Royal HaskoningDHV

Environmental Impact Assessment Study for the proposed Concentrated Solar Power Plant (Parabolic Trough) on the farm Sand Draai 391, Northern Cape – Final Consultation Environmental Impact Report

April 2016

Document Description

Client:

Solafrica Energy (Pty) Ltd

Project Name:

Environmental Impact Assessment Study for the proposed Concentrated Solar Power Plant (Parabolic Trough) on the farm Sand Draai 391, Northern Cape

Royal HaskoningDHV Reference Number:

T01.JNB.000565

Compiled by:

Johan Blignaut

Date:

April 2016

Location:

Woodmead

Review and approval:

Prashika Reddy

Table of Contents

List of Figures

List of Tables

Appendices

Glossary

Activity (Development)	An action either planned or existing that may result in environmental impacts through pollution or resource use. For the purpose of this report, the terms 'activity' and 'development' are freely interchanged.
Alternatives	Different means of meeting the general purpose and requirements of the activity, which may include site or location alternatives; alternatives to the type of activity being undertaken; the design or layout of the activity; the technology to be used in the activity and the operational aspects of the activity.
Applicant	The project proponent or developer responsible for submitting an environmental application to the relevant environmental authority for environmental authorisation.
Biodiversity	The diversity of animals, plants and other organisms found within and between ecosystems, habitats, and the ecological complexes.
Construction	The building, erection or establishment of a facility, structure or infrastructure that is necessary for the undertaking of a listed or specified activity but excludes any modification, alteration or expansion of such a facility, structure or infrastructure and excluding the reconstruction of the same facility in the same location, with the same capacity and footprint.
Cumulative impact	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.
Decommissioning	The demolition of a building, facility, structure or infrastructure.
Direct Impact	Impacts that are caused directly by the activity and generally occur at the same time and at the same place of the activity. These impacts are usually associated with the construction, operation or maintenance of an activity and are generally quantifiable.
Ecological Reserve	The water that is necessary to protect the water ecosystems of the water resource. It must be safeguarded and not used for other purposes. The Ecological Reserve specifies both the quantity and quality of water that must be left in the national water resource. The Ecological Reserve is determined for all major water resources in the different water management areas to ensure sustainable development.
Ecosystem	A dynamic system of plant, animal (including humans) and micro-organism communities and their non-living physical environment interacting as a functional unit. The basic structural unit of the biosphere, ecosystems are characterised by interdependent interaction between the component species and their physical surroundings. Each ecosystem occupies a space in which macro-scale conditions and interactions are relatively homogenous.
Environment	In terms of the National Environmental Management Act (NEMA) (No 107 of 1998)(as amended), "Environment" means the surroundings within which humans exist and that are made up of: a) the land, water and atmosphere of the earth; b) micro-organisms, plants and animal life; c) any part or combination of (i) of (ii) and the interrelationships among and between them; and d) the physical, chemical, aesthetic and cultural properties and conditions of the foregoing that influence human health and wellbeing.

Environmental Assessment	The generic term for all forms of environmental assessment for projects, plans, programmes or policies and includes methodologies or tools such as environmental impact assessments, strategic environmental assessments and risk assessments.
Environmental Authorisation	An authorisation issued by the competent authority in respect of a listed activity, or an activity which takes place within a sensitive environment.
Environmental Assessment Practitioner (EAP)	The individual responsible for planning, management and coordination of environmental impact assessments, strategic environmental assessments, environmental management programmes or any other appropriate environmental instrument introduced through the EIA Regulations.
Environmental Impact	Change to the environment (biophysical, social and/ or economic), whether adverse or beneficial, wholly or partially, resulting from an organisation's activities, products or services.
Environmental Impact Assessment (EIA)	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 as defined in NEMA.
Environmental Issue	A concern raised by a stakeholder, interested or affected parties about an existing or perceived environmental impact of an activity.
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 (EMPr)	A detailed plan of action prepared to ensure that recommendations for enhancing or ensuring positive impacts and limiting or preventing negative environmental impacts are implemented during the life cycle of a project. This EMPr focuses on the construction phase, operation (maintenance) phase and decommissioning phase of the proposed project.
Fatal Flaw	An event or condition that could cause an unanticipated problem and/or conflict which will could result in a development being rejected or stopped.
General Waste	Means waste that does not pose an immediate hazard or threat to health or to the environment, and includes – (a) Domestic waste; (b) Building waste and demolition waste; (c) Business waste; (d) Inert waste; or (e) Any waste classified as non-hazardous waste in terms of the regulations made under section 69, and includes non-hazardous substances, materials or objects within business, domestic, inert, building and demolition wastes as outlined in the National Environmental Management: Waste Amendment Act (No 26 of 2014) Schedule 3: Category B – General Waste.
Groundwater	Water in the ground that is in the zone of saturation from which wells, springs, and groundwater run-off are supplied.
Hazardous Waste	Means 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 and includes hazardous substances, materials or objects within business waste, residue deposits and residue stockpiles as outlined in the National Environmental Management: Waste Amendment Act (No 26 of 2014).Schedule 3: Category A - Hazardous Waste.
Hydrology	The science encompassing the behaviour of water as it occurs in the atmosphere, on the surface of the ground, and underground.

