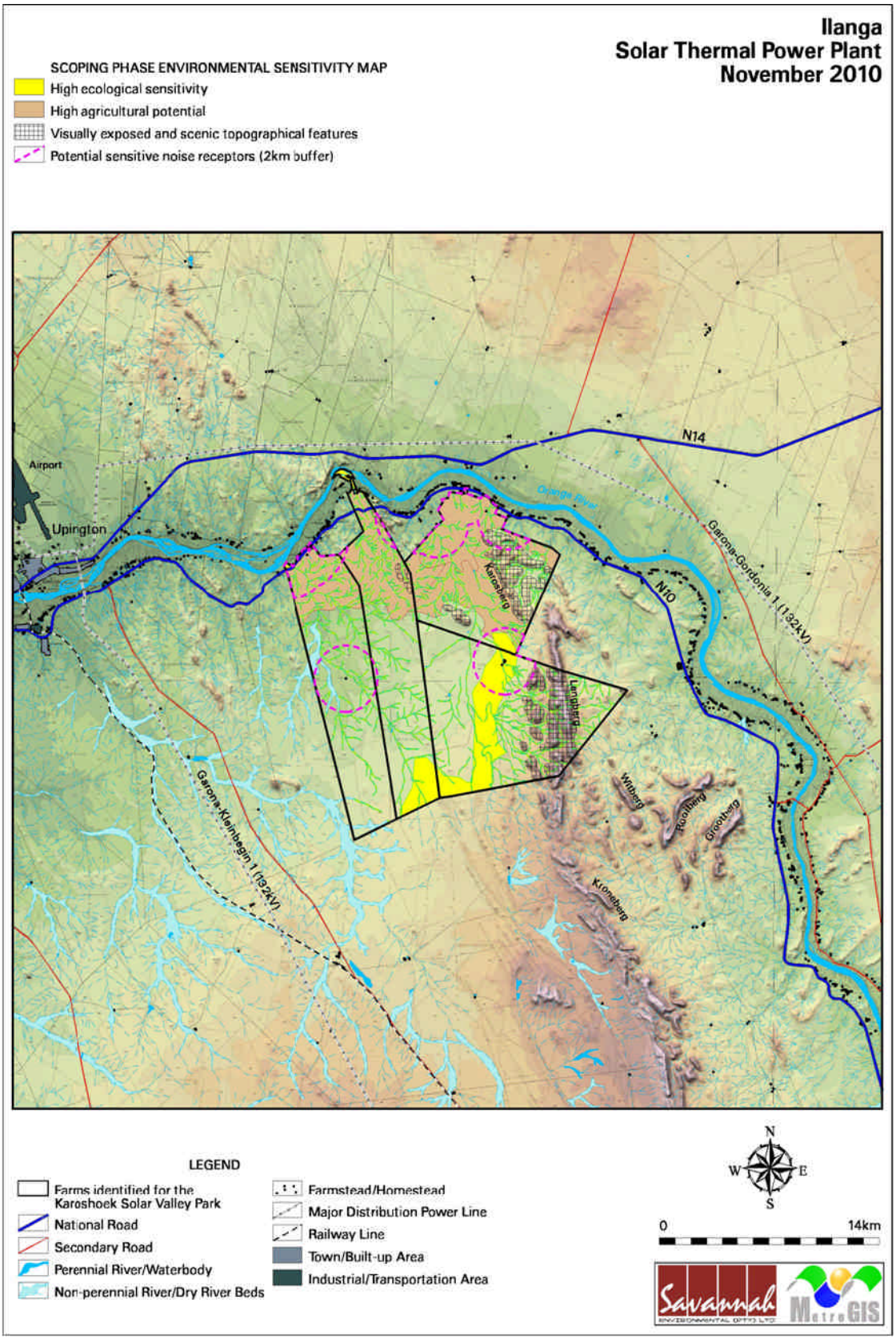

Figure 1.3: Environmental sensitivity map for the proposed Karoshoek Solar Valley site, which includes the site for the proposed Ilanga STPP.

1.2. The Purpose of the Proposed Project

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

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

To contribute towards the renewable energy target set by the Government, and to promote the renewable energy industry in South Africa, Renewable Energy Feed-in Tariffs (REFIT) have been set by the National Energy Regulator of South Africa (NERSA). REFITs promote the development of renewable power generation facilities by Independent Power Producers (IPPs)[6]. Feed-In tariffs have the advantage of giving developers long-term stability and predictability. Power generated by the solar facility known as Project Ilanga will be sold to the designated Single Buyer Office that will manage the REFIT scheme.

1.3. Requirements for an EIA Process

In terms of the Environmental Impact Assessment (EIA) Regulations published in Section 24(5) of the National Environmental Management Act (NEMA, Act No. 107 of 1998), Ilanga CSP 1 requires authorisation from the National Department of Environmental Affairs (DEA)[7] (in consultation with the Northern Cape Department of Agriculture and Nature Conservation (DENC)), for the establishment of the proposed STPP. An application for authorisation has been accepted by DEA under application reference number **12/12/20/2056**. This application included the following listed activities which are triggered by the proposed STPP and its associated infrastructure.

[6] The basic economic principle underpinning the REFITs is the establishment of a tariff (price) that covers the cost of generation plus a "reasonable profit" to induce developers to invest.

[7] As this is a proposed electricity generation project and thereby considered to be of national importance, the National Department of Environmental Affairs is the competent authority for the proposed project.

Relevant Notice:	Activity No:	Description of Listed Activity:	Relevant to:
545, 18 June 2010	1	The construction of facilities or infrastructure for the generation of electricity where the electricity output is 20 MW or more.	The use of parabolic troughs to generate a maximum capacity of 125 MW for integration into the Eskom grid.
545, 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 ha or more; except where such physical alteration takes place for: (i) Linear development activities; or (ii) Agriculture or afforestation where activity 16 in this schedule will apply.	The establishment of the proposed facility within a broader development site of more than 26 000 ha.
544, 18 June 2010	10	The construction of facilities or infrastructure for the transmission and distribution of electricity: (i) Outside urban areas or industrial complexes with a capacity of more than 33 kV but less than 275 kV; or (ii) Inside urban areas or industrial complexes with a capacity of 275 kV or more.	The development of two powerlines to loop into and out of the existing Gordonia-Garona 132 kV line to the north of the site. These powerlines will follow the same alignment as the main water supply pipeline and access road (along the existing main access road to the farm Annashoek), and will necessitate the crossing of the Orange River near the water abstraction point.
GN 544, 18 June 2010	13	The construction of facilities or infrastructure for the storage, or for the storage and handling of a dangerous good, where such storage occurs in containers with a combined capacity of 80 but not exceeding 500 m^3.	During the construction phase the fuel required for the construction vehicles will need to be stored adequately. During the operational phase additional heat transfer fluid for the parabolic troughs as well as the fuel required for 15% augmentation plant will need to be stored adequately.

Relevant Notice:	Activity No:	Description of Listed Activity:	Relevant to:
GN 544, 18 June 2010	22	The construction of a road, outside urban areas: (i) With a reserve wider than 13.5 m; or (ii) Where no road reserve exists where the road is wider than 8 m.	During the construction phase a short internal access road will be required, which is likely to be wider than 8 m.
GN 544, 18 June 2010	23(ii)	The transformation of undeveloped, vacant or derelict land to residential, retail, commercial, recreational, industrial or institutional use, outside an urban area and where the total area to be transformed is bigger than 1 ha but less than 20 ha except where such transformation takes place for linear activities.	The construction of some of the area infrastructure (i.e. abstraction point, holding reservoirs, water treatment works, and accommodation facilities), will result in the transformation of undeveloped land > 1 ha and < 20 ha.
GN 546, 18 June 2010	4(a)ii	The construction of a road wider than 4 m with a reserve less than 13.5 m.	It has been determined due to the location of the proposed development site within the Northern Cape that this activity bears no relevance.
GN 546, 18 June 2010	10(ii)	The construction of facilities or infrastructure for the storage, or storage and handling of a dangerous good, where such storage occurs in containers with a combined capacity of 30 but not exceeding 80 m^3.	This activity is covered through GN 544, 18 June 2010, activity number 13.
546, 18 June 2010	13(c)ii	The clearance of an area of 1 ha or more of vegetation where 75% or more of the vegetative cover constitutes indigenous vegetation.	It has been determined due to the location of the proposed development site within the Northern Cape that this activity bears no relevance.
546, 18 June 2010	16(iii) & (iv)	The construction of: (i) Buildings with a footprint exceeding 10 m^2 in size; or (ii) Infrastructure covering 10 m^2 or more where such construction occurs within a watercourse or within 32 m of a watercourse, measured from the edge of a	The construction of the abstraction point on the Orange River, as well as the towers required on the banks of the river for the powerline.

		watercourse, excluding where such construction will occur behind the development setback line.	

In terms of sections 24 and 24D of NEMA, as read with the EIA Regulations of GNR543, a Scoping and an EIA Phase are required to be undertaken as part of the EIA process which comprises the following four stages:

» *Notification Stage* - where the project is registered with DEA and the public participation process is initiated. This phase is complete.
» *Scoping Phase* - where the potential impacts of the facility are identified in preparation for the EIA Phase. This phase is complete.
» *EIA Phase* - the *current* phase whereby the potential impacts of the facility are assessed and evaluated in terms of their significance). The findings of this stage are detailed within this report.
» *Decision Making Phase* – whereby the competent authority (i.e. DEA) is provided with all the necessary information to compile an environmental authorisation (previously referred to as a Record of Decision). This phase will follow the submission of the Final EIA Report.

1.4. Objectives of the EIA Process

The Scoping Phase was completed in March 2011 and served to identify potential impacts associated with the proposed project and to define the extent of studies required within the EIA Phase. The Scoping Phase included input from the project proponent, specialists with experience in the study area and in EIAs for similar projects, as well as a public consultation process with key stakeholders that included both government authorities and interested and affected parties (I&APs).

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

1.5. Details of the Environmental Assessment Practitioner

Savannah Environmental was contracted by Ilangalethu as the independent Environmental Consultant to undertake the EIA process for Project Ilanga. Neither Savannah Environmental, nor any of its specialist sub-consultants on this project are subsidiaries of, or are affiliated to Ilangalethu. 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 proposed project team members include:

» *Jo-Anne Thomas* who will be the project manager responsible for planning, programming, and overseeing of the EIA process. Jo-Anne has considerable experience (more than 10 years) in conducting EIAs and in EIA project management.

» *Tammy Kruger* who will be the EAP responsible for preparation of the EIA reports and assessment of environmental aspects. Tammy has 4.5 years experience in the environmental field and has been involved with the EIA Process for multiple solar energy facilties, particularly in the Northern Cape.
» *Alicia Govender* who will assist with the public participation process.

Savannah Environmental has gained extensive knowledge and experience on potential environmental impacts associated with electricity generation projects through their involvement in related EIA processes. Savannah Environmental has completed the EIA process and received environmental authorisations for:

» The Eskom Wind Energy Facility on the West Coast;
» The Umoya Energy Hopefield Wind Energy Facility in the Western Cape;
» The African Clean Energy Development Cookhouse Wind Energy Facility in the Eastern Cape;
» The Moyeng Energy West Coast One Wind Energy Facility in the Western Cape;
» The Moyeng Energy Suurplaat Wind Energy Facility in the Northern Cape;
» The !Khi CSP (Abengoa Solar South Africa) Upington Solar Thermal Power Plant in the Northern Cape; and
» The !KaXu CSP (Abengoa Solar South Africa) Pofadder Solar Thermal Power Plant in the Northern Cape.

Savannah Environmental has developed a valuable understanding of impacts associated with the construction and operation of renewable energy facilities. Savannah Environmental has successfully managed and undertaken EIA processes for other power generation projects throughout South Africa. In order to adequately identify and assess potential environmental impacts, Savannah Environmental has appointed several specialist consultants to conduct specialist studies, as required. Curricula vitae for the Savannah Environmental project team and its specialist sub-consultants are included in Appendix A.

TECHNOLOGY DESCRIPTION CHAPTER 2

2.1. Solar Thermal Power

The generation of electricity can be easily explained as the conversion of energy from one form to another. Solar[8] thermal facilities, like conventional fossil fuel-fired power plants, operate by heating water for the purpose of steam generation. This superheated steam is routed to the steam turbine where it expands through the turbine blading to drive the steam turbine, which actuates the AC generator. The generator converts mechanical energy into electrical energy by creating relative motion between a magnetic field and a conductor. Where conventional power stations burn fossil fuels (i.e. coal or gas) to generate steam, their solar counterparts extract this energy from the sun. Different types of solar thermal technologies make use of reflectors / mirrors to concentrate the incoming solar radiation onto a focal point/line. These are referred to as concentrating solar power (CSP) technologies and include parabolic trough, power tower, linear Fresnel, and parabolic dish technology, of which the first is applicable to the proposed Ilanga Solar Thermal Power Plant (STPP).

2.1.1. What is a Parabolic Trough?

The pivotal component of this technology is the solar collector assembly (SCA) which consists of parabolic troughs (i.e. the reflectors) and cylindrical tubes (i.e. the receivers) which run in the focal line of the parabola (refer to Figure 2.1). The reflectors are made of mirrored glass panels which are supported by a truss system that gives the SCA its structural strength. Each SCA tracks the sun on a one-axis basis through an installed drive system thereby allowing for maximum generation capacity as the sun's trajectory changes on a daily and seasonal basis. The reflectors receive the incoming solar radiation and accurately concentrate it onto the receiver tube which is a highly efficient heat collection element. The heat is absorbed by the heat transfer fluid (HTF) (i.e. oil, salt, or water) which flows within the receivers and transfers the absorbed heat from the solar field to the power block of the solar facility in a closed circuit.

[8] Solar technologies can be divided into two categories, those that use water (i.e. solar thermal technology), and those that do not (i.e. photovoltaic technology). The proposed Ilanga facility will utilise water.

Figure 2.1: The bottom photograph illustrates the parabolic troughs together with the receiver tube (bottom photograph) and the pipes conveying the heat transfer fluid (top photograph) (Source: Siemens AG).

2.1.2. Functionality of the proposed Solar Thermal Power Plant

The functionality of the proposed STPP is briefly discussed below as six steps (refer to Figure 2.4).

» *Step 1 - t*he solar radiation is concentrated by the mirrors onto the receiver tube (refer to Figure 2.1) which contains the heat transfer fluid. The solar collectors track the sun during the progression of the day in order to maximise the solar energy yield.
» *Step 2* - the HTF is heated and circulated through the solar field via a series of metal pipes which run aboveground (refer to Figure 2.2).

Figure 2.2: The pipes lain between the troughs convey the heat transfer fluid (Source: Siemens AG).

» *Step 3* - heat exchangers transfer the thermal energy from the HTF to the water steam cycle.
» *Step 4* - cooled HTF is returned to the solar field to repeat the cycle.
» *Step 5:* the water steam cycle transfers the thermal energy to the steam turbine generator which converts the thermal energy to electric power (refer to Figure 2.3).

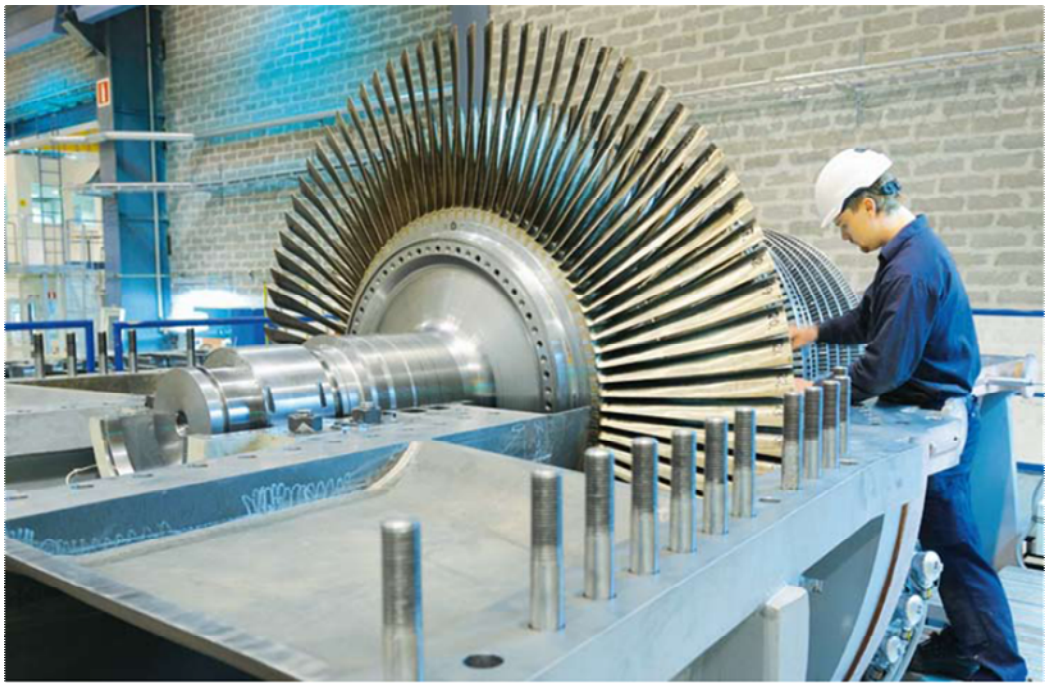

Figure 2.3: The steam turbine rotor, primary component of a steam turbine (Source: Siemens AG).

» *Step 6* - dry cooling will be employed, whereby an air cooled condenser is used to condensate the exhaust steam from the steam turbine. The condensed water is then circulated back to the heat exchangers to repeat the water-steam-cycle. In terms of waste production there is no difference to a conventional power plant with dry cooling, except for the waste produced from the usage of fossil fuel.

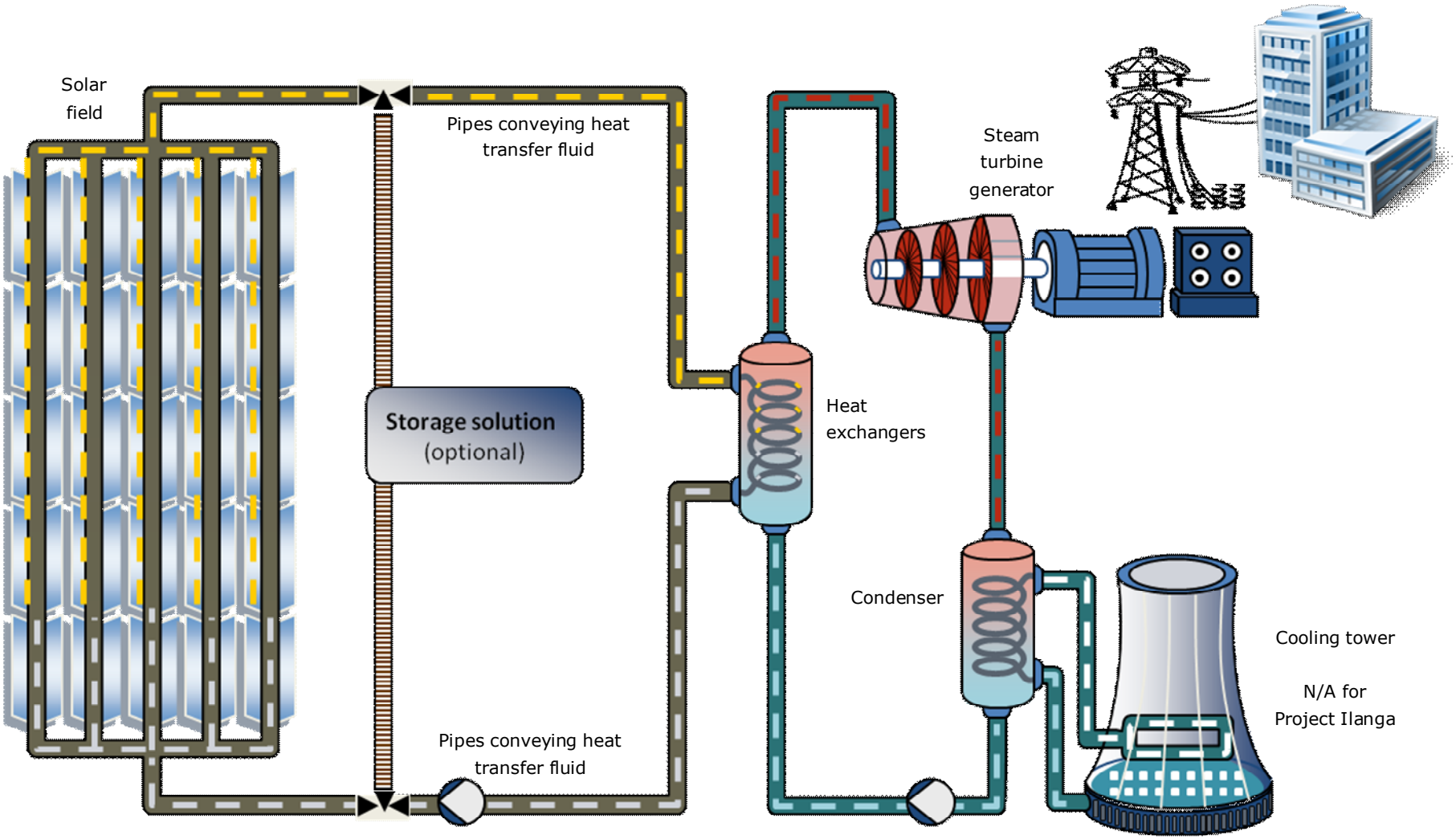

Figure 2.4: Schematic diagram of concentrating solar thermal power plant utilising parabolic trough technology (Source: Siemens AG).

2.1.3. Benefits of Renewable Energy Facilities

South Africa depends on fossil fuels for its energy needs. Fossil fuels supply nearly 90% of the primary energy needs with coal providing about 75% of the national energy demand (i.e. electrical power included). This dependence on fossil fuels, particularly on coal raises a number of issues including but not limited to:

» *Air pollution and the emission of greenhouse gases* - environmental pollution and the emission of CO_2 from the combustion of fossil fuels constitute a threat to the environment. The use of fossil fuels is reportedly responsible for approximately 70% of greenhouse gas emissions worldwide. Solar thermal facilities produce an insignificant quantity of greenhouse gases when compared to conventional coal-fired power stations. Therefore, the large scale implementation of renewable energy (including CSP) facilities should contribute significantly in the reduction of greenhouse gas production (Fluri, 2009).
» *Increasing energy requirements* - economic development over the next several decades will result in an ever increasing demand for energy. However there is some uncertainty as to the availability of economically extractable coal reserves for future use. Furthermore, several of South Africa's power stations are nearing the end of their economic life which is coupled with the expense of the Return to Service (RTS) of older power stations (i.e. Camden, Komati, and Grootvlei is expected to cost in the region of R20 billion to return on line).

As such, countries worldwide are being pressured to increase their share of renewable energy generation. Grid connected renewable energy is currently the fastest growing sector in the global energy market. Targets for the promotion of renewable energy now exist in more than 58 countries, of which 13 are developing countries. The South African Government has recognised the country's high level of renewable energy potential and presently has in place targets of 10 000 GWh of renewable energy 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 IRP 2010 recently approved by Cabinet has outlined 42% of renewable energy by 2030.

PROJECT OVERVIEW CHAPTER 3

This chapter provides an overview of the proposed project including the consideration of alternatives and the scope of works for the different phases of the proposed facility (i.e. design, construction, operation, and decommissioning).

3.1 Nomination of the Northern Cape for Solar Energy Development

The University of Stellenbosch determined which areas of South Africa are most suitable for solar facilities, particularly for solar thermal facilities which require water for steam generation, much like conventional fossil fired power plants (Fluri, 2009). This suitability was determined by overlaying several GIS layers/screens with certain areas such as nature conservancies, airports, military bases, water surfaces, and built up areas being ruled outright. These GIS layers included:

» *The solar resource* – only sites with an annual average daily direct normal irradiation (DNI) higher than 7 kWh/m^2/day were deemed suitable. The proposed site has a mean annual DNI for CSP of 2 806 kWh/m^2/annum.
» *Land use* – areas characterised as "Least Threatened" according to Mucina and Rutherford's Vegetation Map of South Africa were deemed suitable.
» *Topography* – a digital elevation model was used to select only those areas with a slope of less than 1%.
» *Potential for evacuation options* – the solar power plants would need to be sited at a reasonable distance from a point of evacuation to the National Grid in order to remain efficient from a cost and line loss[9] perspective.

The solar resource in the Northern Cape Province has shown the most potential for the development of large scale Concentrating Solar Power (CSP) facilities[10] (Pletka et al, 2007). However, the possible lack of additional water in certain areas of the Northern Cape for industrial development *may* serve to eliminate the establishment of multiple facilities, or at the very minimum encourage the use of dry cooling methods. Following the screening process, only those suitable areas larger than 2 km^2 were deemed viable as solar facilities typically require significant space for the equipment to be installed in the solar field. The study concluded that the Northern Cape alone could accommodate approximately 500 GW (Fluri, 2009).

[9] Line losses usually refer to energy waste resulting from the transmission of electrical energy across power lines.
[10] CSP facilities function by concentrating the incoming solar radiation in order to maximise the efficiency.

3.2 Identification of the proposed Development Site within the Northern Cape

The broader Karoshoek site was selected based on several key factors required to develop a solar thermal power plant which included the solar resource; access to water; site access; access to the national electricity grid for power evacuation; and the proximity of the site to Upington.

Site 1.2 was selected for Project Ilanga by virtue of technical and economic characteristics. This site is located roughly in the middle of the broader development site, thereby making it preferential for the first phase of the Karoshoek facility in terms of site suitability and access of the development of basic infrastructure, including:

» Site slope and topography is beneficial for CSP trough developments.
» Only very limited obstacles for radiation in the area, (i.e. hills and koppies).
» Site access from the N10 national road is and an existing gravel road on Farm Annashoek.
» Supply of fresh water from the Orange River is easily possible.
» Access to the existing National Grid infrastructure is easily possible.

Furthermore, the meteorological station that was installed to measure the climatic conditions of the broader site is located in close proximity to Site 1.2.

3.3 Project Alternatives

In accordance with the requirements of the EIA Regulations[11], alternatives are required to be considered within the EIA process, and may refer to any of the following:

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

3.3.1. Site Alternatives

No site alternatives have been evaluated as part of the EIA process as only Site 1.2 (i.e. located on farm portion Zandemm 944, portion 0) will be evaluated for the location of the Ilanga STPP. This portion of land is located at 21.530969; -28.479968 and covers an extent of 4.84 km^2.

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

It should be noted, that although Site 1.2 is preferential for the development of the Ilanga STPP, this does not allude to the remaining identified sites being unsuitable for the future development of CSP plants on the Karoshoek Solar Thermal Valley site.

3.3.2. Activity Alternatives

No activity alternatives are being considered in this EIA Process.

3.3.3. Design or Layout Alternatives

This alternative was not assessed in the EIA Phase, however social and environmental issues were considered, prior to the production of the layout. The rationale for not considering alternatives in this category is explained below.

» *Parabolic troughs* - the parabolic troughs require a north to south orientation roughs in order to be able to optimally absorb the solar radiation by tracking the sun's path from east to west on the firmament.
» *Site access* - the study site is accessible via the N10 from Upington to Groblershoop. Access off the N10 was originally proposed off an existing access point on the Farm Matjiesrivier 41, portion 2, to traverse south-east across Matjiesrivier into Farm Annashoek 41 to Site 1.2 (via an existing gravel road). However, this access point was eliminated due to potential road incidents with commuters and slow moving construction vehicles (i.e. said access point is situated on a road bend which could cause visibility issues). Therefore access will now be facilitated via an existing access point on the Farm Annashoek 41 (i.e. the property to the east) which is not situated on a bend. From this point access is possible via another existing gravel road on the Farm Annashoek which will also lead to Site 1.2. Furthermore this new alignment allows for the consolidation of linear infrastructure (i.e. the road, powerline, and water pipeline).

3.3.4. Technology Alternatives

CSP technology was determined as the preferential technology for the proposed development site (i.e. over wind and photovoltaic (PV) technologies) for several reasons. Grid stability is highly important for managing the grid load and performance. PV and wind technologies provide direct power only when the sun shines or the wind blows, therefore their momentary production follows the changes in weather (clouds and wind strength). However, CSP production is significantly more stable because of its inherent nature of transforming sunlight to power through heat energy. The large volume of HTF, together with the ability to support the production by means of backup fuel heaters and thermal storage, enables the provision of stable and predictable power to the grid. CSP can be dispatched unlike PV or wind, and production hours can be extended by storage of the produced heat and releasing it when required, thus achieving more flexibility.

This can also be achieved through hybridisation and offers better scope for localisation. Furthermore, CSP is less prone to adverse effects on efficiency due to ambient heat, which is a given phenomenon in the Karoo area.

3.3.5. Operating Alternatives

The following options were considered regarding the operating alternatives of the steam turbine generator.

» *Preferred option* - solar with no thermal storage.
» *Alternative option* - solar with thermal storage - where excess heat is collected and stored in a thermal storage tank. When needed, the heat from the thermal storage tank can be fed into the power block to continue electricity generation, again allowing for a longer operational period beyond daylight hours.

The economic and sustainable development criteria, as well as the outcomes of the EIA process and the BFS will determine the final technology option for the plant.

The water use required by this project is relatively small in a regional context (Scherman, 2011). Cooling alternatives were not assessed as the implementation of dry cooling is preferred by the Department of Water Affairs.

3.3.6. No-go Alternative

Also referred to as the 'do-nothing' option, this refers to Ilanga CSP 1 not constructing the proposed Ilanga Solar Thermal Power Plant on the identified development site east of Upington. In this scenario the potential environmental and social impacts will not occur and the status quo will be maintained. However, should the project not proceed, the contribution of the project (i.e. 125 MW) towards the Government target for renewable energy will not be realised.

3.4 Activities associated with the Project Phases

The main activities associated with the construction, operation and decommissioning phases of Project Ilanga are detailed in the table that follows.

PRE-CONSTRUCTION AND CONSTRUCTION

- *Staff requirements* – on average an estimated labour force of 600 – 800 will be used on-site during the construction phase. However during peak construction periods approximately 800 – 1000 workers will be required on-site. These positions will be comprised of low skilled, semi-skilled, and skilled workers, the latter of which will most likely be sourced outside Upington (i.e. as these skills are unlikely to be available within the local community). The specialists / foreigners forming part of the construction team are likely to make use of the local establishments for accommodation facilities. A feasibility study being undertaken by the developer is considering the possibility of an on-site village that will have the appropriate facilities and amenities to accommodate approximately 100 people. It is expected that most of the construction (i.e. civil works) will be done by local South African companies. The use of local contractors such as Small, Medium, and Micro Enterprises (SMMEs) operating in the area will be considered by the EPC partner[12], and will be driven largely by what skills and services could be sourced from local SMMEs (i.e. as part of a competitive tendering process). The EPC partner will determine the standards which all workers need to comply to and this will be in line with South African standards and laws applicable to the construction industry. The construction of the powerline will be done by Eskom or its approved contractor. Eskom or its approved contractor will determine the size of the labour force that will be involved in the construction of the powerlines. The actual planning and recruitment phase is expected to start approximately 6 months to one year after award of a REFIT bid and financial close.
- *Construction materials and equipment requirements* **-** around 30 - 40% of the construction material and equipment may be sourced locally (i.e. within South Africa), depending on technical capabilities and prices of local industry. The materials and equipment will be transported to site by road, rail, and air if necessary.
- *Housing of the labour force* – although the majority of the low and semi-skilled work force will be sourced from the local area and will be housed off-site, it is possible that approximately 100 people will be housed permanently on-site within the proposed location for a site village. The security team will operate on site in shifts over 24 hours.
- *Length of the construction phase* - commencement of the construction phase is dependent on the project being approved by DEA, a generating license being issued by NERSA, and a Power Purchase Agreement being secured with Eskom/Treasury or the designated buyer of renewable energy electricity and successfully reaching financial close. However, should all approvals be issued, it is expected that construction could start in mid-2012 (i.e. approximately 6 months after the expected receipt of the Environmental Authorisation). Thereafter, the construction phase is expected to take approximately 24 -30 months to complete.

Activity	***Detailed description***
Pre-construction surveys	Prior to initiating construction, a number of detailed surveys will be required including, but not limited to:

[12] The EPC partner for this development is still to be finalised.

	» *Geotechnical survey* – the geology and topography of the study area which was originally identified in the EIA Process will be confirmed. The geotechnical study will look at flood potential, foundation conditions, potential for excavations, and the availability of natural construction materials. This study will serve to inform the type of foundations required to be built (i.e. for the power block, and substation), and the extent of earthworks and compaction required in the establishment of the short internal access road to Site 1.2. » *Site survey* - in order to finalise the design layout of the solar field, the power block, and the other associated infrastructure. The finalisation will need to be confirmed in line with the Environmental Authorisation issued for the facility. » *Power line servitude survey* – once the placement of the power line towers has been finalised, a walk through survey will be undertaken for ecological, archaeology and heritage resources which may necessitate certain towers to be moved to avoid sensitivities.
Undertake site preparation	» Site preparation activities will include: * Clearance of vegetation at the footprint of the area infrastructure (i.e. parabolic troughs, power block, and associated infrastructure). * Levelling of site (as necessary) * Clearance of vegetation at the footprint of the linear component (i.e. internal access road, water supply pipeline). * The development of stormwater control management systems which will include drainage channels which will collect all rain water and lead it to the natural stormwater drainage system after it has been settled/treated in a stormwater retention dam. » These activities will require the stripping of topsoil which will need to be backfilled as construction progresses and stockpiled for future rehabilitation.
Establishment of the access road and powerline servitudes	» The study site is accessible via the N10 from Upington to Groblershoop. Access off the N10 will be facilitated via an existing access road on the Farm Annashoek. A new road will branch off this existing road and lead to the area designated for the facility (i.e. a distance of approximately 1.2 km). The new road is required for construction purposes and is likely to remain in place for maintenance purposes during the operational phase.

