ENVIRONMENTAL IMPACT ASSESSMENT PROCESS
FINAL EIA REPORT
PROPOSED ESTABLISHMENT OF THE UPINGTON SOLAR THERMAL PLANT THREE
NORTHERN CAPE PROVINCE
DEA REFERENCE NUMBER: 14/12/16/3/3/2/657

FINAL REPORT FOR SUBMISSION TO DEA
APRIL 2014

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PROJECT DETAILS

DEA Reference Number	:	14/12/16/3/3/2/657
Title	:	Environmental Impact Assessment Process Final EIA g Report: Proposed Construction Of The Upington Solar Thermal Plant Three, Northern Cape Province
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Client	:	Abengoa Solar Power South Africa (Pty) Ltd
Report Status	:	Final EIA Report
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PURPOSE OF THE ENVIRONMENTAL IMPACT ASSESSMENT REPORT

Abengoa Solar Power South Africa (Pty) Ltd is proposing the construction and operation of a commercial solar thermal electricity generating facility (using trough plant technology) and associated infrastructure near Upington, Northern Cape Province. The project is known as the Upington Solar Thermal Plant Three, and is one of three Abengoa Solar CSP facilities proposed to be established on Portion 3 of the farm McTaggarts Camp 453. The three Abengoa Solar facilities are as follows:

» Khi Solar One Solar Thermal Plant (a 50MW power tower technology), which is currently under construction (planned commercial operation date is end-2014)
» Proposed Upington Solar Thermal Plant Two (up to 125MW power tower technology), which is currently under EIA (DEA Ref Number 14/12/16/3/3/2/656)
» Proposed Upington Solar Thermal Plant Three (up to 125MW trough plant technology), which is the subject of this EIA (DEA Ref Number 14/12/16/3/3/2/657).

Each project is located on a different area within Portion 3 of the Farm McTaggarts Camp 453, which lies approximately 20 km west of the town of Upington in the Northern Cape. It is the developer's intention to the CSP Facility under the Department of Energy's (DoE) Renewable Energy Independent Power Producer Procurement (REIPPP) Programme. The power generated from the CSP facility will be sold to Eskom through a 20-year power purchase agreement (PPA) and will feed into the national electricity grid. Ultimately, the project is intended to be a part of the renewable energy projects portfolio for South Africa. This EIA Report applies to the Proposed Upington Solar Thermal Plant Three (DEA Reference Number: 14/12/16/3/3/2/657).

As the project has the potential to impact on the environment, an Environmental Impact Assessment process is required to be completed in support of an application for environmental authorisation. The Scoping Phase of the EIA process identified potential issues associated with the proposed project, and defined the extent of the studies required within the EIA Phase. The EIA Phase addresses that identified potential environmental impacts and benefits associated with all phases of the project including design, construction, operation and decommissioning and recommends appropriate mitigation measures for potentially significant environmental impacts. The EIA report aims to provide the environmental authorities with sufficient information to make an informed decision regarding the proposed project.

The release of a draft EIA Report provided stakeholders with an opportunity to verify that the issues they have raised to date have been captured and adequately considered within the study. This Final EIA Report incorporated all issues and responses prior to submission to the National Department of Environmental Affairs (DEA), the decision-making authority for the project. **Changes between the draft EIA report and this final EIA report are underlined.**

OPPORTUNITY FOR PUBLIC REVIEW OF THE DRAFT EIA REPORT

The Draft Environmental Impact Assessment Report for the Upington Solar Thermal Plant Three was available for a 30- day public review and comment period at the following public places within the project area from 20 March 2014 –22 April 2014:

» Upington Public Library, Market Street, Upington
» Keimoes Public Library, Main Street, Keimoes

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

OPPORTUNITY FOR PUBLIC REVIEW OF THE FINAL EIA REPORT

In line with Regulation 56 of the EIA regulations of June 2010 registered I&APs were informed via letter that the final EIA report is available for public review, will thereafter be submitted to DEA and that a copy of the report can be requested from Savannah Environmental or downloaded from the website: www.savannahSA.com. Registered I&APs were also informed that any comments on the final EIA report must be submitted directlty to DEA and copied to Savannah Environmental in line with Regulation 56 (6). Contact details for submission any comments on the final EIA report are as follows:

National DEA: **Thabile Sangweni** **Tel:** 012 395 1761 **Fax:** 012 320 7539 **Email:**tsangweni@environment.gov.za **Post:** Private Bag X 447 ,Pretoria,0001	**Savannah Environmental(EAP):** **Gabriele Wood** **Tel:** 011 656 3237 **Fax:** 086 699 5796 **Email:** gabriele@savannahsa.com **Post:** P O Box 148 Sunninghill 2157

KEY CHANGES BETWEEN THE DRAFT EIA AND FINAL EIA REPORT

Changes between the draft EIA report and this final EIA report are underlined. The following changes apply:

Section	Change
Purpose of the EIA report	Addition of commenting dates and procedures revised for comments to be submitted to the DEA case officer and copied to the EAP
Headers and Footers of	Change of the headers to: Final EIA Report April 2014

the EIA report	
Appendix D: Advertisements and Site Notices	Additional of newspaper clippings
Appendix E: Public Participation Information	• Update of comments an responses report • Addition of all comments received on the draft EIA report • Addition of minutes of meeting held during the EIA phase • Addition of correspondence sent out to inform IA&Ps on the draft EIA and public meeting details

EXECUTIVE SUMMARY

Project Information

Abengoa Solar Power South Africa (Pty) Ltd is proposing the construction and operation of a commercial solar thermal electricity generating facility (using trough plant technology) and associated infrastructure near Upington, Northern Cape Province. The project is known as the Upington Solar Thermal Plant Three, and is one of three Abengoa Solar Concentrating Solar Power (CSP) facilities proposed to be established on Portion 3 of the farm McTaggarts Camp 453 (with the Khi Solar One project currently under construction).

Each project is located on a different area within Portion 3 of the Farm McTaggarts Camp 453 (with a total extent of 2200ha), which lies approximately 20 km west of the town of Upington in the Northern Cape. The Upington Solar Thermal Plant Three is proposed to utilise parabolic trough technology with a generation capacity of up to 125MW[1]. The facility will have a total development footprint of up to 500ha (within a 660ha portion identified within the larger farm) and will include the following associated infrastructure:

» Parabolic troughs (parabolic collector units arranged in loops to establish the solar field (i.e. to cover a total extent of approximately 400 ha) with an approximate height of 6m.
» Power island which will include a steam turbine and generator; a generator transformer and substation; auxiliary fossil fuel and/or electric boilers and associated molten salt storage vessels and heat exchangers (approximately 200m x 500m in extent).
» Access roads (road up to 6m wide).
» Plant substation (50m x 50m).
» 132 kV power line up to 8km in length to connect to Eskom's existing McTaggerts Substation, which is located on the same property as the proposed CSP Plant.
» Water abstraction point located at the Gariep River, filter station (20m x 30m) and water supply pipeline (up to 20km in length).
» Water storage reservoir and tanks (combined capacity up to 15 000m^3).
» Packaged water treatment plant (roughly 30m x 30 m).
» Up to 5 lined evaporation ponds (approximately 100m x 100m each).
» Workshop and office buildings (approximately 20m x 50m each).
» Mirror assembly facility (approximately 100m x 50m).

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

[1] Parabolic trough plants are modular in nature, and can easily be adapted to change the generation capacity of the plant. It is expected that the Department of Energy may soon make provision for CSP facilities up to a capacity of 125MW to be bid through their REIPPP Programme (current cap as of March 2014 is 100MW).

Energy (DoE). In response to the need, Abengoa Solar Power South Africa (Pty) Ltd, as an IPP, is proposing the construction and operation of this CSP facility. CSP is the only of the renewable technologies that utilise conventional steam generating equipment with operational and life expectancy similar to that of conventional power plants (i.e. 40 years vs 20 years for other renewable technologies). One advantage of parabolic trough power plants is their potential for storing solar thermal energy to use during non-solar periods and to dispatch electricity when it is needed most.

Environmental Impact Assessment

An EIA process, as defined in the NEMA EIA Regulations, is a systematic process of identifying, assessing, and reporting environmental impacts associated with an activity. The EIA process forms part of the planning 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), Abengoa Solar Power South Africa requires authorisation from the National Department of Environmental Affairs (DEA) for the construction of the Upington Solar Thermal Plant Three 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 undertaken to date 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, and stakeholder letters. Details of registered parties have been included within an I&AP database for the project.
» *Scoping Phase* – identification of potential issues associated with the proposed project and environmental sensitivities (i.e. over the broader project development site - entire extent of Portion 3 of the farm McTaggarts Camp 453), as well as the extent of studies required within the EIA Phase were defined.
» *EIA Phase* – potentially significant biophysical and social impacts[2] and identified feasible alternatives have been comprehensively assessed through specialist investigations. Appropriate mitigation measures have been recommended as part of a draft Environmental Management Programme (EMPr) (refer to Appendix N).

Evaluation Of Impacts Associated With The Facility

The conclusions and recommendations of this EIA are the result of the assessment of identified impacts by specialists, and the parallel process of public participation. The public consultation

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

process has been extensive and every effort has been made to include representatives of all stakeholders in the study area.

From the conclusions of the detailed EIA studies undertaken, sensitive areas within the development footprint area were identified and flagged for consideration and avoidance by the facility layout. Potential impacts which could occur as a result of the proposed project are summarised in the sections which follow. The most significant environmental impacts identified and assessed to be associated with the proposed Upington Solar Thermal Plant Three include:

» Local site-specific impacts
» Visual impacts due to the extent of the solar field and other associated infrastructure.

The areas of high ecological sensitivities of the site are presented in Figure 9.2 and include areas containing riparian vegetation along drainage lines: *Acacia mellifera – Cenchrus ciliaris* ephemeral drainage lines. These areas of high sensitivity also contain protected trees species (*Acacia erioloba* (Camelthorn) *and Boscia foetida* (Shepherds tree), *Boscia albitrunca (*Shepherds *tree).* The number of protected trees that could be destroyed by the development are estimated as follows:

» *Acacia erioloba:* less than 50 trees
» *Boscia albitrunca:* less than 50 tress

This area of high ecological sensitivities amounts to approximately 20 hectares, and is recommended to be avoided by the development footprint. This includes the parabolic trough plant, as well as the main access road to the facility. The ecological specialist recommended that the layout should be refined to avoid the riparian vegetation / high sensitivity zones. This recommendation has been taken into account by the developer, and the layout was refined to avoid the high ecological sensitivity areas. This layout considering the required mitigation measures is included in Figure 9.3, and represents the optimal layout for the facility. This refined layout responds to the following:

» Avoidance of the tributary to the Helbrandkloofspruit
» Avoidance of the destruction of the habitat characteristic of this ephemeral drainage line – infrastructure is planned only within 50m of the feature and destruction is not required.
» Rerouting of access road Alternative 1 – the access road is planned to turn into the site before it crosses the tributary to the to the Helbrandkloofspruit.
» Relocation of the evaporation ponds away from the ephemeral drainage line.

The layout plan as presented in Figure 9.3 has been designed to avoid the majority of the sensitive environments on the site. This layout as presented is acceptable.

Conclusions

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 CSP Plant and associated infrastructure from proceeding on the identified site, provided that the recommended mitigation and management measures are implemented, and given due consideration during the process of finalising the facility layout.
» The proposed development on the site will create a localised reduction of indigenous trees and shrubs, geophytes and other species of conservation concern, but not to a degree that the current conservation status of such species will be negatively affected. Due to the areas of high ecological sensitivity being avoided by the design and layout of the CSP Plant, the **ecological impacts** of the CSP plant will be of a medium acceptable significance.
» The threat to **fauna and avifauna** communities would be from the loss of habitat, disturbance, collisions with the overhead power line and/or any interaction of fauna with the facility, and is not anticipated to have a significant negative impact on fauna in the area.
» Very sparse **heritage resources** were found during the field survey undertaken for the site. From an archaeological perspective the observed heritage resources may be regarded as being of generally low significance. The **fossil record** from Kalahari deposits is very poor with respect to finds of fossil bones of vertebrates.
» The cumulative significance of all the potential impacts on the **soils** is medium to low due to the limited scale of the development and the scarcity of development in the immediate surrounding area.
» The anticipated **visual** impact is not considered to be a fatal flaw from a visual perspective, considering the low incidence of visual receptors in the region and the contained area of potential visual exposure.
» The development will have both positive and negative **social** impacts. It will create employment and business opportunities for locals during both the construction and operational phases and represent an investment in clean, renewable energy infrastructure. The potential for cumulative impacts also exists due to the proximity of the other authorised and proposed CSP and solar projects adjacent to the site, however, these impacts are not considered to represent a fatal flaw, and in addition, there is no indication if (or when) other developments will take place.
» When considering these technical considerations, access Alternative 1 is nominated as the preferred access route alternative.
» The benefits of the project are expected to occur at a national, regional and local level. These benefits partially offset the localised environmental costs of the project.

The significance levels of the majority of identified negative impacts can generally

be reduced by implementing the recommended mitigation measures. With reference to the information available at this planning approval stage in the project cycle, the **confidence** in the environmental assessment undertaken is regarded as **acceptable**.

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 impacts associated with the development of the Upington Solar Thermal Plant Three can be managed and mitigated to an acceptable level.

In terms of this conclusion, the EIA project team support the decision for environmental authorisation.

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

» As far as possible, any component of the facility which could potentially affect areas of high environmental sensitivity should be avoided in the design and layout of the CSP Plant.
» Disturbed areas should be rehabilitated as quickly as possible and an on-going monitoring programme should be established to detect and quantify any alien species.
» During construction, unnecessary disturbance to habitats should be strictly controlled and the footprint of the impact should be kept to a minimum.
» All mitigation measures detailed within this report and the specialist reports contained within Appendices F to M to be implemented.
» The draft Environmental Management Programme (EMPr) as contained within Appendix N of this report should form part of the contract with the Contractors appointed to construct and maintain the proposed solar energy facility, and will be used to ensure compliance with environmental specifications and management measures. The implementation of this EMPr for all life cycle phases of the proposed project is considered key in achieving the appropriate environmental management standards as detailed for this project.
» A comprehensive stormwater management plan should be compiled for the developmental footprint prior to construction.
» An ecological walk through survey for the CSP plant and associated infrastructure (such as pipeline, power line and access roads) must be undertaken prior to construction.
» A permit to be obtained for removal of protected trees and provincially protected flora that are affected.
» A walk-through survey be undertaken by an avifauna specialist for the route of the power line only to identify sections of line requiring collision mitigation.
» The relevant Water Use Licenses for water uses (abstraction and

impacting of water courses) to be obtained from DWA.

» Applications for all other relevant and required permits required to be obtained by Abengoa Solar Power South Africa (Pty) Ltd must be submitted to the relevant regulating authorities. This includes permits for the transporting of all components (abnormal loads) to site, disturbance to any heritage sites, disturbance of protected vegetation and protected trees, disturbance to any water courses and for abstraction of water from any river.

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APPENDICES

ABBREVIATIONS AND ACRONYMS

BID	Background Information Document
CO_2	Carbon dioxide
CSP	Concentrated Solar Plant
DE&NC	Department of Environment & Nature Conservation
DEA	National Department of Environmental Affairs
DoE	Department of Energy
DWA	Department of Water Affairs
EAP	Environmental Assessment Practitioner
EIA	Environmental Impact Assessment
EMPr	Environmental Management Programme
FIT	Feed-in Tariffs
GDP	Gross Domestic Profit
GIS	Geographical Information Systems
GG	Government Gazette
GN	Government Notice
GHG	Green House Gases
GWh	Giga Watt Hour
I&AP	Interested and Affected Party
IDP	Integrated Development Plan
IPP	Independent Power Producer
km^2	Square kilometres
km/hr	Kilometres per hour
kV	Kilovolt
LUPO	Rezoning and Subdivision in terms of Land Use Planning Ordinance, Ordinance 15 of 1985
MAR	Mean Annual Rainfall
m^2	Square meters
m/s	Meters per second
MW	Mega Watt
NEMA	National Environmental Management Act (Act No. 107 of 1998)
NERSA	National Energy Regulator of South Africa
NHRA	National Heritage Resources Act (Act No. 25 of 1999)
NGOs	Non-Governmental Organisations
NWA	National Water Act (Act No. 36 of 1998)
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
SDF	Spatial Development Framework

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.

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.

Commercial Operation date: The date after which all testing and commissioning has been completed and is the initiation date to which the seller can start producing electricity for sale (i.e. when the project has been substantially completed).

Commence: The start of any physical activity, including site preparation and any other activity on site furtherance of a listed activity or specified activity, but does not include any activity required for the purposes of an investigation or feasibility study as long as such investigation or feasibility study does not constitute a listed activity or specified activity.

Commissioning: Commissioning commences once construction is completed. Commissioning covers all activities including testing after all components of the wind turbine are installed.

Construction: Construction means the building, erection or establishment of a facility, structure or infrastructure that is necessary for the undertaking of a listed or specified activity. Construction begins with any activity which requires Environmental Authorisation.

Cumulative impacts: Impacts that result from the incremental impact of the proposed activity on a common resource when added to the impacts of other past, present or reasonably foreseeable future activities (e.g. discharges of nutrients and heated water to a river that combine to cause algal bloom and subsequent loss of dissolved oxygen that is greater than the additive impacts of each pollutant). Cumulative impacts can occur from the collective impacts of individual minor actions over a period and can include both direct and indirect impacts.

Decommissioning: To take out of active service permanently or dismantle partly or wholly, or closure of a facility to the extent that it cannot be readily re-commissioned. This usually occurs at the end of the life of a facility.

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

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

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

Emergency: An undesired/ unplanned event that results in a significant environmental impact and requires the notification of the relevant statutory body, such as a local authority.

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, 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.

Hazardous waste: Any waste that contains organic or inorganic elements or compounds that may, owing to the inherent physical, chemical or toxicological characteristics of that waste, have a detrimental impact on health and the environment (Van der Linde and Feris, 2010;pg 185).

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 because 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 because of the activity.

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

Method statement: A written submission to the ECO and the site manager (or engineer) by the EPC Contractor in collaboration with his/her EO.

Natural properties of an ecosystem (*sensu* convention on wetlands): Defined in Handbook 1 as the "…physical, biological or chemical components, such as soil, water, plants, animals and nutrients, and the interactions between them." (Ramsar Convention Secretariat 2004. Ramsar handbooks for the wise use of wetlands. 2nd Edition. Handbook 1. Ramsar Convention Secretariat, Gland, Switzerland.) (See http://www.ramsar.org/).

No-go areas: Areas of environmental sensitivity that should not be impacted on or utilised during the development of a project as identified in any environmental reports.

Parabolic troughs: Mirrors that are trough-shaped reflectors which focus solar radiation onto a receiver at its focal point.

Pollution: A change in the environment caused by substances (radio-active or other waves, noise, odours, dust or heat emitted from any activity, including the storage or treatment or waste or substances.

Pre-construction: The period prior to the commencement of construction, this may include activities which do not require Environmental Authorisation (e.g. geotechnical surveys).

Ramsar convention on wetlands: "The Convention on Wetlands (Ramsar, Iran, 1971) is an intergovernmental treaty whose mission is "the conservation and wise use of all wetlands through local, regional, and national actions and international cooperation, as a contribution towards achieving sustainable development throughout the world." As of March 2004, 138 nations have joined the Convention as Contracting Parties, and more than 1300 wetlands around the world, covering almost 120 million hectares, have been designated for inclusion in the Ramsar List of Wetlands of International Importance." (Ramsar Convention Secretariat. 2004. Ramsar handbooks for the wise use of wetlands. 2nd Edition, Handbook 1. Ramsar Convention Secretariat, Gland, Switzerland.) (Refer http://www.ramsar.org/). South Africa is a Contracting Party to the Convention.

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

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

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

Waste: Any substance, whether or not that substance can be reduced re-used, recycled and recovered; that is surplus, unwanted, rejected, discarded, abandoned or disposed of which the generator has no further use for the purposes of production. Any product which must be treated and disposed of, that is identified as waste by the minister of Environmental affairs (by notice in the Gazette) and includes waste generated by the mining, medical or other sectors, but: A by-product is not considered waste, and portion of waste, once re-used, recycled and recovered, ceases to be waste (Van der Linde and Feris, 2010; pg 186).

INTRODUCTION CHAPTER 1

Abengoa Solar Power South Africa (Pty) Ltd is proposing the construction and operation of a commercial solar thermal electricity generating facility (using trough plant technology) and associated infrastructure near Upington, Northern Cape Province. The project is known as the Upington Solar Thermal Plant Three, and is one of three Abengoa Solar CSP facilities proposed to be established on Portion 3 of the farm McTaggarts Camp 453. The three Abengoa Solar facilities are as follows:

» Khi Solar One Solar Thermal Plant (a 50MW power tower technology), which is currently under construction (planned commercial operation date is end-2014)
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» Proposed Upington Solar Thermal Plant Three (up to 125MW trough plant technology), which is the subject of this EIA (DEA Ref Number 14/12/16/3/3/2/657).

Each project is located on a different area within Portion 3 of the Farm McTaggarts Camp 453, which lies approximately 20 km west of the town of Upington in the Northern Cape. It is the developer's intention to bid each CSP Facility under the Department of Energy's (DoE) Renewable Energy Independent Power Producer Procurement (REIPPP) Programme. The power generated from the CSP facilities will be sold to Eskom through a 20-year power purchase agreement (PPA) and will feed into the national electricity grid. Ultimately, the projects are intended to be a part of the renewable energy projects portfolio for South Africa. **This EIA Report applies to the Proposed Upington Solar Thermal Plant Three (DEA Reference Number: 14/12/16/3/3/2/657).**

As the project has the potential to impact on the environment, an Environmental Impact Assessment process is required to be completed in support of an application for Environmental Authorisation prior to the commencement of construction of the project. This EIA Report assesses this proposed project and consists of ten chapters, which include:

» **Chapter 1** provides background to the proposed project and the environmental impact assessment, and an introduction to the rationale behind the selected site and technology proposed.
» **Chapter 2** outlines the strategic legal context for the energy planning and the proposed project.
» **Chapter 3** provides a description of the proposed project as well the need and desirability for the Upington Solar Thermal Plant Three project.
» **Chapter 4** provides details of the alternatives considered for the proposed project.
» **Chapter 5** outlines the process which was followed during the EIA process.

» **Chapter 6** describes the existing biophysical and socio-economic environment affected by the proposed project.
» **Chapter 7** provides an assessment of the potential issues and impacts associated with the proposed project and presents recommendations for mitigation of significant impacts.
» **Chapter 8** provides an assessment of cumulative impacts.
» **Chapter 9** presents the conclusions and recommendations based on the findings of the EIA.
» **Chapter 10** provides references used to compile the EIA Report.

1.1. Background to the Proposed Upington Solar Thermal Plant Three Project

The Upington Solar Thermal Plant Three is proposed to utilise parabolic trough technology with a generation capacity of up to 125MW[3]. A locality map showing the proposed location of the Upington Solar Thermal Plant Three on Portion 3 of the Farm McTaggarts Camp 453 (and in relation to the Khi Solar One facility under construction, and the proposed Upington Solar Thermal Two facility) is included as Figure 1.1. The site falls within Ward 8 of the Kai !Garib Local Municipality but is physically closer to the Town of Upington.

Site selection: Why is this development proposed on portion 3 of McTaggarts Camp 453?

The Northern Cape has the best solar resource in the South Africa. Based on existing infrastructure, one of the best suited areas in the Northern Cape for solar energy facilities is close to and surrounding the town of Upington. The proposed location is in close proximity (within 10km) of this town.

The Khi Solar One plant located on Portion 3 of McTaggarts Camp 453 is one of the first CSP facilities awarded preferred bidder status by the Department of Energy, and commenced construction activities in 2012. The Khi Solar One facility only occupies a portion (less than 30%) of the total extent of the farm[4]. The construction of one CSP facility presents opportunities for other facilities to be constructed in the same location in order to benefit from infrastructure and services which have been established to service the first facility established. Abengoa Solar Power South Africa have identified these opportunities and now propose a further CSP facility on the same farm:

[3] Parabolic trough plants are modular in nature, and can easily be adapted to change the generation capacity of the plant. It is expected that the Department of Energy may soon make provision for CSP facilities up to a capacity of 125MW to be bid through their REIPPP Programme (current cap as of March 2014 is 100MW).
[4] The full extent of the farm is owned by Abengoa Solar Power South Africa.

» The new Eskom McTaggerts Substation is located on the McTaggarts Camp property and Eskom's planned transmission grid expansion (by 2016) in close proximity provides a secure point of evacuation for the power to be generated at a new facility.

» A CSP plant requires water for the steam generation process and mirror cleaning. Water is only available from the Gariep River. To reduce the environmental impact on the river, existing abstraction points should be used. The Upington Solar Thermal Plant Three project will abstract water from an existing pool in the river, which currently supplies the Khi Solar One plant, therefore combining infrastructure and reducing the potential for impact.

» No natural ground water exists on the property. The land is not optimal for agricultural land use activities, and the use of the land for solar power production makes use of land that will not have otherwise contributed to development and sustainability.

» The gradient of the land is <1%, making it ideal for CSP construction, which requires a flat surface.

» The farm portion is not a greenfields site and has been disturbed through construction of the Khi Solar One facility in the southern portion of the site. In addition, old excavations and diggings are found in the northern portion of the site where tungsten was dug by hand during the Great Depression (1930 – 1935). The diggings were never rehabilitated.

Approximately 1200 people are currently being employed on the construction site of Khi Solar One, with a significant number coming from the nearby communities (Klippunt, Sesbrugge, Daysons Klip and others). Significant resources and expenses have been incurred by Abengoa Solar to train people in a variety of disciplines in the CSP industry. Developing this project at the same location will create sustainability in employment, in that workers can move from the one project to another.

Further, industries have been created in Upington and the surrounding communities to provide products and services to the Khi Solar One project. Developing the next phase on Portion 3 of the Farm McTaggarts Camp 453 will allow these businesses to continue trading and positively impact on the lives of the community.

Technology selection: Why consider CSP Trough Technology for the development?

Abengoa Solar is the only solar company that commercially implements all CSP technological solutions in projects worldwide. As such, projects are designed to most optimally suit the techno-economic needs of the specific situation or customer.

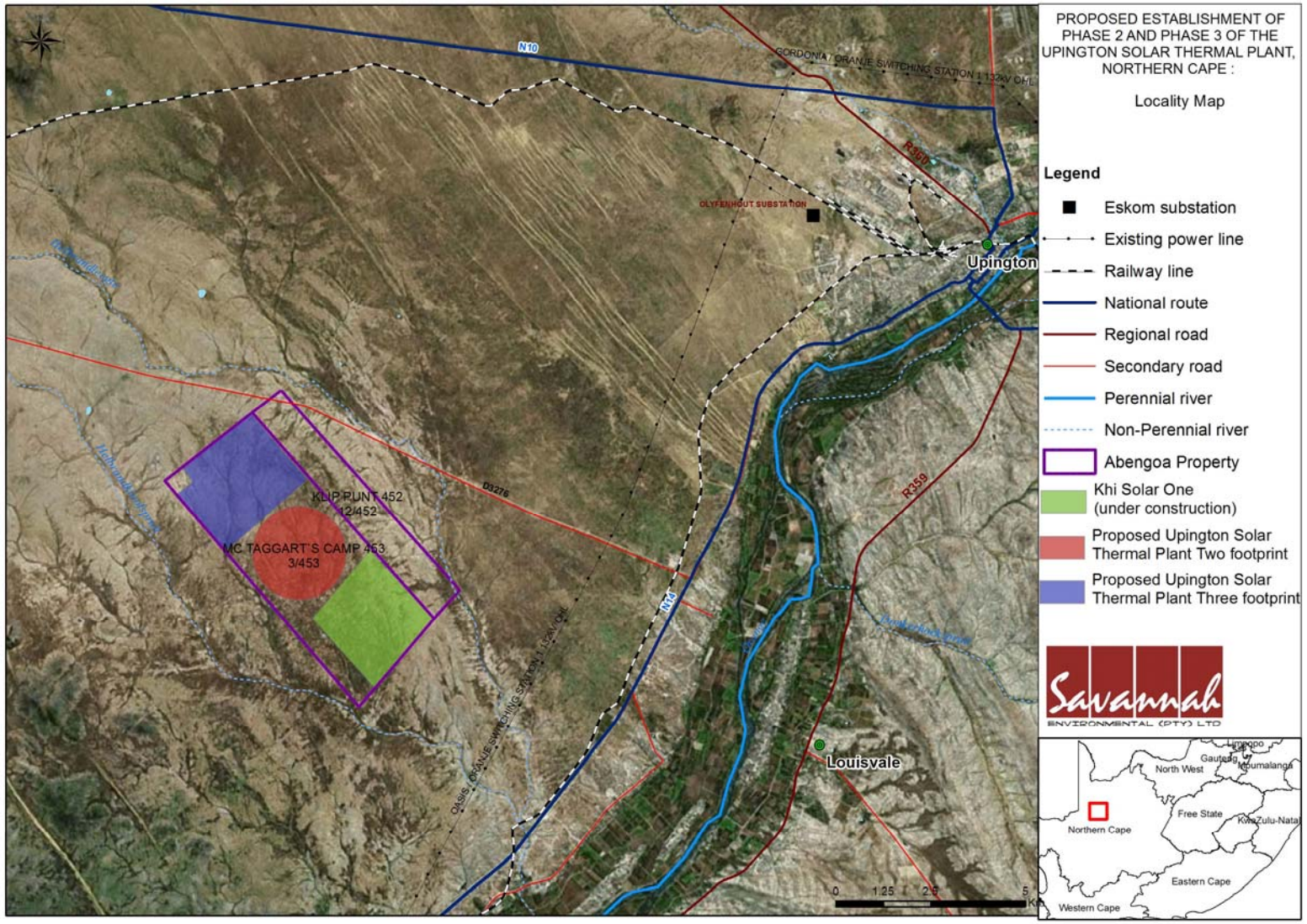

Figure 1.1: Locality map showing the proposed site for the construction of the Upington Solar Thermal Plant Three (in relation to the Khi Solar One Solar Thermal Plant and proposed Upington Solar Thermal Plant Two) on Portion 3 of the farm McTaggarts Camp 453

The Khi Solar One project being developed by Abengoa Solar was limited to the available grid capacity, and no significant storage requirements were in place when the project was developed as part of Round 1 of the REIPPPP programme. As such a 50MW CSP steam tower, with steam storage was found as the optimal solution.

For Round 3 of the REIPPP Programme, the DOE provided an incentive for projects being able to contribute to peak power generation, specifically being able to generate between the hours of 16:30 and 21:30, i.e. requiring at least 5 hours of energy storage for electricity generation to continue after the sun has set (i.e. the primary energy source lost). It was further found that the grid upgrade by Eskom anticipated in 2016 would allow an additional 125MW to be fed into the grid in Upington.

Therefore, considering all these factors, a 125MW parabolic trough with molten salt energy storage represents the optimal technology choice to meet the requirements of the DOE for Round 4 and deliver the greatest value to the country as a whole through socio-economic development being created and least-cost impact on the electricity consumer. Therefore the proposed 125MW Upington Solar Thermal Plant Three is highly preferred from a technical, financial and socio-economic perspective. Environmental feasibility as well as potential impacts of the project is determined further in this EIA report.

Project details: What is proposed for the CSP Facility?

The Upington Solar Thermal Plant Three is proposed to utilise parabolic trough technology with a generation capacity of up to 125MW, and energy storage of up to 6 hours (using molten salts technology). The trough system will be comprised of **parabolic collectors** (i.e. trough-shaped reflectors which focus the solar radiation onto a receiver at its focal point), a **receiver tube**/heat collection element (i.e. a metal absorber containing the heat transfer fluid surrounded by a glass envelope which absorbs the solar energy received from the parabolic trough), a **sun-tracking system** (i.e. an electronic control system and associated mechanical drive system used to focus the reflector onto the sun), and **support structure** (i.e. holds the parabolic trough in accurate alignment with incoming solar radiation while resisting the effects of the wind). The collected energy in the heat transfer fluid is used to generate steam through a conventional heat exchanger system that is in turn used for electricity generation in a conventional steam turbine and generator.

The Upington Solar Thermal Plant Three will have a development footprint of up to 500 ha, to be placed within a demarcated area of 660ha (which is located within a broader site of ~2200 ha) and will include the following associated infrastructure:

- Parabolic troughs (parabolic collector units arranged in loops to establish the solar field (i.e. to cover a total extent of approximately 400 ha) with an approximate height of 6m.
- Power island which will include a steam turbine and generator; a generator transformer and substation; auxiliary fossil fuel and/or electric boilers and associated molten salt storage vessels and heat exchangers (approximately 200m x 500m in extent).
- Access roads (road up to 6m wide).
- Plant substation (50m x 50m).
- 132 kV power line up to 8km in length to connect to Eskom's existing McTaggerts Substation, which is located on the same property as the proposed CSP Plant.
- Water abstraction point located at the Gariep River, filter station (20m x 30m) and water supply pipeline (up to 20km in length).
- Water storage reservoir and tanks (combined capacity up to 15 000m^3).
- Packaged water treatment plant (roughly 30m x 30 m).
- Up to 5 lined evaporation ponds (approximately 100m x 100m each).
- Workshop and office buildings (approximately 20m x 50m each).
- Mirror assembly facility (approximately 100m x 50m).

The scope of the proposed Upington Solar Thermal Plant Three, including details of all elements of the project (for the design/planning, construction, operation and decommissioning phases) is discussed in more detail in Chapter 2.

1.2. Details of the Environmental Assessment Practitioners and Specialist Team

Savannah Environmental was contracted as the independent EAP to undertake both Scoping and EIA Phases for the propose projects. Neither Savannah Environmental nor any of its specialist sub-consultants on this project are subsidiaries of or are affiliated to Abengoa Solar Power South Africa (Pty) Ltd in any way. Furthermore, Savannah Environmental does not have any interests in secondary developments that could arise out of the authorisation of the proposed projects.

Savannah Environmental is a specialist environmental consulting company providing holistic environmental management services, including environmental impact assessments and planning to ensure compliance and evaluate the risk of development, and the development and implementation of environmental management tools. Savannah Environmental benefits from the pooled resources, diverse skills and experience in the environmental field held by its team.

The Savannah Environmental team have considerable experience in environmental impact assessments and environmental management, and have been actively involved in undertaking environmental studies, for a wide variety of projects throughout South Africa, including those associated with electricity generation.

- *Ravisha Ajodhapersadh*, principle author of this report, holds an Honours Bachelor of Science degree in Environmental Management and has 7 years of experience in environmental management. She has undertaken EIAs for various proposed solar energy facilities in South Africa and has been involved in other projects in the Northern Cape.
- *Karen Jodas,* is a Professional Natural Scientist and holds a Master of Science degree and is the registered EAP on the proposed project. She has 17 years of experience consulting in the environmental field. Her key focus is on strategic environmental assessment and advice; management and co-ordination of environmental projects, which includes integration of environmental studies and environmental processes into larger engineering-based projects and ensuring compliance to legislation and guidelines; compliance reporting; the identification of environmental management solutions and mitigation/risk minimising measures; and strategy and guideline development. She is currently responsible for the project management of EIAs for several renewable energy projects across the country.

In order to adequately identify and assess potential environmental impacts associated with the proposed project, the following specialist sub-consultants have provided input into this EIA report:

- Ecology (flora, fauna and avifauna) – Marianne Strohbach and Blair Zoghby
- Soils and Agricultural Potential – Johann Lanz
- Heritage – David Morris
- Palaeontology - John Pether
- Visual - Bernard Oberholzer and Quinton Lawson
- Surface Water Assessment - Brian Colloty
- Noise - Morne De Jager

Refer to Appendix A for the curricula vitae for the EAPs and specialist sub-consultants.

STRATEGIC CONTEXT FOR ENERGY PLANNING CHAPTER 2

2.1. National Policy and Planning Context for Solar Energy Facility Development in South Africa

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 National Energy Regulator of South Africa (NERSA) and Eskom. The hierarchy of policy and planning documentation that support the development of renewable energy projects such as solar energy facilities is illustrated in Figure 3.1. These policies are discussed in more detail in the following sections, along with the provincial and local policies or plans that have relevance to the proposed facility's development.

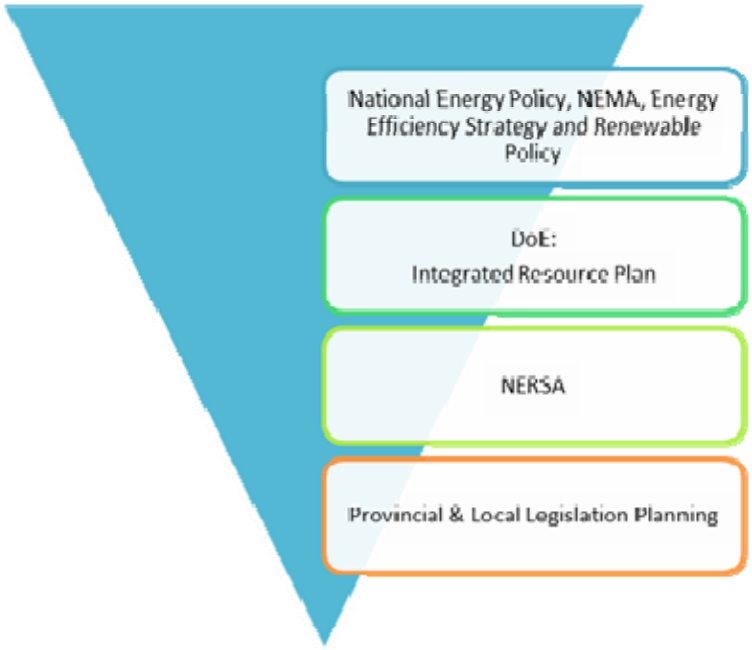

Figure 2.1: Hierarchy of electricity policy and planning documents

2.1.1 The National Energy Act (2008)

The National Energy Act was promulgated in 2008 (Act No 34 of 2008). One of the objectives of the Act was to promote diversity of supply of energy and its sources. In this regard, the preamble makes direct reference to renewable resources, including solar:

> *"To ensure that diverse energy resources are available, in sustainable quantities, and at affordable prices, to the South African economy, in support of*

economic growth and poverty alleviation, taking into account environmental management requirements (…); to provide for (…) increased generation and consumption of renewable energies…(Preamble)."

The National Energy Act aims to ensure that diverse energy resources are available, in sustainable quantities and at affordable prices, to the South African economy in support of economic growth and poverty alleviation, taking into account environmental management requirements and interactions amongst economic sectors, as well as matters relating to renewable energy. The Act provides the legal framework which supports the development of renewable energy facilities for the greater environmental and social good.

2.1.2 White Paper on the Energy Policy of the Republic of South Africa, 1998

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

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

2.1.3 White Paper on the Renewable Energy Policy of the Republic of South Africa (2003)

The White paper on renewable energy supplements the Governments overarching policy on energy as set out in its White Paper on the Energy Policy of the republic of South Africa (DME, 1998). The White Paper on Renewable Energy Policy recognises the significance of the medium and long-term potential of renewable energy. The main aim of the policy is to create the conditions for the development and commercial implementation of renewable technologies. The White Paper on Energy Policy's position with respect to renewable energy is based on the integrated resource planning criterion of:

"Ensuring that an equitable level of national resources is invested in renewable technologies, given their potential and compared to investments in other energy supply options."

This White Paper on Renewable Energy (November, 2003) sets out Government's vision, policy principles, strategic goals and objectives for promoting and implementing renewable energy in South Africa. South Africa relies heavily on coal to meet its energy

needs because it is well-endowed with coal resources; in particular. However South Africa is endowed with renewable energy resources that can be sustainable alternatives to fossil fuels, so far these have remained largely untapped. The White Paper on Renewable Energy sets a target of generating 10 000GWh from renewable energy sources. Therefore the policy supports the investment in renewable energy facilities sources at ensuring energy security through the diversification of supply.

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) and more so when social and environmental costs are taken into account. In spite of this range of resources, the National Energy Policy acknowledges that the development and implementation of renewable energy applications has been neglected in South Africa.

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

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

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*."

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

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

The outcome of the process confirmed that coal-fired options are still required over the next 20 years and that additional base load plants will be required from 2010. The first and interim IRP was developed in 2009 by the Department of Energy. The initial four years of this plan was promulgated by the Minister of Energy on 31 December 2009, and updated on 29 January 2010. The Department of Energy released the Final IRP in March 2011, which was accepted by Parliament at the end of the same month. This Policy-Adjusted IRP is recommended for adoption by Cabinet and subsequent promulgation as the final IRP. In addition to all existing and committed power plants (including 10 GW committed coal), the plan includes 9.6 GW of nuclear; 6.3 GW of coal; 17.8 GW of renewables (including 8.4GW solar); and 8.9 GW of other generation sources.

2.1.5 Electricity Regulation Act, 2006

Under the National Energy Regulator Act, 2004 (Act No 40 of 2004), the Electricity Regulation Act, 2006 (Act No 4 of 2006) and all subsequent relevant Acts of Amendment, NERSA has the mandate to determine the prices at and conditions under which electricity may be supplied by licence to Independent Power Producers (IPPs). NERSA has recently awarded electricity generation licences for new generation capacity projects under the REIPPP programme.

2.2. Provincial Policy and Planning Context

3.1.1 Northern Cape Provincial Growth and Development Strategy

The Northern Cape Provincial Growth and Development Strategy (NCPGDS) identified poverty as the most significant challenge in the Province. All other societal challenges that the Province faces emanate predominantly from the effects of poverty. The NCPGDS notes that the only effective way to reduce poverty is through long-term sustainable economic growth and development. The NCPGDS make reference to the need to ensure the availability of inexpensive energy. The document states that in order to promote economic growth in the Northern Cape the availability of electricity to key industrial users at critical localities at rates that enhance the competitiveness of their industries must be ensured. At the same time, the development of new sources of

energy through the promotion of the adoption of energy applications that display a synergy with the province's natural resource endowments must be encouraged. In this regard the NCPGDS notes "the development of energy sources such as solar energy, the natural gas fields, bio-fuels, etc., could be some of the means by which new economic opportunity and activity is generated in the Northern Cape". The NCPGDS also highlights the importance of close co-operation between the public and private sectors in order for the economic development potential of the Northern Cape to be realised. The NCPGDS also highlights the importance of enterprise development, and notes that the current levels of private sector development and investment in the Northern Cape are low. In addition, the Province also lags in the key policy priority areas of SMME Development and Black Economic Empowerment. The proposed CSP Plant developments are therefore in line with the Northern Cape Provincial Growth and Development Strategy.

3.1.2 Northern Cape Provincial Spatial Development Framework

The Northern Cape Provincial Spatial Development Framework (SDF) of 2012 lists a number of sectoral strategies and plans are to be read and treated as key components of the SDF. Of these there are a number that are relevant to the proposed CSP Plant. The SDF notes that various solar parks and CSP plants have been proposed in the Province, with the Upington area being the hub of such developments (NCPSDF, 2012). The SDF sets out the energy objectives for the Northern Cape Province which makes specific reference to renewable energy. Therefore the CSP facility falls within the key area of the Province ear-marked for solar energy developments.

2.3. Local Policy and Planning Context

2.3.1 Kai! Garib Local Municipality Integrated Development Plan

The Kai !Garib Local Municipality's IDP 2013-2014 identifies a number of Key Performance Areas (KPAs) for development within the municipality. The KPAs that are relevant to the proposed CSP project includes:

» KPA 1: Service Delivery and Infrastructure Development
» KPA 2: Local Economic Development

The renewable energy sector is also recognised as a key sector within the Municipality. The IDP notes that a number of new opportunities have opened up for the Kai !Garib municipal area since the need to facilitate the generation of sustainable energy was introduced in South Africa by Eskom and the South African government. The IDP notes that there are a number of solar projects proposed in the area and that the economic benefits from these projects are eagerly anticipated. Therefore the development of the CSP project is desirable by the local municipality.

2.3.2. //Khara Hais Local Municipality Integrated Development Plan

The //Khara Hais Local Municipality's (KHLM) IDP notes that the SDF identifies the establishment of the Upington Solar Park as a key anchor project. The Upington Solar Park is part of the South African government's policy to reduce the country's dependence on coal-based electricity by introducing renewable energy. Eskom made an undertaking to overcome a major constraint to the development of the solar park by constructing an additional 400kV transmission line to enable solar energy to be exported from the Solar Park. Other key potential developments that have a bearing on the proposed CSP plants include the Upington Industrial Development Zone. The Upington IDZ (± 400 ha) will be a purpose-built industrial estate linked to the Upington Airport. The IDZ will leverage fixed direct investments in value added and export-oriented manufacturing industries. Therefore the CSP project also fits in with the adjacent municipal development plans.

2.3.3. ZF Mgcawu (Siyanda) District Municipality Integrated Development Plan (IDP)

The development of the CSP Plant is aligned with the development goals and objectives listed in the ZF Mgcawu (formerly Siyanda) District Municipality's IDP, such as:

» To deliver a positive contribution to the sustainable growth and development within its boundaries and the rest of the Northern Cape.
» The creation of a healthy and environmentally friendly environment within and outside of the Councils" district boundaries, must be attempted;
» The promotion of human resources within and outside the organisation through training and the implementation of new technological aids.
» Promote the infrastructure development, including electricity.

2.3.4. ZF Mgcawu District Municipality Environmental Management Framework

The ZF Mgcawu (formerly Siyanda) District Municipality has compiled an Environmental Management Framework (EMF), in which environmental concerns and conservation priorities for all landscapes within the municipality are listed and mapped. According to the EMF, Bushmanland Arid Grasslands have a medium conservation priority and the proposed project area does not fall within areas earmarked for conservation.

Similarly, the proposed project area has been mapped as Zone 7 in the EMF Environmental Control Zones, indicating the threat that the area has relatively less sensitivity than other zones and no special protection or environmental management parameters or concerns, except those already implemented or required by law. This implies that there is no specific restriction on development of the area.

The Lower Gariep Alluvial Vegetation (which is located outside the site) on the banks of the Gariep River is regarded as a Critical Biodiversity Area, of which remaining sections have been listed as threatened ecosystems. These areas fall outside the proposed development footprint.

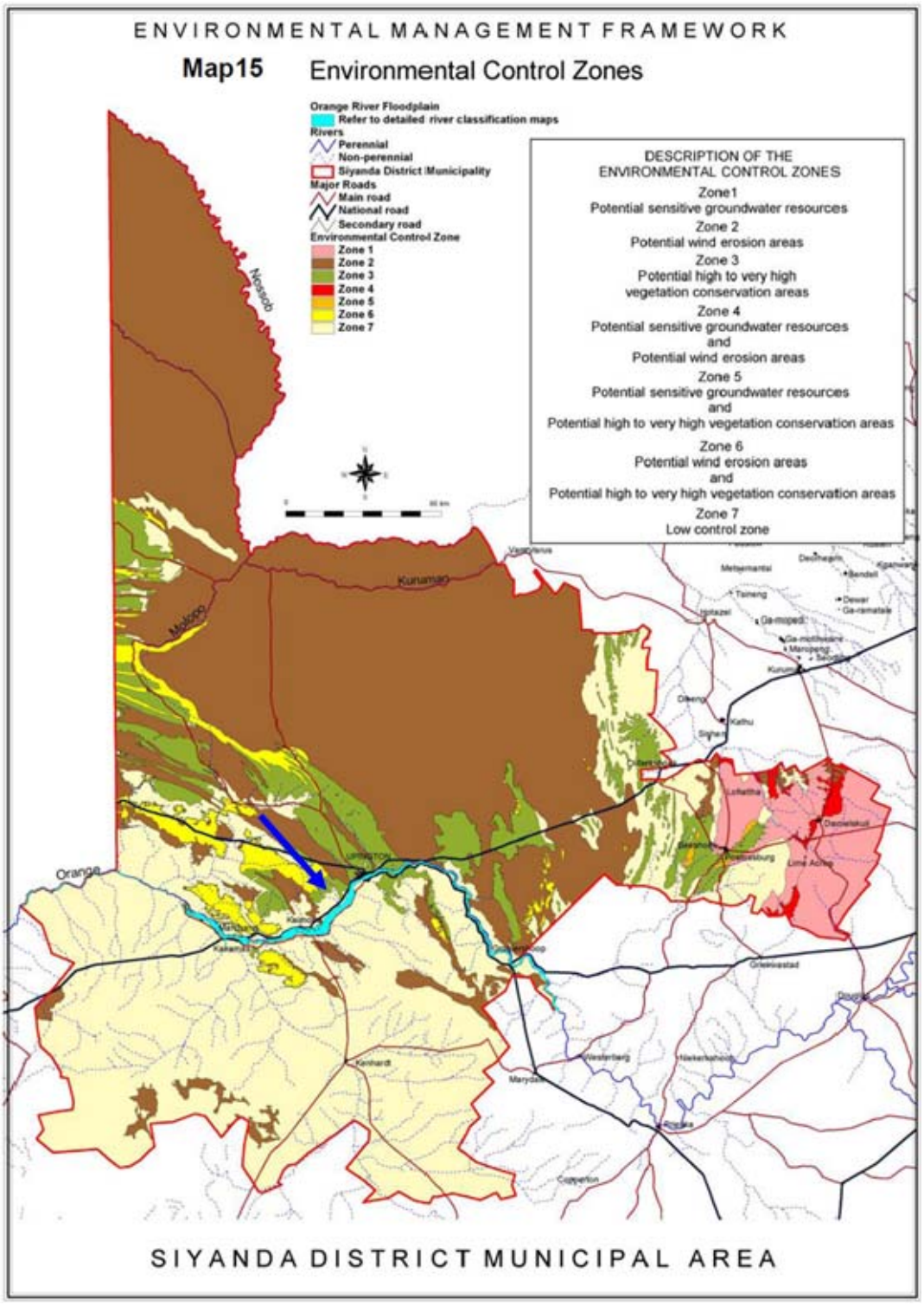

Figure 2.2: Map from the ZF Mgcawu (formerly Siyanda) EMF showing the environmental control zones. The proposed development location is indicated by the blue arrow

2.4. Regulatory Hierarchy for Energy Generation Projects

The South African energy industry is evolving rapidly, with regular changes to legislation and industry role-players. The regulatory hierarchy for an energy generation project of this nature consists of three tiers of authority who exercise control through both statutory and non-statutory instruments – that is National, Provincial and Local levels.

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

» *Department of Energy (DoE):* This Department is responsible for policy relating to all energy forms, including renewable energy, and is responsible for forming and approving the IRP (Integrated Resource Plan for Electricity).
» *National Energy Regulator of South Africa (NERSA):* This body is responsible for regulating all aspects of the electricity sector, and will ultimately issue licenses for solar energy developments to generate electricity.
» *Department of Environmental Affairs (DEA):* This Department is responsible for environmental policy and is the controlling authority in terms of NEMA and the EIA Regulations. The DEA is the competent authority for this project, and charged with granting the relevant environmental authorisation.
» *The South African Heritage Resources Agency (SAHRA):* SAHRA is a statutory organisation established under the National Heritage Resources Act, No 25 of 1999, as the national administrative body responsible for the protection of South Africa's cultural heritage.
» *National Department of Agriculture, Forestry, and Fisheries (DAFF):* This Department is responsible for activities pertaining to subdivision and rezoning of agricultural land. The forestry section is responsible for the protection of tree species under the National Forests Act (Act No 84 of 1998).
» *South African National Roads Agency (SANRAL):* This Agency is responsible for the regulation and maintenance of all national routes.
» *National Department of Water Affairs:* This Department is responsible for water resource protection, water use licensing and permits. Water uses within this area of the Northern Cape are not generally authorised by DWA, and so water use license applications are routed to the National Department for approval.
» *Eskom:* Commenting authority regarding Eskom infrastructure and grid connection.

At the Provincial Level, the main regulatory agencies are:

» *Provincial Government of the Northern Cape – Department of Environmental and Nature Conservation (NC DENC):* This Department is the commenting authority for the project.

- *Department of Transport and Public Works:* This Department is responsible for roads and the granting of exemption permits for the conveyance of abnormal loads on public roads.
- *Provincial Department of Water Affairs:* This Department is responsible for water resource protection, water use licensing and permits.
- *Ngwao Boswa ya Kapa Bokone (Northern Cape Heritage Authority):* This body is responsible for commenting on heritage related issues in the Northern Cape Province.
- *Northern Cape Department of Agriculture, Land Reform and Rural Development:* This Department is responsible for all matters which affect agricultural land.
- *Northern Cape Department of Mineral Resources (DMR):* Approval from the may be required to use land surface contrary to the objects of the Act in terms of Section 53 of the Mineral and Petroleum Resources Development Act (Act No 28 of 2002): In terms of the Act approval from the Minister of Mineral Resources is required to ensure that proposed activities do not sterilise a mineral resource that might occur on site.