Indirect Impacts	Indirect or induced changes that may occur as a result of the activity. These types if impacts include all of the potential impacts that do not manifest immediately when the activity is undertaken or which occur at a different place as a result of the activity.
Integrated Environmental Management	A philosophy that prescribes a code of practice for ensuring that environmental considerations are fully integrated into all stages of the development and decision-making process. The IEM philosophy (and principles) is interpreted as applying to the planning, assessment, implementation and management of any proposal (project, plan, programme or policy) or activity - at local, national and international level - that has a potentially significant effect on the environment. Implementation of this philosophy relies on the selection and application of appropriate tools for a particular proposal or activity. These may include environmental assessment tools (such as strategic environmental assessment and risk assessment), environmental management tools (such as monitoring, auditing and reporting) and decision-making tools (such as multi-criteria decision support systems or advisory councils).
Interested and Affected Party (I&AP)	Any person, group of persons or organisation interested in or affected by an activity; and any organ of state that may have jurisdiction over any aspect of the activity.
Mitigate	The implementation of practical measures designed to avoid, reduce or remedy adverse impacts or enhance beneficial impacts of an action.
No-Go Option	In this instance the proposed activity would not take place, and the resulting environmental effects from taking no action are compared with the effects of permitting the proposed activity to go forward.
Overburden	Layers of soil and rock covering a coal seam. In surface mining operations, overburden is removed prior to mining using large equipment. When mining has been completed, it is either used to backfill the mined areas or is hauled to an external dumping and/or storage site.
Public Participation Process	A process in which potential interested and affected parties are given an opportunity to comment on, or raise issues relevant to, specific matters.
Rehabilitation	A measure aimed at reinstating an ecosystem to its original function and state (or as close as possible to its original function and state) following activities that have disrupted those functions.
Scoping	The process of determining the spatial and temporal boundaries (i.e. extent) and key issues to be addresses in an environmental assessment. The main purpose of scoping is to focus the environmental assessment on a manageable number of important questions. Scoping should also ensure that only significant issues and reasonable alternatives are examined.
Sensitive Environments	Any environment identified as being sensitive to the impacts of the development.
Significance	Significance can be differentiated into impact magnitude and impact significance. Impact magnitude is the measurable change (i.e. magnitude, intensity, duration and likelihood). Impact significance is the value placed on the change by different affected parties (i.e. level of significance and acceptability). It is an anthropocentric concept, which makes use of value judgements and science-based criteria (i.e. biophysical, social and economic).
Stakeholder Engagement	The process of engagement between stakeholders (the proponent, authorities and I&APs) during the planning, assessment, implementation and/or management of proposals or activities.

Sustainable Development	According to World Commission on Environment and Development (1987), this is development that meets the needs of the present without compromising the ability of future generations to meet their own needs.
Watercourse	Defined as: a) a river or spring; b) a natural channel or depression in which water flows regularly or intermittently; c) a wetland, lake or dam into which, or from which, water flows; and d) any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse as defined in the National Water Act, 1998 (No 36 of 1998) and a reference to a watercourse includes, where relevant, its bed and banks.
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 land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil.

Abbreviations and Acronyms

CER – Certified Emission Reduction

CDM – Clean Development Mechanism

CSP – Concentrated Solar Power

DEA – Department of Environmental Affairs

DOE – Department of Energy

DWS – Department of Water and Sanitation

EAP – Environmental Assessment Practitioner

EIA - Environmental Impact Assessment

EIAR – Environmental Impact Assessment Report

EMPr - Environmental Management Programme

ESR - Environmental Scoping Report

ESS - Environmental Scoping Study

GHG – Greenhouse Gas

GN – Government Notice

I&AP – Interested and Affected Party

IRP – Integrated Resource Plan

kWh – Kilowatt Hour

MW – Megawatts

NCDENC – Northern Cape Department of Environment and Nature Conservation

NDP – National Development Plan

NEMA – National Environmental Management Act (No 107 of 1998)

NERSA - National Energy Regulator of South Africa

PV – Photovoltaic

REIPPPP – Renewable Energy Independent Power Producer Programme

RO – Reverse Osmosis

SADC – Southern Africa Development Community

SIP – Strategic Infrastructure Projects

1 INTRODUCTION

Economic growth and social development within South Africa is placing a growing demand on energy supply. Coupled with the rapid advancement in economic and social development, is the increased awareness of environmental impact, climate change and the need for sustainable development.