	» The power will be evacuated via a 132 kV power line of approximately 14 km which will have a loop-in/loop out[13] connection with the existing Gordonia-Garona 132 kV line located to the north of the site. This will necessitate crossing the Orange River. A servitude of approximately 35 m width for each power line will need to be established. Only the centre line may need to be cleared for stringing purposes. The reminder of the servitude will not be cleared, except where trees higher than 4m exist which could interfere with the operation of the power line. This work will be undertaken by an Eskom approved contractor.
Transport of components to site	» Depending on the local availability of equipment, the majority of the facility components and civil engineering construction equipment (i.e. excavators, trucks, graders, compaction equipment, cement trucks, etc.) will be sourced locally from Upington and will either be transported to site via provincial and local roads. The important equipment is likely to be imported to Saldanha Bay harbour and then transported to site via road or rail. This is still to be finalised through the Transportation Study. » Some of the power block components may be defined as abnormal loads in terms of the Road Traffic Act (Act No. 29 of 1989)[14] by virtue of dimensional limitations (i.e. length and weight). » In some instances, the dimensional requirements of the loads to be transported (e.g. the boiler, the steam turbine, the main transformers, etc.) may require alterations to the existing road infrastructure (i.e. widening on corners), and protection of road-related structures (i.e. bridges, culverts, etc) due to those loads that are defined as abnormal.
Establishment of construction camps, storage facilities, laydown areas, and accommodation facilities	» Once the required equipment has been transported to site, dedicated construction camp(s), storage facilities, and laydown area/s will need to be established. These areas serve to confine activities to a designated area to limit potential site disturbance. The laydown area will be used for the assembly of the parabolic troughs, as a logistical area for the contractors and as a prefabrication area. » An area for accommodation will be established for the purpose of housing approximately 100 people during the construction phase, with the potential to construct more permanent structures in the future. An application will be made to the //Khara Hais Municipality for sanitation, water, electricity, and waste disposal services for this accommodation facility. » The fuel required for on-site construction vehicles and equipment will need to be secured in a

[13] This type of connection requires the use of two powerlines such that the power can travel in a bidirectional manner between the on-site substation and the powerlines.

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

	temporary bunded facility within the construction camp to prevent leakages and soil contamination.
Establishment of electricity generation infrastructure	» Following the pre-construction surveys and clearing activities, the power block infrastructure (i.e. the steam turbine, generator, substation, and thermal storage units) will be constructed. Foundations will be established using concrete mixed at an off-site or on-site batching plant. » The parabolic troughs will be assembled in the parabola assembly building located in the solar field logistic area and transported around the site to the exact position where they will be erected and connected to its adjacent trough and the pipes conveying the heat transfer fluid (refer to Figure 2.5). Approximately one loop which consists of 48 collectors) will be constructed per day (i.e. one loop is approximately 300 metres in length).
Establishment of water supply infrastructure	» *Abstraction point* - the water required for the steam cycle is proposed to be abstracted from the Orange River via an existing abstraction point near Farm Annashoek. The water will be piped via a 200 mm (ø) pipeline a distance of approximately 250 m to pass through a still basin, the main pump set, a sand filter, and a coffer dam[15]. » *Pipelines, reservoirs, etc* – the pipeline will continue from the sand filter in a south-westerly direction for approximately 200 m until it reaches the N10. » At this point it will cross under the N10 (800 mm - 1000 mm cover at road crossing) and continue alongside it for approximately 1.3 km to meet with the existing gravel road that crosses the Farm Annashoek. » The pipeline will then follow the road for approximately 1.5 km to meet up with a 24 hour holding raw water reservoir (steel reservoir 12.2 m (L) x 12.2 m (W) x 4.88 m (H)), a water treatment works, and a 48 hour holding potable water steel reservoir (15.86 m (L) x 15.86 m (W) x 4.88 m (H). » Thereafter the pipeline will continue for approximately 5 km to a 72 hour holding reservoir (steel reservoir 19.52 m (L) x 19.52 m (W) x 4.88 m (H)) for potable water[16]. Water will gravitate from this 72 hour reservoir to a 24 hour reservoir at Site 1.2 via a 250 mm ø pipeline. » At Site 1.2 a 24 hour holding reservoir, a package treatment plant (i.e. for production of

[15] The coffer dam will be used to store filter backwash for future use.

[16] At a point on this route (i.e. about 700 m from the water treatment plant), the pipeline will T-off to the west to deliver water to the proposed site for the accommodation areas for the construction crew.

	demineralised water that will be used in the water steam cycle and cleaning of the troughs), and a 48 hour holding reservoir for plant use will be located. » Any concrete that may be required for these facilities is proposed to be mixed at both an on and off-site batching plants.
Undertake site rehabilitation	» Areas requiring rehabilitation will include those areas disturbed during the construction phase and are not required for operation and maintenance operations. Rehabilitation should be undertaken in an area as soon as possible after the completion of construction activities within that area. » Where relevant disturbed areas must be rehabilitated/re-vegetated with appropriate natural vegetation and/or local seed mix. Re-vegetated areas may have to be protected from wind erosion and maintained until an acceptable plant cover has been achieved. » All temporary facilities, temporary equipment, and waste materials must be removed from site. » Erosion control measures (i.e. drainage works and anti-erosion measures) should be used in sensitive areas (i.e. steep slopes, hills, and drainage lines), to minimise loss of topsoil and control erosion. » Any access points and/or access roads which are not required during the operational phase must be closed as part of the post-construction rehabilitation.
Pipe cleaning	» In order to get a clean piping, a pipe cleaning process will be undertaken. This consists mainly of blow-out, acid pickling, and cleaning. The final acid pickling agent to be used is not defined yet, but most probably hydrofluoric acid will be used. Waste from acid pickling will be collected, adequately treated, and carefully disposed according to the applicable regulation.

OPERATION

» *Staff requirements* - approximately 100 staff members are expected to be required on-site during the operational phase of the project.
» *Length of the operation phase* – the facility is expected to be commissioned in December 2014 and is expected to be operational for 30 - 40 years, where after it could be decommissioned or its lifespan extended depending on the power generation requirements at the time.

Activity	***Detailed description***
Sourcing, treatment and use of water	» Approximately 224 110 m^3 of water will need to be abstracted annually from the Orange River to meet the phase one requirements (i.e. 125 MW STPP). The water will be pumped to the de-gritting and

	filtration reservoir. The water will flow by gravity through the pipeline (as described above) to the storage reservoir at the power block area, where it will be treated according to the needs of the project. » Through a series of heat exchangers the water will be converted into steam for driving the turbine. The water cycle will be cooled through a process of dry cooling (i.e. air cooled condensers will be used instead of cooling towers). The HTF will be cooled in the boiler of the water steam cycle (i.e. main heat exchanger). No additional cooling of the HTF is foreseen, apart from minor fan coolers for certain equipment in the HTF system. » Once the water leaves the steam cycle, it will be released into the evaporation pond.
Treatment and disposal of waste water	» Water from the condensate polishing plant will be collected in a neutralisation basin and then will be forwarded to the collecting pond while wastewater from the demineralisation plant will go directly to the collecting pond. All surface water, storm water, and drains, etc. will pass through an oil separator station and all chemical wastewater will be pH adjusted before entering the collecting pond. The water from the collecting pond is finally forwarded to the evaporation pond. Any water from ablution facilities will be collected in a septic tank.
Chemical dosing for the water-steam cycle	» In order to maintain the required condensate quality of the water-steam cycle, ammonia is dosed in small quantities.
Inhibitor dosing for the closed cooling system	» To minimize oxidation of the system a corrosion inhibitor (carbohydrazide) is dosed to the closed system.
Operation of the solar field	» The solar radiation will be concentrated by the mirrors onto the receiver which contains the heat transfer fluid. The heat transfer fluid is heated and circulated through the solar field back to the power block area where heat exchangers will transfer the collected solar thermal energy from the heat transfer system to the water steam cycle where superheated steam is generated. » The thermal energy in form of superheated steam is routed to the steam turbine generator in which the thermal energy is converted into electric power. » The solar collectors will track the sun during the progression of the day in order to maximise the solar energy yield.
Antifreeze heating	» Thermal oil in the HTF-system freezes at ambient conditions. Hence, the oil always has to be kept at a certain operation temperature, even if the plant is not in operation. For this purpose, antifreeze

	heaters will be installed, running on LPG or biofuel. The installed boilers will comply with the relevant emission standards and regulation.
Operation of the electrical infrastructure	» The steam turbine generator will generate electricity at a voltage of approx 16 kV and will be alternating current (AC). The electricity will be stepped up to a voltage of 132 kV and evacuated into the overhead distribution line and into the electricity grid.
Site operation and maintenance	» It is anticipated that a full-time security, maintenance, and control room staff will be required on site. » The facility will be operational except under circumstances of mechanical breakdown, unfavourable weather conditions, or routine maintenance activities.

DECOMMISSIONING

» *Length of the decommissioning phase* – following the operational phase it could be decommissioned or its lifespan extended depending on the power generation requirements at the time.
» *Activities during the decommissioning phase* - it is most likely that decommissioning would comprise the disassembly and replacement of the individual components with more appropriate technology/infrastructure available at that time.

Activity	***Detailed description***
Site preparation	» Site preparation activities similar to those undertaken in the construction phase will be required during the decommissioning phase. This will include confirming the integrity of site access to the site in order to accommodate the required equipment (e.g. lay down areas and decommissioning camp) and the mobilisation of decommissioning equipment.
Disassemble and replace existing components	» The components would be disassembled, and reused and recycled (where possible), or disposed of in accordance with regulatory requirements.

Figure 2.5: Photograph illustrating the transport of a built parabolic trough on the development site (Source: Siemens AG).

REGULATORY AND LEGAL CONTEXT CHAPTER 4

4.1. 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 4.1. 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.

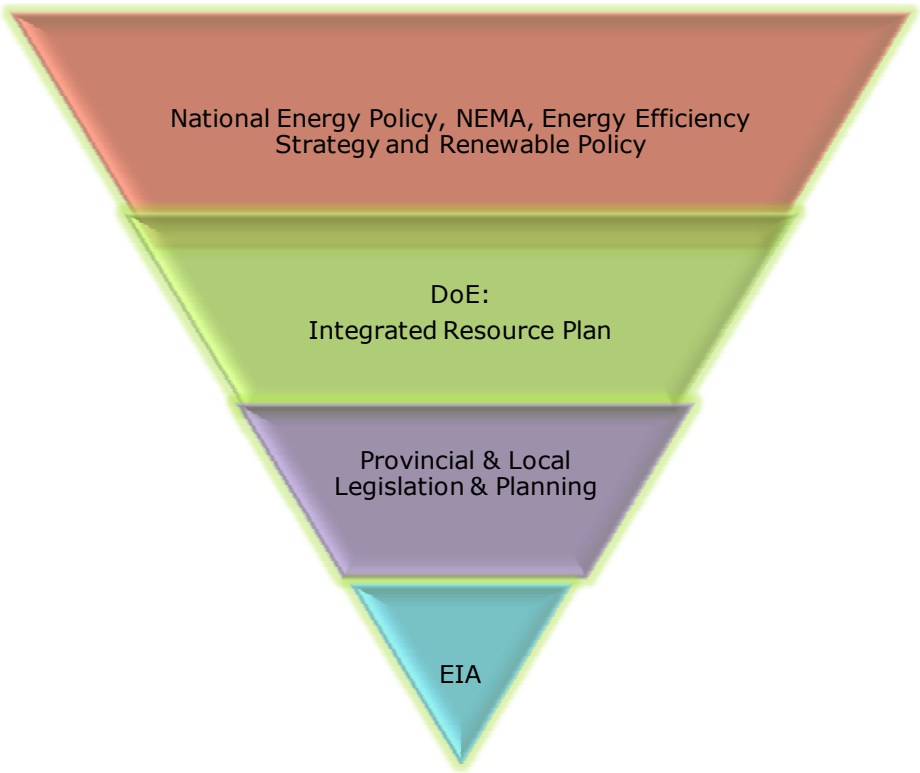

Figure 4.1: Hierarchy of electricity policy and planning documents

4.1.1. White Paper on the Energy Policy of South Africa, 1998

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

Investment in renewable energy initiatives, such as the proposed solar energy facility, is supported by the White Paper on Energy Policy for South Africa. In this regard the document notes that government policy is 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 in South Africa. The support for renewable energy policy is guided by a rationale that South Africa has a very attractive range of renewable resources, particularly ***solar*** and wind and that renewable applications are in fact the least cost energy service in many cases; more so when social and environmental costs are taken into account.

4.1.2. Renewable Energy Policy in South Africa, 1998

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. 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. Government policy on renewable energy is therefore concerned with meeting economic, technical, and other constraints on the development of the renewable industry.

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*."

4.1.3. Integrated Energy Plan, 2003

In response to the requirements of the National Energy Policy, the DME commissioned the Integrated Energy Plan (IEP) in 2003 to provide a framework in which specific energy policies, development decisions and energy supply trade-offs can be made on a project-by-project basis. The framework is intended to create a balance between the energy demand and resource availability to provide low cost electricity for social and economic development, while taking into account health, safety, and environmental parameters.

The draft IEP recognised that South Africa is likely to be reliant on coal for at least the next 20 years as the predominant source of energy. However, the potential and a need to diversify energy supply through increased use of natural gas and new and renewable energies were recognised.

4.1.4 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;
» Provide the framework for Ministerial determination of new generation capacity (inclusive of the required feasibility studies)

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

The outcome of the process confirmed that coal-fired options are still required over the next 20 years and that additional base load plants will be required from 2010. The first and interim IRP was developed in 2009 by the Department of Energy. The initial four years of this plan was promulgated by the Minister of Energy on 31 December 2009, and updated on 29 January 2010. The Department of Energy released the Final IRP in March 2011, which was accepted by Parliament at the end of March. This Policy-Adjusted IRP is recommended for adoption by Cabinet and subsequent promulgation as the final IRP. In addition to all existing and committed power plants (including 10 GW committed coal), the plan includes 9.6 GW of nuclear; 6.3 GW of coal; 17.8 GW of renewables (including 8,4GW solar); and 8.9 GW of other generation sources.

4.1.5 Electricity Regulation Act, 2006

Renewable Energy Feed-in Tariffs (REFIT) have been set by NERSA. This has been done to contribute towards the renewable energy target set by the government, to contribute towards socio-economic and environmentally sustainable growth, and to stimulate the renewable energy industry in South Africa. The establishment of the REFIT in South Africa provides the opportunity for an increased contribution by the renewable energy sector by promoting competitiveness with conventional energies in the medium- and

long-term. 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).

4.2. 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 (i.e. National, Provincial, and Local). The main regulatory agencies at a national level include:

» *Department of Energy (DoE)* - the DoE is the controlling authority in terms of the Electricity Act (Act No. 41 of 1987), and is responsible for policy relating to energy including renewable energy. Solar energy is considered under the White Paper for Renewable Energy and the DoE undertakes research in this regard.
» *National Energy Regulator of South Africa (NERSA)* - this body is responsible for regulating all aspects of the electricity sector, and will ultimately issue generation licenses for renewable energy developments.
» *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. DEA has been made the competent authority responsible for granting the relevant environmental authorisations for all renewable energy projects which are regarded of national importance.
» *The South African Heritage Resources Agency (SAHRA)* - the National Heritage Resources Act (Act No. 25 of 1999) and the associated provincial regulations provides legislative protection for listed or proclaimed sites, such as urban conservation areas, nature reserves and proclaimed scenic routes.
» *South African National Roads Agency Limited (SANRAL):* this department is responsible for all national road routes.

The main regulatory agencies at a provincial level include:

» *Northern Cape Department of Environment and Nature Conservation (DENC)* - this department is responsible for environmental policy and is the provincial authority in terms of NEMA and the EIA Regulations. The DENC is the commenting authority for this project.
» *Northern Cape Department of Transport and Public Works* - this department is responsible for provincial roads in the Northern Cape and the granting of exemption permits for the conveyance of abnormal loads on public roads.

» *Northern Cape Department of Agriculture* - this department's involvement relates specifically to sustainable management of the agricultural resources in the Northern Cape.
» *Northern Cape Department of Water Affairs* – this department will be involved in the allocation of water resources for a project of this nature.

By-laws and policies have been formulated by local authorities to protect visual and aesthetic resources relating to urban edge lines, scenic drives, special areas, signage, communication masts, etc. Bioregional planning involves the identification of priority areas for conservation and their placement within a planning framework of core, buffer, and transition areas. These could include reference to visual and scenic resources and the identification of areas of special significance, together with visual guidelines for the area covered by these plans. The main regulatory agencies at a local level include:

» *The Khara Hais Local Municipality* – this municipality is one of the principal regulatory authorities responsible for planning, land use, and environmental management.
» *The Siyanda District Municipality* – like the local municipality, this department is also a regulatory authority responsible for planning, land use, and environmental management. An Environmental Management Framework (EMF) has been developed by the Siyanda District Municipality to ensure that future development in the area occurs in a manner that is appropriate to the unique features and character of the area. The EMF identifies constraints, opportunities, issues, and the relative desired state for a wide range of biophysical, social, and socio-economic topics.
» *Municipal Systems Act (Act No. 32 of 2000)* - it is compulsory for all municipalities to go through an Integrated Development Planning (IDP) process to prepare a five-year strategic development plan for the area under their control.

4.3. Applicable Legislation and Guidelines

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 (GNR R545, GNR 546 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)

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 that follows.

Table 4.1: Relevant legislative and permitting requirements applicable to the establishment of Project Ilanga

Legislation	*Applicable Requirements*	*Relevant Authority*	*Compliance requirements*
National Legislation			
» National Environmental Management Act (Act No. 107 of 1998)	» NEMA requires, inter alia, that: * Development must be socially, environmentally, and economically sustainable." * Disturbance of ecosystems and loss of biological diversity are avoided, or, where they cannot be altogether avoided, are minimised and remedied." * A risk-averse and cautious approach is applied, which takes into account the limits of current knowledge about the consequences of decisions and actions." » EIA Regulations have been promulgated in terms of Chapter 5. 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 considered, investigated, assessed and reported on to the competent authority charged by NEMA	» National Department of Environmental Affairs » Northern Cape Department of Environment and Nature Conservation (DENC)	» This EIA Report is to be submitted to the DEA for review and decision making. » The DENC will act as the commenting authority.

Legislation	*Applicable Requirements*	*Relevant Authority*	*Compliance requirements*
	with granting of the relevant environmental authorisation. » In terms of GNR 543 of 18 June 2010, a full Scoping and EIA Process is required to be undertaken for the proposed project.		
» National Environmental Management Act (Act No. 107 of 1998)	» A project proponent is required to consider a project holistically and to consider the cumulative effect of potential impacts. » 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 a project is avoided, stopped or minimised.	» National Department of Environmental Affairs	» While no permitting or licensing requirements arise directly, the holistic consideration of the potential impacts of the proposed project has found application in the EIA Phase. » The implementation of mitigation measures are included as part of the Draft EMP and will continue to apply throughout the life cycle of the project.
» National Environmental Management: Biodiversity Act (Act No. 10 of 2004)	» In terms of the Biodiversity Act, the developer has a responsibility for: * The conservation of endangered ecosystems and restriction of activities according to the categorisation of the area (not just by listed activity as specified in the EIA regulations). * The application of appropriate	» National Department of Environmental Affairs	» As the applicant will not carry on any restricted activity in terms of S57, no permit is required to be obtained in this regard. » In terms of GNR 152 specialist flora and fauna studies have been undertaken as part of the EIA process. These studies have been undertaken as part of the

Legislation	*Applicable Requirements*	*Relevant Authority*	*Compliance requirements*
	environmental management tools to ensure integrated environmental management of activities. * Limit further loss of biodiversity and conserve endangered ecosystems. » In terms of S57, a person may not carry out a restricted activity involving a specimen of a listed threatened or protected species without a permit issued in terms of Chapter 4. In this regard the Minister of Environmental Affairs has published a list of critically endangered, endangered, vulnerable, and protected species in GNR 151 in Government Gazette 29657 of 23 February 2007 and the regulations associated therewith in GNR 152 in GG29657 of 23 February 2007, which came into effect on 1 June 2007. » In terms of S75, (1) The control and eradication of a listed invasive species must be carried out by means of methods that are appropriate for the species concerned and the environment in which it occurs. (2) Any action taken to control and eradicate a listed invasive species must be executed with caution and in a manner that may cause the		previously EIAs undertaken for the power station site. » A permit may be required should any protected plant species on site be disturbed or destroyed because of the proposed development.

Legislation	*Applicable Requirements*	*Relevant Authority*	*Compliance requirements*
	least possible harm to biodiversity and damage to the environment. (3) The methods employed to control and eradicate a listed invasive species must also be directed at the offspring, propagating material and re-growth of such invasive species in order to prevent such species from producing offspring, forming seed, regenerating, or re-establishing itself in any manner. » In terms of GNR 152 of 23 February 2007: regulations relating to listed threatened and protected species, the relevant specialists must be employed during the EIA Phase to incorporate the legal provisions as well as the regulations associated with listed threatened and protected species (GNR 152) into specialist reports in order to identify permitting requirements. » In terms of GNR 1477 of 2009: Draft National List of Threatened Ecosystems published under S52(1)(a) of the Act provides for the listing of threatened or protected ecosystems based on national criteria. The list of threatened terrestrial ecosystems supersedes the information regarding terrestrial ecosystem status in		

Legislation	*Applicable Requirements*	*Relevant Authority*	*Compliance requirements*
	the National Spatial Biodiversity Assessment (2004). » GNR1187 Amendment of Critically Endangered, Endangered, Vulnerable and Protected Species List published under S56(1)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. » In terms of the regulations published in terms of this Act (GN 718), a Basic Assessment or Environmental Impact Assessment is required to be undertaken for identified listed activities. » Any person who stores waste must at least take steps, unless otherwise provided by this Act, to ensure that (a) 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; (b) Adequate measures are taken to prevent accidental spillage or leaking; (c) The waste cannot be blown away; (d) Nuisances such as odour, visual	» National Department of Water and Environmental Affairs » Provincial Department of Environmental Affairs	» A waste license will be required for the storage of waste, and for the waste water treatment plant. » By virtue of these volumes an EIA process is required to be undertaken. » Waste handling, storage and disposal during construction and operation is required to be undertaken in accordance with the requirements of this Act, as detailed in the EMP.

Legislation	*Applicable Requirements*	*Relevant Authority*	*Compliance requirements*
	impacts and breeding of vectors do not arise; and (e) Pollution of the environment and harm to health are prevented.		
» National Environmental Management: Air Quality Act (Act No. 39 of 2004)	» S18, S19 and S20 of the Act allow certain areas to be declared and managed as "priority areas" » Declaration of controlled emitters (Part 3 of Act) and controlled fuels (Part 4 of Act) with relevant emission standards » 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 Department of Environmental Affairs » Local authority	» While no permitting or licensing requirements arise from this legislation, this act will find application during the construction phase of the project. » As the 15% fossil fuel augmentation plant has a generating capacity of less than 50 MW, an air emissions license will not be required from DEA. However, a license may be required from the local authority.
» National Water Act (Act No. 36 of 1998)	» Under S21 of the act, water uses 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. » In terms of S19, the project proponent must ensure that reasonable measures are taken throughout the life cycle of this project to prevent and remedy the effects of pollution to water resources	» National Department of Water Affairs » Northern Cape Department of Water Affairs	» The abstraction of water, the storage of water, and the alteration of the characteristics of a watercourse are regarded as a water use (as defined in terms of S21 of the NWA). As such a Water Use License (WUL) is being applied for in parallel with the EIA process. » Requirements set by S19 will

Legislation	*Applicable Requirements*	*Relevant Authority*	*Compliance requirements*
	from occurring, continuing, or recurring.		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)	» National Department of Environmental Affairs » Northern Cape Department of Environment and Nature Conservation » Local Authorities	» There is no requirement for a noise permit in terms of the legislation. » Any noisy activities carried out during the construction phase that could present an intrusion impact to the local community should be limited to 6:00am to 6:00pm Monday – Saturday (excluding public holidays). » Should these specific activities need to be undertaken outside of these times, the surrounding communities will need to be notified and appropriate approval will be obtained from the DEA and the Local Municipality.
» 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 (i.e. materials from a borrow pit) in accordance with the provisions of the Act. » Requirements for Environmental Management Programmes and Environmental Management Plans are	» Department of Minerals and Energy	» As no borrow pits are expected to be required for the construction of the facility, no mining permit or mining right is required to be obtained.

Legislation	*Applicable Requirements*	*Relevant Authority*	*Compliance requirements*
	set out in S39 of the Act.		
» National Heritage Resources Act (Act No. 25 of 1999)	» S38 states that Heritage Impact Assessments (HIAs) are required for certain kinds of development including » The construction of a road, power line, pipeline, canal or other similar linear development or barrier exceeding 300 m in length; » Any development or other activity which will change the character of a site exceeding 5 000 m^2 in extent » The relevant Heritage Authority must be notified of developments such as linear developments (i.e. roads and power lines), bridges exceeding 50 m, or any development or other activity which will change the character of a site exceeding 5 000 m^2; or the re-zoning of a site exceeding 10 000 m^2 in extent. This notification must be provided in the early stages of initiating that development, and details regarding the location, nature and extent of the proposed development must be provided. » Stand alone HIAs are not required where an EIA is carried out as long as the EIA contains an adequate HIA component	» South African Heritage Resources Agency	» As per S38 an HIA has been undertaken as part of the EIA Phase. » A permit may be required should identified cultural/heritage sites on site be required to be disturbed or destroyed as a result of the proposed development. » If concentrations of archaeological heritage material and human remains are uncovered during construction, all work must cease immediately. The find must be reported to a heritage specialist so that systematic and professional investigation/ excavation can be undertaken.

Legislation	*Applicable Requirements*	*Relevant Authority*	*Compliance requirements*
	that fulfils the provisions of S38. In such cases only those components not addressed by the EIA should be covered by the heritage component.		
» National Forests Act (Act No. 84 of 1998)	» In terms of S5(1) no person may cut, disturb, damage or destroy any protected tree or possess, collect, remove, transport, export, purchase, sell donate or in any other manner acquire or dispose of any protected tree or any forest product derived from a protected tree, except under a license granted by the Minister to an (applicant and subject to such period and conditions as may be stipulated". » GN 1042 provides a list of protected tree species.	» National Department of Forestry	» This Act has found application during the EIA Phase and a recommendation will be made that a permit would need to be obtained for any protected trees that are affected.
» National Veld and Forest Fire Act (Act 101 of 1998)	» Provides requirements for veldfire prevention through firebreaks and required measures for fire-fighting. Chapter 4 places a duty on landowners to prepare and maintain firebreaks, and Chapter 5 places a duty on all landowners to acquire equipment and have available personnel to fight fires. » In terms of S21 the applicant would be obliged to burn firebreaks to ensure that	» Department of Forestry	» While no permitting or licensing requirements arise from this legislation, this act will find application during the operational phase of the project in terms of fire prevention and management.

Legislation	*Applicable Requirements*	*Relevant Authority*	*Compliance requirements*
	should a veldfire occur on the property, that it does not spread to adjoining land. » In terms of S12 the firebreak would need to be 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 sS17ection 17, the applicant must have such equipment, protective clothing, and trained personnel for extinguishing fires.		
» Government Notice No. 1477 of 2009: Draft National List of Threatened Ecosystems	» Published under S52(1)(a) of NEMA: Biodiversity Act (Act No. 10 of 2004), it provides for the listing of threatened or protected ecosystems based on national criteria. The list of threatened terrestrial ecosystems supersedes the information regarding terrestrial ecosystem status in the National Spatial Biodiversity Assessment (2004).	» Provincial Department of Environmental Affairs	» N/A
» 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	» National Department of Agriculture	» Subdivision will have to be in place prior to any subdivision approval in terms of S24 and 17 of LUPO. » Subdivision is required to be undertaken following the issuing

Legislation	*Applicable Requirements*	*Relevant Authority*	*Compliance requirements*
			of an environmental authorisation for the proposed project.
» Hazardous Substances Act (Act No. 15 of 1973)	» This Act regulates the control of substances that may cause injury, or ill health, or death due to their toxic, corrosive, irritant, strongly sensitising, or inflammable nature or the generation of pressure thereby in certain instances and for the control of certain electronic products. To provide for the rating of such substances or products in relation to the degree of danger; to provide for the prohibition and control of the importation, manufacture, sale, use, operation, modification, disposal or dumping of such substances and products. » Group I and II: Any substance or mixture of a substance that might by reason of its toxic, corrosive etc, nature or because it generates pressure through decomposition, heat or other means, cause extreme risk of injury etc., can be declared to be Group I or Group II hazardous substance; » Group IV: any electronic product;	» 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.

Legislation	***Applicable Requirements***	***Relevant Authority***	***Compliance requirements***
	» 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.		
» National Road Traffic Act (Act No 93 of 1996)	» The technical recommendations for highways (TRH 11): "Draft Guidelines for Granting of Exemption Permits for the Conveyance of Abnormal Loads and for other Events on Public Roads" outline the rules 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	» South African National Roads Agency Limited (national roads) » Provincial Department of Transport	» An abnormal load/vehicle permit may be required to transport the various components to site for construction. These include route clearances and permits 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).

Legislation	*Applicable Requirements*	*Relevant Authority*	*Compliance requirements*
	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.		
» Development Facilitation Act (Act No 67 of 1995)	» Provides for the overall framework and administrative structures for planning throughout the Republic » S2- 4 provide general principles for land development and conflict resolution.	» Local and District Municipality	» The applicant must submit a land development application in the prescribed manner and form as provided for in the Act. » A land development applicant who wishes to establish a land development area must comply with procedures set out in the Act.
» 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.	» National Department of Environmental Affairs	» No permitting or licensing requirements.
» Promotion of Administrative Justice Act (Act No. 3 of 2000)	» In terms of S3 the government is required to act lawfully and take procedurally fair, reasonable, and rational decisions. » Interested and affected parties have right to be heard.	» National Department of Environmental Affairs	» No permitting or licensing requirements.
Provincial Legislation			
» Northern Cape Nature Conservation Act, No.	» This Act provides for: * The sustainable utilisation of wild	» Northern Cape Department of Environmental Affairs	» No permitting requirements have been identified however several

Legislation	*Applicable Requirements*	*Relevant Authority*	*Compliance requirements*
9 of 2009	animals, aquatic biota and plants. * Offences and penalties for contravention of the Act. * The appointment of nature conservators to implement the provisions of the Act. » The Act provides lists of protected species for the Province.		mitigation measures will find place in the management of the project in terms of: * Erection of boundary fences. * Impact on aquatic habitats. * Management of invasive species.
Nature Conservation Ordinance (Act No. 19 of 1974)	» Article 63 prohibits the picking of certain fauna (including cutting, chopping, taking, and gathering, uprooting, damaging, or destroying). » Schedule 3 lists endangered flora and Schedule 4 lists protected flora. » Articles 26 to 47 regulate the use of wild animals.	» Provincial Department of Environmental Affairs	» No permitting or licensing requirements arise from this legislation for the proposed activities to be undertaken for the proposed project.
Guideline Documents			
» Draft Guidelines for Granting of Exemption Permits for the Conveyance of Abnormal Loads and for other Events on Public Roads	» Outlines the rules and conditions which apply to the transport of abnormal loads and vehicles on public roads and the detailed procedures to be followed in applying for exemption permits.	» Provincial Department of Transport	» N/A
Policies and White Papers			
» The White Paper on	» Investment in renewable energy	» N/A	» N/A

Legislation	*Applicable Requirements*	*Relevant Authority*	*Compliance requirements*
the Energy Policy of the Republic of South Africa (December 1998)	initiatives, such as the proposed solar energy facility, is supported by this white Paper.		
» The White Paper on Renewable Energy (November 2003)	» This Paper sets out Government's vision, policy principles, strategic goals and objectives for promoting and implementing renewable energy in South Africa.	» N/A	» N/A
» Khara Hais Local Municipality, Integrated Development Plan (2005) »	» According to the Municipal Systems Act of 2000, all Municipalities have to undertake an Integrated Development Planning (IDP) process to produce Integrated Development Plans (IDPs). As the IDP is a legislative requirement it has a legal status and it supersedes all other plans that guide development at local government level.	» Khara Hais Local Municipality	» N/A
» Siyanda District Municipality's Environmental Management Framework (2008)	» The purpose of the EMF is to ensure that future development in the Siyanda DM area occurs in a manner that is appropriate to the unique features and character of the area. The objectives of the EMF include: » The provision of strategic guidance for the area. » Assisting in the identification of	» Siyanda District Municipality	» N/A

Legislation	*Applicable Requirements*	*Relevant Authority*	*Compliance requirements*
	"identified geographical areas" in terms of NEMA. » Assisting in the identification of "specified activities" within "identified geographical areas" in terms of NEMA. » The provision of a decision support system in respect to environmental attributes, issues, and priorities in the EMF area.		
» The White Paper on the Energy Policy of the Republic of South Africa (December 1998)	» Investment in renewable energy initiatives, such as the proposed solar energy facility, is supported by this white Paper.	N/A	N/A

APPROACH TO UNDERTAKING THE EIA PHASE CHAPTER 5

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 GNR544; GNR545; and GNR546 of Section 24(5) of NEMA (Act No. 107 of 1998). The environmental studies for this proposed project were undertaken in two phases, in accordance with the EIA Regulations.

5.1. Phase 1: Scoping Phase

The Scoping Study, which was completed in March 2011 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 Upington Public Library, at the Upington Police Station, and on the Savannah Environmental website for I&AP review and comment. All the comments, concerns, and suggestions received during the Scoping Phase and the review period were included in the Final Scoping Report.

The Scoping Report was submitted to the National Department of Environmental Affairs in January 2011. The Final Scoping Report and Plan of Study for the EIA Phase were accepted by the DEA, as the competent authority, in March 2011. In terms of this acceptance, an EIA was required to be undertaken for the proposed project.

5.2. 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 7). The EIA Phase aims to achieve the following:

» Provide a comprehensive assessment of the social and biophysical environments affected by the proposed alternatives put forward as part of the project.
» Assess potentially significant impacts (direct, indirect, and cumulative, where required) associated with the proposed facility.
» Comparatively assess any alternatives put forward as part of the project (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[17] 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.