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

DESCRIPTION OF THE PROPOSED PROJECT CHAPTER 3

This chapter provides a description of the components and infrastructure which comprises the Upington Solar Thermal Plant Three, the need and desirability of the project and details the project scope which includes the planning/design, construction, operation and decommissioning activities. This chapter also explores site and technology alternatives as well as the 'do nothing' option. Lastly, it provides some insight to concentrated solar energy facilities as a means for power generation.

The Upington Solar Thermal Plant Three is proposed to consist of Parabolic Trough technology using heat transfer fluid (HTF), with a generation capacity of up to 125MW. The Concentrated Solar Power (CSP) facility will include the following associated infrastructure: parabolic troughs arranged in loops, a power island including a steam turbine generator, auxiliary boilers, salt or direct steam storage vessels, plant substation, power line, access roads, water abstraction point on the Gariep River and supply pipeline, water storage tanks, packaged water treatment plant, lined evaporation ponds, workshop, mirror assembly facility and office buildings. The Upington Solar Thermal Plant Three will be located in the north-western portion of Portion 3 of the Farm McTaggarts Camp 453.

The Upington Solar Thermal Plant Three will have a total development footprint of up to 500 hectares (within a 660ha portion of the larger 2200 ha farm) and includes the following infrastructure:

» Parabolic troughs (parabolic collector units arranged in loops to establish the solar field (i.e. to cover a total extent of approximately 400 ha) with an approximate height of 6m.
» Power island which will include a steam turbine and generator; a generator transformer and substation; auxiliary fossil fuel and/or electric boilers and associated molten salt storage vessels and heat exchangers (approximately 200m x 500m in extent).
» Access roads (road up to 6m wide).
» Plant substation (50m x 50m).
» 132 kV power line up to 8km in length to connect to Eskom's existing McTaggerts Substation, which is located on the same property as the proposed CSP Plant.
» Water abstraction point located at the Gariep River, filter station (20m x 30m) and water supply pipeline (up to 20km in length).
» Water storage reservoir and tanks (combined capacity up to 15 000m^3).
» Packaged water treatment plant (roughly 30m x 30 m).
» Up to 5 lined evaporation ponds (approximately 100m x 100m each).
» Workshop and office buildings (approximately 20m x 50m each).
» Mirror assembly facility (approximately 100m x 50m)

3.1. Need and desirability of the proposed project

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

3.1.1 Kai !Garib Local Municipality Integrated Development Plan

The Kai !Garib Local Municipality's IDP 2013-2014 identifies a number of Key Performance Areas (KPAs) for development within the municipality. The IDP notes that there are a number of solar projects proposed in the area and that the economic benefits from these projects are eagerly anticipated. Therefore the development of the CSP project is desirable by the local municipality and aligned with the IDP.

3.1.2 //Khara Hais Local Municipality Integrated Development Plan

The //Khara Hais Local Municipality's (KHLM) IDP notes that the SDF identifies the establishment of the Upington Solar Park as a key anchor project. The Upington Solar Park is part of the South African government's policy to reduce the country's dependence on coal-based electricity by introducing renewable energy. The CSP project also fit in to the adjacent municipal development plans.

3.1.3 Strategic Integrated Projects (SIPs)

In 2010, a National Development Plan was drafted to address socio economic issues affecting development in South Africa. These issues were identified and placed under 18 different Strategic Integrated Projects (SIPs) to address the spatial imbalances of the past by addressing the needs of the poorer provinces and enabling socio-economic development. Amongst these is the green energy in support of South African Economy i.e. SIP 8. The SIP aims at supporting sustainable green energy initiatives on national scale through a diverse range of clean energy options as envisaged in the Integrated Resource Plan (IRP, 2010). Abengoa Solar Power South Africa (Pty) Ltd is proposing the establishment of the CSP Plant for the purpose of reducing total carbon emissions and diversifying electricity supply. In the event of the projects being developed, it will contribute to the local electricity supply and increase the security of supply to consumers. In addition, the implementation of the proposed project will both economic stimulus to the local economy through the construction process and long term employment in site management and operation and maintenance of the facility.

Therefore should the proposed CSP Plant become a preferred bidder project, it could potentially become a SIP 8 project.

3.1.4 Renewable Energy Development Zones (REDZ)

The DEA has been mandated to undertake a Strategic Environmental Assessment (SEA) process. The wind and solar photovoltaic SEAs are being undertaken in order to identify geographical areas most suitable for the rollout of wind and solar photovoltaic energy projects and the supporting electricity grid network. The DEA and CSIR have released a map with focus areas best suited for the roll-out of wind and solar photovoltaic energy projects in South Africa. Although CSP technology has not been specifically considered in the SEA, it follows that all solar technologies would be focussed in similar areas. The aim of the assessment is to designate renewable energy development zones (REDZs) within which such development will be incentivised and streamlined. The proposed Upington Solar Thermal Plant Three falls within the identified geographical areas / focus area most suitable for the rollout of the development of solar energy projects (called "Upington Solar priority area") within the Northern Cape Province.

Coupled to the Renewable Energy SEA, Eskom's Electricity Grid Infrastructure Strategic Environmental Assessment (SEA) is also underway. The area where the Upington Solar Thermal Plant Three is proposed is currently within the corridor planned to be strengthened by Eskom.

3.1.5 The Need for the CSP Plant

The need for harnessing renewable energy resources (such as solar energy for electricity generation) is linked to increasing pressure on countries to increase their share of renewable energy generation due to concerns such as exploitation of non-renewable resources and the rising cost of fossil fuels. In order to meet the long-term goal of a sustainable renewable energy industry, a target of 17.8 GW of renewables by 2030 has been set by the Department of Energy (DoE) within the Integrated Resource Plan (IRP) 2010 and incorporated in the Renewable Energy Independent Power Producer Procurement (REIPPP) Programme initiated by the DoE. This programme has been designed so as to contribute towards a target of 3725 MW to be generated from renewable energy sources, required to ensure the continued uninterrupted supply of electricity, towards socio-economic and environmentally sustainable growth, and to start and stimulate the renewable industry in South Africa. The energy procured through this programme will be produced mainly from wind, solar, biomass, and small-scale hydro (with wind and solar comprising the bulk of the power generation capacity). This 17,8GW of power from renewable energy amounts to ~42% of all new power generation being derived from renewable energy forms by 2030.

In responding to the growing electricity demand within South Africa, as well as the country's targets for renewable energy, Abengoa Solar Power South Africa (Pty) Ltd proposes the establishment of the Upington Solar Thermal Plant Three to add new capacity to the national electricity grid. The development of the project would benefit the local/regional/national community by developing a renewable energy project. Surrounding communities would also benefit from the development through job creation and spin-offs. In addition, according to Department of Energy (DoE) bidding requirements the developer must plan for a percentage of the profit per annum from the solar energy facility to go back into the community through a social beneficiation scheme. Therefore there is a potential for creation of employment and business opportunities, and the opportunity for skills development of for the local community.

The projects have the potential to contribute to the national electricity supply and to increase the security of supply to consumers as well as supporting South Africa's commitment to reducing greenhouse gas emissions. Over 90% of South Africa's electricity generation is currently coal-based, resulting in annual per capita carbon emissions of approximately 8.9 tons per person, according to 2008 World Bank estimates. According to the Carbon Dioxide Information Analysis Centre, South Africa is the 13th largest carbon dioxide emitting country, based on 2008 fossil-fuel CO_2 emissions. The nation is also the largest emitting country on the continent of Africa, pinpointing the importance of introducing greener solutions to the energy mix. Furthermore, it may provide both economic stimulus to the local economy through the construction process and long term employment (i.e. management and maintenance) during the operation phase of the project.

3.1.6 The Desirability of the CSP Plant

The use of solar irradiation for electricity generation is essentially a non-consumptive use of a natural resource. A solar energy facility also qualifies as a Clean Development Mechanism (CDM) project (i.e. a financial mechanism developed to encourage the development of renewable technologies) as it meets all international requirements in this regard. The proposed site was selected for the development of multiple CSP Plants based on its predicted climate (solar resource), suitable proximity in relation to the existing and available electricity grid, and minimum technical constraints from a construction and technical perspective. Studies of solar irradiation worldwide indicate that the Northern Cape shows great potential for the generation of solar power. The proposed project is located in an area of high irradiation generating up to 2240 kWh/m² annually, as shown in Figure 3.1 below.

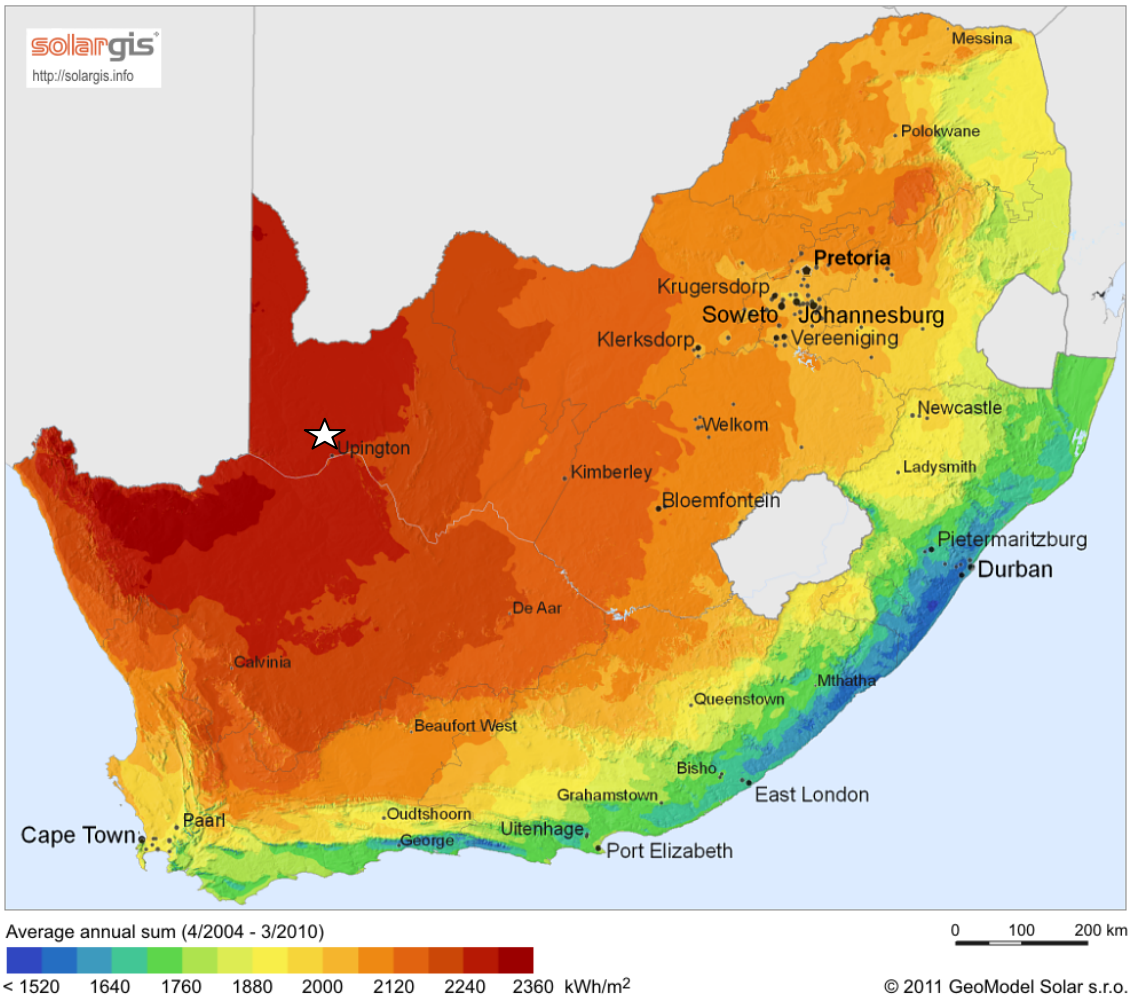

Figure 3.1 Solar irradiation map for South Africa (Source: GeoModel Solar, 2011). The study area is indicated by the white star.

Receptiveness of the site to CSP Development:

Abengoa Solar Power South Africa (Pty) Ltd considers this area, and specifically the demarcated site on Portion 3 of the Farm McTaggarts Camp 453, to be highly preferred for the development of a solar energy facility. The reasons include:

» Extent of site: Availability of level land of sufficient area can be a restraining factor, as a 125 MW parabolic trough system requires 500 ha of land space. The larger farm portion owned by the developer is approximately 22 km^2 in extent, and the northern portion of the farm which is allocated for the development of the trough plant is 660ha in extent, which is sufficient for the installation of the facility allowing for avoidance of site sensitivities.

» Power transmission considerations: An Eskom substation has been built on the site for the Khi Solar One CSP project, and allows for direct connection of the Upington Solar Thermal Plant Three to this new McTaggerts Substation (<8km of power line required).

» Site access: the site can be readily accessed via the N14 national road, or via the D3276. The Khi Solar One project has also established a formal access off the N14 for access to the McTaggarts Camp farm which could provide access for a portion of the distance to the site.
» Loss of current land use: There are no cultivated agricultural land in the study area or directly adjacent to it, which could be impacted upon by the proposed development.
» Climatic conditions: Climatic conditions determine the economic viability of a solar energy facility as it is directly dependent on the annual direct solar irradiation values for a particular area. The Northern Cape receives the highest average daily direct normal and global horizontal irradiation in South Africa which indicates that the regional location of the project is appropriate to a solar energy facility. Factors contributing to the location of the project include the relatively high number of daylight hours and the low number of rainy days experienced in this region. A Direct Normal Irradiation (DNI)[5] of more than 2800 kWh/m²/year is relevant for the area in which the site is located.
» Topographic conditions: The site conditions are optimum for a development of this nature, with the project area being of a suitable gradient for a CSP project.

Technology choice:
CSP is the only of the renewable technologies that utilise conventional steam generating equipment with operational and life expectancy similar to that of conventional power plants (i.e. 40 years vs 20 years for other renewable technologies). One advantage of parabolic trough power plants is their potential for storing solar thermal energy to use during non-solar periods and to dispatch power when it is needed most. As a result, thermal energy storage allows parabolic trough power plants to achieve higher annual capacity factors — from 25% without thermal storage, up to 70% or more with it. CSP, through energy storage, can serve peaking and mid merit demand requirements and due to its conventional power station nature has significant socio-economic benefits.

Benefits to local economy:
The long-term benefits for communities and/or society in general can be realised should the site prove acceptable (from a technical and environmental perspective), for the construction of two additional solar thermal plants. Each CSP solar facility will contribute to the economic and social development of surrounding local communities with job creation in excess of a 1000 during construction (24 to 36 months) and 40 to 60 permanent jobs during the operational life of the plant (typically 30 to 40 years and extendible as with conventional plant). The knock-on effect could potentially add another 100 to 200 jobs in the support and service industries.

[5] GHI is the total amount of shortwave radiation received from above by a surface horizontal to the ground. The value of particular interest to CSP installations is the Direct Normal Irradiance (DNI) as mirrors track the suns movements throughout the day.

CSP technology, once economies of scale have kicked in through sustained roll out, can have a significant impact on local manufacture more so than any of the other renewable technologies. Case and point being the mirror manufacturing plant already established adjacent to the Upington Airport aiming to expand and serve more than just the Khi Solar One project and currently permanently employing more than 80 people.

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

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

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

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

3.2. Parabolic Trough Technology proposed for the Upington Solar Thermal Plant Three

Solar power generating facilities use the energy from the sun to generate electricity. Concentrating Solar Power (CSP) collects the incoming solar radiation and concentrates it (focusing or combining it), on a single point, thereby increasing the potential electricity generation. The proposed Upington Solar Thermal Plant Three will consist of parabolic trough technology with a heat transfer fluid (HTF), and a generation capacity of up to 125MW. Infrastructure associated with the facility includes:

» Parabolic troughs utilising a heat transfer fluid (HTF)
» Power Plant/Power Island: power island with steam turbine generator, auxiliary boilers, dry cooling and molten salt storage.

» Associated infrastructure: access roads, plant substation, power line, water abstraction point and supply pipeline, water storage tanks, packaged water treatment plant, lined evaporation ponds, and workshop and office buildings.

A parabolic trough system is comprised of two component groups, firstly a heat collection system and secondly a conventional generating plant portion. The heat collection system is comprised of **parabolic collectors** (i.e. trough-shaped reflectors which focus the solar radiation onto a receiver at its focal point), a **receiver tube/heat collection element** (i.e. a metal absorber containing the heat transfer fluid surrounded by a glass envelope (maintaining a vacuum), which absorbs the solar energy received from the parabolic trough), a **sun-tracking system** (i.e. an electronic control system and associated mechanical drive system used to focus the reflector onto the sun), and support structure (i.e. holds the parabolic trough in accurate alignment with incoming solar radiation while resisting the effects of the wind). The collected energy in the heat transfer fluid is used to generate steam through a conventional heat exchanger system that is in turn used for electricity generation in a conventional steam turbine and generator.

A conceptual illustration showing the power tower operating system is shown in Figure 3.2.

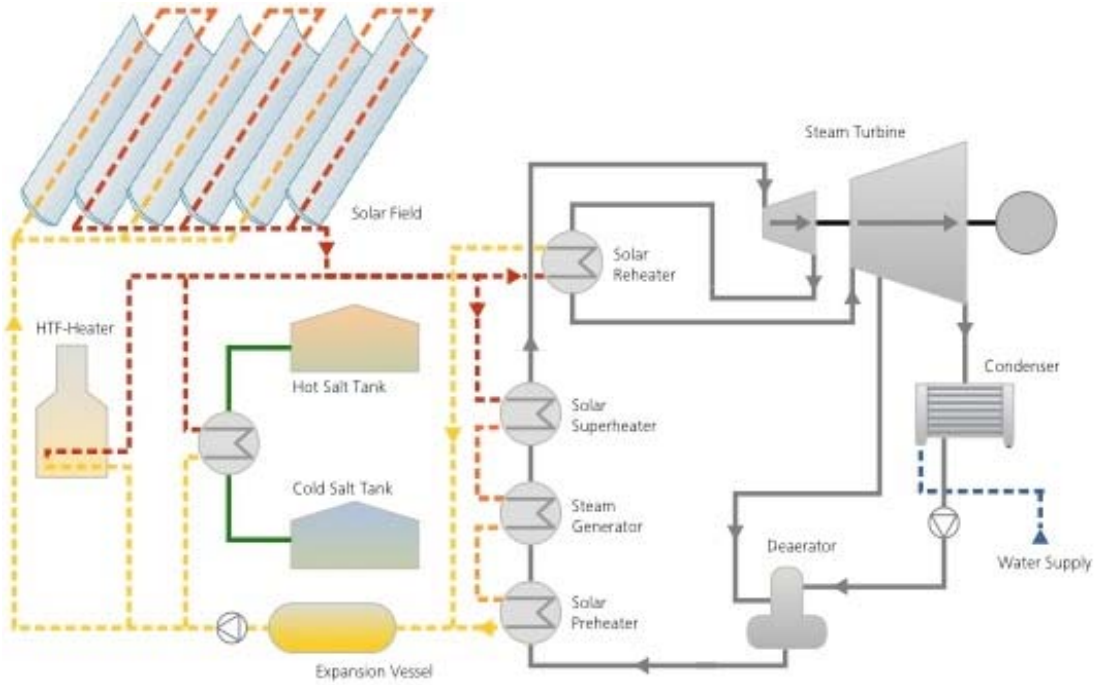

Figure 3.2: Illustration of the parabolic trough solar thermal system

The parabolic trough plant plus associated infrastructure requires an area of up to 500 hectares. The CSP plant will operate as a Zero Effluent Discharge (ZLED) facility, with lined evaporation ponds for the power plant discard stream (boiler blow down and

packaged water treatment plant discard streams). The sand filter backwash stream at the abstraction point is proposed on private property next to the river, which will be used to irrigate adjacent existing crops. Material will be borrowed from the spoils heaps of a worked out tungsten mine in the north-west corner of the property. The plant will connect to the existing Eskom McTaggerts Substation located on the property. Critical staff will be housed on site during the construction phase.

Figure 3.3: Photographs illustrating CSP parabolic troughs plants, courtesy of Abengoa Solar S.A.

Pictures of the project components are shown in Figure 3.4. These pictures are coutesy of Abengoa Solar Power South Africa, and were taken at the Abengoa trough plant being constructed near Pofadder (Kaxu).

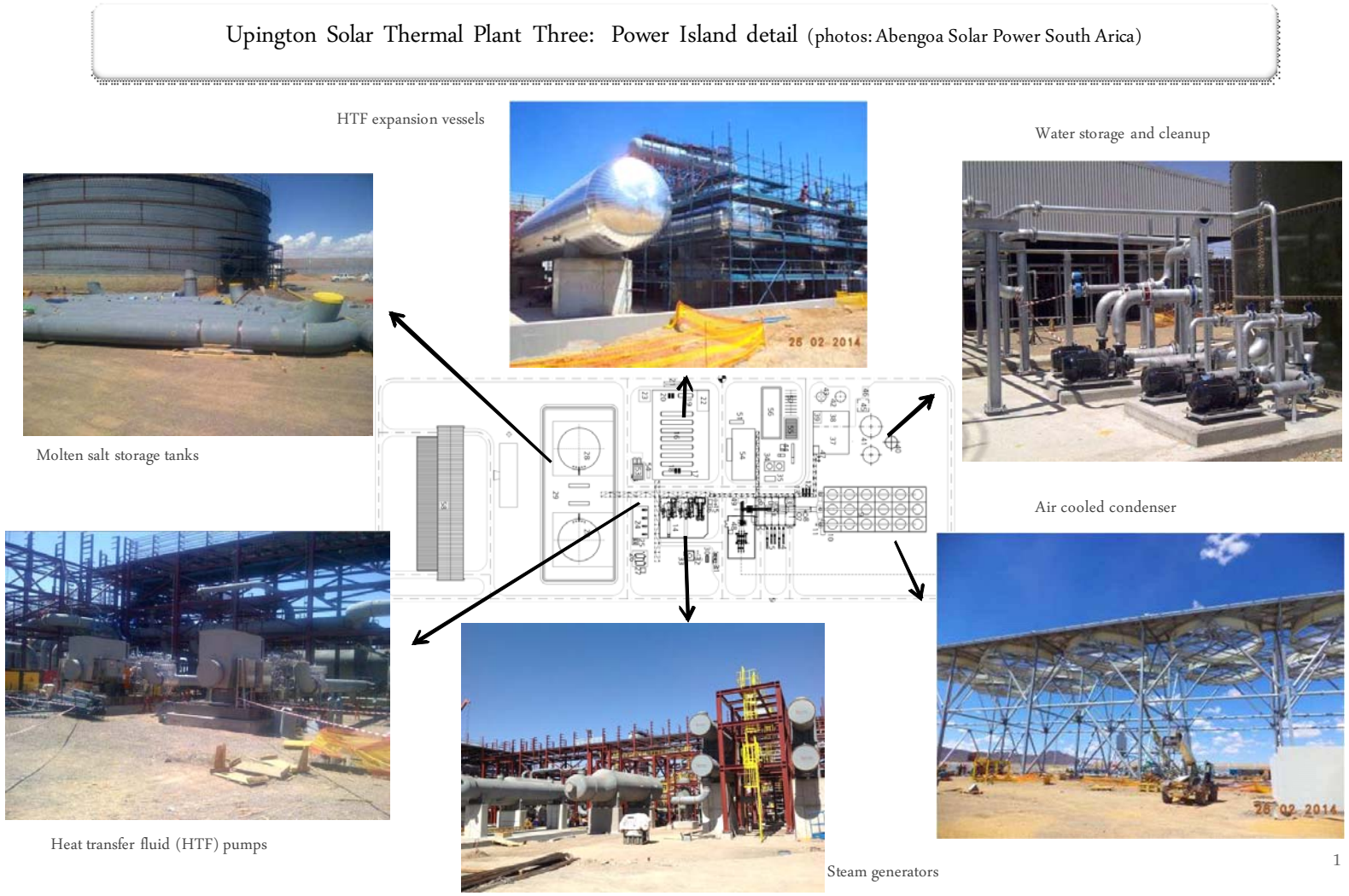

Figure 3.4: Photos illustrating components of a trough plant (courtesy of Abengoa , and taken at the Kaxu Plant near Pofadder)

3.2.1 Functioning of CSP Facilities

The following stages form part of the operating function of the CSP systems.

Stage 1: the water is pumped from low to high pressure and steam is extracted from the steam turbine generator and is used to pre-heat the water prior to entering the steam generator system (i.e. this increases overall cycle efficiency).

Stage 2: the high pressure working fluid enters the steam generator system where it is heated by the heat transfer fluid to become superheated steam.

Stage 3: The super heated steam expands through the high pressure section of the steam turbine turning the generator to produce electricity. This steam is then reheated in a re-heater that is part of the steam generator system and sent to the low pressure steam turbine. All sections of the steam turbine generator decrease the temperature and pressure of the steam with the low pressure section extracting the last available energy until the steam is operating under vacuum pressure.

Stage 4: the wet steam from the low pressure section of the steam turbine then enters the condenser where it is condensed back into a liquid which is returned to stage 1. The solar field provides the heat input into stage 2 and for the re-heater in stage 3. As the heat transfer fluid through the solar field, light from the sun reflects off the solar collectors (i.e. parabolic troughs) and is concentrated on the heat collection elements located at the focal point of the parabolic troughs. Fluid flowing through these elements absorbs the heat and provides a high-temperature energy source for the entire cycle.

Low quality waste heat is rejected at stage 4. As the turbine exhaust is condensed, the heat is transferred to the air cooled condenser.

3.2.2 Dimensions of the main infrastructural components

Table 3.1 below described the dimensions of the main infrastructural components for one 125W parabolic trough plant (the Upington Three Solar Thermal Plant).

Table 3.1: Dimensions of the main infrastructural components for a 125W parabolic trough plant

Infrastructure	Footprint	Height
Parabolic troughs solar field and	up to 400 ha	6 m
Power island and steam turbine and generator	200m x 500m	30m
Molten salt storage tanks	4 tanks each 40 m diameter	30 m

Infrastructure	Footprint	Height
Auxiliary boilers	10m x 10 m	5 m
Water storage reservoir and tanks (combined capacity up to 15 000m^3) and associated infrastructure	Tanks 15 to 20m diameter	Up to 20 m
Substation	50m x 50 m	30 m
132 kV power line	32 m servitude, 8 km in length	20-30 m towers
Workshop building (maintenance) and office buildings	20m x 50 m each	20 m
Packaged waste treatment plant	30m x 30 m	10 m
Lined evaporation ponds	5 ha - 5 ponds 100m x 100m each	1.8 m deep
Mirror assembly facility	100m x 50m	20 m
Internal access roads	6m wide, 10 km in length	n/a
Water abstraction point located at the Gariep River, filter station	20m x 30m	1 storey
Water supply pipeline	20 km in length	± 1m depth (where practical)
Temporary laydown area and construction camp.	200m x 200 m	10 m
Concrete batching plant	112m x 80 m	15 m

3.3. Life-cycle Phases of the proposed Power Station

Construction Phase

In order to construct the solar thermal plant and associated infrastructure, a series of activities will need to be undertaken.

Conduct Surveys

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

Establishment of Access Roads to the Site

The broader site can be accessed via a secondary road (i.e. D3276) or the Khi Solar One access road, both of which connect with the N14. Within the site itself, access will be required to the individual facility components for construction purposes (and later limited access for maintenance). The amount of earthworks and compaction required in the

establishment of the access roads will be established through the detailed geotechnical study to be conducted for the site.

Depending on the technology choices there will be one internal surfaced access road of approximately 6m in width which will lead directly to the power island. Between the troughs there will be a stabilised gravel track that would be used for maintenance purposes during the operational phase. The final layout of the access roads will be determined following the identification of site related sensitivities.

Undertake Site Preparation

Site preparation activities will include clearance of vegetation at the footprint of each component and the establishment of internal access roads. These activities will require the stripping of topsoil which will need to be stockpiled, backfilled and/or spread on site.

Transport of Components and Equipment to Site

The components for the proposed facility will be transported to site in sections by road. Some of the power station components may be defined as abnormal loads in terms of the Road Traffic Act (Act No. 29 of 1989)[6] by virtue of the dimensional limitations (i.e. length and weight). Components of various specialised construction and lifting equipment are required and will need to be transported to site. In addition, typical civil engineering construction equipment will need to be brought to the site (e.g. excavators, trucks, graders, compaction equipment, cement trucks, etc.) as well as components required for the establishment of the substation and power line.

The equipment will be transported to the site using appropriate National, Provincial and local roads, and then the dedicated access/haul road to the site itself.

Establishment of Laydown Areas on Site

Laydown and storage areas will be required for the typical construction equipment which will be required on site. Hardstanding areas will also need to be established for operation of any cranes used on site.

Construct Power Island and Substation

A steam turbine and generator will be housed within a structure up to 30m in height (power island). A generator transformer and a small substation will be established outside the building. The position of the power island and substation within the site footprint will be informed by the final positioning of the solar generating components.

The construction of the power island and substation would require a survey of the site, site clearing and levelling and construction of access road/s (where required), construction of a level terrace and foundations, assembly, erection, installation and

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

connection of equipment, and rehabilitation of any disturbed areas and protection of erosion sensitive areas. Material for infilling will be sourced from commercial sources/ licenced borrow pits, which can only be determine closer to the construction phase.

Establishment of Ancillary Infrastructure

Ancillary infrastructure includes a water supply pipeline/s to the facility from the extraction point on the Gariep River, a de-gritting and basic filtration facility at the abstraction point, a water treatment plant and water storage facilities on the site, and a blow down or evaporation pond (for wastewater from the generation process). A workshop, storage areas as well as a contractor's equipment camp will also be required.

The establishment of these facilities/buildings will require the clearing of vegetation and levelling of the development site and the excavation of foundations prior to construction. A laydown area for building materials and equipment associated with these buildings will also be required.

Connect Substation to Power Grid

An overhead power line will feed into the McTaggerts Substation which is on the same property as the proposed facility (newly constructed for the Khi Solar One project). The proposed CSP project is intended to connect into this new McTaggerts Substation via a 132 kV overhead power line (up to 8 km in length).

Figure 3.5: Photographs of the newly constructed McTaggerts Substation located on Portion 3 of the farm McTaggarts Camp 453

Undertake Site Remediation

Once construction is completed and once all construction equipment is removed, the site must be rehabilitated where practical and reasonable. On full commissioning of the

facility, any access points to the site which are not required during the operational phase must be closed and prepared for rehabilitation.

3.3.1 Operation Phase

The operations phase is discussed in more detail below. A simplified flow chart of the general operation of a Solar Thermal Plant showing inputs and outputs of the process is shown in the table below.

Table 3.2: Process Flow for a Solar Thermal Plant – Operational Phase Only

Input	Process	Output
Solar energy	**Solar thermal energy generation process**	*Positive outputs:* Energy / electricity
Water		*Negative outputs:* Wastewater
Fossil fuel to start up		*Negative outputs:* Exhaust fumes / CO_2
Dosing chemicals for water treatment plant		*Negative outputs:* Wastewater/brine stream to evaporation ponds

Services required for the operational CSP Plant such as sewage and refuse removal will be done by the plant operator.

Sourcing of water for the CSP facility

CSP technologies function through the generation of steam to drive a conventional steam turbine and generator. Therefore, suitable and sufficient water resources are required. The water will be sourced through an extraction point on the Gariep River. Water supply pipelines will be constructed and the required volume of water treated and pumped to the facility. Potable water will also be required for on-site staff.

Water supply, use, and treatment

A water supply pipeline will be established from the extraction point on the Gariep River to the site. Abstracted water will be pumped to a holding reservoir for supply buffering. A second storage reservoir will be located on the identified site itself. The water use of the facility for one 125MW CSP Plant will include:

» Makeup water for the steam generator
» Water for mirror washing
» Service water
» Potable water
» Fire protection water

Water treatment will be required to remove salts from the raw water, as well as blow down brine handling. The water treatment works infrastructure will include a primary treatment or basic sand filtration plant at the raw water supply source, as well as a reverse osmosis and deionisation packaged water treatment plant at the site.

Table 3.3: Estimated water consumption for the 125MW Upington Solar Thermal Plant Three and main water uses

Description	Approximate annual use (m^3/year)
Raw water consumption	Up to 400 000
Mirror washing	76 000
Boiler makeup	85 000
Potable and other	9 000
Evaporation losses	110 000
Wastewater to evaporation ponds	Up to 120 000 (typically 85 000)

In order to reduce the overall water consumption and the requisite sizing of the evaporation ponds, service water will first be used as circulating water makeup. Water conditioning chemicals may be fed into the makeup water to minimise corrosion and to inhibit mineral scale formation. The blow down from the circulating water will be treated by reverse osmosis and ion-exchange softeners prior to being used for other plant requirements. Only the discard streams will be delivered to the evaporation ponds.

Evaporation Ponds

a. Technical Information about the evaporation ponds

Up to 5 evaporation ponds (5ha) will be required for the facility. The purpose of the evaporation ponds is to receive the water discard stream from the generation process. The evaporation ponds will be located on the site and within the development footprint. The proposed facility will be operated as a Zero Liquid Effluent Discharge (ZLED) facility; therefore no wastewater from the evaporation ponds will be permitted to be released into the environment or any water bodies. Each pond will have a surface area of approximately 1ha and be 1.8m deep including free board. A picture of a typical evaporation pond required for a CSP Plant is shown in Figure 3.6.

Figure 3.6: Photograph of a typical lined evaporation pond utilised for a CSP Plant

b. Evaporation Pond Management

The plant waste discard stream will be piped from the power island wastewater tank at ambient temperature to on-site dual lined surface evaporation ponds for de-watering. The ponds will be designed so that the residual solids will not require removal for the duration of the Project's operating life. If solids removal is necessary for pond maintenance reasons, the removed solids will be shipped to an appropriate off-site disposal facility.

Up to five evaporation ponds are planned for the CSP facility to allow plant operations to continue in the event that a pond needs to be taken out of service for maintenance purposes etc. Each pond will have enough surface area so that the evaporation rate exceeds the blow-down rate at maximum design conditions and at annual average climatic conditions. The planned pond depth (capacity), is therefore intended to avoid the need for residual solids removal during the life of the Project. The wastewater is not classified as hazardous, however, the ponds will be designed in accordance with international and local SANS (1526:2003 - Thermoplastics sheeting for use as a Geomembrane and installation guidelines; 10409:2004 - Design, selection and installation of Geomembranes) requirements and will incorporate suitable HDPE liners with a leachate (leak detection system) in order to ensure no ground contamination.

Typical evaporation ponds discard streams could have a total dissolved solids (TDS) of up to 60 000 ppm at a temperature of 40ºC and be roughly 85 000 m^3 per annum - obviously production and solar resource dependant. Should a leak be detected, the leaking pond in question would immediately be drained into adjacent ponds and repaired. In the case of a catastrophic failure of one of the ponds, the contaminated topsoil layer will be removed and treated in a remedial soil treatment area and disposed of at an appropriate off-site disposal facility.

The remaining residue within the evaporation ponds will be stored in the pond, until the end of the CSP Plant's lifespan, where the residue will be removed, and the evaporation pond sites will be remediated and rehabilitated.

Site Operation and Maintenance

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

Non-hazardous solid wastes (maintenance-derived wastes) will be recycled to the extent practical. Those maintenance-derived wastes that cannot be recycled will be transported for disposal at an appropriate landfill.

Decommissioning Phase

The solar thermal plant is expected to have a design lifespan of approximately 35 years (extendable with appropriate refurbishment), and the power plant infrastructure would only be decommissioned once it has reached the end of its economic life. It is most likely that decommissioning activities of the infrastructure of the facility discussed in this EIA would comprise the disassembly and replacement of the individual components with more appropriate technology/infrastructure available at that time. The land-use of the site after decommissioning will have to be determined.

The following decommissioning activities will form part of the project scope.

Site Preparation

Site preparation activities will include confirming the integrity of the access to the site to accommodate the required equipment (e.g. lay down areas, construction platform) 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.

PROJECT ALTERNATIVES CHAPTER 4

In terms of the Environmental Impact Assessment (EIA) Regulations, reasonable and feasible alternatives are required to be considered within the Environmental Impact Assessment process. All identified, feasible alternatives are required to be assessed in terms of social, biophysical, economic and technical factors.

A key challenge of the EIA process is the consideration of alternatives. Most guidelines use terms such as 'reasonable', 'practicable', 'feasible' or 'viable' to define the range of alternatives that should be considered. Essentially there are two types of alternatives:

» incrementally different (modifications) alternatives to the project; and
» fundamentally (totally) different alternatives to the project.

Fundamentally different alternatives are usually assessed at a strategic level, and EIA practitioners recognise the limitations of project-specific EIAs to address fundamentally different alternatives. Electricity generating alternatives have been addressed as part of the National Integrated Resource Plan (IRP) by the Department of Energy. In this regard, the need for renewable power generation has been identified. Abengoa Solar Power South Africa are therefore proposing the development of a parabolic trough solar thermal plant.

Incrementally different alternatives relate specifically to the project under investigation. "Alternatives", in relation to a proposed activity, means different ways of meeting the general purposes and requirements of the activity, which may include alternatives to:

» The property on which, or location where, it is proposed to undertake the activity;
» The type of activity to be undertaken;
» The design or layout of the activity;
» The technology to be used in the activity; and
» The operational aspects of the activity.

These alternatives are discussed below.

4.1. Site Alternatives

No site alternatives are proposed for this project as the placement of the CSP facilities is strongly dependent on several factors including climatic conditions, topography, grid connection, water supply, and the extent of the site. Portion 3 of the farm McTaggarts Camp 453 was identified by Abengoa Solar Power South Africa (Pty) Ltd as being highly desirable for development of solar thermal plants in 2009 and are currently constructing one of the first CSP facilities in South Africa on the site. The site is considered to be highly favourable for CSP development due to the following site characteristics:

- **Climatic Conditions**: The economic viability of a solar facility is directly dependent on the annual direct solar irradiation values. The Northern Cape receives the highest average daily direct normal irradiation in South Africa. Factors contributing to the location of the project include the relatively high number of daylight hours and the low number of rainy days experienced in this region. A Direct Normal Irradiation (DNI) of more than 2800 kWh/m²/year is relevant for the area in which the site is located.
- **Water availability**: CSP facilities require water as the heat transfer medium for the generation of high temperature steam which is used to drive a conventional turbine and generator. Water will be required to be extracted from the Gariep River. The water source is therefore located a distance of less than 20km from the site.
- **Topography**: A surface area with favourable topography facilitates the work involved in construction and maintenance of the solar thermal facility (parabolic troughs for example require a level surface preferably with a slope of less than 1%).
- **Extent of site:** Availability of level land of sufficient area can be a restraining factor, as a 125 MW parabolic trough system requires 500 ha of land space. The larger farm portion owned by the developer is approximately 22 km^2 in extent, which will be sufficient for the installation of up to three CSP facilities on a single site.
- **Power transmission considerations:** Eskom's planned transmission grid expansion (by 2016) in close proximity to the site provides a secure point of evacuation for the power to be generated at a new facility.
- **Site access**: the site can be accessed via the D3276, or via the N14 national road.

The whole of Portion 3 of the Farm McTaggarts Camp 453 was purchased by Abengoa Solar for development. The whole property has been rezoned for this intended use. In addition, due to the successful development and construction of the Khi Solar One project on the same site (Portion 3 of the Farm McTaggarts Camp 453), Abengoa Solar Power South Africa (Pty) Ltd is proposing two additional 125MW CSP projects on the remainder of the farm portion (more than 1400ha in extent). Based on these considerations, Abengoa Solar Power South Africa (Pty) Ltd considers the proposed site as *highly preferred* in terms of the development of two additional 125MW CSP projects (Upington Solar Thermal Plant Two and Three) and drawing on synergies. No site alternatives are available for assessment.

4.2. Activity Alternatives

As it is the intention of the developer to develop renewable energy projects as part of the DoE's REIPPP Programme, only renewable energy technologies are being considered. Solar energy is considered to be the most suitable renewable energy technology for this site, based on the site location, ambient conditions and energy resource availability (i.e. solar irradiation).

Abengoa Solar is an international solar company that commercially implements all concentrated solar power (CSP) technological solutions worldwide. The activity which is selected for implementation (and therefore assessment) is the generation of electricity, using CSP technology.

CSP is the only one of the renewable technologies that utilises conventional steam generating equipment with operational and life expectancy similar to that of conventional power plants (i.e. 40 years vs 20 years for other renewable technologies). CSP, through energy storage, can serve peaking and mid merit demand requirements and due to its conventional power station nature has significant socio-economic benefits.

In addition, due to the successful development and construction of the Khi Solar One project on the same site (Portion 3 of the Farm McTaggarts Camp 453), Abengoa Solar Power South Africa (Pty) Ltd is proposing two additional 125MW CSP projects on the farm portion. More than 1400ha remains available on Portion 3 of the Farm McTaggarts Camp 453, which is already owned by Abengoa Solar Power South Africa (Pty) Ltd, for development. Based on these considerations, Abengoa Solar Power South Africa (Pty) Ltd considers the proposed site as *highly preferred* in terms of the development of two additional 125MW CSP projects (Upington Solar Thermal Plant Two and Three) and drawing on synergies. No activity alternatives are available for assessment.

4.3. Layout Design Alternatives

The 125 MW parabolic trough plant and associated infrastructure will have a development footprint of up to 500 ha, to be placed within a demarcated area of 660ha, located within a broader site of ~2200 ha. Therefore the Upington Solar Thermal Plant Three and its associated infrastructure can be appropriately located within the broader site (on Portion 3 of the Farm McTaggarts Camp 453). During the Scoping Phase potentially environmentally sensitive areas were identified for consideration in detail (through site-specific specialist studies) during this EIA Phase. The layout of the proposed facility occupies the full extent of areas of low ecological and heritage sensitivity. The layout plan provided by the developer is therefore considered to be the most optimal layout from an environmental perspective and the need to present further layout alternatives for the main facility is constrained on this basis. The environmental sensitivity identification process informed the layout design for the Upington Solar Thermal Plant Three, avoiding sensitive areas, as far as possible.

The power line which connects the facility to the McTaggerts Substation is designed to be the shortest route possible, while considering other infrastructure restrictions. The route is planned along the eastern farm boundary to avoid environmental sensitivities and other infrastructure restrictions. The full extent of the power line is on Portion 3 of the Farm McTaggarts Camp 453.

The abstraction point and water pipeline from the Gariep River is designed to mirror the infrastructure which is currently in place for the Khi Solar One facility. The principle of consolidating impacts to a single alignment has been followed. The only deviation from the alignment of the existing pipeline is where the new pipeline would enter into the Upington Solar Thermal Plant Three development footprint, on the northern side of Portion 3 of the Farm McTaggarts Camp 453.

The primary access road to the site would be off the N14 via the existing Khi access road, or the D3276. These alternatives are explained in further detail in Section 4.5.

1. The Khi Solar One project has established a formal access off the N14 for access to the McTaggarts Camp farm which could provide access for a portion of the distance to the site; or
2. The site can be accessed via the D3276 to the northern boundary of Portion 3 of the Farm McTaggarts Camp 453, with access to the facility area then being from the north.

No other feasible layout alternatives are available for assessment.

4.4. Alternative technologies to be used in the Activity

Abengoa Solar is the only solar company that commercially implements all CSP technological solutions in projects worldwide. As such, projects are designed to most optimally suit the techno-economic needs of the specific situation or customer.

Abengoa Solar Power South Africa (Pty) Ltd is considering two CSP technology types for implementation on the site near Upington in order to maximise the capacity and land available on the site, namely: heliostats and a power tower system (Power Tower technology) and parabolic trough technology (Trough technology).

Both CSP technologies are based on the operating principle that the power gained from the sun can be maximised if the radiant energy of the sun is gathered and concentrated on a single point. By concentrating the sun's rays, CSP technologies maximise the amount of sunlight that can be converted into electricity, thereby reducing wastage and increasing output.

Technological similarities between power tower and parabolic trough plants include:

» Both technologies operate on a steam turbine system to generate electricity.
» The energy can be stored to enhance despatchability for both technologies.

Technological differences between power tower and parabolic trough plants include:

» Parabolic troughs are typically 5m to 10m in height and a heat transfer fluid is heated within the trough receiver tubes.

» Heliostats are mirrors which reflect the sunlight onto one central receiver – located on top of the power tower which is up to 300m in height.

The two CSP technologies are indicated in Figure 4.1.

The Renewable Energy Independent Power Producer Procurement Program selection process (details of which are not yet finalised for future bidding rounds), IRP from Government, and the economics of the solar facility will be key in determining the final technology combination and the schedule of implementation for the facility. The preferred/optimal technology option (from a technical, financial and socio-economic perspective) for Upington Solar Thermal Plant Three located on the northern portion of the project development site is considered to be *parabolic trough technology with molten salt energy storage*. Abengoa Solar consider this technology choice to meet the requirements of the DOE and deliver the greatest value to the country as a whole through socio-economic development being created and least-cost impact on the electricity consumer. No technology alternatives are available for assessment, as the project is designed to best meet the DOE requirements for the REIPPP Programme. Environmental feasibility as well as potential impacts of the project is determined further in this EIA report.

4.5. Alternative access to site during construction and operation

The primary access road to the site would be off the N14 national road between Upington and Keimos. Two reasonable and feasible alternatives have been considered (refer to Figure 4.2):

1. *Access Alternative 1- Access off the N14 via the existing Khi Solar One access road*. The Khi Solar One project has established a formal surfaced access road off the N14 for access to the McTaggarts Camp farm, and specifically the Khi Solar One project development site. The road is available to provide access for a portion of the distance to the site up to the Khi Solar One boundary (5.5km), with an additional 5.5km of road to then be constructed within the boundary of Portion 3 of the Farm McTaggarts Camp 453. This access road would provide direct access to the facility area from the south; or
2. *Access Alternative 2- Access off the N14 via the existing district road D3276.* The existing district road D3276 is a gravel road (and would be required to be surfaced). This road intersects with the northern boundary of Portion 3 of the Farm McTaggarts Camp 453 approximately 12 km from the N14. A short section of road (~1.5km) would be required to be constructed to access the facility area from the north.

Environmental feasibility as well as potential impacts of the two alternative access roads will be assessed further in Chapter 7.

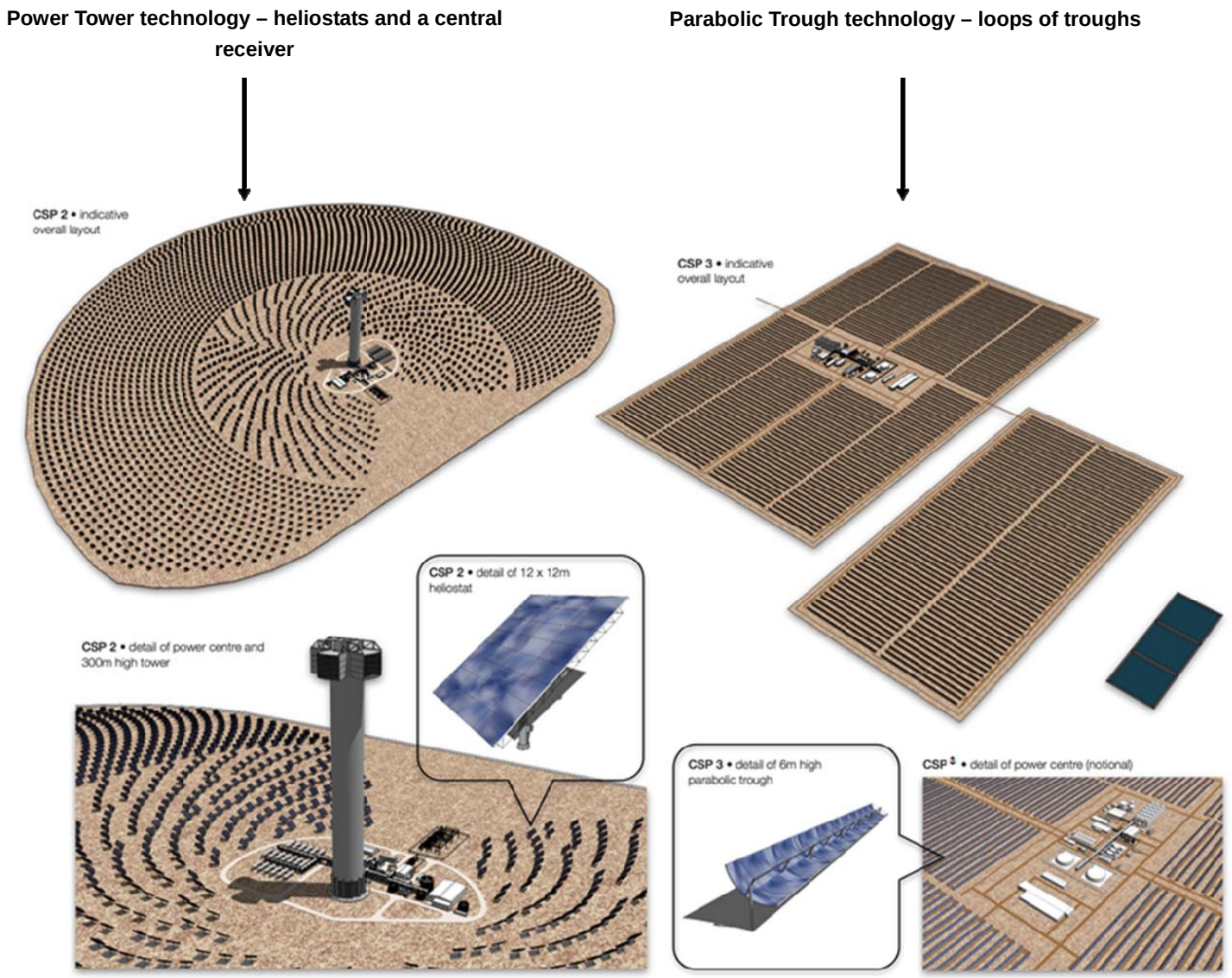

Figure 4.1: Images illustrating the two available CSP technologies considered for the Upington Solar Thermal Plant Three

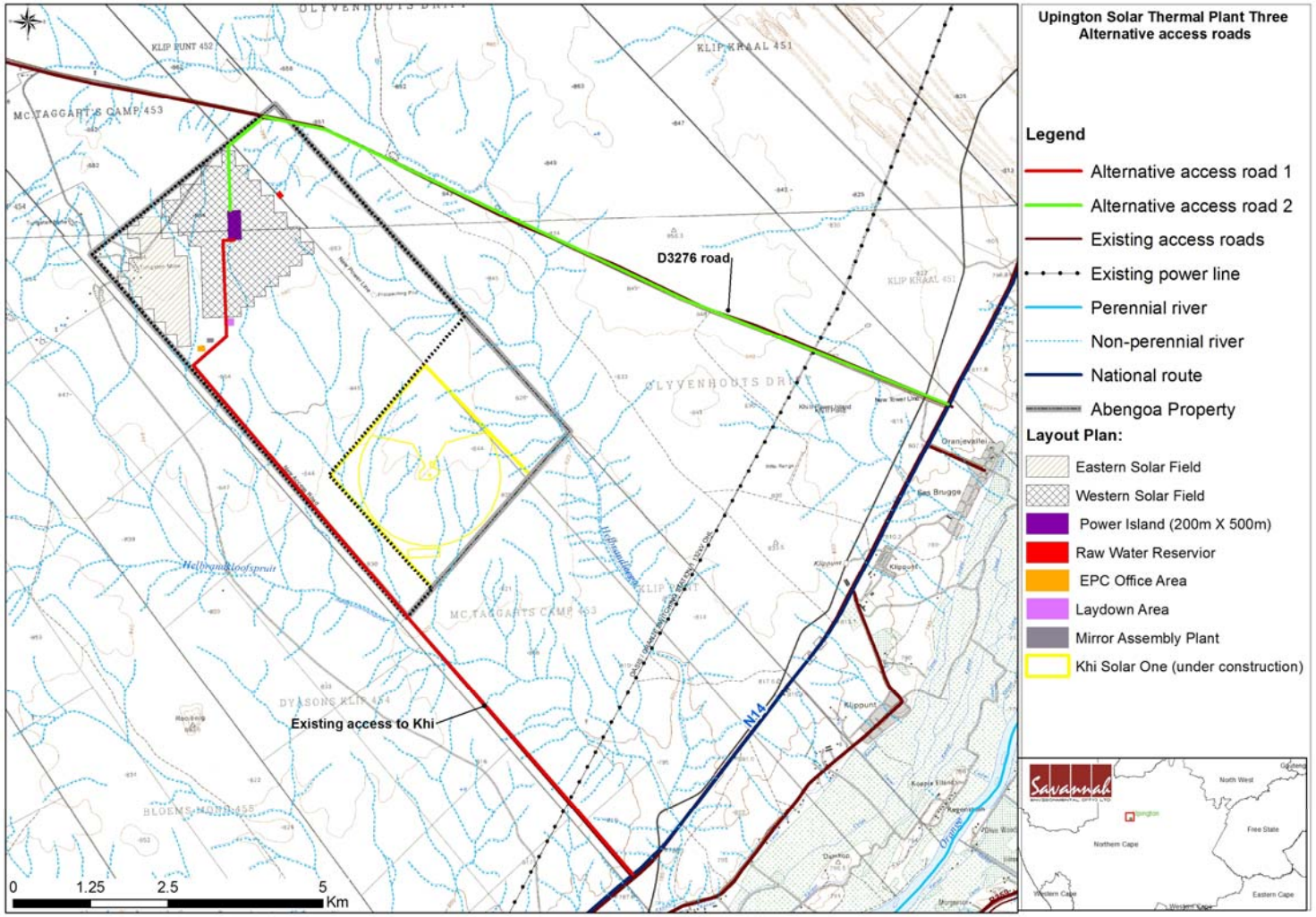

Figure 4.2: Map illustrating the two alternative access roads between the N14 and the Upington Solar Thermal Plant Three

4.6. The 'Do-Nothing' Alternative

The 'do-nothing' alternative is the option of not constructing the Upington Solar Thermal Plant Three. The no-go option would mean that the proposed CSP plant including all associated infrastructure would not be developed. Should this alternative be selected, there would be no direct impacts on the area designated for the construction of the CSP plant due to the associated construction and operation activities.