Whilst South Africa relies heavily on coal to meet its energy needs, the country is well endowed with renewable energy resources that offer sustainable alternatives to fossil fuels. Renewable energy harnesses naturally occurring non-depletable sources of energy, such as solar, wind, biomass, hydro, tidal, wave, ocean current and geothermal, to produce electricity, gaseous and liquid fuels, heat or a combination of these energy types[1]. The successful use of renewable energy technology in South Africa still requires extensive investigation, however, Concentrating Solar Power (CSP) technologies have been demonstrated to be economically and environmentally viable and capable of being employed on a large scale.

Solafrica Energy (Pty) Ltd (Solafrica) is currently assessing the feasibility of constructing a CSP plant based on Parabolic Trough technology including all associated infrastructure with a maximum electrical generation capacity of 150 MW on the farm Sand Draai 391. The proposed plant is required to be sited on a technically and environmentally feasible site and to this end, Solafrica has considered land availability, land use capability, fuel availability and costs, grid connection proximity, capacity and strengthening, and other aspects related to the feasibility of solar power sites.

The CSP plant using Parabolic Trough technology will consist of the following components:

- A solar collection field of parabolic trough collectors;
- A heat transfer fluid system with thermal storage;
- A power block; and
- Ancillary infrastructure (evaporation ponds; access roads; power line; water pipeline linked to water abstraction system; raw water storage (regulation) ponds; administration building; construction camp and laydown areas).

1.1 Project Background

South Africa experiences some of the highest levels of solar radiation in the World. The average daily solar radiation in South Africa varies between 4.5 and 6.5 kWh/m^2 (16 and 23 MJ/m^2)[2], compared to about 3.6 kWh/m^2 for parts of the United States and about 2.5 kWh/m^2 for Europe and the United Kingdom. Figure 1 below shows the annual solar radiation (direct and diffuse) for South Africa, which reveals considerable solar resource potential for solar water heating applications, solar photovoltaic and solar thermal power generation.

[1] Department of Minerals and Energy. 2003. *White Paper on Renewable Energy.*
[2] Stassen, G.1996. *Towards a Renewable Energy Strategy for South Africa*, unpublished PhD Thesis, University of Pretoria.