5.2.1. Tasks to be completed during the EIA Phase

The EIA Phase has been undertaken in accordance with the EIA Regulations published in Government Notice 28753 of 21 April 2006, in terms of NEMA. Key tasks undertaken within the EIA phase included:

» Consultation with relevant decision-making and regulating authorities (at a national, provincial, and local level).
» Undertaking a public participation process throughout the EIA process in accordance with Regulation 56 of Government Notice R385 of 2006 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 59 of Government Notice No R385 of 2006.

[17] "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).

5.2.2. Authority Consultation

Authority consultation has continued throughout the EIA process and has included the notification of the following relevant organs of state:

» National Department of Environmental Affairs
» National Department of Water Affairs
» National Department of Agriculture
» Northern Cape Department of Environment and Nature Conservation
» Northern Cape Department of Agriculture and Land Reform
» Northern Cape Department of Economic Development
» Northern Cape Department of Roads and Public Works
» Northern Cape Department of Water Affairs
» South African Heritage Resources Agency
» South African National Roads Agency Limited - Western Region
» Khara Hais Local Municipality
» Siyanda District Municipality

A record of all stakeholder consultation undertaken thus far in the EIA process is included within Appendix B and is summarised in the table below.

Scoping Phase	
Activity	**Date**
Placement of site notices	05 November 2010
Placement of an advert informing of the commencement of the EIA process in: » Die Gemsbok (English and Afrikaans) » Die Volksblad (Afrikaans)	 10 November 2010 15 November 2010
Distribution of a background information document	05 November 2010 - ongoing
Placement of an advert informing of the availability of the draft Scoping Report and the public meeting: » Die Gemsbok (English and Afrikaans)	 12 November 2010
Distribution of stakeholder letter to Organs of State and registered I&APs	10 November 2010 and 26 November 2010
Distribution of the draft Scoping Report for comment	15 November 2010 to 15 December 2010
Public meeting and focus group meetings in Upington	01 December 2010
Notification to registered I&APs of submission of final Scoping Report to DEA & if any comments on the document	17 March 2011

EIA Phase	
Placement of an advert informing of the availability of the draft EIA Report and the public meeting:	
» Die Gemsbok (Afrikaans)	15 June 2011
» Die Volksblad (Afrikaans)	09 June 2011
Distribution of stakeholder letter to Organs of State and registered I&APs	09 June 2011

5.2.3. Public Consultation

Public consultation which was initiated at the start of the EIA process has continued throughout the Scoping and EIA Phases. 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.
» Community/public meetings were facilitated in Afrikaans where necessary.
» 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, considered, and, where appropriate, incorporated into the EIA process.

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.

In order to accommodate the varying needs of stakeholders and I&APs, as well as ensure the relevant interactions between stakeholders and the EIA specialist team, the following opportunities have been provided for I&APs issues to be recorded and verified through the EIA Phase, including focus group meetings (pre-arranged and stakeholders invited to attend); public meetings (advertised in the local press), and written, faxed or e-mail correspondence. The following table outlines the meetings proposed for the EIA Phase.

Date	Time	Organisation	Attendees
22 June 2011	13:00- 15:00	Department of Water Affairs, and Upington Water Use Association	Mashudu Ranwedzi, and Stanley Chamberlain
23 June 2011	11:00	Farmers Union	Farmers (Open)
	13:00	Rural community in close proximity to the site	Open
	18:00 for 18:30	Public Meeting	Open
24 June 2011	09:00	Forestry (Northern Cape)	Jackie Mans
	TBC	Siyanda District Municipality and Kara Hais Local Municipality	J Nakoo (Siyanda) Hennie Auret (Kara Hais)

5.2.4. 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 a Comments and Response Report (refer to Appendix D3 for the Comments and Response Reports compiled from both the Scoping and EIA Phases).

The Comments and Response Report includes comments received on the proposed project as well as 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.

5.2.5. Assessment of Issues Identified through the Scoping Process

Based on the findings of the Scoping Study, potential visual impacts (i.e. during construction) and noise related impacts were identified as being of potential low significance. Issues which require further investigation within the EIA phase, as well as the specialists involved in the assessment of these impacts are indicated in the table below.

Specialist	Area of Expertise	Appendix
David Hoare of David Hoare Consulting cc	Ecology	E
Iain Paton of Outeniqua Geotechnical Services cc	Geology and erosion potential	F
Johan van der Waals of Terra Soil Science	Agricultural potential and soils	G
Johnny van Schalkwyk (Environmental Consultant and Researcher)	Heritage	H
Patsy Scherman and Brian Colloty of Scherman Colloty and Associates cc	Water Resources	I
Lourens du Plessis of MetroGIS	Visual	J
Ingrid Snyman of Batho Earth Social and Environmental Consultants	Social	K

The specialist studies considered direct and indirect environmental impacts associated with the development of all components of the proposed Ilanga STPP. 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 Ilanga CSP 1 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 Environmental Management Programme (EMP) is included as Appendix L.

5.2.6. Assumptions and Limitations

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

» All information provided by Ilanga CSP1 and I&APs to the environmental team was correct and valid at the time it was provided.
» It is assumed that the development site represents a technically suitable site for the establishment of the proposed CSP facility. No feasible sites have been identified for this proposed development.
» It is assumed that the point of connection with the Eskom grid is feasible and that the grid has capacity to accommodate the additional load.
» This report and its investigations are project-specific, and consequently the environmental team did not evaluate any other power generation alternatives.

DESCRIPTION OF THE AFFECTED ENVIRONMENT CHAPTER 6

This section of the EIA Report provides a description of the environment that may be affected by the proposed project against which the potential impacts of the proposed facility can be assessed and future changes monitored. This information is provided in order to assist the reader and the competent authority in understanding the possible effects of the proposed project on the environment. Aspects of the regional, local, and site-specific biophysical, social, and economic environment that could directly or indirectly be affected by, or could affect, the proposed development have been described. This information has been sourced from both existing information available for the area as well as collected field data, and aims to provide the context within which this EIA is being conducted. A more detailed description of each aspect of the affected environment is included within the specialist reports contained within Appendices E - K.

6.1. Regional Setting

The proposed development site is located approximately 30 km east of Upington in the Northern Cape Province of South Africa. The Northern Cape is the largest province in South Africa and covers an area of approximately 360 000 km^2 which constitutes approximately 30% of South Africa. The study area falls within the Siyanda District and Khara Hais Local Municipalities, of which the latter has Upington as its main town which serves as both the agricultural hub of the region and a portal to Namibia, the Kalahari, and the Kgalagadi Transfrontier Park.

This region of the Northern Cape is sparsely populated with small concentrations in and around small towns along the Orange River. This key natural feature has to a large degree dictated the settlement pattern by providing a source of irrigation water for the cultivation of grapes and other crops (i.e. lucerne, wheat, vegetables, deciduous fruits, and maize). The Orange River supplies irrigation water to the urban and agricultural areas of Upington, Kakamas, and Keimoes and to the Upington Irrigation Scheme. Various canal schemes within the region have been established to supply water to those areas requiring irrigation.

The main access routes to the area include the N14 and the N10. Regional roads include the R360 and the R27 from Keimoes. These roads, as well as the local roads are generally in a good condition even though large volumes of heavy vehicle traffic are experienced on the main routes. Industrial infrastructure includes the Upington Airport[18], transmission, and distribution power lines (e.g. the Garona-Gordonia No 1

[18] Upington airport caters for daily passenger flights from the main centres in South Africa, as well as various national and international cargo carrier flights. The establishment of an International Development Zone (IDZ)

132kV line to the north east of the proposed development site, and the Garona-Kleinbegin No 1 132kV line to the west of the proposed development site), as well as several substations. The railway line through Upington connects the area to Karasburg in Namibia, Keimoes, and Kakamas to the west of Upington and De Aar in the south, which again links with Johannesburg, Kimberley and Cape Town.

6.2. Climatic Conditions

The Northern Cape is characterised by an arid climate with summer rainfall with a long-term average annual rainfall in the region of 175 mm, of which 81% falls between November and April. Rainfall events are erratic, both locally and seasonally and therefore cannot be relied on for agricultural practices (refer to Figure 6.1). The average evaporation is 2 375 mm per year, peaking at 11.2 mm per day in December. Temperatures vary from an average monthly maximum and minimum of 35ºC and 18.7ºC for January to 20.8ºC and 3.3°C for July respectively. Frost occurs most years on 6 days on average between mid-June and mid-August.

The Weinert Climatic N-number[7] for the area, which is between 40 and 50, indicates that the climate is extremely arid and mechanical weathering processes are dominant.

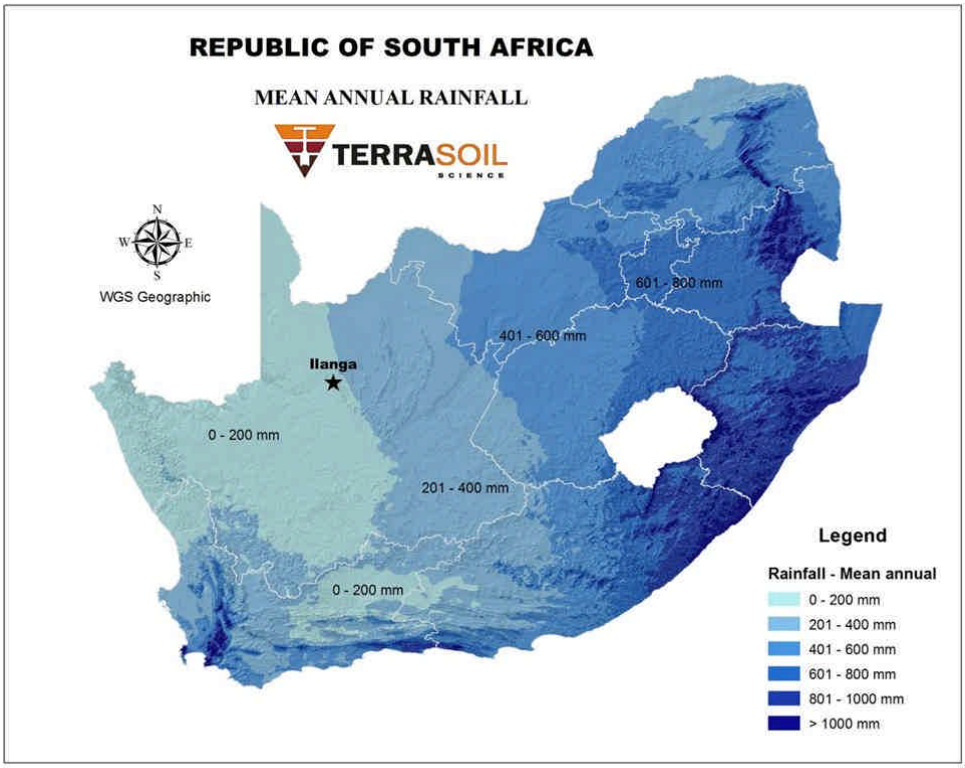

Figure 6.1: Rainfall map of South Africa indicating the survey site.

at the airport has been proposed to further enhance its strategic importance for the local, regional and provincial economy.

6.3. Topography and Geology

There is a range of steep hills running in a north-south direction along the eastern part of the broader development site and a series of scattered hills in the central northern part of the site. The elevation on the broader site varies from 820 to 950 m above sea level (amsl), while Site 1.2 varies between 870 and 890 (amsl).

The study area is located within the Namaqualand Metamorphic Belt which comprises very old and very highly deformed sedimentary and igneous rocks of the Mokolian and Namibian Erathem that form part of the Southern African Basement Complex. The rocks have undergone both regional and contact metamorphism and the culminating deformation phase has been dated at about 1000Ma. These basement rocks are covered by Quaternary sands of the Gordonia Formation and sporadic Tertiary Calcrete deposits (refer to Figure 6.3.). A significant percentage of the proposed site is underlain by unconsolidated or semi-consolidated Quaternary soil cover of the Gordonia Formation. Aerial photography indicates that rock outcrops are likely to be concentrated in the northern and eastern portions of the study area, with sand cover likely to be thickest in the southern lowland areas. There are several geological faults traversing the study area which are considered dormant with a low seismic activity[19].

[19] The anticipated seismic activity is rated as V[19] on the Modified Mercalli Scale and peak horizontal ground accelerations are typically less than 50cm/s with a 10% chance of being exceeded at least once in a 50 year period.

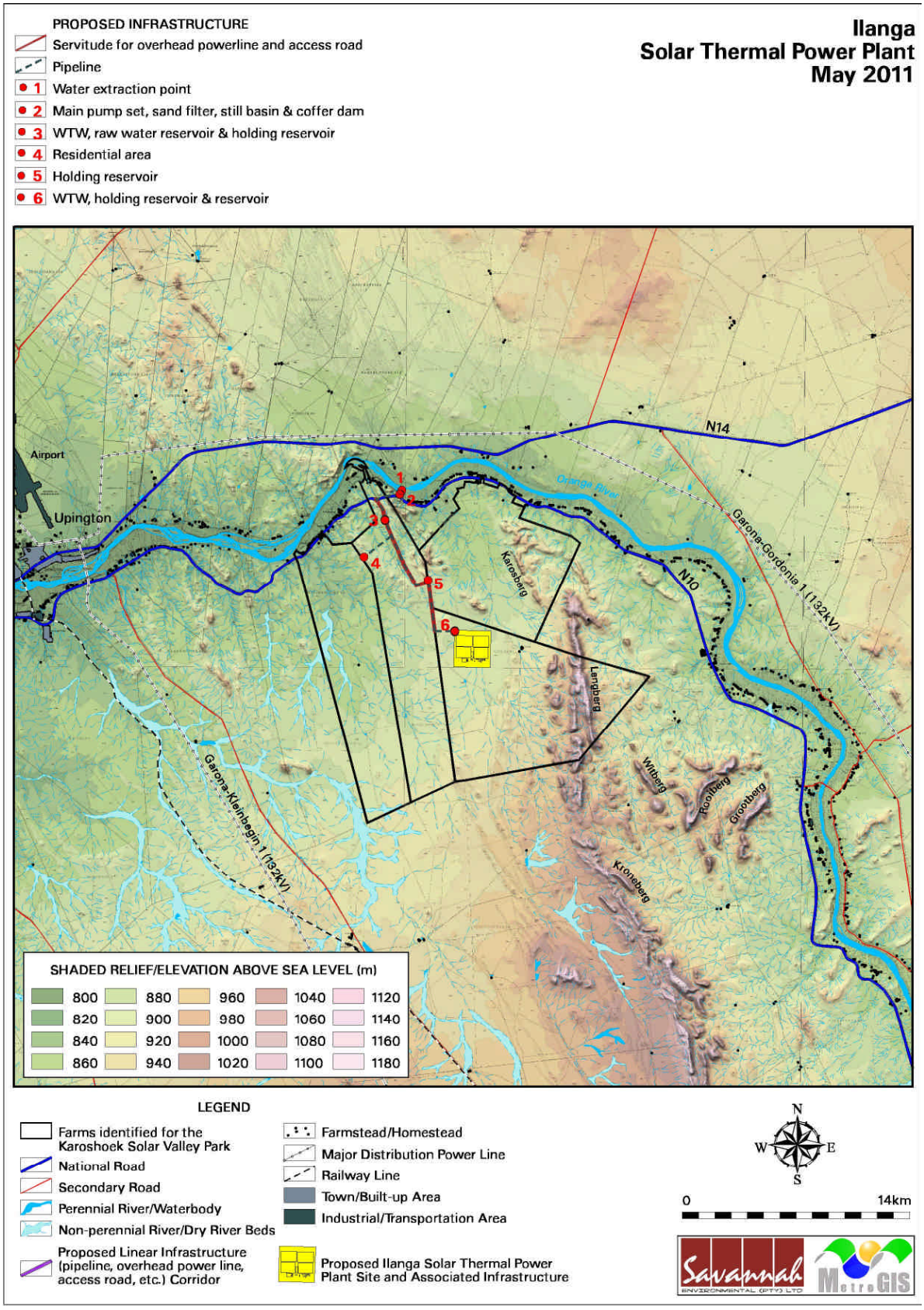

Figure 6.2: Shaded relief map indicating the topography and elevation.

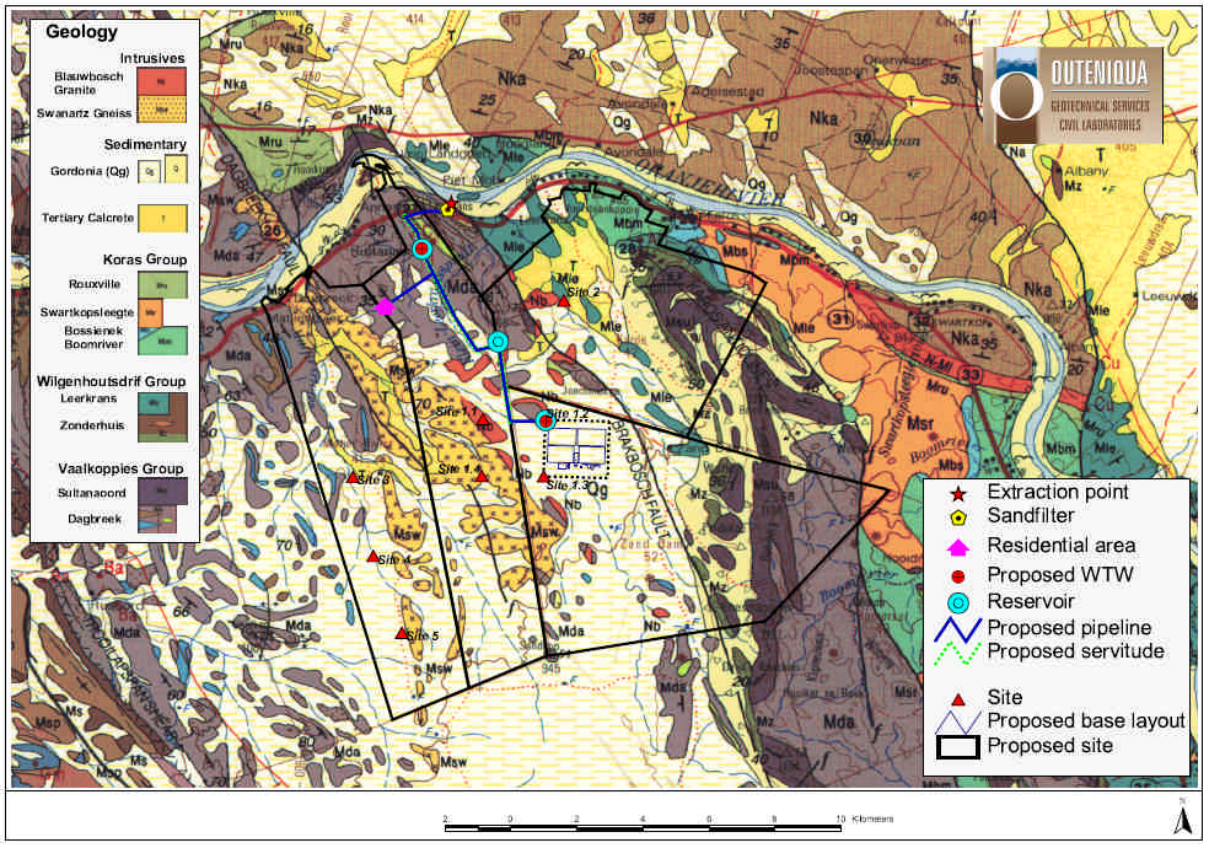

Figure 6.3: Geology of the study area, Site 1.2 is indicated by the red block.

6.4. Hydrological Profile

The study area falls within the Lower Orange Water Management Area which stretches from the Namibian border to just beyond Groblershoop. The Lower Orange River is the stretch between the Orange-Vaal confluence and Alexander Bay where the river meets the ocean. The proposed development site is situated within quaternary catchments D73D and D73E, which are dominated by several highly ephemeral river systems that flow directly towards the Orange River. Potential run-off from the site would flow in a northerly direction towards the Orange River via drainage systems such as the Klein-leerkransspruit and Matjies River or directly into the canal systems and siphons that run along the Orange River.

The Lower Orange River Management Strategy (2005) study found that the Lower Orange River is characterised as largely modified. From an ecosystem point of view, all the dry river beds and the associated riparian systems are extremely sensitive to development, in particular the mainstem systems such as the Klein-leerkransspruit and Majties (Matjes) River within the study area.

Surface water quality

The water quality in the Lower Orange Water Management Area is affected by upstream activities in the Vaal and Orange River catchments. Given the arid nature of the Lower Orange River and the high potential evaporation, the evaporative losses result in an increase in concentrations along the length of the lower Orange River (ORASECOM, 2007).

Water quality between Boegoeberg and Onseepkans is generally good despite extensive irrigation and settlements in the Upington area. The salinity deteriorates downstream of the confluence of the Vaal and Orange rivers but still remains good. There is an increase in Electrical Conductivity (i.e. salinity) from Prieska to Vioolsdrift along the reaches of the lower Orange River (i.e. due to irrigation return flows and evaporative losses along the river). Eutrophication is evident in localised areas along the Lower Orange River, and intermittent blooms of toxic algae have been reported in the Upington area. Some of the water withdrawn for irrigation is returned to the river environment for reuse, but its quality is degraded as a result of considerably higher salts, and nutrient concentrations which contribute significantly to the salts load in the Orange River.

Although the inflows from the Vaal River systems are low, the poor water quality from this system would seem to have a significant impact on the sub-basin and the Lower Orange WMA. In its natural state, water in the Orange River is of good quality. The ORASECOM study (2007) indicated that the salinity in this sub-basin deteriorates downstream of the confluence of the Vaal and Orange rivers, but remains acceptable for human use. Detailed information on the water quality data is contained in the Lower Orange Management Study (LORMS) (LORMS, 2005).

Groundwater quality

The quality of the groundwater is considered brackish or mineralised, but is suitable for the majority of uses and is commonly used in drier areas. The mineralogical groundwater quality class is relatively high within the Lower Orange sub-basin, with Total Dissolved Solids (TDS) values ranging between 601 and 1800 mg/L (DWAF, 2002 cited in ORASECOM, 2007). This can be compared to the overall surface water TDS values ranging between 260 and 600 mg/L (DWAF, 2002), which is a tolerable range or class in terms of its fitness for human use range criteria. The potential for faecal contamination is considered low due to the type and extent of local aquifers.

Surface water quantity

In terms of national demand, the total water requirements of all the users within the Lower Orange sub-basin amounts to approximately 11 490 million m^3/annum spread among:

» Environmental requirement including natural evaporative losses from the Orange River.
» Namibia including water use from the Orange and Fish rivers.
» Lesotho and transfers to South Africa with the full Lesotho Highlands Water Project Phase 1 active.
» South Africa Orange River demand including transfers to the Eastern Cape.
» South Africa Vaal River demand where the Vaal demand is supplied from locally generated runoff.
» Evaporation and losses.

In terms of regional demand, three major areas downstream of the proposed facility receive water directly from the Orange River, i.e. Upington (urban and surrounds), Upington Irrigation Scheme, and Kakamas /Keimoes (urban and irrigation). Various canal schemes within the region are used to supply the irrigated areas. Future demand in the study area is limited largely to the increase in agricultural production, with emphasis on emerging farmers within the Upington Irrigation Area and future CSP facilities.

Groundwater quantity

It is estimated that approximately 60% of the Lower Orange sub-basin depends solely on groundwater for rural supplies, stock watering, and supply to inland towns. The low rainfall for the area impedes recharge, resulting in only small quantities that can be abstracted on a sustainable basis. Groundwater abstracted near the river induces recharge from the river, i.e. surface water from the Orange River is drawn into the surrounding aquifers because of water being abstracted. The hard geological formation underlying most of the region has resulted in unfavourable aquifer characteristics, i.e. low borehole yields and poor storage of groundwater.

6.5. Soils and Agricultural Potential

Study area

The broader survey site lies in the Ae11, Ae111, Ag4, Ag5 (Site 1.2), Af25 and Ic156 land type (Land Type Survey Staff, 1972 - 2006) (refer to Figure 6.4). These land types consist of shallow apedal (structureless) soils with regular occurrences of rock outcrops and lime in the soil profiles. The soils are typical of arid environment soils in that distinct soil formation is lacking and the soils exhibit only signs of physical weathering processes of parent materials. In terms of land capability and land use, extensive grazing dominates over crops due to climatic and soil constraints. The agricultural potential of the study site is very low in its natural state due to soil and climate constraints with the potential of improvement in the case of land preparation, provision of irrigation and intensive land management.

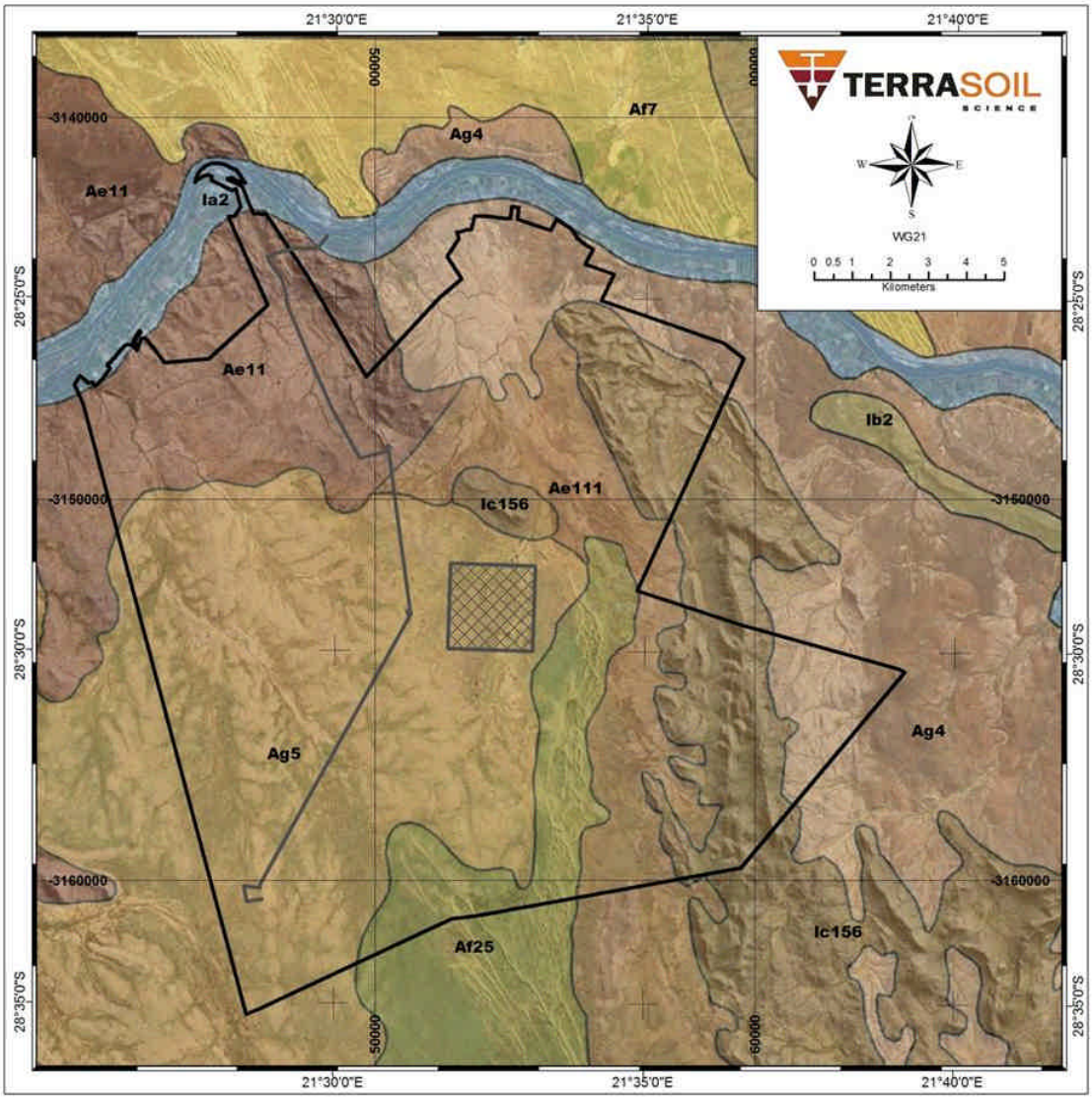

Figure 6.4: Land type map of the survey site

Site 1.2

This area is characterised by a range of soils mainly derived from aeolian sands. These red soils have formed due to the long-term slow wind deposition of Kalahari sands and the subsequent weathering of these profiles to lead to the formation of lime rich subsoil horizons). In the transitional zones (between the rocky areas and flat areas) the soils are often covered with quartz pebbles grading into shallow soils. Due to the sand and well-drained nature of these soils they are suited to irrigated crop production activities with water availability being the obvious restricting factor. In a dry-land environment their agricultural potential is low due to climatic constraints.

6.6. Flora

The study area falls within the Nama-Karoo Biome which occurs on the central plateau of the western half of South Africa, at altitudes between 500 and 2 000 m, with most of the biome failing between 1 000 and 1 400 m. Grassy, dwarf shrubland dominates with grasses being more common in depressions and on sandy soils, and less abundant on clayey soils. Fires are rare within the biomes due to the insufficient fuel loads.

Terrestrial Vegetation Types

There are five vegetation types occurring within the study site, namely Kalahari Karroid Shrubland, Bushmanland Arid Grassland, Gordonia Duneveld, Lower Gariep Alluvial Vegetation, and Lower Gariep Broken Veld (Refer to Figure 6.5).

» *Kalahari Karroid Shrubland* – occurs on flat gravel plains and contains no known endemics. At a national scale this vegetation type is considered as Least Threatened as only 12% has been transformed (i.e. through the development of roads and invasion by the alien invasive *Prosopis*). A small percentage is conserved in the Augrabies Falls National Park.
» *Bushmanland Arid Grassland* - occurs on extensive, relatively flat plains and is sparsely vegetated by tussock grasses. At a national scale this vegetation type is considered as Not Threatened by virtue of its small scale of transformation and its conservancy status (i.e. 27% is conserved in the Augrabies Falls National Park).
» *Gordonia Duneveld* - occurs on parallel dunes (i.e. approximately 3 - 8 m above the surrounding plains) and in open shrubland with ridges of grassland on the dune crests and *Acacia haematoxylon* on the dune slopes. At a national scale this vegetation type is considered as Least Threatened as less than 1% has been transformed and approximately 14% is conserved out of a target of 16%.
» *Lower Gariep Alluvial Vegetation* - occurs between Groblershoop and the mouth of the Orange River at the Atlantic Ocean with numerous small to extensive sand-banks in the river-bed which may contain a number of temporary to semi-permanent plant communities. At a national scale this vegetation type is considered as Endangered as more than 50% has been transformed by agriculture and only 6% conserved in Augrabies Falls National Park, out of a target of 31%.
» *Lower Gariep Broken Veld* - consists of sparse vegetation dominated by shrubs and dwarf shrubs, spring annuals conspicuous and perennial grasses and herbs to a lesser extent. At a national scale this vegetation type is considered as Not Threatened as it has been transformed to a small degree with a proportion conserved in the Augrabies Falls National Park.

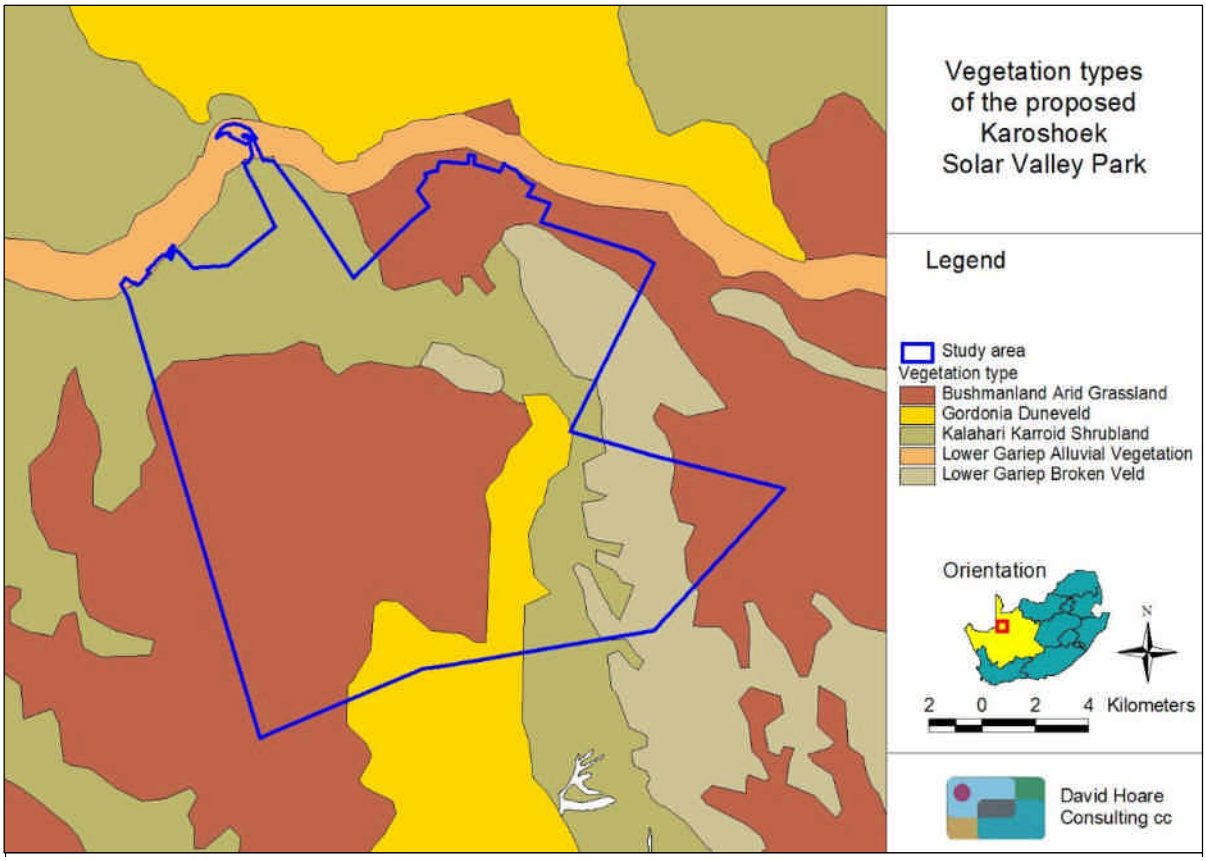

Figure 6.5: Nama-Karoo Biome Vegetation types located within the study area

Aquatic Vegetation Types

At the proposed location of the abstraction point, the instream habitat appears to be fast deep habitat (rapids) and deep pools, with the river banks and channel margins densely lined with reeds (*Phragmites australis*). This locality provides the type of habitat preferred by a number of sensitive fish species.