Land use considerations for the site

The predominant land use of Portion 3 of the Farm McTaggarts Camp 453 was historically grazing (albeit that the area has low carrying capacity) and some sections were mined by hand more than 60 years ago. Neither land use has proven to be commercially viable or profitable, nor had any major socio-economic benefits. The full extent of the farm portion has now been purchased by Abengoa Solar and historic land use practises have ceased. The new land use for the southern-most third of the property is renewable energy, with the construction of the Khi Solar One CSP facility. Rezoning has taken place. There are no unique benefits to be realised considering the land use potential of the site.

The study area is situated in the Nama-Karoo biome. The vegetation types dominating the study area are Bushmanland Arid Grassland and Kalahari Karroid Shrubland. Both vegetation types are regarded as least threatened. Although some species of conservation value do occur within the study area, the habitat is not considered to be unique for flora, terrestrial fauna or avifauna, and is repeated across the landscape. The implementation of the project would result in total loss of the development footprint, and the implementation of the do nothing alternative will allow for the natural grassland to persist (albeit that veld management practices will be required to be implemented). There are no unique benefits to be realised considering the habitat and ecology of the site.

Surrounding land uses

The region west of Upington and north of the Gariep River has received a considerable amount of attention with respect to renewable energy facility applications, and specifically planned CSP facilities. One CSP project (Khi Solar One) is under construction (to the south of the study site) and three large CSP facility applications have been authorised, including Eskom's CSP facility (located to the north and west of the study site). In addition, the proposed Upington Solar Thermal Plant Three falls within the DEA's identified geographical area/focus area considered most suitable for the rollout of the development of solar energy projects within the Northern Cape Province. It, therefore, follows that as the Upington Solar Thermal Plant Three falls in an identified

renewable energy node, and that projects of a similar nature are expected to be developed in this node and surround this site.

Therefore, it is considered likely that should this portion of the McTaggarts Farm not be developed for solar energy, it could be isolated through development of directly neighbouring portions.

While the no-go alternative will have limited socio-economic benefits at a local and regional scale, the extent of the physical impact in the area would be minimised by the number of projects developed in the Upington area. The do-nothing alternative will therefore likely result in minimising the cumulative impact on the land, although it is expected that pressure to develop the site for renewable energy purposes will be actively pursued due to the very factors which make the site a viable option for renewable energy development as discussed previously. Other developers will likely seek to develop the site for renewable energy purposes in order to realise targets for renewable energy in the country, the socio-economic and environmental benefits.

Benefits associated with the CSP Facility

A CSP facility of this extent has proven socio-economic spin-offs[7], most specifically during the construction phase (up to 3 years) but also during operation. Should the do nothing alternative be selected, then the benefits of this renewable energy facility will not be realised, as the generation of electricity from renewable energy resources can offer a range of socio-economic and environmental benefits for South Africa. These include:

» **Increased energy security:** The current electricity crisis in South Africa highlights the significant role that renewable energy can play in terms of power supplementation and specifically CSP as it uses conventional steam generation coupled to storage which enhances despatchability i.e. being capable of supplying energy during the peak demand periods when it is most needed. In addition, renewables offer the opportunity for improving grid strength and supply quality, and result in generation facilities being deployed in a decentralised manner across the country (i.e. away from the dominant power house of the Mpumalanga coal fields).
» **Resource saving:** Conventional coal-fired plants are major consumers of water during their requisite cooling processes. It is estimated that the achievement of the targets in the Renewable Energy White Paper will result in water savings of approximately 16.5 million kilolitres, when compared with wet cooled conventional power stations. This translates into revenue savings of R26.6 million. As an already water-stressed nation, it is critical that South Africa engages in a variety of water

[7] All socio-economic benefits and targets envisaged and set for Khi Solar One have all been achieved.

conservation measures, particularly due to the detrimental effects of climate change on water availability.

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

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

» **Climate friendly development:** The uptake of renewable energy offers the opportunity to address energy needs in an environmentally responsible manner and thereby allows South Africa to contribute towards mitigating climate change through the reduction of greenhouse gas (GHG) emissions. South Africa is estimated to be responsible for ~1% of global GHG emissions and is currently ranked 9th worldwide in terms of per capita CO_2 emissions.

» **Support for international agreements:** The effective deployment of renewable energy provides a tangible means for South Africa to demonstrate its commitment to its international agreements (under the Kyoto Protocol[8]), and for cementing its status as a leading player within the international community.

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

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

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

[8] The second commitment period applies to emissions between 2013-2020. The protocol was amended in 2012 to accommodate the second commitment period, but this amendment has (as of January 2013) not entered into legal force.

APPROACH TO UNDERTAKING THE ENVIRONMENTAL IMPACT ASSESSMENT PHASE CHAPTER 5

The EIA process for the proposed Upington Solar Plant Three is regulated by the EIA Regulations of June 2010 (as amended), which involves the identification of and assessment of direct, indirect, and cumulative environmental impacts (both positive and negative) associated with a proposed project. The EIA process forms part of the feasibility studies for a project, and comprises a Scoping Phase and EIA Phase which culminates in the submission of an EIA Report together with an Environmental Management Programme (EMPr) to the competent authority for decision-making.

The EIA process for the proposed Upington Solar Plant Three has been undertaken in accordance with the EIA Regulations in terms of Sections 24 and 24D of NEMA, as read with the EIA Regulations of GNR543; GNR544; GNR545; and GNR546 of Section 24(5) of the National Environmental Management Act (NEMA Act No. 107 of 1998). In line with the EIA Regulations, an application for authorisation was lodged with the National DEA for the proposed Upington Solar Plant Three. The Scoping Report, which considered both Upington Solar Plant Three as well as another phase of the project (the proposed Upington Solar Plant Two) was accepted by DEA in March 2014. In terms of this acceptance of scoping, an EIA phase study (separate EIA report) was undertaken for each of the two CSP Projects.

5.1. Relevant Listed Activities

In terms of sections 24 and 24D of the National Environmental Management Act (Act No 107 of 1998), as read with Government Notices R543 (Regulations 20–25), R544, R545 and R546 (as amended), environmental authorisation is required for various activities associated with the proposed Project. The activities that are applied for are summarised in Table 5.1.

Table 5.1: Summary of the GN 544, 545 and 546, **listed activities** number and short description of the activities that require authorisation under NEMA

Number and date of the relevant notice	Activity No (in terms of the relevant notice)	Description of Listed Activity	Relevant Component(s) of Facility
GN 544, 18 June 2010	9 (ii)	The construction of facilities or infrastructure exceeding 1000 metres in length for the bulk transportation of water, sewage or storm water - (ii) with a peak throughput of 120 litres per second or more, excluding where: a. such facilities or infrastructure are	***Ancillary infrastructure includes the construction of a water supply pipeline to the facility from the abstraction point at the Gariep (Orange) River.***

Number and date of the relevant notice	Activity No (in terms of the relevant notice)	Description of Listed Activity	Relevant Component(s) of Facility
		for bulk transportation of water, sewage or storm water or storm water drainage inside a road reserve; or b. where such construction will occur within urban areas but further than 32 metres from a watercourse, measured from the edge of the watercourse.	
GN 544, 18 June 2010	10 (i)	The construction of facilities or infrastructure for the transmission and distribution of electricity – i. Outside urban areas or industrial complexes with a capacity of more than 33kv but less than 275kv	***The proposed facility will be required to evacuate electricity into the national grid and include the construction of a distribution line of less than 275kV to McTaggarts Substation located on the site.***
GN 544, 18 June 2010	11	The construction of:÷ (iii) bridges; (x) buildings exceeding 50 square metres in size; or (xi) infrastructure or structures covering 50 square metres or more Where such construction occurs within a watercourse or within 32 metres of a watercourse, measures from the edge of a watercourse , excluding where such construction will occur behind the development setback line	***Bridges for access roads and cabling structures are required to cross the non-perennial stream traversing the site, and infrastructure exceeding 50 m² are required to be constructed with 32 m of a watercourse.***
GN 544, 18 June 2010	12	The construction of facilities or infrastructure for the off-stream storage of water, including dams and reservoirs, with a combined capacity of 50000 cubic metres or more, unless such storage falls within the ambit of activity 19 of Notice 545 of 2010.	***Ancillary infrastructure includes water storage reservoir/s on the site and evaporation ponds (for wastewater from the generation process and water treatment plant). The combined capacity of these would exceed 50 000m³.***
GN 544, 18 June 2010	18	The infilling or depositing of any material of more than 5 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock or more than 5 cubic metres from: i. A watercourse.	***The construction of the facility and/or associated infrastructure which crosses the non-perennial drainage line may require the infilling or excavation, removal or moving of any material (soil) into or from a watercourse.***
GNR 544, 18 June 2010	39 (iii) & (v)	The expansion of (iii) bridges; (v) bulk storm water outlet structures	***Bridges and bulk storm water outlet structures will require expansion which occurs within 32***

Number and date of the relevant notice	Activity No (in terms of the relevant notice)	Description of Listed Activity	Relevant Component(s) of Facility
		within a watercourse or within 32 metres of a watercourse, measured from the edge of a watercourse, where such expansion will result in an increased development footprint but excluding where such expansion will occur behind the development setback line.	***m of a watercourse.***
GNR 544, 18 June 2010	47 (ii)	The widening of a road by more than 6 metres, or the lengthening of a road by more than 1 kilometre (ii) where no reserve exists, where the existing road is wider than 8 metres – excluding widening or lengthening occurring inside urban areas.	***The development of the facility will require the widening or lengthening of the existing gravel road on the site.***
GN 545, 18 June 2010	1	The construction of facilities or infrastructure, for the generation of electricity where the output is 20 megawatts or more.	***The Upington Solar Thermal Plant Three will utilise parabolic troughs CSP technology (consisting of several loops of parabolic troughs) with a generation capacity of ~ 125MW.***
GN 545, 18 June 2010	3	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 more than 500 cubic metres.	***The auxiliary steam boiler will be used to provide process steam to the facility (i.e. to supplement generation). The fuel (i.e. diesel or liquid petroleum gas (LPG) for the boiler will be required to be stored at the facility and will have a storage capacity of more than 500 cubic metres.***
GN 545, 18 June 2010	5	The construction of facilities or infrastructure for any process or activity which requires a permit or license in terms of national or provincial legislation governing the generation or release of emissions, pollution or effluent and which is not identified in Notice No. 544 of 2010 or included in the list of waste management activities published in terms of section 19 of the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) in which case that Act will apply.	***The project will require a water use licence in terms of the National Water Act.***
GN 545, 18 June 2010	15	Physical alteration of undeveloped, vacant or derelict land for residential, retail, commercial, recreational,	***The total area to be transformed will be more than 20 hectares. The Upington Solar Thermal Plant***

Number and date of the relevant notice	Activity No (in terms of the relevant notice)	Description of Listed Activity	Relevant Component(s) of Facility
		industrial or institutional use where the total area to be transformed is 20 hectares 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.	***Three will utilise parabolic trough technology (consisting of several loops of parabolic troughs and associated infrastructure) to be constructed over an area of 500ha.***
GN 546, 18 June 2010	2 (a) iii (bb)	The construction of reservoirs for bulk water supply with a capacity of more than 250 cubic metres in the Northern Cape in the Northern Cape outside urban areas in sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority .	***Ancillary infrastructure includes water storage reservoirs on the site in a sensitive area as identified in the Siyanda District Municipality's[9] environmental management framework (EMF). The EMF identifies the area the site is located within as an area of high conservation priority and the site is also demarcated as occurring in Zone 2 in the EMF – i.e. potentially high vegetation conservation areas.***
GN 546, 18 June 2010	4(a) ii (cc)	The construction of a road wider than 4 metres with a reserve less than 13,5 metres in the Northern Cape outside urban areas in sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority	***A road wider than 4 m may need to be constructed in a sensitive area as identified in the Siyanda District Municipality's environmental management framework (EMF). The EMF identifies the area the site is located within as an area of high conservation priority and the site is also demarcated as occurring in Zone 2 in the EMF – i.e. potentially high vegetation conservation areas.***
GN 546, 18 June 2010	10 (a) ii (cc)	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 cubic metres in the Northern Cape, outside urban areas in sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority.	***Fuel to be used during construction will need to be stored on-site in a sensitive area as identified in the Siyanda District Municipality's environmental management framework (EMF). The EMF identifies the area the site is located within as an area of high conservation priority and the site is also demarcated as occurring in Zone 2 in the EMF – i.e. potentially high vegetation***

[9] Note that the name of the Siyanda District Municipality has been changed to the ZF Mgcawu District Municipality.

Number and date of the relevant notice	Activity No (in terms of the relevant notice)	Description of Listed Activity	Relevant Component(s) of Facility
			conservation areas.
GN 546, 18 June 2010	13(c) ii (cc)	The clearance of an area of 1 hectare or more of vegetation where 75% or more of the vegetative cover constitutes indigenous vegetation in the Northern Cape, outside urban areas in (cc) Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority.	***An area of 1 ha or more of indigenous vegetation cover (where 75% or more of the vegetative cover constitutes indigenous vegetation) may need to be cleared in a sensitive area as identified in the Siyanda District Municipality's environmental management framework (EMF). The EMF identifies the area the site is located within as an area of high conservation priority and the site is also demarcated as occurring in Zone 2 in the EMF – i.e. potentially high vegetation conservation areas.***
GN 546, 18 June 2010	14 (a) i	The clearance of an area of 5 hectares or more of vegetation where 75% or more of the vegetative cover constitutes indigenous vegetation in the Northern Cape, outside urban areas.	***An area of 5 ha or more of indigenous vegetation cover (where 75% or more of the vegetative cover constitutes indigenous vegetation) will need to be cleared outside an urban area.***
GN 546, 18 June 2010	16(iii) & (iv) (a) (ii) (dd)	The construction of (iii) buildings with a footprint exceeding 10 square metres in size or (iv) infrastructure covering 10 square metres or more where such construction occurs within a watercourse or within 32 metres of a watercourse, measured from the edge of a watercourse, excluding where such construction will occur behind the development setback line. (a) In the Northern Cape, outside urban areas in sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority.	***Buildings larger than 10 m^2 which occur within 32 m of a watercourse may be required to be built.***

This EIA Report forms part of the EIA process for the Upington Solar Thermal Plant Three and was conducted in accordance with the requirements of the EIA Regulations of June 2010 and in terms of Section 24(5) of the National Environmental Management Act (NEMA; Act No 107 of 1998), in support of the application for environmental authorisation.

5.2. Scoping Phase

In accordance with the EIA Regulations, the main purpose of the Scoping Phase is to focus the environmental assessment in order to ensure that only potentially significant issues and reasonable and feasible alternatives are examined in the EIA Phase. The Draft Scoping Report provided stakeholders with an opportunity to verify that the issues they have raised through the process to date have been captured and adequately considered, and provides a further opportunity for additional key issues for consideration to be raised. This Final Scoping Report incorporated all issues and responses raised during the public review of the Draft Scoping Report prior to submission to DEA. The Final Scoping Report was accepted by DEA in March 2014 (refer to Appendix B).

The full extent of the project development site (i.e. Portion 3 of the Farm McTaggarts Camp 453) was evaluated within the Scoping phase of the EIA process.

The **potentially sensitive areas** which have been identified through the environmental scoping study are listed below. The scoping sensitivity map was a rough scale estimate of sensitivity on the site identified at a desk-top level. This map represents potentially sensitive areas identified through scoping within which more investigation is required. The map will be further refined in this EIA phase on the basis of these specialist studies, in order to inform the final design of the facility. These potentially sensitive areas already identified through the scoping study include:

» Areas along ephemeral drainage lines and seasonal pans – water resources
» Tributaries of the Heldbrandkloofspruit
» Areas previously disturbed through mining activities (25 hectares in extent)
» Heritage Sites (a Middle Stone Age site near the Khi Solar One Plant, however not within the vicinity of the construction footprint for the Upington Solar Thermal Plant Three)
» Sensitive Vegetation (Kalahari Karroid Shrubland vegetation)

With an understanding of which areas of the site are sensitive, Abengoa Solar Power South Africa (Pty) Ltd prepared infrastructure layouts for the Upington Solar Thermal Plant Three for consideration within this EIA Phase.

5.3. Environmental Impact Assessment Phase

The EIA Phase for the proposed Upington Solar Plant Three aims to achieve the following:

» Provide a comprehensive assessment of the social and biophysical environments affected by the proposed project.
» Assess potentially significant impacts (direct, indirect, and cumulative, where required) associated with the proposed facilities.

» Comparatively assess any alternatives put forward as part of the projects.
» Identify and recommend appropriate mitigation measures for potentially significant environmental impacts.
» Undertake a fully inclusive public participation process to ensure that I&APs are afforded the opportunity to participate, and that their issues and concerns are recorded.

The EIA Report addresses potential direct, indirect, and cumulative[10] impacts (both positive and negative) associated with the the proposed Upington Solar Plant Three 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.

5.3.1. Tasks completed during the EIA Phase

The EIA Phase for the proposed the proposed Upington Solar Plant Three has been undertaken in accordance with the EIA Regulations published in GN 33306 of 18 June 2010 (as amended), in terms of NEMA. Key tasks undertaken within the EIA phase included:

» Consultation with relevant decision-making and regulating authorities (at National, Provincial and Local levels).
» Undertaking a public participation process throughout the EIA process in accordance with Regulation 54 of GN R543 of 2010 in order to identify any additional issues and concerns associated with the proposed project.
» Preparation of a Comments and Response Report detailing key issues raised by I&APs as part of the EIA Process (in accordance with Regulation 57 of GN R543 of 2010).
» Undertaking of independent specialist studies in accordance with Regulation 32 of GN R543 of 2010.
» Preparation of a Draft EIA Report in accordance with the requirements of the Regulation 31 of GN R543 of 2010.
» Prepare a Comments and Response Report detailing key issues raised by I&APs as part of the EIA Process (in accordance with Regulation 57 of GN R543 of 2010).
» Undertaking of independent specialist studies in accordance with Regulation 32 of GN R543 of 2010.
» Preparation of a Draft EIA Report in accordance with the requirements of the Regulation 31 of GN R543 of 2010.

5.3.2. Authority Consultation

[10] "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).

The National DEA is the competent authority for this application. A record of all authority consultation undertaken is included within this EIA report. Consultation with the regulating authorities (i.e. DEA and Northern Cape DENC) has continued throughout the EIA process. On-going consultation included the following:

» The Final Scoping Report for the proposed Upington Solar Plant Two and Three together with a Plan of Study for the EIA phase was submitted in December 2013. The Scoping Report was accepted by DEA in March 2014.
» A meeting had held with the Northern Cape Department of Environment and Nature Conservation on 8 January 2014 to inform the department on the project and EIA process.

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

» Submission of a final EIA Report to DEA following a public review period for the draft EIA (30 days) and final EIA report.
» If required, an opportunity for DEA and NC DENC representatives to visit and inspect the proposed site, and the study area.
» Notification and Consultation with Organs of State that may have jurisdiction over the project, including:
  * Provincial and local government departments (including South African Heritage Resources Agency, Department of Water Affairs, South African National Roads Agency Limited, Department of Agriculture, etc.).
  * Government departments

A record of consultation with DEA in the EIA process is included within **Appendix B**.

5.3.3. Public Involvement and Consultation

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

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

In order to accommodate the varying needs of stakeholders and I&APs within the study area, as well as capture their inputs regarding the project, various opportunities for stakeholders and I&APs to be involved in the EIA Phase of the process have been provided, as follows:

- Focus group meetings and a public meetings (pre-arranged and stakeholders invited to attend.
- Written, faxed or e-mail correspondence.
- The Draft EIA Report was released for a 30-day public review period from 20 March 2014 –22 April 2014: The comments received from I&APs will be captured within a Comments and Response Report, which will be included within the Final EIA Report, for submission to the authorities for decision-making.
- I&APs will be informed on the availability of the final EIA report prior to submitting this report to DEA.

In terms of the requirement of Chapter 6 of the EIA Regulations of June 2010, the following public participation tasks have been undertaken:

- Distribution of Letters of Notification to I&APs to inform them on the project and planned EIA phase.
- Fixing a notice board at a place conspicuous to the public at the boundary or on the fence of—
    (i) the site where the activity to which the application relates is or is to be undertaken; and
    (ii) any alternative site mentioned in the application;
- Giving written notice to:
    (i) the owner or person in control of that land if the applicant is not the owner or person in control of the land;
    (ii) the occupiers of the site where the activity is or is to be undertaken or to any alternative site where the activity is to be undertaken;
    (iii) Owners and occupiers of land adjacent to the site where the activity is or is to be undertaken or to any alternative site where the activity is to be undertaken;
    (iv) the municipal councillor of the ward in which the site or alternative site is situated and any organisation of ratepayers that represent the community in the area;
    (v) the municipality which has jurisdiction in the area;
    (vi) any organ of state having jurisdiction in respect of any aspect of the activity; and
    (vii) any other party as required by the competent authority.
- Placing an advertisement in:
    (i) one local newspaper; and
    (ii) in at least one provincial newspaper.
- Open and maintain a register/ database of interested and affected parties and organs of state.
- Release of a Draft Scoping Report and Draft EIA Report for Public Review for a 30-day period.
- Hosting of a Public Meeting and Focus Group Meetings during the scoping phase and EIA phase by the EAP to discuss and share information on the project.

» Preparation of a Comments and Responses Report which document all the comments received and responses from the project team.
» Apart from the 30 day commenting period on the Draft EIR, in order to give effect to Regulation 56(2), registered Interested and Affected parties will be given access to, and an opportunity to comment on the final report before submitting the final environmental impact assessment report to the DEA.

A record of the documents relevant to the above-mentioned public participation process is contained within Appendix E.

Below is a summary of the key public participation activities conducted up to this point in the process.

» **Placement of Site Notices**
Site notices have been placed on-site and at relevant public places and proof of this is included in Appendix D.

» **Identification of I&APs and establishment of a database**
Identification of I&APs was undertaken by Savannah Environmental through existing contacts and databases, recording responses to site notices and the newspaper advertisement, as well as through the process of networking. The key stakeholder groups identified include authorities, local and district municipalities, public stakeholders, Parastatals and Non-Governmental Organisations (refer to Table 5.1 below).

Table 5.1: Key stakeholder groups identified during the EIA Process

Stakeholder Group	Department
National and Provincial Authorities	» Northern Cape – Department of Environmental and Nature Conservation (DENC) » Northern Cape - Agriculture and Rural Development » Northern Cape - Public Works, Roads and Transport » Northern Cape - Water Affairs » South African Heritage Resources Agency » Department of Agriculture, Forestry and Fisheries » South African National Roads Agency » Department of Energy » Civil Aviation Authority » Square Kilometre Array (SKA) Project
Municipalities	» Kai !Garib Local Municipality » ZF Mgcawu District Municipality.
Public stakeholders	» Landowners, surrounding landowners, occupiers of land
Parastatals & service providers	» Eskom Transmission and Distribution » Ngwao Boswa ya Kapa Bokone (Northern Cape Provincial Heritage Authority)
NGOs/Business forums	» Wildlife Environment Society of South Africa » BirdLife South Africa

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 undertaken by Savannah Environmental, the identification and registration of I&APs has been on-going for the duration of the EIA phase of the process.

» **Newspaper Advertisements**
A first round of newspaper adverts was placed to inform the public on the availability of the draft scoping report and first public meeting in the following newspapers:
* The Volksblad (30 October 2013)
* Gemsbok (30 October 2013)

A second round of newspaper adverts during the EIA phase was placed in March 2014 to inform the public on the availability of the draft EIA Report and second public meeting in the same newspapers (The Volksblad and Gemsbok).

Refer to Appendix D for proof of advertisements which were placed.

» **Consultation**
In order to accommodate the varying needs of stakeholders and I&APs, the following opportunities have been provided for I&AP issues to be recorded and verified through the EIA phase, including:
* Focus group meetings (stakeholders invited to attend)
* Public meeting (advertised in the local press)
* Written, faxed or e-mail correspondence

» In order to further facilitate comments on the Draft EIA report and to provide feedback on the findings of the EIA report, a public feedback meeting was held on 08 April 2014 and registered interested and affected parties were invited to attend the public meeting. Details of the meeting were advertised in the Volksblad and Gemsbok newspapers for the benefit of the broader public.

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

5.3.4. Identification and Recording of Issues and Concerns

Issues and comments raised by I&APs over the duration of the EIA process will be synthesised into an EIA Phase Comments and Response Report. The Comments and Response Report includes responses from members of the EIA project team and/or the project proponent. Where issues are raised that the EIA team considers beyond the scope and purpose of this EIA process, clear reasoning for this view is provided.

5.3.5. Assessment of Issues Identified through the Scoping Process

Issues which require investigation within the EIA Phase, as well as the specialists involved in the assessment of these impacts are indicated in Table 5.2 below.

Table 5.2: Specialist studies undertaken as part of the EIA

Specialist Study Undertaken	Specialist	Appendix
Ecology, including flora, terrestrial fauna and avifauna	Marianne Strohbach and Blair Zoghby of Savannah Environmental	Appendix F
Soils and Agricultural potential	Johan Lanz	Appendix G
Water Resources	Brian Colloty of Scherman, Colloty and Associates	Appendix H
Visual assessment	Quinton Lawson and Bernard Oberhozer of Bernard Oberholzer Landscape Architects and MLB Architects	Appendix I
Social assessment	Tony Barbour of Tony Barbour Consulting and Research	Appendix J
Heritage assessment	David Morris of the McGregor Museum	Appendix K
Desktop palaeontological assessment	John Pether (Geological and Palaeontological Consultant)	Appendix L
Noise assessment	Morne De Jager of Enviro-Acoustic Research cc	Appendix M

Specialist studies considered direct, indirect, cumulative, and residual environmental impacts associated with the development of the Upington Solar Plant Three. 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**, wh0ich describes the likelihood of the impact actually occurring. Probability is estimated on a scale, and a score assigned:
- Assigned a score of 1–5, where 1 is very improbable (probably will not happen)
- Assigned a score of 2 is improbable (some possibility, but low likelihood)
- Assigned a score of 3 is probable (distinct possibility)
- Assigned a score of 4 is highly probable (most likely)
- Assigned a score of 5 is definite (impact will occur regardless of any prevention measures)

» The **significance**, which is determined through a synthesis of the characteristics described above (refer formula below) and can be assessed as low, medium or high
» The **status**, which is described as either positive, negative or neutral
» The degree to which the impact can be reversed
» The degree to which the impact may cause irreplaceable loss of resources
» The degree to which the impact can be mitigated

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

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

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

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

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

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

5.3.6. Assumptions and Limitations

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

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

Refer to the specialist studies in **Appendices F – M** for specialist study specific limitations.

5.4 Legislation, Policies and Guidelines which have informed the EIA Process

The following legislation and guidelines have informed the scope and content of this Final EIA Report:

» National Environmental Management Act (Act No 107 of 1998)
» EIA Regulations, published under Chapter 5 of the NEMA (GN R543, GN R544 and GN R546 in Government Gazette 33306 of 18 June 2010)
» Guidelines published in terms of the NEMA EIA Regulations, in particular:
  * Companion to the National Environmental Management Act (NEMA) Environmental Impact Assessment (EIA) Regulations of 2010 (Draft Guideline; DEA, 2010).
  * Public Participation in the EIA Process (DEA, 2010).
» International guidelines – the Equator Principles

Several other acts, standards, or guidelines have also informed the project process and the scope of issues addressed and assessed in the EIA Report. A review of legislative requirements applicable to the proposed project is provided in the **Table 5.3.** .

Table 5.3: Relevant legislative permitting requirements applicable to the Upington Solar Thermal Plant Three

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
National Legislation			
National Environmental Management Act (Act No 107 of 1998)	» 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 (the decision-maker) charged by NEMA with granting of the relevant environmental authorisation. » In terms of GNR 387 of 21 April 2006, a scoping and EIA process is required to be undertaken for the proposed project	» National Department of Environmental Affairs – lead authority » NC DENC - commenting authority	The listed activities triggered by the proposed solar energy facility have been identified and assessed in the EIA process being undertaken (i.e. Scoping and EIA). This EIA Report will be submitted to the competent and commenting authority in support of the application for authorisation.
National Environmental Management Act (Act No 107 of 1998)	» In terms of the Duty of Care provision in S28(1) the project proponent must ensure that reasonable measures are taken throughout the life cycle of this project to ensure that any pollution or degradation of the environment associated with this project is avoided, stopped or minimised. » In terms of NEMA, it has become the legal duty of a project proponent to consider a project holistically, and to consider the cumulative effect of a variety of impacts.	» Department of Environmental Affairs (as regulator of NEMA)	While no permitting or licensing requirements arise directly by virtue of the proposed project, this section has found application during the EIA Phase through the consideration of potential impacts (cumulative, direct, and indirect). It will continue to apply throughout the life 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 » NC DENC - commenting authority » Local Authorities » District & Local Municipality	» There is no requirement for a noise permit in terms of the legislation. Noise impacts may result from specific activities carried out during the construction phase of the project and could present an intrusion impact to the local community. Any such

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
			specific activities 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.
National Water Act (Act No 36 of 1998)	» 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.	» Department of Water Affairs	» The abstraction of water is regarded as a water use (as defined in terms of S21 of the NWA) and for other water uses. » A water use license (WUL) is required to be obtained if wetlands or drainage lines are impacted on, or if infrastructure lies within 500m of wetland features or the regulated area of a watercourse (being the riparian zone or the 1:100yr floodline whichever is greatest). » A water use license application will be applied for in line with the DWA and DoE requirements, once the project has obtained proffered bidder status.
National Water Act (Act No 36 of 1998)	» In terms of S19, the project proponent must ensure that reasonable measures are taken throughout the life cycle of this project to prevent and remedy the effects of pollution to water resources from occurring, continuing, or recurring.	» Department of Water Affairs (as regulator of NWA)	» This section will apply throughout the life cycle of the project.
Minerals and Petroleum Resources Development Act	» A mining permit or mining right may be required where a mineral in question is to be	» Department of Minerals and Energy	» As no borrow pits are expected to be required for the construction of the

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
(Act No 28 of 2002)	mined (e.g. materials from a borrow pit) in accordance with the provisions of the Act. » Requirements for Environmental Management Programmes and Environmental Management Plans are set out in S39 of the Act.		facility, no mining permit or right is required to be obtained.
National Environmental Management: Air Quality Act (Act No 39 of 2004)	» S21 – Listed activities requiring an Air Emissions License. » Minimum emission standards are set for Listed Activities. » Measures in respect of dust control (S32) and National Dust Control Regulations of November 2013. » Measures to control noise (S34) - no regulations promulgated yet. » 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 » District Municipality	» While no permitting or licensing requirements arise from this legislation, this act will find application during the operational phase of the project. » The Act provides that an air quality officer may require any person to submit an atmospheric impact report if there is reasonable suspicion that the person has failed to comply with the Act.
National Heritage Resources Act (Act No 25 of 1999)	» Stipulates assessment criteria and categories of heritage resources according to their significance (S7). » Provides for the protection of all archaeological and palaeontological sites, and meteorites (S35). » Provides for the conservation and care of cemeteries and graves by SAHRA where this is not the responsibility of any other authority (S36). » Lists activities which require developers any person who intends to undertake to notify the responsible heritage resources authority and furnish it with details regarding the location, nature, and extent of the proposed development (S38). » Requires the compilation of a Conservation	South African Heritage Resources Agency and the Provincial Heritage Resources Agency	An HIA and PIA has been undertaken as part of the EIA Process to identify heritage sites (refer to Appendix K and L). Should a heritage resource be impacted upon, a permit may be required from SAHRA.

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
	Management Plan as well as a permit from SAHRA for the presentation of archaeological sites as part of tourism attraction (S44).		
National Environmental Management: Biodiversity Act (Act No 10 of 2004)	» Provides for the MEC/Minister to identify any process or activity in such a listed ecosystem as a threatening process (S53) » A list of threatened and protected species has been published in terms of S 56(1) - Government Gazette 29657. » Three government notices have been published, i.e. GN R 150 (Commencement of Threatened and Protected Species Regulations, 2007), GN R 151 (Lists of critically endangered, vulnerable and protected species) and GN R 152 (Threatened or Protected Species Regulations). » Provides for listing threatened or protected ecosystems, in one of four categories: critically endangered (CR), endangered (EN), vulnerable (VU) or protected. The first national list of threatened terrestrial ecosystems has been gazetted, together with supporting information on the listing process including the purpose and rationale for listing ecosystems, the criteria used to identify listed ecosystems, the implications of listing ecosystems, and summary statistics and national maps of listed ecosystems (National Environmental Management: Biodiversity Act: National list of ecosystems that are threatened and in need of protection, (G 34809, GN 1002), 9 December 2011). » This Act also regulates alien and invader species.	Department of Environmental Affairs	Under this Act, a permit would be required for any activity which is of a nature that may negatively impact on the survival of a listed protected species. An ecological study has been undertaken as part of the EIA Phase. As such the potentially occurrence of critically endangered, endangered, vulnerable, and protected species and the potential for them to be affected has been considered. This report is contained in Appendix F.
Conservation of Agricultural	» Prohibition of the spreading of weeds (S5)	» Department of Agriculture	» While no permitting or licensing

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
Resources Act (Act No 43 of 1983)	» Classification of categories of weeds & invader plants (Regulation 15 of GN R1048) & restrictions in terms of where these species may occur. » Requirement & methods to implement control measures for alien and invasive plant species (Regulation 15E of GN R1048).		requirements arise from this legislation, this Act will find application during the EIA phase and will continue to apply throughout the life cycle of the project. In this regard, soil erosion prevention and soil conservation strategies must be developed and implemented. In addition, a weed control and management plan must be implemented.
National Forests Act (Act No. 84 of 1998)	According to this Act, the Minister may declare a tree, group of trees, woodland or a species of trees as protected. The prohibitions provide that 'no person may cut, damage, disturb, destroy or remove any protected tree, or collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree, except under a licence granted by the Minister'.	National Department of Forestry	A licence is required for any removal of protected trees.
National Veld and Forest Fire Act (Act 101 of 1998)	In terms of S12 the applicant must ensure that the firebreak is wide and long enough to have a reasonable chance of preventing the fire from spreading, not causing erosion, and is reasonably free of inflammable material. In terms of S17, the applicant must have such equipment, protective clothing, and trained personnel for extinguishing fires.	Department of Agriculture, Forestry and Fisheries (DAFF)	While no permitting or licensing requirements arise from this legislation, this Act will find application during the construction and operational phase of the project.
Aviation Act (Act No 74 of 1962) 13th amendment of the Civil Aviation Regulations (CARS) 1997	» Any structure exceeding 45 m above ground level or structures where the top of the structure exceeds 150 m above the mean ground level, the mean ground level considered the lowest point in a 3km radius around such structure.	» Civil Aviation Authority (CAA)	» While no permitting of licence requirements arise from the legislation, this act will find application during the operational phase of the project. Appropriate marking is required to meet the

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
	» Structures lower than 45 m, which are considered as a danger to aviation shall be marked as such when specified.		specifications as detailed in the CAR Part 139.01.33.
Hazardous Substances Act (Act No 15 of 1973)	» This Act regulates the control of substances that may cause injury, or ill health, or death by reason of 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; » 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.	» Department of Health	» It is necessary to identify and list all the Group I, II, III and IV hazardous substances that may be on the site and in what operational context they are used, stored or handled. If applicable, a license is required to be obtained from the Department of Health.
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	Provincial Department of Transport (provincial roads) » South African National Roads Agency Limited (national roads)	» 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

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
	exemption permits are described and discussed. » Legal axle load limits and the restrictions imposed on abnormally heavy loads are discussed in relation to the damaging effect on road pavements, bridges, and culverts. » The general conditions, limitations, and escort requirements for abnormally dimensioned loads and vehicles are also discussed and reference is made to speed restrictions, power/mass ratio, mass distribution, and general operating conditions for abnormal loads and vehicles. Provision is also made for the granting of permits for all other exemptions from the requirements of the National Road Traffic Act and the relevant Regulations.		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).
Development Facilitation Act (Act No 67 of 1995)	» Provides for the overall framework and administrative structures for planning throughout the Republic » Sections 2- 4 provide general principles for land development and conflict resolution.	» Local Municipality, District Municipality	» The applicant must submit a land development application in the prescribed manner and form as provided for in the Act. A land development applicant who wishes to establish a land development area must comply with procedures set out in the DFA.
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	» Local Municipality, District Municipality	» Subdivision will have to be in place prior to any subdivision approval in terms of Section 24 and 17 of LUPO. » Subdivision is required to be undertaken following the issuing of an environmental authorisation for the proposed project.
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	National Department of Water and Environmental Affairs (hazardous	» As no waste disposal site is to be associated with the proposed project,

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
	effect on the environment. » The Minister may amend the list by— *(a)* adding other waste management activities to the list; *(b)* removing waste management activities from the list; or *(c)* making other changes to the particulars on the list. » 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 impacts and breeding of vectors do not arise; and *(e)* pollution of the environment and harm to health are prevented	waste and effluent) Provincial Department of Environmental Affairs (general waste)	no permit is required in this regard. » Waste handling, storage and disposal during construction and operation is required to be undertaken in accordance with the requirements of this Act, as detailed in the EMPr.
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 (DEA)	» 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 (DEA)	» No permitting or licensing requirements
Provincial Legislation			

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
Northern Cape Nature Conservation Act, Act No. 9 of 2009	This Act provides for the sustainable utilisation of wild animals, aquatic biota and plants; provides for the implementation of the Convention on International Trade in Endangered Species of Wild Fauna and Flora; provides for offences and penalties for contravention of the Act; provides for the appointment of nature conservators to implement the provisions of the Act; and provides for the issuing of permits and other authorisations. Amongst other regulations, the following may apply to the current project: » Boundary fences may not be altered in such a way as to prevent wild animals from freely moving onto or off of a property; » Aquatic habitats may not be destroyed or damaged; » The owner of land upon which an invasive species is found (plant or animal) must take the necessary steps to eradicate or destroy such species. » The Act provides lists of protected species for the Province.	Northern Cape Department of Environment and Nature Conservation	A collection/destruction permit must be obtained from Northern Cape Nature Conservation for the removal of any protected plant species found on site. .

DESCRIPTION OF THE RECEIVING ENVIRONMENT CHAPTER 6

This section of the EIA Report provides a description of the environment that may be affected by the proposed Upington Solar Thermal Plant Three. This chapter is also contains maps shwing the the Upington Solar Thermal Two, as both projects are located adjacent to each other Portion3 of the Farm McTaggarts Camp 453. Information is provided in order to assist the reader in understanding the receiving environment within which the proposed facility is situated. Features of the biophysical, social and economic environment that could directly or indirectly be affected by, or could affect, the proposed development have been described. This information has been sourced from existing information available for the area, the Scoping and EIA Report for the Upington Solar Thermal Plant (known as the Khi Solar One Project, which is currently under construction), as well as collected field data from the EIA process, and aims to provide the context within which this EIA is being conducted.

6.1 Regional Setting: Location of the Study Area

The study site is proposed on Portion 3 of the farm McTaggarts Camp 453, which is located approximately 20 km south west of Upington. Portion 3 of the Farm McTaggarts Camp 453 has a total surface area of approximately 2200 ha (which includes the Khi Solar One development footprint), which is much larger than the development footprint required for development of a new 125MW CSP plant. The first Phase of the Upington Solar Thermal Plant referred to as the Khi Solar One project, is currently under construction and has a footprint of ~470 hectares and is located on the southern section of Portion 3 of the Farm McTaggarts Camp 453. The proposed Upington Solar Thermal Plant Three (a 125 MW parabolic trough plant) is planned to have development footprint of up to 500 ha.

The proposed site falls within Ward 8 of the Kai !Garib Local Municipality which has its administrative centre at Kakamas. This local municipality is one of 8 local municipalities that fall within the greater ZF Mgcawu (formerly Siyanda) District Municipality. The site can be accessed via the N14 and an existing farm road (D3276). An existing gravel road has been upgraded for the Khi Solar One project and will provide the main access point to the farm.

The current land-use in this area of the Northern Cape consists primarily of farms used as rangeland for commercial livestock production. These regions have been commercially farmed as stock ranches for close to 100 years. Degradation of vegetation has been attributed to high stocking rates of domestic livestock in commercial farming areas.

There are other solar energy facilities proposed in the broader study area, including Eskom's planned CSP Plants on the Farm Olyvenhouts Drift and the Khi Solar One CSP project which is currently under construction on Portion 3 of Farm McTaggarts Camp 453.

6.2 Climatic Conditions

The study area is characterised by an arid climate with summer rainfall. The long-term average annual rainfall in this region of the Northern Cape is only 175 mm, of which 142 mm, or 81%, falls from November to April. Rainfall events are erratic, both locally and seasonally and therefore cannot be relied on for agricultural practices. 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 35.0ºC and 18.7ºC for January to 20.8ºC and 3.3ºC for July respectively. Frost occurs most years on 6 days on average between mid-June and mid-August.

6.3 Biophysical Characteristics of the Study Area

6.2.1 Conservation Planning

The ZF Mgcawu (formerly Siyanda) District Municipality has compiled an Environmental Management Framework (EMF), in which environmental concerns and conservation priorities for all landscapes within the municipality are listed and mapped. According to the EMF, Bushmanland Arid Grasslands have a medium conservation priority and the proposed project area does not fall within areas earmarked for conservation. Similarly, the proposed project area has been mapped as Zone 7 in the EMF Environmental Control Zones. The Lower Gariep Alluvial Vegetation (which is located outside the site) on the banks of the Gariep River is regarded as a Critical Biodiversity Area, of which remaining sections have been listed as threatened ecosystems. Although these areas fall outside the proposed development, the intermittent drainage lines on either side of the development site drain directly into the Gariep River.

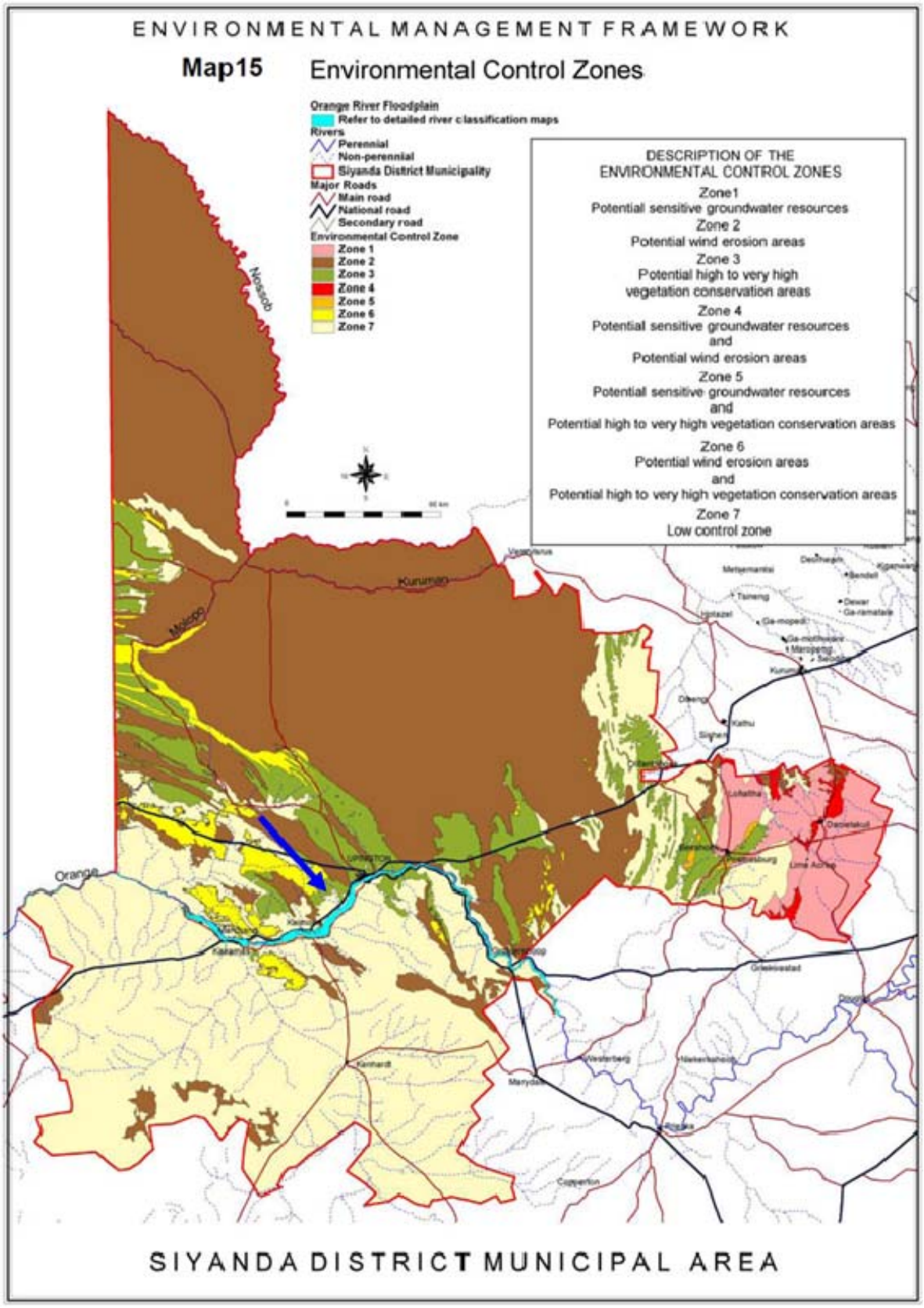

Figure 6.1: Map from the ZF Mgcawu (formerly Siyanda) EMF showing the environmental control zones. The proposed development location is indicated by the blue arrow.

6.2.2 Topographical Profile

The 22 km^2 (i.e 22 000 hectares) study area (including the Khi Solar One development footprint) is situated on the plains located to the north of the Gariep River. The study area has a flat to very gently sloping topography which ranges in altitude from 870 m in the north to 820 m amsl in the south, a gradient of approximately 1:150. Numerous ephemeral tributaries of the Helbrandkloofspruit drain the study site in a southerly direction towards the Gariep River.

6.2.3 Geological Profile

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 Erathem (2100 - 1200Ma) that form part of the Southern African Basement Complex. The rocks of this complex have undergone both regional and contact metamorphism and the culminating deformation phase has been dated at about 1000 Ma.

The bedrock geology of the study area is covered by Quaternary red-brown wind-blown sands of the Gordonia Formation. Localised outcrops of Dyasons Klip gneisses of Mokolian age protrude through the sand cover in the southern portion of the study area. Other metamorphic rocks of Mokolian age in the near vicinity of the study area include Louisvale granite and Bethseda gneiss. A calcrete capping of Tertiary age also occurs in the southern portion of the study area. Rocky outcrops are likely to be very sparse and the majority of the study area is covered in Quaternary unconsolidated sands.

Inactive opencast mining operations in the study area include tungsten, tin, arsenic and fluoride. Fairly extensive diggings appear to have been carried out in the north-western portion of the farm portion.

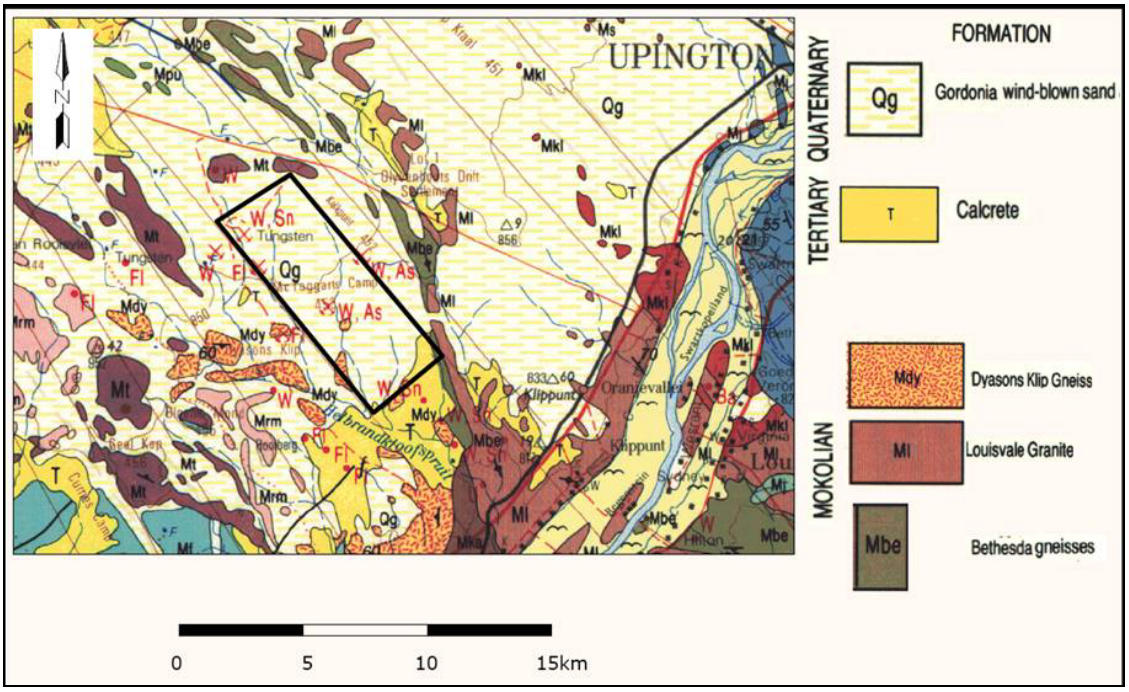

Figure 6.2: Geology of the study area

6.2.4 Soils and Agricultural Potential

a. Terrain, soils and agricultural capability

The proposed site extends inland to the north of the Orange River on almost flat ground with a south easterly aspect towards the river at a slope of approximately 1%. The land type classification is a nation-wide survey that groups areas of similar soil and terrain conditions into different land types. There are two land types across the full extent of the property, but the site for the new CSP Plant is entirely on the northern land type, Ae10 (refer to Figure 6.3). The soils of this land type are shallow to moderately deep, sandy soils on underlying hardpan carbonate or rock. The other land type, Ag1 occupies the southern part of the site where the existing project is located. The soils are also shallow, sandy soils predominantly on rock, and this land type has more rock outcrops on the surface.