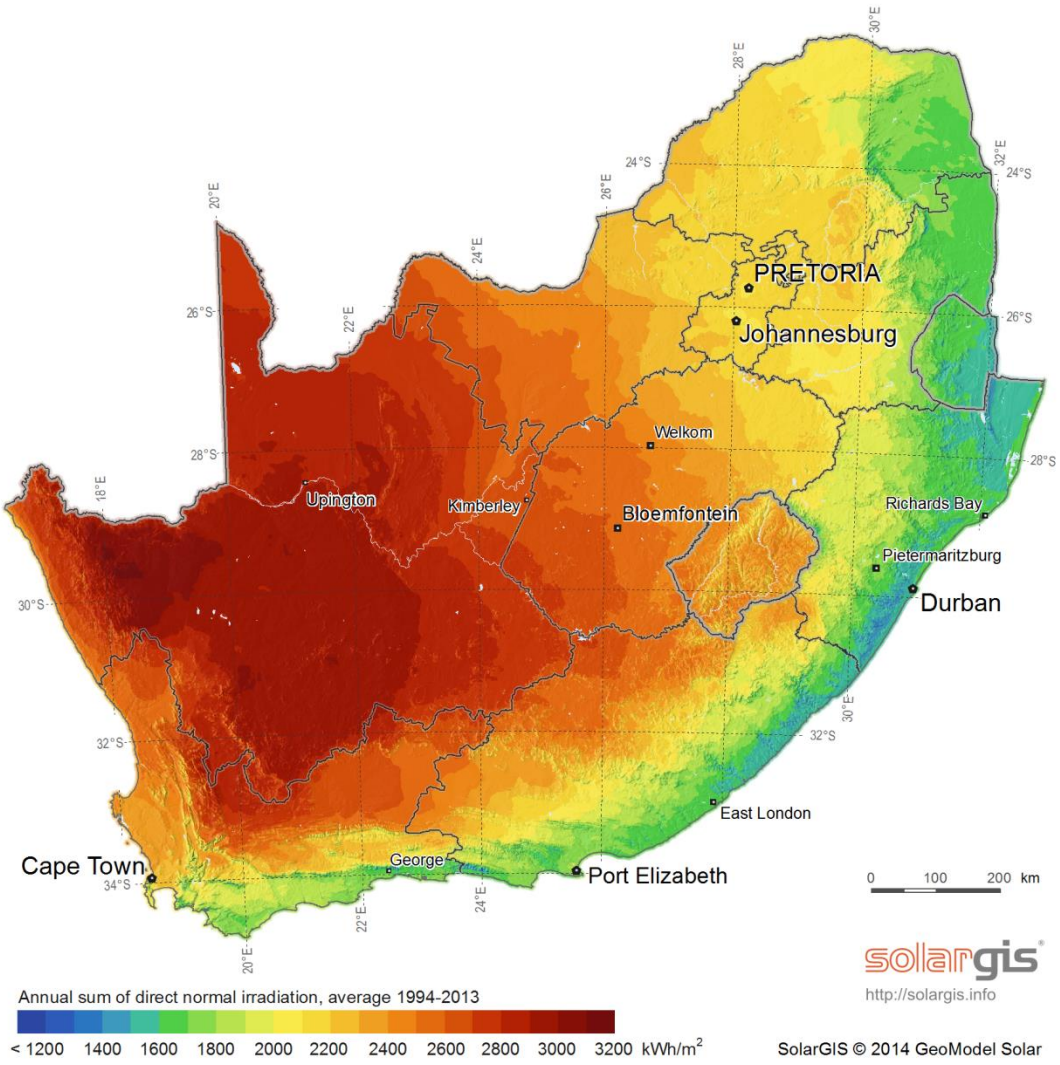


Figure 1: Annual incoming short wave radiation for South Africa[3]

In 2006, Eskom Holdings SoC Ltd (Eskom) conducted an Environmental Impact Assessment (EIA) Study for a pilot CSP plant with an installed capacity of approximately 100MW. Through a series of feasibility and high-level screening studies undertaken by Eskom, the Northern Cape Province ranked as the most favourable area for the establishment of a new CSP plant. Within the Northern Cape Province, Upington and Groblershoop were identified as preferred sites for the establishment of the CSP plant. Subsequent to the Scoping and EIA studies, a northern portion of the farm Olyvenhouts Drift was selected as the preferred site and with consideration of the site specific environmental sensitivities, a preferred location for the plant on the farm was selected.

Against the backdrop of the Eskom study, Solafrica proposed to construct a CSP plant in the Northern Cape Province on either of the two alternative sites identified during the Eskom CSP EIA study. These two alternative sites included:

- Site 1: Olyvenhouts Drift (15 km west of Upington) – southerly portion; and
- Site 2: Bokpoort 390 (northwest of Groblershoop).

[3] Courtesy: DME, Eskom, CSIR.

Solafrica subsequently pursued the development on the farm Bokpoort 390 and the plant has nearly achieved commercial operations.

Between 2013 – 2014, Solafrica, embarked on a feasibility study to develop another Solar Thermal Farm in the Upington area consisting of two CSP plants (central receiver and parabolic trough technology) and a PV plant on the farm Sand Draai 391 with an electricity generation capacity of between 125 and 150 MW each (Figure 2).

The CSP plant using central receiver technology (14/12/16/3/3/3/204) EIA is subject to a separate application and EIA study. The public participation processes for both projects have been combined to prevent I&AP and Stakeholder fatigue.

A third application (14/12/16/3/3/2/822) and Scoping study for a Photovoltaic plant on the farm Sand Draai 391 was also conducted, however the Applicant (Solafrica) has decided not to proceed further with the project and the application is currently being withdrawn.