Five woody plant species were found to be associated with the riparian systems within the study site. Although none of these are obligate or facultative river/wetland species, they do show a preference for riparian soil conditions. The only obligate wetland plants observed were those found in association with the man-made canals and along the Orange River itself. Species observed included *Typha capensis, Phragmites australis* and *Cyperus latifolius*.

No wetlands, other than the riparian systems found along the Orange River are shown on the SANBI National Wetlands Map v2 (SANBI, 2010).

Red Data Species

Five species on the IUCN Red Data List could occur in habitats available in the study area. According to IUCN one of these is listed as Vulnerable, one as Near Threatened and three as Declining. One Vulnerable species was evaluated as having a high probability of occurring on site.

Tree species protected under the National Forest Act that have a sparse geographical distribution across the study area include *Acacia erioloba* (Camel Thorn, Kameeldoring), *Acacia haematoxylon* (Grey Camel Thorn, Vaalkameeldoring), *Boscia albitrunca* (Shepard's Tree, Witgatboom, !Xhi) and *Euclea pseudebenus* (Ebony Tree, Ebbeboom).

Alien Invasive Species

Alien invasive species common to the Nama Karoo Biome include *Opuntia aurantiaca* (Prickly Pear) and *Prosopis glandulosa* (Mesquite).

6.7. Fauna

Red Data Species

There are three mammal species of low conservation concern that could occur in available habitats in the study area. This includes three species classified nationally as Near Threatened, the Honey Badger, Littledale's Whistling Rat and the Dassie Rat, all three of which are classified as Least Concern globally. The site was found to be suitable for the Honey Badger, and Littledale's Whistling Rat, although no individuals or confirmed evidence of these species was found on site.

There are three threatened bird species (all listed as Vulnerable) and three Near Threatened bird species that have a medium probability of utilising available habitats in the study area, either for foraging or breeding. The two species most likely to use parts of the site for breeding are the Kori Bustard and Ludwig's Bustard. The Martial Eagle, Secretarybird, Lanner Falcon and Sclater's Lark may also use the site for foraging. Ludwig's Bustard are reportedly commonly found on the site.

The Giant Bullfrog is the only amphibian species with a distribution that includes the study area and which could occur on site. This species is classified as Least Concern globally and Near Threatened in South Africa. It is, however, protected under the National Environmental Management: Biodiversity Act. No suitable habitat for this species was found within the proposed footprint of infrastructure.

According to the water resources assessment the fish biodiversity in the Lower Orange River within the study area (i.e. from Upington to Onseepkans) is relatively high

compared to the entire river system, with a total of 13 indigenous species being recorded, including five of the six endemic Orange River species. The endemic Namaqua barb, *Barbus hospes* only occurs below the Augrabies Falls, as does an isolated population of the indigenous river sardine, *Mesobola brevianalis*.

The Largemouth yellowfish (*Labeobarbus kimberleyensis*) was classified as "Near Threatened" according to the 2010 IUCN 2010 Red List. The Namaqua barb (*Barbus Hospes)* and the rock catfish (*Austroglanis sclateri)* were classified as "Near Threatened" and Data Deficient" respectively in 1996 (Swartz and Impson, 2007; Swartz *et al*., 2007). The other two endemic fish species, Smallmouth Yellowfish (*Labeobarbus aeneus*) and Orange River mudfish (Labeo capensis) are fairly abundant. However, the conservation status of these two species are also of some concern due to the deterioration of their habitat in the Lower Orange (LORMS, 2005).

6.8. Heritage Resources

Stone Age

Occupation in the region by early humans would probably date to the Middle Stone Age and would consist of open sites near stream beds or hills and outcrops. Population density might have increased during the Later Stone Age and people would have occupied rock shelters (where available) as well as open sites. During this later period they also produced rock engravings, although none are known from the immediate region.

Surveys done by Sampson (1985) to the south-east of the study area indicate a rich legacy in Stone Age sites in the Karoo. Quarries where Later Stone Age people obtained material for the production of stone tools are known to exist on the farm Vaalkoppies located to the west of the study area. No sites, features, or objects dating to the Iron Age were identified in the study area.

Historic period

The town of Upington, originally known as Olijvenhoutsdrift, was founded in 1871 as part of a mission station by the German missionary Rev Schröder. The town was renamed in 1884 after Sir Thomas Upington, who was the Prime Minister of the Cape Colony. An irrigation canal was reportedly started by Rev Schröder in 1883, and completed in 1885. By 1884 there were already 77 irrigation farms.

Two small house structures were identified on the northern outer edge of the development site.

Heritage Sites

The cultural landscape qualities of the study area essentially consist of a rural area in which the human occupation is made up of a pre-colonial element (Stone Age) as well as a much later colonial component. Most of the known, declared heritage sites (provincial) are located near the Orange River and has to do with irrigation activities.

Archaeological and palaeontological sites of known significance on/near the study area

» A low density of stone tools (i.e. < 1 in 100 m^2), was encountered adjacent to the track leading on the development site. This route will be used for the installation of the infrastructure for the site such as the access road, water pipeline, and power line. The tools and cores mostly date to the Later Stone Age, but a few that could be defined as dating to the Middle Stone Age were also noted. This material is evaluated as having a very low significance and therefore does not warrant any further action concerning the proposed development.

» A non-perennial stream passes to the south of the development site, ending in pan. Significant numbers of stone tools dating to the Later Stone Age occur along this stream as well on the outer edge of the pan. This area is located outside the development area and therefore there would be no impact on it resulting from the proposed facility.

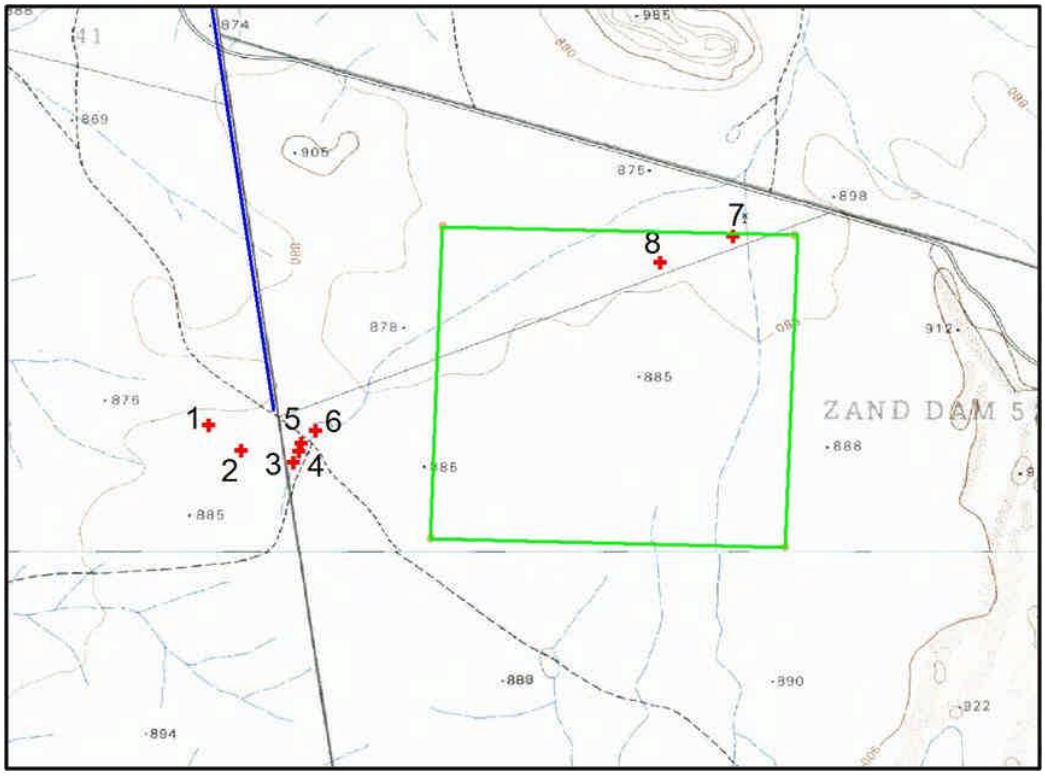

Figure 6.6: Map of the study area, showing known sites of significance (red crosses) (Map 2821BC: Chief Surveyor-General).

The table below includes the location of archaeology and paleontological sites and their significance grading in terms of Section 35 of the National Heritage Resourced Act (Act No. 25 of 1999), which describes the protection given to resources of archaeology and paleontological importance.

Location:					
No. 1	S 28.49227	E 21.51588	No. 2	S 28.49389	E 21.51799
No. 3	S 28.49464	E 21.52133	No. 4	S 28.49395	E 21.52172
No. 5	S 28.49341	E 21.52184	No. 6	S 28.49263	E 21.52279
Description: It is believed that the granite outcrop occurring in the stream bed retain water for much longer, drawing people to settle here. The material identified include tool, flakes and cores, indicated that people stayed here for some time.					
Significance: High on a local level – Grade III (refer to Appendix H for a description of the grading levels).					
Mitigation: These sites are located outside the area of development and would not be affected by the proposed development.					

Buildings, structures, places, and equipment of cultural significance on/near the study area

The tables below includes the location of sites with cultural significance grading in terms of Section 34 of the National Heritage Resourced Act (Act No. 25 of 1999), which describes the protection given to structures older than 60 years.

Location:		
No. 7	S 28.48176	E 21.54503
Description: Rectangular house built with clay bricks, a flat roof, and a fire-place added to the one side wall.		
Significance: Low on a local level – Grade III		
Mitigation: » This site is located right on the border of the development site and would therefore not be impacted on. » Furthermore, it is viewed to have a low significance, therefore no mitigation is necessary		

Location:		
No. 8	S 28.48010	E 21.54974
Description: A single roomed structure built with clay bricks. The roof and other fittings have been removed. It is difficult to determine the age of the structure, but, as it seem to have had steel window frames it is judged not to be very old.		
Significance: Low on a local level – Grade III		

Mitigation:
As this structure is of low significance and actually falls just outside the development area, it is viewed to be documented in full after submission of this report to the South African Heritage Resources Agency (SAHRA). Therefore no mitigation is necessary.

6.9. Social Characteristics of the Study Area

The proposed site falls within the municipal jurisdiction of the //Khara Hais Local Municipality and the Siyanda District Municipality in the Northern Cape Province. Upington is the main town of the //Khara Hais Local Municipality and serves as portal to Namibia, the Kalahari, and the Kgalagadi Transfrontier Park. Furthermore, it functions as the agricultural hub of the area (//Khara Hais SDF, 2008).

6.9.1. Northern Cape

The Northern Cape has the smallest population[20] of South Africa (i.e. 1.8%), despite having the largest surface area.

» *Education* - 71.3% have primary or secondary education, while 15.1% has received no formal education. Those with a higher educational qualification accounted for 3.7% of the population.
» *Income and economic activity* - a high percentage of the population lives in extreme poverty, with the economy being heavily dependent on the primary sectors of the economy (i.e. mining and agriculture). Of the economically active population, 55.5% were employed while 26.1% could not find employment (i.e. this is lower than the national figure of 29.5%).

6.9.2. Khara Hais Municipality

The //Khara Hais Local Municipality has twelve wards and the following settlements:

» Upington (including Paballelo and Louisvaleweg);
» Lambrechtsdrift;
» Karos;
» Leerkrans;
» Leseding;
» Louisvale;
» Raaswater;
» 6 Brugge and Klippunt; and
» Kalksloot (//Khara Hais SDF, 2008).

[20] The population can be classified as young with 57.7% < than 30 years old and a third of the total population < 15 years old. The female proportion makes up approximately 51.2% of the total with males making up the remaining 48.8%.

The population of the //Khara Hais Municipality is distributed in and around Upington, Paballelo and Louisvaleweg. A Community Survey undertaken in 2007, indicated a significant increase from the 2001 Census data as the population of //Khara Hais is estimated at 100 920 for 2007 which represents an increase of 33.36% (//Khara Hais SDF, 2008). The discrepancies in the population count and growth could negatively influence the financial and planning processes of the Municipality and subsequently influence the development and service delivery capabilities of the municipality. The //Khara Hais Local Municipality has thus launched a socio-economic survey to update the population profile with the correct figures (//Khara Hais SDF, 2008).

» *Education* - 19% of the population has some secondary education; 12% have completed Matric; 3% have some form of higher education; 16% is functionally illiterate; and 7% are completely illiterate. This is directly connected to low income levels and will have severe negative socio-economic implications for the area if not attended to (//Khara Hais SDF, 2008).
» *Employment status and income* - 63% of the total population falls within the working age category (i.e. 15 - 65 years; //Khara Hais SDF (2008)). Of this only 24% of these individuals are employed, 13% are unemployed, and 26% are not economically active (i.e. housewives/homemakers, students, pensioners and retired people, and those not seeking work). Of those employed (i.e. the labour force), 55% earn between R401 and R1 600 per month, and 19% earn less than R400 per month. As the employed labour force constitutes only 24%, it is thus concluded that the majority of the population lives in extreme poverty and are dependent on the income of the employed sector.
» *Safety and security* - the area is characterised by relatively low crime levels. The main challenges revolve around vandalism, family violence, smuggling of illegal substances, as well as alcohol and drug related violence (//Khara Hais SDF, 2008).

6.9.3. Tourism in the Study Area

Tourism is an important economic sector in this region and includes a broad range of tourist amenities and opportunities, which include, amongst others:

» Agri-tourism opportunities and associated with vineyard farming, wine-making, and so forth.
» The Orange River Wine Route includes five wineries in Upington, Kakamas, Keimoes, Grootdrink, and Groblershoop respectively.
» Game and eco-tourism opportunities associated with the Orange River and various lodges outside of Upington.
» Game and eco-tourism opportunities associated with the Spitskop Nature Reserve, Augrabies Falls National Park, as well as the Kgalagadi Transfrontier Park.

» A number of festivals throughout the year such as the Kalahari Kuierfees, the Upington Agricultural Show (Northern Cape Expo) and the Orange River Young Wine Show
» Conferencing facilities.
» Culture tourism presented in Paballelo.
» Testing of vehicles within extreme conditions by car manufacturers in the area.

6.9.4. Land use characteristics of the broader study site

The farms affected by the proposed development are mainly used for cattle farming and leisure activities. Smaller farming units to the north of the N10 are mainly used for the cultivation of grapes and raisins by means of irrigation farming.

Homesteads in the area are scarce and of the twelve wards within the //Khara Hais Local Municipality the following settlements are located within 20 km of the facility:

» Lambrechtsdrift
» Karos
» Leerkrans
» Ntsikelelo
» Luisvale

Only one homestead is located on the site, of which it is only used occasionally.

ASSESSMENT OF POTENTIAL IMPACTS: CHAPTER 7

This chapter serves to determine the significance of the positive and negative environmental impacts (direct, indirect, and cumulative) associated with the development of Project Ilanga. This assessment is done for all the phases of the project's development and for all the facility's components which will comprise:

» *The solar field* - this will comprise multiple loops of parabolic troughs which serve to receive and concentrate the solar radiation. They will be directly associated with piping which will convey the heat transfer fluid between the troughs and the steam cycle.
» *The power block* - comprising a conventional steam turbine generator and a substation into which the electricity can be evacuated.
» *Water related infrastructure* - including an existing abstraction point near the Farm Annashoek[21] (i.e. associated with a still basin, a main pump set, a sand filter, and a coffer dam), a water supply pipeline; several water treatment and storage reservoirs, and evaporation ponds.
» *Power evacuation* – two 132 kV power lines will be constructed which will have a loop-in loop-out connection[22] into the existing Gordonia-Garona 132 kV line located to the north of the site. This will necessitate crossing the Orange River, the N10, and the N14 national roads. Within the broader Karoshoek site it is proposed that these power lines follow the same alignment as the main water supply pipeline and access road (along the existing main access road to the farm Annashoek) to reach the on-site substation.
» *Associated infrastructure* –a short internal access road, storerooms, parking facilities, security and administrative buildings, and temporary waste storage facilities.

The development of Project Ilanga will comprise the following phases:

» *Pre-Construction and Construction* – will include preconstruction surveys; site preparation; establishment of the access road, electricity generation infrastructure, water supply infrastructure, power line servitudes, construction camps, storage facilities, laydown areas, and temporary construction crew accommodation facilities[23]; transportation of components/construction equipment to site; and undertaking site rehabilitation and establishment and implementation of a stormwater management plan.

[21] The abstraction point may need to be upgraded.
[22] If a double circuit power line is proposed then two lines will no longer be necessary.
[23] Note that this facility may become a permanent facility if proven feasible through a feasibility study and separate EIA process

» *Operation* – will include sourcing of water and water treatment; operation of the facility and the generation of electricity; and site operation.
» *Decommissioning* – depending on the economic viability of the plant, the length of the operational phase may be extended. Alternatively decommissioning will include site preparation; disassembling of the components of the facility; clearance of the site and rehabilitation. Note that impacts associated with decommissioning are expected to be similar to construction. Therefore, these impacts are not considered separately within this chapter.

7.1. Areas of sensitivity identified across the broader Karoshoek site during the Scoping Study

Several potentially sensitive areas were identified for the broader Karoshoek site, including:

» *Areas of high ecological sensitivity* – high concentrations of dunes within parts of the site, and several non-perennial drainage lines and pans.
» *Areas of visual exposure* – receptors within an 8 km radius of the facility (i.e. users of national and secondary roads).
» *Areas of high agricultural potential* – the northern portion of the site (i.e. south of the N10[24]).
» *Areas with sensitive noise receptors* – several rural settlements located near the Orange River and the N10 and any receptor located within 2 km of the facility[25].

These and other environmental issues have been assessed during the EIA Phase. The sensitivity map produced from the Scoping Phase of the EIA process has been updated to include the preliminary layout of the proposed facility (refer to Figure 7.1). This map indicates how the design of the proposed facility has taken identified sensitive areas into consideration.

[24] The development of dry land cropping in these areas is limited by low rainfall, and lack of irrigation facilities.
[25] Note that since the proposed Project Ilanga development site is located more than 2km from sensitive noise receptors, no noise impact assessment has been undertaken within this EIA.

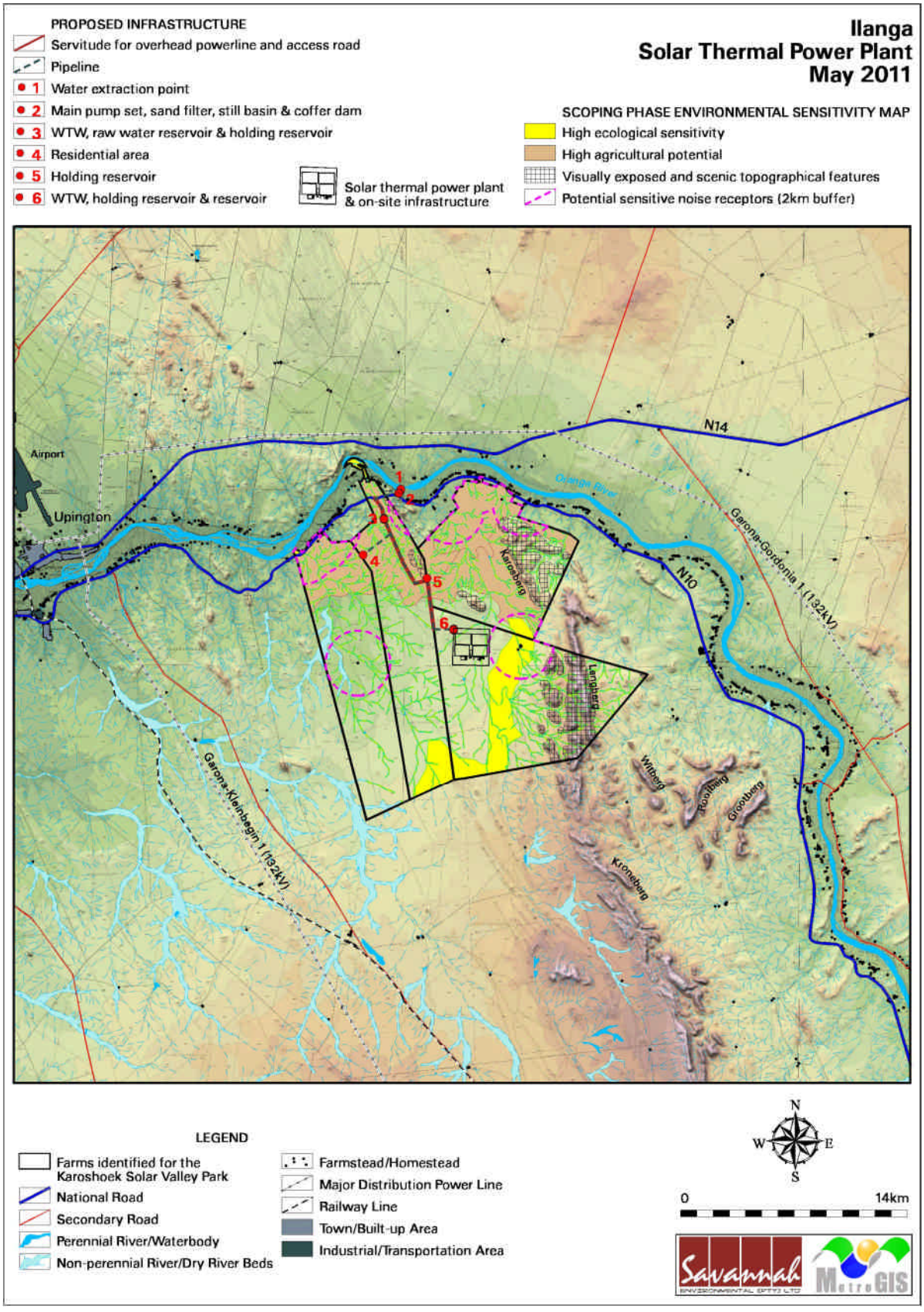

Figure 7.1: Sensitivity map illustrating those sensitive areas across the broader site, in relation to the proposed layout for Project Ilanga.

7.2. Methodology for the assessment of potentially significant impacts associated with Project Ilanga

A broader site of 26 000 ha (i.e. the broader Karoshoek site) was originally identified by the project developer for the purpose of establishing the proposed Karoshoek Solar facility, of which Project Ilanga forms the first phase. Following the Scoping Phase of the EIA process, and a technical evaluation of the broader site, Site 1.2 was identified as the preferred area for this first phase of the broader project based on environmental and technical constraints[26]. This assessment therefore only considers potential environmental impacts associated with the development of the proposed solar facility on Site 1.2, as well as those impacts associated with the associated infrastructure.

The assessment of potential issues has involved key input from specialist consultants, the project developer, key stakeholders, and interested and affected parties (I&APs). The revised Comments and Response Report included within Appendix D3 lists these issues, the initial response given by the EAP during the Scoping Phase, and a revised response (if applicable) following the completion of the specialist studies as part of the EIA Phase.

In order to assess the potential impacts associated with the proposed facility, it was necessary to quantify the extent of the permanently and temporarily affected areas (i.e. both area and linear infrastructure). This includes the area required for the solar field (i.e. parabolic troughs), the power block and its associated infrastructure, the linear infrastructure (i.e. pipeline, road, power lines), and water related infrastructure (water reservoirs and water treatment works, and the abstraction point with its associated infrastructure).

[26] *Please note: although this area is preferential for the development of Project Ilanga, this does not allude to the remaining site being unsuitable for the future development of the Karoshoek Solar Park.*

Permanent Component – Site 1.2 (total 484 ha)	Approximate extent (in ha)
Solar field (parabolic troughs) and power block[27]	400

Permanent Component –outside Site 1.2 but within the broader development site (total 25 516 ha)	Approximate extent (in ha)
Power lines – assuming a length of 10 km and a servitude width of 70 m[28]	**70**
Interal access road – assuming a length of 1.2 km and a width of 10 m	**1.2**
Water reservoirs (water treatment and storage)	0.08
Abstraction point near farm Annashoek, the abstraction point used by the local water board	
TOTAL (ha)	**<40**

Permanent Component –beyond the broader development site	Approximate area/extent (in ha)
Pipeline – assuming a distance of 2 km and servitude width of 70 m	14
TOTAL	**N/A**

Temporarily affected areas include the pipeline outside Site 1.2 but within the broader Karoshoek site.

Temporary Component	Approximate area/extent (in ha)
Pipeline – assuming a distance of 12 km and an excavation and laydown width of 30 m	36 ha
TOTAL	**N/A**

[27] Assuming the facility is developed with storage, the area it amounts to 4 km^2.

[28] The power lines will be a total of 14 km, of which 2 km will be located within Site 1.2, and 2 km will extend beyond the broader property boundary, over the Orange River, to the connection point with the existing 132kV power line. A loop-in loop-out connection is proposed which means that two lines in parallel are required, each of which requires a servitude of 35 m, unless a double circuit tower is used.

7.3. Assessment of the Potential Impacts associated with the proposed Solar Thermal Power Plant

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 facility on the identified site (i.e. Site 1.2). Issues were assessed in terms of the criteria detailed in Chapter 5. The nature of the potential impact is discussed and the significance is calculated (i.e. with and without mitigation/enhancement[29]). Recommendations have been made regarding mitigation and management measures for potentially significant impacts, and the possibility of residual and cumulative impacts[30] are noted. Recommended mitigation have been included within the draft Environmental Management Programme (EMP) included within Appendix L.

7.3.1. Ecology

The type of construction activities required for the establishment of the facility of this nature may lead to:

» *Impacts on indigenous natural vegetation* - the loss of indigenous natural vegetation may lead to:
  * Negative change in the conservation status of habitat (Driver et al. 2005).
  * Increased vulnerability of remaining portions to future disturbance.
  * General loss of habitat for sensitive species.
  * Loss in variation within sensitive habitats.
  * General reduction in biodiversity.
  * Increased fragmentation (depending on location of impact).
  * Disturbance to processes maintaining biodiversity and ecosystem goods and services; and loss of ecosystem goods and services.

» *Impacts on protected tree species* - there are a number of tree species that are protected according to the National Forests Act, 1998 (Act No. 84 of 1998). In terms of Section 1 5(1) "No person may cut, disturb, damage or destroy any protected tree or possess, collect, remove, transport, export, purchase, sell donate or in any other manner acquire or dispose of any protected tree or any forest product derived from a protected tree, except under a license granted by the Minister".

» *Impacts on threatened animal species* – threatened animal species are indirectly affected by the overall loss of habitat. Direct construction impacts can often be avoided due to the movement of individuals from the path of construction. The loss of individuals or localised populations is unlikely to lead to a change in the conservation status of the species, unless they are classified as threatened. In the case of threatened animal species, the loss of a population or individual could lead to

[29] Where relevant for positive impacts.

[30] 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.

a direct change in its conservation status. This may arise if the proposed infrastructure is located where it will affect such individuals or populations or the habitat that they depend on. Consequences may include:

- Fragmentation of populations of affected species.
- Reduction in area of occupancy of affected species.
- Loss of genetic variation within affected species.

In turn these impacts may all lead to a negative change in the conservation status of the affected species, which implies a reduction in the chances of the species overall survival chances.

» *Impacts on threatened plant species* – Plant species are especially vulnerable to construction activities as they cannot move out of the path of impact. They are also affected by the overall loss of habitat. Threatened species include those classified as critically endangered, endangered, or vulnerable. The significance of impacts on threatened plant species is the same as mentioned above for threatened animal species.

» *Impacts on drainage lines* – wetlands, riparian zones, and watercourses are defined in the National Water Act (Act No. 36 of 1998) as a water resource. These systems (i.e. including dry river beds and drainage lines) provide important habitat for a number of species, especially in arid environments, including those with a restricted distribution or species with an elevated conservation status. Any activities that are contemplated that could affect the wetlands requires authorisation in terms of the act. Construction may lead to direct or indirect loss of or damage to some of these areas or changes to their catchment, which may in turn affect the hydrology of the landscape.

» *Establishment of alien invasive plant species* - major factors contributing to invasion by alien invader plants include high disturbance activities and negative grazing practices (Zachariades et al. 2005). Consequences of this may include:

- Loss of indigenous vegetation.
- Change in vegetation structure leading to change in various habitat characteristics.
- Change in plant species composition.
- Change in soil chemical properties.
- Loss of sensitive habitats.
- Loss or disturbance to individuals of rare, endangered, endemic, and/or protected species.
- Fragmentation of sensitive habitats.
- Change in flammability of vegetation, depending on alien species.
- Hydrological impacts due to increased transpiration and runoff.
- Impairment of wetland function.

Impact table summarising the significance of impacts on ecology during the construction and operation phases

Nature: Impacts on indigenous natural terrestrial vegetation

It has been established that the vegetation types that will be affected by the proposed infrastructure are *Bushmanland Arid Grassland* and *Kalahari Karroid Shrubland*, both of which are classified as Least Threatened. Transformation rates within both vegetation types are less than 2% and most of the vegetation is in a natural state, except for localised disturbances associated with the national road and grazing damage.

	Without mitigation	***With mitigation***
Extent (Site 1.2)	Local (1)	Local (1)
Extent (Powerlines)	Local (1)	Local (1)
Extent (Linear components)	Local (1)	Local (1)
Extent (Abstraction point)	N/A	N/A
Duration (Site 1.2)	Permanent (5)	Permanent (5)
Duration (Powerlines)	Long-Term (4)	Long-Term (4)
Duration (Linear components)	Permanent (5)	Permanent (5)
Duration (Abstraction point)	N/A	N/A
Magnitude (Site 1.2)	Moderate (6)	Moderate (5)
Magnitude (Powerlines)	Small (2)	Small (1)
Magnitude (Linear components)	Small (2)	Small (1)
Magnitude (Abstraction point)	N/A	N/A
Probability (Site 1.2)	Definite (5)	Definite (5)
Probability (Powerlines)	Highly Probable (4)	Highly Probable (4)
Probability (Linear components)	Definite (5)	Definite (5)
Probability (Abstraction point)	N/A	N/A
Significance (Site 1.2)	**Medium (60)**	**Medium (55)**
Significance (Powerlines)	**Low (28)**	**Low (24)**
Significance (Linear components)	**Medium (40)**	**Medium (35)**
Significance (Abstraction point)	**N/A**	**N/A**
Status (positive or negative)	Negative	
Reversibility	Not reversible	
Irreplaceable loss of resources	Yes	
Can impacts be mitigated	To some extent	

Mitigation:

» Avoid unnecessary impacts on natural vegetation surrounding infrastructure. Impacts should be contained, as much as possible, within the footprint of the infrastructure.
» If possible, infrastructure should be placed within existing disturbed areas on site, or close to these.
» The area must be fenced prior to construction and no impacts beyond the fenceline permitted.

Cumulative impacts:
» Soil erosion, alien invasions may lead to additional loss of habitat that will exacerbate this impact.
Residual impacts:
» Some loss of this vegetation type will occur, but this is insignificant relative to the total extent of the vegetation type.

Nature: Impacts on threatened plant species

There are very few threatened species listed for the study area, reportedly due to the fact that the area is under collected, floristically speaking, and the local flora is not well documented. Therefore, there may be no records for species occurring in the area.

There are six known Red List or Orange List plant species with a known geographic distribution in this region. Of these, five could occur in available habitats in the study area. This includes one species classified as Vulnerable, one as Near Threatened, and three as Declining. *Aloe dichotoma*, the Near Threatened species has been recorded on site.

	Without mitigation	***With mitigation***
Extent (Site 1.2)	Local (1)	Local (1)
Extent (Powerlines)	Local (1)	Local (1)
Extent (Linear components)	Local (1)	Local (1)
Extent (Abstraction point)	N/A	N/A
Duration (Site 1.2)	Permanent (5)	Permanent (5)
Duration (Powerlines)	Permanent (5)	Permanent (5)
Duration (Linear components)	Permanent (5)	Permanent (5)
Duration (Abstraction point)	N/A	N/A
Magnitude (Site 1.2)	Low (2)	Low (1)
Magnitude (Powerlines)	Low (4)	Small (1)
Magnitude (Linear components)	Low (4)	Small (1)
Magnitude (Abstraction point)	N/A	N/A
Probability (Site 1.2)	Improbable (2)	Improbable (2)
Probability (Powerlines)	Probable (3)	Improbable (2)
Probability (Linear components)	Improbable (2)	Highly Improbable (1)
Probability (Abstraction point)	N/A	N/A
Significance (Site 1.2)	**Low (16)**	**Low (14)**
Significance (Powerlines)	**Medium (30)**	**Low (14)**
Significance (Linear components)	**Low (20)**	**Low (7)**
Significance (Abstraction point)	N/A	N/A
Status (positive or negative)	Negative	
Reversibility	Not Reversible	
Irreplaceable loss of resource	Yes	

Can impacts be mitigated	Partially
Mitigation:	
» Educate personnel on the conservation value of the species and the need to prevent disturbance to any individuals.	
» If necessary, shift tower positions slightly to avoid having to negatively affect threatened plants.	
Cumulative impacts:	
» Loss of habitat, soil erosion, and alien invasions may all lead to additional impacts that will exacerbate this impact.	
Residual impacts:	
» None likely	

Nature: Impacts on threatened animals

Three mammal species and six bird species of conservation concern could occur in the proposed study area. This includes three species classified as Vulnerable (i.e. Kori Bustard, Ludwig's Bustard, and Martial Eagle), and six species classified as Near Threatened (i.e. Secretarybird, Lanner Falcon, Sclater's Lark, Honey Badger, Littledale's Whistling Rat, and the Dassie Rat). Littledale's Whistling Rat, the Honey Badger, and Ludwig's Bustard have a high probability of occurring on site. The site is considered important for (Ludwig's Bustard).