Land capability is the combination of soil suitability and climate factors. The entire site (Portion 3 of the Farm McTaggarts Camp 453) has a land capability classification, on the 8 category scale, of Class 7 - non-arable, low potential grazing land. The land has a low to moderate water erosion hazard (class 5). The site is susceptible to wind erosion due to the sandy texture of the soil. Predominantly because of the aridity constraints, but also because of poor soils, agricultural land use is restricted to low intensity grazing only.

b. Land use and development at the site

The southern section of Portion 3 of Farm McTaggarts Camp 453 is already being used for the development of the Khi Solar One CSP Plant, and there is currently no agricultural activity or any agricultural infrastructure on the property (with the project developer of Khi Solar One being the landowner for the full extent of the farm portion). The site is within a sheep farming agricultural region. The natural grazing capacity is low, 31-40 hectares per animal unit across the site. Because of the aridity and soil constraints the only possible agricultural land use is grazing. There are no areas of agricultural sensitivity that should be avoided by the development. There has never been any cultivation or irrigation on the site. The north western corner of the site has been mined in the past for tungsten and old, un-rehabilitated mining excavations are still present in the area.

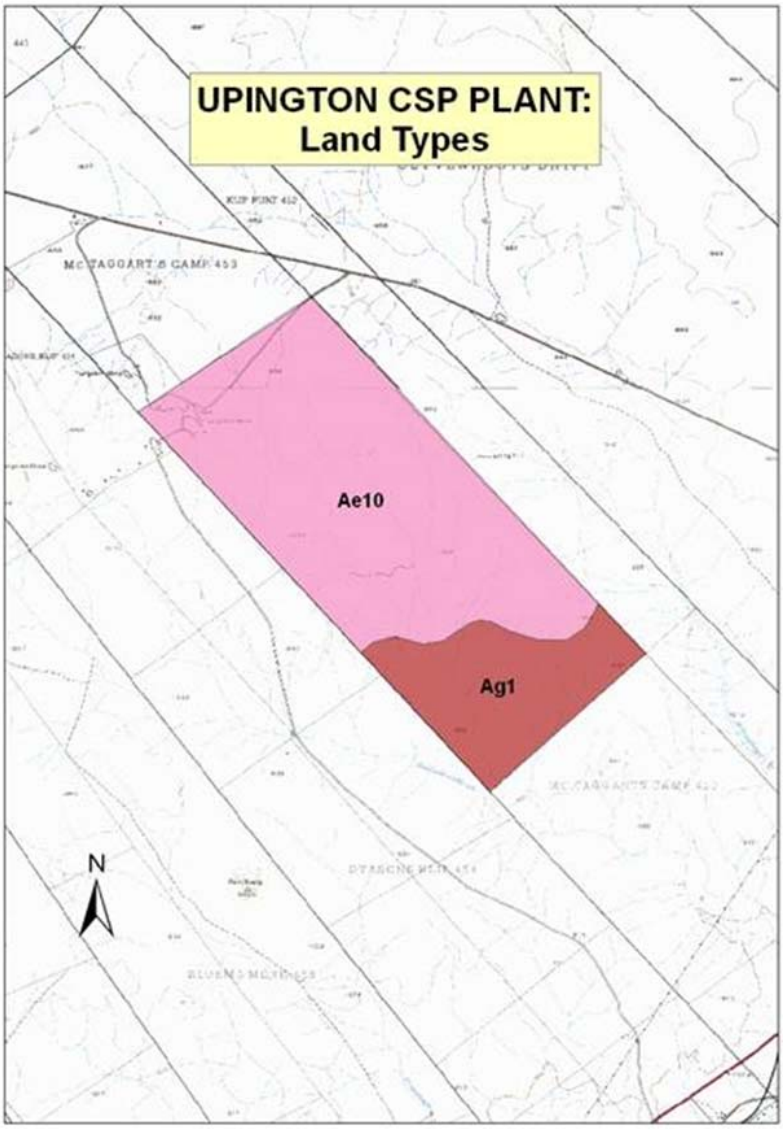

Figure 6.3: Land types within the proposed study area

6.2.5 Ecological Profile

a. Vegetation

The study area is situated in the Nama-Karoo biome. The vegetation types dominating the study area are Bushmanland Arid Grassland (NKb 3) and Kalahari Karroid Shrubland (NKb 5). Both vegetation types are regarded as least threatened. The Lower Gariep Alluvial Vegetation (AZa 3) occurs about 11-15 km beyond the main study area along the Gariep River and is the only vegetation type that has been listed as an endangered (Mucina & Rutherford 2006). This alluvial vegetation type will be minimally impacted by the construction of the pipeline associated with the proposed development.

The Bushmanland Arid Grassland landscapes consist of extensive or broken plains on a slightly sloping plateau. Vegetation density can vary annually from relatively sparse to higher densities, dominated by grasses of the genus *Stipagrostis* . Other prominent grass genera include *Enneapogon*, *Eragrostis*, and *Schmidtia*. A variable density of high shrubs can be found, dominated by *Acacia mellifera*, *Rhigozum trichotomum*, and *Boscia foetida* subsp *foetida*. Dwarf karroid shrubs are common, especially of the genera *Pentzia*, *Aptosimum*, *Pteronia*, and *Salsola*. The Bushmanland Arid Grassland vegetation is considered least threatened. A target of 21% has been earmarked for conservation, of which only a small portion is already protected in the Augrabies National Park. Overall, very little of the vegetation has been transformed, but extensive areas may be in various states of degradation due to grazing pressure.

Figure 6.4: Bushmanland Arid Grassland during the growing season on Portion 3 of the Farm McTaggarts Camp.

Within the study area, the Bushmanland Arid Grassland merges to some degree into mosaics of the Kalahari Karroid Shrubland. This shrubland vegetation typically occurs in narrow or restricted belts on calcrete outcrops or along gravelly scarps of intermittent rivers. It consists of a low karroid shrub layer, and grasses and shrubs more related to the sandy region of the Kalahari region. Small trees and tall shrubs are dominated by *Acacia mellifera, Rhigozum trichotomum*, *Parkinsonia africana,* and *Boscia foetida* subsp *foetida*. Dominant genera within the low shrub layer include *Hermannia, Aptosimum, Leucosphaera,* and *Monechma*. The grass layer is variable, consisting mostly of *Stipagrostis, Enneapogon, Eragrostis,* and *Schmidtia* species.

The Kalahari Karroid Shrubland vegetation is considered as least threatened. Of the 21% target for conservation, up to date only a small portion is protected in the Augrabies National Park. Many of the belts of this vegetation type have, in the past, been preferred for road construction, which has led to the introduction of several alien invasive species.

The Lower Gariep Alluvial Vegetation is situated on flat alluvial terraces and riverine islands along the lower Gariep River. The vegetation structure ranges from riparian thickets to reed beds or grasslands. Both reed beds and grasslands are subject to high levels of disturbance during periods of high flood. The riparian thickets are dominated by *Acacia karroo*, *Asparagus laricinus, Diospyros lycioides, Euclea pseudebenus, Gymnosporia linearis, Searsia lancea, Salix mucronata*, *Schotia afra*, *Tamarix usneoides*, and *Ziziphus mucronata*. Several more tree species can be found here, many having grown to immense sizes. Lower-lying terraces and islands, which get flooded more often, are covered with grasses or reeds that can regrow very rapidly after floods.

This vegetation type is most impacted by human disturbance. The usually narrow band of permanent woodland that is the major physical barrier to human movement into the floodplain, is often removed to improve access. It is also severely affected by regular burning of reed beds and thus highly susceptible to invasion by alien plants (ZF Mgcawu EMF). The construction of major dams upstream in the Gariep River has buffered the extent of seasonal floods, resulting in large expanses of this riparian vegetation to be cleared to gain access to the fertile soils for agricultural purposes. The lower Gariep Alluvial Vegetation is been listed as an endangered ecosystem, and all remaining intact sections of vegetation should not be disturbed further.

The vegetation types in relation to the study area are shown in Figure 65.

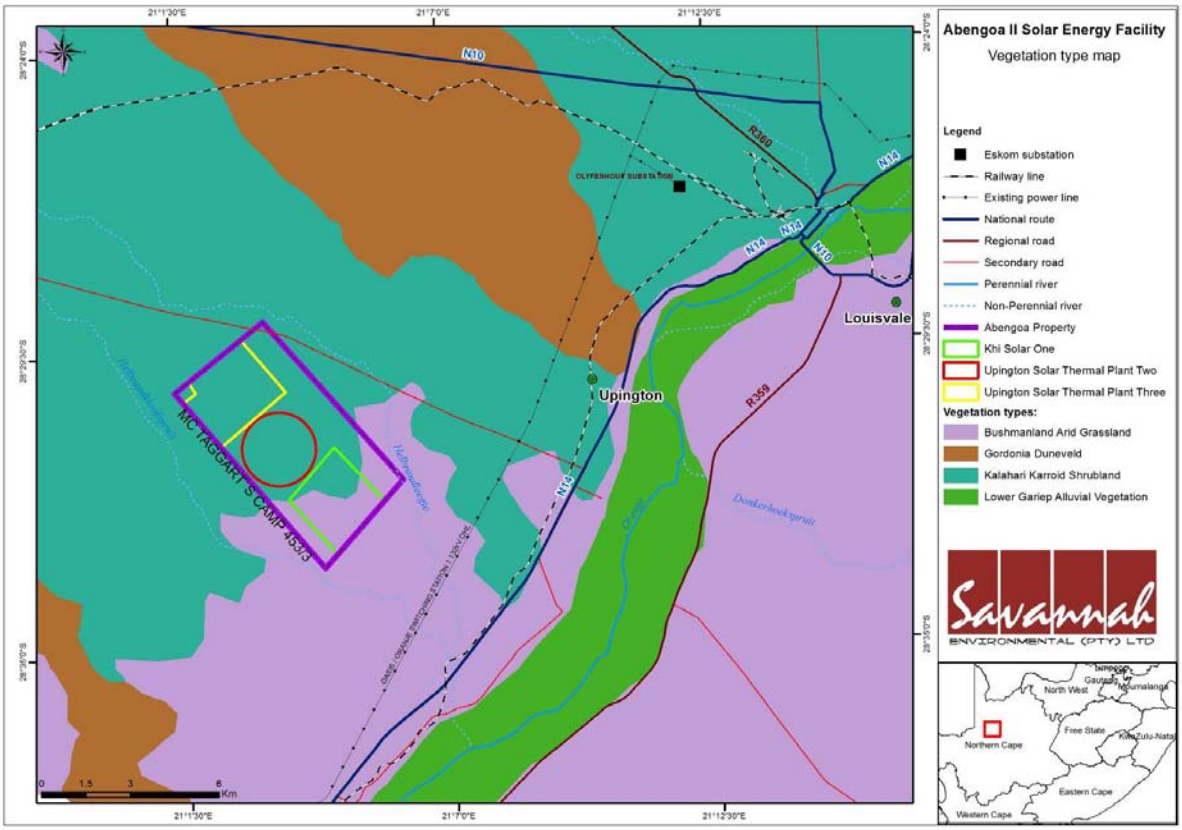

Figure 6.5: Vegetation types as mapped by Mucina and Rutherford (2006) for the study area

b. Results of the Ecological Survey

Vegetation of the study area consists of a transitions from Bushmanland Arid Grasslands to Kalahari Karroid Shrublands, with small areas of denser and higher riparian vegetation around washes and pans. Small-scale plant diversity and ecological state of the vegetation varies considerably across the entire farm portion, depending on soil surface rockiness, depth of soil and position in the landscape. Despite past disturbances such as gravel roads, farm tracks, a homestead, farming activities and small-scale mining (from the 1930s), the natural vegetation is relatively intact, with only a low presence of alien invasives. Geophytes could be observed during the survey, but none were in a flowering state. Likewise, there was a much lower presence of annual herbs than expected for the area. It can be expected that several additional species, mostly annuals and species resprouting from underground storage organs, can emerge throughout the study area during more favourable rainfall seasons. The 200 species that could be expected to be present in the study area is only a rough estimate and has been used as a comparative tool to help assess the conservation value and sensitivities of habitats. A list of species that has been recorded in the wider area on the SANBI database is provided in Ecological Impact Assessment Report which is attached to Appendix F. Vegetation units/associations identified during this studyare based on the overall similarity in species composition, vegetation structure and biophysical attributes

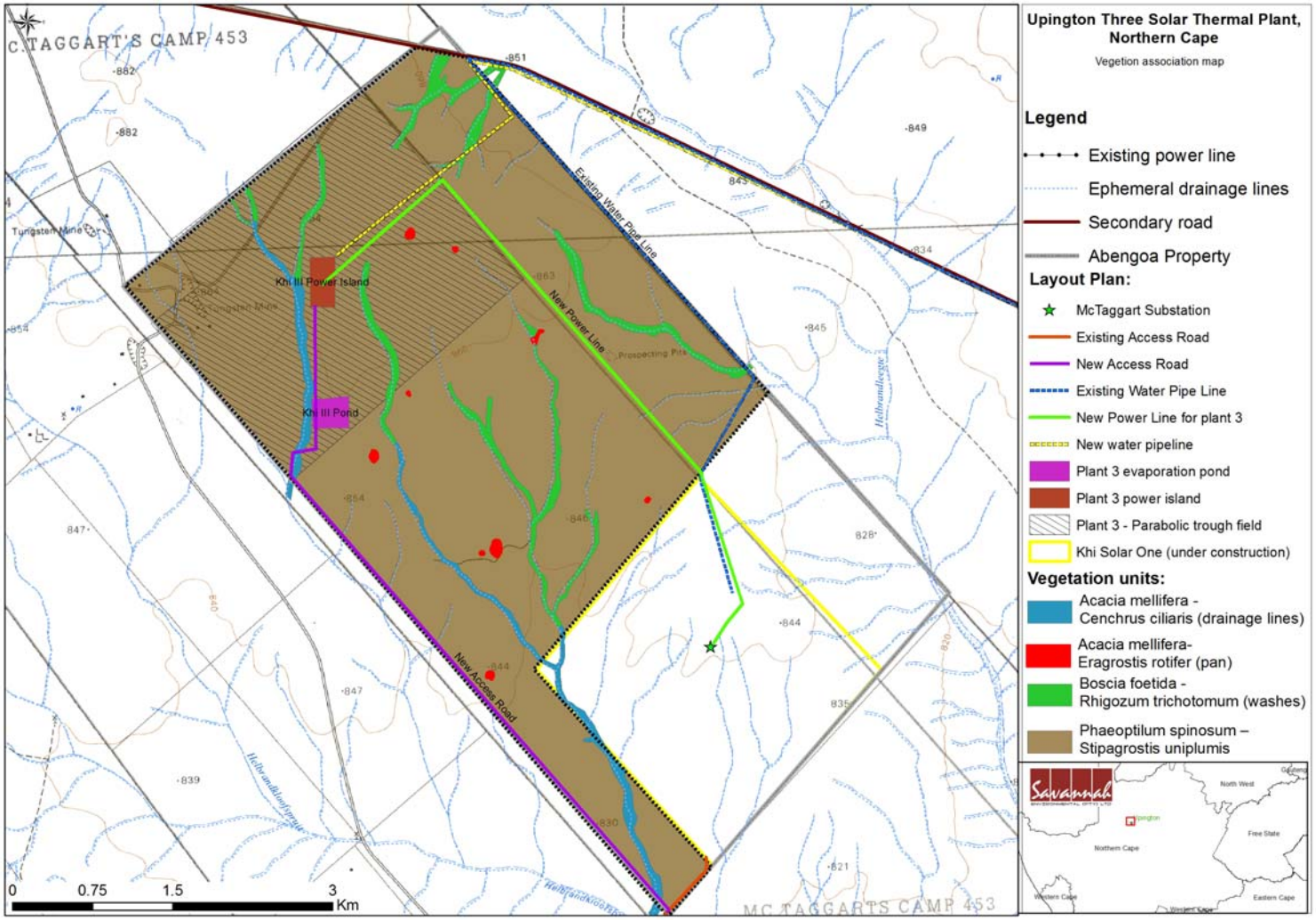

Figure 6.6: The vegetation associations as identified with a detailed field investigation of the study area**.**

that are part of an ecosystem, but smaller phytosociological differences within each vegetation unit are present. Vegetation associations occur in intricate mosaics throughout the study area, with edges of such associations generally relatively vague. There is also a large degree of species overlap between the mapped edges of vegetation associations identified.

The following vegetation associations occur on the site:

» Association 1: *Acacia mellifera – Cenchrus ciliaris* ephemeral drainage lines:
Density, height and composition of the woody and herb layer vary immensely. Specimens of the protected *Acacia erioloba* and *Boscia foetida* as well as other tree and shrub species are scattered along the larger drainage lines on the south-west of the study area. Several of the large *Acacia erioloba* trees are currently 'occupied' by active social weavers' nests. Surface water in these drainage lines will be mostly ephemeral, but subsurface water reserves may persist for several weeks or months after sufficient rainfall.
» Association 2: *Acacia mellifera – Eragrostis rotifer* intermittent pans:
These pans range from about 50 m to 100 m in diameter. Depending on the amount of silt and underlying rock of the central areas of these pans, they may be able to retain surface water or be waterlogged for one to three weeks after large rainfall events, seldom longer. They may also remain dry for several successive years. The central areas of the pans are covered only with a sparse herbaceous layer – if at all vegetated – and species here typically need or prefer occasionally waterlogged soils so be able to persist.
» Association 3: *Boscia foetida – Rhigozum trichotomum* washes:
Larger washes with a distinct central sandy bed can be found throughout the study area. Their banks are vegetated with either a dense herbaceous layer of mostly perennial grasses or dense shrubs. These washes channel runoff during large rainfall events to lower-lying larger drainage lines, but surface water will most likely seep away within hours after a rainfall event. Drainage of moisture may continue underground to slowly percolate into ground water or downstream drainage lines. Peripheries of both this and association 2 are popular habitats for birds and burrowing vertebrates, whilst they also provide grazing, seeds and fruit to a variety of fauna.
» Association 4: *Phaeoptilum spinosum – Stipagrostis uniplumis* mixed shrublands:
Covers the majority and remainder of the study area. Species composition is overall very diverse, but local forb and low shrub composition varies to a high degree from one locality to the next, depending on geology, soil depth, surface rockiness and slope. Similarly, the presence of grasses and annuals is driven by rainfall during the season and the abiotic characteristics of a specific locality. Occasional smaller trees of *Acacia erioloba* do occur. The area is generally prone to invasion by the indigenous *Acacia mellifera* subsp. *detinens* and *Rhigozum trichotomum*. This association, in a highly disturbed form, also covers the road

servitude up to the N14 (not specifically mapped due to the disturbed nature of this vegetation), in which the pipeline is proposed to be situated.

» The lowest section of the proposed pipeline route, between the N14 and the Orange River, traverses a more rocky area. The vegetation here has been highly disturbed in the past with a wide servitude that has been cleared for the Khi Solar One pipeline. As the vegetation here is not considered to be in a natural state any longer, it has not been specifically described.

c. Amphibians, Reptiles and Mammals

The study area was investigated during the vegetation survey for signs or the presence (observations) of amphibians, reptiles, and mammals. Species and signs of such sighted during the survey on and in the vicinity of the study area were the following:

Cape Hare (*Lepus capensis*)
Common (Grey) duiker (*Sylvicapra grimmia*)
Signs of Porcupine (*Hystrix africaeaustralis)*
Yellow Mongoose (*Cynictis penicillata*)
Cape Ground Squirrel (*Xerus inauris*)
Bat-eared Fox (*Otocyon megalotis*)
Aardvark (*Orycteropus afer)*
Ostrich (*Struthio camelus*)

Sightings during the development of Khi Solar one also includes Aardwolf (*Proteles cristatus*).

A full list of vertebrate species that could occur in the study area according to the ADU and SANBI databases, as well as Apps (2000) is presented in the ecology report (Appendix F). While fauna species are mobile and the impact of new structures does not destroy animals as it does plants, they do depend on specific habitats.
Another example would be the tree mouse (*Thallomys paedulcus*), which may occur in the area but needs large trees with holes to build its nests, and feeds on fruit and young shoots of tree and shrub species found in riparian woodlands.

The presence of the invertebrate tadpole shrimp (*Triops granaries)* has been noted in the small ephemeral pans close to Khi Solar One. These will only hatch in the pans if there is sufficient standing water for one to two consecutive weeks, during which they can complete their entire growing cycle, die off, and be present only as eggs until the next large rainfall event. The presence of the tadpole shrimp indicates that the small pans may on occasion be used by migratory Flamingo, as the latter feed on these and distribute their eggs (Beryl Wilson, personal communication).

d. Red data flora and fauna species

The following red data flora and fauna species have been recorded from the area (Grid 2821) according to the red data species list of SANBI and the ADU database:

Species	RD Status	Suitable Habitat	Possibility of being present	Threat
Plants				
Acacia erioloba	Declining, P	Sandy savannas	Confirmed	Habitat loss, wood harvesting
Boophone disticha	Declining, P	Savanna	Slight	Medicinal trade
Crinum bulbispermum	Declining, P	Plains with seasonally high moisture levels	Slight	Medicinal trade Habitat loss
Drimia sanguinea	NT, P	Sandy plains	Slight	Medicinal trade
Dinteranthus wilmotianus	NT, P	Gravel plains	Slight	Horticultural trade Habitat loss
Hoodia gordonii	DDD, P	Variable plains	Slight -Observed outside study area	Medicinal trade
Hoodia officinalis subsp. *officinalis*	NT, P	Variable plains	Slight	Medicinal trade
Terrestrial Vertebrates				
Dassie Rat ***Petromus typicus***	NT, P	Rocky areas on river edges	Slight	Habitat loss
African Wild Cat ***Felis silvestris***	VU	Variable	Roaming only	Habitat loss, cross-breeding with domestic cats

The following faunal species encountered on the study site are protected:

The Northern Cape Nature Conservation Act, Act No 9 of 2009
Schedule 1: Specially Protected Species
Fauna:

» Aardwolf (*Proteles cristatus*)
» Bat-eared Fox (*Otocyon megalotis*)
» Social Weavers and their nests

Flora:

» Ghaap: *Hoodia gordonii* *

* observed outside development area, could be present on development area

The Northern Cape Nature Conservation Act, Act No 9 of 2009
Schedule 2: Protected Species

Fauna:
Cape Hare (*Lepus capensis*)
Porcupine (*Hystrix africaeaustralis)*
Cape Ground Squirrel (*Xerus inauris*)

Yellow Mongoose (*Cynictis penicillata*)
Steenbok (*Raphicerus campestris*)
Common duiker (*Sylvicapra grimmia*)
Aardvark (*Orycteropus afer)*

Flora:
Acacia erioloba
Adenium oleifolium
*Aloe spp**
*Anacampseros sp**
Asclepias stellifera
Avonia albissima
*Babiana hypogaea**
Boscia albitrunca
Boscia foetida
*Euphorbia striata**
Fockea angustifolia
*Gethyllis sp**
Manulea nervosa
*Microloma sagittatum**
Moraea spp
Oxalis spp
*Psilocaulon coriarium**
Ruschia spinosa
*Tavaresia barklyi**
*Stapelia sp**

* observed outside development area, could be affected by access road, pipeline or other related activities, could be present on development area

National Forest Act (Act No. 84 of 1998)
» *Acacia erioloba*
» *Boscia albitrunca*

e. Alien invasive species

Current levels of alien invasive species are very low on the development area. The only species observed was *Prosopis glandulosa*. However, beyond the study area and along major transport routes are several alien invasive species, most notably *Salsola kali* sp and *Nicotiana glauca*. There is a high risk of invasion of these and other alien invasive species onto the property and development area during and after construction, necessitating regular monitoring and eradication of such species as soon as observed.

f. Avifauna species

Bird community assemblage within the study area:

The study area falls within the Nama Karoo Biome, which in terms of avifauna, is relatively species-poor and is mostly comprised of korhaans, larks, warblers and canaries as well as a variety of raptors. Twenty eight bird species were detected within the study area, with the most common species across the entire project area being the Spike-heeled Lark, Sociable Weaver and Ant-eating Chat. The highest species richness was recorded in the vicinity of the *Acacia mellifera – Cenchrus ciliaris* ephemeral drainage lines that occur to the south-west and west of the study area and do not fall within the demarcated site footprint. Here large *Acacia erioloba* and *Boscia foetida* as well as other tree and shrub species provide nesting and foraging habitats for birds. Social weaver's nests occur in large *Acacia erioloba* trees in most of the riparian areas.

Across the remainder of the study area, and within the demarcated site footprint, *Phaeoptilum spinosum – Stipagrostis uniplumis* mixed shrublands dominate and are largely unproductive and low in bird density and diversity. Here Spike-heeled Lark, Fawn-coloured Lark and Northern Black Korhaan make up the majority of the bird community present. A few small *Boscia foetida – Rhigozum trichotomum* washes, where vegetation along the peripheries is slightly denser, occur within this area, however these did not have a significant influence on the bird community present. No Species of Special Concern were detected during the site visit.

In addition to the site visit, the second South African Bird Atlas Project (SABAP2) database as well as information from previous studies, was consulted to form a composite list of what species might occur on site. This list, as well as a list of the species detected during the site visit, is contained within the ecology report (Appendix F).

Bird Species of Special Concern

Eight bird species of Special Concern have been identified, based on distribution ranges and habitat requirements that are sympatric with the study area. These species are listed in the table below and described in further detail in the ecology report (Appendix F).

Species of Special Concern that may occur within the study area

Common Name	Scientific Name	Conservation Status
Secretarybird	*Sagittarius serpentarius*	Near Threatened
Lanner Falcon	*Falco biarmicus*	Near Threatened
Sclater's Lark	*Spizocorys sclateri*	Near Threatened
Kori Bustard	*Ardeotis kori*	Vulnerable
Ludwig's Bustard	*Neotis ludwigii*	Vulnerable
Martial Eagle	*Polemaetus bellicosus*	Vulnerable

6.2.6 Hydrological Characteristics

This section provides information on the Gariep River system, as water supply is required for the CSP Plant, as well as riparian vegetation and fish fauna at the abstraction point and on-site. The following definitions apply:

» **Drainage line**: A drainage line is a lower category or order of watercourse that does not have a clearly defined bed or bank. It carries water only during or immediately after periods of heavy rainfall i.e. non-perennial, and riparian vegetation may or may not be present.
» **Perennial and non-perennial:** Perennial systems contain flow or standing water for all or a large proportion of any given year, while non-perennial systems are episodic or ephemeral and thus contain flows for short periods, such as a few hours or days in the case of drainage lines.
» **Riparian**: the area of land adjacent to a stream or river that is influenced by stream-induced or related processes. Riparian areas which are saturated or flooded for prolonged periods would be considered wetlands and could be described as riparian wetlands. However, some riparian areas are not wetlands (e.g. an area where alluvium is periodically deposited by a stream during floods but which is well drained).
» **Wetland**: land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which under normal circumstances supports or would support vegetation typically adapted to life in saturated soil (Water Act 36 of 1998); land where an excess of water is the dominant factor determining the nature of the soil development and the types of plants and animals living at the soil surface (Cowardin *et al*., 1979).
» **Water course**: as per the National Water Act means -
  - a river or spring;
  - a natural channel in which water flows regularly or intermittently;
  - a wetland, lake or dam into which, or from which, water flows; and
  - any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse, and a reference to a watercourse includes, where relevant, its bed and banks

a. The Lower Gariep River System

The study area falls within the Lower Gariep River sub-basin, which comprises the Gariep River from the confluence with the Vaal River to the Gariep River Mouth. The major river systems that contribute to flows in the Gariep River include the Ongers and Sak rivers from the northern Karoo; the Kuruman and Molopo rivers from the Northern Cape Province, north of the Gariep River and the southern part of Botswana; and the Fish River from Namibia. Notably these rivers drain arid and semi-arid areas, which are bordered by the Upper Orange-Senqu and the Vaal sub-basins.

The study area site is situated within quaternary catchment D73F and is dominated by highly ephemeral river systems that flow directly into the Gariep River, which bisects this quaternary catchment. An ephemeral drainage line is defined as a drainage line or even larger river that will carry water only for very brief periods of time – as short as one hour to one or two days, and only after a larger rainfall event. It may typically have more below-ground water reserves supporting higher/denser vegetation, but soil does not remain saturated for long enough to support specially adapted flora. Note: Smaller ephemeral drainage lines may be referred to as waterwashes, or upper ephemeral tributaries of waterwashes or drainage lines.

Potential runoff from the site would flow in a south-easterly direction towards the Gariep River. The primary drainage line in close proximity to the site, the Helbrandkloofspruit, typically flows once a year for no more than two days at a time. Water bodies and rivers are of specific importance to a variety of Red Data species in this arid area. The perennial Gariep River is situated 10 - 13 km south-east of the proposed development sites, and the river together with its surrounding vegetation along the river are regarded as Critical Biodiversity Areas, which should have a high conservation priority.

The Lower Gariep River can be defined as that stretch of the Gariep River between the Gariep-Vaal confluence and Alexander Bay or Oranjemund where the river meets the ocean. The area is hot and dry with rainfall varying from 400mm in the east to 50mm on the west coast and large parts of the catchment considered desert with annual precipitation dropping to below 25mm in some areas (ORASECOM, 2013).

Land-use is primarily irrigation and mining, with the area highly dependent on water from the Gariep River. Sheep and goat farming is practised over most of the area, with large parts falling within conservation areas. Cultivation is restricted to isolated patches where somewhat higher rainfall occurs, and extensive irrigation is practised in the fertile alluvial soils along the Gariep River valley. This irrigation is supplied with releases from Vanderkloof Dam. The water quality in the Lower Orange WMA is affected by upstream activities in the Vaal and Gariep River catchments. Given the arid nature of the Lower Gariep River and the high potential evaporation, the evaporative losses result in an

increase in concentrations along the length of the lower Gariep River (ORASECOM, 2013).

Water quality state can be summarised as follows (ORASECOM, 2009 and Golder Associates, 2009, as cited in Scherman, 2010b):

» 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 Gariep Rivers but still remains good. There is an increase in Electrical Conductivity (EC) from Prieska to Vioolsdrift along the reaches of the lower Gariep River. This is due to irrigation return flows and evaporative losses along the river.
» Eutrophication is evident in localised areas along the Lower Gariep River; 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 seriously degraded with considerably higher salts and nutrient concentrations which contribute significantly to the salts load in the Gariep River.

b. Flow distributions at Upington

Information on flows in the Lower Gariep River are taken from the current ORASECOM EFR study for EFR site O2 at Boegoeberg (below Boegoeberg Dam), i.e. the most upstream site from the abstraction point at Upington. Data from hydrological gauging weir D7H008 (real time gauge downstream of Boegoeberg Dam) was used for the assessment. The length of the hydrological record is 1932 – 2007 (on the database, but data recordings to present day). The distribution of flow is still similar to the natural seasonal distribution, but much lower in the wet season and a little bit lower in the dry season. The reason for the difference is the large dams upstream and highly regulated flows from Vanderkloof Dam.

c. Fish fauna

The fish biodiversity in the Lower Gariep 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 Gariep 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 nearest adjacent population of river sardine occurs in the Okavango system.

The recent IUCN 2010 Red List for the fish species found in the Lower Gariep River includes only largemouth yellowfish (*Labeobarbus kimberleyensis*) as "Near Threatened" (Impson and Swartz, 2007), with the remaining fish listed as of "Least Concern". However, correspondence with local fish experts, who have been involved with recent

fish studies in the Lower Gariep River (pers. comm. Ben Benade 30/08/2010; pers. comm. Piet Kotzé, 31/08/2010), consider that this IUCN Red Listing is not applicable to the endemic fish populations in the Lower Gariep.

Both these fish researchers feel that the Namaqua barb (*Barbus Hospes)* and the Rock catfish (*Austroglanis sclateri)* may be threatened in the Lower Gariep and recommend that these species require further studies to establish their true conservation status in this locality. In this regard, the Namaqua barb (*Barbus hospes)* was IUCN listed as Near Threatened in 1996 (Swartz and Impson, 2007), and the rock catfish (*A. sclateri)* as Data Deficient in 1996 (Swartz et al., 2007). The other two endemic fish species, Smallmouth Yellowfish (*Labeobarbus aeneus*) and Gariep 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), as discussed below.

Table 6.1: List of indigenous fish species found the Lower Gariep River within the Study Area, with the most recent IUCN (2013) Red listing for the various species. The IUCN fish species Red List category marked with an * (and shaded) are considered to be "near threatened" or even "vulnerable" in the Lower Gariep River by local fish experts - see text. LC = least concern; NT = near threatened; E = endemic; I = indigenous.

FAMILY	SPECIES		STATUS		
	Scientific Name	**Common Name**	**E**	**I**	**Red List**
Anguillidae	*Anguilla mossambica*	Longfin eel		x	LC
Cyprinidae	*Mesobola brevianalis*	River sardine		x	LC
	Labeo capensis	Gariep River Mudfish	x		LC
	Labeo umbratus	moggel		x	LC
	Barbus hospes	Namaqua barb	x		LC*
	Barbus palidinosus	Straightfin barb		x	LC
	Barbus trimaculatus	Threespot barb			LC
	Labeobarbus kimberleyensis	Largemouth yellowfish	x		NT
	Labeobarbus aeneus	Smallmouth yellowfish	x		LC
Cichlidae	*Pseudocrenilabrus philander*	Southern mouthbrooder		x	LC
	Tilapia sparrmanii	Banded tilapia		x	LC
Clariidae	*Clarias gariepinus*	Sharptooth catfish		x	LC
Austroglanididae	*Austroglanis sclateri*	Rock catfish	x		LC*

The five endemic fish species present in the Lower Orange include:

» Largemouth yellowfish *Labeoarbus kimberleyensis*

» Namaqua barb *Barbus hospes*

» Smallmouth yellowfish *Labeobarbus aeneus*

» Gariep River Mudfish *Labeo capensis*

» Rock catfish *Austroglanis sclateri.*

Environmental impacts affecting the spawning habitats of riverine fish can threaten the survival of vulnerable species with specific spawning requirements. The above description of the breeding requirements of the endemic fish in the Lower Gariep River emphasises the importance of suitable river flows in summer and the presence of clean, silt-free gravel or cobble spawning areas in flowing water habitats. Altered river flows and increased sediment input are impacts that could theoretically be associated with the proposed solar thermal facilities, as discussed later.

Vulnerable fish species requiring specific environmental conditions such as good quality water flowing over clean rocks and gravel substrate for feeding and particularly for breeding, include the two most important fish species of concern in the Lower Gariep River, namely largemouth yellowfish (*Labeobarbus kimberleyensis)* and the Rock catfish (*Austroglanis sclateri*). It is therefore of particular concern that recent fish surveys in the lower Orange in May 2010 have captured very few of these two species (pers. comm., Pieter Kotzé, 31 August 2010). In addition, the Rock catfish is considered the best indicator species to use when determining instream flow requirements when designing future water projects due to its specific habitat requirements related to river flow and water quality (ORASECOM, 2007).

The three other endemic fish species present in the Study Area (Gariep River Mudfish, smallmouth yellowfish and Namaqua barb) were found to be well represented in the May 2010 survey catches by Kotzé (pers. com. 31/08/2010) and appear to be relatively tolerant of the habitat alteration that has occurred. *A. sclateri* was recorded in the ORASECOM (2011) assessment upstream and downstream of the study area.

d. Ecological Reserve Results: Lower Gariep River System

Historical assessments

The Present Ecological State (PES) of a river represents the extent to which it has changed from the reference or near pristine condition (Category A) towards a highly impacted system where there has been an extensive loss of natural habit and biota, as well as ecosystem functioning (Category E). The LORMS (2005) study found that the overall PES of the Lower Gariep River, including fish and the other biota (algae, vegetation, macroinvertebrates), to be in a *D Category*. This is defined as where the habitat integrity has been largely modified and where a large loss of natural habitat, biota and basic ecosystem functions has occurred.

In addition, the LORMS (2005) study found fish in the Lower Orange to be on a negative trajectory of change with the PES dropping to D/E in 20 years unless the current impacts are reduced or reversed. In terms of fish, the main negative impacts are related to changes in river flow and deterioration in water quality.

The absence of scouring floods due to the large upstream dams and lack of the natural seasonal flow variations can have major negative impacts on fish biota. The resultant impacts on fish habitat and environmental conditions include, among others:

» Absence of spring floods (i.e. the November or December freshets) required to trigger and synchronise fish spawning and flush out silt from the gravel and cobble fish spawning habitat.

» Invasion of rapids, riffles, and gravel spawning areas by the reed *Phragmites australis*, which when established in turn traps more sediment, resulting in further colonisation of preferred fish habitat by *Phragmites* reeds. During recent fish surveys (May 2010) in the Lower Gariep River, P. Kotzé (pers. comm., 31/08/2010) found areas in the channel colonized by reeds to be "dead zones" that do not appear to provide adequate or preferred habitat for fish. These reed-dominated areas were found to be largely devoid of fish.

The above habitat modifications appear to have reduced the availability of suitable clean riffle and gravel habitats used for fish spawning and feeding. Sensitive fish species most reliant on these habitats and environmental conditions, such as the largemouth yellowfish and Rock Catfish, appear to have been the most negatively impacted by these man-induced modifications.

Current ORASECOM assessment
The Reserve (or EFR / EWR) assessment will supersede all previous reserves conducted for the system. The results of assessments at the EFR site at Boegoeberg in quaternary catchment D73C, i.e. EFR site O2, will inform the Water Use License Application (WULA) process (Louw, 2010). The results of the downstream EFR site O3, at Augrabies, will also be considered. The assessment of the sensitivity of biota and habitats has also informed the impact assessment.

e. Riparian vegetation on the site

This assessment was based on a broad evaluation of the natural vegetation found within the region and how localised surface and groundwater systems functioned in the formation of any recognisable riparian systems. During the site visit the site was ground-truthed (in order to produce a GIS map of the site) as well as indicate any additional areas that may be impacted upon by the proposed development. This information was also then compared to the GIS databases such as the National Freshwater Ecosystems Priority Atlas data (NEFPA, Nel *et al*. 2011), 1:50 000 topo-cadastral data and available aerial photographs.

Eighteen woody plant species were found associated with the riparian systems within the study site. Although none of these were obligate or facultative river/wetland species, they do show a preference for riparian soil conditions. Species within the site were

dominated by *Acacia erioloba* (Camel Thorn, Kameeldoring), *Acacia haematoxylon* (Grey Camel Thorn), *Boscia foetida* (Stink Shepard's Tree) and *Euclea pseudebenus* (Ebony Tree), notably protected under the National Forest Act.

The only obligate wetland plants observed were those found in association with the man-made dams found at the confluence of the Helbrandkloofspruit and the Gariep River and along the Gariep River itself. Species observed included *Typha capensis, Phragmites australis, Prosopis glandulosa* and *Cyperus marginatus*. Notably the prevalence of *Prosopis* and alien invasive tree species had increased between 2010 and this survey within the sites that had been visited previously by this report author.

During the ORASECOM (2011) assessment, the following additional species were also observed within the study area between sites *OSAEH 26 17 and EFR 03:*

"Marginal Zone: Cobble and bedrock areas have a vibrant population of *Gomphostigma virgatum*. Other dominants however are *Salix mucronata*, *Phragmites australis*, *Cyperus marg inatus, Persecaria decipiens*, *P. lapathifolia* and *Cynodon dactylon*.

Lower Zone: Well wooded in places with *G. virgatum*, and S*. mucronata* mainly, but also with Acacia karroo recruits. Areas which are open (mainly cobble/boulder) or dominated by non-woody vegetation (*P. australis*, *Crinum bulbispermum*, *C. marginatus*, *Persecaria* and *C. dactylon* mainly) make up the mosaic.

Upper Zone: The right bank (RB) has extensive open areas (cobble or boulder) with *Tamarix usneoides* mainly. Otherwise the zone is predominantly woody with common species on both banks but the left bank (LB) mainly being *T. usneoides, Accacia karoo, Rhus pendulina, Ziziphus mucronata. Diospyros lycioides, Lycium hirsutum A. erioloba, Prosopis glandulosa* and *Prosopis velutina*). A single specimen of *Combretum erythrophyllum* was found."

f. Water Bodies on the Site (Portion 3 of the Farm McTaggarts Camp 453)

On either side portion 3 of the Farm McTaggarts Camp 453 larger ephemeral drainage lines occur, which merge further south and then flow into the Gariep River. These drainage lines may only flow once every couple of years after sufficient rainfall, but they do collect enough of the runoff from surrounding areas to support much denser and higher vegetation than on the surrounding plains, especially on the farm adjacent to the southern border of McTaggarts Camp. This higher vegetation creates numerous microhabitats.

No classified wetlands, other than the riparian systems found along the Gariep River, are shown on the national wetlands map. Seasonal pans and ephemeral waterwashes (also

referred to as ephemeral drainage lines) occur on the site and drain into the Gariep River.

Dry river beds and riparian zones occur on the site. All the dry river beds and the associated riparian systems would be rated as extremely sensitive to development, in particular the mainstem systems such as Helbrandleegte and Helbrandkloofspruit, which flows through the site. The conservation importance of these systems (i.e. rare or protected plant species) was considered in the Ecological Impact Assessment (Savannah Environmental, 2014).

When mapping these systems, it became evident that the active channel could not be used to define the lateral extent of the river system. Due to the nature of the soils and geomorphology, these systems are able to form various meanders within the greater landscape.

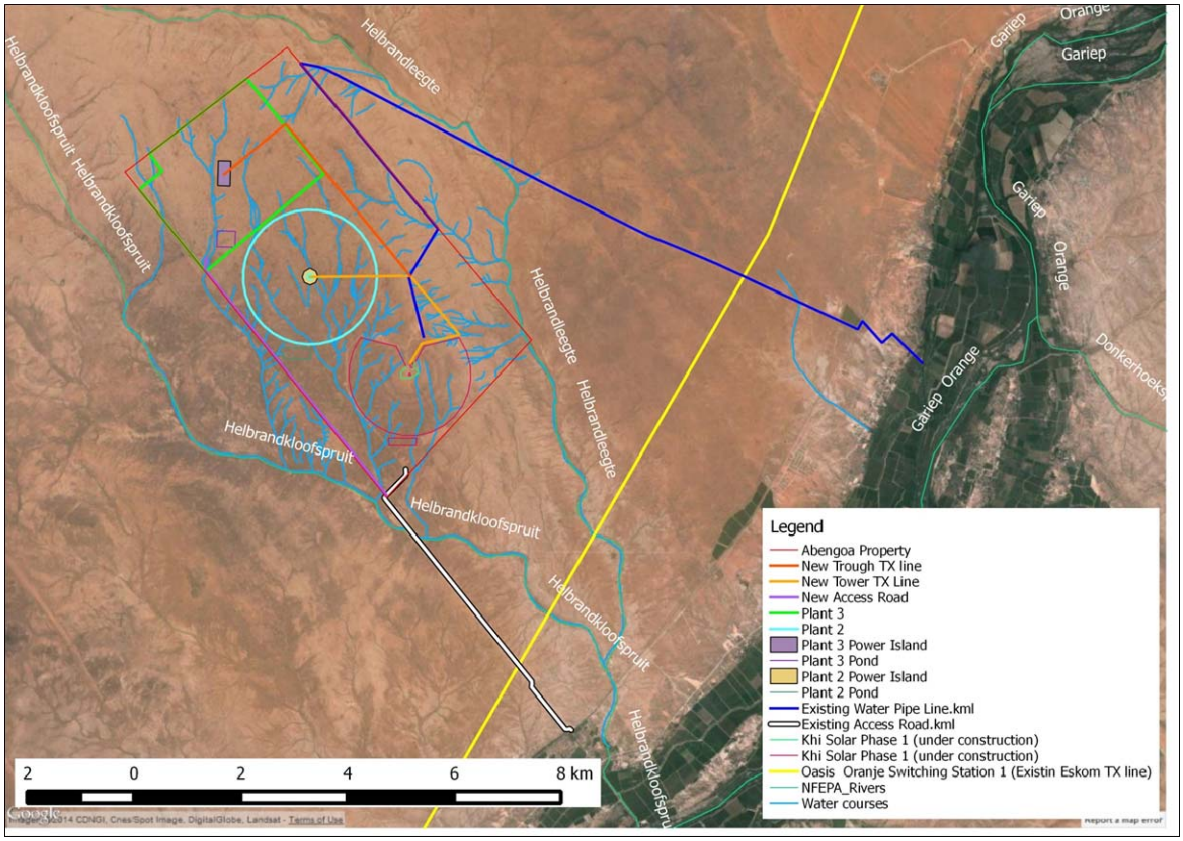

Figure 6.7: The water courses observed within the site and along the pipeline route

6.4 Social Characteristics of the Study Area and Surrounds

The proposed site for the CSP Plants is located within Ward 8 of the Kai !Garib Local Municipality (NC067) within the Northern Cape. This municipality is a category-B municipality[11], which forms part of the greater ZF Mgcawu District Municipality (DC8, category-C municipality), and is located in the north-central portion of the Northern Cape, approximately 428 km west of the provincial capital of Kimberley. The nearest settlements to the site (in order of closest proximity) include: Louisvale, Kiemos, Upington and Kakamas). The majority of the study area is sparsely populated (less than 10 people per km^2) and consists of a landscape of wide-open expanses and vast desolation. The scarcity of water and other natural resources has strongly influenced settlement within this region - the population distribution is concentrated along the Gariep River.

This local municipality is largely rural and agricultural with three urban/semi-urban nodes at Kakamas, the designated administrative centre of the municipality Keimoes and Kenhardt. The municipality is approximately 7 445 km^2 in size (~7.2% of the ZF Mgcawu District Municipality) and is bordered to the north, south and west by a District Management Area and in the east by the //Khara Hais and !Kheis Local Municipalities. The Khi Solar One CSP Facility is under construction.

6.4.1 Demographic Profile

The population the Kai !Garib Local Municipality is estimated at 56 501 (2007), approximately 10% of the total population of the greater ZF Mgcawu District Municipality. The average population growth for the local municipality (2001-2007) is estimated at approximately 1.4%.

The population is 66.5% Coloured, 22.2% Black African, 7.8% White and 0.05% Asian. The dominant language within the municipality is Afrikaans (78.8%) followed by Setswana (20.2%) with the remainder made up of isiXhosa (0.4%), English (0.2%) and other African languages (0.2%).

In terms of education levels, approximately 14.7% of the population has no formal education, while approximately 42% have less than a Grade 7. When these totals are added to figures for people with no formal education they indicate that over half of people in the Kai !Garib Local Municipality (~58%) have less than a Grade 7 qualification. Only 11.1% of the population have a matric qualification, while less than 4% have a tertiary qualification.

[11] A category-B municipality is defined as a municipality that shares executive and legislative authority in its area with a category- C municipality within whose area it falls.

6.4.2 Economic Profile

Employment data for Kai !Garib Local Municipality indicates that 57.8% of the population between 15 and 65 is employed in the formal sector and the unemployment rate is 12%. The agricultural sector provides approximately 28% of the formal employment, followed by the community services, wholesale and retail sectors which employ approximately 6% and 2% of the employed population in the area respectively. According to the 2001 Census data, the majority of employment is characterised as 'undetermined' (~62%).

Approximately 48.8% of the population have no formal income and a majority 93.7% of the population earn less than R800 per month (this is the figure used by the South African Government as the official breadline figure). The low-income levels reflect the limited formal employment opportunities highlighted above. Approximately 22% of the population is dependent on social grants, of which 52% are child support grants and a total 2 706 households are subsidised by the services subsidy scheme (Kai !Garib Local Municipality IDP (2009).

6.4.3 Social and Noise Receptors

Portion 3 of the farm McTaggarts Camp 453 is owned by Abengoa Solar Power South Africa. No people live on the site. There are no potentially noise-sensitive receptors living within 2,000 meters from the proposed CSP Plant. There are landowners practicing agriculture in the broader study area.

6.5 Heritage

The McGregor Museum carried out a survey on Portion 3 of the farm McTaggarts Camp 453. The heritage artefacts on the site are well understood.

6.5.1. Colonial frontier

McTaggarts Camp derives its name from events during the Korana War of 1879-1880, when Captain McTaggart set up his military camp here (Van Vreeden 1961:431). It is not known exactly where this encampment was, though it seems most likely that it was close to the river, hence well away from the proposed solar facilities. The ephemeral nature of such an event is unlikely to have left much of a discernible archaeological trace. There was further military activity in the area in the early twentieth century in relation to Jacob Marengo, shot dead on 20 September 1907 near Eensaamheid Pan where, in an incident of "severe overkill", 5000 rounds were fired to exterminate the resistance leader, five other armed Nama and two accompanying women (Masson 1995). Eensaamheid is about100 km north-west of Upington. Mining took place at the north western-most part of McTaggarts Camp in the 1930s (Morris 2012).

6.5.2. Later Stone Age

Late Holocene Later Stone Age (LSA) sites are frequently noted in surveys south of and south west of the study areas and along the Gariep River (e.g. Morris & Beaumont 1991; Beaumont *et al*. 1995). These are generally short-duration occupations by small groups of hunter-gatherers. In contrast, there are substantial herder encampments along the Gariep River floodplain itself (Morris & Beaumont 1991) and in the hills north of Kakamas (Parsons 2003). In a range of hills north east of Keimoes, on Zovoorby, a rock shelter and specularite working (a sparkling mineral with known cosmetic and ritual use in the precolonial past) has been excavated (Smith 1995). LSA sites are usually focused on a particular feature in the landscape such as a hill or rocky outcrop and in relation to resources like water and associated habitats richer in animals and plant foods (Morris 2011).

6.5.3. Pleistocene: Middle and Earlier Stone Age

A low density surface scatter of Middle Stone Age material was found on McTaggarts Camp (logged at the McGregor Museum as 2821CA003 McTaggarts Camp 1) in 2010, and this was sampled in Phase 2 mitigation (Morris 2012). It was focused around a bedrock exposure where water would be held for a time after good rain.

Figure 6.8: Google Earth Image Showing Middle Stone Age material was found on McTaggarts Camp

6.5.4. Results of the Heritage Survey

» Stone Age: The heritage survey found Stone Age traces which consist of wide scattered/isolated finds, none of those noted being of major heritage significance. Should there be local sources of Dwyka tillite, these may have served as raw materials often drawn upon in Pleistocene times. If not, it might be expected that any archaeological traces would be sparse. Adjacent terrain, both on McTaggarts Camp and property alongside, surveyed by the McGregor Museum, has minimal Stone Age traces comprising widely scattered/isolated stone artefacts mainly based on jaspilite (banded ironstone) sourced from the banks and terraces of the Orange/Gariep River. Many of the stone artefacts found were based on banded ironstone, some on quartzite, the former most likely sourced from the Orange River gravels to the south; no tillites occur in the study area. There appear to be none of the features such as hills or rocky features (such as Spitskop north of Upington) which in other parts of this landscape provide shelters with traces of precolonial Stone Age occupation/activity.
» No shelters occur.
» Rock outcrops provide for temporary water pools after rain but any increased activity around these features in the CSP plants is not reflected in increased stone tool densities.
» Nineteenth- and twentieth-century cultural history and intangible heritage values attached to places may be difficult to recover owing to the sparse population. It is not thought likely that any significant intangible heritage values would be attached to the particular terrain in question. Recovery of stories and intangible heritage on this landscape would be difficult in the absence of residual long-term inhabitants.
» Apart from the remains of a tungsten mine, noted above, there appear not to be colonial era built environment features in the areas of proposed CSP plant.
» Several features of the tungsten mine were noted including ruins, an explosives magazine and, for the most part, trenches, pits and debris heaps associated with prospecting/mining.

6.5.5. Palaeontology

The fossil record from Kalahari deposits is very poor with respect to finds of fossil bones of vertebrates. The Kalahari sediments and calcretes have low fossil potential, but possibility of fossils being encountered in diggings cannot be totally excluded. The fossils contexts are those of ephemeral watercourses and aeolian settings, particularly interdune areas where local ponding or pans developed. Most of the fossils in the aeolianites are associated with particular contexts, particularly buried, stable surfaces (palaeosurfaces) where time has permitted bones to accumulate. The common fossils include shells of land snails, fossil tortoises, ostrich incl. egg fragments, sparsely scattered bones etc. "Blowout" erosional palaeosurfaces may carry fossils concentrated

by the removal of sand by the wind. Hollows between dunes (interdune areas) are the sites of ponding of water seeping from the dunes, leading to the deposits of seeps and pans/vleis. Being water sources, such may be richly fossiliferous. Most of fossils obtained from the Kalahari deposits have been from pans. Ephemeral watercourse deposits are poorly fossiliferous, but abraded bone fragments and loose teeth may occur sparsely in channel lags.