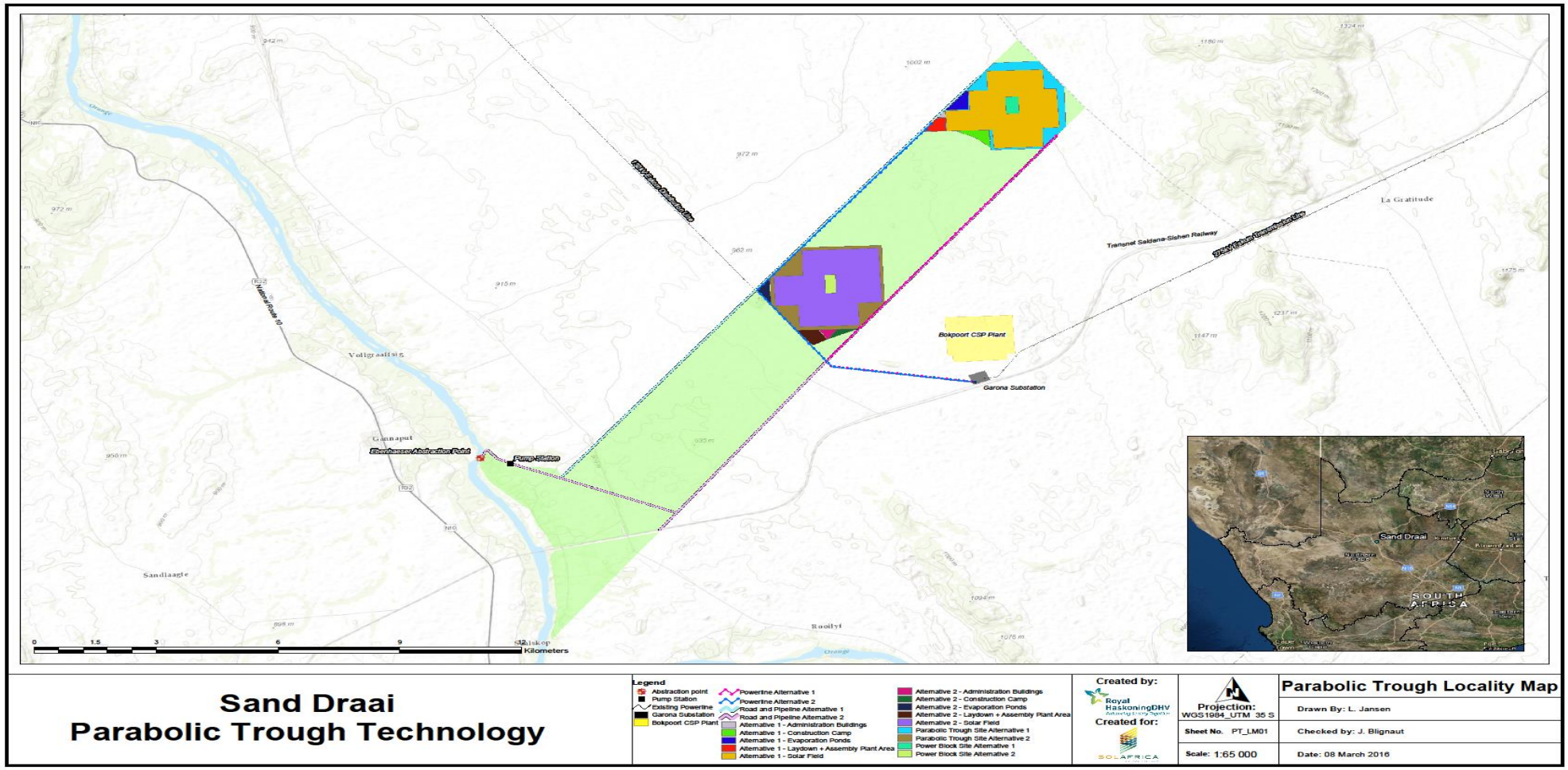


Figure 2:Locality map

1.2 Approach to the Environmental Impact Assessment Study

The environmental impacts associated with the proposed project require investigation in compliance with the EIA Regulations (2014) published in Government Notice (GN) R. 982 to GN R. 985 and read with Section 24 (5) of the National Environmental Management Act (No 107 of 1998) as amended. In addition, GN No 921 of 2013 (List of waste management activities that have, or are likely to have a detrimental effect on the environment) of the National Environmental Management: Waste Act (No 59 of 2008) will also be considered in this study.

An Integrated Environmental Authorisation (IEA) process is being undertaken; this is because a Waste Management Licence (WML) and an Environmental Authorisation (EA) are required for the proposed project. The Department of Environmental Affairs (DEA) is the Competent Authority (CA) that will issue a decision for the project and the Northern Cape Department of Environment and Nature Conservation (NCDENC) is the commenting authority for this IEA process. Correspondence from the DEA is attached as ***Appendix B***.

This process is being undertaken in two phases (Figure 3) that will ultimately allow the competent authority (DEA) to make an informed decision:

- Phase 1 - Environmental Scoping Study (ESS) and Plan of Study for EIA (already completed); and
- Phase 2 - Environmental Impact Assessment (EIA) and Environmental Management Programme (EMPr).