	Without mitigation	***With mitigation***
Extent (Site 1.2)	Site and surroundings (2)	Site and surroundings (2)
Extent (Powerlines)	Site and surroundings (2)	Site and surroundings (2)
Extent (Linear components)	Site and surroundings (2)	Site and surroundings (2)
Extent (Abstraction point)	N/A	N/A
Duration (Site 1.2)	Long-Term (4)	Long-Term (4)
Duration (Powerlines)	Long-Term (4)	Long-Term (4)
Duration (Linear components)	Long-Term (4)	Long-Term (4)
Duration (Abstraction point)	N/A	N/A
Magnitude (Site 1.2)	Low (4)	Low (3)
Magnitude (Powerlines)	Low (4)	Low (3)
Magnitude (Linear components)	Minor (1)	Minor (1)
Magnitude (Abstraction point)	N/A	N/A
Probability (Site 1.2)	Highly Probable (4)	Highly Probable (4)
Probability (Powerlines)	Highly Probable (4)	Highly Probable (4)
Probability (Linear components)	Improbable (2)	Improbable (2)
Probability (Abstraction point)	N/A	N/A
Significance (Site 1.2)	**Medium (40)**	**Medium (36)**
Significance (Powerlines)	**Medium (40)**	**Medium (36)**
Significance (Linear components)	**Low (14)**	**Low (14)**
Significance (Abstraction point)	N/A	N/A
Status (positive or negative)	Negative	

Reversibility	Reversible With effective rehabilitation
Irreplaceable loss of resource	Yes
Can impacts be mitigated	To Some Degree
Mitigation: » Construction activities should only begin outside of the breeding season of affected species. » If construction activities are considered to be of a nature that they may negatively impact on the survival of the species, then a permit is required. » If construction or the presence of the powerline is considered to be of a nature that they may negatively impact on the survival of the species, then a permit is required. » Suitable measures must be taken to make the powerline more visible to flying birds.	
Cumulative impacts: » Loss of indigenous natural vegetation, alien invasions may all lead to additional impacts that will exacerbate this impact.	
Residual impacts: » None likely	

Nature: Impacts on protected tree species

Acacia erioloba, Acacia haematoxylon, Boscia albitrunca, and *Euclea pseudebenus* have a geographic distribution which includes the study area. Four *Acacia erioloba* trees were recorded near proposed infrastructure and more than 50 *Boscia albitrunca* trees were recorded per square kilometre near proposed infrastructure (estimate). It is further estimated that more than 200 individuals could potentially occur on the broader study site. The other two species, *Acacia haematoxylon* and *Euclea pseudobenus*, were not recorded on site.

	Without mitigation	***With mitigation***
Extent (Site 1.2)	Local (1)	Local (1)
Extent (Powerlines)	Local (1)	Local (1)
Extent (Linear components)	Local (1)	Local (1)
Extent (Abstraction point)	N/A	N/A
Duration (Site 1.2)	Permanent (5)	Permanent (5)
Duration (Powerlines)	Permanent (5)	Permanent (5)
Duration (Linear components)	Permanent (5)	Permanent (5)
Duration (Abstraction point)	N/A	N/A
Magnitude (Site 1.2)	Low to Moderate (3)	Low to Moderate (3)
Magnitude (Powerlines)	Minor (2)	Minor (2)
Magnitude (Linear components)	Minor (2)	Minor (2)
Magnitude (Abstraction point)	N/A	N/A
Probability (Site 1.2)	Definite (5)	Definite (5)
Probability (Powerlines)	Highly Probable (4)	Probable (3)
Probability (Linear components)	Highly Probable (4)	Probable (3)
Probability (Abstraction point)	N/A	N/A

Significance (Site 1.2)	**Medium (45)**	**Medium (45)**
Significance (Powerlines)	**Medium (32)**	**Low (24)**
Significance (Linear components)	**Medium (32)**	**Low (24)**
Significance (Abstraction point)	**N/A**	**N/A**
Status (positive or negative)	Negative	
Reversibility	Not reversible	
Irreplaceable loss of resources	Yes	
Can impacts be mitigated	Not necessary	
Mitigation: » If possible, place infrastructure in areas where protected trees do not occur or occur in low densities and attempt to avoid disturbing older/larger individuals. » Obtain a permit for any protected trees that have to be destroyed. » Undertake a field survey to collect the information required for applying for the permit.		
Cumulative impacts: » Impacts due to alien invasions and damage to watercourses may possibly cause damage to habitat where protected trees could grow that may exacerbate this impact.		
Residual impacts: » None likely		

Nature: Impacts on drainage lines (wetlands) The site is in a very arid area. There are no wetlands on site, but there are a number of drainage lines.		
	Without mitigation	***With mitigation***
Extent (Site 1.2)	Local and surroundings (2)	Local and surroundings (2)
Extent (Powerlines)	Local and surroundings (2)	Local and surroundings (2)
Extent (Linear components)	Local and surroundings (2)	Local and surroundings (2)
Extent (Abstraction point)	Local and surroundings (2)	Local and surroundings (2)
Duration (Site 1.2)	Permanent (5)	Permanent (5)
Duration (Powerlines)	Long-term (4)	Long-term (4)
Duration (Linear components)	Permanent (5)	Permanent (5)
Duration (Abstraction point)	Short-term (1)	Short-term (1)
Magnitude (Site 1.2)	Moderate (6)	Moderate (5)
Magnitude (Powerlines)	Minor (2)	Minor (1)
Magnitude (Linear components)	Moderate (5)	Low (4)
Magnitude (Abstraction point)	Minor (2)	Minor (2)
Probability (Site 1.2)	Definite (5)	Highly probable (4)
Probability (Powerlines)	Improbable (2)	Highly improbable (1)
Probability (Linear components)	Highly probable (4)	Probable (3)
Probability (Abstraction point)	Highly likely (4)	Highly likely (4)

Significance (Site 1.2)	**High (65)**	**Medium (48)**
Significance (Powerlines)	**Low (16)**	**Low (7)**
Significance (Linear components)	**medium (48)**	**medium (33)**
Significance (Abstraction point)	**Low (20)**	**Low (20)**
Status (positive or negative)	Negative	
Reversibility	» No with respect to Site 1.2 » Reversible with effective rehabilitation with respect to the powerlines	
Irreplaceable loss of resources	Yes	
Can impacts be mitigated	To a small degree	

Mitigation:

» Control stormwater and runoff water to avoid erosion impacts on watercourses. Erosion and flow-control features should be positioned immediately downstream of infrastructure to prevent downstream impacts.
» Powerline towers must be positioned a minimum of 50 m outside the outer boundary of any watercourse.
» For any new roads, adequate culvert and/or bridge structures are required to ensure that construction impacts do not permanently affect channel structure and morphology.
» Construction of infrastructure must not cause the width of the watercourse to be narrowed or the general morphology to be altered.
» Cross watercourses at or close to existing disturbances.
» Rehabilitate any disturbed areas as quickly as possible
» No structures should be permanently positioned within the bed of watercourses. If this is not possible to achieve, then obtain a permit from DWA to impact on any wetland or water resource.
» Obtain a permit from DWA to impact on any wetland or water resource.

Cumulative impacts:

» Soil erosion, alien invasions may all lead to additional impacts on watercourses that will exacerbate this impact

Residual impacts:

» Despite proposed mitigation measures, it is expected that this impact will still occur to some degree.

Nature: Establishment and spread of declared weeds and alien invader plants

No alien plants have been identified on the site. Potential species with a distribution centred on arid regions of the country include *Salsola kali*, *Atriplex lindleyi*, *Opuntia ficus-indica, Opuntia imbricata, Prosopis glandulosa, Prosopis velutina, Atriplex numularia,* and *Nicotiana glauca*, of which. The shrub, *Prosopis glandulosa*, is potentially the most problematic as it invades riverbeds, riverbanks and drainage lines in semi-arid and arid regions. There is therefore the potential for it and other alien plants to spread or invade following disturbance on site, although the risk is considered relatively low.

	Without mitigation	***With mitigation***
Extent (All components)	Site & surroundings (2)	Site & surroundings (2)
Duration (All components)	Long-term (4)	Long-term (4)

Magnitude (All components)	Moderate (5)	Low (3)
Probability (All components)	Probable (3)	Improbable (2)
Significance (All components)	**Medium (33)**	**Low (18)**
Status (positive or negative)	Negative	
Reversibility	Reversible	
Irreplaceable loss of resources	Yes	
Can impacts be mitigated	To some degree	

Mitigation:

» Keep disturbance of indigenous vegetation to a minimum.
» Rehabilitate disturbed areas as quickly as possible following completion of construction activities in an area.
» Do not translocate soil stockpiles from areas with alien plants.
» Control any alien plants immediately to avoid establishment of a soil seed bank that would take decades to remove.
» Establish an ongoing monitoring programme to detect and quantify any aliens that may become established.

Cumulative impacts:

» Soil erosion, habitat loss, damage to wetlands may all lead to additional impacts that will exacerbate this impact.

Residual impacts:

» Will probably be very low if control measures are effectively applied.
» However, residual impacts may include the growth of the seed bank in the area, and downstream deposition of seeds.

Implications for Project Implementation

» No impacts which would prevent the project from proceeding were identified through this assessment.
» The majority of impacts are expected to be of moderate to low significance after the implementation of appropriate mitigation measures.
» Due to the presence of drainage lines on site and the potential presence of various plant species of conservation concern, the final layout should aim to avoid these areas as far as possible. Furthermore, construction camps should also be positioned to avoid these sensitive areas.
» Permits are required to be obtained for any protected trees that may be affected.
» A permit is required from the Department of Water Affairs if there are expected impacts on any water resources (i.e. the drainage lines).

7.3.2. Geology, Soils and Erosion Potential

The construction activities will include excavation, loosening, displacement and/or burial of soil, stockpiling, mixing, wetting, filling and compaction. These activities may negatively affect the soil profile, contributing to soil degradation and possibly accelerated

erosion[31]. These activities could also cause negative indirect impacts such as increased siltation in other areas away from the site impacting on water sources and agriculture with potential socio-economic repercussions.

Impact tables summarising the significance of impacts on Geology, Soil, and Erosion Potential

Nature: Impacts on soil through excavation activities and removal of soil for roads, pipelines, and foundations		
No quarrying activities have been proposed and excavations for the foundation, pipelines, access road etc are localised and typically limited to a depth of approximately 1.5m. Therefore, the impact on the bedrock is likely to be minor in terms of these activities. The main environmental impacts of cutting into bedrock include unsightly scars in the hillside, alteration of the hydrological regime, soil degradation, and slope instability.		
	Without mitigation	***With mitigation***
Extent	Local (1)	Local (1)
Duration	Long term (4)	Medium term (3)
Magnitude	Moderate (6)	Low (4)
Probability	Definite (5)	Definite (5)
Significance	**Moderate (55)**	**Moderate (40)**
Status (positive or negative)	Negative	Negative
Reversibility	Partially reversible	
Irreplaceable loss of resources	Yes	
Can impacts be mitigated	Yes, to a certain extent.	
Mitigation: » Use existing roads where possible. » Design platforms and roads according to contours to minimise cut and fill operations. » Restrict activity outside of authorised construction areas. » Rehabilitate soil in activity areas after construction.		
Cumulative impacts: » Although the impact of soil removal for the proposed activity has a moderate significance, the cumulative impact of soil removal in the area is considered low due to the undeveloped nature of the area.		
Residual impacts: » Minor negative residual impacts due to the slow regeneration of topsoil.		

Nature: Soil degradation Through loosening, mixing, wetting, and compacting of in situ soil during earthworks.		
	Without mitigation	***With mitigation***
Extent	Local (1)	Local (1)
Duration	Medium term (3)	Short term (2)

[31] The Erosion Index for South Africa indicates that the area where the site is located has a moderate to low susceptibility to erosion, primarily due to the very dry climate.

Magnitude	Moderate (6)	Low (4)
Probability	Definite (5)	Definite (5)
Significance	**Moderate (50)**	**Moderate (35)**
Status (positive or negative)	Negative	Negative
Reversibility	Irreversible	
Irreplaceable loss of resources	Yes	
Can impacts be mitigated	Yes, to a certain extent	

Mitigation:

» Use existing roads where possible.
» Design platforms and roads according to contours to minimise cut and fill operations.
» Control activity outside of construction disturbance areas.
» Rehabilitate soil in disturbance areas after construction.

Cumulative impacts:

» Although the impact for the proposed activity has only moderate-low significance, the cumulative impact of earthworks in the area is considered low due to the undeveloped nature of the area

Residual impacts:

» Minor negative residual impacts due to the slow regeneration of topsoil.

Nature: Soil degradation

Pollution of soil by waste products (human and synthetic) and contaminants used in construction (e.g. fuel, oil, chemicals, cement). Soil pollution may affect soil forming processes primarily during the construction phase due to the presence of vehicles and construction equipment.

	Without mitigation	***With mitigation***
Extent	Local (1)	Local (1)
Duration	Medium term (2)	Very short term (1)
Magnitude	Low (4)	Minor (2)
Probability	Probable (3)	Probable (3)
Significance	**Low (21)**	**Low (12)**
Status	Negative	Negative
Reversibility	Partially reversible	Partially reversible
Irreplaceable loss of resources	Yes, minor	Yes, minor
Can impacts be mitigated	Yes	

Mitigation:

» Control use and disposal of potential contaminants or hazardous materials.
» Provide sufficient ablution and sanitation facilities.
» Remove contaminants and contaminated topsoil and replace topsoil in affected areas.

Cumulative impacts:

» The cumulative impact of soil pollution is considered low.

Residual impacts:

» Minor negative residual impacts due to the slow regeneration of soil processes in and under topsoil.

Nature: Soil erosion

Water erosion is generally considered as more important due to the magnitude of the potential impact over a relatively short period of time which can be very difficult to control. Erosion potential is increased on construction sites where soil is loosened and vegetation cover is stripped. Unconsolidated or partly consolidated fine-grained soils of low plasticity along drainage lines and on moderate to steep slopes or at the base of steep slopes are most vulnerable to severe levels of water erosion. These areas are typically called "highly sensitive" areas. Erosion will continually occur all over the site, as this is a natural process, but severe erosion is usually related to human impacts and this needs to be restricted as far as possible.

A significant percentage of the proposed site is underlain by unconsolidated or semi-consolidated Quaternary soil cover of the Gordonia Formation. The soil cover in this geological terrain may be sensitive to water erosion, if subjected to concentrated run-off, such as along natural drainage lines or on construction sites where water is discharged onto the ground in an uncontrolled manner. The presence of shallow rock or outcrops in other areas will restrict severe erosion.

Wind erosion from areas that are stripped of vegetation should not be underestimated and can lead to severe dust pollution which will attract negative responses from neighbours.

	Without mitigation	***With mitigation***
Extent	Local (1)	Local (1)
Duration	Medium term (3)	Very short term (1)
Magnitude	Moderate (6)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	**Moderate (30)**	**Low (18)**
Status (positive or negative)	Negative	Negative
Reversibility	Irreversible	Practically irreversible
Irreplaceable loss of resources	Yes, moderate to low	Yes, low
Can impacts be mitigated	Yes	

Mitigation:

» Restrict size of areas to be disturbed during construction.
» Control activities outside of authorised construction areas.
» Implement effective erosion control measures.
» Carry out earthworks in phases across site to minimise exposed ground at any one time.
» Keep to existing roads, where practical, to minimise loosening of undisturbed ground.
» Protect and maintain bare slopes, excavations, and material stockpiles to minimise erosion and instability.

Cumulative impacts:

» The cumulative impact of soil erosion in the area is considered low due to the undeveloped nature of the area.

Residual impacts:

» Minor residual impacts due to the localised movement of sediment and slow regeneration of soil processes.

Nature: Siltation of waterways and dams downstream from site

The proposed activity may potentially result in indirect impacts, such as increased siltation in drainage systems downstream from the site or dust pollution in the area surrounding the site. The severity or significance of the various impacts is related to the nature and extent of the activity.

	Without mitigation	***With mitigation***
Extent	Regional (3)	Local (1)
Duration	Long term (4)	Long term (4)
Magnitude	Low (4)	Minor (2)
Probability	Probable (3)	Probable (3)
Significance	**Moderate (33)**	**Low (21)**
Status (positive or negative)	Negative	
Reversibility	Irreversible	
Irreplaceable loss of resources	Yes, low	
Can impacts be mitigated	Yes	

Mitigation:

» Install appropriate anti-erosion measures such as silt fences, geosynthetic erosion protection, and/or flow attenuation along watercourses below construction sites.
» Strictly control activities in or near water courses/natural drainage lines as sediment transport is higher in these areas.

Cumulative impacts:

» Due to all the agricultural activity in the area, as well as other developments proposed in the area, the cumulative impact of siltation in the area is potentially high.

Residual impacts:

» Minor residual impacts are expected do to the localised movement of soil across the site.

Nature: Dust pollution

If not managed properly, construction sites may result in the creation of dust which may affect surrounding areas (i.e. depending on the wind direction, and presence of receptors).

	Without mitigation	***With mitigation***
Extent	Regional (2)	Local (1)
Duration	Very short term (1)	Very short term (1)
Magnitude	Low (4)	Minor (2)
Probability	Highly probable (4)	Highly probable (4)
Significance	**Moderate (28)**	**Low (16)**
Status	Negative	Negative
Reversibility	Irreversible	Irreversible
Irreplaceable loss of resources?	Yes, low	Yes, minor
Can impacts be mitigated?	Yes	

Mitigation:

» Place dust covers on stockpiles.
» Use suitable gravel wearing course on access roads.

» Apply straw bales or dampen dusty denuded areas.
Cumulative impacts:
» The cumulative impact of dust in the area is considered low.
Residual impacts:
Minor residual impacts are expected do to the localised movement of soil across the site.

Implications for Project Implementation

» The natural drainage lines/watercourses on the site are regarded as highly sensitive in terms of erodibility potential. Some facility components are sited near / across these drainage lines. Special engineering designs such as culverts etc may need to be considered to minimise impacts on these features.
» Areas underlain by thick Quaternary Gordonia Formation soils are regarded as moderately sensitive as minor natural erosion is currently taking place. Heavy downpours or increased flow due to concentrated discharge of construction water may exacerbate this erosion.
» The identified potential impacts on the geological environment range from a low to moderate significance and with effective implementation of mitigating measures the impacts can be reduced to an acceptable level.

7.3.3. Agricultural Potential

Nature: Loss of agricultural potential and land capability owing to the development
The establishment of the facility and its associated infrastructure will not affect land of high agricultural potential (i.e. closer to the river). Furthermore, the agricultural potential of the rest of the site is very low due to climatic constraints as well as the shallow and rocky soils distributed throughout. The improvement of the agricultural potential is dependent on extensive and costly soil preparation and establishment of irrigation infrastructure.

	Without mitigation	***With mitigation***
Extent	Low (1) – Site	Low (1) – Site
Duration	Permanent (5)	Permanent (5)
Magnitude	Low (2)	Low (2)
Probability	Improbable (2)	Improbable (2)
Significance	**16 (Low)**	**16 (Low)**
Status	Negative	Negative
Reversibility	Medium	Medium
Irreplaceable loss of resources?	No	No
Can impacts be mitigated	No	

Mitigation:
» There are no mitigation measures that can combat the long term loss of agricultural potential.
» Mitigation is restricted to the limitation of the developmental footprint to the immediate area of impact and minimisation of off-site impacts.

Cumulative impacts:
» Soil erosion may arise owing to increased surface water runoff. Adequate management nd erosion control measures should be implemented.
Residual impacts:
» The loss of agricultural land is a long term loss which extends to the post-construction phase. The agricultural potential however is very low.

Implications for Project Implementation

» Irrigated farming activities exist within the broader site between the N10 and the Orange River. However, these activities will not be direct;y impacted by the proposed facility. In addition, additional/alternative farming activities are being investigated by Ilangalethu for the broader Karoshoek site (i.e. within areas of higher agricultural potential identified during the Scoping Phase). A prefeasibility study has identified the potential of growing more table grapes, vegetables, and paprika. Crop production will only be possible with very intensive preparation, in the form of ripping and land form shaping, and irrigation. The preparation and establishment costs are such that it is only considered if a long term plan, with adequate market research and funding, has been drawn up.
» Site 1.2 falls within soil type Ag5 which has regular occurrences of rock outcrops. This will be taken into consideration during the geotechnical survey which will look at the potential for excavations and the availability of natural construction materials. This study will also serve to inform the type of foundations required to be constructed (i.e. for the power block).

7.3.4. Water Resources

Nature: Impact on the biological environment through loss of riparian systems
From a habitat and ecosystem point of view, all the dry river beds and associated riparian systems are rated as extremely sensitive to development, in particular the mainstem systems such as Klein-leerkransspruit and Majties (Matjes) River.

The physical removal of the narrow strips of woody riparian zones, being replaced by hard engineered surfaces (i.e. at the location of the abstraction point). This biological impact would however be localised, as a large portion of the remaining farm and the catchments would remain intact.

	Without mitigation	***With mitigation***
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Moderate (6)	Low (4)
Probability	Definite (5)	Definite (5)
Significance	**High (55)**	**Medium (45)**
Status (positive or negative)	Negative	Negative
Reversibility	High	

Irreplaceable loss of resources	No
Can impacts be mitigated	Yes

Mitigation:

» This area is a significant distance from the main drainage systems, and is thus unlikely to be flooded or in itself pose a risk to the aquatic systems should there be any major spills (i.e. heat transfer fluid).

Cumulative impacts:

» None

Residual impacts:

» There may be a possible impact on the catchment due to changes in run-off characteristics of the development site.

Nature: Impact on the physical environment (i.e. dry riverbeds and localised drainage systems) through loss of riparian systems

The physical removal of narrow strips of woody riparian zones being replaced by hard engineered surfaces will alter the hydrological nature of the area, by increasing the surface run-off velocities, while reducing the potential for any run-off to infiltrate the soils. This impact would however be localised, as a large portion of the remaining farm and the catchment would remain intact.

	Without mitigation	***With mitigation***
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Low (4)	Low (4)
Probability	Definite (5)	Probable (3)
Significance	**Medium (45)**	**Low (24)**
Status (positive or negative)	Negative	Negative
Reversibility	High	
Irreplaceable loss of resources	No	
Can impacts be mitigated	Yes	

Mitigation:

» The most significant form of mitigation would be to select a development area which contained no drainage lines. However due to the nature of the site, this was not possible, thus an area with the least number of riparian systems was earmarked, i.e. the south eastern corner of the site. Any stormwater within the site will be handled in a suitable manner, i.e. separate clean and dirty water streams around the plant, and install stilling basins to capture large volumes of run-off, trap sediments, and reduce flow velocities.

Cumulative impacts:

» Possible cumulative impacts due to the loss of these systems due to agricultural activities and other developments.

Residual impacts:

» Diversion of run-off away from downstream systems is unlikely to occur as the site is not near the main drainage channel and the annual rainfall figures are low.

Nature: Impact on riparian systems through the increase in surface water runoff

The increase in surface water runoff my lead to increased erosion and subsequently increased sedimentation in the river.

	Without mitigation	***With mitigation***
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Low (2)	Low (2)
Probability	Definite (5)	Probable (3)
Significance	**Medium (35)**	**Low (19)**
Status (positive or negative)	Negative	Negative
Reversibility	Medium	
Irreplaceable loss of resources	No	
Can impacts be mitigated	Yes	

Mitigation:

» Any stormwater within the site must be handled in a suitable manner, i.e. separate clean and dirty water streams around the plant. It is also recommended that stilling basins are installed to capture large volumes of run-off, trap sediments, and reduce flow velocities (e.g. water used when washing the mirrors).
» The project should also try capture and recycle any form of run-off created by the daily operations. This would minimise the amount of water required by the project, but also serve to limit the downstream impacts on the riparian systems through an increase in run-off, a situation that these systems are currently unaccustomed too.

Cumulative impacts:

» Downstream alteration of hydrological regimes due to the increased run-off from the area which will have a cumulative impact when combined with existing farming practices..

Residual impacts:

» Possible impact on the remaining catchment due to changes in run-off characteristics in the development site.

Nature: Impact on the riparian environment and fish communities as a result of increased sedimentation and erosion within the development footprint

Although relatively far from the river itself, sediment-laden runoff from the primary development footprint (i.e. Site 1.2) could occur, particularly if flash floods occur during site clearing and construction. Sediment mobilisation could result from, among others:

» Disturbance of existing flood protection embankments.
» Inadequate erosion control or containment of sediment-laden runoff during site clearing and construction activities.

Increased siltation and sedimentation could result in a number of negative impacts, including:

» Reducing the depth of pools in the river channel causing these sanctuary habitats to become too shallow during low flows to support fish life or other aquatic biota.
» Fine sediment could be washed downstream and smother important fish spawning areas, such as gravel and cobble riffles used by Largemouth yellowfish and rock catfish.

» Sediment deposits would further encourage reed invasion in the river channel and thus degrade preferred fish habitats.

Elevated turbidity levels associated with increased sediment washing into the river has a number of negative impacts on aquatic biota, and include:

» The food web can be disrupted due to reduced light penetration and photosynthesis, resulting in reduced primary production, a reduction in submerged plant life, including phytoplankton.
» Reduced number of bottom organisms (e.g. benthic algae, crabs, small aquatic invertebrates) due to smothering by layers of silt.
» The smothering of incubating eggs (fish, tadpoles, etc.) and larval fish.
» Clogging, abrading and damage to fish gills, leading to reduced oxygen absorption, damage to gill filaments, resulting in increased stress, disease and even death, (Whitfield and Paterson, 1995).
» Reduced feeding efficiency – a major impact on visual predators such as Largemouth yellowfish, as they are unable to see and find enough food in the turbid water.

The above impacts could eliminate sensitive species from the affected areas and cause fish species and other biota to vacate the area. Fish species such as the near threatened Largemouth yellowfish that requires silt-free gravel and/or cobble habitats for spawning, would be particularly affected by elevated sediment inputs.

	Without mitigation	***With mitigation***
Extent	Local (1) (riparian environment) – Site (2) (fish)	Local (1) (riparian environment and fish)
Duration	Short term (2) (fish) - Long-term (4) (riparian environment)	Short-term (2) (fish) - Long-term (4) (riparian environment)
Magnitude	Low (1) (riparian environment) – Moderate (6) (fish)	Low (1) (riparian environment) – Minor (2) (fish)
Probability	Highly probable (4) (fish) - Definite (5) (riparian environment)	Improbable (2) (fish) - Probable (3) (riparian environment)
Significance	**Medium (30) (riparian environment) – Medium (40) (fish)**	**Low (10) (fish) - Low (18) (riparian environment)**
Status (positive or negative)	Negative	Negative
Reversibility	Medium	
Irreplaceable loss of resources	No (riparian environment) Medium – Low (fish)	
Can impacts be mitigated	Yes	

Mitigation:

» A comprehensive storm water management plan should be initiated incorporating anti-erosion measures. Included in this plan is the handling of on-site stormwater (i.e. separate clean and dirty water streams, install stilling basins to capture large volumes of run-off, trap sediments, and reduce flow velocities (i.e. water used when washing the mirrors).

» Site clearing and preparation for the construction of the facility should take steps to avoid surface run-off and storm-water erosion of cleared areas where practicable. » All surface runoff should be discharged via detention dams to allow sediment to settle out before leaving the site. » Stormwater should not be released directly into the Orange River.
Cumulative impacts: » Potential sedimentation into the Orange River (i.e. particularly from activities at the abstraction point) may be exacerbated due to existing farming practices up-stream of the site, as well as due to other proposed developments of a similar nature along the river system.
Residual impacts: » The potential change in the physical characteristics of the river may have a residual impact on those negatives impacts for aquatic biota.

Nature: Impact of increased sedimentation and river bank damage due to the establishment of the water abstraction infrastructure

There is a risk of elevated sediment input into the Orange River during the establishment or extension of the water abstraction facilities on the banks and floodplains of the Orange River. Increased sedimentation may result from inadequate erosion control or containment of sediment-laden runoff during site clearing and construction activities for infrastructure required at the abstraction points (e.g. pipelines and reservoirs).

It is assumed that some refurbishment of the abstraction facility may be required, but that the current facility will be used.

	Without mitigation	***With mitigation***
Extent	Site (2)	Local (1)
Duration	Short-term (2)	Very short-term (1)
Magnitude	Low (4)	Minor (1)
Probability	Probable (3)	Improbable (2)
Significance	**24 (low)**	**6 (low)**
Status (positive or negative)	Negative	Negative
Reversibility	Yes	
Irreplaceable loss of resources	Yes	
Can impacts be mitigated	Yes	

Mitigation:

» Appropriate hard-engineered bank erosion protection structures.
» Careful rehabilitation using natural riparian vegetation to stabilise the riverbanks and all disturbed areas in the riparian zone.
» Stormwater drains should be correctly located and designed with appropriate erosion-control features to ensure local stormwater run-off over the flood embankments and natural riverbanks do not cause erosion and subsequent bank slumping.
» During construction, sensitive riparian habitats should be made out of bounds for all construction activities and for all construction workers.
» Construction work should preferably take place in the dry winter months to avoid storm-

water erosion of cleared areas and damage due to river flooding.
***Cumulative impacts**:* » Artificial elevation of the river banks, embankment construction, and earthmoving activities in the floodplain of the Orange River has severely affected the ecological functioning of this system. Further manipulation will exacerbate these impacts, but to a very limited degree with a localised impact.
Residual impacts: » There will be a low residual impact due to the alteration of the river banks at the abstraction point.

Nature: Operation of the reservoir and high pressure sand filtration plant
The discharge of sediment-laden backwash water from the sand filter into a natural drainage line about 500 m from river could have a potential impact by discharging into and raising the turbidity of the Orange River.

	Without mitigation	***With mitigation***
Extent	Site (2)	Local (1)
Duration	Long-term (4)	Very short (1)
Magnitude	Minor-low (3)	Minor (2)
Probability	Highly probable (4)	Improbable (2)
Significance	**36 (medium)**	**8 (low)**
Status (positive or negative)	Negative	Negative
Reversibility	Yes	
Irreplaceable loss of resources	Yes	
Can impacts be mitigated	Yes	

***Mitigation**:*
» The backwash should be directed into a suitably designed retention pond to allow most of the sediment to settle out before the clear water is allowed to flow back to the river.

Cumulative impacts:
» The construction of the proposed facility will add to the already elevated sediment load into the river due to agricultural activities.

***Residual impacts**:*
» Residual impacts should not be apparent if mitigation is correctly carried out.

Nature: Physical disturbance by the supporting infrastructure (pump stations) on the riparian environment
The proposed pipeline route and pump infrastructure will have limited to no impact on the functioning of any riparian systems.

	Without mitigation	***With mitigation***
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Moderate (6)	Low (3)
Probability	Definite (5)	Probable (3)
Significance	**Medium (55)**	**Low (24)**
Status (positive or negative)	Negative	Negative
Reversibility	Medium	

Irreplaceable loss of resources	No
Can impacts be mitigated	Yes

Mitigation:

» The current placement is within an area of dense reed growth (*Phragmites australis*), and would not be considered a severe impact as the related infrastructure is already in place and the pipeline will follow the existing road.
» Suitable erosion protection will be installed were the pipeline does cross any drainage lines, which will later become vegetated.

Cumulative impacts:

» Additional downstream erosion and sedimentation of the Orange River with existing farming activities.

Residual impacts:

» During flood events, the unstable banks (eroded areas) and sediment bars (sedimentation downstream) will further increase the suspended sediment loads within the Orange River system.

Nature: Chemical and other pollutants into the Orange River

During the construction phase chemical pollutants (i.e. hydrocarbons, cleaning fluids, cement powder, wet cement, shutter-oil, etc.) associated with site-clearing machinery and construction activities could be washed downslope via the ephemeral streams into the Orange River. In addition, washing soap, faeces, and other waste material from workers, particularly those working near the river, could contaminate surface run-off and pollute the river water. During the operational phase, spills and leaks from the evaporation or blow down ponds or spills of the heat transfer fluid could be washed by stormwater run-off via the natural drainage lines into the Orange River.

The distance of the proposed facility from the Orange River (approximately 9.5 km) will reduce the risk of contaminated run-off from the facility. However the well-defined drainage lines or ephemeral streams such as those adjacent to Site 1.2 would increase this risk during rainstorms and local flash floods, which normally occur during the summer months.

These pollutants could be harmful to aquatic biota, particularly during low flows when dilution is reduced, and could pose a health risk to locals using the river water for domestic purposes. Larval fish, which often utilise shallow productive habitats near the river bank as nursery areas, are usually more sensitive than adult fish to poor water quality. In addition, the important and rare rock catfish is thought to be particularly sensitive to poor water quality. Lime-containing (high pH) construction materials such as concrete, cement, grouts, etc., deserve a special mention, as they are highly toxic to fish and other aquatic biota. If dry cement powder or wet uncured concrete is exposed to surface run-off or river water, these compounds can elevate the pH to lethal levels.

	Without mitigation	***With mitigation***
Extent	Site (2)	Local (1)
Duration	Short-term (2)	Short-term (2)
Magnitude	Moderate (6)	Minor (2)
Probability	Probable (3)	Improbable (2)

Significance	**30 (medium)**	**10 (low)**
Status (positive or negative)	Negative	Negative
Reversibility	Yes	
Irreplaceable loss of resources	Yes	
Can impacts be mitigated	Yes	

Mitigation:

» Strict use and management of all hazardous materials used on site.
» Strict management of potential sources of pollution (e.g. litter, hydrocarbons from vehicles, machinery, and cement during construction, etc.).
» Containment of all contaminated water by means of run-off management on the development site.
» Strict control over the behaviour of construction workers.
» Working protocols incorporating pollution control measures (including approved method statements by the contractor) should be clearly set out in the Environmental Management Programme for the project and strictly enforced.

Cumulative impacts:

» The widespread use of chemicals in farming activities (fertilisers, insecticides, herbicides, etc.) means that any chemical pollution from the facility will have a marked cumulative impact on aquatic biota. However, the pollutants and chemicals from the site itself are unlikely to reach the river.