ASSESSMENT OF IMPACTS: CHAPTER 7
PROPOSED UPINGTON SOLAR THERMAL PLANT THREE

The Upington Solar Thermal Plant Three is proposed to utilise parabolic trough technology with a generation capacity of up to 125MW, and energy storage of up to 6 hours (using molten salts technology). The Upington Solar Thermal Plant Three will be located in the northern quadrant of Portion 3 of the Farm McTaggarts Camp 453. This chapter serves to assess the significance of the positive and negative environmental impacts (direct, indirect, and cumulative) expected to be associated with the development of the proposed facility (refer to **Figure 7.1**). This assessment has considered the construction of the Upington Solar Thermal Plant Three, with a total development footprint of up to 500 hectares (within a 660ha portion of the larger farm), and includes the following associated infrastructure:

» Parabolic troughs (parabolic collector units arranged in loops to establish the solar field (i.e. to cover a total extent of approximately 400 ha) with an approximate height of 6m.
» Power island which will include a steam turbine and generator; a generator transformer and substation; auxiliary fossil fuel and/or electric boilers and associated molten salt storage vessels and heat exchangers (approximately 200m x 500m in extent).
» Access roads (road up to 6m wide).
» Plant substation (50m x 50m).
» 132 kV power line up to 8km in length to connect to Eskom's existing McTaggerts Substation, which is located on the same property as the proposed CSP Plant.
» Water abstraction point located at the Gariep River, filter station (20m x 30m) and water supply pipeline (up to 20km in length).
» Water storage reservoir and tanks (combined capacity up to 15 000m^3).
» Packaged water treatment plant (roughly 30m x 30 m).
» Up to 6 lined evaporation ponds (approximately 100m x 100m each).
» Workshop and office buildings (approximately 20m x 50m each).
» Mirror assembly facility (approximately 100m x 50m).

The establishment of a solar energy facility project is comprised of various phases, including pre-construction, construction, operation, and decommissioning. The **construction activities** involved for the proposed CSP plant will include the following:

» Conduct pre-construction surveys.
» Establishment of access roads.

» Undertaking site preparation (i.e. including clearance of vegetation; and stripping and stockpiling of topsoil).
» Transportation of equipment to site and establishment of construction camps; laydown areas (i.e. including storage facilities, batching facilities and mirror assembly plant).
» Assemble and construct parabolic trough loops.
» Construct power island and substation.
» Establish abstraction point; pipeline; water storage/treatment facilities and evaporation ponds.
» Construction of the 132kV power line to connect the on-site substation to the Eskom grid at McTaggerts Substation.
» Establish and implement a stormwater management plan.
» Undertake site remediation.

The construction phase is expected to take approximately 30 months.

The **operational activities** will include the following:

» The operation of the solar facility (parabolic trough plant).
» The operation of the power island.
» The abstraction, treatment; pumping and storage of water for use in the facility and wastewater handling.
» Site operation and maintenance.

The operational phase is expected to extend in excess of 40 years.

The **decommissioning activities** will include the following:

» Removal and disposal of project infrastructure
» Site rehabilitation

The majority of the environmental impacts associated with the facility will occur during the construction phase. Environmental issues associated with **construction and decommissioning** activities of the CSP Plant are similar and include, among others:
» Impact on ecology (flora, fauna and avifauna) and loss of protected species.
» Potential soil loss and change in land-use for the footprint of the facility.
» Impact on heritage resources.
» Social impacts (positive and negative).
» Visual impacts.

Environmental issues specific to the **operation** of the CSP Plant include, among others:
»
» Visual impacts (intrusion, negative viewer perceptions and visibility of the facility).

» Social impacts (positive and negative).

These and other environmental issues were originally identified through a scoping evaluation of the proposed CSP plant. Potentially significant impacts have now been assessed during this EIA Phase. This EIA process has involved key input from specialist consultants, the project developer, and from key stakeholders and interested and affected parties. The significance of impacts associated with a facility of this nature is project specific, and therefore impacts may vary significantly between facilities.

This chapter serves to assess the identified potentially significant environmental impacts associated with the development of the proposed Upington Solar Thermal Plant Three, and to make recommendations for the management of these impacts for inclusion in the draft Environmental Management Programme (Refer to Appendix N).

7.1. Approach to the Assessment of Impacts associated with the proposed CSP Plant

In order to assess the potential impacts associated with the proposed Upington Solar Thermal Plant Three, it was necessary to understand the extent of the affected area. This affected area will include the area infrastructure (i.e. solar fields; power island; abstraction point; water storage/treatment reservoirs) and linear infrastructure (i.e. the internal and external access roads; the water supply pipeline and the power line).

Portion 3 of the Farm McTaggarts Camp 453 is 22 km^2 (2200 ha) in extent. The farm was originally identified by the project developer for the purposed of establishing CSP facilities. The following 'no-go' zones apply to the larger farm portion:

» The development footprint of the Khi Solar One CSP Facility (which is currently under construction) and the development footprint for the other authorised phases of this project (~600 hectares).
» The mined out area on the north-western corner of the site (currently being rehabilitated under the Khi Solar One project due to safety risk associate with open excavations/ depressions) (~25 hectares).

Therefore, at least 625 ha of the 2200 ha farm portion is unavailable for further development. The remaining 1575 hectares is available land (which is owned by Abengoa Solar Power South Africa Pty Ltd), which has been put forward for consideration for the construction of two new CSP projects – known as Upington Solar Thermal Plant Two and Upington Solar Thermal Plant Three. This EIA report only considers Upington Solar Thermal Plant Three[12]. This phase of the development has been earmarked for an area approximately 660ha in extent located in the northern quadrant of the farm portion.

[12] Note that a separate EIA report for the Upington Solar Thermal Plant Two has also been prepared by Savannah Environmental (DEA reference number: 14/12/16/3/3/2/656).

From the results of the facility layout determination, the CSP Plant will have a total development footprint of up to 500 ha. This amounts to 30% of the total 1575 ha originally available for development (and ~75% of the 660ha area considered), and is illustrated in the schematic in Figure 7.1.

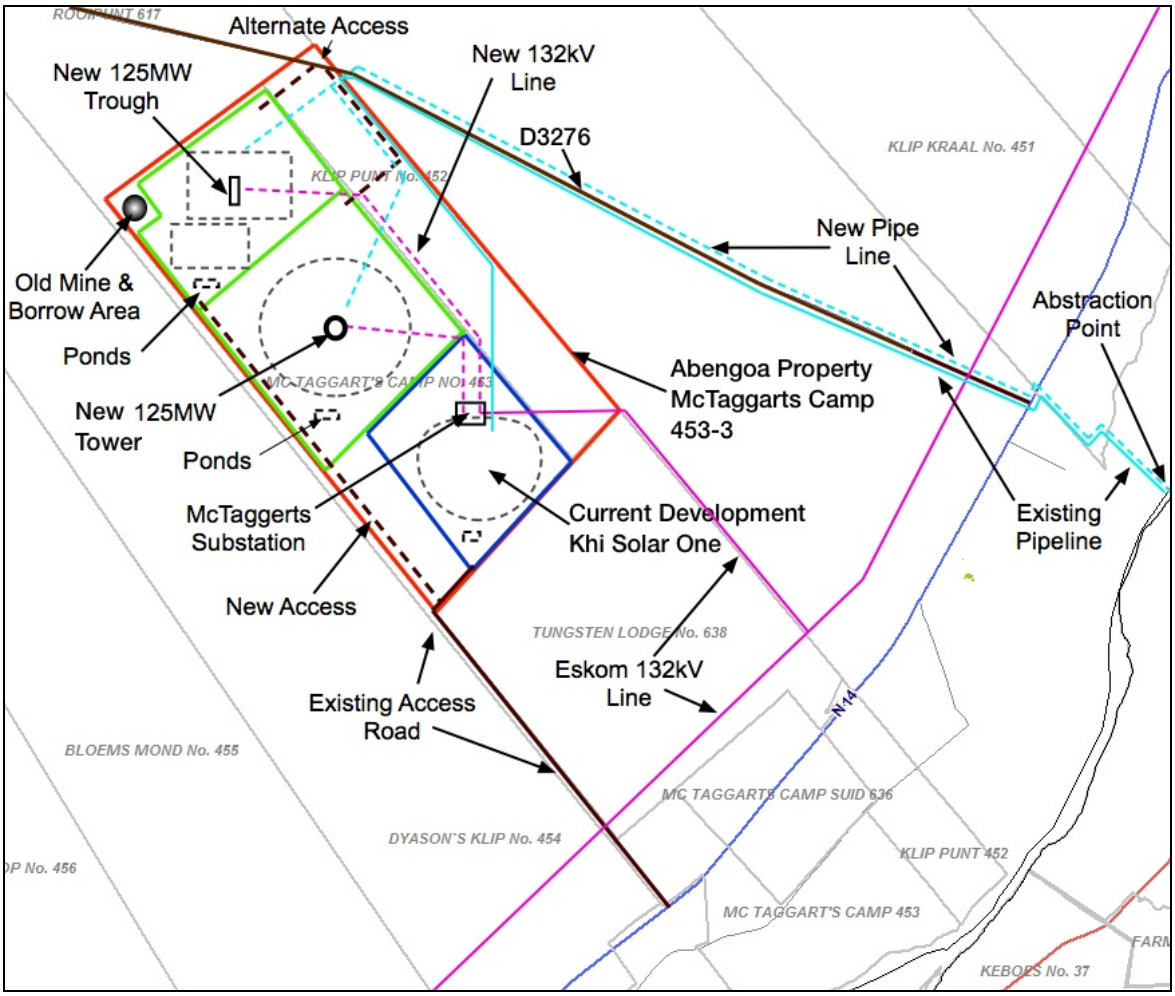

Figure 7.1: Schematic illustrating the relative locations of the Upington Solar Thermal Plant Three (the subject of this EIA), Upington Solar Thermal Plant Two (considered in a separate EIA), and the Khi Solar One project (under construction).

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 Upington Solar Thermal Plant Three on the identified site. This assessment has been informed by specialist studies contained in Appendix F – M. 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 with and without the implementation of mitigation measures. Recommendations are made regarding mitigation and

management measures for potentially significant impacts and the possibility of residual and cumulative impacts are noted.

7.2. Alternative access to site during construction and operation

The primary access road to the site would be off the N14 national road between Upington and Keimos. Two reasonable and feasible alternatives are have been considered (refer to Figure 7.2):

3. *Access Alternative 1- Access off the N14 via the existing Khi Solar One access road*. The Khi Solar One project has established a formal surfaced access road off the N14 for access to the McTaggarts Camp farm, and specifically the Khi Solar One project development site. The road is available to provide access for a portion of the distance to the site up to the Khi Solar One boundary (5.5km), with an additional 5.5km of road to then be constructed within the boundary of Portion 3 of the Farm McTaggarts Camp 453. This access road would provide direct access to the facility area from the south; or
4. *Access Alternative 2- Access off the N14 via the existing district road D3276.* The existing district road D3276 is a gravel road (and would be required to be surfaced). This road intersects with the northern boundary of Portion 3 of the Farm McTaggarts Camp 453 approximately 12 km from the N14. A short section of road (~1.5km) would be required to be constructed to access the facility area from the north.

Potential impacts pertaining to access to the site is assessed in the sections below, and a comparative assessment of the two access alternatives is provided.

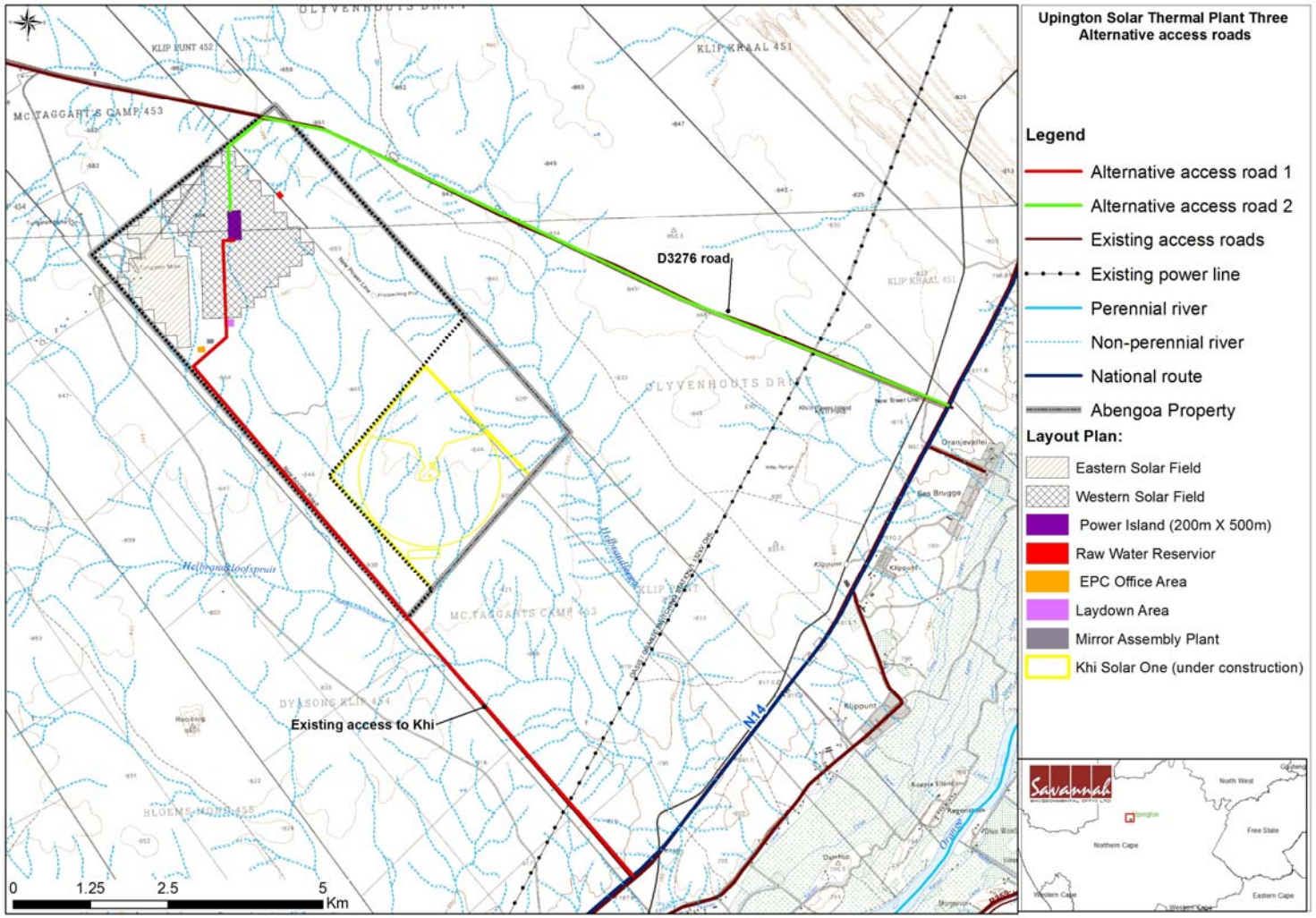

Figure 7.2: Map illustrating the two alternative access roads between the N14 and the Upington Solar Thermal Plant Three

7.3. Potential Impacts on Ecology (Flora, Fauna and Ecosystems)

CSP facilities require relatively large areas of land for placement of infrastructure; this 125MW CSP facility requires 500 hectares. The expected negative impact will be due to loss of habitat which may have direct or indirect impacts on individual species. Potential impacts and the relative significance of the impacts are summarised below (refer to Appendix F - Ecology Report for more details).

7.3.1 Results of the Ecological Study

The study area is situated in the Nama-Karoo biome. The vegetation types dominating the study area are Bushmanland Arid Grassland and Kalahari Karroid Shrubland. Both vegetation types are regarded as least threatened. Vegetation of the study area consists of a transitions from Bushmanland Arid Grasslands to Kalahari Karroid Shrublands, with small areas of denser and higher riparian vegetation around washes and pans. Small-scale plant diversity and ecological state of the vegetation varies considerably across the entire farm portion, depending on soil surface rockiness, depth of soil and position in the landscape. Despite past disturbances such as gravel roads, farm tracks, a homestead, farming activities and small-scale mining (from the 1930s), and the development of the Kh Solar One facility on the southern portion of the farm, the natural vegetation is relatively intact, with only a low presence of alien invasives.

The site does not fall within any "protected areas" or "Critical biodiversity areas". However, protected trees occur on the site, as do other species which are protected at a Provincial level.

The ecological sensitivity assessment identifies those parts of the study area that have high conservation value or that may be sensitive to disturbance. This sensitivity assessment is based on a desktop study, detailed field evaluation of the site and detailed analysis of aerial photography. From this assessment, it has been concluded that the majority of the site is of low sensitivity associated with riparian areas. The areas of high ecological sensitivities of the site are presented in Figure 7.3 and include:

» **Areas containing riparian vegetation along drainage lines**: Due to the poorly developed nature of drainage lines at the site, the areas containing riparian vegetation along drainage lines are noted to be of importance (Vegetation Association 1: *Acacia mellifera – Cenchrus ciliaris* ephemeral drainage lines). Density, height and composition of the woody and herb layer vary immensely. Large specimens of the protected *Acacia erioloba* and *Boscia foetida* as well as other tree and shrub species are scattered along the larger drainage lines on the south-west and west of the study area. Some of the larger *Acacia erioloba* trees are currently 'occupied' by active social weavers' nests. Surface water in these drainage lines will be mostly

ephemeral, but subsurface water reserves may persist for several weeks or months after sufficient rainfall.

» **Pans**: There are intermittent pans situated within the northern section of the site. Intermittent Pans are described Vegetation Association 2- *Acacia mellifera – Eragrostis rotifer*. These pans range from ~50 to 100 m in diameter. Depending on the amount of silt and underlying rock of the central areas of these pans, they may be able to retain surface water or be waterlogged for one to three weeks after large rainfall events, seldom longer. They may also remain dry for several successive years. The central areas of the pans are covered only with a sparse herbaceous layer – if at all vegetated – and species here typically need or prefer occasionally waterlogged soils so be able to persist.

» **Areas containing protected trees species** (*Acacia erioloba* (Camelthorn) *and Boscia foetida* (Shepherds tree), *Boscia albitrunca (*Shepherds *tree).*

The areas of high ecological sensitivity amount to an area of ~20ha, and it is recommended that these areas be avoided by infrastructure in order to minimise the impact on vegetation and fauna.

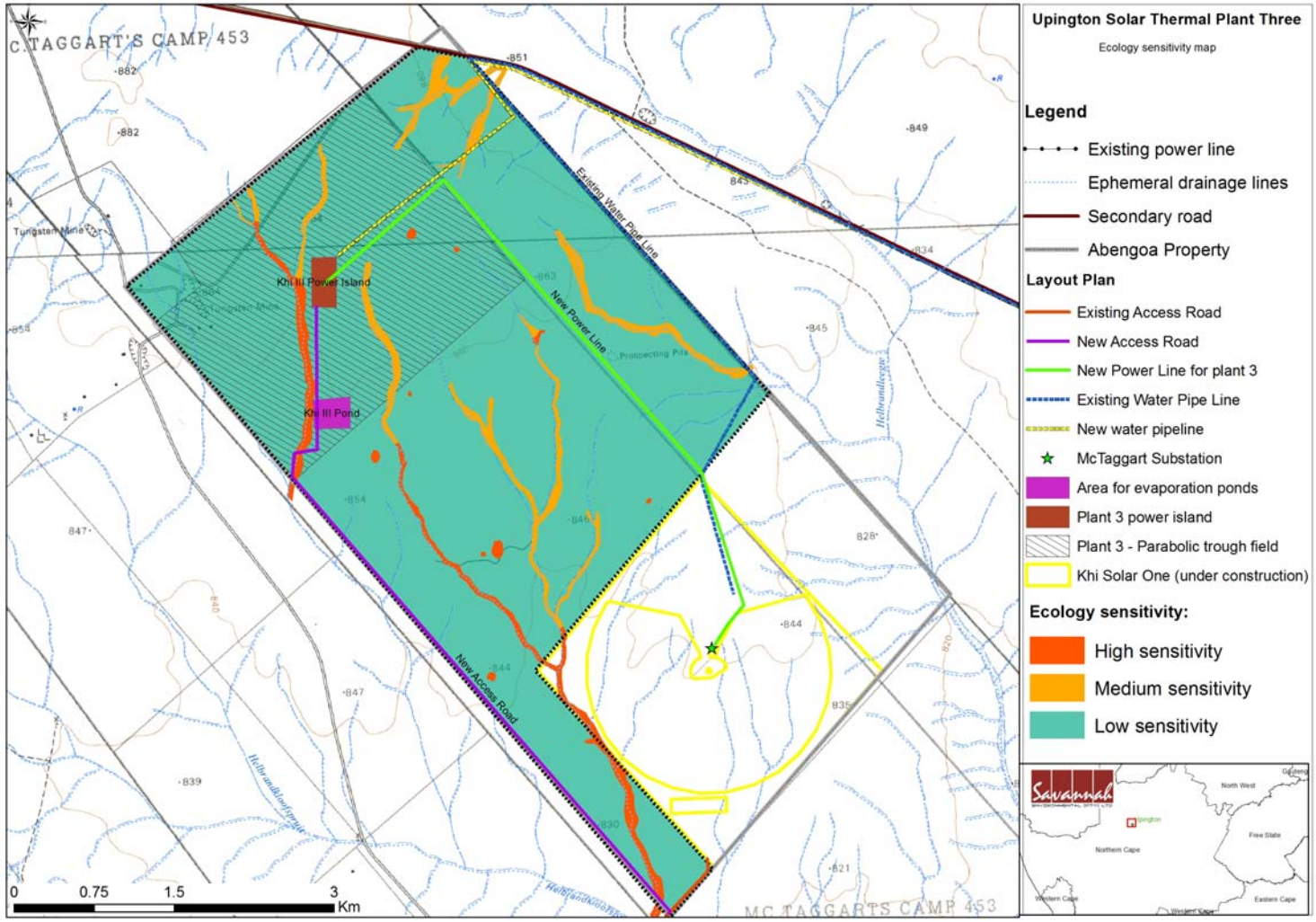

Figure 7.3: Ecological sensitivity map of the site for the Upington Solar Thermal Plant Three

7.3.2 Description of Ecological Impacts

- » Localised reduction of indigenous trees and shrubs, geophytes and other species of conservation concern, but not to a degree that the current conservation status of such species will be negatively affected. However, this effect is and will be further exacerbated by surrounding and regional developments (cumulative impacts).
- » A number of small intermittent pans and ephemeral washes will be permanently transformed. Due to the semi-arid nature of the environment, it is not expected that this will have a significant impact on downstream wetland hydrology or functionality with the implementation of mitigation measures. However, the functionality of the small intermittent pans and their resources to other biodiversity will be lost. This may create a localised loss of species, but not affect their conservation status.
- » Potentially significant negative impacts on the ecological environment could include soil degradation on and beyond the development area, loss of functional and productive topsoil, possible introduction of weeds and invasive plants, a long-term (more than 8 months) low or absent vegetation cover after construction and possible contamination of lower-lying ephemeral drainage and perennial wetland systems.
- » The impact on fauna is expected to be small for the development, but may become more of an issue if the cumulative impact of all surrounding developments is considered. Presence of indigenous terrestrial vertebrates within the study area is relatively low due to absence of permanent surface water. Animals that may be permanently present can be relocated or will move away during construction, and may resettle after construction, depending on safety specifications necessitated by the development. No restricted or specific habitat of vertebrates exists on the study area and will be affected by the proposed development; especially if the proposed development remains outside the more sensitive areas as recommended.

7.3.3 Impact table summarising the significance of impacts on ecology during the construction and operation phases (with and without mitigation)

Nature: Upgrading and creation of site access and internal maintenance roads can cause loss of vegetation, increase in runoff and erosion, possible distribution and increased establishment of alien invasive species, possible disturbance and reduction of habitat or injury to burrowing vertebrates, possible rise of road-kill incidences of fauna, possible change of natural runoff and drainage patterns, possible loss of protected species, possible permanent loss of re-vegetation potential of soil surface, increase in dust levels.		
Listed activities: GNR 544, 18 June 2010 Activity 47 (iii) GNR 546, 18 June 2010 Activity 4(a) ii		
	Without mitigation	**With mitigation**

Extent	Local (2)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	High (8)	Moderate (7)
Probability	Definite (5)	Definite (5)
Significance	**High (70)**	**Medium (60)**
Status (positive, neutral or negative)	Negative	Negative Notes: reduced impact on existing roads and tracks
Reversibility	Not reversible	Relatively reversible
Irreplaceable loss of resources?	Probable	Likely
Can impacts be mitigated?	Reasonably well	

Mitigation:

- » During construction: Create designated servitude areas and strictly prohibit any off-road driving or parking of vehicles and machinery outside designated areas.
- » Avoid or reduce impact on all pans, riparian vegetation around large intermittent rivers.
- » Ensure adequate drainage where the Helbrandskloofspruit tributaries are crossed.
- » Avoid pans as far as possible, maintaining a buffer zone of at least 32 m, preferably a minimum of 50 m from all pans that will not be within the solar development footprints.
- » Ensure that suitable stormwater management structures are in place.
- » Design the access route to go as far as possible along existing roads of the Khi Solar One access and other larger farm tracks.
- » Conduct an ecological walk through survey prior to construction to determine the full extent of protected fauna and flora that will be affected and compile a suitable photo record that can be used by EO/ECO/construction staff to identify the relevant species.
- » Protected geophytic plant species must be relocated.
- » Animal burrows: must be monitored by EO/ECO prior to construction for activity/presence of animal species. If detected, such animals must be removed and relocated by a qualified professional/contractor.
- » Amphibians or tadpole shrimps that may emerge in the small pans after larger rainfall events must be relocated to similar pans not affected by the development.
- » Should any mammals be injured during construction, they must be taken to a local veterinarian for rehabilitation or humane euthanization.
- » Create designated turning areas and strictly prohibit any off-road driving or parking of vehicles and machinery outside designated areas.

- » Ensure that concrete, tar or other construction material is not spilled or discarded next to newly built roads or stormwater structures, but disposed of at a designated area.
- » Keep the clearing of natural vegetation to a minimum.
- » Dust levels must be controlled and minimised.
- » If filling material is to be used, this should be sourced from areas free of invasive species:
    - o Moderate volumes of spoil material have been created by the Khi Solar One development, which should be used as first option for filling material, after which more fill material will most likely become available from landscaping operations from the development.
    - o The creation of any additional borrow pits should thus be avoided.
- » Topsoil (the upper 25 cm of soil) is an important natural resource; where it must (and can) be stripped, never mix it with subsoil or any other material, store and protect it separately until it can be re-applied, minimise handling of topsoil.
- » Topsoil and spoil material/subsoil storage areas must be delineated in the final layout plan.
- » Combined final stockpiles may not exceed 4 m in height, preferably should not be higher than 1 m, and must be managed according to a strict landscaping, rehabilitation and soil erosion management plan until decommissioning.
- » Reinforce portions of existing access routes that are prone to erosion, create structures or low banks to drain the access road rapidly during rainfall events, yet preventing erosion of the track and surrounding areas.
- » Ensure that runoff from compacted or sealed surfaces is slowed down and dispersed sufficiently to prevent accelerated erosion from being initiated (erosion management plan required).
- » Prevent leakage of oil or other chemicals or any other form of pollution, as this may infiltrate local groundwater reserves or end up in the Orange River where it can affect all downstream users.
- » Monitor the establishment of (alien) invasive species and remove as soon as detected, whenever possible before regenerative material can be formed.
- » Strictly enforce a speed limit of 30 to 60 km/hour on all construction and access routes as appropriate and limit driving to daytime hours to try and prevent collisions with fauna, especially nocturnal mammals.
- » After decommissioning, if access roads or portions thereof will not be of further use to other stakeholders, remove all foreign material, rip and treat the area to facilitate the establishment of vegetation, followed by a suitable re-vegetation program.

Cumulative impacts:

- » Possible erosion of areas lower than the access road, possible contamination of groundwater reserves due to oil or other spillage
- » Possible spread and establishment of alien invasive species
- » Increased transformed areas (together with surrounding developments) that will

affect local fauna and flora population dynamics and runoff patterns
» Loss of small ephemeral pans and washes that could influence seasonal migration patterns of fauna

Residual impacts:
» Localised loss of vegetation
» Altered topsoil conditions
» Potential barren areas remaining after decommissioning
» Potential for erosion and invasion by weed or alien species
» Potential for increased dust and its impact on surrounding environments and biodiversity
» Potential permanent loss of small ephemeral pans and drainages that could influence seasonal migration patterns of fauna

Nature: Fencing area and CSP Plant may cause loss of habitat and mortality of fauna due to removal of vegetation, compaction of soils, creation of runoff zone, impact on protected species and impact on terrestrial vertebrates by restricting movement.

Listed activities:
GNR 546, 18 June 2010 Activity 13(c) ii
GNR 546, 18 June 2010 Activity 14 (a) i

	Without mitigation	**With mitigation**
Extent	Local (2)	Local (1)
Duration	Long-term (4)	Long term (4)
Magnitude	Low (4)	Minor (2)
Probability	Definite (5)	Highly Probable (4)
Significance	**Medium (50)**	**Low (28)**
Status (positive, neutral or negative)	Negative	Negative
Reversibility	Partially reversible	Reversible
Irreplaceable loss of resources?	Probable	Not likely
Can impacts be mitigated?	Reasonably well	

Mitigation:
» All old/existing fencing must be checked routinely for and freed of snares; all staff need to be made aware that any form of poaching is a criminal offence and will be investigated.

- During the design phase, the possible impact of burrowing vertebrates and rodents on the development must be determined, and fencing must be designed to either exclude such fauna if it will be detrimental or enable occasional migration of smaller vertebrates onto and across the site (which could be beneficial to small vertebrate populations).
- Minimise area affected, especially during construction.
- During construction strictly prohibit any off-road driving or parking of vehicles and machinery outside the footprint areas.
- If the area will be used as fire-break as well, maintain a suitably low vegetation layer by regular mowing or appropriate plant species selection, but do not leave soil bare. Alternatively, ensure that the soil has a covering of gravel or small rock that prevents erosion.
- The firebreak and fencing area will have to be kept clear of all weeds and indigenous invasive species to enable continued effective maintenance until decommissioning.

Cumulative impacts:

- Possible erosion of cleared areas and associated accelerated erosion from surrounding areas.
- Possible loss of ecosystem functioning due to increase in invasive species.
- Increased habitat fragmentation and displacement of terrestrial vertebrates in the region.

Residual impacts:

- Altered vegetation composition.
- Compacted topsoils.
- Possibility for erosion and invasion by alien and indigenous invasives.

Nature: Construction and operation of parabolic trough field will cause transformation of the land and ecosystem on an area of up to 400 hectares due to large scale removal of vegetation, transformation of soil surface and loss of microhabitats, compaction of soils, removal of topsoil.

Listed activities:
GNR 545, 18 June 2010 Activity 15

	Without mitigation	**With mitigation**
Extent	Local (5)	Local (3)
Duration	Long-term (4)	Long-term (4)
Magnitude	Very High (10)	High (8)
Probability	Definite (5)	Definite (5)
Significance	**High (95)**	**High (75)**

Status (positive, neutral or negative)	Negative	Negative
Reversibility	Low reversibility	Partially reversible
Irreplaceable loss of resources?	Highly Probable	Medium Probability
Can impacts be mitigated?	Reasonably but with limited full restoration potential	

Mitigation:

» Avoid all riparian vegetation around natural pans and larger intermittent drainage lines as far as practically possible.
» During the design phase, ensure that a buffer of at least 50 m is maintained around ephemeral pans and larger washes and drainage lines outside of the footprint area to maintain the species diversity and buffering capacity of these systems.
» Ensure that stormwater management structures do not negatively affect the above or pose any contamination risk of lower-lying larger ephemeral drainage lines, rivers and the Gariep (Orange) River.
» However, aim to channel runoff back into larger natural drainage lines to maintain seasonal moisture replenishment of these drainage lines beyond the development area to prevent the die-off of keystone species in drainage lines outside the development area.
» Conduct an ecological walk through survey prior to construction to determine the full extent of protected fauna and flora that will be affected and compile a suitable photo record that can be used by EO/ECO/construction staff to identify the relevant species.
» Keep areas affected to a minimum, strictly prohibit any disturbance outside the demarcated footprint area.
» Clear as little vegetation as possible, aim to maintain all indigenous vegetation where it will not interfere with the construction or operation of the development, rehabilitate an acceptable vegetation layer where permissible according to rehabilitation recommendations of the EMPr.
» Shred all shrubs and trees cleared and used the chips for dust and erosion control.
» Use only species that were part of the original non-invasive indigenous species composition as listed in the specialist report for re-vegetation.
» Alternatively, soil surfaces where no re-vegetation seems possible will have to be covered with gravel or small rock fragments to increase porosity of the soil surface, slow down runoff and prevent wind- and water erosion.
» Remove all invasive vegetation, completely uproot and eradicate potentially resprouting high shrubs, especially *Rhigozum trichotomum*, *Phaeoptilum spinosum*, *Lycium* species and *Acacia mellifera.*
» Aim to cover all permanently bare areas either with a layer of gravel over sheets of weed-barrier sheeting, or porous asphalt.

- » Continuously monitor the establishment of new invasive species and remove as soon as detected, whenever possible before regenerative material can be formed, up to decommissioning.
- » Use excavated materials to fill up and close old mining pits.
- » If filling material is to be used, this should be sourced from areas free of invasive species
    - o Moderate volumes of spoil material have been created by the Khi Solar One development, which should be used as first option for filling material, after which more fill material will most likely become available from landscaping operations from the development
    - o The creation of any additional borrow pits should thus be avoided
- » Monitor the area below and around the parabolic troughs regularly after larger rainfall events to determine where erosion may be initiated and then mitigate accordingly.
- » Runoff may have to be specifically channeled or stormwater adequately controlled to prevent localised rill and gully erosion.
- » Prevent leakage of oil or other chemicals, strictly prohibit littering and spillages of any kind.
- » The rehabilitation plan for all affected areas after decommissioning must aim to re-introduce all non-weed indigenous species listed in the specialist report as a minimum, taking the observed original cover percentages as a guideline of acceptable vegetation cover.

Cumulative impacts:

- » If mitigation measures are not strictly implemented the following could occur:
    - o Loss of biodiversity across an extended area
    - o Possible accelerated erosion of areas around the panels and continued erosion of the development area with associated siltation and/or erosion of lower-lying wetlands
    - o possible contamination of drainage lines, lower-lying rivers or wetlands
    - o possible spread and establishment of invasive species
- » Increased habitat fragmentation and displacement of terrestrial vertebrates in the region.
- » Increased transformed areas (together with surrounding developments) that will affect local fauna and flora population dynamics and runoff patterns.
- » A die-off of larger trees and shrubs and other species depending on higher soil moisture levels in downstream drainage lines due to the reduction of occasional floods as upper tributaries are removed from the system
- » Possible creation of heat-island effects by the anticipated increased temperatures of large bare areas
- »

Residual impacts:

- » ***Positive impact***: current old mine pits that are dangerous traps to fauna and man

will be filled and covered and associated contaminants cleared
» Altered topsoil characteristics and some loss of functional topsoil
» Loss of and alteration of microhabitats, especially the loss of smaller ephemeral washes and pans and the alteration of ephemeral drainage lines
» Altered vegetation composition, lower vegetative cover and loss of species diversity
» Possible continued die-off of larger trees and shrubs and other species depending on higher soil moisture levels in downstream drainage lines due to the reduction of occasional floods as upper tributaries are obliterated
» Low functionality and productivity of large cleared areas that may remain susceptible to further degradation for many years after decommissioning
» Increased habitat fragmentation and displacement of terrestrial vertebrates
» Higher risk of the establishment by alien and indigenous invasive plant species

Nature: Construction of a power line as part of the grid connection to connect into from each development into the Khi Solar One substation. This is the shortest and environmentally most viable option, hence no other option is being considered. The power line will cause limited loss of vegetation, potential loss of individuals of keystone species and associated microhabitats, increase in runoff and erosion, disturbance of burrowing animals.

Listed Activities:
GNR 544, 18 June 2010 Activity 10

	Without mitigation	**With mitigation**
Extent	Local (2)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Minor (2)	Small (0)
Probability	Definite (5)	Highly Probable (4)
Significance	**Medium (40)**	**Low (20)**
Status (positive, neutral or negative)	Negative	Slightly negative
Reversibility	Partially reversible	Reversible
Irreplaceable loss of resources?	Probable	Not likely
Can impacts be mitigated?	Reasonably	

Mitigation:
» Conduct an ecological walk through survey of the power line prior to construction.

» Aim to minimise the destruction of indigenous large shrubs and trees.
» Limit clearing of indigenous vegetation to pylon positions and access routes.
» Shred all shrubs cleared and used the chips for dust and erosion control.
» Monitor the establishment of invasive species along the power line route and remove as soon as detected, whenever possible before regenerative material can be formed.

Cumulative impacts:

» Possible erosion of surrounding areas if no mitigation is implemented, no major cumulative impact on flora or fauna expected

Residual impacts:

» Localised alteration of soil surface characteristics
» Localised loss of flora and displacement of fauna

Nature: Construction of an abstraction point and water pipeline to abstract water from the Gariep River will cause limited removal of vegetation, compaction of soils, temporary or permanent damage to animal burrows.

Listed Activities:
GNR 544, 18 June 2010 Activity 9

	Without mitigation	**With mitigation**
Extent	Local (2)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Low (4)	Small (1)
Probability	Definite (5)	Definite (5)
Significance	**Medium (50)**	**Medium (30)**
Status (positive, neutral or negative)	Negative	Slightly negative
Reversibility	Partially reversible	Reversible
Irreplaceable loss of resources?	Probable	Not likely
Can impacts be mitigated?	Reasonably	

Mitigation:

» Design the pipeline route to be positioned directly adjacent to the Khi Solar One pipeline servitude as far as possible; or as an alternative, within existing disturbed road servitudes.
» Avoid additional clearing of vegetation and rocky areas in the section between the

N14 National Road and the Orange River. Use overland pipelines in area where it is not feasible to bury the pipeline.

- » If possible, share the same embankment for river access and cleared area for the pumping reservoir.
- » Conduct an ecological walk through survey of the pipe line prior to construction to determine the full extent of protected fauna and flora that will be affected. And compile a suitable photo record that can be used by EO/ECO/construction.
- » Aim to minimise the destruction of indigenous large shrubs and trees.
- » During construction: create designated servitude areas and strictly prohibit any off-road driving or parking of vehicles and machinery outside designated areas.
- » Remove and store topsoil and subsoil separately, store topsoil on the side of the excavation where it will not be affected by subsequent construction.
- » Re-landscape and rehabilitate affected areas immediately after construction according to the general rehabilitation and re-vegetation plan.
- » In areas where existing topsoil is very limited due to the presence of surface calcrete, a layer of topsoil sourced from the development footprints can be added over the re-landscaped sections to enable re-vegetation regrowth.
- » Monitor the establishment of invasive species along the pipeline route and remove as soon as detected, whenever possible before regenerative material can be formed.

Cumulative impacts:

- » Possible erosion of surrounding areas if no mitigation is implemented, no major cumulative impact on flora or fauna expected

Residual impacts:

- » Localised alteration of soil surface characteristics
- » Localised loss of flora and displacement of fauna

Nature: Construction of associated infrastructure, including buildings and other structures on the site over 100ha will result in loss of vegetation and/or species of conservation concern, loss of microhabitats, reduced vegetation cover, altered distribution of rainfall and resultant runoff patterns, increase in *concentrated* runoff from sealed surfaces and possibly higher accelerated erosion, reduction of habitat and resource availability for terrestrial fauna, possible pollution from permanent infrastructure and/or facilities etc.

Listed Activities:
GNR 544, 18 June 2010 Activity 12
GNR 544, 18 June 2010 Activity 39 (iii) & (v)
GNR 546, 18 June 2010 Activity 6(iii) & (iv)

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

Duration	Long-term (4)	Long-term (4)
Magnitude	Moderate (6)	Low (3)
Probability	Definite (5)	Definite (5)
Significance	**Medium (60)**	**Medium (40)**
Status (positive, neutral or negative)	Negative	Negative
Reversibility	Partially reversible	Reversible
Irreplaceable loss of resources?	Probable	Not likely
Can impacts be mitigated?	Reasonably	

Mitigation:

- » Ensure that stormwater management structures do not negatively affect the above or pose any contamination risk of lower-lying larger ephemeral drainage lines, rivers and the Orange River
- » However, aim to channel runoff back into larger natural drainage lines to maintain seasonal moisture replenishment of these drainage lines beyond the development area to prevent the die-off of keystone species in drainage lines outside the development area
- » Aim to minimise the destruction of indigenous large shrubs and trees.
- » Conduct an ecological walk through survey of all infrastructure.
- » During construction: stay within demarcated footprint areas and strictly prohibit any off-road driving or parking of vehicles and machinery outside designated areas
- » Prevent spillage of construction material and other pollutants, contain and treat any spillages immediately, strictly prohibit littering.
- » Topsoil (the upper 25 cm of soil) is an important natural resource; where it must and can be stripped, never mix it with subsoil or any other material, store and protect it separately until it can be re-applied, minimise handling of topsoil.
- » Temporarily stored topsoil must be re-applied within 6 months, topsoils stored for longer need to be managed according to a detailed topsoil management plan.
- » Rehabilitate and re-vegetate all areas outside footprint area that have been disturbed.
- » After decommissioning remove all foreign material prior to starting the rehabilitation.
- » The rehabilitation plan for all temporarily affected areas and for the development area after decommissioning must aim to re-introduce all non-invasive indigenous species listed in the specialist report as a minimum, taking the observed original cover percentages as a guideline of acceptable vegetation cover
- » Monitor the establishment of invasive species and remove as soon as detected, whenever possible before regenerative material can be formed.

Cumulative impacts:

- If mitigation measures are not strictly implemented the following could occur:
  - Erosion of areas around sealed surfaces and continued erosion of the development area with associated siltation and/or erosion of lower-lying wetlands
  - Contamination of ground water resources and possibly the Orange River
  - Spread and establishment of invasive species
- Increased habitat fragmentation and displacement of terrestrial vertebrates in the region.
- Increased transformed areas (together with surrounding developments) that will affect local fauna and flora population dynamics.

Residual impacts:

- Altered topsoil characteristics.
- Loss of and alteration of microhabitats, especially the loss of smaller ephemeral washes and pans and the alteration of ephemeral drainage lines.
- Altered vegetation composition, lower vegetative cover and loss of species diversity.
- Low functionality and productivity of cleared areas that may remain susceptible to further degradation for many years after decommissioning.
- Increased habitat fragmentation and displacement of terrestrial vertebrates.
- Higher risk of the establishment by alien and indigenous invasive plant species.

Nature: Construction of evaporation ponds could cause environmental degradation and pollution of water bodies.

Listed Activities:
GNR 544, 18 June 2010 Activity 11
GNR 544, 18 June 2010 Activity 12
GNR 544, 18 June 2010 Activity 18
GNR 545, 18 June 2010 Activity 3
GNR 546, 18 June 2010 Activity10 (a) ii

	Without mitigation	**With mitigation**
Extent	Regional (5)	Minor (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	High (8)	Low (4)
Probability	Definite (5)	Definite (5)
Significance	**High (85)**	**Medium (50)**
Status (positive, neutral or negative)	Negative	Negative

Reversibility	Partially reversible	Partially reversible
Irreplaceable loss of resources?	Probable	Not likely
Can impacts be mitigated?	Reasonably	

Mitigation:

- » Avoid all areas with a high occurrence of natural pans and larger intermittent drainage lines for the location of evaporation ponds.
- » During the design phase, ensure that a buffer of at least 150 m, preferably more, is maintained around all ephemeral pans and larger washes and drainage lines to eliminate any contamination risk of lower-lying pans, washes, drainage lines and rivers
  - o Indicate all evaporation ponds on the final layout plan submitted prior to commencement of construction
  - o Ensure an appropriate management and response plan is in place to deal with accidental spillages or overflows which may result from extreme weather events or infrastructure breakages
- » Monitor erosion of areas and control where necessary
- » Continually monitor the infrastructure to detect any cracks or possible leakage early
- » Ensure that the evaporation ponds are lined.
- » Undertake monitoring of the evaporation ponds to check for leakages during the operational phase.

Cumulative impacts:

- » If mitigation measures are not strictly followed the following could occur:
  - o Contamination of lower-lying wetlands and the Gariep river
  - o Potential for increased chemical-laden dust and its impact on surrounding environments and biodiversity

Residual impacts:

- » Altered topsoil characteristics
- » Altered vegetation composition, lower vegetative cover and loss of species diversity

Nature: Topsoil stockpiles that will be required during and after construction and large topsoil and subsoil volumes will be removed from the leveling of areas for the parabolic trough plant which could cause soil loss, possible degradation of downstream habitats, possible excessive establishment and spread of weeds and invasive species (alien and indigenous) on disturbed areas, possible marginal increase in ambient temperatures in the immediate vicinity of the development due to hotter soil surface temperatures if stockpiles remain bare, possible excessive loss of topsoil resources, possible long term source of dust.

Listed Activities:
GNR 545, 18 June 2010 Activity 1
GNR 545, 18 June 2010 Activity 15

	Without mitigation	**With mitigation**
Extent	Local (2)	Local (1)
Duration	Permanent (5)	Long-term (4)
Magnitude	High (8)	Moderate (5)
Probability	Definite (5)	Definite (5)
Significance	**High (75)**	**Medium (50)**
Status (positive, neutral or negative)	Negative	Negative
Reversibility	Partially reversible	Partially reversible
Irreplaceable loss of resources?	Probable	Not likely
Can impacts be mitigated?	Reasonably	

Mitigation:

- » Indicate all stockpile areas and anticipated volumes of stored materials on the final layout plan prior to commencement of construction.
- » Ensure an appropriate management plan is in place for the construction, rehabilitation and erosion control of the stockpile areas prior to commencement of construction.
- » Minimise handling of topsoil, and aim to reduce double-handling of topsoil.
- » All areas utilised for topsoil stockpiles must be rehabilitated and alien vegetation cleared.
- » Topsoil (the upper 25 cm of soil) is an important natural resource; where it must and can be stripped, never mix it with subsoil or any other material, store and protect it separately until it can be re-applied.
- » .emporarily stored topsoil must be re-applied within 6 months, topsoils stored for longer need to be managed according to a detailed topsoil management plan.
- » After construction remove all foreign material prior to starting the rehabilitation
- » The rehabilitation plan for all temporarily affected areas must aim to re-introduce all non-weed indigenous species listed in the specialist report as a minimum, taking the observed original cover percentages as a guideline of acceptable vegetation cover.

Cumulative impacts:

- » If mitigation measures are not strictly followed the following could occur:
  - o Continued erosion of the altered surfaces with associated degradation of the site and surrounding areas

o Spread and establishment of invasive species » Increased transformed areas (together with surrounding developments) that will affect local fauna and flora population dynamics and runoff patterns. » Excessive loss of functional topsoil and associated loss of rangeland productivity and susceptibility of rangelands to degradation.
Residual impacts: » Altered topsoil characteristics » Loss of and alteration of microhabitats » Altered vegetation composition, lower vegetative cover and loss of species diversity » Potential for increased dust and its impact on surrounding environments and biodiversity » Higher risk of invasion by alien plant species

7.3.4 Comparative Assessment of Access Road Alternatives

Both routes will require new road construction within the boundaries of Portion 3 of the Farm McTaggarts Camp 453. New road construction should be in accordance with the mitigation as proposed for the removal of vegetation, transformation of soil surface and loss of microhabitats, compaction of soils, and removal of topsoil.

1. *Access Alternative 1- Access off the N14 via the existing Khi Solar One access road*. The Khi Solar One project has established a formal surfaced access road off the N14 for access to the McTaggarts Camp farm, and specifically the Khi Solar One project development site. The road is available to provide access for a portion of the distance to the site up to the Khi Solar One boundary (5.5km), with an additional 5.5km of road to then be constructed within the boundary of the farm. Consolidation of the impacts to a single corridor (Khi and Upingon Three) is supported.
2. *Access Alternative 2- Access off the N14 via the existing district road D3276.* The existing district road D3276 is a gravel road (and would be required to be reconstructed and surfaced along its route to avoid erosion with increased used). This route is currently infrequently used by heavy or regular traffic.

The proposed layout includes a crossing of the Helbrandskloofspruit tributary by Alternative 1. This is not considered desirable from an ecological perspective, and the access road is recommended to be realigned. Both alternatives will result in disturbance to habitats (flora and fauna) and displacement of fauna. Both alternatives require additional earth works and construction activities. Therefore considering the aridity of the area and the difficulty of new vegetation establishment, there is **no significance** difference in the potential impacts associated with the two corridors, provided that the Alternative 1 is rerouted to not traverse the Helbrandskloofspruit tributary.

7.3.5 Implications for Project Implementation

With the diligent implementation of mitigating measures by the developer, contractors, and operational staff, the severity of ecological impacts of the CSP plant can be significantly reduced or avoided. The Upington Solar Thermal Plant Three can be developed and ecological impacts managed by adhering to the following key actions:

» The areas of high ecological sensitivity amount to an area of ~20 hectares, it is recommended that these areas are avoided by infrastructure layout for the CSP Plant.
» The current location of evaporation pond is proposed to be in close proximity of larger intermittent drainage lines and should be relocated.
» The layout of the CSP Plant should avoid the areas of high ecological sensitivities of the site are presented in the sensitivity map (Figure 7.3)
» Design the access route to go as far as possible along existing roads of the Khi Solar One access and other larger farm tracks.
» A permit to be obtained for removal of protected trees that are affected.
» Ensure adequate drainage where the Helbrandskloofspruit tributaries are crossed.
» Avoid pans as far as possible, maintaining a buffer zone of at least 32 m, preferably a minimum of 50 m from all pans that will not be within the solar development footprints.
» A licence is required from DWA if there are impacts on any water resources (i.e. the drainage lines/ abstraction of water from the Gariep River).
» Ensure that suitable stormwater management structures are in place.
» An ecological walk through survey for the CSP plant and associated infrastructure (such as pipeline, power line and access roads) must be undertaken prior to construction.
» All disturbed areas must be rehabilitated. Areas can that be re-vegetated must be determined during the construction phase.

7.4. Potential Impacts on Avifauna

Six species of conservation concern could occur in the study area including: the Secretarybird; Lanner Falcon; Sclater's Lark; Kori Bustard; Ludwig's Bustard and Martial Eagle. A pair of ostrich has been observed in the area. Some of the larger *Acacia erioloba* trees are currently 'occupied' by active social weavers' nests.

Little is known about the impacts of solar thermal plants on birds, largely because commercial-scale solar technologies are only now under construction in South Africa. The primary impact on bird species and communities is mainly due to the large footprint required for commercial-scale energy production. This would refer to the habitat loss and disturbance created during the construction phase of the facility. Secondary impacts

relate to the operation of the facility and include avian mortality due to direct interactions with the facilities and their associated infrastructure, namely power lines.

A substation is currently under construction on the site for the Khi Solar One CSP project and the proposed project is intended to connect into this new McTaggerts Substation via a 132 kV overhead power lines (up to 8km in length).

Potential impacts on avifauna include:
» Impact on local bird communities due to habitat loss
» Impact on local bird communities due to disturbance
» Collision of birds with power lines
» Electrocution of birds on associated power line tower structures

7.4.1 Sensitivity Assessment

From a habitat and ecosystem point of view majority of the site is of low ecological and therefore avifaunal habitat sensitivity, the CSP Plant and the associated infrastructure are suitable for the proposed site provided that the areas of high ecological sensitivity are avoided and that power lines are fitted with bird diverters. Eagle eye devices may be used, if feasible to deter birds from the CSP plant area/ solar field.