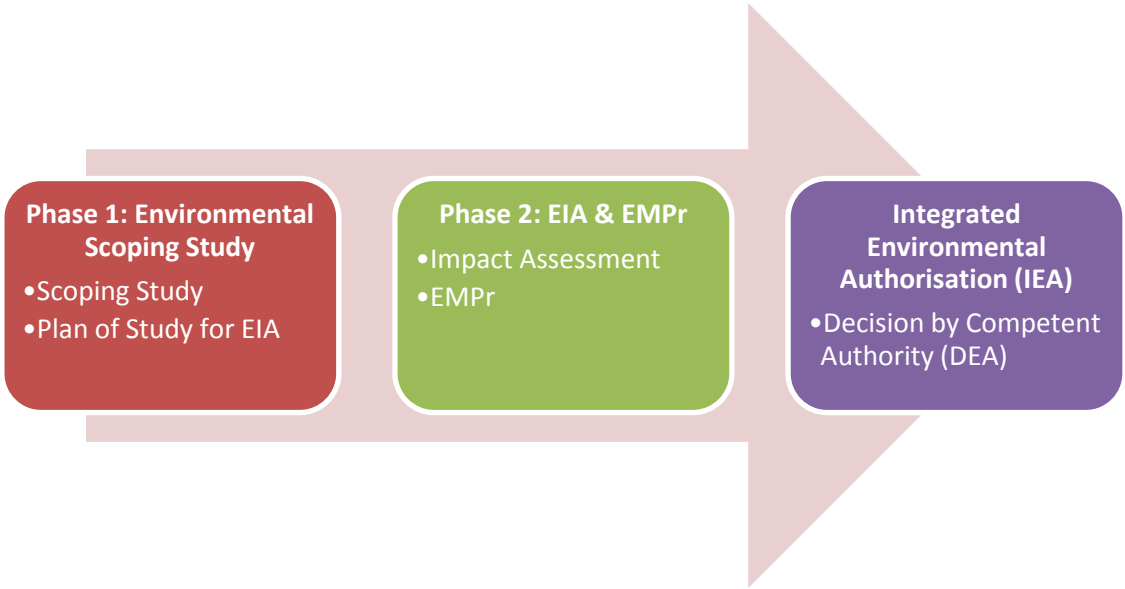


Figure 3: Environmental studies flowchart

1.2.1 Conclusions of the Environmental Scoping Study (ESS)

The ESS provided a description of the receiving environment and how the environment may be affected by the proposed project. The ESS aimed to identify any fatal flaws, alternatives and mitigation options to be evaluated and investigated during the EIA phase of the project.

Desktop studies making use of existing information and a site visit were used to highlight and assist in the identification of potential significant impacts (both social and biophysical) associated with the proposed project.

Additional issues for consideration were extracted from feedback during the Public Participation Process, which commenced at the beginning of the Scoping phase, and which will continue throughout the duration of

the project. All issues identified during the ESS were documented within the Environmental Scoping Report (ESR). The Final Consultation ESR and Plan of Study for EIA were submitted to the DEA on 29 September 2015 and accepted on 11 November 2015.

1.2.2 Environmental Impact Assessment Process

This EIA process is being undertaken in line with the approved Plan of Study submitted to the DEA on 29 September 2015 as well as Appendix 3 of GN R.982.

The objective of the EIA process is to, through a consultation process:

- Determine the policy and legislative context within which the activity is located and document how the proposed activity complies with and responds to the policy and legislative context;
- Describe the need and desirability of the proposed activity, including the need and desirability of the activity in the context of the preferred location;
- Identify the location of the development footprint within the preferred site based on an impact and risk assessment process inclusive of cumulative impacts and a ranking process of all the identified development footprint alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects of the environment;
- Determine the-
    (i) nature, significance, consequence, extent, duration and probability of the impacts occurring to inform identified preferred alternatives; and
    (ii) degree to which these impacts can be reversed; may cause irreplaceable loss of resources, and can be avoided, managed or mitigated;
- Identify the most ideal location for the activity within the preferred site based on the lowest level of environmental sensitivity identified during the assessment;
- Identify, assess, and rank the impacts the activity will impose on the preferred location through the life of the activity;
- Identify suitable measures to avoid, manage or mitigate identified impacts; and
- Identify residual risks that need to be managed and monitored.

1.2.2.1 Environmental Impact Assessment Report Structure

This Environmental Impact Assessment Report (EIR) will be compiled in accordance with the accepted Plan of Study and incorporates the findings and recommendations from the Scoping Study as well as specialist studies conducted for the project.

In addition, this EIR is being compiled according to the guidelines provided in Appendix 3 of GN R.982 of the EIA Regulations (2014).