Residual impacts:

» Residual impacts will be negligible after appropriate mitigation.

Nature: Abstraction of water from the Orange River: timing and volume

The flow and quality component focuses on the impact of the development on the availability of the water resources of the area, particularly from the regional context of the Lower Orange River system.

The proposed constant abstraction of large volumes of water from the Orange River (i.e. 224 110 m^3/a for Project Ilanga) may reduce present day flows and affect negatively on aquatic biota. This impact would be particularly evident in summer when high river flows are required for fish spawning migrations and egg incubation. It is anticipated that constant pumping during droughts may affect drought flow requirement.

	Without mitigation
Extent	Region (3)
Duration	Medium-term (3)
Magnitude	Low (4)
Probability	Probable (3)
Significance	**30 (medium)**
Status (positive or negative)	Negative
Reversibility	High
Irreplaceable loss of	Yes

resources	
Can impacts be mitigated	No - None
Mitigation: » Mitigation measures may be difficult and expensive, however, possible measures to reduce volumes of water abstracted from the Orange River could include: o Optimise the design or technology of the facility to reduce consumptive water requirements. o Adapt the abstraction regime to meet the ecological water and downstream user requirements.	
Cumulative impacts: » Cumulative impacts due to water abstraction in the Lower Orange River are already considered high and will be exacerbated by the abstractions for this project. » However, the water use required by this project is relatively small in a regional context.	
Residual impacts: » No residual impacts expected if water use is reduced as much as possible.	

Implications for Project Implementation

» The Orange River system is highly regulated which may affect the site (i.e. releases from the Vanderkloof Dam, although the release patterns are re-evaluated every year to provide for irrigators and is therefore well known).
» From a habitat and ecosystem point of view, all the dry river beds and the associated riparian systems are rated as extremely sensitive to development, in particular the mainstem systems such as Klein-leerkransspruit and Majties (Matjes) River. Therefore during the planning and design phase, these sensitive areas will need to be considered with respect to the layout.
» The facility is deemed to have a limited potential impact on the aquatic environment. The only significant risk to the project is the water use license not being granted by the Department of Water Affairs. Although dry cooling will be practiced which will reduce water requirements, the Orange River system is under pressure in terms of water requirements.

7.3.5. Heritage Resources

Impacts on heritage resources are largely expected during the construction phase of the facility. Construction activities including clearance or excavation activities could alter or destroy the context of heritage resources or the resources themselves in the event of such archaeological materials being present. All sites identified within the study area are classified as being of Grade III significance, i.e. heritage resources worthy of conservation on a local authority level.

Impact tables summarising the significance of impacts on heritage resources

Nature: Impacts on small surface scattering of stone tools dating to the Later Stone Age

Acts or activities resulting in disturbance of surfaces and/or sub-surfaces containing artefacts (causes) resulting in the destruction, damage, excavation, alteration, removal or collection from its original position (consequences), of any archaeological material or object (what affected).
These potential impacts would tend to be direct, once-off events occurring during the initial construction period. In the long term, the proximity of operations in a given area could result in secondary indirect impacts resulting from the movement of people or vehicles in the immediate or surrounding vicinity. Certain activities would generally have a lower impact than others (i.e. power lines tend to be less destructive on Stone Age sites than access roads).

These objects are surface material and are therefore out of primary context and are viewed to have a low significance.

	Without mitigation	***With mitigation***
Extent	Local (1)	Local (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	Moderate (2)	Moderate (2)
Probability	Probable (1)	Probable (1)
Significance	**8 (Low)**	**8 (Low)**
Status	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources	Yes	
Can impacts be mitigated	Yes	

Mitigation:

» None required as the objects are out of context.
» Should archaeological sites or graves be exposed during construction work, it must immediately be reported to a heritage practitioner so that an investigation and evaluation of the finds can be made.

Cumulative impacts:

» N/A

Residual impacts:

» N/A

Nature: Impacts on colonial sites

Two buildings occur on the northern outer edge of the development site. They are not viewed as having cultural significance.

	Without mitigation	***With mitigation***
Extent	Local (1)	Local (1)
Duration	Permanent (5)	Permanent (3)
Magnitude	Moderate (2)	Moderate (4)
Probability	Probable (1)	Probable (3)
Significance	**8 (Low)**	**8 (Low)**
Status	Negative	Negative

Reversibility	Low	Low
Irreplaceable loss of resources	Yes	
Can impacts be mitigated	Yes	
Mitigation: » No mitigation measures are required.		
Cumulative impacts: » N/A		
Residual impacts: » N/A		

Implications for Project Implementation

» In the event of archaeological materials being present such activity would alter or destroy their context (even if the artefacts themselves are not destroyed, which is also obviously possible).
» No sites, features or objects of cultural heritage significance were identified in the study area. Therefore, there would be no impact from the proposed development.
» From a heritage point of view it is recommended that the proposed development be allowed to continue.
» The final pipeline route and power line tower footprints must be surveyed to confirm that there are no sites of significance affected by the construction of this proposed linear infrastructure.
» In the event that such resources are found, they are likely to be of a nature that potential impacts could be mitigated by documentation and/or salvage following approval and permitting by the South African Heritage Resources Agency and, in the case of any built environment features, by Ngwao Boŝwa ya Kapa Bokone (the Northern Cape Heritage Authority).

7.3.6. Visual Aesthetics

Potential visual impacts associated with the construction phase

The construction phase will last for approximately 24 – 30 months. During this time construction related traffic (i.e. in terms of vehicles and construction workers) will frequent the area and may cause a visual nuisance to other road users and landowners in the area.

Potential visual impacts associated with the operational phase

The facility would be visually exposed to those areas that lie within the broader site, and to the immediate west and south west. The Orange River valley is, for the most part, shielded from potential visual exposure by virtue of its topography. However, those areas north of the Orange River are very flat and visually exposed. The low hills beyond

the river in the north-west offer some visual protection for outlying areas in that direction. The low hills within and to the east of the site also shield the region further east.

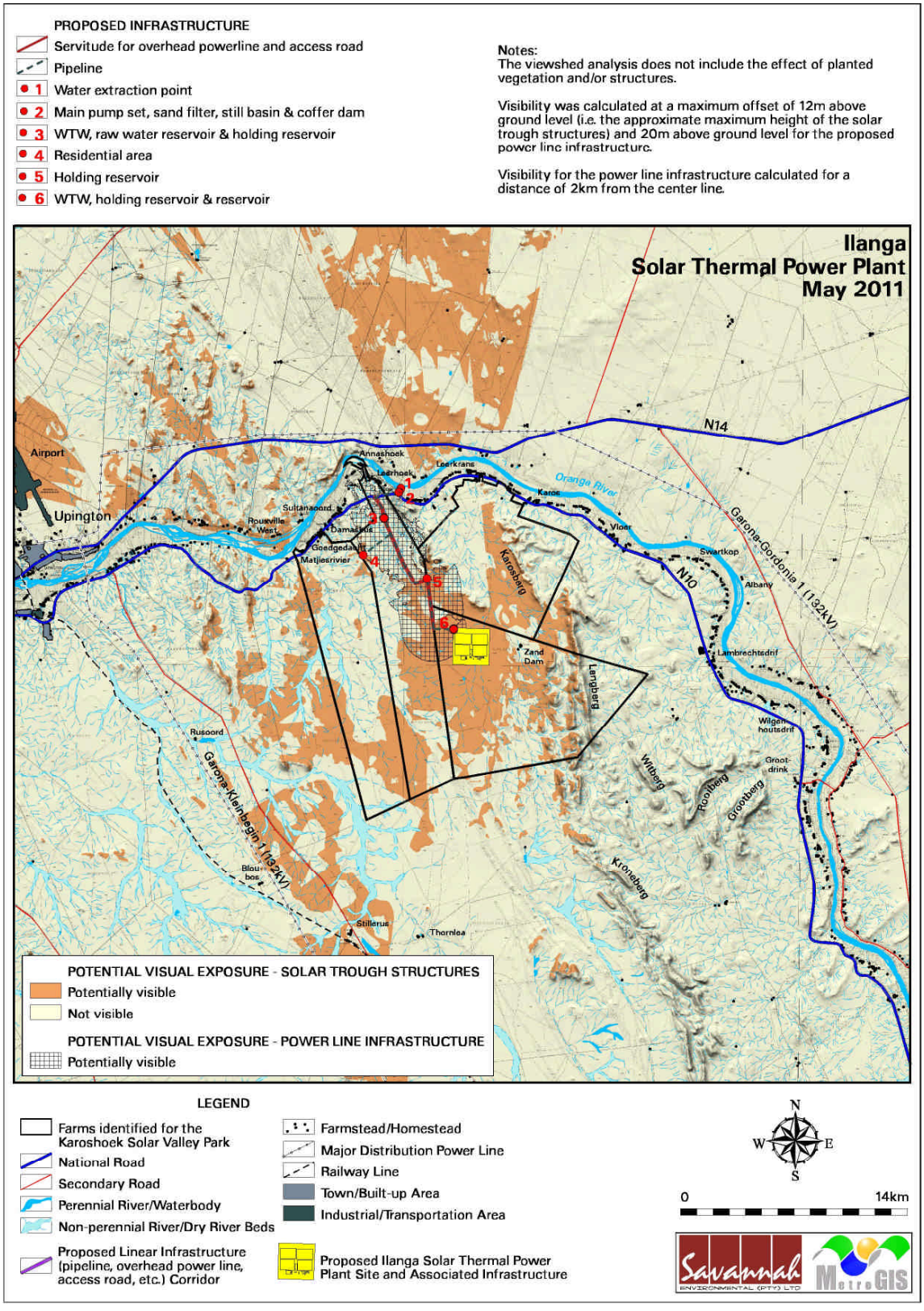

Figure 6.2: Map illustrating the theoretical potential visual exposure of the facility.

In terms of the observer proximity, viewer incidence is highest from certain positions along the N10 and N14 national roads and as well as the secondary roads within the study area. Commuters and tourists using these roads could potentially be negatively impacted upon by visual exposure to the facility. Tourists travelling through the area are seen as possible sensitive visual receptors upon which the construction of the proposed facility could have a negative visual impact.

Other than along the above roads, viewer incidence within a 16 km radius of the facility is concentrated among the homesteads and settlements located along the Orange River. The severity of the impact on these receptors decreases with increased distance from the proposed facility.

The remaining areas beyond 16 km consist predominantly of vacant natural land (i.e. for grazing purposes) and very sparsely scattered homesteads. The highest concentration of potential observers is in Upington, which lies more than 20 km from the site, and it is unlikely that the facility will be visible from this distance.

The combined results of the visual exposure, viewer incidence / perception and visual distance of the proposed facility was calculated. Here the weighted impact and the likely areas of impact have been indicated as a visual impact index. Values have been assigned for each potential visual impact per data category and merged in order to calculate the visual impact index. An area with short distance, high frequency of visual exposure to the proposed facility, a high viewer incidence, and a predominantly negative perception would therefore have a higher value (greater impact) on the index. This helps in focusing the attention to the critical areas of potential impact when evaluating the issues related to the visual impact.

The visual impact index map (refer to Figure 6.4) represents the anticipated visual impact for the facility and its associated infrastructure located within the development footprint[32]. It indicates a core area of potentially moderate visual impact within a 4 km radius of the proposed facility. No infrastructure or settlements lie within this area. Potential areas of low visual impact lie between 4 km and 8 km from the proposed STPP. No infrastructure or settlements will be affected. Between the 8 km and 16 km radius, areas of low visual impact include a very short stretch of the N14 (north of the Orange River), and the secondary road south east of the site. In addition, a number of homesteads (Rouxville West) along the Orange River, to the north west of the site, will potentially be exposed to low visual impact. Remaining areas between 8 km and 16 km from the site will be exposed to very low visual impact. Visual impact beyond 16 km, including the eastern outskirts of Upington, is likely to be negligible.

[32] The map does not indicated the index for the powerlines.

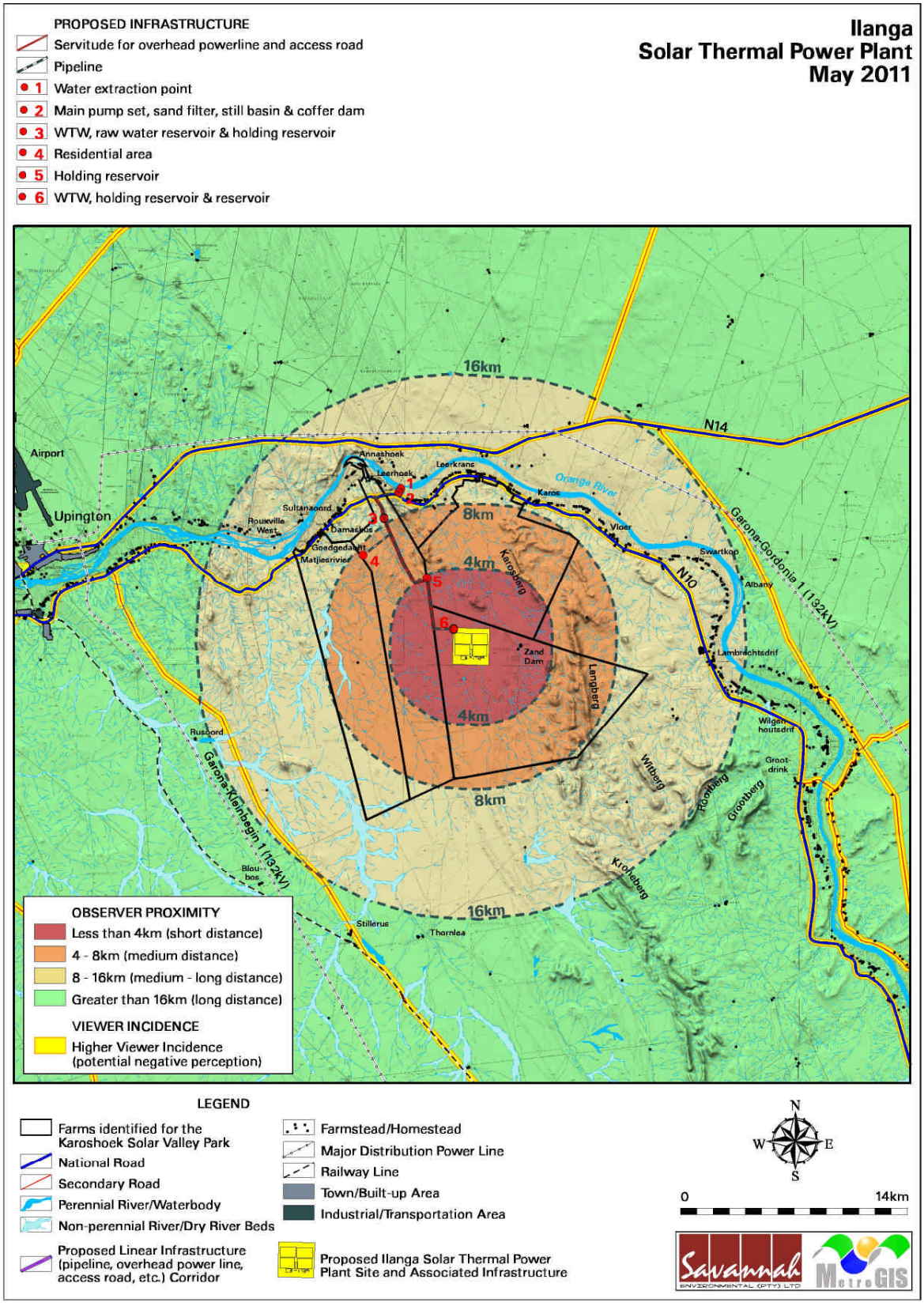

Figure 6.3: Observer proximity to the proposed facility and areas of high viewer incidence.

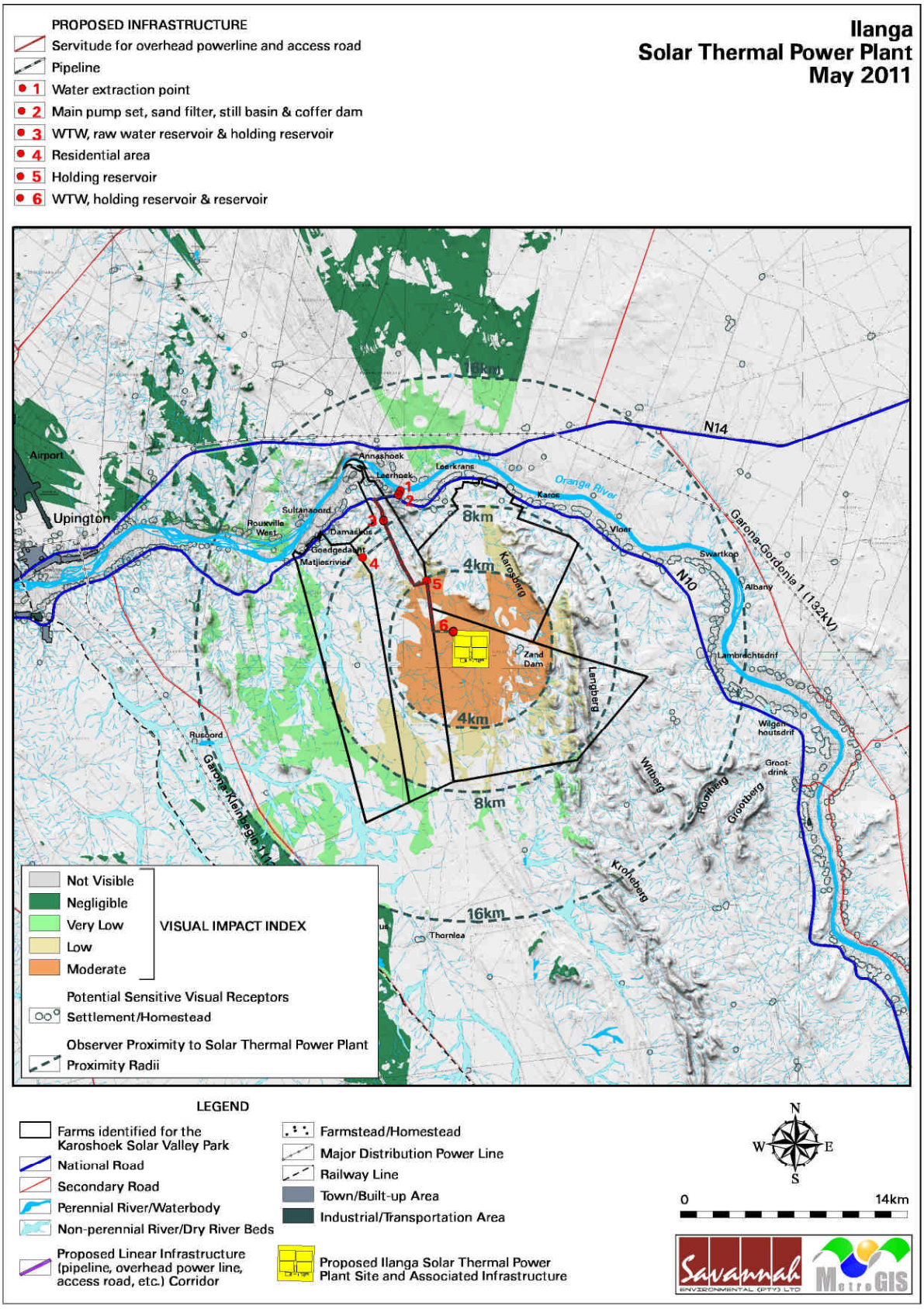

Figure 6.4 Visual impact index

Impact table summarising the significance of visual impacts

Nature: Visual impact on users of national and secondary roads within the region The N14 and N10 national roads (to the north and south of the river respectively) and a few secondary roads traverse the study area. The N10 runs along the northern boundary of the site, traversing it for a small portion. A number of secondary roads, which are located to the west and east of the site, form links between the N10 road and the N14. Viewer incidence is calculated to be the highest along these roads and therefore commuters and tourists using them could be negatively impacted upon by visual exposure to the facility.	
	Without mitigation
Extent	Regional (3)
Duration	Long term (4)
Magnitude	Low (4)
Probability	Improbable (2)
Significance	**Low (22)**
Status (positive or negative)	Negative
Reversibility	Recoverable (3)
Irreplaceable loss of resources	No
Can impacts be mitigated during the operational phase	No
Mitigation: *Decommissioning -* » Removal of the facility and its ancillary infrastructure following the operational phase. » Ripping and rehabilitation of decommissioned infrastructure, roads, and servitudes following the operational phase.	
Cumulative impacts: » The construction of the facility and its associated infrastructure will increase the cumulative visual impact of electricity related infrastructure within the region. This is relevant in light of: » The authorised Eskom and Khi CSP facilities to be located west of Upington; and the » Existing power line infrastructure, albeit limited in extent and scale.	
Residual impacts: » None. The visual impact will cease after decommissioning.	

Nature: Visual impact on residents of settlements and homesteads within the region The broader study area includes the town of Upington and a number of settlements and homesteads, mainly concentrated along the banks of the Orange River. Therefore the visibility of the facility to, and potential visual impact on settlements and homesteads within the study area has been assessed.	
	Without mitigation
Extent	Regional (3)
Duration	Long term (4)
Magnitude	Low (4)

Probability	Improbable (2)
Significance	**Low (22)**
Status (positive or negative)	Negative
Reversibility	Recoverable (3)
Irreplaceable loss of resources	No
Can impacts be mitigated during the operational phase	No

***Mitigation*:**

Decommissioning -

» Removal of the facility and its ancillary infrastructure following the operational phase.
» Ripping and rehabilitation of decommissioned infrastructure, roads, and servitudes following the operational phase.

Cumulative impacts:

» The construction of the facility and its associated infrastructure will increase the cumulative visual impact of electricity related infrastructure within the region. This is relevant in light of:
  » The authorised Eskom and Khi CSP facilities to be located west of Upington; and the
  » Existing power line infrastructure, albeit limited in extent and scale.

Residual impacts:

» None. The visual impact will cease after decommissioning.

Nature: Visual impact of ancillary infrastructure within the development footprint on sensitive visual receptors

Ancillary infrastructure to be located within the development footprint includes the area infrastructure (i.e. parabolic troughs, power block, evaporation ponds, storerooms, and accommodation facilities all located within Site 1.2 etc), and the linear infrastructure (i.e. electricity distribution lines, access roads, and water supply pipelines that cross the broader Karoshoek site).

Although no dedicated viewshed has been generated for the infrastructure, it is expected that the area of potential visual impact will lie within that of the proposed facility.

	Without mitigation
Extent	Regional (3)
Duration	Long term (4)
Magnitude	Low (4)
Probability	Improbable (2)
Significance	**Low (22)**
Status (positive or negative)	Negative
Reversibility	Recoverable (3)
Irreplaceable loss of resources	No
Can impacts be mitigated during the operational phase	No

Mitigation: *Decommissioning -* » Removal of the facility and its ancillary infrastructure following the operational phase. » Ripping and rehabilitation of decommissioned infrastructure, roads, and servitudes following the operational phase. *Construction -* » Rehabilitation of construction areas and servitudes.
Cumulative impacts: » The construction of ancillary infrastructure will increase the cumulative visual impact of disturbance due to vegetation clearing and development within the region.
Residual impacts: » None. The visual impact will cease after decommissioning.

Nature: Potential visual impact of lighting at night on sensitive visual receptors
The area surrounding the proposed facility has a relatively low incidence of populated places. Therefore, light trespass and glare from the security and after-hours operational and security lighting will have some significance for residents in the area.

In addition, the potential lighting impact known as sky glow will be of relevance. Sky glow is the condition where the night sky is illuminated when light reflects off particles in the atmosphere such as moisture, dust, or smog. The sky glow intensifies with the increase in the amount of light sources. Each new light source, especially upwardly directed lighting, contribute to the increase in sky glow. Therefore, the facility may contribute to the effect of sky glow in an otherwise dark environment.

	Without mitigation
Extent	Local (4)
Duration	Long term (4)
Magnitude	Moderate (6)
Probability	Probable (3)
Significance	**Moderate (42)**
Status (positive or negative)	Negative
Reversibility	Recoverable (3)
Irreplaceable loss of resources?	No
Can impacts be mitigated during the operational phase	No

Mitigation: *Planning -* » Pro-active lighting design and planning. *Decommissioning:* » Removal of the facility and its ancillary infrastructure following the operational phase.
Cumulative impacts: » The addition of lighting in an otherwise dark environment will increase the cumulative visual impact of light pollution within the region.
Residual impacts: » None. The visual impact will cease after decommissioning.

Nature: Potential visual impact of construction activities and accommodation on sensitive visual receptors

No visual impact index for construction accommodation has been generated, as this position has not yet been finalised. Nonetheless, it is likely that this housing facility, which will accommodate approximately 100 people, will be visible to receptors for the duration of the construction phase.

Furthermore, there will be a noticeable increase in heavy vehicles utilising the N10 to the development site. This may cause a visual nuisance to other road users and land owners in the area.

	Without Mitigation	***After Mitigation***
Extent	Local (4)	Local (4)
Duration	Short (2)	Short (2)
Magnitude	Moderate (6)	Low (4)
Probability	High (4)	Improbable (2)
Significance	**Moderate (48)**	**Low (20)**
Status (positive or negative)	Negative	Negative
Reversibility	Recoverable (3)	Recoverable (3)
Irreplaceable loss of resources?	No	No
Can impacts be mitigated during the construction phase	No	No

Mitigation:

» Proper planning and management of the construction site.

Cumulative impacts:

» The construction phase will temporarily increase the cumulative visual impact of disturbance due to vegetation clearing and development within the region.

Residual impacts:

» None. The visual impact will be removed after decommissioning.

Nature: Visual impact of the proposed facility and its ancillary infrastructure on the visual character and sense of place within the region

Sense of place refers to a unique experience of an environment by a user, based on his or her cognitive experience of the place. Visual criteria and specifically the visual character of an area (informed by a combination of aspects such as topography, level of development, vegetation, noteworthy features, cultural / historical features, etc) play a significant role.

A visual impact on the sense of place is one that alters the visual landscape to such an extent that the user experiences the environment differently, and more specifically, in a less appealing or less positive light. Specific aspects contributing to the sense of place of this region include the rugged natural beauty of the area and the wide open vistas and expanses.

	Without Mitigation
Extent	Regional (3)
Duration	Long term (4)
Magnitude	Low (4)
Probability	Improbable (2)
Significance	**Low (22)**

Status (positive or negative)	Negative
Reversibility	Recoverable (3)
Irreplaceable loss of resources?	No
Can impacts be mitigated during the operational phase	No
Mitigation: *Decommissioning -* » Removal of the facility and its ancillary infrastructure following the operational phase. » Ripping and rehabilitation of decommissioned infrastructure, roads, and servitudes following the operational phase.	
Cumulative impacts: » The construction of the facility and its associated infrastructure will increase the cumulative visual impact of electricity related infrastructure within the region. This is relevant in light of: » The authorised Eskom and Khi CSP facilities to be located west of Upington; and the » Existing power line infrastructure, albeit limited in extent and scale.	
Residual impacts: » None. The visual impact will be removed after decommissioning.	

Nature: Visual impact of the proposed facility and ancillary infrastructure on tourist routes and tourism potential within the region The aesthetic appeal of the area lies in its natural features (especially the Orange River), the rural character of riverbank farms, settlements, and homesteads, and the undeveloped, wide open, natural spaces. These characteristics afford the area a level of tourism potential, especially along the river, although this has not yet been optimised. In addition, the N14 and N10 are national tourist access routes, already known and in use. Visual intrusion through the development of industrial type infrastructure within this environment could jeopardise the area's tourism value and potential.	
	Without Mitigation
Extent	Regional (3)
Duration	Long term (4)
Magnitude	Low (4)
Probability	Improbable (2)
Significance	**Low (22)**
Status (positive or negative)	Negative
Reversibility	Recoverable (3)
Irreplaceable loss of resources?	No
Can impacts be mitigated during the operational phase	No

Mitigation:
Decommissioning -
» Removal of the facility and its ancillary infrastructure following the operational phase.
Ripping and rehabilitation of decommissioned infrastructure, roads, and servitudes following the operational phase.
Cumulative impacts:
» The construction of the facility and its associated infrastructure will increase the cumulative visual impact of electricity related infrastructure within the region. This is relevant in light of:
» The authorised Eskom and Khi CSP facilities to be located west of Upington; and the
Existing power line infrastructure, albeit limited in extent and scale.
Residual impacts:
» None. The visual impact will be removed after decommissioning.

Implications for Project Implementation

» The construction and operation of the Ilanga Solar Thermal Power Plant and ancillary infrastructure will have a visual impact on the natural scenic resources and rural character of the study area, and particularly within 4km of the proposed facility.
» The anticipated visual impact is not likely to detract from the regional tourism appeal, numbers of tourists travelling along the N10 and N14 or the tourism potential of the area. These receptors will be exposed to the proposed facility for a very short period of their journey.
» As a result of the location of the proposed facility, the majority of impacts identified are expected to be of low significance.
» Due to the nature of the facility, it is not always possible to mitigate the visual impacts associated therewith. However, where possible, recommended mitigation of visual impacts should be implemented and maintained on an on-going basis.
» No fatal flaws have been identified which would prevent the project from proceeding.

7.3.7. Socio-Economics

During the construction phase of the project, several socio-economic impacts may materialise. These issues may include change in social composition, job creation, skills inequities, and procurement, inflow of workers and jobseekers, accommodation of the construction workforce, daily living and movement patterns, farming activities, impacts on the Local Municipality, impacts on traffic, tourism related issues, heath and safety issues, impact on the visual aesthetics, and increased noise.

Impacts associated with this phase of the project is of a relatively short duration, while temporary in nature, but could have long term effects on the surrounding environment.

Impact tables summarising the significance of social impacts associated with the construction phase

Nature: Change in social composition

The change in the social composition refers to the change in the size and density, as well as demographic profile of the local community.

Based on information received it is estimated that approximately 1 000 construction workers would be employed during the peak construction period. If all 1000 individuals (worst case scenario) are sourced outside the study area, it would result in a noticeable change in the local population (i.e. in term of the overall size, density, demographic profile). This may have subsequent negative impacts on the infrastructure and services provided in the area.

	Without mitigation	***With mitigation***
Extent	Local (3)	Local (3)
Duration	Short duration (2)	Short duration (2)
Magnitude	Moderate (6)	Moderate (6)
Probability	Highly Probable (4)	Highly Probable (4)
Significance	**Medium (44)**	**Medium (44)**
Status (positive or negative)	Positive	Positive
Reversibility	Yes	
Irreplaceable loss of resources	No	
Can impacts be mitigated	Positive impacts can be enhanced	

Mitigation:

» Local labourers with existing accommodation facilities in the area should be employed.
» The development of an on-site accommodation facility could assist in mitigating negative impacts on the services and infrastructure in the area.

Cumulative impacts:

» Possible establishment of new informal townships without the required infrastructure and services which may exacerbate environmental pollution and heath issues.

Residual impacts:

» Possible environmental pollution due to insufficient housing and inadequate infrastructure and services.

Nature: Job creation, skill development/inequities

Due to the demographics of this area (i.e. education levels[33], and employment status[34]), the majority of the population lives in extreme poverty. Therefore the issues of job creation and skills development are highly significant.

The construction phase would require unskilled, semi-skilled, and highly skilled individuals, with

[33] 16% of the population of the Municipality is functionally illiterate, while 7% are fully illiterate. This is directly connected to low income levels and will have severe negative socio-economic implications for the area if not attended to (//Khara Hais SDF, 2008).

[34] Although 63% of the Municipal population falls within the working age category, only 24% of these individuals are employed, 55% earn between R401 and R1 600 per month, and 19% earn even less than R400 per month.

semi-skilled positions likely to make up the bulk of the staff component. Unskilled positions would include activities requiring predominately manual labour (i.e. clearing and excavation activities). Semi-skilled positions would possibly include assembly and erection activities (i.e. for the parabolic troughs, and other the associated components). Skilled positions would include management, supervision, and implementation (i.e. electricians and engineers).

Employment equity refers to the availability of local skills to meet the developer's requirements. Due to the low level of skills found amongst the local population (i.e. Leerkrans, Karos, and Ntsikelelo), it is likely that only a limited number of unskilled, and semi-skilled positions could be filled by locals. Despite the limited number of these positions, and their inherently short term nature, they would still have positive impacts. It is likely that the skilled positions would be filled by those people sourced from around South Africa or abroad. However, the possible discrepancies between locally available skills and the project requirements could be mitigated through training and skills development programmes prior to the construction phase.

	Without Enhancement	***With Enhancement***
Extent	Regional (4)	Local (3)
Duration	Short duration (2)	Short duration (2)
Magnitude	Moderate (6)	Moderate (6)
Probability	Improbable (2)	Probable (3)
Significance	**Low (24)**	**Medium (33)**
Status (positive or negative)	Positive	Positive
Reversibility	Yes	
Irreplaceable loss of resources	No	
Can impacts be enhanced	Positive impacts can be enhanced	

Enhancement:

» Where possible maximise the employment of locals, with preference being given to community members from Leerkrans, Ntsikelelo, Karos, and Upington.
» Identify and involve relevant organisations which could assist in identifying skills within the local community and training requirements.
» A labour desk as well as a skills audit should be undertaken in this regard, with particular emphasis on the needs of women and the youth.
» Conditions that are conducive for the involvement of entrepreneurs, small businesses, and SMME's should be created during the construction process. These conditions should be included in the tender documentation.
» Communication efforts concerning job creation opportunities should refrain from creating unrealistic expectations.

Cumulative impacts:

» This may have a positive cumulative impact with other proposed solar facilities in the area.

Residual impacts:

» Possible economic downfall of individuals after the period of employment has lapsed as they have become used to a certain income level.
» The proposed project could further result in capacity building through on-site training and skills development opportunities for local community members.

Nature: Local procurement

Most of the technology requirements associated with a project of this nature (i.e. parabolic troughs, generators etc) would be available locally. Local procurement would be focused on general construction materials and goods (e.g. steel and concrete). This would result in positive local economic spin-offs and benefits (i.e. increased income and expansion of other local economic sectors).