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

Nature: Impact on local bird community due to habitat loss from the construction of the CSP plant and associated infrastructure including power lines.		
Listed activities: GNR 545, 18 June 2010 Activity 1 GNR 544, 18 June 2010 Activity 47 (iii) GNR 545, 18 June 2010 Activity 15 GNR 546, 18 June 2010 Activity 13		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Long Term (4)	Long Term (4)
Magnitude	Minor (2)	Small (0)
Probability	Highly Probable (4)	Highly Probable(4)
Significance	**Low (28)**	**Low (20)**
Status	Negative	Negative
Reversibility	Possible	Possible

Irreplaceable loss of resources	None	None
Can impacts be mitigated	Yes	Yes

Mitigation measures:

» Where possible, avoid clearing vegetation in drainage channels or washes, where bird density and diversity has the potential to be higher (although this higher diversity was not recorded during the site visit).
» If possible, the servitude of the power line exiting the site should follow existing roads and not cut across habitat.
» All construction and maintenance activities must be undertaken in accordance with Eskom's T Environmental Best Practise Standards.
» The construction footprint and access roads should be restricted to within the development footprint.
» The ostrich pair has been observed in the area must be monitored prior to construction to ensure that they are not nesting on site. If so, the nesting area must be suitably protected and excluded from the construction process until all eggs have hatched and the animals can be relocated.
» All social weavers nests that may be affected by the development must be moved by a qualified contractor or with the assistance of the relevant qualified persons; other bird nests in trees/higher shrubs need to be monitored and only removed if not used for breeding.

Cumulative impacts:

The loss of habitat on-site has the potential to add to the cumulative impacts that habitat loss in the region is having on avifauna. However, ±500ha in the context of the amount of similar habitat in the region is a negligible amount.

Residual impacts:

None

Nature: Impact on local bird community due to disturbance on site and in surrounding area. Sensitive and threatened species are of most concern and particularly while breeding

Listed activities:

GNR 545, 18 June 2010 Activity 1
GNR 544, 18 June 2010 Activity 47 (iii)
GNR 545, 18 June 2010 Activity 15
GNR 546, 18 June 2010 Activity 13

	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Short Duration (2)	Short Duration (2)
Magnitude	Minor (2)	Minor (2)
Probability	Distinct Possibility (3)	Distinct Possibility (3)

Significance	**Low (15)**	**Low (15)**
Status	Negative	Negative
Reversibility	Possible	Possible
Irreplaceable loss of resources	None	None
Can impacts be mitigated	Yes	Yes
Mitigation measures: » Contractors need to minimise the amount of disturbance during the construction phase of the facility, by staying within the demarcated ±500ha construction area. » If the nest of a large species is detected within the vicinity of the area to be disturbed, then the Northern Cape Department needs to be notified and all attempts made to minimise the amount of disturbance near it.		
Cumulative impacts: Development of multiple solar energy facilities in this region near Upington may have cumulative imapcts of birds, however limited due to the species which occur in the area. Each CSP plant will have to individually assess If mitigation measures are required to protect avifauna.		
Residual impacts: N/A		

Nature: Impact on of birds being attracted to the parabolic troughs		
	Without mitigation	**With mitigation**
Extent	Local (1) -	Local (1) -
Duration	Long Term (4)	Long Term (4)
Magnitude	Minor (2)	Minor (2)
Probability	Very Improbable (1)	Very Improbable (1)
Significance	**–Low (7)**	**Low (7)**
Status	Negative	Negative
Reversibility		
Irreplaceable loss of resources	None	None
Can impacts be mitigated	No	No
Mitigation measures:	None required	
Cumulative impacts:	N/A	
Residual impacts:	N/A	

Nature: Impact on local bird communities due to the power line due to collision and electrocution by the overhead power lines		
Listed activities: GNR 545, 18 June 2010 Activity 10		
	Without mitigation	**With mitigation**
Extent	Low(1)	Low(1)
Duration	Long term (4)	Long term (4)
Magnitude	Moderate (6)	Minor (2)
Probability	Distinct possibility (4)	Improbable (2)
Significance	**Medium (44)**	**Low (14)**
Status	Negative	Negative
Reversibility	n/a	n/a
Irreplaceable loss of resources	None	None
Can impacts be mitigated	Yes	n/a
Mitigation measures: » The line should be kept as low as possible taking into account engineering and legal requirements. » The span lengths should be kept as short as is reasonable. » Placement of bird flappers as markers on the earth wire, which will increase the visibility of the power line. » Markers should be placed with sufficient regularity (at least every 5-10m).		
Cumulative impacts: There are a number of power lines in the vicinity of Upington as well as throughout the Northern Cape. It is therefore unlikely that the addition of the proposed power line will significantly add to the cumulative impact of electrocution events in the region.		
Residual impacts: N/A		

7.4.3 Comparative Assessment of Access Road Alternatives

Both routes will require new road construction within the boundaries of Portion 3 of the Farm McTaggarts Camp 453. In terms of impacts arising from disturbance and displacement as a result of construction activities, there is **no significant** difference in the potential impacts associated with the two access road routes. Therefore, there is **no preference** between the alternatives.

7.4.4 Implications for Project Implementation

» Placement of bird flappers as markers on the earth wire, which will increase the visibility of the power line. Markers should be placed with sufficient regularity (at least every 5-10m).
» Eagle eye devices may be used, if feasible to deter birds from the CSP plant area/ solar field.
» In terms of habitat loss, during construction and in the long term, the EMPr must contain measures to manage the impacts of habitat loss.

7.5. Assessment of Impacts on Surface Water Resources

7.5.1 Results of the Surface Water Resources Assessment

The study area falls within the Lower Gariep River sub-basin and the site is situated within quaternary catchment D73F. The site dominated by highly ephemeral river systems that flow directly into the Gariep River, which bisects this quaternary catchment. The primary drainage line in close proximity to the site, the Helbrandkloofspruit, typically flows once a year for no more than two days at a time. Water bodies and rivers are of specific importance to a variety of Red Data species in this arid area. The perennial Gariep River is situated 10 - 13 km south-east of the proposed development sites.

Fish fauna:
Five endemic fish species present in the Lower Orange is therefore of relevance to the present investigation in terms of potential impacts of the proposed CSP Plant. These include:

» Largemouth yellowfish *Labeoarbus kimberleyensis*
» Largemouth yellowfish *Labeoarbus kimberleyensis*
» Smallmouth yellowfish *Labeobarbus aeneus*
» Gariep River Mudfish *Labeo capensis*
» Rock catfish *Austroglanis sclateri*

The three other endemic fish species present in the Study Area (Gariep River Mudfish, smallmouth yellowfish and Namaqua barb) were found to be well represented.

Present Ecological Status of the Lower Gariep River
The LORMS (2005) study found that the overall Present Ecological Status (PES) of the Lower Gariep River, including fish and the other biota (algae, vegetation, macroinvertebrates), to be in a *D Category*. This is defined as where the habitat integrity has been largely modified and where a large loss of natural habitat, biota and basic ecosystem functions has occurred.

Riparian Vegetation on the development footprint (Portion 3 of the Farm McTaggarts Camp 453)

Eighteen woody plant species were found associated with the riparian systems within the study site. Although none of these were obligate or facultative river/wetland species, they do show a preference for riparian soil conditions. Species within the site were dominated by *Acacia erioloba* (Camel Thorn, Kameeldoring), *Acacia haematoxylon* (Grey Camel Thorn), *Boscia foetida* (Stink Shepard's Tree) and *Euclea pseudebenus* (Ebony Tree), notably protected under the National Forest Act. The only obligate wetland plants observed were those found in association with the man-made dams found at the confluence of the Helbrandkloofspruit and the Gariep River and along the Gariep River itself. Species observed included *Typha capensis*, *Phragmites australis*, *Prosopis glandulosa* and *Cyperus marginatus*. The prevalence of *Prosopis* and alien invasive tree species had increased between a survey undertaken in 2010 and now in 2014.

Water Bodies on the Site (Portion 3 of the Farm McTaggarts Camp 453)

Figure 7.4 illustrates the watercourses observed within the site and along the pipeline route. No classified wetlands, other than the riparian systems found along the Gariep River, are shown on the national wetlands map. However, season pans and ephemeral waterwashes (also referred to as ephemeral drainage lines) occur on the site and drain into the Gariep River.

On either side of Portion 3 of the Farm McTaggarts Camp 453 larger ephemeral drainage lines occur, which merge further south and then flow into the Gariep River. These drainage lines may only flow once every couple of years after sufficient rainfall, but they do collect enough of the runoff from surrounding areas to support much denser and higher vegetation than on the surrounding plains, especially on the farm adjacent to the southern border of McTaggarts Camp. This higher vegetation creates numerous microhabitats.

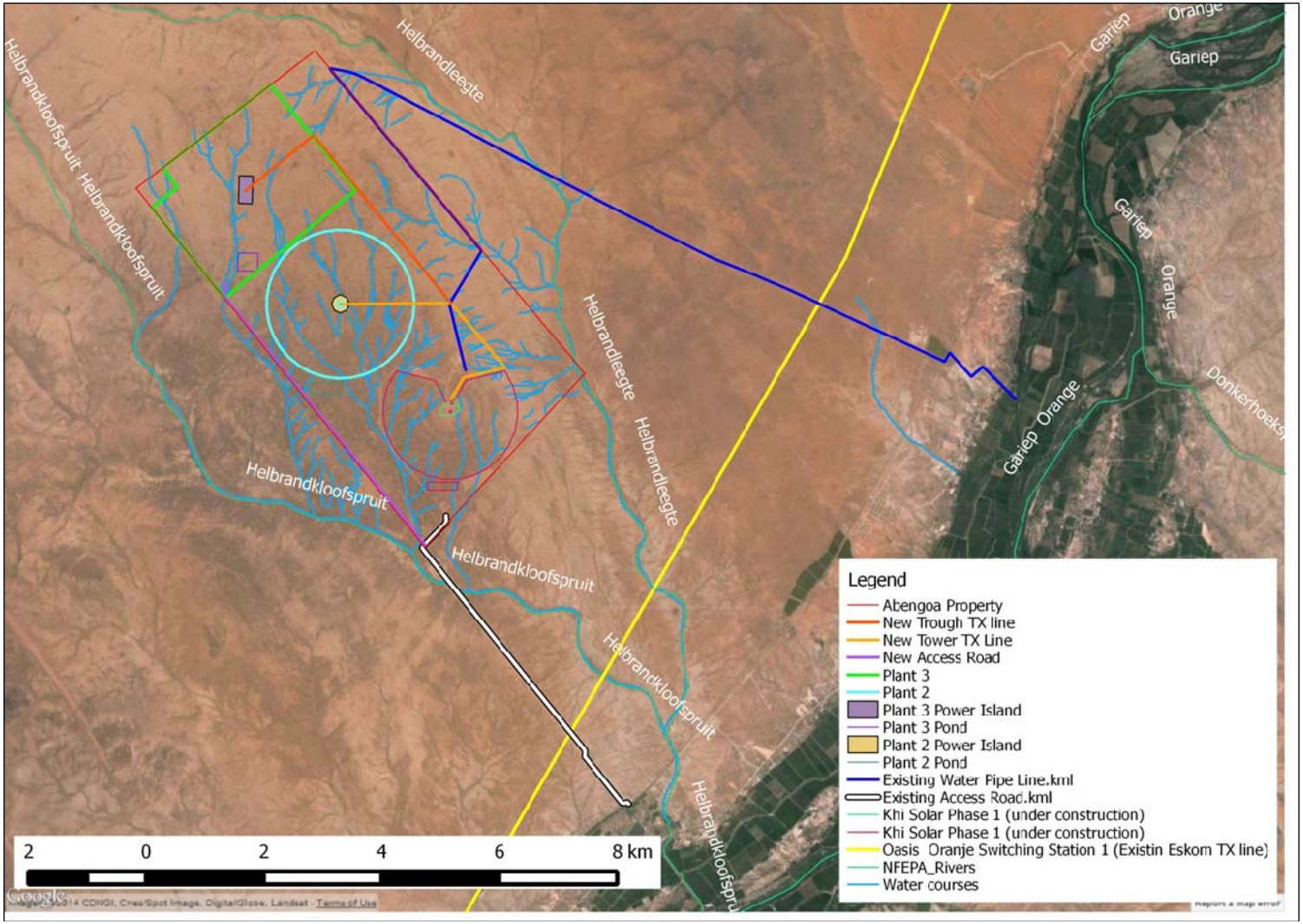

Figure 7.4: Map illustrating the ephemeral watercourses observed within the site and along the pipeline route

Dry river beds and riparian zones occur on the site. All the dry river beds and the associated riparian systems would be rated as extremely sensitive to development, in particular the mainstem systems such as Helbrandleegte and Helbrandkloofspruit, which flows through the site. Due to the nature of the soils and geomorphology, these systems are able to form various meanders within the greater landscape.

The impact assessment on surface water resources deals with three separate components, i.e., flow and water quality impacts, riparian vegetation and fish fauna impacts. In generic terms, many of the potential environmental impacts on the Gariep River due to construction activities associated with the water abstraction infrastructure on the banks and riparian zones are similar, and will be applicable to any construction activity in or adjacent to rivers.

7.5.2 Sensitivity Assessment

From a habitat and ecosystem point of view, all the dry river beds and the associated riparian systems which occur on the site would be rated as extremely sensitive to development, in particular the mainstem systems such as Helbrandleegte and Helbrandkloofspruit systems, which flow within the site. However from a riparian and aquatic standpoint, the CSP Plant and the associated infrastructure are suitable for the proposed site, for the following reasons:

» The areas where the Upington Solar Thermal Plant Three is proposed exhibited the least diversity in term of riparian structure, with most species being ubiquitous within the region.
» The presence of alluvial fans is limited.
» Habitat complexity is low, e.g. no geomorphological changes such as rock outcrops were observed. There is little diversity regarding instream habitats and few refugia would be impacted upon.
» There is sufficient space between the proposed footprint areas of the 125MW CSP project and the significant mainstem riverbeds to institute suitable stormwater management structures (silt traps) and pollution containment areas.

7.5.3 Flow and Water Quality Impacts

General Surface Water Impacts: Sedimentation and Elevated Turbidity

Causes:
Although relatively far from the river itself, sediment-laden runoff from the proposed CSP plant could occur, particularly if flash floods occur during the site clearing and construction phases of the project. Sediment mobilisation could result from, among others:

» Inadequate erosion control or containment of sediment-laden runoff during site clearing and construction activities for infrastructure at both the abstraction points (e.g. pipe lines and reservoirs) and at the solar plant site.
» Backwash water discharged from the sand filters could result in sediment laden water reaching the Gariep River, with a resultant impact on habitat availability for instream biota.

Consequences:
Increased siltation and sedimentation has been described as one of the biggest threats facing some rivers in South Africa and 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, including fish. These include.
» The whole 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 require silt-free gravel and/or cobble habitats for spawning, would be particularly affected by elevated sediment inputs.

Thus the ecological functioning of the impacted reach of the Gariep River could be seriously impacted by high sediment inputs associated with the proposed construction activities, particularly of the water abstraction facilities.

General Surface Water Impacts: Water Pollution

Potential causes:

During both pre-construction and construction activities, chemical pollutants (hydrocarbons from equipment and vehicles, cleaning fluids, cement powder, wet cement, shutter-oil, etc.) associated with site-clearing machinery and construction activities could wash into the rivers. 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 operation, significant spillage of the heat transfer fluid (HTF) could contaminate water resources.

Consequences:

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. Thus extreme care should be taken when these hazardous compounds are used near water. For fish, pH levels of over 10 are considered toxic.

7.5.4 Impact assessment: Riparian Zones

The riparian zone component includes the functional or ecosystem services importance of the dry river beds and riparian zones on site and how the proposed development would affect the riparian environment. Impacts non riparian vegetation due to the development of the CSP Plant includes:

- Loss of riparian systems.
- Impact on dry riverbeds and localised drainage systems.
- Impact on riparian systems through the possible increase in surface water runoff on riparian form and function.
- Increase in sedimentation and erosion.

Due to the nature of the aquatic environment within the study area, together with the high number of drainage lines, selecting a development site that avoids any of these areas is not entirely possible. Therefore any stormwater within the site must be handled in a suitable manner. These impacts on riparian zones will occur as the CSP Plant will

require removal of riparian vegetation. Within the power island no vegetation cover will remain. There is riparian vegetation that occurs along drainage lines (refer to ecological sensitivity map contained in Figure 7.3), and where these areas cannot be avoided by the CSP plant these will be completely transformed. Physical impacts on the Helbrandleegte /Helbrandkloofspruit catchment would be limited, and these spruits will mostly remain intact.

7.5.5 Impact table summarising the significance of impacts on riparian zones during the construction and operation phases (with and without mitigation)

Nature: Loss of riparian systems

The physical removal of the narrow strips of woody riparian zones, being replaced by hard engineered surfaces. This biological impact would however be localised, as a large portion of the remaining farm and the Helbrandleegte and Helbrandkloofspruit catchment would remain intact.

Listed Activities:

GNR 545, 18 June 2010 Activity 1
GNR 545, 18 June 2010 Listed Activity 3
GNR 544, 18 June 2010 Activity 11
GNR 544, 18 June 2010 Activity 12
GNR 544, 18 June 2010 Activity 18

	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	**Medium (55)**	**Medium (45)**
Status (positive or negative)	Negative	Negative
Reversibility	Medium	Medium
Irreplaceable loss of resources	No	No
Can impacts be mitigated	Yes	

Mitigation:

Due to the nature of the aquatic environment within the study area, together with the high number of drainage lines, selecting a development site that avoids any of these areas is not entirely possible. Therefore any stormwater within the site must be handled in a suitable manner such as:

» Separate clean and dirty water streams around the plant
» Install stilling basins to capture large volumes of run-off
» Trap sediments and reduce flow velocities.
» Monitor riparian zones for erosion and is erosion occurs, utilise erosion control measures to stabilise soils.

Cumulative impacts:

None

Residual impacts:

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

Nature: Impact on dry riverbeds and localised drainage 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 Helbrandleegte /Helbrandkloofspruit catchment would remain intact.

Listed Activities:

GNR 545, 18 June 2010 Activity 1
GNR 545, 18 June 2010 Listed Activity 3
GNR 544, 18 June 2010 Activity 11
GNR 544, 18 June 2010 Activity 12
GNR 544, 18 June 2010 Activity 18

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

Mitigation:

Due to the nature of the aquatic environment within the study area, together with the high number of dry riverbeds and localised drainage system, selecting a development site that avoids any of these areas is not entirely possible. Therefore any stormwater within the site must be handled in a suitable manner such as:

» Separate clean and dirty water streams around the plant
» Install stilling basins to capture large volumes of run-off
» Trap sediments and reduce flow velocities.
» Monitor dry riverbeds and drainage lines for erosion and is erosion occurs, utilise erosion control measures to stabilise soils.

Cumulative impacts:

The increase in surface run-off velocities and the reduction in the potential for groundwater infiltration is likely to occur, considering that the site is near the main drainage channels and however the annual rainfall figures are low.

Residual impacts:
Diversion of run-off away from downstream systems is unlikely to occur as the annual rainfall figures are low.

Nature: Impact on riparian systems through the possible increase in surface water runoff on riparian form and function

Listed Activities:
GNR 545, 18 June 2010 Activity 1
GNR 544, 18 June 2010 Activity 11
GNR 544, 18 June 2010 Activity 12
GNR 544, 18 June 2010 Activity 18

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

Mitigation:
Any stormwater within the site must be handled in a suitable manner such as:

» Separate clean and dirty water streams around the plant
» Install stilling basins to capture large volumes of run-off
» Trap sediments and reduce flow velocities.
» Monitor on riparian zones for erosion and is erosion occurs, utilise erosion control measures to stabilise soils.
» Attempt to capture and recycle any form of run-off created by the daily operations of the CSP Plant. 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.

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

Nature: Increase in sedimentation and erosion within the development footprint of the CSP Plant (up to 500 hectares).

Listed Activities:
GNR 545, 18 June 2010 Activity 1
GNR 544, 18 June 2010 Activity 11
GNR 544, 18 June 2010 Activity 12
GNR 544, 18 June 2010 Activity 18

	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Low (1)	Low (1)
Probability	Definite (5)	Probable (3)
Significance	**Medium (30)**	**Low (18)**
Status (positive or negative)	Negative	Negative
Reversibility	Medium	Medium
Irreplaceable loss of resources	No	No
Can impacts be mitigated	Yes	

Mitigation:
Any stormwater within the site must be handled in a suitable manner such as:
» Separate clean and dirty water streams around the plant.
» Install stilling basins to capture large volumes of run-off.
» Trap sediments and reduce flow velocities (e.g. water used when washing the mirrors).
» If erosion occurs, utilise erosion control measures to stabilise soils.

Cumulative impacts:
Downstream erosion and sedimentation of the downstream systems and farming operations. During flood events, the unstable banks (eroded areas) and sediment bars (sedimentation downstream) already deposited downstream will then be washed into the Gariep River.

Residual impacts:
During flood events, the unstable banks (eroded areas) and sediment bars (sedimentation downstream) already deposited downstream will then be washed into the Gariep River.

7.5.6 Impact assessment: Gariep River - Flow and quality issues

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 Gariep River system. The distance of the proposed facility from the Gariep River (approximately 3 km) will reduce the risk of contaminated run-off polluting the Gariep River. However the well defined drainage lines or ephemeral streams such as the Helbrandleegte and Helbrandkloofspruit within the site would increase this risk during rainstorms and local flash floods which normally occur during the summer months.

7.5.7 Impact assessment: Gariep River – Fish fauna (biotic study)

The fish fauna component focuses on the impact of the CSP Plant's development on the biota of the water resources of the area, i.e. the Gariep River as the water source for the development. Water is intended to be abstracted from the Gariep River. The water will be sourced through an extraction point on the Gariep River. Water supply pipelines will be constructed and the required volume of water treated and pumped to the facility. Potable water will also be required for on-site staff. Approximately 440 000 m^3 of water per year is required for operation of one 125MW CSP Plant. Water is required for generation of steam to drive a conventional steam turbine and generator, mirror washing, potable purposes and for fire-fighting.

There is a moderate risk of impacts to the Gariep River resulting from elevated sediment loads and polluted runoff from the facility reaching the river during site preparation and construction, if appropriate mitigation is not taken. The construction of infrastructure associated with the abstraction point also poses a moderate risk of impacting negatively on aquatic habitats and biota in the adjacent Gariep River, unless appropriate mitigation is taken.

The proposed constant abstraction of water from the Gariep River during the operation of the CSP Plant (440 000 m^3/a) could reduce present day flows and impact 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. However, without detailed data on present-day flows, volumes abstracted by other users or Ecological Water Requirements, this impact is difficult to quantify. The system is also highly regulated (i.e. many dams upstream in the system), making an assessment more difficult. However, it is anticipated that constant pumping during droughts may impact on drought flow requirements needed to meet the EWR. Cognisance will have to be taken of other user requirements.

Impacts on the Gariep River system due to water abstraction, and site-specific impacts on instream biota are difficult to quantify due to the number of unknowns and the highly regulated nature of the system. Releases from Vanderkloof Dam could affect the site,

although release patterns are re-evaluated every year to provide for irrigators and is therefore well known. A 280 million m^3/a release for the estuary is also made as variable base flows over 12 months, although it is unknown as to whether this water actually reaches the estuary. Operating losses and requirements (such as to top up the upstream Boegoeberg Dam after draining it for cleaning) are also included in this allocation. Note that Boegoeberg Dam (upstream of Upington) is not used to operate flows into the river, but rather as a diversion weir for the canal systems. The only flows from this dam into the Gariep River are spills and when bottom releases are made (approximately once a year) to clean the dam (WRP Consulting, pers. comm., September 2010, for the ORASECOM EFR study).

7.5.8 Impact table summarising the significance of impacts on the Gariep River during the construction and operation phases (with and without mitigation)

Nature: Sediment input into the Gariep River
Vegetation clearing and earthmoving operations at the site during pre-construction and construction of the infrastructure (including access roads and ponds etc.) will increase the risk of soil erosion and sediment being washed into the Gariep River during heavy rains.

Listed Activities:
GNR 544, 18 June 2010 Activity 9
GNR 544, 18 June 2010 Activity 11
GNR 544, 18 June 2010 Activity 18

	Without mitigation	**With mitigation**
Extent	Site (2)	Local (1)
Duration	Short-term (2)	Short-term (2)
Magnitude	Moderate (6)	Minor (2)
Probability	Highly probable (4)	Improbable (2)
Significance	**Medium (40)**	**Low (10)**
Status (positive or negative)	Negative	Negative
Reversibility	Medium	Low
Irreplaceable loss of resources	Yes (medium)	Yes (low)
Can impacts be mitigated	Yes (high)	

Mitigation:

» Site clearing and preparation for the construction of the solar facility should take steps to avoid surface run-off and storm-water erosion of cleared areas where practicable.
» Comprehensive Storm Water Management Plan (SWMP) incorporating anti-erosion measures on site should be put in place.
» All surface run-off should be discharge via detention dams to allow sediment to settle out before leaving the site.

Cumulative impacts:

Man-induced erosion and sedimentation in this area from intensive farming activities along the Gariep River is expected to be unnaturally high. The cumulative impact on the Gariep River could thus exceed the tolerances of the aquatic biota, including sensitive fish species.

Residual Impacts:
Residual Impacts should be minimal with appropriate mitigation.

Nature: Chemicals, the HTF and other pollutants causing contamination of the water in the Gariep River

During both preconstruction, construction and operational activities, chemical pollutants (hydrocarbons from equipment and vehicles, 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 Gariep River. During the operational phase, spills and leaks from the evaporation or blow down ponds could be washed by stormwater run-off via the natural drainage lines into the Gariep River.

Listed Activities:
GNR 545, 18 June 2010 Activity 1
GNR 545, 18 June 2010 Activity 3
GNR 544, 18 June 2010 Activity 9
GNR 544, 18 June 2010 Activity 11
GNR 544, 18 June 2010 Activity 18

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

Mitigation:

» Appropriate ablution facilities should be provided for construction workers during construction and on-site staff during the operation of the facility.
» Strict use and management of all hazardous materials used on site.
» Strict management of potential sources of pollution (e.g. litter, hydrocarbons from vehicles and machinery, cement during construction, etc.).
» Containment of all contaminated water by means of careful 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 (EMPr) for the project and strictly enforced.
Cumulative impacts: The widespread use of chemicals in farming activities (fertilizers, insecticides, herbicides, etc.) means that any chemical pollution from the CSP plant will have a marked cumulative impact on aquatic biota.
Residual impacts: Residual impacts will be negligible after appropriate mitigation.

Nature: Abstraction of water from the Gariep River impact on water flow: timing and volume		
Listed Activities: GNR 544, 18 June 2010 Activity 9 GNR 544, 18 June 2010 Activity 11 GNR 544, 18 June 2010 Activity 18 GNR 545, 18 June 2010 Activity 3		
	Without mitigation	**With mitigation**
Extent	Region (3)	n/a
Duration	Long-term (4)	n/a
Magnitude	Low (4)	n/a
Probability	Probable (3)	n/a
Significance	**Medium (33)**	n/a
Status (positive or negative)	Negative	n/a
Reversibility	High	n/a
Irreplaceable loss of resources	Yes	n/a
Can impacts be mitigated	Yes	
Mitigation: » If possible, optimise the design or technology of the facility to reduce consumptive water requirements as possible. » Supplement water sources, such as use water other sources, such as ground water resources. » Adapt the water abstraction regime to meet the EWR and requirements of other users where required.		
Cumulative impacts: Note that the water use required by this project is relatively small in a regional context.		
Residual impacts: No residual impacts expected if mitigation possible.		

Nature: Operation of the water 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 Gariep River.

Listed Activities:
GNR 544, 18 June 2010 Activity 2

	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	**Medium (36)**	**Low (8)**
Status (positive or negative)	Negative	Negative
Reversibility	Yes (high)	Yes (high)
Irreplaceable loss of resources	Yes	Yes
Can impacts be mitigated	Yes	

Mitigation:
» The backwash water 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:
This will be a cumulative impact as it 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.

7.5.9 Comparative Assessment of Access Road Alternatives

Both routes will require new road construction within the boundaries of Portion 3 of the Farm McTaggarts Camp 453. New road construction should be cognisant of impacts to ephemeral drainage lines.

Alternative 2 crosses the Helbrandleegte. The proposed layout includes a crossing of the Helbrandskloofspruit tributary by Alternative 1, and can be realigned prior to construction. Both alternatives will result in disturbance to ephemeral drainage lines. There is **no significance** difference in the potential impacts associated with the two corridors. If Alternative 1 is rerouted to not traverse the Helbrandskloofspruit tributary, this is a preferred alternative.

7.5.10 Implications for Project Implementation

With suitable mitigation and implementation of the proposed layout, the development should have limited impact on the overall status of the riparian systems within the region. This assessment of the potential impacts of the facility on the fish biota of Gariep River also did not reveal any significant impacts on the fish fauna and associated aquatic habitats, provided the appropriate mitigation measures are taken. A possible impact on the development would be the quantity of water to be abstracted from the Gariep River required for operation of the facility. All impacts that were assessed as being of moderate significance which could readily be reduced to low significance by appropriate mitigation, apart from the moderate impact of water abstraction from the Gariep River.

The following mitigation / actions are required:

» Any stormwater within the site must 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. Therefore a comprehensive Stormwater Management Plan incorporating anti-erosion measure on site should be put in place.
» Working protocols incorporating emergency response and pollution control measures (including approved method statements by the contractor) should be clearly set out in the EMPr for the project and strictly enforced.
» The backwash water 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.
» The relevant Water Use Licenses for water uses (abstraction and impacting of water courses) to be obtained from DWA.

7.6. Assessment of Potential Impacts on Heritage Sites

7.6.1 Results of the Heritage Survey

» Stone Age: The heritage survey found Stone Age traces which consist of wide scattered/isolated finds, none of those noted being of major heritage significance. Many of the stone artefacts found were based on banded ironstone, some on quartzite, the former most likely sourced from the Orange River gravels to the south; no tillites occur in the study area. There appear to be none of the features such as hills or rocky features (such as Spitskop north of Upington) which in other parts of this landscape provide shelters with traces of pre-colonial Stone Age occupation/activity.

» No shelters occur.
» Rock outcrops provide for temporary water pools after rain but any increased activity around these features in the CSP plants is not reflected in increased stone tool densities.
» Nineteenth- and twentieth-century cultural history and intangible heritage values attached to places may be difficult to recover owing to the sparse population. It is not thought likely that any significant intangible heritage values would be attached to the particular terrain in question.
» Apart from the remains of a tungsten mine, noted above, there appear not to be colonial era built environment features in the areas of proposed CSP plant.
» Several features of the tungsten mine were noted including ruins, an explosives magazine and, for the most part, trenches, pits and debris heaps associated with prospecting/mining.
» The Kalahari sediments and calcretes have low fossil potential, but possibility of fossils being encountered in diggings cannot be totally excluded.
» Archaeological (Stone Age traces) and cultural (mining) heritage observations made were assessed as being of low heritage significance.
» No graves were found on the site.

During the construction phase deep excavations could result in loss/ find of heritage resources and impacts including:
» Disturbance of heritage resources.
» Impacts on cultural landscape and sense of place.

7.6.2 Impact tables summarising the significance of impacts on heritage resources (with and without mitigation)

Nature: Construction activities could result in loss of heritage resources (archaeology and fossils)
Activities resulting in disturbance of surfaces and/or sub-surfaces containing heritage / paleontological artefacts resulting in the destruction, damage, excavation, alteration, removal or collection from its original position, of any archaeological material or object.
Listed Activities: GNR 545, 18 June 2010 Activity 1 GNR 544, 18 June 2010 Activity 47 (iii) GNR 545, 18 June 2010 Activity 15 GNR 546, 18 June 2010 Activity 13

	Without mitigation	**With mitigation**
Extent	1	n/a
Duration	5	n/a
Magnitude	2	n/a
Probability	2	n/a

Significance	**Low (16)**	**n/a**
Status (positive or negative)	Negative	n/a
Reversibility	No	n/a
Irreplaceable loss of resources?	Yes	n/a
Can impacts be mitigated?	Yes – but not considered necessary.	n/a
Mitigation:: Mitigation measures are not considered necessary, however should any heritage resources, actions will be required for inclusion in the EMPr including: » Development an on-going heritage monitoring procedure for the construction and operational phase which must also provide guidelines on what to do in the event of any major heritage feature being encountered during any phase of development of the CSP Plant. » The ECO must monitor if any accidental disturbance of previously undetected heritage features occurs. » In the event of any archaeological deposits or features (such as a grave or an ostrich eggshell cache) being encountered, relevant personnel should halt work and notify SAHRA immediately (Tel: 021 462 4502. Fax: 021 462 4509; 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000) to allow for investigation and possible mitigation.		
Cumulative impacts: where any archaeological contexts occur the impacts are once-off permanent destructive events.		
Residual Impacts: None		

7.6.3. Comparative Assessment of Access Road Alternatives

The scattered/isolated finds during the field survey are not noted to be of major heritage significance. In terms of impacts arising from disturbance and loss as a result of the access roads, there is **no significant** difference in the potential impacts. Therefore, there is **no preference** between the alternatives.

7.6.4. Implications for Project Implementation

» Very sparse heritage traces were found on the site and from an archaeological perspective the observed heritage resources may be regarded as being of generally low significance.
» 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).

» The EMPr should contain an on-going heritage monitoring procedure for the construction and operational phase which must also provide guidelines on what to do in the event of any major heritage feature being encountered during any phase of development of the CSP Plant.
» During construction, the ECO must monitor if any accidental disturbance of previously undetected heritage features occurs.
» In the event of any archaeological deposits or features (such as a grave or an ostrich eggshell cache) being encountered, relevant personnel should halt work and notify SAHRA immediately (Tel: 021 462 4502. Fax: 021 462 4509; 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000) to allow for investigation and possible mitigation.

7.7. Impacts on Soils, Land-Use and Agricultural Potential

7.7.1. Results of the Soils Survey

The soils and agricultural potential study revealed the following:

» The proposed site extends inland to the north of the Orange River on almost flat ground with a south easterly aspect towards the river at a slope of approximately 1%.
» The site of the new CSP Plant is entirely on the northern land type, Ae10. The soils of this land type are shallow to moderately deep, sandy soils on underlying hardpan carbonate or rock.
» The entire site (Portion 3 of the Farm McTaggarts Camp 453) has a land capability classification, on the 8 category scale, of Class 7 - non-arable, low potential grazing land. The land has a low to moderate water erosion hazard (class 5).
» The site is susceptible to wind erosion due to the sandy texture of the soil. Predominantly because of the aridity constraints, but also because of poor soils, agricultural land use is restricted to low intensity grazing only.
» A section of the site (Portion 3 of Farm McTaggarts Camp 453) is already being used for the development of the Khi Solar One CSP Plant, and there is currently no agricultural activity or any agricultural infrastructure on the property.
» There are no areas of agricultural sensitivity that should be avoided by the development. There has never been any cultivation or irrigation on the site.
» The north western corner of the site has been mined in the past for tungsten and old, un-rehabilitated mining excavations occur. The mined out areas is ~25 hectares in total and is currently being rehabilitated under the Khi Solar One project (due to safety risk associate with open excavations/depressions). The previously mined area is considered a no-go area for development.

7.7.2. Impacts on Soils

The components of the project that can impact on soils, agricultural resources and productivity are:

» Construction activities that disturb the soil profile and vegetation, for example for levelling, excavations, blasting (if required), drilling and so forth.
» Long term use of the land for the CSP Plant which will result in bare areas devoid of vegetation and hardened surfaces.
» Spills or contamination from dangerous goods or hazardous fuels utilised on the site during construction or operation (heat transfer fluid).

The following impacts will occur:

» Change in land-use from agricultural land to a CSP Plant (500 hectares in extent).
» Loss of topsoil.
» Soil loss and soil erosion.

The significance of all agricultural impacts is influenced by the fact that the proposed site is on land of extremely limited agricultural potential that is only suitable as non-arable, low potential grazing land.

7.7.3. Impact tables summarising the significance of impacts on soils and land use (with and without mitigation)

Nature: Loss of topsoil due to construction activities Caused by: poor topsoil management (burial, erosion, etc.) during construction related soil profile disturbance (levelling, excavations, disposal of spoils from excavations etc.) And having the effect of: loss of soil fertility on disturbed areas after rehabilitation.		
Listed Activities: GNR 545, 18 June 2010 Activity 1 GNR 545, 18 June 2010 Activity 10 GNR 544, 18 June 2010 Activity 47 (iii) GNR 545, 18 June 2010 Activity 15 GNR 546, 18 June 2010 Activity 13		
	Without mitigation	**With mitigation**
Extent	Low (1) - Site	Low (1) - Site
Duration	Long term (4)	Long term (4)
Magnitude	Minor (3)	Minor (2)
Probability	Probable (3)	Very improbable (1)
Significance	**Low (24)**	**Low (7)**

Status	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	

Mitigation:

» Strip and stockpile topsoil from all areas where soil will be disturbed.
» After cessation of disturbance, re-spread topsoil over the surface.
» Dispose of any sub-surface spoils from excavations where they will not impact on agricultural land, or where they can be effectively covered with topsoil.
» Topsoil (the upper 25 cm of soil) is an important natural resource; where it must and can be stripped, never mix it with subsoil or any other material, store and protect it separately until it can be re-applied, minimise handling of topsoil.
» Topsoil and spoil material/subsoil storage areas must be delineated in the final layout plan.
» Combined final stockpiles may not exceed 4 m in height, preferably should not be higher than 1 m, and must be managed according to a strict landscaping, rehabilitation and soil erosion management plan until decommissioning.
» Temporarily stored topsoil must be re-applied within 6 months, topsoils stored for longer need to be managed according to a detailed topsoil management plan.

Cumulative impacts:
The development of multiple solar projects in the area can have cumulative impact on soil; however this can be managed to acceptable levels.

Residual impacts: None

Nature: Loss of agricultural land and change in land use
Caused by: direct occupation of land by energy facility infrastructure; and having the effect of: taking the entire property out of agricultural production.

Listed Activities:
GNR 545, 18 June 2010 Activity 1
GNR 544, 18 June 2010 Activity 47 (iii)
GNR 545, 18 June 2010 Activity 15
GNR 546, 18 June 2010 Activity 13

	Without mitigation	**With mitigation**
Extent	Low (1) - Site	Low (1) - Site
Duration	Permanent (5)	Permanent (5)

Magnitude	Small (1)	Small (1)
Probability	Definite (5)	Definite (5)
Significance	**Medium (35)**	**Medium (35)**
Status	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	No	
Cumulative impacts: The overall loss of agricultural land in the region due to other developments. The significance is low due to the extremely limited agricultural potential of the area.		
Residual impacts: No mitigation possible so same as impacts without mitigation		

Nature: Soil Erosion Caused by: alteration of run-off characteristics due to hard surfaces and access roads; And having the effect of: loss and deterioration of soil resources.		
Listed Activities: GNR 545, 18 June 2010 Activity 1 GNR 545, 18 June 2010 Activity 10 GNR 544, 18 June 2010 Activity 47 (iii) GNR 545, 18 June 2010 Activity 15 GNR 546, 18 June 2010 Activity 13		
Comment: There is low risk of erosion due to the very gentle slopes.		
	Without mitigation	**With mitigation**
Extent	Low (1) - Site	Low (1) - Site
Duration	Long term (4)	Long term (4)
Magnitude	Low (4)	Minor (3)
Probability	Probable (3)	Very improbable (1)
Significance	**Low (27)**	**Low (8)**
Status	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	No	No

Can impacts be mitigated?	Yes
Mitigation: » Implement an effective system of run-off control, where it is required, that collects and disseminates run-off water from hardened surfaces and prevents potential down slope erosion. This should be in place and maintained during all phases of the development. » Develop an erosion management plan (within EMPr). » Monitor the site for erosion areas. » Utilise soil stabilisation/ erosion control measures, should erosion occur.	
Cumulative impacts: None	
Residual impacts: Low	

7.5.11Comparative Assessment of Access Road Alternatives

Both routes will require new road construction within the boundaries of Portion 3 of the Farm McTaggarts Camp 453. There is **no significance** difference in the potential impacts associated with the two access roads in terms of soils. If Alternative 1 is re-routed to not traverse the Helbrandskloofspruit tributary, this is a preferred alternative.

7.7.4. Implications for Project Implementation

» The development of the CSP Plant will have low to medium negative impacts on soils, agricultural resources and productivity.
» The significance of all agricultural impacts is influenced by the fact that the site has extremely limited agricultural potential, with a land capability of class 7, non-arable, low potential grazing land.
» Soils are red, sandy soils on underlying rock and calcrete, varying from very shallow to moderately deep.
» The major limitations to agriculture are the aridity and lack of access to water, as well as the shallow soils. The land is only suitable for low intensity grazing.
» Three potential negative impacts of the development on agricultural resources and productivity were identified as:
  * Loss of agricultural land use caused by direct occupation of land by the energy facility footprint (medium significance with and without mitigation).
  * Soil Erosion caused by alteration of the surface run-off characteristics (low significance with and without mitigation).
  * Loss of topsoil in disturbed areas, causing a decline in soil fertility (low significance with and without mitigation).
» There are no fatal flaws associated with the soils on the site and the project can be developed with the use of good soil management measures during all phases of development of the project.

7.8. Assessment of Potential Visual Impacts

7.8.1 Visual Character of the landscape

» Vegetation Cover and Land Use: The southern portion of the study area, where the Khi Solar One is located, is characterised by arid grassland and the remainder as karroid shrubland. The vegetation is sparse and of low heights, and has been disturbed by grazing and mining. Vineyards occur largely along the Gariep River terraces. Abandoned mines in the form of shallow trenches and a few deep pits occur in the north-west corner of the McTaggart Camp property, as well as scattered trenches in the surrounding area. Farming in the area consists of sheep, goats, cattle and horses although the grazing potential is low in the arid landscape. Wildlife still inhabits the area.
» Existing Infrastructure: The Khi Solar One Power Tower CSP Plant is being constructed on the site. An existing Eskom 132 kV power line runs between the site and the N14. An existing rail line runs almost parallel with the N14 but appears to have not been in use for some time. A number of buildings, such as a substation, and a water supply pipeline from the Gariep River have recently been constructed as part of the Khi Solar One project.
» Visual Significance: The visual significance of Upington are largely on the Gariep River for settlements, farmsteads and recreation, along with extensive vineyards, wineries and guesthouses, forming part of the area's tourism potential. The N14 is an important tourist route to Augrabies Falls National Park, and the N10 to the Kgalagadi Transfrontier Park and Namibia. The Spitskop Nature Reserve, some 16 km away, is one of the few protected areas, while the Upington airport provides a gateway to the region.
» Opportunities and Constraints: The region, with its long sunshine hours, has already been identified as having opportunity for the production of solar energy, with the proposed solar facilities tending to be located on the semi-arid plains, away from the Gariep River settlements and farmlands. The wilderness and rural qualities, including the vineyards, that contribute to the area's sense of place, along with the main tourist routes, are some of the major visual constraints.

7.8.2 Visual Assessment

The methodology for the visual impact assessment involves both quantitative and qualitative criteria to determine potential visual impacts. These are rated to determine both the expected level and significance of the visual impacts. To determine the nature and degree of potential visual impacts, the following criteria have been used:

» **Viewpoints:** Viewpoints were selected based on prominent viewing positions in the area, where uninterrupted views of the proposed CSP Plant could be obtained,

including potentially sensitive viewpoints. The proposed CSP Plant would be potentially visible from the outskirts of Upington, from numerous settlements and farmsteads along the Gariep River, from the N14 and N10 National Routes, and even from Upington Airport 23 km away. Refer to Figure 7.5 for the viewpoints utilised for the visual assessment.

» **Visibility:** Visibility tends to be determined by distance between the proposed CSP Plant and the viewer. Distance radii are shown in Figure 7.5 to assist in quantifying visibility of the proposed parabolic trough plant.

Table 7.1: Potential Visibility of the CSP Plant

Viewpoints	**Location**	**CSP 3**	**Visibility**
Vp1	N14 / D3276 Intersection	11.3 km	Moderate
Vp2	N14 Klippunt	10.9 km	Moderate
Vp3	N14 Khi Solar 1 Entrance	11.4 km	Moderate
Vp4	N14 Dyason's Klip	11.5 km	Moderate
Vp5	Start of New Access Road	5.8 km	High
Vp6	New Access Road opposite Khi Solar 1	4.6 km	High
Vp7	CSP 3 SW Boundary	265 m	High
Vp8	Old Tungsten Mine	364 m	High
Vp9	Kanoneiland Settlement	15.7 km	Moderate
Vp10	Mc Taggert's Camp Settlement	12.3 km	Moderate
Vp11	Klippunt Settlement	12.3 km	Moderate
Vp12	Ses Brugge Settlement	11.9 km	Moderate
Vp13	Upington western outskirts	14.3 km	Moderate
Vp15	Road crest on D3276	7.1 km	High
Vp16	NE Boundary on D3276	1.4 km	High
Vp18	R360 at Spitskop Nature Reserve	17.4 km	Marginal
Vp14	Pump station		High
Vp17	D3276 at ESKOM Power Line		High

» **Visual Exposure:** Visual exposure is determined by the 'viewshed' or 'view catchment', being the geographic area within which the project would be visible. The viewshed is shown in in Figure 7.6. The viewshed boundary tends to follow ridgelines and high points in the landscape. Some areas within the view catchment area fall within a view shadow, and would therefore not be affected by the proposed energy facilities. Given the flatness of the landscape and the height of the Khi Solar One Plant, there are few view shadows.

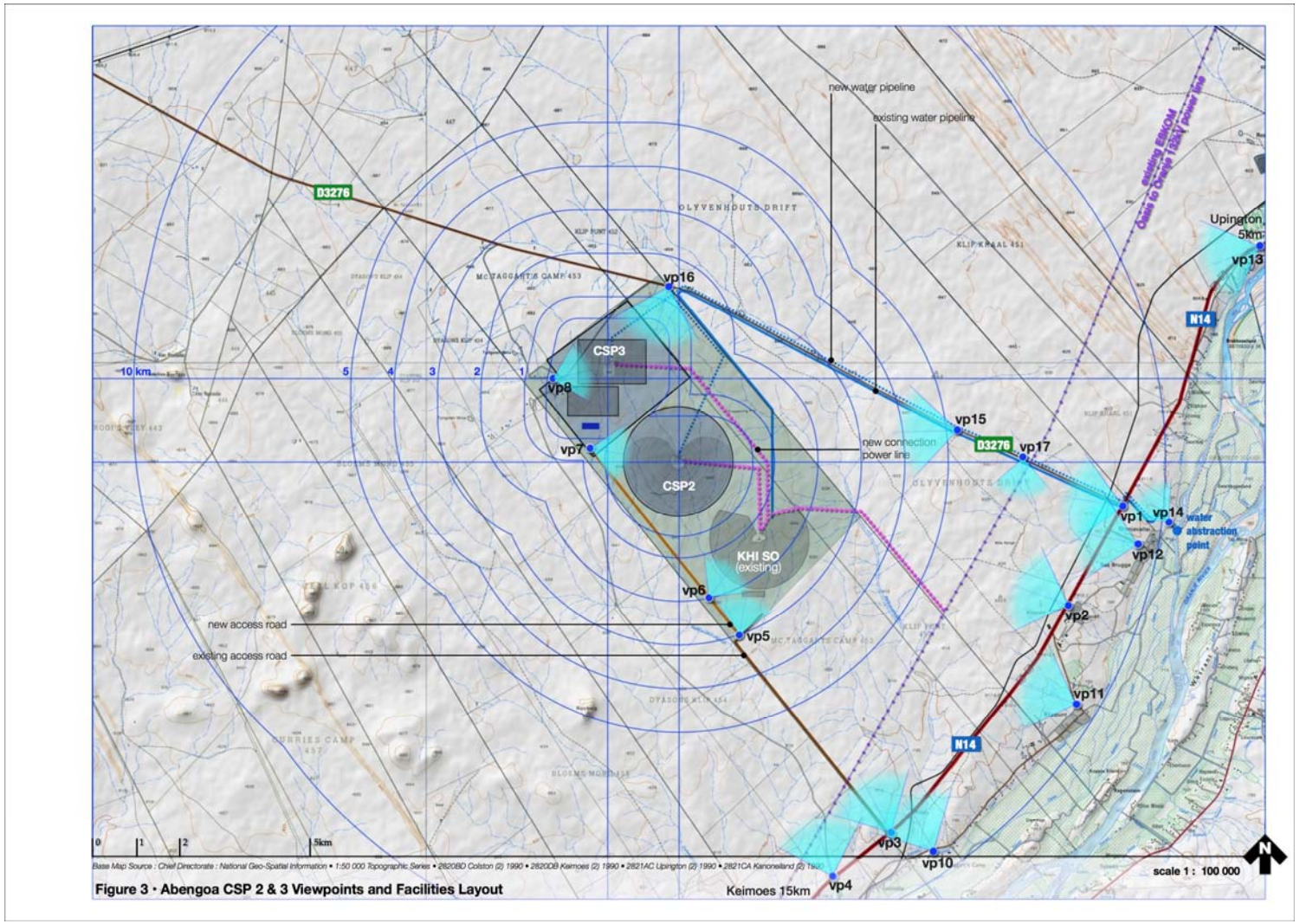

Figure 7.5: Viewpoints selected in the study area

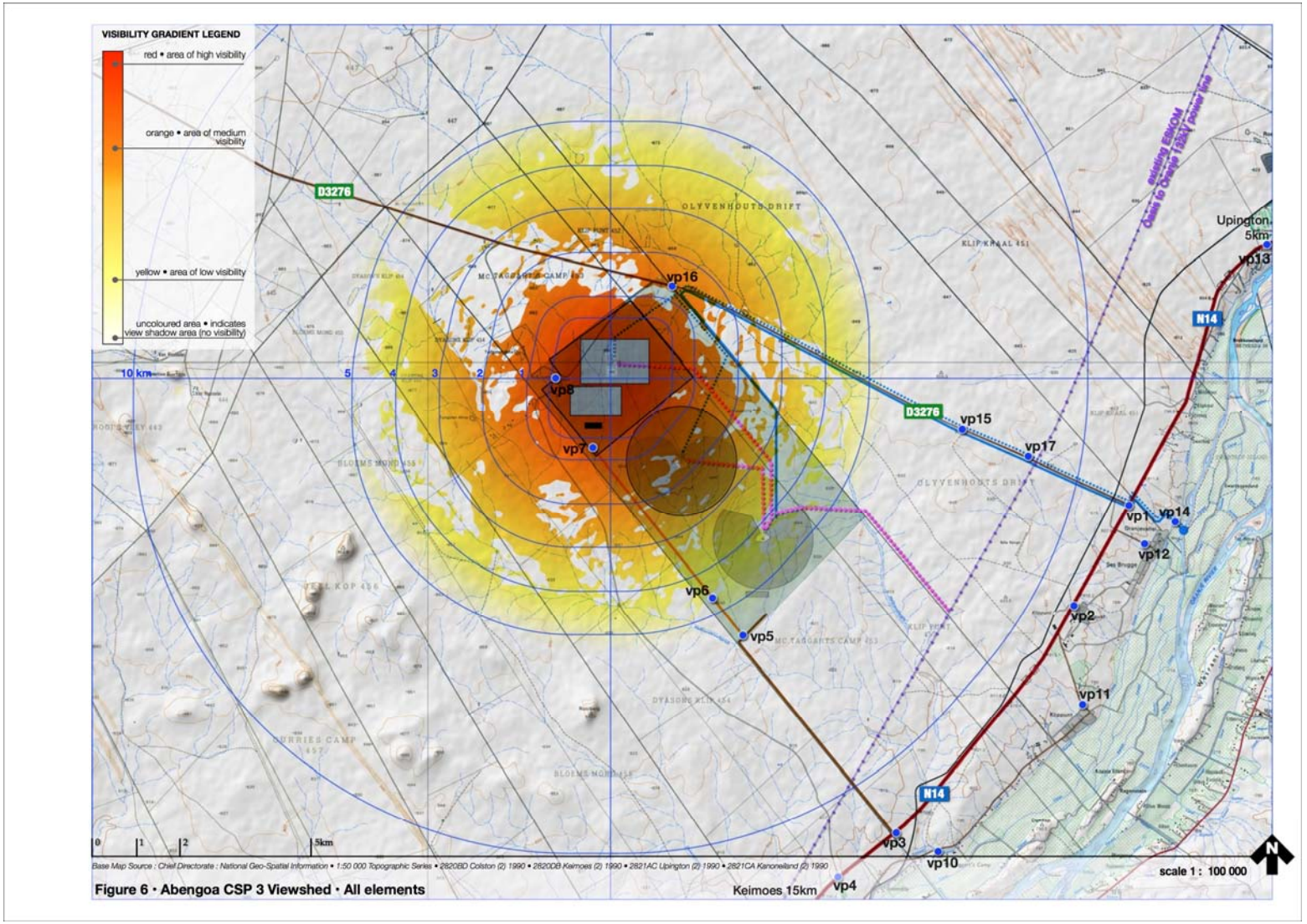

Figure 7.5: Viewshed for the Upington Solar Thermal Plant Three (Parabolic troughs at 6m in height)

A photomontage showing the Upington Solar Thermal Plant Three is shown in Figure 7.6.