Table 1: EIR requirements according to Appendix 3 of GN R. 982

EIR Requirements according to Appendix 3 of GN R. 982	Chapter/ Section
(a) details of (i) the EAP who prepared the report; and (ii) the expertise of the EAP, including a curriculum vitae.	1.4
(b) the location of the activity, including: (i) the 21 digit Surveyor General code of each cadastral land parcel; (ii) where available, the physical address and farm name; and (iii) where the required information in items (i) and (ii) is not available, the coordinates of the boundary of the property or properties.	Section 2.1; Figure 2; Appendix A
(c) a plan which locates the proposed activity or activities applied for as well as the associated structures and infrastructure at an appropriate scale, or, if it is- (i) a linear activity, a description and coordinates of the corridor in which	

EIR Requirements according to Appendix 3 of GN R. 982	Chapter/ Section
the proposed activity or activities is to be undertaken; or (ii) on land where the property has not been defined, the coordinates within which the activity is to be undertaken.	
(d) a description of the scope of the proposed activity, including- (i) all listed and specified activities triggered and being applied for; and (ii) a description of the associated structures and infrastructure related to the development.	Chapter 2 and Chapter 5
(e) a description of the policy and legislative context within which the development is located and an explanation of how the proposed development complies with and responds to the legislation and policy context.	Chapter 5
(f) a motivation for the need and desirability for the proposed development, including the need and desirability of the activity in the context of the preferred location.	Chapter 4
(g) a motivation for the preferred development footprint within the approved site.	Chapter 9 and 10
(h) a full description of the process followed to reach the proposed development footprint within the approved site, including: (i) details of the development footprint alternatives considered; (ii) details of the public participation process undertaken in terms of regulation 41 of the Regulations, including copies of the supporting documents and inputs; (iii) a summary of the issues raised by interested and affected parties, and an indication of the manner in which the issues were incorporated, or the reasons for not including them; (iv) the environmental attributes associated with the development footprint alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects; (v) the impacts and risks identified including the nature, significance, consequence, extent, duration and probability of the impacts, including the degree to which these impacts- (aa) can be reversed; (bb) may cause irreplaceable loss of resources; and (cc) can be avoided, managed or mitigated; (vi) the methodology used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks; (vii) positive and negative impacts that the proposed activity and alternatives will have on the environment and on the community that may be affected focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects; (viii) the possible mitigation measures that could be applied and level of residual risk; (ix) if no alternative development locations for the activity were investigated, the motivation for not considering such; and (x) a concluding statement indicating the preferred alternative development location within the approved site;	Chapter 2 (Project Description); Chapter3 (Project Alternatives); Chapter 6 (Public Participation Process); Chapter 9 (Impact Assessment)
(i) a full description of the process undertaken to identify, assess and rank the impacts the activity and associated structures and infrastructure will impose on the preferred (i) location through the life of the activity, including- (ii) a description of all environmental issues and risks that were identified during the environmental impact assessment process; and (iii) an assessment of the significance of each issue and risk and an indication of the extent to which the issue and risk could be avoided or addressed by the adoption of mitigation measures;	Chapter 9
(j) an assessment of each identified potentially significant impact and risk, including- (i) cumulative impacts; (ii) the nature, significance and consequences of the impact and risk; (iii) the extent and duration of the impact and risk;	Chapter 9

EIR Requirements according to Appendix 3 of GN R. 982	Chapter/ Section
(iv) the probability of the impact and risk occurring; (v) the degree to which the impact and risk can be reversed; (vi) the degree to which the impact and risk may cause irreplaceable loss of resources; and (vii) the degree to which the impact and risk can be mitigated;	
(k) where applicable, a summary of the findings and recommendations of any specialist report complying with Appendix 6 to these Regulations and an indication as to how these findings and recommendations have been included in the final assessment report.	Chapter 8
(l) an environmental impact statement which contains- (i) a summary of the key findings of the environmental impact assessment: (i) a map at an appropriate scale which superimposes the proposed activity and its associated structures and infrastructure on the environmental sensitivities of the preferred site indicating any areas that should be avoided, including buffers; and (ii) a summary of the positive and negative impacts and risks of the proposed activity and identified alternatives.	Chapter 10
(m) based on the assessment, and where applicable, recommendations from specialist reports, the recording of proposed impact management objectives, and the impact management outcomes for the development for inclusion in the EMPr as well as for inclusion as conditions of authorisation.	Chapter 8 and 9; EMPR (Appendix G)
(n) a the final proposed alternatives which respond to the impact management measures, avoidance, and mitigation measures identified through the assessment.	Chapter 10
(o) any aspects which were conditional to the findings of the assessment either by the EAP or specialist which are to be included as conditions of authorisation.	Chapter 10
(p) a description of any assumptions, uncertainties and gaps in knowledge which relate to the assessment and mitigation measures proposed.	Chapter 10
(q) a reasoned opinion as to whether the proposed activity should or should not be authorised, and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation.	Chapter 10
(r) where the proposed activity does not include operational aspects, the period for which the environmental authorisation is required and the date on which the activity will be concluded and the post construction monitoring requirements finalised.	Not applicable
(s) an undertaking under oath or affirmation by the EAP in relation to: (i) the correctness of the information provided in the reports; (ii) the inclusion of comments and inputs from stakeholders and I&APs; (iii) the inclusion of inputs and recommendations from the specialist reports where relevant; and (iv) any information provided by the EAP to interested and affected parties and any responses by the EAP to comments or inputs made by interested or affected parties.	Chapter 10
(t) where applicable, details of any financial provisions for the rehabilitation, closure, and ongoing post decommissioning management of negative environmental impacts.	Not applicable
(u) an indication of any deviation from the approved scoping report, including the plan of study, including- (i) any deviation from the methodology used in determining the significance of potential environmental impacts and risks; and (ii) a motivation for the deviation.	Not applicable
(v) any specific information that may be required by the competent authority.	Addressed throughout the report
(w) any other matters required in terms of section 24(4)(a) and (b) of the Act.	Not applicable