	Without enhancement	***With enhancement***
Extent	Regional (4)	Regional (4)
Duration	Short duration (2)	Short duration (2)
Magnitude	Low (4)	Moderate (6)
Probability	Improbable (2)	Probable (3)
Significance	**Low (20)**	**Medium (36)**
Status (positive or negative)	Positive	Positive
Reversibility	Yes	
Irreplaceable loss of resources	No	
Can impacts be enhanced	Yes, positive impacts can be enhanced	

Enhancement:

» Local businesses, entrepreneurs, and SMME's should be provided the opportunity to be involved in the tender process for procurement.
» Determine what goods and materials can be sourced locally.

Cumulative impacts:

» Stimulation of and support to local businesses which could have a positive cumulative impact with other proposed solar facilities in the area.

Residual impacts:

» Positive local economic stimulus.

Nature: Inflow of construction workers and jobseekers

Jobs are a scarce commodity in the local area, with most opportunities being short term, seasonal work within the agricultural sector. Introducing various new types of construction related job opportunities is likely to create competition among those seeking employment.

Introducing a large number of outsiders is expected to aggravate the situation (i.e. especially concerning difference in age, race, ethnical composition and local culture). As a result possible discontentment concerning the project and social conflict between the groupings may occur.

Furthermore the inflow of temporary workers will affect the social dynamics and networks in the area due to the possible spread of sexually transmitted diseases, intrusions on private properties, misbehaviour of workers, indecent, the development of informal vending stations and the possible added pressure on the service levels and infrastructure development in the area.

Even though the unemployment levels in the area are high and of concern, a massive influx of jobseekers to the construction site is not foreseen due to the distance of the construction sites from the main road (N10) and the low-income settlements.

	Without mitigation	***With mitigation***
Extent	Local (3)	Local (3)

Duration	Short duration (2)	Short duration (2)
Magnitude	Moderate (6)	Moderate (6)
Probability	Highly Probable (4)	Probable (3)
Significance	**Medium (44)**	**Medium (33)**
Status (positive or negative)	Negative	Negative
Reversibility	Yes	
Irreplaceable loss of resources	No	
Can impacts be mitigated	Yes	

Mitigation:

» Construction workers falling within the semi-skilled to unskilled category should be sourced from the local population where possible.
» Construction workers should be supervised at all times and construction activities should be kept to legislated working hours.
» Workers should receive induction training on site.
» Property owners surrounding the construction areas should be informed of the construction schedules and activities.
» Security on-site should be active prior to the construction period.
» The construction site and accommodation facility should be properly managed to avoid any littering and possible environmental pollution. Water and sanitation facilities should be up to standard.
» Information distributed as part of the existing HIV/Aids awareness campaigns should be focused on and communicated to the local workforce.
» Unrealistic employment expectations should not be created.
» The development of informal vending "stations" should be properly managed, to avoid littering and possible environmental pollution. Workers should preferably receive daily meals on site or should be responsible for their own food and drink requirements.

Cumulative impacts:

» This could have a cumulative impact with other proposed solar facilities in the area.

Residual impacts:

» Long term consequences concerning the provision of services and implementation of infrastructure should construction workers from outside the study area remain in the area without suitable accommodation facilities or permanent employment.

Nature: Potential impacts associated with accommodation of the workforce

A larger area on the farms Matjiesrivier and Annashoek will be developed as an onsite village with the necessary services and infrastructure. This area has been set aside for accommodation of approximately 100 workers. The aim is that this facility would remain to serve as permanent accommodation facility during the operational phase.

The presence of this on-site workforce could affect the social nature of the close-knit communities surrounding the site (i.e. Karos, Leerkrans, and Ntsikelelo as well as the farming community to the north of the N10). Furthermore concerns were raised by surrounding landowners that the presence of the workers could negatively influence the criminal activities in the area. Although crime levels in the area are low, farmers are already experiencing high incidences of stock theft which may increase once a workforce is accommodated in this area.

Other impacts on the local social dynamics could materialise due to "outsiders" seeking after hour's recreational activities within the existing settlements, potentially leading to increased alcohol abuse and associated criminal activities, and short term relationships leading to unwanted pregnancies and so forth.

The quality of life of surrounding property owners could furthermore be gravely interrupted as the establishment of a formal village would affect the quiet rural character of the area.

Accommodation of the specialist teams, albeit limited numbers, at established accommodation facilities could be beneficial to the local hospitality industry. The requirement for accommodation opens up an opportunity for local farmers who wish to develop accommodation facilities on their properties, especially along the Orange River. However, this may not be sustainable following the completion of the construction phase.

	Without mitigation	***With mitigation***
Extent	Local (3)	Local (3)
Duration	Short duration (2)	Short duration (2)
Magnitude	High (8)	Moderate (6)
Probability	Highly probable (4)	Probable (3)
Significance	**Medium (52)**	**Medium (33)**
Status (positive or negative)	Negative	Negative
Reversibility	Yes	
Irreplaceable loss of resources	No	
Can impacts be mitigated	Yes	

Mitigation:

» Local labour should be used as far as possible to eliminate the need for additional accommodation facilities within the area.
» The on-site accommodation should have the required services and infrastructure (water delivery, roads, lighting, sanitation services, and so forth).
» The proposed accommodation facility should be situated and designed as such to have the least negative impact on the rural character and quality of life of the surrounding farmers and property owners
» Team members that would make use of Bed and Breakfast facilities should preferably make use of the local facilities available in close proximity to the site.

Cumulative impacts

» This could have a cumulative impact with other proposed solar facilities in the area more so as housing is an issue in this area (i.e. predominately for young adults).

Residual impacts

» Residual economic benefits to local accommodation facilities and hospitality industry.

Nature: Impact on farming activities

The farms affected by the proposed development are mainly used for cattle farming and leisure activities. Smaller farming units to the north of the N10 are mainly used for the cultivation of grapes and raisins by means of irrigation farming.

Farmland could be lost to the development footprint (i.e. the area associated with the solar

infrastructure, but excluding the majority of the pipelines, several reservoirs, the powerline, and the abstraction point). Farming activities adjacent to the river would be retained and other future farming activities are proposed.

Grape and raisin farming activities on other farms may be impacted through the possible "loss" of seasonal workers during the harvesting (January until March) and pruning (July to August) seasons. Should the local labourers be employed as part of the construction team it would result in a situation whereby the local farmers would not have sufficient resources available to assist them with their farming practices. However, it should be noted that some local farmers are not only employing local labourers are already sourcing labourers or adding to their labour content by recruiting additional individuals from nearby towns or outside the municipal area (i.e. from Kuruman, Kakamas, Keimoes, and so forth).

Another possible impact relates to contesting remuneration packages. Concerns relate to the possibility that the employment opportunities created because of the presence of the facility in the area could lead to a situation that remuneration packages for farm workers would have to be adapted to compete with those packages provided to employees at the facility with subsequent negative financial impacts to the farmers.

	Without mitigation	***With mitigation***
Extent	Local (3)	Local (3)
Duration	Short duration (2)	Short duration (2)
Magnitude	Moderate (6)	Moderate (6)
Probability	Probable (3)	Improbable (2)
Significance	**Medium (33)**	**Low (22)**
Status (positive or negative)	Negative	
Reversibility	Yes	
Irreplaceable loss of resources	Yes to some extent	
Can impacts be mitigated	Yes	

Mitigation:

» Construction activities should not interfere with the farming activities that would continue on the larger site (i.e. the grape farming next to the river, grazing in the broader area).
» Local labourers should be used during the construction phase to limit the inflow of outsiders to the area.
» Remuneration packages should be market related and should take note of the sensitivities at hand.

Cumulative impacts:

» Possibility of insufficient numbers of farm workers available for nearby farmers during the peak seasons especially with other proposed solar facilities in the area.

Residual impacts:

» Permanent loss of grazing areas and sterilisation of the land for farming practices due to footprint of facility.
» Additional ongoing farming activities on larger site not affected by the footprint of the facility.

Nature: Impact on the Local Municipality

A project of this nature would require basic infrastructure and services which will be provided by the IPP and the contractor. Should this not be the case, the burden may fall on the //Khara Hais Municipality which would lead to some planning and financial impacts.

	Without mitigation	***With mitigation***
Extent	Local (3)	Local (3)
Duration	Short duration (2)	Short duration (2)
Magnitude	Moderate (6)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	**Medium (36)**	**Medium (30)**
Status (positive or negative)	Negative	Negative
Reversibility	Yes	
Irreplaceable loss of resources	No	
Can impacts be mitigated	Yes	

Mitigation:

» The project applicant should be responsible for the provision of services and infrastructure to the site. If this would not be the case, then the //Khara Hais Local Municipality should undertake a detailed audit of the services and infrastructure requirements that would required.
» Detailed planning and discussions with the //Khara Hais Local Municipality in this regard should be undertaken to ensure integrated planning.
» A dedicated planning forum should attend to this issue to avoid any delays in the project commissioning.

Cumulative impacts:

» This could have a cumulative impact with other proposed solar facilities in the area.

Residual impacts:

» Long term financial impact for the //Khara Hais Local Municipality.

Nature: Impact on traffic

Heavy and light vehicles will be used to transport goods and building materials (i.e. earth moving trucks, excavators, graders etc) to the site. At this stage it is not clear how many vehicles would make use of this road on a daily basis but it is expected that it would increase the traffic volume. Thereby increasing the risk of accidents. Additional pressure on the capacity and road surface of the N10 is also foreseen.

Non-compliance to the speed limits may affect residents alongside the N10 especially in and around the smaller settlements (i.e. Dagbreek, Leerkrans, Straussburg, and Ntsikelelo areas) where pedestrians frequently cross the road. This increased traffic volume could temporarily affect these individuals due to the noise pollution and increased risk of accidents.

	Without mitigation	***With mitigation***
Extent	Local (3)	Local (3)
Duration	Short duration (2)	Short duration (2)
Magnitude	Moderate (6)	Moderate (6)
Probability	Probable (3)	Improbable (2)
Significance	**Medium (33)**	**Low (22)**
Status (positive or negative)	Negative	Negative

Reversibility	Yes
Irreplaceable loss of resources	No
Can impacts be mitigated	Yes

Mitigation:

» Additional access roads at the construction sites should be kept to a minimum.
» Access roads and entrances to the site should be carefully planned to limit any intrusion on the neighbouring property owners and road users.
» Dust should be controlled for either by spraying the gravel roads with water or constructing them in such a way that dust creation is limited.
» Construction vehicles should adhere to the speed limits.
» Construction vehicles and those transporting materials and goods should be inspected to ensure that these are in good working order and are not overloaded.
» The movement of abnormal loads should be communicated to the property owners in the study area and the necessary permits and authorisations should be obtained from the relevant government departments.
» Source general construction material and goods locally where available to limit long distance transportation.
» Strict vehicle safety standards should be implemented and monitored.

Cumulative impacts:

» This could have a cumulative impact with other proposed solar facilities in the area.

Residual impacts:

» Poor local road and surface conditions which are unlikely to be attended to by the provincial and/or local authorities.

Nature: Impact on tourism

Skilled personnel are likely to make use of the local accommodation facilities, thereby benefitting local establishments in and around Upington. Although only temporary, this could create additional jobs or assist in maintaining existing jobs for locals employed in this industry. The impact is however rated as temporary and of a limited significance.

Seeing as the construction site is unlikely to be visible from the N10, it is expected that the local tourism sector would not be impacted upon.

	Without Enhancement	***With Enhancement***
Extent	Local (3)	Regional (4)
Duration	Short duration (2)	Short duration (2)
Magnitude	Low (4)	Moderate (6)
Probability	Probable (3)	Probable (3)
Significance	**Low (27)**	**Medium (36)**
Status (positive or negative)	Positive	Positive
Reversibility	Yes	
Irreplaceable loss of resources	No	
Can impacts be enhanced	Positive impacts can be enhanced	

Enhancement measures:

» Members of the applicant's team, contractors, specialists and other construction team members should be encouraged to make use of the local accommodation facilities situated in

close proximity to the construction site.
» Should the construction of the Ilanga facility coincide with other construction activities in and around Upington, it is recommended that the accommodation facility on site should be strongly considered.

Cumulative impacts:
» Should the construction phases for Project Ilanga and other large construction projects coincide, it could put pressure on the local hospitality industry.

Residual impacts:
» Residual positive economic benefits to local accommodation establishments.

Nature: Impacts on health and safety
The inflow of a large number of workers to the area could have a negative in terms of crime, sexually transmitted diseases (STDs), basic health care services, the actual safety of construction workers, unauthorised individuals and even children accessing the construction site, the increased risk of fires, and the risk associated with the movement of heavy vehicles or machinery through the local settlements adjacent the N10.

Should locals be employed it could minimise the perceived and actual risk in this regard and would then thus serve as key mitigation measure in this regard.

	Without Mitigation	***With Mitigation***
Extent	Local (3)	Local (3)
Duration	Short duration (2)	Short duration (2)
Magnitude	Moderate (6)	Moderate (6)
Probability	Highly probable (4)	Probable (3)
Significance	**Medium (44)**	**Medium (33)**
Status (positive or negative)	Negative	Negative
Reversibility	Yes	
Irreplaceable loss of resources	No	
Can impacts be mitigated	Yes	

Mitigation measures:
» Employing local community members could minimise the potential for criminal activity or perceived perception of an increase in criminal activity due to the presence of an outside workforce.
» Screening of workers that apply for work could be useful to lessen the perceived negative perceptions about the outside workforce.
» Construction workers should be easily identifiable by wearing uniforms and even identity tags.
» Local community organisations and policing forums must be informed of the presence of the outside workforce.
» Care should be taken to avoid conflict between the local communities and the "outside" workforce especially concerning the securing of jobs.
» The property owners surrounding the construction area should be involved during the construction process by communicating the construction schedule and movement of workers with these representatives.
» Property owners and their workers, together with the relevant community structures should be motivated to be involved in crime prevention and by reporting crimes.

» The construction site should be fenced. » It is important that a fire/emergency management plan and associated communication channels are developed at the onset of the construction phase. It would be important to regularly review the functionality and efficiency of such a plan in conjunction with the local emergency teams and surrounding landowners.
Cumulative impacts:
» This could have a cumulative impact with other proposed solar facilities in the area.
Residual impacts:
» Residual health and safety issues due to residual jobseekers in the area.

Nature: Impacts on noise		
Noise related impacts are anticipated to emanate from heavy vehicles travelling to and from the site, the noise created by the "reverse indication" of the trucks, the noise generated by the general construction activities, and the noise from the individuals residing at the accommodation facility. Given the general low ambient noise levels in the area, this could be particularly intrusive on site, for those in sufficiently close proximity to the accommodation facility and along the N10 where most of the people and vehicle movement is expected.		
	Without Mitigation	***With Mitigation***
Extent	Local (3)	Local (3)
Duration	Short duration (2)	Short duration (2)
Magnitude	Low (4)	Minor (2)
Probability	Probable (3)	Improbable (2)
Significance	**Low (27)**	**Low (14)**
Status (positive or negative)	Negative	Negative
Reversibility	Yes	
Irreplaceable loss of resources	No	
Can impacts be mitigated	Yes	
Mitigation measures: » Construction related noise should be kept to a minimum. » Vehicles should be kept in good working order and drivers should keep to the speed limit.		
Cumulative impacts: » No cumulative impacts are expected as there are no other noise related activities planned on the broader site as yet.		
Residual impacts: » None anticipated.		

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

Nature: Change in social composition
The inflow of a "new" workforce to the area and possible on-site accommodation facility that would house members of the permanent workforce would result in a change in the social composition in the local area surrounding the site. The extent would depend on the number of locals to be permanently employed. This increase in the population could have negative impacts as it would put additional pressure on the existing infrastructure and services if not properly attended to. A

possible change in the number of school going children over the long term could create the need for educational facilities.

The positive impact associated with an increase in the population size relate to the increase in the local buying power and increased tax base of the municipality.

	Without Mitigation	***With Mitigation***
Extent	Local (3)	Local (3)
Duration	Permanent (5)	Permanent (5)
Magnitude	High (8)	Moderate (6) / Moderate (6) (+)
Probability	Highly probable (4)	Probable (3) / Probable (3) (+)
Significance	**High (64)**	**Medium (42) (- and +)**
Status (positive or negative)	Negative	Negative and positive
Reversibility	Yes	
Irreplaceable loss of resources	No	
Can impacts be mitigated	Yes	

Mitigation:

» The employment of locals could mitigate negative impacts associated with the change in the social composition.
» Should the accommodation facility be implemented as part of the Ilanga project, the infrastructural requirements of such a facility should be attended to, in order to limit any possible additional pressure on the existing services and infrastructure in the area.
» The developer could investigate some assistance (not necessarily financial assistance only) to local schools as part of their "corporate social investment."

Cumulative impacts:

» This could have a cumulative impact with other proposed solar facilities in the area.

Residual impacts:

» Long term development of the local economy (i.e. positive).
» Residual impacts relating to the inflow of jobseekers who do not vacate the area.

Nature: Job creation

Once operational approximately 80 - 100 individuals will be required (i.e. 50 – 80 on average). Management and maintenance personnel would make up the majority of the staff component (i.e. cleaning of the troughs and the site, possible replacement of troughs and/or other mechanical and infrastructural repairs). Additional employment opportunities will be required for the provision of ancillary services (i.e. security).

Permanent employment opportunities would change the occupational profile of the local community members who are currently employed within the agricultural sector. Recruitment of people who already form part of the existing labour force may create a negative situation where there is a loss of suitable labourers for farming, and potential unrealistic competitive remuneration requirements to secure local employment.

Additional negative impacts could occur should outsiders be employed due to different sets of skills required which cumulatively could bring about social conflict between the local population and these outsiders.

32% of the local municipality is under the age of 15 years, therefore within the next 5 – 10 years they will be economically active. .This situation emphasises the need for employment creation in the area. Therefore skills training programmes are imperative to ensure that the employment benefits accrue to the locals and especially the youth. Further positive employment related impacts are the indirect economic spin-offs and indirect job opportunities created because of the proposed development and the possible increase in the local population figures and their associated buying power.

	Without Enhancement	***With Enhancement***
Extent	Local (3)	Local (3)
Duration	Long term (4)	Long term (4)
Magnitude	Moderate (6)	High (8)
Probability	Probable (3)	Highly probable (4)
Significance	**Medium (39)**	**High (60)**
Status (positive or negative)	Positive	Positive
Reversibility	Yes	
Irreplaceable loss of resources	No	
Can impacts be enhanced	Positive impacts can be enhanced	

Mitigation:

» Contractors should capacitate locals where practical.
» The project proponent should consider training and capacity building programmes to lessen the skills disparity.
» The skill requirements should be communicated to the local community leaders and community based organisations.
» Skills training should be focused on the electricity sector (to start during the construction phase).
» The Contractors and/or the applicant should make use of local recruitment agencies or other relevant community based organisations to obtain a list of jobseekers.
» An equitable process should be implemented whereby minorities and previously disadvantaged individuals (women) are taken into account.

Cumulative impacts:

» This could have a cumulative impact with other proposed solar facilities and other development in the area

Residual impacts:

» Individuals are provided with skills which can be used post the operational phase.
» Skills and expertise can be passed on to other members of the community.

Nature: Impact on daily living and movement patterns

Individuals leaving their existing full time employment positions at farms in the area to obtain work at the facility could result in possible negative impacts on the farming community as previously discussed. Employing outsiders and accommodating them at the planned accommodation facility could also affect the community's social dealings with each other as well as

the traditional character of the area. This variable would be influenced by the values, beliefs and practices of the "outsiders" compared to that of the locals. In worst cases it could result in social conflict between the various groupings.

The operational phase is not anticipated to severely affect the neighbouring farmers' living and movement patterns, apart from a limited increase in the movement of people to and from the site, as well as the presence of these employees on-site on a permanent basis. Possible noise pollution, vehicle movement and the visual impact associated with such a facility which could intrude on the surrounding landowner's quality of life.

	Without Mitigation	***With Mitigation***
Extent	Local (3)	Local (3)
Duration	Long term (4)	Long term (4)
Magnitude	Moderate (6)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	**Medium (39)**	**Medium (33)**
Status (positive or negative)	Negative	Negative
Reversibility	Yes	
Irreplaceable loss of resources	No	
Can impacts be mitigated	Yes	

Mitigation:

» Employment of locals would limit possible social conflict.
» For safety reasons and dust creation, speeding on the local roads should be avoided.
» Site access should be regularly maintained to keep the local road conditions in a good condition.

Cumulative impacts:

» This could have a cumulative impact with other proposed solar facilities in the area.

Residual impacts:

» Residual conflict between any "newcomers" and the existing community members.

Nature: Impact on tourism

The aesthetic impact of the facility and its associated infrastructure (i.e. the water pipeline, reservoirs, and the powerlines) are anticipated to have the most marked potential impact on the local tourism industry. Even though the site has a distinguishable footprint it is unlikely that it would be permanently visible from the N10. Furthermore, the N10 is not seen as a major tourist route.

The proposed facility could become a tourist attraction in its own right as these facilities are viewed by some in a positive light, mainly due to the clean technology used and overall positive impact on the environment. Therefore the proposed project could even assist with marketing the area as a destination focused on renewable energy sources.

	Without Enhancement	***With Enhancement***
Extent	Local (3)	Local (3)
Duration	Long term (4)	Long term (4)
Magnitude	Moderate (6)	Moderate (6)
Probability	Probable (3)	Probable (3)

Significance	**Medium (39) (negative)**	**Medium (39) (positive)**
Status (positive or negative)	Negative	
Reversibility	Yes	
Irreplaceable loss of resources	No	
Can impacts be mitigated/enhanced	Negative impacts can be mitigated; Positive impacts can be enhanced	
Mitigation: » The mitigation measures and recommendations of the Visual Impact Assessment should be strictly implemented.		
Enhancement: » The proposed facility could be included as an attraction in the //Khara Hais Local Municipality's Tourism Strategy.		
Cumulative impacts: » This could have a cumulative impact with other proposed solar facilities in the area.		
Residual impacts: » Residual positive impact on the local tourism industry.		

Nature: Local procurement

The proposed facility would diversify the local economy directly through the presence of new employment opportunities, and indirectly, albeit to a lesser extent, through the consumption of locally manufactured goods and services. Depending on the extent of purchases made within the local communities, other sectors of the local economy could grow. Local procurement for general materials, goods, and services (e.g. catering and security) could materialise with subsequent growth in these sectors.

	Without Enhancement	***With Enhancement***
Extent	Local (3)	Local (3)
Duration	Long term (4)	Long term (4)
Magnitude	Moderate (6)	Moderate (6)
Probability	Improbable (2)	Probable (3)
Significance	**Low (26)**	**Medium (39)**
Status (positive or negative)	Positive	Positive
Reversibility	Yes	
Irreplaceable loss of resources	No	
Can impacts be enhanced	Yes	

Enhancement:

» Sourcing of locating materials and general services to assist in providing economic, and employment opportunities for the local people.

Cumulative impacts:

» Stimulation of and support to local businesses and local economy in addition to any proposed developments in the area.

Residual impacts:

» Long term job opportunities.

Nature: Impact on farming activities

The areas to the south of the N10 of the farms Annashoek and Matjiesrivier are mainly being used for cattle grazing, but have irrigation rights used for the cultivation of raisins.

The existing farming activities as undertaken by the current property owners would cease with the selling of the land to Ilangalethu. However it is planned that the agricultural practices on the properties would be retained. Furthermore alternative farming activities and practices, albeit on a smaller scale, are also being explored by the developer.

The possible impacts that the proposed project could have on the surrounding property owners' farming practices relate to the use of water. Water is a scarce resource and operations at the plant could put additional pressure on the water service delivery sector. The farmers to the north of the N10 are dependent on the water from the Orange River for their irrigation practices. Should the water quality and/or quantity be affected, it could have economic consequences for these farmers.

Concerns were raised that water rental agreements on the farm Matjiesrivier would not be renewed or would be cancelled without sufficient notice which would result in possible economic losses, however the proponent has agreed to review these agreements.

	Without Mitigation	***With Mitigation***
Extent	Local (3)	Local (3)
Duration	Long term (4)	Long term (4)
Magnitude	Moderate (6)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	**Moderate (39)**	**Moderate (33)**
Status (positive or negative)	Negative	Negative
Reversibility	Yes	
Irreplaceable loss of resources	No	
Can impacts be mitigated	Yes	

Mitigation:

» Discussions with the affected farmers regarding their "water rental agreements" should be undertaken promptly so to ensure the farmers an opportunity to plan accordingly.
» Reduce any negative impacts on farming activities by keeping fencing within the site to a minimum and designing fencing to maximise efficiency of stock movements.
» Limit the development on new access roads on site as far as possible.

Cumulative impacts:

» This could have a cumulative impact with other proposed solar facilities in the area.

Residual impacts:

» Permanent impact on existing or proposed farming activities.

Nature: Impact on land values

The exact impact on the different properties, however, could only be undertaken as part of a detailed property evaluation and/or economic study. From a social perspective it is however fair to state that the actual impact would also be determined by social aspects such as:

» The location of the property in relation to the proposed facility;

» The activities undertaken on the property and the location of dwellings and other infrastructure;
» The perception of property owners with regards to the impact of the facility on the social and bio-physical environment;
» The role which the facility would play with regards to the promotion of the local tourism industry;
» The perception of property owners and the larger community with regards to the operation of the facility and maintenance of the equipment;
» The possible impact of the facility on surrounding land-uses; and
» The local economic climate and need for properties in the area.

The proposed facility could negatively affect the property values in the surrounding area during the short term, as the facility could be seen as an intrusion on the existing environment and land use, thereby influencing the sense of place. The uncertainty associated with the development of such a facility due to it being an "unfamiliar" development could furthermore influence the property prices in the area.

	Without Mitigation	***With Mitigation***
Extent	Local (3)	Local (3)
Duration	Short duration (2)	Long term (4)
Magnitude	Moderate (6)	Moderate (6)
Probability	Probable (3)	Improbable (2)
Significance	**Medium (33)**	**Low (26)**
Status (positive or negative)	Negative	Possibly negative to neutral
Reversibility	No	
Irreplaceable loss of resources	No	
Can impacts be mitigated	Yes	

Mitigation:
» The VIA recommendations should be implemented to limit any potential negative impacts on the sense of place.
» Equipment should be maintained and serviced on a regular basis.
» The facility should be managed according to international best practice.

Cumulative impacts:
» This could have a cumulative impact with other proposed solar facilities in the area.

Residual impacts:
» Very limited possible long-term impact on the property values.

Nature: Impact on health

The operation the proposed facility are not expected to negatively impact on the health of the employees or those in close proximity to the site as it would not create any emissions. However, poor management of the facility could result in littering, as well as improper waste and sanitation management contributing to health related impacts among the workers, and possible on surrounding properties and residents.

Due to the presence of the proposed accommodation facility, concerns about the impact of

additional pressure on the local health services are valid.

On a larger scale the project is anticipated to have positive social and health related impacts through the "greener" technology that will be used (no emissions and so forth).

	Without Mitigation	***With Mitigation***
Extent	Local (3)	Local (3)
Duration	Long term (4)	Long term (4)
Magnitude	Moderate (6)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	**Medium (39)**	**Medium (33)**
Status (positive or negative)	Negative	Negative
Reversibility	Yes	
Irreplaceable loss of resources	No	
Can impacts be mitigated	Yes	

Mitigation:

» Marketing of "green" technology to assist in awareness creation about its benefits.
» Engineering aspects and the design of the facility and accommodation facility should ensure no environmental pollution. Proper waste, water and sanitation facilities must thus be installed

Cumulative impacts:

» Wider awareness of "green" technology.

Residual impacts:

» Wider awareness of and support for renewable energy developments.

Implications for Project Implementation

» The developer will purchase all the properties contained within the Karoshoek site, and therefore there are no implications in terms of landowner consent.
» Many of the local labourers in the area currently have seasonal employment with the farmers. This may impact the facility in terms of the availability of local labour.
» The proposed Ilanga facility could create an opportunity for the transfer of skills which is anticipated to be localised.
» The proposed project could assist in the generation of "green energy" which would lessen South Africa's dependency on coal generated energy and the impact of such energy sources on the bio-physical environment.
» It is recommended, from a social perspective, that the proposed Ilanga facility be developed, but that the proposed mitigation measures be implemented to limit the negative impacts and enhance the positives.

7.3. Summary of Impacts

As a summary of the potential impacts identified and assessed through the EIA process, the following provide a tabular representation of the significance ratings for the potential biophysical and social impacts.

As indicated in Chapter 3, the significance weightings for potential impact have been rated 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:** Moderate (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 a summary of the potential impacts identified and assessed through the EIA process, the following table provides a summary of the impact rating.

Nature	***Without mitigation***	***With mitigation***
Potential impacts on Flora, Fauna, and Ecology[35]		
Impacts on indigenous natural vegetation	Moderate (43)	Moderate (38)
Impacts on threatened plant species	Low (22)	Low (12)
Impacts on threatened animals	Moderate (32)	Moderate (31)
Impacts on protected tree species	Moderate (31)	Low (29)
Impacts on drainage lines (wetlands)	Moderate (38)	Low (27)
Establishment and spread of declared weeds and alien invader plants	Moderate (33)	Low (18)
Potential impacts on Geology, Soil, and Erosion Potential		
Impacts on soil through excavation activities and removal of soil for roads, pipelines, and foundations	Moderate (55)	Moderate (40)
Soil degradation Through loosening, mixing, wetting, and compacting during earthworks	Moderate (50)	Moderate (35)
Soil pollution by waste products (human and synthetic) and contaminants used in construction (e.g. fuel, oil, chemicals, cement)	Low (21)	Low (12)
Soil erosion	Moderate (30)	Low (18)
Siltation of waterways and dams downstream from site	Moderate (33)	Low (21)

[35] Average over Site 1.2, the linear components, the powerlines, and the abstraction point.

Nature	Without mitigation	With mitigation
Dust pollution	Moderate (28)	Low (16)
Potential impacts on Agricultural Potential		
Loss of agricultural potential and land capability	16 (Low)	16 (Low)
Potential impacts on Heritage Sites		
Loss of stone artefact scatters and possible sites during the construction phase	Low (8)	Low (8)
Impacts on colonial sites	Low (8)	Low (8)
Potential impacts on Water Resources		
Impact on the biological environment through loss of riparian systems	High (55)	Medium (45)
Impact on the physical environment (i.e. dry riverbeds and localised drainage systems) through loss of riparian systems	Medium (45)	Low (24)
Impact on riparian systems through the increase in surface water runoff	Medium (35)	Low (19)
Impact on the riparian environment and fish communities as a result of increased sedimentation and erosion within the development footprint	Medium (30) (riparian environment) – Medium (40) (fish)	Low (10) (fish) - Low (18) (riparian environment)
Impact of increased sedimentation and river bank damage due to the establishment of the water abstraction infrastructure	Low (24)	Low (6)
Operation of the reservoir and high pressure sand filtration plant	Medium (36)	Low (8)
Physical disturbance by the supporting infrastructure (pump stations) on the riparian environment	Medium (55)	Low (24)
Chemical and other pollutants into the Orange River	Medium (30)	Low (10)
Abstraction of water from the Orange River: timing and volume	Medium (30)	N/A
Potential Visual Impacts		
Visual impact on users of national and secondary roads within the region	Low (22)	
Visual impact on residents of settlements and homesteads within the region	Low (22)	
Visual impact of ancillary infrastructure within the development footprint on sensitive visual receptors	Low (22)	
Potential visual impact of lighting at night on sensitive visual	Moderate (42)	

Nature	***Without mitigation***	***With mitigation***
receptors		
Potential visual impact of construction activities and accommodation on sensitive visual receptors	Moderate (48)	Low (20)
Visual impact of the proposed facility and its ancillary infrastructure on the visual character and sense of place within the region	Low (22)	
Visual impact of the proposed facility and ancillary infrastructure on tourist routes and tourism potential within the region	Low (22)	
Potential social impacts		
Change in social composition	Construction	
	Medium (44)	Medium (44)
	Operation	
	High (64)	Medium (42) (- and +)
Job creation, skill development/inequities	Construction	
	Low (24) +	Medium (33) +
	Operation	
	Medium (39)+	High (60) +
Local procurement	Construction	
	Low (20) +	Medium (36)+
	Operation	
	Low (26)+	Medium (39)+
Inflow of construction workers and jobseekers	Medium (44)	Medium (33)
Potential impacts associated with accommodation of the workforce	Medium (52)	Medium (33)
Impact on farming activities	Construction	
	Medium (33)	Low (22)
	Operation	
	Moderate (39)	Moderate (33)
Impact on the Local Municipality	Moderate (36)	Moderate (30)
Impact on traffic	Moderate (33)	Low (22)
Impact on tourism	Construction	
	Low (27)	Medium (36)
	Operation	
	Medium (39) (negative)	Medium (39) (positive)
Impacts on health and safety	Construction	

Nature	*Without mitigation*	*With mitigation*
	Medium (44)	Medium (33)
	Operation	
	Medium (39)	Medium (33)
Impacts on noise	Low (27)	Low (14)
Impact on daily living and movement patterns during operation	Medium (39)	Medium (33)
Impact on land values	Medium (33)	Low (26)

From the table above, it is clear that the majority of impacts associated with the proposed development are of moderate to low significance and that impacts can be mitigated to acceptable levels. In addition, positive impacts have been identified for the social environment at a local and regional scale.

7.4. 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 undertakings in the area[36]. The cumulative impacts associated with the proposed facility primarily refer to those impacts associated with visual, water, and social impacts, and are mainly associated with the agricultural activities in the area as well as with other developments of a similar nature proposed within the broader region.

» *Ecology* – impacts as a result of loss of natural vegetation to agricultural activities and development of natural land. As facilities such as that propose result in the loss of vegetation and habitats within the footprint of the development site, numerous developments of a similar nature within one area could result in cumulative impacts on sensitive species of conservation concern as well as on protected species. These potential impacts are however difficult to assess at present as most solar developments are only within the planning phase.