Figure 7.6: Photo simulation showing the Upington Solar Thermal Plant Three

» **Landscape Integrity**

Visual quality is enhanced by the scenic-ness or intactness of the landscape, and lack of other visual intrusions. The existing Khi Solar One project and Eskom 132 kV power line and other industrial type sheds or structures are some of the existing visual intrusions. The surrounding landscape has a generally rural quality, but other energy facilities are proposed in the area, which need to be taken into account

» **Cultural Landscape**: Besides natural attributes, landscapes have a cultural value, enhanced by the presence of historical settlements, old routes, graves and farmsteads.

» **Visual Absorption Capacity**: This is the potential to screen the project. Given the scale of the proposed facility, both in terms of footprint and height, along with the open nature of the landscape, there is little opportunity for screening.

» **Cumulative Visual Impact**: This is the accumulation of visual impacts in the area, particularly in relation to the Khi Solar One CSP Plant and other proposed energy projects and industrial-type facilities in the area.

The criteria above are considered in combination to give an indication of the nature and degree of the potential visual impacts, as outlined in **Table 7.2** below.

Table 7.2: Nature and Degree of Potential Visual Impacts / Benefits

Criteria	Comments	Phase 3 Parabolic Troughs	Connecting Power Lines	Pump House And Pipeline At Gariep River
Visibility of facilities Distance from selected viewpoints	Views of CSP facilities from the N14 tend to be the most significant, but are some 8 km distant. Settlements are from 9 or more km distance.	Medium	Low	Low
Visibility of lights at night	Depends on the amount of security lighting at the substation and other facilities.	Medium	n/a	Low
Visual exposure Zone of visual influence or view catchment	Parabolic troughs.	Medium	Low-medium	Low
Visual sensitivity Effect on landscape features and scenic value	A visually exposed landscape in a sparsely populated area.	Medium	Medium	Medium
Landscape integrity Effect on character of the area	Industrial-type facilities would contrast with rural / wilderness landscape. However precedent already exists for similar	Medium-high	Medium	Medium

	facilities.			
Visual absorption capacity (VAC) Lack of concealment	Low potential of open landscape to visually absorb CSP facilities. Phase 3 would be partly screened by Khi Solar One CSP Plant.	Medium	Medium	Low-medium
Cumulative impacts Accumulation of impacts in the area	Other solar energy facilities are proposed within a 30km radius. Adds to footprint of Khi Solar One.	Medium-high	Medium	Medium-low
Overall impact rating		Medium	Range is low to medium	Range is low to medium

» The Phase 3 parabolic trough CSP Plant does not require a power tower, and would therefore have a low visual impact as due to the low height of the parabolic troughs (6m in height). In addition it is even further from the N14 Route and Gariep River. Potential visual impacts would be medium significance before mitigation and slightly less with mitigation.
» Potential visual impacts for associated infrastructure include the connecting power lines, which are rated as medium significance before mitigation, with little opportunity for mitigation.
» The water abstraction facilities at the Gariep River would be fairly localised with a potential visual impact of medium-low before mitigation and could be partly mitigated to low significance, including rehabilitation/re-vegetation. All pipelines and power lines related to water abstraction should be located underground where possible.
» The construction phase of the project would include the use of cranes and a batching plant, both of which have visual implications, but these would be temporary, and were therefore not considered to have an important effect on the overall visual impact significance ratings.
» The decommissioning phase of the projects, at the end of their useful life, would involve the dismantling and removal (recycling) of the structures, although concrete foundations would probably remain in the landscape.
» Given that the proposed CSP plant would be even further away from receptors than the Khi Solar One, and that the area has been generally identified for the location of solar energy plants, no fatal flaws are expected in terms of potential visual impacts.
» The assessment indicates that visual impacts would be of an acceptable level provided the mitigation measures are implemented.

7.8.3 Impact table summarising the significance of visual impacts (with and without mitigation)

Nature of impacts: Visual impact of the Upington Three Solar Thermal Plant (parabolic trough technology)		
Listed Activities: GNR 545, 18 June 2010 Activity 1		
	Without mitigation	**With Mitigation**
Extent	Low (2)	Low (2)
Duration	Long Term (4)	Long Term (4)
Magnitude	Medium (6)	Medium (5)
Probability	Highly Probable (4)	Highly Probable (4)
Significance	**Medium (48)**	**Medium (44)**
Status *(positive/negative)*	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Marginally	n/a
Mitigation: » Ensure a compact layout of facilities to minimise sprawl of buildings in the landscape. » Use earth berms for visual screening. » Use natural colours for buildings. » All structures to be removed in the decommissioning phase, and the landscape rehabilitated/ re-vegetated. » The entrance gate facilities to be set back a min. 200 m from the N14. » Signage to be controlled, and should not break the skyline.		
Cumulative impacts: Would add to the footprint of existing first phase Khi Solar One on the site. Will add to other solar projects envisioned around Upington.		
Residual impacts: Industrial-type facility in a rural area. Concrete foundations would probably remain after decommissioning.		

Nature of impacts: Visual impact of the power line		
Listed Activities: GNR 545, 18 June 2010 Activity 10		
	Without mitigation	**With Mitigation**

Extent	Low (2)	Low (2)
Duration	Long Term (4)	Long Term (4)
Magnitude	Low (4)	Low (4)
Probability	Highly Probable (4)	Highly Probable (4)
Significance	**Medium (36)**	**Medium (36)**
Status *(positive/negative)*	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	No	No
Mitigation: None		
Cumulative impacts: Would add to footprint of existing first phase Khi Solar One powerlines and the existing Eskom 132 kV power line.		
Residual impacts: Powerlines could be visually prominent in the exposed landscape. Concrete foundations would probably remain after decommissioning.		

Nature of impacts: Visual impact of the Pumphouse and Pipeline at Gariep River		
Listed Activities: GNR 545, 18 June 2010 Activity 9 GNR 546, 18 June 2010 Activity 2		
	Without mitigation	**With Mitigation**
Extent	Low (2)	Low (2)
Duration	Long Term (4)	Long Term (4)
Magnitude	Low (4)	Low (2)
Probability	Probable (3)	Probable (3)
Significance	**Low (27)**	**Low (21)**
Status *(positive/negative)*	Negative	Negative
Reversibility	Low	Low

Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	
Mitigation: » All pipelines and powerlines at the Gariep water abstraction site to be located underground where possible, and the water tanks painted dark green. Above-ground structures to be screened by berms and tree planting. » Cluster new facilities with existing ones to minimise scatter of structures in the landscape. Areas exposed by excavations or fill to be regraded and re-vegetated to restore the natural landscape. » All structures, above-ground pipelines and powerlines to be removed in the decommissioning phase and the disturbed areas rehabilitated/re-vegetated.		
Cumulative impacts: Would add to footprint of existing first phase Khi Solar One pump house, pipeline and water tanks.		
Residual impacts: Above-ground pipeline and water tanks could be visually intrusive in the rural landscape. Concrete foundations would probably remain after decommissioning.		

7.8.4. Comparative Assessment of Access Road Alternatives

Both routes will require new road construction within the boundaries of Portion 3 of the Farm McTaggarts Camp 453. In terms of visual impacts as a result of construction of the road, there is **no significant** difference in the potential impacts associated with the two access road routes. Therefore, there is **no preference** between the alternatives.

7.8.5. Implications for Project Implementation

» Given that the proposed CSP plant would be even further away from receptors than the Khi Solar One, and that the area has been generally identified for the location of solar energy plants, no fatal flaws are expected in terms of potential visual impacts.
» Pipelines and powerlines at the Gariep water abstraction site to be located underground where possible, and the water tanks painted dark green. Above-ground structures to be screened by berms and tree planting.
» Disturbed areas rehabilitated/re-vegetated after construction has been completed/ should the facility be decommissioned.

7.9. Noise Impacts

A noise study was undertaken by an acoustic specialist to determine is noise was an issue related to the development of the CSP Plant. Excluding single noise events from the N14 (traffic), there are no noise sources of significance in the area and relative low ambient sound levels are expected, especially at night. Excluding contractors busy with the construction of the Khi Solar One facility working on the property there are no potentially noise-sensitive receptors living within 2,000 meters from the proposed facility.

7.9.1. Construction Phase Noise Impacts

Potential Noise Sources during the construction phase include:

» Construction equipment: The equipment likely to be required to complete the above tasks will typically include: excavators/graders, bulldozer(s), dump trucks(s), vibratory roller, bucket loader, rock breaker(s), drill rig, flatbed truck(s), pile drivers, TLB, concrete truck(s), crane(s), fork lift(s) and various 4WD and service vehicles.
» Construction Vehicles: This will include trucks transporting equipment, aggregate and cement as well as various components used to develop the facility.
» Construction workers.

Construction activities are highly dependent on the final operational layout. A number of different noise-generating activities might take in the area. It has assumed that the existing Khi Solar One plant will be operational when construction of the CSP Plant will commence. The cumulative impact will therefore be considered simultaneously with the various construction activities.

The following construction activities are assumed to take place simultaneously for the construction of a 125 MW Trough Plant:

»
» Area where the new 125 MW Conventional Electrical Power Generation Plant will be situated, together with supporting services. Construction activities modelled included: General noise, digging trenches (excavator), cement truck offloading, crane operating, portable electrical generator (diesel - noisy).
» Site preparation for the construction of the troughs. Construction activities modelled included: Digging trenches (excavator), portable electric generator (diesel – noisy), grader, water dozing.
» Road traffic: An average of five vehicles per hour on the access roads travelling between the various areas at speeds of 60 km/h, with three of these being heavy vehicles.

There will be a number of smaller equipment, but the addition of the general noise source (at each point) covers most of these noise sources. It is assumed that all equipment would be operating under full load (generate the most noise) at a number of locations and that atmospheric conditions would be ideal for sound propagation. This is likely the worst case scenario that can occur during the construction of the facility.

Even though construction activities are projected to take place only during day time, it might be required at times that these activities take place during the night (particularly for a large project). Construction activities that might occur during night time include:

» Concrete pouring: Large portions of concrete do require pouring and vibrating to be completed once started, and work is sometimes required until the early hours of the morning to ensure a well-established concrete foundation. However the work force working at night for this work will be considerably smaller than during the day.
» Working late due to time constraints: Weather plays an important role in time management in construction. A spell of bad weather can cause a construction project to fall behind its completion date. Therefore, it is hard to judge beforehand if a construction team would be required to work late at night.

The scenario was modelled using the layout for the CSP Plant. The impact assessment for the various construction activities that may impact on the surrounding environment is presented in the table below.

Nature: Numerous simultaneous construction activities that could cause noise and impact on receptors.	
Listed Activities: GNR 545, 18 June 2010 Activity 1	
Acceptable Rating Level	Rural district (excluding construction traffic): 45 dBA outside during day (refer **Error! Reference source not found.**). Use of $L_{Req,D}$ of 45 dBA for rural areas Ambient sound level = 20 dBA
Extent ($\Delta L_{Aeq,D}$>7dBA)	**Local** – Assuming a uniformly 20 dBA ambient sound level over the study area, ambient sound levels could extend further than 1,000 meters from activities **(3)**
Duration	**Short** – Noisy activities in the vicinity of the receptors would last the duration of the construction period **(2)**
Magnitude	Noise Rating Levels (at receptors) < Rating Level – **Low (2)**
Probability	While it is possible that the closest receptors may hear construction activities at some time during the construction period (ideal sound propagation conditions), it is definite that it will not impact on them.**Unlikely (1)**
Significance	**Low (7)**

Status	Negative.
Reversibility	High
Irreplaceable loss of resources?	n/a
Comments	Modelling considered a worse-case scenario with significant activities taking place for 16 hours each day
Can impacts be mitigated?	Mitigation not required.
Mitigation:	Not required.
Cumulative impacts: This impact is cumulative with existing ambient sound as well as other noisy activities conducted in the same area.	
Residual Impacts: This impact will only disappear once construction activities cease.	

7.9.2. Operational Phase Noise Impacts

The main noise source associated with the operation of the CSP Plant relates to the fans used to assist with the condensing of the steam/water used in the power generation circuit. The following noise sources will be evaluated during the operational phase:

» Noises from the conventional electrical power generating plant (steam generation, steam storage, steam turbine and cooling system).
» Plant-generated traffic (maintenance crew, cleaning crew(s), etc.)
» Ancillary equipment such as pumps and pressure release valves.
» Possible general noise from the maintenance/workshop.
» With the steam turbine and generators situated within a building (that will significantly reduce the noise generation from these sources) noises from the fans will be the dominating noise in the area. The impact assessment therefore would focus on the noise generated by the fans and no other equipment.

The noise study therefore considers the worse-case scenario and illustrates the noise rating contours from 35 dBA (rural night-time acceptable rating level) upwards. Figure 7.7 illustrates the projected *cumulative* noise rating levels due to the operation of three proposed CSP facilities (Khi Solar One, Upington Solar Thermal Plant Two and the Upington Solar Three). It does not consider potential cumulative impacts due to existing ambient sound levels and assumes a very quiet background sound level.

Nature: Noise due to fans related to the CSP Plants and others solar plants operating simultaneously	
Acceptable Rating Level	Rural district (excluding construction traffic): 45 and 35 dBA outside during day and night respectively (refer **Error! Reference source not found.**). Use of $L_{Req,D}$ of 45 dBA and $L_{Req,N}$ of 35 dBA for rural areas Ambient sound level = 20 dBA
Extent ($\Delta L_{Aeq,n}$>7dBA)	**Local** – Impact could extend further than 1,000 meters from activity. **(3).**
Duration	**Long** – Facility will operate for a number of years **(4).**
Magnitude	Noise Rating Levels (at receptors) < Rating Level – **Low (2)**
Probability	While it is possible that the closest receptors may hear construction activities at some time during the construction period (ideal sound propagation conditions), it is definite that it will not impact on them.**Unlikely (1)**
Significance	**Low (16)**
Status	Negative.
Reversibility	High.
Irreplaceable loss of resources?	*Not relevant.*
Can impacts be mitigated?	Not required.
Mitigation: None	
Cumulative impacts: This impact is cumulative with existing ambient background noises.	
Residual Impacts: This impact will only disappear once the operation of the facility stops, or the sensitive receptor no longer exists.	

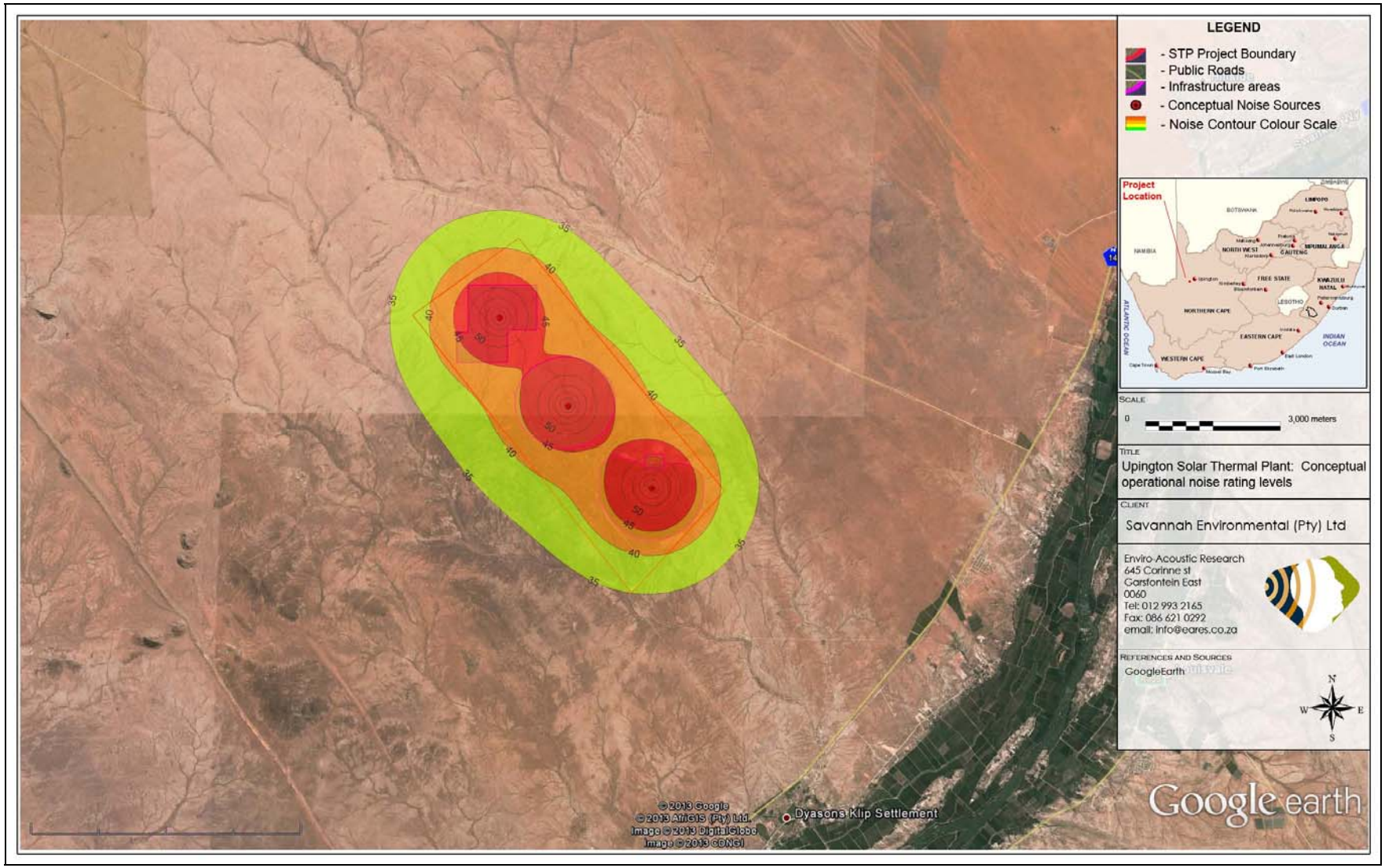

Figure 7.7: Projected Noise Rating Levels; Contours of constant sound levels due to the cumulative operation of three CSP Plants on Portion 3 of the Farm McTaggarts Camp 453

7.9.3. Implications for Project Implementation

» The noise study utilised the noise emission characteristics of equipment expected to be used at the CSP plant. With the input data as used, this assessment indicated that the potential noise impact would be insignificant during both the construction and operational phases.
» No routine noise measurements are recommended before the construction starts or during the operational phase. However, if a valid and reasonable noise complaint is registered (relating to the operation of the facility) additional noise monitoring should be conducted by an acoustic consultant. Noise monitoring must be continued as long when noise complaints are registered.
» The developer should re-evaluate the noise study if the layout is changed (where any noise-generating equipment are moved closer or added within 1,000 meters from any potential noise-sensitive receptor).
» With its potential for environmental and economic advantages, solar power generation has significant potential to become a large industry in South Africa. Though it poses a very low noise risk to surrounding communities, the fans does generate noise. If constructed close to potential sensitive receptors, consideration must be given to ensuring a compatible co-existence where the potential noise-sensitive receptors are not adversely affected.
» The developer must implement a method of communication for lodgings of noise complaints.

7.10. Assessment of Potential Social Impacts

The key social issues associated with the **construction phase** include the following **potential positive impacts:**

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

The key social issues associated with the **construction phase** include the following **potential negative impacts:**

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

The key social issues affecting the **operational phase** include the following potential **positive** impacts:

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

The key social issues affecting the **operational phase** include the following potential **negative** impacts:
» The visual impacts and associated impact on sense of place.

The Social Impact Assessment Report (SIA) contains a detailed assessment of social impacts, which is summarised in the impact tables below. The findings of the SIA indicate that the development of the proposed Upington Solar Thermal Plant Three will create employment and business opportunities for locals during both the construction and operational phase of the project. The enhancement measures listed in the report should be implemented in order to enhance these benefits. In addition, the proposed establishment of a number of other renewable energy facilities in the area will create significant socio-economic opportunities for the local municipalities in the area, which, in turn, will result in a positive social benefit.

The establishment of a Community Trust funded by revenue generated from the sale of energy from the proposed project also creates an opportunity to support local economic development in the area. Given the size of the CSP Plant (125MW) this will represent a significant social benefit for an area where there are limited opportunities. The proposed development also represents an investment in clean, renewable energy infrastructure, which, given the challenges created by climate change, represents a positive social benefit for society as a whole. In addition, no affected or adjacent landowner or local community has objected to the development of the CSP Plant during the public participation process undertaken by Savannah Environmental. The establishment of the proposed Upington Solar Thermal Plant Three is therefore supported by the findings of the SIA.

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

Nature: Creation of 300 – 600 employment and business opportunities during the construction phase.

Listed Activities:
GNR 545, 18 June 2010 Activity 1

	Without Mitigation	**With Enhancement**
Extent	Local – Regional (2)	Local – Regional (4)
Duration	Short Term (2)	Short Term (2)
Magnitude	Low (4)	Moderate (6)
Probability	Highly probable (4)	Definite (5)
Significance	**Medium (32)**	**High (60)**
Status	Positive	Positive
Reversibility	N/A	N/A
Irreplaceable loss of resources?	N/A	N/A
Can impact be enhanced?	Yes	

Enhancement:

Employment

» Where reasonable and practical the contractors appointed by the proponent should appoint local contractors and implement a 'locals first' policy, especially for semi and low-skilled job categories. However, due to the low skills levels in the area, the majority of skilled posts are likely to be filled by people from outside the area.

» Where feasible, efforts should be made to employ local contactors that are compliant with Broad Based Black Economic Empowerment (BBBEE) criteria;

» Before the construction phase commences the proponent and its contractors should meet with representatives from the Kai !Garib Local Municipality (KGLM) and bordering //Khara Hais Local Municipality(KHLM) to establish the existence of a skills database for the area. If such as database exists it should be made available to the contractors appointed for the construction phase.

» The local authorities, community representatives, and organisations on the interested and affected party database should be informed of the final decision regarding the project and the potential job opportunities for locals and the employment procedures that the proponent intends following for the construction phase.

» Where feasible, training and skills development programmes for locals should be

initiated prior to the initiation of the construction phase.

» The recruitment selection process should seek to promote gender equality and the employment of women wherever possible.

Business

» The proponent should seek to develop a database of local companies, specifically Broad Based Black Economic Empowerment (BBBEE) companies, which qualify as potential service providers (e.g. construction companies, catering companies, waste collection companies, security companies etc.) prior to the commencement of the tender process for construction contractors. These companies should be notified of the tender process and invited to bid for project-related work.

» The proponent, in consultation with the KGLM and KHLM and the local Chamber of Commerce, should identify strategies aimed at maximising the potential benefits associated with the project.

Note that while preference to local employees and companies is recommended, it is recognised that a competitive tender process may not guarantee the employment of local labour for the construction phase.

Cumulative impacts: Opportunity to up-grade and improve skills levels in the area.

Residual impacts: Improved pool of skills and experience in the local area.

Nature: Potential impacts on family structures and social networks associated with the presence / disturbances by construction workers.

Listed Activities:
GNR 545, 18 June 2010 Activity 1

	Without Mitigation	**With Mitigation**
Extent	Local (2)	Local (1)
Duration	Medium Term for community as a whole (3)	Medium Term for community as a whole (3)
Magnitude	Low for the community as a whole (4)	Low for community as a whole (4)
Probability	Probable (3)	Probable (3)
Significance	Low for the community as a whole (27)	Low for the community as a whole (24)
Status	Negative	Negative
Reversibility	No in case of HIV and AIDS	No in case of HIV and AIDS
Irreplaceable loss of resources?	Yes, if people contract HIV/AIDS. Human capital plays a critical role in communities that rely on farming	

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

Mitigation:

» Where possible, the proponent should make it a requirement for contractors to implement a 'locals first' policy for construction jobs, specifically semi and low-skilled job categories.
» Provide forums to communicate matters regarding environmental management.
» The proponent and the contractors should develop a Code of Conduct for the construction phase. The code should identify what types of behaviour and activities by construction workers are not permitted. Construction workers that breach the code of good conduct should be dismissed. All dismissals must comply with the South African labour legislation.
» The proponent and the contractor should implement an HIV/AIDS awareness programme for all construction workers at the outset of the construction phase.
» The movement of construction workers on and off the site should be closely managed and monitored by the contractors. In this regard the contractors should be responsible for making the necessary arrangements for transporting workers to and from site on a daily basis.
» The contractor should make necessary arrangements to enable workers from outside the area to return home over weekends and or on a regular basis during the 24 month construction phase. This would reduce the risk posed by non-local construction workers to local family structures and social networks.
» The contractor should make the necessary arrangements for ensuring that all non-local construction workers are transported back to their place of residence once the construction phase is completed. This would reduce the risk posed by non-local construction workers to local family structures and social networks.
» With the exception of security personnel, no construction workers should be permitted to stay overnight on the site.

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

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

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

Listed Activities:
GNR 545, 18 June 2010 Activity 1

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

Mitigation:

» Provide forums to communicate matters regarding environmental management.
» The proponent should hold contractors liable for compensating any impacted farmer and communities for any stock losses and/or damage to farm infrastructure that can be linked to construction workers. This should be contained in tender documents for contractors and the Code of Conduct to be signed between the proponent, the contractors and neighbouring landowners. The agreement should also cover loses and costs associated with fires caused by construction workers or construction related activities (see below);
» The EMPr must outline procedures for managing and storing waste on site, specifically plastic waste that poses a threat to livestock if ingested.
» Contractors appointed by the proponent should ensure that all workers are informed at the outset of the construction phase of the conditions contained on the Code of Conduct, specifically consequences of stock theft and trespassing on adjacent farms.
» Contractors appointed by the proponent should ensure that construction workers who are found guilty of stealing livestock, poaching and/or damaging farm infrastructure should be charged as per the conditions contained in the Code of Conduct. All dismissals must be in accordance with South African labour legislation;
» The housing of construction workers on the site should be limited to security

personnel.
Cumulative impacts: No**,** provided losses are compensated for
Residual impacts: Not applicable if losses are compensated for

Nature: Potential loss of livestock, crops and houses, damage to farm infrastructure and threat to human life associated with increased incidence of veld fires		
Listed Activities: GNR 545, 18 June 2010 Activity 1		
	Without Mitigation	**With Mitigation**
Extent	Local (4) (Rated as 4 due to potential severity of impact on local farmers)	Local (2) (Rated as 2 due to potential severity of impact on local farmers)
Duration	Short Term (2)	Short Term (2)
Magnitude	Moderate due to reliance on livestock for maintaining livelihoods (6)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	**Medium (36)**	**Low (24)**
Status	Negative	Negative
Reversibility	Yes, compensation paid for stock and losses and damage etc.	
Irreplaceable loss of resources?	No	No
Can impact be mitigated?	Yes	
Mitigation: » Contractor should ensure that open fires on the site for cooking or heating are not allowed except in designated areas. » No smoking on the site, except in designated areas should be permitted. » Contractor should ensure that construction related activities that pose a potential fire risk, such as welding, are properly managed and are confined to areas where the risk of fires has been reduced. Measures to reduce the risk of fires include clearing working areas and avoiding working in high wind conditions when the risk of fires is		

greater. In this regard special care should be taken during the high risk dry, windy winter months.
» Contractor should provide adequate fire fighting equipment on-site.
» Contractor should provide fire-fighting training to selected construction staff.
» As per the conditions of the Code of Conduct, in the advent of a fire being caused by construction workers and or construction activities, the appointed contractors must compensate farmers for any damage caused to their farms. The contractor should also compensate the fire fighting costs borne by farmers and local authorities.
» The developer should also ensure that they join the local fire protection agency.

Cumulative impacts: No, provided losses are compensated for.

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

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

Listed Activities:
GNR 545, 18 June 2010 Activity 1
GNR 544, 18 June 2010 Activity 47 (iii)

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

Mitigation:
» The proponent should ensure that damage to the D3276 is repaired on a regular basis and that the road is returned to its original state once the construction phase is completed.
» Drivers should be made aware of the potential risk posed to school children and other local residents. All drivers must ensure that speed limit of 60 km per hour is

enforced along the section of the N14 that runs past residential units.

» Abnormal loads along the N14 should be timed to avoid times of the year when traffic volumes are likely to be higher, such as start and end of school holidays, long weekends and weekends in general etc.
» The contractor must ensure that all damage caused to the internal access road by the construction related activities, including heavy vehicles, is repaired before the completion of the construction phase. The costs associated with the repair must be borne by the contractor.
» Dust suppression measures must be implemented for heavy vehicles such as wetting of gravel roads on a regular basis and ensuring that vehicles used to transport sand and building materials are fitted with tarpaulins or covers.
» All vehicles must be road-worthy and drivers must be qualified, made aware of the potential road safety issues, and need for strict speed limits.
» Construction should be done in phases so that the area cleared is kept to a minimum. This will also allow for progressive rehabilitation of disturbed areas during the 24 month construction phase.

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

Residual impacts: Reduced quality of road surfaces and impact on road users

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

Listed Activities:
GNR 545, 18 June 2010 Activity 1
GNR 544, 18 June 2010 activity 9

	Without Mitigation	**With Mitigation**
Extent	Local (1)	Local (1)
Duration	Long term-permanent if disturbed areas are not effectively rehabilitated or compensation is not paid (5)	Medium Term if damaged areas are rehabilitated (3)
Magnitude	Low (4)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	**Low (28)**	**Low (28)**

Status	Negative	Negative
Reversibility	Yes, disturbed areas can be rehabilitated	Yes, disturbed areas can be rehabilitated
Irreplaceable loss of resources?	Yes, loss of farmland. However, disturbed areas can be rehabilitated	Yes, loss of farmland. However, disturbed areas can be rehabilitated
Can impact be mitigated?	Yes, however, loss of farmland cannot be avoided	Yes, however, loss of farmland cannot be avoided
Mitigation: » The footprint associated with the construction related activities (access roads, construction platforms, workshop etc.) should be kept to a minimum. » The installation of the components should be phased so that the area cleared is kept to a minimum. This will also allow for progressive rehabilitation of disturbed areas during the construction phase. » An Environmental Control Officer (ECO) should be appointed to monitor the construction phase. » All areas disturbed by construction related activities, such as access roads on the site, construction platforms, workshop area etc., should be rehabilitated at the end of the construction phase; » The implementation of a rehabilitation programme should be included in the terms of reference for the contractor/s appointed. The specifications for the rehabilitation programme should be drawn up a suitably qualified person/s. » The implementation of the Rehabilitation Programme should be monitored by the ECO.		
Cumulative impacts: Overall loss of farmland could affect the livelihoods of the affected farmer, and the workers on the farm and their families. However, disturbed areas can be rehabilitated and loses would be off-set by compensation		
Residual impacts: Land would be available for farming once rehabilitation has been completed.		

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

Nature: Creation of ~80 employment and business opportunities associated with the operational phase		
Listed Activities: GNR 545, 18 June 2010 Activity 1		
	Without Mitigation	**With Enhancement**
Extent	Local and Regional (1)	Local and Regional (2)
Duration	Long term (4)	Long term (4)
Magnitude	Moderate (6)	Moderate (6)
Probability	Probable (3)	Highly Probable (4)
Significance	**Medium (33)**	**Medium (48)**
Status	Positive	Positive
Reversibility	N/A	
Irreplaceable loss of resources?	No	
Can impact be enhanced?	Yes	
Enhancement: The proponent should implement a training and skills development programme for locals during the first 5 years of the operational phase. The aim of the programme should be to maximise the number of locals employed during the operational phase of the project.		
Cumulative impacts: Creation of permanent employment and skills and development opportunities for members from the local community and creation of additional business and economic opportunities in the area		
Residual impacts: Creation of pool of people with experience in field of CSP Plants.		

Nature: Establishment of a Community Trust funded by revenue generated from the sale of energy. The revenue can be used to fund local community development
Listed Activities: GNR 545, 18 June 2010 Activity 1

	Without Mitigation	**With Enhancement**
Extent	Local and Regional (2)	Local and Regional (3)
Duration	Long term (4)	Long term (4)
Magnitude	Moderate (6)	Moderate (6)
Probability	Probable (3)	Definite (5)
Significance	**Medium (36)**	**High (65)**
Status	Positive	Positive
Reversibility	N/A	
Irreplaceable loss of resources?	No	
Can impact be enhanced?	Yes	
Enhancement: » The proponent in consultation with the KGLM and KHLM should establish criteria for identifying and funding community projects and initiatives in the area. The criteria should be aimed at maximising the benefits for the community as a whole and not individuals within the community; » The proponent in consultation with the KGLM and KHLM should ensure that strict financial management controls, including annual audits, should be implemented to ensure that the funds generated for the Community Trust are managed for benefit of the community as a whole and not individuals within the community.		
Cumulative impacts: Promotion of social and economic development and improvement in the overall well-being of the community		
Residual impacts: Investment in local economic development in the area that would benefit the community post operational phase		

Nature: Promotion of clean, renewable energy		
Listed Activities: GNR 545, 18 June 2010 Activity 1		
	Without Mitigation	**With Mitigation** (The provision of renewable energy infrastructure is in itself a mitigation measure)
Extent	Local, Regional and National (4)	Local, Regional and National (4)
Duration	Long term (4)	Long term (4)

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

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

Nature: Social impacts associated with retrenchment including loss of jobs, and source of income should the CSP Plant be decommissioned.		
Listed Activities: GNR 545, 18 June 2010 Activity 1		
	Without Mitigation	**With Mitigation**
Extent	Local and regional (3)	Local and regional (2)
Duration	Medium Term (2)	Very Short Term (1)
Magnitude	Moderate (6)	Low (4)
Probability	Highly Probable (4)	Highly Probable (4)
Significance	**Medium (44)**	**Low (16)**
Status	Negative	Negative-Neutral

Reversibility	Yes, assumes retrenchment packages are paid to all affected employees	
Irreplaceable loss of resources?	No	
Can impact be mitigated?	Yes	
» **Mitigation:** » The proponent should ensure that retrenchment packages are provided for all staff who stand to lose their jobs when the plant is decommissioned. » All structures and infrastructure associated with the proposed facility should be dismantled and transported off-site on decommissioning. » The proponent should investigate the option of establishing an Environmental Rehabilitation Trust Fund to cover the costs of decommissioning and rehabilitation of disturbed areas. The Trust Fund should be funded by a percentage of the revenue generated from the sale of energy to the national grid over the 20 year operational life of the facility. The rationale for the establishment of a Rehabilitation Trust Fund is linked to the experiences with the mining sector in South Africa and failure of many mining companies to allocate sufficient funds during the operational phase to cover the costs of rehabilitation and closure.		
Cumulative impacts: Loss of jobs and associated loss of income etc. can impact on the local economy and other businesses. However, decommissioning can also create short term, temporary employment opportunities associated with dismantling etc.		
Residual impacts: See cumulative impacts		

7.10.4. Comparative Assessment of Access Road Alternatives

Whichever road is technically preferred should be utilised and no preference in terms of social impacts related to the road alternatives are made. The proponent should ensure that damage to the D3276 is repaired on a regular basis (the D3276 is a public road which is currently a gravel road), and that the road is returned to its original state once the construction phase is completed.

7.10.5. Implications for Project Implementation

» The findings of the SIA undertaken for the proposed Upington Solar Thermal Plant Three indicate that the development will create employment and business opportunities for locals during both the construction and operational phase of the project.
» The establishment of a Community Trust will also create an opportunity to support local economic development in the area.

- The development of renewable energy has also been identified as key growth sector by the local municipality and also represents an investment in clean, renewable energy infrastructure, which, given the challenges created by climate change, represents a positive social benefit for society as a whole.
- Where reasonable and practical the contractors appointed by the proponent should appoint local contractors and implement a 'locals first' policy, especially for semi and low-skilled job categories. However, due to the low skills levels in the area, the majority of skilled posts are likely to be filled by people from outside the area.
- A skills development and training programme to be developed for the construction and operational phases.
- Any negative social impacts during construction and operational of the plant can be managed to acceptable levels.
- It is therefore recommended that the Upington Solar Thermal Plant Three can be developed, subject to the implementation of the recommended enhancement and mitigation measures contained in the EMPr.

7.11. Impacts Related to the Storage and Handling of Dangerous Goods

During the operational phase, the CSP plant will require the storage of materials which may be considered to be dangerous goods.

"Dangerous goods" is defined under the Listing Notices that deal with the storage, or storage and handling, of dangerous goods. "Dangerous goods" are defined in the Listing Notices as:

"Goods containing any of the substances as contemplated in South African National Standard No. 10234, supplement 2008 1.00: designated "List of classification and labelling of chemicals in accordance with the Globally Harmonized Systems (GHS)" published by Standards South Africa, and where the presence of such goods, regardless of quantity, in a blend or mixture, causes such blend or mixture to have one or more of the characteristics listed in the Hazard Statements in section 4.2.3, namely physical hazards, health hazards or environmental hazards"

The above definition makes specific reference to SANS 10234. South Africa has implemented the Globally Harmonized System of Classification and Labelling of Chemicals by issuing this national standard.

The operation of the CSP Plant requires fuel for start-up, heat transfer fluid (synthetic oil), diesel and other chemicals. The facilities or infrastructure for the storage, or storage and handling of a dangerous good in containers will have a combined capacity of up to / not exceeding 500 cubic metres. These chemicals will be stored on-site in appropriate storage vessels in bunded areas/ on impervious services. The storage and handling of these dangerous goods has the potential to result in soil and/or water

contamination should any spillages/leakages occur. While not all materials to be stored on site are considered to be hazardous (or have a hazard rating), materials such as fuel and oils are flammable and also have the potential to cause fires, explosions, damage to infrastructure, as well as injuries of staff.

Two materials which are specific to the operation of a parabolic trough CSP plant are heat transfer fluid (HTF) and molten salts for thermal energy storage.

Heat transfer fluid (HTF) – in a parabolic trough, a tube or pipe which runs the length of the trough at its focal line contains a fluid which is heated to a high temperature by the energy of the sunlight. Heat transfer fluid (usually thermal oil) runs through the tube to absorb the concentrated sunlight. This increases the temperature of the fluid to some 400°C. The heat transfer fluid is then used to heat steam in a standard turbine generator. The HTF is a hydrotreated mineral oil, and is not hazardous. It is, however, flammable.

Molten salts - The molten salt to be utilised in the CSP Plant is made up of a blend of Sodium Nitrate (approximately 60%) and Potassium Nitrate (approximately 40%). Neither is listed under Annex A of SANS 10234 supplement 2008 1.00: designated "List of classification and labelling of chemicals in accordance with the Globally Harmonized Systems (GHS)" published by Standards South Africa. Molten salt therefore does not qualify as a dangerous good in terms of the definition under NEMA EIA Regulations. It is, however, superheated when being used for thermal energy storage.

Nature: Soil and water contamination due to the handling and storage of dangerous goods during the construction and operational phases.		
Listed Activities: GNR 545, 18 June 2010 Listed Activity 3		
	Without mitigation	**With mitigation**
Extent	Local (5)	Local (5)
Duration	Short (2)	Short (1)
Magnitude	High (8)	Moderate (6)
Probability	Probable (3)	Probable (3)
Significance	**Medium (45)**	**Medium (36)**
Status (positive or negative)	Negative	Negative
Reversibility	Irreversibility	Irreversibility
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	Yes

Mitigation::

» Any spillages of dangerous substances must be contained, and remedial and clean-up actions initiated immediately.
» Regular inspections of the permanent bunded areas for storage of dangerous goods must be undertaken.
» Maintenance vehicles must have access to spill kits.
» An emergency spill response plan must be developed for implementation during the construction and the operational phase.
» A fire management plan must be developed for implementation during the construction and the operational phase.
» Store the HTF (oil) in enclosed containers away from heat, sparks, open flames, or oxidizing materials.
» Develop and implement a procedure for handling and clean-up of the heat transfer fluid (oil) in the event of spills including the following:
  - Should any spillage of the HTF occur, these must be cleaned up as soon as possible
  - Use appropriate techniques such as non-combustible absorbent materials for clean-up of HTF spillages.
  - Store collected / contaminated material in a suitable labelled container.
  - If heated material is spilled, allow it to cool to ambient before proceeding with disposal methods.
  - Keep area around hot, spilled material well ventilated.
  - Reporting: Report spills to appropriate local authorities. This product is classified as dangerous good.
  - Discharge or spills that produce a visible sheen on surface water or in waterways/sewers that lead to surface water must be reported to appropriate authorities.
» Develop a monitoring and leak detection procedure for monitoring of the HTF

Cumulative impacts:

The development of the CSP plant and its proximity to the Khi Solar One Plant will increase the cumulative environmental risk of contamination due to the storage and handling of chemicals and flammable substances.

Residual Impacts:

None

Nature: Operation of the CSP Plant including: regular washing of mirrors; possible breakage of heat transfer fluid piping, possible release of toxic substances and associated contamination of soil and groundwater and downstream wetlands, possible contamination and damage to terrestrial fauna, possible rapid establishment of weeds or invasive species within solar fields and source of regenerative material of such species, possible increase of dust levels.

Listed Activities:
GNR 545, 18 June 2010 Activity 1
GNR 545, 18 June 2010 Listed Activity 3

	Without mitigation	**With mitigation**
Extent	Regional (4)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Low (4)	Small (0)
Probability	Definite (5)	Probable (3)
Significance	**Medium (60)**	**Low (15)**
Status (positive, neutral or negative)	Negative	Negative
Reversibility	Partially reversible	Reversible
Irreplaceable loss of resources?	Probable	Not likely
Can impacts be mitigated?	Reasonably	

Mitigation:

» No polluting chemicals may be used in mirror wash water.
» Routinely check the piping of heat transfer fluid (HTF) in the parabolic trough field to detect potentially weak areas or leaks early.
» Prior to construction and up to decommissioning, clear method statements must be drafted and available on site at all times on how any breakages of HTF pipelines will be contained and remediated.

Cumulative impacts:

» Possible pollution of surrounding areas and downstream rivers and wetlands if no mitigation is implemented

Residual impacts:

» None expected if mitigation measures are implemented

7.12. Assessment of the Do Nothing Alternative

The 'Do-Nothing' alternative is the option of not constructing the proposed Upington Solar Thermal Plant Three. Should this alternative be selected, there would be no environmental impacts on the site due to the construction and operation activities of a solar energy facility. Currently, the southern portion of the site is utilised for the Khi Solar One CSP project. Abandoned mines in the form of shallow trenches and a few deep pits occur in the north-west corner of the McTaggart Camp property, as well as scattered trenches in the surrounding area. Some wildlife occur on the broader farm portion. Should the current land use activities continue, degradation of the site vegetation will need to be managed through a site-specific management strategy to manage the potential for degradation of vegetation on site.

In addition, the project is proposed on the same property/site as the Khi Solar One tower plant, which includes a new Eskom substation (the Eskom Distribution McTaggerts Substation). The construction of the Khi facility has included vegetation clearance on the portion of the land where the facility is situated, several access roads, as well as a power line. The new substation will be utilised for connection of new and additional renewable facilities proposed in the area until Eskom's new Transmission substation is constructed on their site for their planned CSP plant. The developer finds this site suitable for this development (among other reasons as explained in Chapter 3).

At a local and regional level, the new employment opportunities created through the construction of the Khi Solar One project will not be continued in terms of transfer of skills to people in terms of the construction and operation of the solar energy facility. The landowner and developer would have lost an opportunity of using the land in a sustainable manner. Furthermore, the community would lose the opportunity to improve and uplift their infrastructures through the additional community trust to be put in place.

At a broader scale, the benefits of additional capacity to the electricity grid and those associated with the introduction of renewable energy would not be realised. Although the facility is only proposed to contribute 75 MW to the grid capacity, this would assist in meeting the growing electricity demand throughout the country and would also assist in meeting the government's goal for renewable energy. The generation of electricity from renewable energy resources offers a range of potential socio-economic and environmental benefits for South Africa. These benefits include:

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

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

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

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

» **Pollution reduction:** The releases of by-products through the burning of fossil fuels for electricity generation have a particularly hazardous impact on human health and contribute to ecosystem degradation.

» **Climate friendly development:** The uptake of renewable energy offers the opportunity to address energy needs in an environmentally responsible manner and thereby allows South Africa to contribute towards mitigating climate change through the reduction of greenhouse gas (GHG) emissions. South Africa is estimated to be responsible for ~1 % of global GHG emissions and is currently ranked 9th worldwide in terms of per capita CO_2 emissions.

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

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

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

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

The 'do nothing' alternative will do little to influence the macro-level renewable energy targets set by government due to competition in the sector, and the number of renewable energy projects being bid to the DoE, specifically around the Upington area, However, as the site experiences some of the best irradiation in the country and optimal grid connection opportunities are available, not developing the project would see such an opportunity being lost. The loss of the land to this project is therefore not considered significant. In addition the Northern Cape grid will be deprived of an opportunity to benefit from the additional generated power being evacuated directly into the Province's grid. The "Do Nothing" alternative is therefore not preferred as South Africa needs to diversify electricity generation sources, to which this project will contribute.

ASSESSMENT OF POTENTIAL CUMULATIVE IMPACTS CHAPTER 8

Cumulative impacts in relation to an activity are defined in the Environmental Impact Assessment Regulations (GN R543) as meaning "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".

There has been a steady increase in renewable energy developments recently in South Africa as legislation is evolving to facilitate the introduction of Independent Power Producers (IPPs) and renewable energy into the electricity generation mix. The Department of Energy has, under the REIPPP Programme released requests for proposals to contribute towards Government's renewable energy target of 3725 MW and to stimulate the industry in South Africa.

In a parallel process, a Strategic Environmental Assessment process is underway in order to identify geographical areas most suitable for the rollout of wind and solar photovoltaic energy projects and the supporting electricity grid network. Although CSP technology has not been specifically considered in the SEA, it follows that all solar technologies would be focussed in similar areas. The aim of the assessment is to designate renewable energy development zones (REDZs) within which such development will be incentivised and streamlined. The proposed Upington Solar Thermal Plant Three falls within the identified geographical areas / focus area most suitable for the rollout of the development of solar energy projects within the Northern Cape Province. Coupled to the Renewable Energy SEA, Eskom's Electricity Grid Infrastructure Strategic Environmental Assessment (SEA) is also underway. The area where the Upington Solar Thermal Plant Three is proposed is currently within the corridor planned to be strengthened by Eskom. It, therefore, follows that as the Upington Solar Thermal Plant Three falls in an identified renewable energy node, that projects of a similar nature are expected to be developed in this node.

Due to the growth in interest in renewable energy developments in South Africa, it is important to follow a precautionary approach in accordance with NEMA to ensure that the potential for cumulative impacts are considered and minimised where required and possible. This chapter considers whether the proposed CSP project's potential impacts become more significant when considered in combination with the other known or proposed solar energy facility projects within the area.

8.1 Assessment of Potential Cumulative Impacts

A cumulative impact, in relation to an activity, refers to the impact of an activity that in itself may not be significant, but may become significant when added to the existing and potential impacts eventuating from similar or diverse undertaking in the area[13].

Significant cumulative impacts that could occur due to the development of the solar energy facilities and its associated infrastructure in proximity to each other include impacts such as:

» Visual impacts
» Socio-economic impacts
» Loss of vegetation and impacts on ecology
» Impacts to soil
» Impacts on heritage resources
» Impacts related to abstraction of water from the Gariep River/ water resources.

The cumulative effect or impacts are presented as follows:

» Cumulative impacts potentially occurring due to the cumulative effects of the Upington Solar Thermal Plant Three added to all other renewable energy facilities under construction in the Upington area. These impacts will be registered throughout the Upington area requiring mitigation through planning at a regional level.
» Cumulative impacts potentially occurring due to the cumulative effects of the Upington Solar Thermal Plant Three, the proposed Upington Solar Thermal Plant Two and the Khi Solar One under construction, which are all proposed to be located on different areas within Portion 3 of the Farm MsTaggarts Camp 453. These impacts will be registered within the boundaries of the greater farm portion.

8.2 Cumulative Impacts of Renewable Energy Facilities in the Region

Several projects are being proposed in the area, authorised projects relevant to the Upington Solar Thermal Plant Three include:

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

Project Name	Location	Project Status
1. Eskom CSP Facility	Farm Olyvenhouts Drift	Received Authorisation
2. Abengoa Solar 50MW Khi CSP facility (power tower technology)	Portion 3 of the farm McTaggarts Camp 453	Construction underway
3. Solar Reserve CSP project	Remaining extent of Farm Rooipunt 617	Received Authorisation
4. Sasol New Energy Project Solis (CSP Plant)	Portions 443 to 450 of Van Roois Vley Farm	Received Authorisation
5. Sirius Solar Energy Facility (2 X 75MW PV projects)	Remaining Extent of the Farm Tungsten Lodge	EIA completed in February 2014
6. S-Kol photovoltaic plant near Keimoes	Farm Geelkop 456	Received Authorisation
7. Ofri ZX PV Facility	Remaining extent of Farm 616	Received Authorisation
8. Sonneberg PV Facility	Portion 11 of Farm Baviaanz Kranz 474	Received Authorisation

These projects were identified using the Department of Environmental Affairs Geographic Information System digital data developed by the CSIR[14]. A map showing the other relevant solar projects (both CSP as well as PV technology) in the study area is shown in Figure 8.1. Only the Khi Solar One Project is under construction by the same developer for the Upington Solar Thermal Plant Three i.e. Abengoa Solar Power South Africa (Pty) Ltd. There are atleast six authorised solar projects in the area.

In addition, The Central Energy Fund (CEF) proposes a Solar Park on the Farm Klip Kraal 451 which is located adjacent to Eskom's CSP Plants site (on Farm Olyvenhouts Drift). The CEF Solar Park is proposed to comprise of 1 GW of solar electricity generating plant consisting of a mix of solar technologies including PV, CPV, parabolic trough and central receiver CSP technologies.

[14] It must be noted that the accuracy of this data has not been confirmed by DEA.

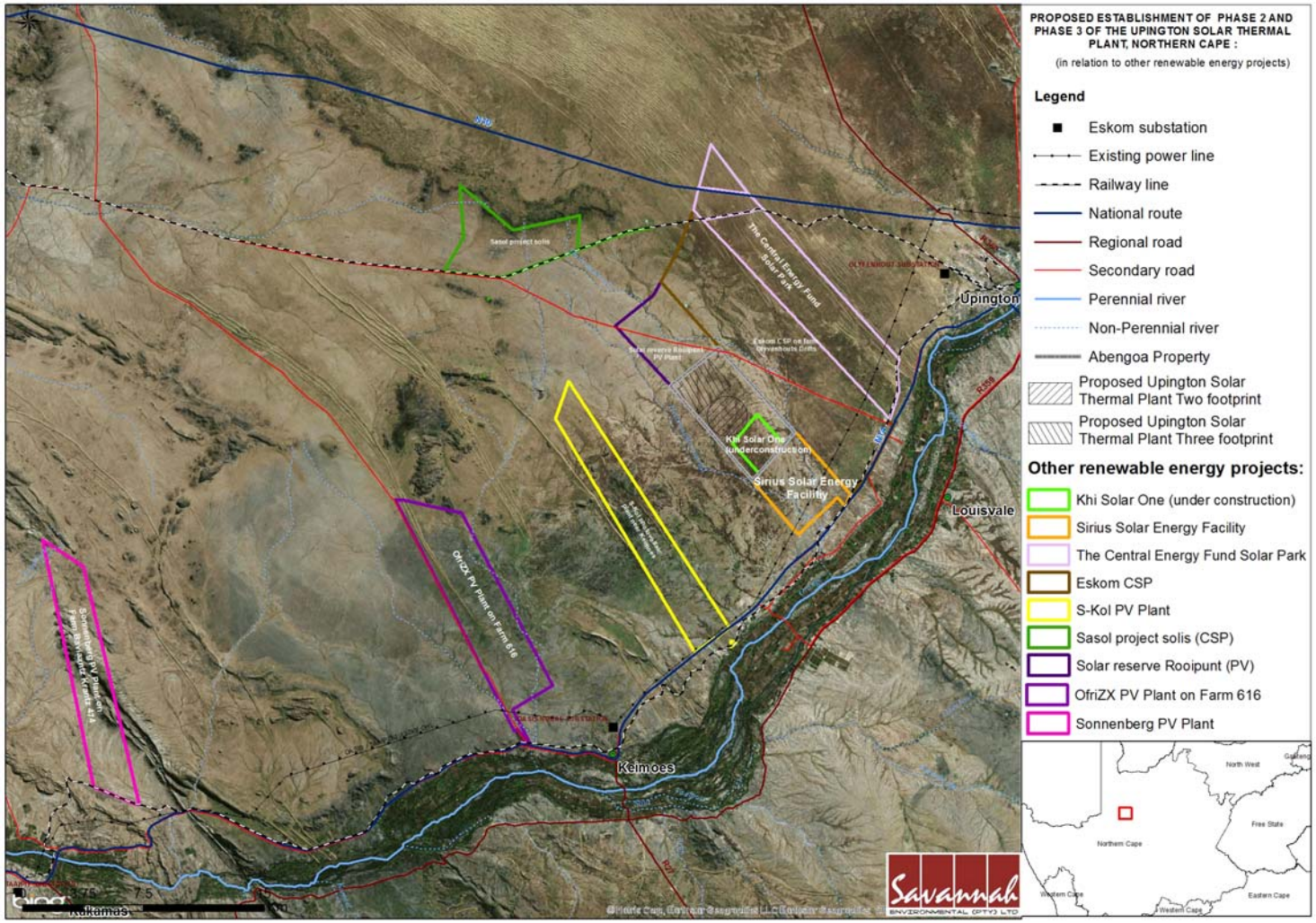

Figure 8.1: Map showing other projects in the study area. These projects were identified using the Department of Environmental Affairs Geographic Information System digital data developed by the CSIR

8.2.1. Visual impacts

The cumulative impacts associated with CSP and PV facilities are largely linked to the visual impact on the areas sense of place and landscape character. The construction of the Upington Three CSP Plant and three other CSP plants will increase the cumulative visual impact of industrial type infrastructure within the region. This is especially relevant in light of the other CSP facilities proposed in adjacent to the site.

Considering these three authorised CSP facilities, there is no doubt that the addition of the proposed Upington Solar Thermal Plant Three will contribute to the cumulative visual impact within the region. Of note is that should enough alternative energy facilities exist within a region, it begins to be defined by such. Therefore, considering those facilities already in possession of an Environmental Authorisation, the anticipated cumulative impact on the visual quality of the landscape and the sense of place of the region will be of medium-high significance. Given the vastness of the area, the significance of the impact on the areas sense place and character is likely to be moderate. The cumulative impact on the areas landscape character will also be reduced by the concentration of a number of solar energy facilities in one area as opposed to being spread out over a larger area.

8.2.2. Socio-economic impacts

The proposed Upington Solar Thermal Plant Three together with the establishment of the other solar projects in the area also have the potential to result in significant positive cumulative socio-economic impacts for the local municipalities in the area (Kai !Garib Local Municipality, //Khara Hais Local Municipality and the ZF Mgcawu District Municipality). Positive cumulative impacts include creation of employment, skills development and training opportunities (construction and operational phase), creation of downstream business opportunities and stimulation of the local property market. The significance of this impact is rated as a high positive with enhancement.

However, the establishment of a large number of solar energy facilities in the area will also create a number of potential challenges for the local and district municipalities. These challenges are linked to provision of services and infrastructure. These challenges will need to be addressed by the municipalities to ensure that the benefits associated with the renewable energy sector are maximised for the benefit of the broader community.

8.2.3. Ecological Processes

The solar energy developments in the area are largely outside of the National Protected Areas Expansion Strategy 2008 (NPAES) focus areas, suggesting that the affected areas are not likely to be considered highly sensitive from a broad-scale conservation perspective. This agrees with observations from the area which suggests that the relatively flat topography of the area and relatively homogenous vegetation are factors which are likely to reduce the overall cumulative impact on the area to a relatively low level in terms of the potential of the high local development intensity to disrupt broad scale ecological processes. The cumulative loss of habitat resulting from the current and as well as the other developments in the area are not likely to impact the country's ability to meet conservation targets and objectives as the affected vegetation types are widespread and have been little impacted by transformation to date. Cumulative ecological impacts include:

» Excessive clearing of slow growing trees, especially *Boscia albitrunca* and *Acacia erioloba* could significantly impact local and regional population dynamics, as well as microhabitats and resources associated with these species available to other fauna and flora species. Clearing of such trees, must be kept to the absolute minimum, and large vigorous specimens should be a priority for conservation and exclusion from development footprints.
» Excessive clearing of vegetation and landscaping will influence runoff and stormwater flow patterns and dynamics, which could cause excessive accelerated erosion of plains, small ephemeral to larger intermittent drainage lines, rivers and this could also have detrimental effects on the lower lying Gariep River.
» Rehabilitation and re-vegetation of all surfaces disturbed or altered during construction is desirable. Runoff from sealed surfaces or surfaces that need to be kept clear of vegetation to facilitate operation of a development needs to be monitored regularly to ensure that erosion control and stormwater management measures are adequate to prevent the degradation of the surrounding environment.
» Large-scale disturbance of indigenous vegetation creates a major opportunity for the establishment of invasive species and the uncontrolled spread of alien invasives into adjacent rangelands.

Cumulative negative impacts on ecology related to transformation of land, disturbance and habitat loss may occur during construction as well as impacts on fauna and flora. The significance of this impact is expected to be of a medium significance with mitigation for each project, through sound environmental management during construction and operation and by formal conservation and active management of the natural areas on site. This will result in the negative impacts on ecosystems on each site being managed to acceptable levels, and therefore in keeping with the principles of sustainable development. With the implementation of good environmental management practise

during the life cycle of each project, cumulative impacts on ecology as a result of the establishment of similar facilities will be to an acceptable level.

8.2.4. Cumulative impacts on soil

The impact of the proposed project on soil and the loss of agricultural land available to grazing is of low to medium significance.. The cumulative impact is offset by major limitations to agriculture in the area due to the aridity and lack of access to water, as well as the shallow soils prevailing in the area. Generally, land is only suitable for low intensity small stock farming and the cumulative impact is therefore expected to be low.

8.2.5. Cumulative Heritage Impacts

Archaeological sites are non-renewable and impact on any archaeological context or material will be permanent and destructive. Very sparse heritage traces were found on the site and from an archaeological perspective the observed heritage resources may be regarded as being of generally low significance. It still remains important for each facility to observe mitigation measures and to incorporate any sensitive heritage features into the layout plans where possible.

8.2.6. Cumulative effects on Water Resources

Potential cumulative water related impacts may occur with special reference to downstream erosion and sedimentation of the Orange River; water abstraction from the Orange River; the potential for chemical pollution; downstream alteration of hydrological regimes due to the increased run-off from the area and downstream erosion and sedimentation downstream of the Orange River. Volumes of water to be abstracted from the Orange River are controlled by the DWA, who will determine if sufficient reserves exist for the Lower Orange River Catchment. All applicants will have to apply to DWA for a water use licence for abstraction of water from the Orange River.

8.3 Cumulative impacts of adding two additional 125MW CSP projects on Portion 3 of the Farm McTaggarts Camp 453

The potential cumulative impacts over the Portion 3 of the Farm McTaggarts Camp 453, should the development of two additional 125MW CSP Plants be realised, are likely to be contained to within the boundaries of the farm, and with the application of the necessary mitigation measures, contained within each of the respective plant areas. This is deduced based on the following:

» The development footprints of the two new proposed 125MW CSP projects are aligned with areas of low ecological sensitivity and largely outside of the identified high to very high sensitive areas.
» Stone Age material is found on the greater farm but is of low heritage significance.

- Visual impacts of developing 2 new 125MW plants will be of medium significance. A cumulative viewshed showing the Khi Solar One Plant, Upington Solar Thermal Two Plant and Upington Solar Thermal Three Plant is shown in Figure 8.2.
- The development of up to three CSP plants on the site means that each plant will require water. Water quantity may be affected; however volumes of water to be abstracted from the Orange River are controlled by the DWA, who will determine if sufficient reserves exist for the Lower Orange River Catchment. All applicants will have to apply to DWA for a water use licence for abstraction of water from the Orange River.
- The development of up to three CSP plants may impact on public roads during construction. However, this impact can be managed.
- Shared infrastructure between Plant Three and Khi solar one could include a shared access road and sharing of the McTaggarts substation. This is favourable.
- Social – benefit to people in the area and increased opportunities for employment and spin-offs may occur. This is favourable.

Based on the above, the cumulative impacts associated with the construction and operation of two additional 125MW CSP Plants the Portion 3 of the Farm McTaggarts Camp 453 are considered to be acceptable provided that environmental impacts are mitigated to suitable standards by strict control and implementation of EMPrs for each project.

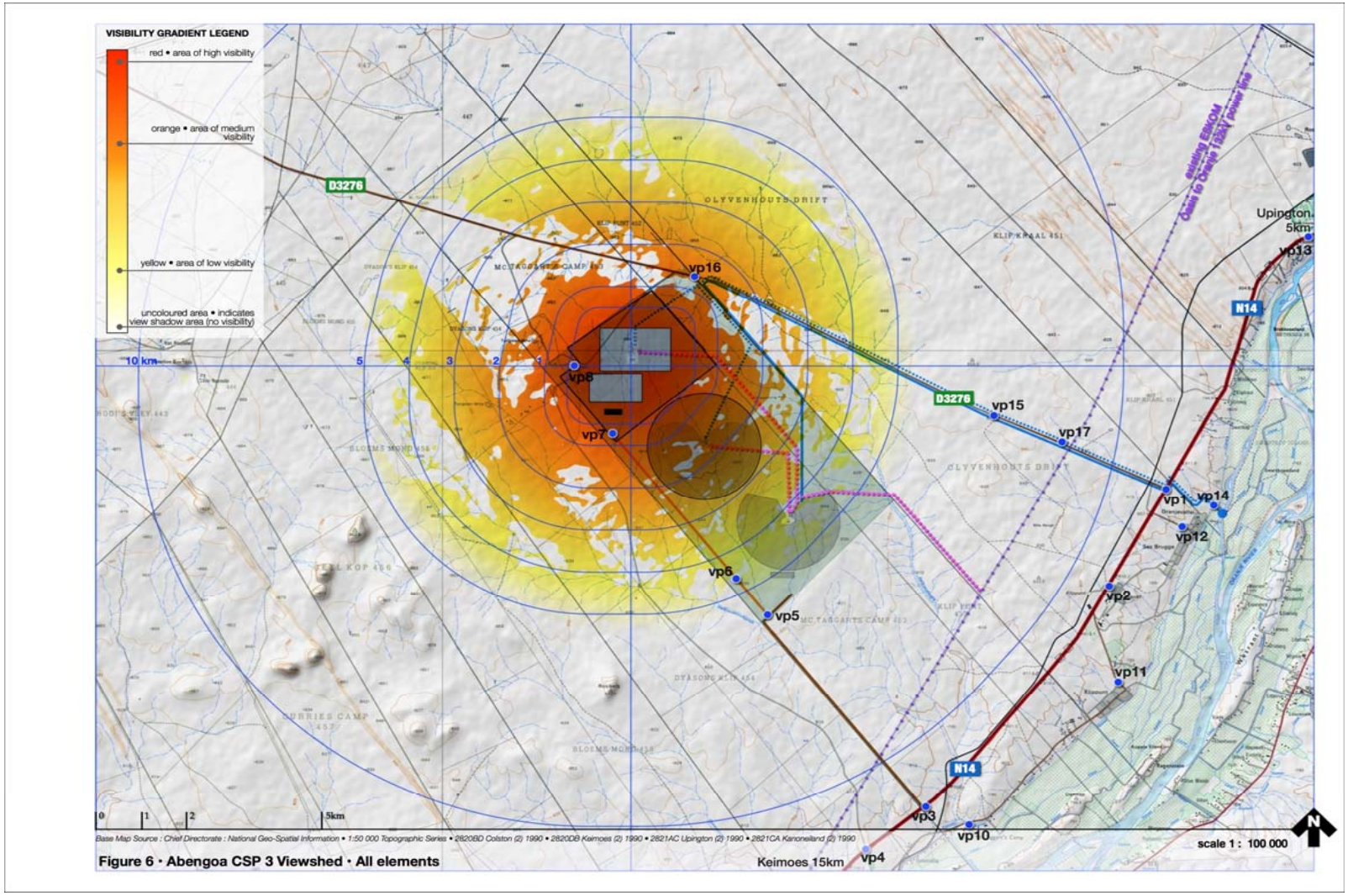

Figure 8.2: Cumulative viewshed showing the Khi Solar One Plant, Upington Solar Thermal Two Plant and Upington Solar Thermal Three Plant

8.4 Conclusion regarding Cumulative Impacts

Cumulative impacts and benefits on various environmental and social receptors will occur to varying degrees with the development of several renewable energy facilities in South Africa. The degree of significance of these cumulative impacts is difficult to predict without detailed studies based on more comprehensive data/information on each of the receptors and the site specific developments. This however, is beyond the scope of this study.

The alignment of renewable energy developments with South Africa's National Energy Response Plan and the global drive to move away from the use of non-renewable energy resources and to reduce greenhouse gas emissions is undoubtedly positive. The economic benefits of renewable energy developments at a local, regional and national level have the potential to be significant.

The Upington Solar Thermal Plant Three falls within the identified geographical area most suitable for the rollout of the development of solar energy projects within the Northern Cape Province. This implies that projects of the same nature will be consolidated in one area creating a node, and ultimately aiming to reduce the potential for cumulative impacts associated with such developments when spatially fragmented.

It is also important to note that it is unlikely that all proposed renewable energy facilities proposed in the area will be built due to capacity constraints on the Eskom grid and the limits placed on renewable energy targets. Considering the findings of the specialist assessments undertaken for the project, the cumulative impacts for the proposed Upington Solar Thermal Plant Three will be acceptable and of **moderate significance.**

CONCLUSIONS AND RECOMMENDATIONS CHAPTER 9

Abengoa Solar Power South Africa (Pty) Ltd is proposing the construction and operation of a commercial solar thermal electricity generating facility (using trough plant technology) and associated infrastructure near Upington, Northern Cape Province. The project is known as the Upington Solar Thermal Plant Three, and is one of three Abengoa Solar Concentrating Solar Power (CSP) facilities proposed to be established on Portion 3 of the farm McTaggarts Camp 453 (with the Khi Solar One project currently under construction).

Each project is located on a different area within Portion 3 of the Farm McTaggarts Camp 453 (with a total extent of 2200ha), which lies approximately 20 km west of the town of Upington in the Northern Cape. The Upington Solar Thermal Plant Three is proposed to utilise parabolic trough technology with a generation capacity of up to 125MW[15]. The facility will have a total development footprint of up to 500ha (within a 660ha portion identified within the larger farm) and will include the following associated infrastructure:

» Parabolic troughs (parabolic collector units arranged in loops to establish the solar field (i.e. to cover a total extent of approximately 400 ha) with an approximate height of 6m.
» Power island which will include a steam turbine and generator; a generator transformer and substation; auxiliary fossil fuel and/or electric boilers and associated molten salt storage vessels and heat exchangers (approximately 200m x 500m in extent).
» Access roads (road up to 6m wide).
» Plant substation (50m x 50m).
» 132 kV power line up to 8km in length to connect to Eskom's existing McTaggerts Substation, which is located on the same property as the proposed CSP Plant.
» Water abstraction point located at the Gariep River, filter station (20m x 30m) and water supply pipeline (up to 20km in length).
» Water storage reservoir and tanks (combined capacity up to 15 000m^3).
» Packaged water treatment plant (roughly 30m x 30 m).
» Up to 6 lined evaporation ponds (approximately 100m x 100m each).
» Workshop and office buildings (approximately 20m x 50m each).
» Mirror assembly facility (approximately 100m x 50m).

A layout of the facility is shown in Figure 9.1.

[15] Parabolic trough plants are modular in nature, and can easily be adapted to change the generation capacity of the plant. It is expected that the Department of Energy may soon make provision for CSP facilities up to a capacity of 125MW to be bid through their REIPPP Programme (current cap as of March 2014 is 100MW).

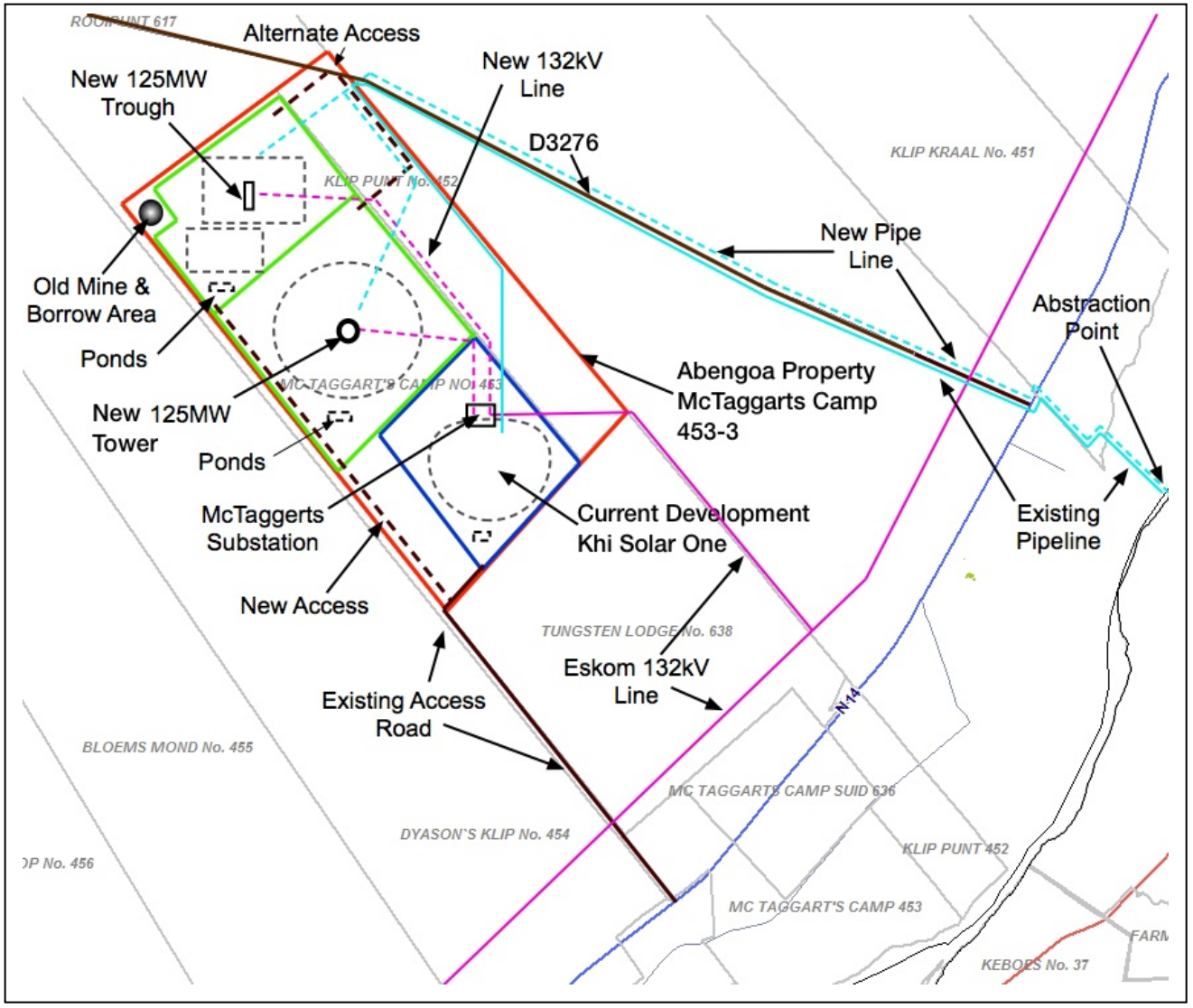

Figure 9.1: Map illustrating the location of the development footprint for Upington Solar Thermal Plant Three facility and associated infrastructure and the proposed layout of the proposed facility

The purpose of the proposed facility is to add new capacity for generation of power from renewable energy to the national electricity supply (which is short of generation capacity to meet current and expected demand), and to aid in achieving the goal of a 30% share of all new power generation being derived from independent power producers (IPPs), as targeted by the Department of Energy (DoE). In response to the need, Abengoa Solar Power South Africa (Pty) Ltd, as an IPP, is proposing the construction and operation of this CSP facility. CSP is the only of the renewable technologies that utilise conventional steam generating equipment with operational and life expectancy similar to that of conventional power plants (i.e. 40 years vs 20 years for other renewable technologies). One advantage of parabolic trough power plants is their potential for storing solar thermal energy to use during non-solar periods and to dispatch electricity when it is needed most.

An EIA process, as defined in the NEMA EIA Regulations, is a systematic process of identifying, assessing, and reporting environmental impacts associated with an activity. The EIA process forms part of the planning 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), Abengoa Solar Power South Africa requires authorisation from the National Department of Environmental Affairs (DEA) for the construction of the Upington Solar Thermal Plant Three 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 undertaken to date 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, and stakeholder letters. Details of registered parties have been included within an I&AP database for the project.
» *Scoping Phase* – identification of potential issues associated with the proposed project and environmental sensitivities (i.e. over the broader project development site - entire extent of Portion 3 of the farm McTaggarts Camp 453), as well as the extent of studies required within the EIA Phase were defined.
» *EIA Phase* – potentially significant biophysical and social impacts[16] and identified feasible alternatives have been comprehensively assessed through specialist investigations. Appropriate mitigation measures have been recommended as part of a draft Environmental Management Programme (EMPr) (refer to Appendix N).

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

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

9.1. Evaluation of the Proposed Project

The preceding chapters of this report together with the specialist studies contained within Appendices F - M provide a detailed assessment of the environmental impacts on the social and biophysical environment that may result from the proposed CSP project. This chapter concludes the final EIA Report by providing a summary of the conclusions of the assessment of the proposed site for the CSP Plant and the associated infrastructure. In so doing, it draws on the information gathered as part of the EIA process and the knowledge gained by the environmental consultants during the course of the EIA and presents an informed opinion of the environmental impacts associated with the proposed project.

From the conclusions of the detailed EIA studies undertaken, sensitive areas within the development footprint area were identified and flagged for consideration and avoidance by the facility layout (refer to Figure 9.2). Potential impacts which could occur as a result of the proposed project are summarised in the sections which follow. The most significant environmental impacts identified and assessed to be associated with the proposed Upington Solar Thermal Plant Three include:

» Local site-specific impacts
» Visual impacts due to the extent of the solar field and other associated infrastructure.

Local site-specific impacts: impacts on ecology, drainage lines and pans, and soils

Local site-specific impacts as a result of physical disturbance/modification to the site (500 hectares) with the establishment of a parabolic trough CSP plant that may occur during the construction phase will include:

» Impacts on biodiversity which includes any impacts on protected, red data or sensitive plant species and on overall species richness due to transformation of the land and loss of vegetation cover. The site does not fall within any "protected areas" or "Critical biodiversity areas". However, protected trees occur on the site, as do other species which are protected at a Provincial level. The area of high ecological sensitivities amounts to approximately 20 hectares, and is recommended to be avoided by the development footprint. This includes the parabolic trough plant, as well as the main access road to the facility. The ecological specialist recommended

that the layout should be refined to avoid the riparian vegetation / high sensitivity zones.

» Localised reduction of indigenous trees and shrubs, geophytes and other species of conservation concern, but not to a degree that the current conservation status of such species will be negatively affected. However, this effect is and will be further exacerbated by surrounding and regional developments (cumulative impacts).
» A number of small intermittent pans and ephemeral washes will be permanently transformed. Due to the semi-arid nature of the environment, it is not expected that this will have a significant impact on downstream wetland hydrology or functionality with the implementation of mitigation measures. However, the functionality of the small intermittent pans and their resources to other biodiversity will be lost. This may create a localised loss of species, but not affect their conservation status.
» Soil degradation on and beyond the development area, loss of functional and productive topsoil, possible introduction of weeds and invasive plants, a long-term (more than 8 months) low or absent vegetation cover after construction and possible contamination of lower-lying ephemeral drainage and perennial wetland systems.
» Soil erosion induced or increased by human activity.

These impacts will be limited to the development site (500 hectares) located within the north-western portion of Portion 3 of the Farm McTaggarts Camp 453.

Visual impacts

Visual quality is enhanced by the scenic-ness or intactness of the landscape, and lack of other visual intrusions. The existing Khi Solar One project on the same farm portion and Eskom 132 kV power line and other industrial type structures are some of the existing visual intrusions. The surrounding landscape has a generally rural quality, but other energy facilities are already constructed, or proposed in the area, which need to be taken into account. Given the scale of the proposed facility, both in terms of footprint and height, along with the open nature of the landscape, there is little opportunity for screening.

» The parabolic trough CSP Plant has a low visual impact as due to the low height of the parabolic troughs (6m in height). In addition it is located even further from the N14 Route and Gariep River than the existing Khi Solar One facility. Potential visual impacts would be medium significance before mitigation and less with mitigation.
» Potential visual impacts for associated infrastructure include the connecting power lines, which are rated as medium significance before mitigation, with little opportunity for mitigation.
» The water abstraction facilities at the Gariep River would be localised with a potential visual impact of medium-low before mitigation, and could be mitigated to low significance, including rehabilitation/re-vegetation.
» The construction phase of the project would include the use of cranes and a batching plant, both of which have visual implications, but these would be temporary, and

were therefore not considered to have an important effect on the overall visual impact significance ratings.

» The decommissioning phase of the projects, at the end of their useful life, would involve the dismantling and removal (recycling) of the structures, although concrete foundations would probably remain in the landscape.
» Given that the proposed CSP plant would be even further away from receptors than the Khi Solar One, and that the area has been generally identified for the location of solar energy plants, no fatal flaws are expected in terms of potential visual impacts.
» The assessment indicates that visual impacts would be of an acceptable level provided the mitigation measures are implemented.

The environmental impacts associated with the proposed project, as identified through the EIA, can be summarised as follows:

» The overall impact on the **ecology (including flora and fauna)** is likely to be of a medium to high significance prior to mitigation. This could be reduced to **medium** negative significance following the implementation of mitigation measures. Areas of sensitivity include riparian vegetation, occurrence of protected and red data plant species, drainage lines and pans.
» The overall impact on the **avifauna** is likely to be of a **low significance**. The primary concern will be habitat loss and collision/electrocution of birds with the power line. This impact on avifauna is potentially of moderate significance, but can be reduced to a low significance with the implementation of mitigation measures.
» The overall impact on the **soils, land-use and agricultural potential** is likely to be of a **low to medium significance**. The significance of all agricultural impacts is influenced by the fact that the site has extremely limited agricultural potential, with a land capability of class 7, non-arable, low potential grazing land. Soils are red, sandy soils on underlying rock and calcrete, varying from very shallow to moderately deep. The major limitations to agriculture are the aridity and lack of access to water, as well as the shallow soils. The land is only suitable for low intensity grazing.
» The overall impact on the **water resources** is of a **moderate significance**. These impacts are reduced to **low significance** through mitigation, apart from the moderate impact of water abstraction from the Gariep River. The development should have limited impact on the overall status of the riparian systems within the region. Impacts are related to the quantity of water to be abstracted from the Gariep River (440 000m^3/a) required for operation of the facility, and impacts to ephemeral drainage lines. The mainstem system (known as the Helbrandkloofspruit) flows along the western boundary of the site and is avoided by the development footprint, and only tributaries to this ephemeral system are impacted by the development footprint. The relevant Water Use Licenses for water uses (abstraction and impacting of water courses) are required to be obtained from DWA.
» The overall impact on the **heritage resources** is likely to be of a **low significance** as very sparse heritage traces (of low heritage value) were found during the field

survey. The **fossil record** from Kalahari deposits is very poor with respect to finds of fossil bones of vertebrates.

» The overall **visual** impact is likely to be of a **medium significance**. The proposed CSP facility will transform the natural views surrounding the site for the entire operational lifespan. This anticipated impact is not, however, considered a fatal flaw from a visual perspective, especially considering the low incidence of visual receptors in the region.

» The overall **social** impact is likely to be of a **medium significance** in terms of positive impacts, and a **low – medium significance** in terms of the negative impacts. The development will create employment and business opportunities for locals during both the construction and operational phase of the project and represents an investment in clean, renewable energy infrastructure.

No environmental fatal flaws were identified with the establishment of the proposed Upington Solar Thermal Plant Three. However a number of issues requiring mitigation have been highlighted. Areas of environmental sensitivity are discussed under Section 9.2. Environmental specifications for the management of potential impacts are detailed within the draft Environmental Management Programme (EMPr) included within Appendix N.

9.2. Assessment of Potential Cumulative Impacts

Cumulative impacts and benefits on various environmental and social receptors will occur to varying degrees with the development of several renewable energy facilities in South Africa. The degree of significance of these cumulative impacts is difficult to predict without detailed studies based on more comprehensive data/information on each of the receptors and the site specific developments. This however, is beyond the scope of this study. The alignment of renewable energy developments with South Africa's National Energy Response Plan and the global drive to move away from the use of non-renewable energy resources and to reduce greenhouse gas emissions is undoubtedly positive. The economic benefits of renewable energy developments at a local, regional and national level have the potential to be significant.

The Upington Solar Thermal Plant Three facility falls within the identified geographical area most suitable for the rollout of the development of solar energy projects within the Northern Cape Province. This implies that projects of the same nature will be consolidated in one area creating a node, and ultimately aiming to reduce the potential for cumulative impacts associated with such developments when spatially fragmented. It is also important to note that it is unlikely that all proposed renewable energy facilities located in the region will be built due to capacity constraints on the Eskom grid and the limits placed on renewable energy targets. The site is located in close proximity to the Khi Solar One facility, which is currently under construction. The cumulative impacts for the proposed Upington Solar Thermal Three have been assessed to be acceptable.

9.3 Comparison of Access Road Alternatives

The primary access road to the site would be off the N14 national road between Upington and Keimos. Two reasonable and feasible alternatives have been considered:

5. *Access Alternative 1- Access off the N14 via the existing Khi Solar One access road*. The Khi Solar One project has established a formal surfaced access road off the N14 for access to the McTaggarts Camp farm, and specifically the Khi Solar One project development site. The road is available to provide access for a portion of the distance to the site up to the Khi Solar One boundary (5.5km), with an additional 5.5km of road to then be constructed within the boundary of Portion 3 of the Farm McTaggarts Camp 453. This access road would provide direct access to the facility area from the south; or
6. *Access Alternative 2- Access off the N14 via the existing district road D3276.* The existing district road D3276 is a gravel road (and would be required to be surfaced). This road intersects with the northern boundary of Portion 3 of the Farm McTaggarts Camp 453 approximately 12 km from the N14. A short section of road (~1.5km) would be required to be constructed to access the facility area from the north.

In terms of the specialist studies undertaken, the following conclusions were made regarding the preferred access road alternatives:

	Access Alternative 1	**Access Alternative 2**
Ecology	No significant difference in impacts – preference, provided that the route does not traverse the drainage line	No significant difference in impacts - preference
Avifauna	No significant difference in impacts - preference	No significant difference in impacts - preference
Surface water resources	No significant difference in impacts – preference, provided that the route does not traverse the drainage line	No significant difference in impacts - preference
Soils and agricultural potential	No preference	No preference
Visual	No significant difference in impacts - preference	No significant difference in impacts - preference
Heritage & palaeontology	No preference	No preference
Social	Preferred	Less preferred, as it is a public road

There are no impacts of unacceptably high significance associated with either access road alternative assessed for the proposed project. In addition, there is little or no difference between the impacts associated with the two access road alternatives as both

routes are partially existing, and there no strong preference for one technology. Both are considered to be environmentally acceptable for implementation at the Upington Solar Thermal Plant Three. From a technical perspective, Alternative 1 is preferred as it allows for the developer to utilise infrastructure which has already been purpose-built (i.e. the portion of the access road off the N14 to the entrance for the Khi Solar One site). This is also a private road, and so impacts on the public D3276 would be avoided. In addition, the developer would be responsible for the upkeep of the road surface. When considering these technical considerations, access Alternative 1 is nominated as the preferred access route alternative.

9.4. Environmental Sensitivity Mapping

The areas of high ecological sensitivities of the site are presented in Figure 9.2 and include areas containing riparian vegetation along drainage lines: *Acacia mellifera – Cenchrus ciliaris* ephemeral drainage lines. These areas of high sensitivity also contain protected trees species (*Acacia erioloba* (Camelthorn) *and Boscia foetida* (Shepherds tree), *Boscia albitrunca (*Shepherds *tree).* The number of protected trees that could be destroyed by the development are estimated as follows:

- *Acacia erioloba:* less than 50 trees
- *Boscia albitrunca:* less than 50 tress

This area of high ecological sensitivities amounts to approximately 20 hectares, and is recommended to be avoided by the development footprint - This includes the parabolic trough plant, as well as the main access road to the facility. The ecological specialist recommended that the layout should be refined to avoid the riparian vegetation / high sensitivity zones. This recommendation has been taken into account by the developer, and the layout was refined to avoid the high ecological sensitivity areas. This layout considering the required mitigation measures is included in Figure 9.3, and represents the optimal layout for the facility. This refined layout responds to the following:

» Avoidance of the tributary to the Helbrandkloofspruit
» Avoidance of the destruction of the habitat characteristic of this ephemeral drainage line – infrastructure is planned only within 50m of the feature and destruction is not required.
» Rerouting of access road Alternative 1 – the access road is planned to turn into the site before it crosses the tributary to the to the Helbrandkloofspruit.
» Relocation of the evaporation ponds away from the ephemeral drainage line.

Letters from the relevant specialist confirming that this layout is acceptable is attached to Appendix P.

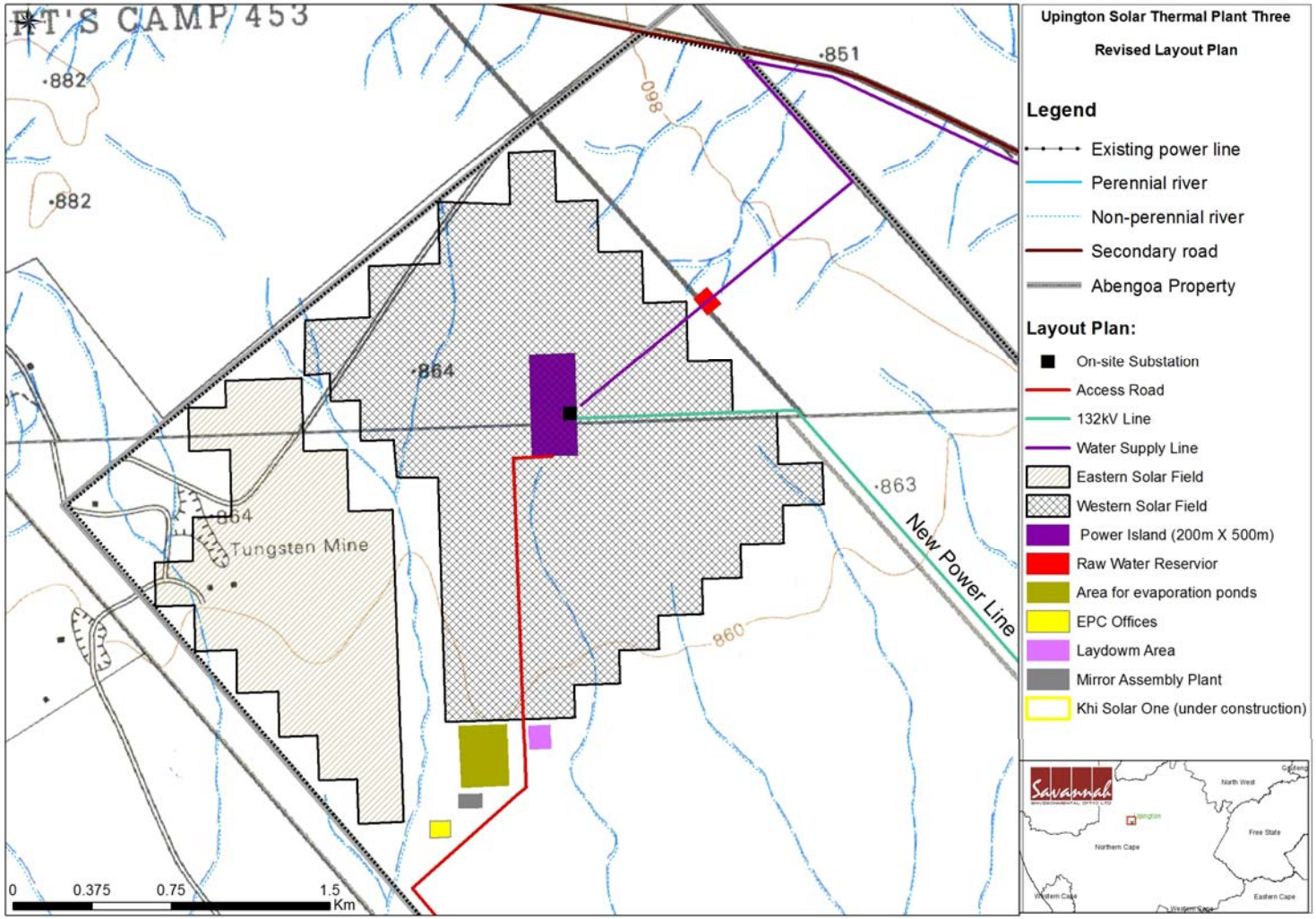

Figure 9.2 (a): Environmental Sensitivity Map for the Upington Solar Thermal Plant Three, Northern Cape Province (zoomed in version)

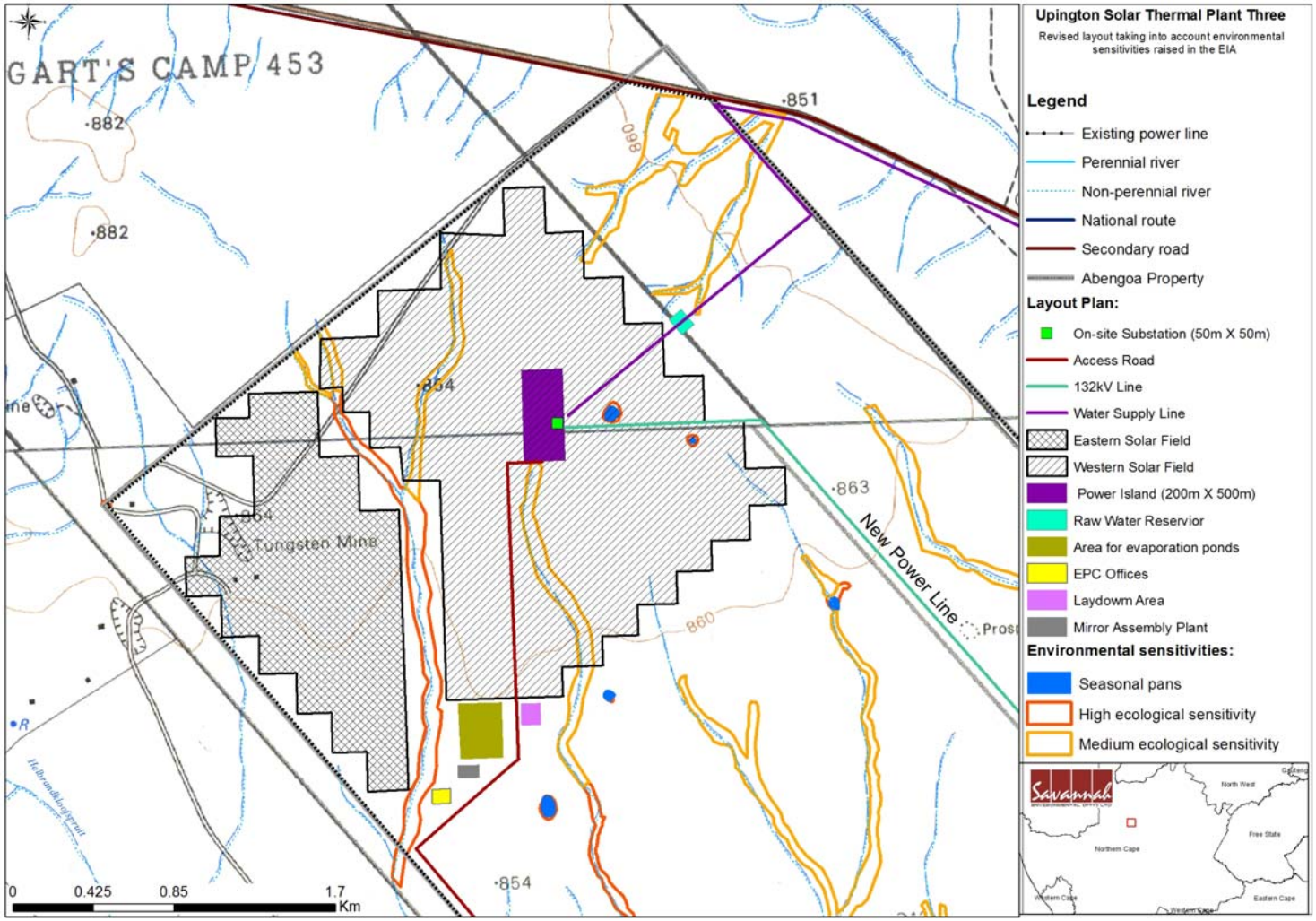

Figure 9.2 (b): Environmental Sensitivity Map for the Upington Solar Thermal Plant Three, Northern Cape Province (full extent showing linear infrastructure)

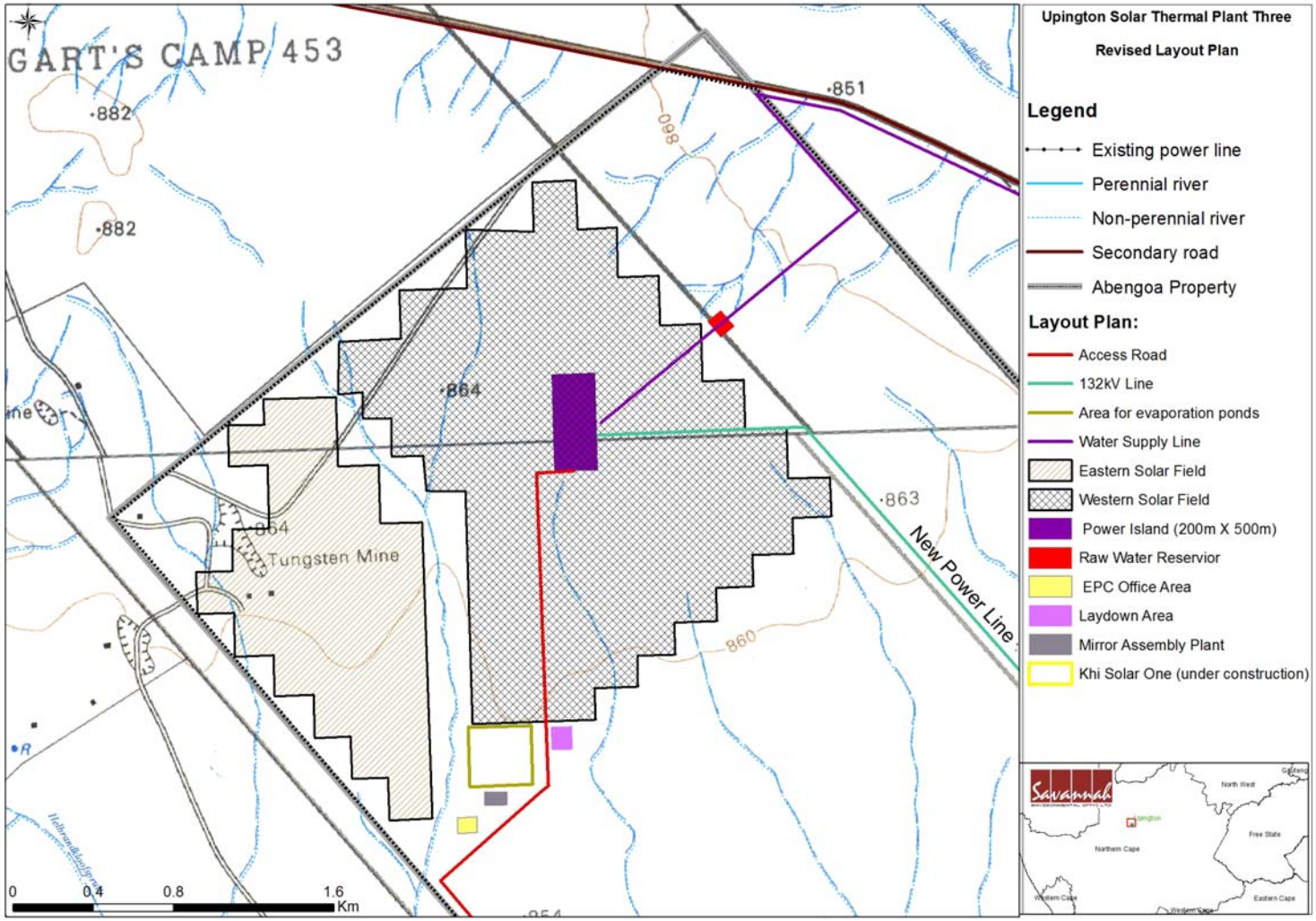

Figure 9.3 Refined layout which avoids the high ecological sensitivity areas

9.5 Environmental Costs of the Project versus Benefits of the Project

Environmental (natural environment, economic and social) costs can be expected to arise from the project proceeding. This could include:

» Direct loss of biodiversity, flora, fauna and soils due to the clearing of land for the construction and utilisation of land for the CSP project (which is limited to the development footprint of 500 hectares). The cost of loss of biodiversity has been minimised on the site through the careful location of the development to avoid key areas supporting biodiversity of particularly high conservation importance.
» Visual impacts associated with the facility and power line. The cost of loss of visual quality to the area is reduced due to the area already been visually impacted by the Khi Solar One facility, and power lines and surrounding infrastructure associated with agriculture.

These costs are expected to occur at a local and site level and are considered acceptable so long as the mitigation measures as outlined in the EMPr are adhered to.

Benefits of the project include the following:

» The project is poised to bring about important economic benefit at the local and regional scale through job creation, procurement of materials and provision of services and other associated downstream economic development. These will transpire during the preconstruction/ construction and operational phases.
» The project serves to diversify the economy and electricity generation mix of South Africa by addition of solar energy to the mix.
» South Africa's per capita greenhouse gas emissions being amongst the highest in the world due to reliance on fossil fuels, the proposed project will contribute to South Africa achieving goals for implementation of non-renewable energy and 'green' energy. Greenhouse gas emission load is estimated to reduce by 0.86% for a 500MW coal-fired power station compared to a similar MW solar project, on a like for like basis.

The benefits of the project are expected to occur at a national, regional and local level. These benefits partially offset the localised environmental costs of the project.

9.5. Overall Conclusion (Impact Statement)

The viability of establishing a parabolic trough CSP Plant with a maximum generating capacity of 125 MW on a site near Upington has been established by Abengoa Solar Power South Africa (Pty) Ltd. The positive implications of establishing a CSP Plant on the identified site within the Northern Cape include:

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

The findings of the specialist studies undertaken within this EIA to assess both the benefits and potential negative impacts anticipated from the proposed project conclude that:

» There are **no environmental fatal flaws** that should prevent the proposed CSP Plant and associated infrastructure from proceeding on the identified site, provided that the recommended mitigation and management measures are implemented, and given due consideration during the process of finalising the facility layout.
» The proposed development on the site will create a localised reduction of indigenous trees and shrubs, geophytes and other species of conservation concern, but not to a degree that the current conservation status of such species will be negatively affected. Due to the areas of high ecological sensitivity being avoided by the design and layout of the CSP Plant, the **ecological impacts** of the CSP plant will be of a medium acceptable significance.
» The threat to **fauna and avifauna** communities would be from the loss of habitat, disturbance, collisions with the overhead power line and/or any interaction of fauna with the facility, and is not anticipated to have a significant negative impact on fauna in the area.
» Very sparse **heritage resources** were found during the field survey undertaken for the site. From an archaeological perspective the observed heritage resources may

be regarded as being of generally low significance. The **fossil record** from Kalahari deposits is very poor with respect to finds of fossil bones of vertebrates.

» The cumulative significance of all the potential impacts on the **soils** is medium to low due to the limited scale of the development and the scarcity of development in the immediate surrounding area.
» The anticipated **visual** impact is not considered to be a fatal flaw from a visual perspective, considering the low incidence of visual receptors in the region and the contained area of potential visual exposure.
» The development will have both positive and negative **social** impacts. It will create employment and business opportunities for locals during both the construction and operational phases and represent an investment in clean, renewable energy infrastructure. The potential for cumulative impacts also exists due to the proximity of the other authorised and proposed CSP and solar projects adjacent to the site, however, these impacts are not considered to represent a fatal flaw, and in addition, there is no indication if (or when) other developments will take place.

The significance levels of the majority of identified negative impacts can generally be reduced by implementing the recommended mitigation measures. With reference to the information available at this planning approval stage in the project cycle, the **confidence** in the environmental assessment undertaken is regarded as **acceptable**.

9.6. Overall Recommendation

Global climate change is widely recognised as being one of the greatest environmental challenges facing the world today. How a country sources its energy plays a big part in tackling climate change. As a net off-setter of carbon, renewable energy technologies can assist in reducing carbon emissions, and can play a big part in ensuring security of energy supply, as other sources of energy are depleted or become less accessible. South Africa currently relies on coal-powered energy to meet more than 90% of its energy needs. As a result, South Africa is one of the highest per capita producers of carbon emissions in the world and Eskom, as an energy utility, has been identified as the world's second largest producer of carbon emissions. With the aim of reducing South Africa's dependency on coal generated energy, and to address climate change concerns, the South African Government has set a target, through the Integrated Resource Plan (IRP) for electricity to develop 17.8 GW of renewables (including 8.4GW solar) within the period 2010 – 2030.

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 impacts associated with the development of the Upington Solar Thermal Plant Three can

be managed and mitigated to an acceptable level. In terms of this conclusion, the EIA project team support the decision for environmental authorisation.

The layout plan as presented in Figure 9.3 has been designed to avoid the majority of the sensitive environments on the site:

» Avoidance of the tributary to the Helbrandkloofspruit
» Avoidance of the destruction of the habitat characteristic of this ephemeral drainage line – infrastructure is planned only within 50m of the feature and destruction is not required.
» Rerouting of access road Alternative 1 – the access road is planned to turn into the site before it crosses the tributary
» Relocation of the evaporation ponds away from the ephemeral drainage line.

Therefore this layout as presented is acceptable. The following conditions would be required to be included within an authorisation issued for the project:

» As far as possible, any component of the facility which could potentially affect areas of high environmental sensitivity should be avoided in the design and layout of the CSP Plant.
» Disturbed areas should be rehabilitated as quickly as possible and an on-going monitoring programme should be established to detect and quantify any alien species.
» During construction, unnecessary disturbance to habitats should be strictly controlled and the footprint of the impact should be kept to a minimum.
» All mitigation measures detailed within this report and the specialist reports contained within Appendices F to M to be implemented.
» The draft Environmental Management Programme (EMPr) as contained within Appendix N of this report should form part of the contract with the Contractors appointed to construct and maintain the proposed solar energy facility, and will be used to ensure compliance with environmental specifications and management measures. The implementation of this EMPr for all life cycle phases of the proposed project is considered key in achieving the appropriate environmental management standards as detailed for this project.
» A comprehensive stormwater management plan should be compiled for the developmental footprint prior to construction.
» An ecological walk through survey for the CSP plant and associated infrastructure (such as pipeline, power line and access roads) must be undertaken prior to construction.
» A permit to be obtained for removal of protected trees and provincially protected flora that are affected.
» A walk-through survey to be undertaken by an avifauna specialist for the route of the power line only to identify sections of line requiring collision mitigation.
» The relevant Water Use Licenses for water uses (abstraction and impacting of water courses) to be obtained from DWA.

» Applications for all other relevant and required permits required to be obtained by Abengoa Solar Power South Africa (Pty) Ltd must be submitted to the relevant regulating authorities. This includes permits for the transporting of all components (abnormal loads) to site, disturbance to any heritage sites, disturbance of protected vegetation and protected trees, disturbance to any water courses and for abstraction of water from any river.

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