» *Agricultural Potential* – future proposed development in the study area may lead to an impact on the agricultural potential of the region. However, with respect to this facility the cumulative impact will be small as the site has low agricultural potential.
» *Water Resources* - Cumulative impacts can be expected in terms of increased sedimentation (as a result of erosion), pollution, and water abstraction for existing farming activities and proposed industrial activities (such as solar energy facilities) in the area which in turn will cumulatively affect the ecological functioning of this system. The development of the proposed facility will potentially add to the already

[36] Definition as provided in the EIA Regulations, 2010 (GNR 543).

elevated sediment load into the river due to agricultural activities. The widespread use of chemicals in farming activities (fertilisers, insecticides, herbicides, etc.) means that any chemical pollution from the facility (i.e. most likely to be from the construction of infrastructure / operation near the river) would add to this impact. Cumulative impacts due to water abstraction in the Lower Orange River are already considered high and will be exacerbated by the abstractions for this project. However, the water use required by this project is relatively small in a regional context.

» *Heritage* – Impacts on heritage resources relate to the loss of heritage sites as well as a change in the sense of place of an area. Numerous developments within an area could therefore result in a significant impact in this regard if appropriate mitigation measures are not implemented. This is not considered to be the case with the current proposed development due to the low significance of heritage sites identified within the study area as well as the fact that the site is removed from potentially sensitive visual receptors.
» *Visual* – The construction of the facility and its associated infrastructure will increase the cumulative visual impact of electricity related infrastructure within the region. This is relevant in light of the authorised Eskom and Khi CSP facilities to be located west of Upington; and the existing power line infrastructure surrounding the site, albeit limited in extent and scale.
» *Social* – The development of the facility will have a cumulative impact on several existing issues within the area, predominately within rural settlements associated with the potential influx of workers and job seekers. With the increased population density, this may lead to a cumulative impact on housing requirements, services (i.e. water, electricity and sanitation), health issues, safety and security New informal townships are unlikely to have the required infrastructure and services,. With the existing rural settlements in the area this will have a cumulative impact on the environment and health (i.e. in terms of ablution facilities). This will be impacted on even further with respect to other proposed solar facilities in the area.
» *Positive impacts* - Cumulative positive impacts are, however, also anticipated should a number of similar solar developments be developed in the area, largely due to job creation opportunities, business opportunities for local companies, skills development and training. The development of renewable energy facilities will have a positive impact at a national and international level through the generation of "green energy" which would lessen South Africa's dependency on coal generated energy and the impact of such energy sources on the bio-physical environment. The proposed project would fit in with the government's aim to implement renewable energy projects as part of the country's energy generation mix over the next 20 years as detailed in the Integrated Resource Plan (IRP).

Cumulative effects have been considered within the detailed specialist studies, where applicable (Refer to Appendices E – K).

CONCLUSIONS AND RECOMMENDATIONS CHAPTER 8

In order to be able to adequately provide for the growing electricity demand within South Africa, the addition of new generation capacity is required. The Department of Energy has in its Integrated Resource Plan (IRP) determined that 42% of this new capacity should be produced through renewable energy. This will be achieved through the installation of ~17.8GW by 2030 of renewable energy technologies as part of the power generation mix. Much of this power generation is expected to be derived from projects planned and developed by independent power producers (IPPs). IPPs will be remunerated by way of a Renewable Energy Feed-in Tariff (REFIT) which is a guaranteed price for electricity supply. The establishment of the South African REFIT provides the opportunity for an increased contribution towards the sustained growth of the renewable energy sector within the country. The National Energy Regulator of South Africa (NERSA) has the mandate to determine the REFIT guidelines, prices at, and conditions under which electricity may be supplied by a generation licence.

As such **Ilangalethu Solar Power (Pty) Ltd** (Ilanga CSP 1), as an IPP, is investigating the possible establishment of a 125 MW solar thermal power plant (STPP) and associated infrastructure for the purpose of commercial electricity generation. Hereafter referred to as **Project Ilanga**, this facility is proposed as a first phase of the future proposed 1GW Karoshoek Solar Valley Site situated approximately 30 km east of Upington in the Northern Cape. Additional phases of this broader development will be the subject of separate EIA processes.

The broader site comprises four including Portion 0 of Karos 959; Portion 3 of Annashoek 41; Portion 2 of Matjiesrivier 41; and Portion 0 of Zandemm 944. Together these farm portions cover an extent of approximately 26 000 ha (refer to Figure 8.1). Nine potentially suitable areas for the greater Karoshoek facility have been identified within this broader site. Of these nine areas, Site 1.2 has been identified as the most feasible site from a technical and environmental perspective for the development of Project Ilanga (refer to Chapter 3 for more details in this regard). This site is approximately 4.84 km^2 in extent and is located at 28°28'48.11" S; 21°31'51.46" E (refer to Figure 8.2).

Project Ilanga will be comprised of the following primary elements (refer to Chapter 3 for more details):

» *The solar field* - this will comprise multiple loops of parabolic troughs which serve to receive and concentrate the solar radiation.
» *The power block* - comprising a conventional steam turbine generator and a substation into which the electricity can be evacuated.

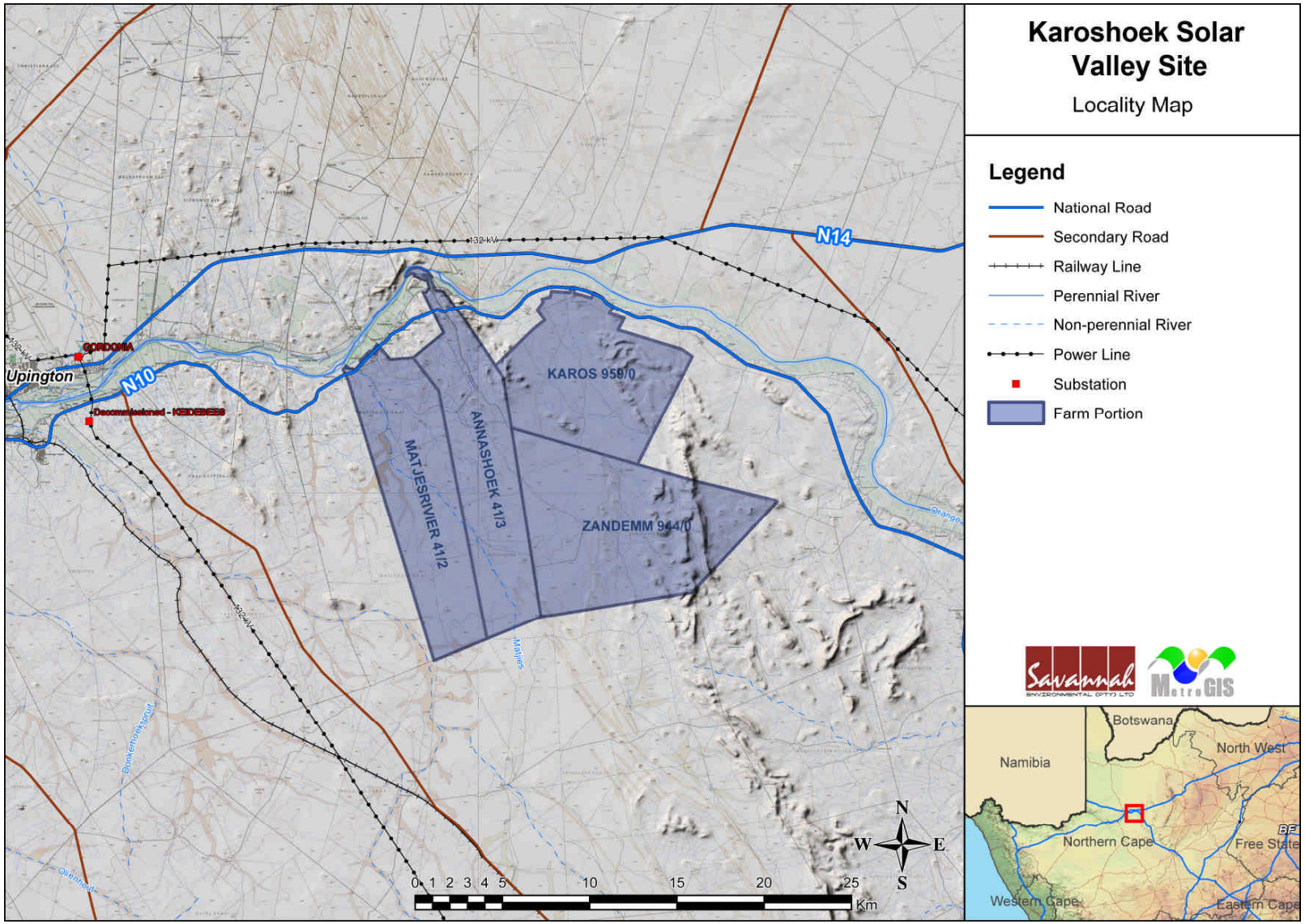

Figure 8.1: The broader development site showing the relevant farm portions.

Figure 8.2: Google Earth Image illustrating the location of Site 1.2 within the broader Karoshoek site

» *Water related infrastructure* - including an existing abstraction point near Farm Annashoek[37] (i.e. associated with a still basin, a main pump set, a sand filter, and a coffer dam), a water supply pipeline; several water treatment and storage reservoirs, and evaporation ponds.
» *Power evacuation* – two 132kV powerlines will be constructed which will have a loop-in loop-out connection[38] into the existing Gordonia-Garona 132kV line to the north of the site. This will necessitate crossing the Orange River, the N10, and the N14 national roads. Within the site it is proposed that these powerlines follow the same alignment as the main water supply pipeline and access road (along the existing main access road to the farm Annashoek) to reach the on-site substation.
» *Associated infrastructure* – a short internal access road, storerooms, parking facilities, security and administrative buildings, and temporary waste storage facilities.

The area infrastructure (i.e. solar field (parabolic troughs), power block etc.) will be entirely contained within this identified site and will have a developmental footprint of approximately 4.84 km^2. The associated infrastructure will extend beyond Site 1.2 across the Karoshoek site, i.e. the power line will extend to its connection point with the existing Gordonia-Garona 132kV line to the north of the site, and the water pipeline will extend to the abstraction point along the Orange River.

Parabolic trough technology is proposed for Project Ilanga. The pivotal component of this technology is the solar collector assembly (SCA) which consists of parabolic troughs (i.e. the reflectors) and cylindrical tubes (i.e. the receivers) which run in the focal line of the parabola. The reflectors are made of mirrored glass panels which are supported by a truss system that gives the SCA its structural strength. Each SCA tracks the sun on a one-axis basis through an installed drive system thereby allowing for maximum generation capacity as the sun's trajectory changes on a daily and seasonal basis. The reflectors receive the incoming solar radiation and accurately concentrate it onto the receiver tube which is a highly efficient heat collection element. The heat is absorbed by the heat transfer fluid (HTF) (i.e. oil, salt, or water) which flows within the receivers and transfers the absorbed heat from the solar field to the power block of the solar facility in a closed circuit. The functionality of the proposed facility is briefly discussed below:

» *Step 1* - *t*he solar radiation is concentrated by the mirrors onto the receiver tube which contains the heat transfer fluid. The solar collectors track the sun during the progression of the day in order to maximise the solar energy yield.
» *Step 2* - the HTF is heated and circulated through the solar field via a series of metal pipes which run aboveground.

[37] The abstraction point may need to be upgraded.
[38] If a double circuit powerline is proposed then two lines will no longer be necessary.

» *Step 3* - heat exchangers transfer the thermal energy from the HTF to the water steam cycle.
» *Step 4* - cooled HTF is returned to the solar field to repeat the cycle.
» *Step 5:* the water steam cycle transfers the thermal energy to the steam turbine generator which converts the thermal energy to electric power.
» *Step 6* - dry cooling will be employed, whereby an air cooled condenser is used to condensate the exhaust steam from the steam turbine. The condensed water is then circulated back to the heat exchangers to repeat the water-steam-cycle. In terms of waste production there is no difference to a conventional power plant with dry cooling, except for the waste produced from the usage of fossil fuel.

8.1. Requirements of the EIA Process

An Environmental Impact Assessment (EIA), 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), Ilanga CSP 1 requires authorisation from the National Department of Environmental Affairs (DEA) (in consultation with the Northern Cape Department of Agriculture and Nature Conservation (DENC)), 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 stakeholders 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 Karoshoek site), as well as the extent of studies required within the EIA Phase were identified.
» *EIA Phase* – potentially significant biophysical and social impacts[39] and identified feasible alternatives put forward as parts of the project have been comprehensively assessed. Appropriate mitigation measures have been recommended as part of a draft Environmental Management Programme (EMP).

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

8.1.1. Assessment of Alternatives

In accordance with the requirements of the EIA Regulations[40], the following alternatives were considered within the EIA process from an environmental perspective.

Operating alternatives

In this alternative Ilanga CSP 1 technically assessed to either develop the facility with dry cooling and no thermal storage (i.e. Base Case), or a wet cooling and storage (i.e. Option 1), or the Base Case with supplementary fuel (i.e. Option 2), or the Base Case with thermal storage (i.e. Option 3). Due to water related constraints wet cooling was not considered an option within the EIA.

The land utilised for the area infrastructure at Site 1.2 will effectively be sterilised for the duration of the construction and operational phase, regardless of which operating alternative is implemented. Furthermore the vegetation located underneath the parabola would need to be removed to prevent the risk of veld fires or damage to the moving parts of the machinery[41]. It is not envisaged that Site 1.2 would be utilised for any other activities during the operational phase (i.e. grazing). Therefore, from an ecological perspective, due to the potential impact or sterilisation of the land, the alternative options with a smaller area could be regarded as preferable. However, the size differences between the affected extents of the options with a larger area are not considered significantly different.

The use of storage (i.e. Option 3) will assist in providing grid stability due to the ability to provide power for longer periods, since production hours can be extended through the storage of the produced heat and the releasing thereof when required. This is highly important for managing the grid load and performance and preferred from a technical perspective. The large volume of heat transfer fluid (HTF), together with the ability to support the production by means of thermal storage will enable the provision of stable and predictable power to the grid.

It appears that the preferred alternative from a technical perspective would be to develop the STPP with storage, although this is still to be confirmed from an economic perspective. From an environmental perspective, the implementation of this alternative would not result in significantly higher impacts than the development of the STPP without storage.

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

[41] An erosion control mechanism would need to be initiated following the removal of the vegetation and the supporting root structures (i.e. gravel layer).

No-go alternative

In this alternative Ilanga CSP 1 will not establish and operate the proposed Ilanga STPP. In this scenario the status quo will be maintained, and subsequently the potential environmental and social impacts that have been identified and assessed will not occur. However, should the project not proceed, the contribution of the project (i.e. 125 MW) towards the Government target for renewable energy will not be realised. When assessing this alternative, the biophysical and social value of the land in its current state must be weighed up against the potential value of the land as part of a proposed development.

» *Alternative land use* – an alternative land use for the proposed development site is agriculture. However, due to the low rainfall within the study area, this would require the development of irrigation infrastructure from the Orange River. This option will in all probability have similar impacts to those expected from the proposed solar energy facility. It is unknown whether this option would be economically feasible due to the high costs associated with such infrastructure. From the landowner's perspective (i.e. the developer), this is not considered to be a preferred alternative. However, the development of the proposed solar facility may present opportunities to cultivate other areas of the site which were previously not feasible for this type of development, due to the supply of water via the solar facility.

» *Water* – water demand from the Orange River catchment is dominated by irrigation along the river, where approximately 1 800 million m^3 is used per year. Although the volume required by the proposed development is relatively small in a regional context (i.e. 224 110 m^3/a), the cumulative impact due to other proposed solar facilities as well as the NamPower Lower Orange Hydroelectrical Power Scheme will be exacerbated by the abstractions for this project. Therefore depending on the outcomes of the water allocation exercise to be undertaken by the Department of Water Affairs, the no-go alternative may be preferred.

» *Visual* – generally speaking, should the no-go alternative be implemented then the visual aesthetics of an area, and potential sensitive receptors would not be affected by a proposed facility. In addition, the construction of the facility and associated infrastructure may increase the cumulative visual impact of electricity related infrastructure within the region. This is relevant in light of the future Eskom CSP and Khi CSP plants to be located west of Upington (i.e. environmental authorisation issued) and existing power line infrastructure already present in the area, albeit limited in extent and scale. However, due several characteristics of Project Ilanga the potential visual impact is not significant in a way to motivate for this alternative. These characteristics include:

- The nature of the proposed technology - parabolic troughs which are of limited height, unlike power towers or even wind turbines.
- The nature of the site - due to the topography, the visibility of the development site to potentially sensitive visual receptors (e.g. those travelling along the N10 and N14 national road located north of the site) is limited to none.

» *Social* – the no-go alternative may be preferable where significant negative impacts on the social environment are expected. This may include the inflow of construction workers and jobseekers into the area which can lead to an increase in the transmission of sexually transmitted diseases and the proliferation of violence. However with the implementation of mitigation measures (i.e. the use of local labourers) the significance of these issues can be managed to acceptable levels. However, with respect to local procurement, job opportunities, and skills development the loss of these opportunities is significant in that the no-go alternative is not preferred.

» *Energy generation* – if Project Ilanga is not established (i.e. the no-go alternative) the evacuation of 125 MW to the Eskom grid will not be realised at this point within the electricity network. This is unfavourable as the development and implementation of renewable energy projects (mainly solar and wind developments) is targeted by the Department of Energy as part of the energy mix for power generation over the next 20 years. Therefore, the establishment of Project Ilanga facility is supported as it will also contribute to the government's green growth strategy and job creation.

8.2. Nomination of the proposed Site for the Development of a Solar Facility

The Northern Cape was nominated for the establishment of the proposed facility primarily due to the solar resource. The broader Karoshoek site was selected based on several key factors including access to water, site access, proximity to current and future evacuation points, land availability and the proximity of the site to Upington. From an ecological sensitivity perspective, the broader development site is preferable due to the following.

» The site is not within a National Protected Area – the closest is 150 km north.
» The site is not within a National Protected Area Expansion Strategy Focus area – the closest is 10 km east.
» No World Heritage Sites or Biosphere Reserves have been identified within the study area.
» No wetland areas that are protected according to international conventions occur near the site.
» There are no fine-scale plans for the municipality within which the site is located or provincial conservation plans that cover the whole province. Furthermore, no Critical Biodiversity Areas (CBAs) have been identified that cover the site.

» The site is further than 10 km from a National Park (see point 1 above), and the site is more than 5 km from any other protected area.
» As the site is inland, high water marks and development setbacks are not applicable.

Site 1.2 was selected for the development of Project Ilanga[42] (i.e. Phase 1 of the Karoshoek Solar Valley Site) by virtue of technical, economic, and environmental considerations. This site is located roughly in the middle of the broader development site, thereby making it preferential for the first phase of the Karoshoek facility in terms of site suitability and access of the development of basic infrastructure.

8.3. Site Sensitivity

Several potentially sensitive areas were identified for the broader Karoshoek site, including:

» *Areas of high ecological sensitivity* – high concentrations of dunes primarily in the south-western and some northern parts of the site, and several non-perennial drainage lines and pans.
» *Areas of visual exposure* – receptors within an 8 km radius of the facility (i.e. users of national and secondary roads).
» *Areas of high agricultural potential* – the northern portion of the site (i.e. south of the N10[43]).
» *Areas with sensitive noise receptors* – several rural settlements located near the Orange River and the N10 and any receptor located within 2 km of the facility.

The preliminary design of the proposed facility and associated infrastructure has considered these identified areas (refer to Figure 8.3).

[42] Due to logistical reasons certain infrastructural requirements will be located outside the boundary of Site 1.2 and will cross the broader site (i.e. power line, pipelines, access road, abstraction point, and several water storage/treatment reservoirs).
[43] The development of dry land cropping in these areas is limited by low rainfall, and lack of irrigation facilities.

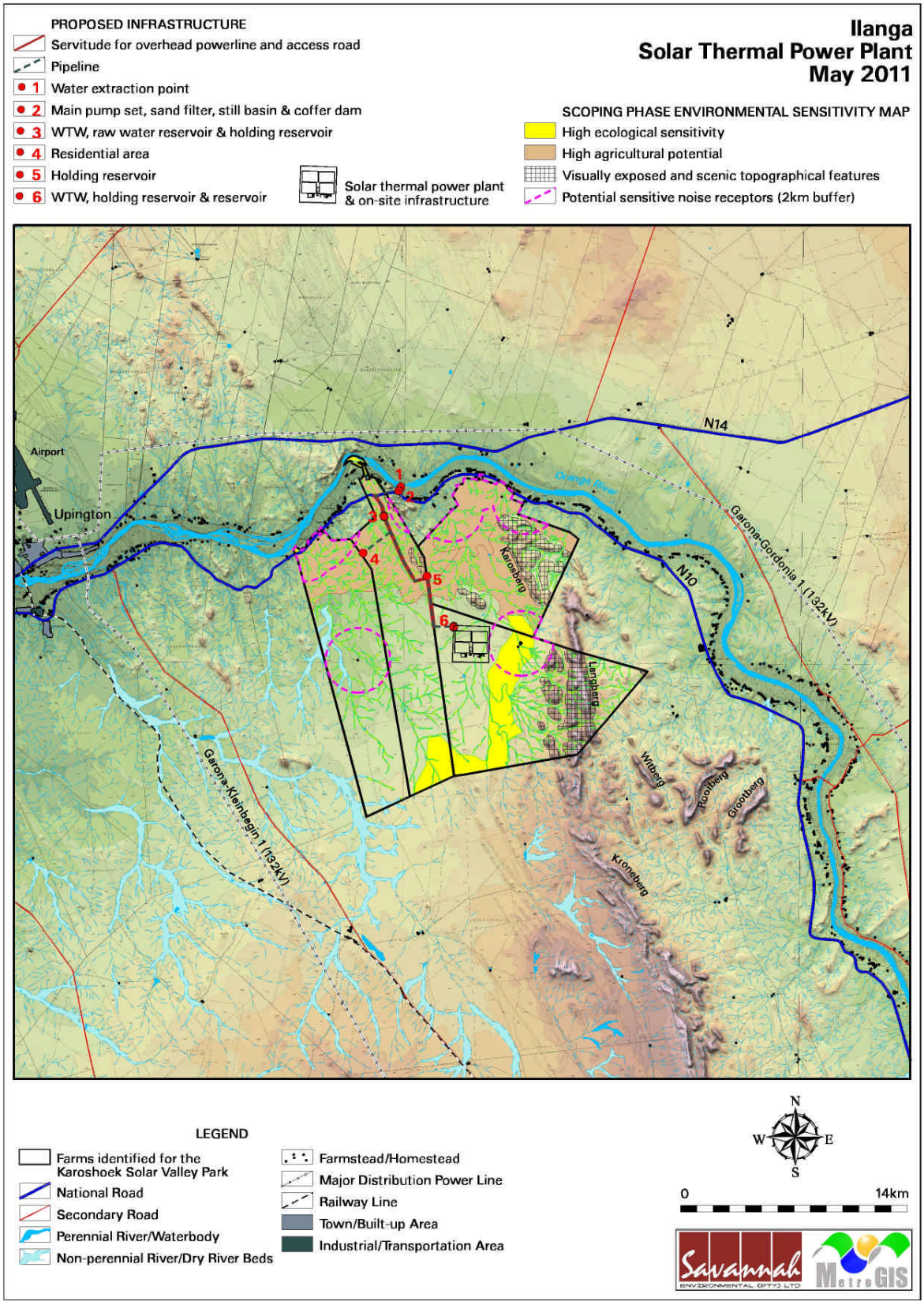

Figure 8.3: The preliminary design of the proposed facility

8.4. Evaluation of the Proposed Project

The preceding chapters of this report together with the specialist studies contained within Appendices F - L provide a detailed assessment of the potential impacts on the social and biophysical environment that may result from the proposed project. This chapter concludes the EIA Report by providing conclusions of the assessment of the proposed facility. In doing so, it draws on the information gathered as part of the EIA Process and the knowledge gained by the environmental consultants and presents an informed opinion of the potential environmental impacts.

No environmental fatal flaws were identified to be associated with the proposed facility. However the following potentially significant environmental impacts have been identified through the EIA Phase.

» Local site specific impacts resulting from the physical modification/disturbance of the site primarily during the construction phase.
» Impacts associated with the power lines.
» Impacts on water resources.
» Impacts on the social environment.

8.4.1. Local site-specific impacts

The broader development site is approximately 26 000 ha in extent, the bulk of which will not be disturbed by the proposed 125 MW Project Ilanga facility and associated infrastructure. Concentrating Solar Power technology, as proposed for this project, typically require a large area for the establishment of the solar field, and the power generation infrastructure (i.e. the power block). This infrastructure is typically located in close proximity to each other. This will results in broad scale disturbance to the development site (i.e. Site 1.2). Permanently affected areas include the area infrastructure and linear infrastructure within Site 1.2, outside Site 1.2 but within the broader Karoshoek site, and beyond this broader site.

During the construction phase local site-specific impacts may occur because of physical disturbance/modification to the site. These include:

» Impacts on biodiversity which includes any impacts on protected trees species (i.e. Camel Thorn and Shepard's Tree), and species of conservation concern (i.e. Largemouth Yellowfish, Namaqua Barb, Rock Catfish, Honey Badger, Littledale's Whistling Rat, Dassie Rat, Kori Bustard, Ludwig's Bustard, Martial Eagle, Secretarybird, Lanner Falcon, Sclater's Lark, and Giant Bullfrog), and on overall species richness.
» Impacts on sensitive habitats (i.e. drainage lines located across the site, reed bed wetland systems along the Orange River, and dunes primarily in the south-western

quarter and in some northern parts of the site), that leads to direct or indirect loss of such habitat.
» Soil degradation, wind/water erosion and subsequent sedimentation of drainage lines and the Orange River.

These impacts will be associated with the establishment of project infrastructure and are expected at Site 1.2, at the abstraction point on the Orange River, at the sites of several water storage/treatment reservoirs and along the linear infrastructure (i.e. power lines, pipelines, and access road servitudes). These impacts are expected to be of moderate to low significance and can be mitigated to acceptable levels through the implementation of appropriate management measures.

8.4.2. Impacts associated with the Power lines

It is proposed to connect the substation at Site 1.2 via a 14 km long loop-in / loop-out power line (i.e. two power lines in parallel) with the existing Gordonia-Garona 132kV line located to the north of the site. This will necessitate the crossing of the Orange River; a distance of approximately 500 m. A servitude of approximately 35 m in width for each power line will need to be established (i.e. a total of 70m for two lines). Only the centre line may need to be cleared for stringing purposes. The remainder of the servitude will not be cleared, except where trees higher than 4 m exist which could interfere with the operation of the power line. This work will be undertaken by an Eskom approved contractor.

Impacts which may result from the proposed power lines include the potential visual impact, impacts on avifauna as a result of collisions and electrocution (particularly across active cultivated agricultural land and across the river), and the potential impact on the riverine environment from the installation of the towers and the stringing of the power line during the construction phase.

Potential visual impacts associated with the proposed power lines are not possible to mitigate. However, the visual impact is expected to be limited to within 2km of the location of the power lines, and would primarily be associated with views from the N10 and N14 national roads. Visual impacts on the affected property to the north of the river would also occur.

Avifauna may be affected due to potential collisions, and or electrocutions with the power lines. Large species are particularly prone and may include Kori Bustard and Ludwig's Bustard. Impact on avifauna can be effectively mitigated through the following:

» Rivers are often used by birds for navigation purposes. Therefore the span across the river should be planned in such a way that it is as short as possible.

» Large, slower moving bird species typically collide with the earth wire as they cannot divert their flight path in time. Therefore this line should be appropriately marked[44] along the river span, as well as where the power lines pass through active agricultural land.

Impacts on the riverine environment are potentially associated with the clearance of vegetation at tower footprints as well as the clearance of vegetation for stringing purposes. These impacts can be effectively avoided through the placement of power line towers outside of the riparian zone as well as the implementation of alternative stringing techniques. These methods have been successfully implemented by Eskom in the past. As the power lines are to be constructed by an Eskom approved contractor, it is expected that these methods can be employed and the impacts avoided.

8.4.3. Impacts on Water Resources

Water demand from the Orange River catchment is dominated by irrigation along the river, where approximately 1 800 million m^3 is used per year. Although the volume required by the proposed development is relatively small in a regional context (i.e. 224 110 m^3/a), the cumulative impact due to other proposed solar facilities as well as the NamPower Lower Orange Hydroelectrical Power Scheme will be exacerbated by the abstractions for this project. The Lower Orange River Management Strategy (2005) study found that the overall present state of the Lower Orange River (i.e. the stretch of the Orange River between the Orange-Vaal confluence and Alexander Bay or Oranjemund) is in a *D category*, i.e. largely modified.

Impacts on water resources associated with the proposed facility relate largely to the abstraction of water from the Orange River System, as well as potential impacts on the water quality of the river due to sedimentation and/or contamination. However, the majority of impacts can be reduced to low significance with the implementation of appropriate mitigation measures, and the proposed development should, therefore, have limited impact on the overall status of the riparian systems within the region. Impacts on the Orange River system due to water abstraction, and site-specific impacts on in-stream biota are difficult to quantify due to the highly regulated nature of the system.

The only significant risk to the project is the water use license not being granted by the Department of Water Affairs. Although dry cooling will be practiced which will reduce water requirements, the Orange River system is under pressure in terms of water requirements.

» [44] These devices are referred to as flappers which hang off the line and are able to move with the wind. These steel flappers reflect the light as they move thus enabling the bird to see it a sufficient distance before collision.

8.4.4. Impacts on the Social Environment

The proposed development site is located within a rural setting and is removed from settlements and homesteads. 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.

The Ilanga facility would involve some thousand workers over the course of the construction phase, between eighty to hundred permanent jobs during operation, and would be an approximate R5 to R6 billion economic injection into the area. Positive impacts associated with the project are largely due to job creation opportunities, business opportunities for local companies, skills development, and training. The proposed project could assist in alleviating poverty amongst some individuals in the study area through the provision of permanent employment opportunities. Should the subsequent phases of the Karoshoek Solar Valley Site be developed, the cumulative positive impacts would be of great value to the communities in the area.

The development of a renewable energy facility of this nature will have a positive impact at a national and international level through the generation of "green energy" which would lessen South Africa's dependency on coal generated energy and the impact of such energy sources on the bio-physical environment. The proposed project would fit in with the government's aim to implement renewable energy projects as part of the country's energy generation mix over the next 20 years as detailed in the Integrated Resource Plan (IRP).

Potential negative impacts which require mitigation relate to an influx of workers and jobseekers to an area (whether locals are employed or outsiders are employed) and an associated perceived risk of an increase in crime in the area, and intrusion influences during construction. As a limited number of workers are proposed to be housed on site, certain impacts could arise as a result of worker conduct at this site. Stringent mitigation is required to be implemented to reduce these impacts to acceptable levels.

Impacts on farming activities may occur as a result of the proposed development. However, due to the limited agricultural potential of the proposed development site (Site 1.2), and the low rainfall in the area, the impact on agricultural potential as a result of the loss of land associated with the development is not expected to be significant. In fact, the proposed development may present opportunities for additional agriculture on the site and surrounds in that the water supply infrastructure could be utilised to transport water to irrigate crops within these areas. This would be a positive impact.

8.5. Overall Conclusion (Impact Statement)

Global climate change is widely recognised as being one of the greatest environmental challenges facing the world today. How we source our energy plays a big part in tackling climate change. As a net off-setter of carbon, renewable energy technologies 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. 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 thermal power plant with a generating capacity of 125 MW on a site near Upington has been established by Ilangalethu. The positive implications of establishing a solar energy facility on the identified site within the Northern Cape include:

» The potential to harness and utilise solar energy resources, which are known to be significant within the Northern Cape.
» The project would assist the South African government in reaching their set targets for renewable energy.
» The project would assist the South African government on the implementation of its green growth strategy and job creation targets.
» The National electricity grid in the Northern Cape would benefit from the additional generated power.
» Promotion of clean, renewable energy in South Africa
» Positive impacts on the tourism economy of the area
» 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 from the proposed project conclude that there are **no environmental fatal flaws** that should prevent the proposed facility from proceeding. The majority of impacts identified are of moderate to low significance and can be successfully mitigated to acceptable levels, provided the specifications as detailed within the Environmental Management Programme (EMP) for the project are implemented. 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**.

8.6. 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 Ilanga Solar Thermal Power Plant can be mitigated to an acceptable level, and therefore that the application for the proposed solar energy facility and associated infrastructure as detailed within this EIA Report be authorised by DEA. The following conditions of this recommendation must be included within the authorisation issued:

» As far as possible, any component of the facility which could potentially affect sensitive areas (i.e. primary drainage lines) should be shifted in order to avoid these areas of high sensitivity (i.e. best practice is impact avoidance). Where this is not possible, alternative mitigation measures as detailed in this report must be implemented.
» The final alignment of the water supply pipeline and location of the power line towers must be informed by surveys undertaken by an ecological and heritage specialist. The EMP for construction must be updated to include site-specific information and specifications resulting from the final walk-though surveys. This EMP must be submitted to DEA for approval prior to the commencement of construction.
» Following the final design of the facility, a revised layout must be submitted to DEA for review and approval prior to commencing with construction.
» An independent Environmental Control Officer (ECO) should be appointed to monitor compliance with the specifications of the EMP for the duration of the construction period.
» The EMP as contained within Appendix L of this report should form part of the contract with the EPC Contractor appointed to construct the proposed solar energy facility, and must 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 in this report.
» All relevant practical and reasonable mitigation measures detailed within this report and the specialist reports contained within Appendices F to L must be implemented.
» During construction, unnecessary disturbance to habitats should be strictly controlled and the footprint of the impact should be kept to a minimum.
» Disturbed areas should be rehabilitated as quickly as possible once construction is completed in an area, and an on-going monitoring programme should be established to detect, quantify, and manage any alien species.
» A comprehensive stormwater 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 Ilanga CSP 1 must be submitted to the relevant regulating authorities. This includes permits for the transporting of all components (abnormal loads) to site, disturbance to heritage sites, disturbance of protected vegetation, and disturbance to any drainage lines or riparian vegetation.

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