1.2.2.2 Specialist Studies

To ensure the scientific vigour of the EIA process as well as a robust assessment of impacts, Royal HaskoningDHV was assisted by various specialists and specialist assessments in order to comprehensively identify both potentially positive and negative environmental impacts (social and biophysical) associated with the project and where possible mitigate the potentially negative impacts and enhance the positive impacts.

The following specialist studies have been conducted for the proposed project from 2014 and 2016 (

Table 2).

Table 2: List of specialist studies undertaken from 2014 – 2016

Specialist Study	Specialist and Organisation
Avifauna	Chris van Rooyen - Chris van Rooyen Consulting
Biodiversity	Clayton Cook & Prof. Leslie Brown
Geohydrology	Groundwater Consulting Services - Groundwater Consulting Services
Noise	Lodewyk Jansen (Royal HaskoningDHV)
Visual	Paul da Cruz (Royal HaskoningDHV)
Heritage	Kobus Dreyer
Social	Kementhree Moonsamy (Royal HaskoningDHV)
Air Quality	Stuart Thompson (Royal HaskoningDHV)
Waste	Siva Chetty (Royal HaskoningDHV)
Surface Water & Aquatic Ecology	Paul da Cruz & Matthew Ross

In addition to the above specialist studies, the following reports have been prepared in support of the EIA study (

Table 3):

Table 3: Specialist studies undertaken for EIA Study

Specialist Study	Specialist and Organisation	Peer Review
Avifauna Assessment and Monitoring	Chris van Rooyen – Chris van Rooyen Consulting	Not Required
Biodiversity Assessment	Clayton Cook & Prof. Leslie Brown	Not Required
Geohydrology Assessment	Claudia du Plessis - Groundwater Consulting Services	Not Required
Noise Assessment	Lodewyk Jansen – Royal HaskoningDHV	Derek Cosjin – Jongens Keet Associates/ Calyx Environmental cc
Visual Assessment	Paul da Cruz – Royal HaskoningDHV	Paul Buchholz
Social Assessment	Kementhree Moonsamy – Royal HaskoningDHV	Hilda Bezuidenhout
Air Quality Assessment	Stuart Thompson – Royal HaskoningDHV	Nicola Walton – WSP
Waste Assessment	Siva Chetty & Seun Oyebode – Royal HaskoningDHV	Reon Piennaar - AECOM
Surface Water Assessment	Paul da Cruz – Royal HaskoningDHV	Peter Shepherd – SRK Consulting
Aquatic Ecology Assessment	Mathew Ross - EnviRossCC	Not Required
Economic & Agricultural Assessment	Gerrie Muller & Lieb Venter	Not Required
Traffic Impact Assessment	Mike van Tonder - Aurecon	Not Required

It should also be noted that a recommendation and mitigation measures was provided by Stephanie Dippenaar (Birds and Bats Unlimited) regarding the impact of the proposed project on the bat population.

1.2.2.3 Final Environmental Management Programme

As part of this EIR, a final EMPr will be compiled in accordance with Appendix 4 of GN R.982 of the EIA Regulations (2014). The final EMPr provides the actions for the management of identified environmental impacts emanating from the proposed CSP based on parabolic trough technology and a detailed outline of the implementation programme to minimise and/or eliminate the anticipated negative environmental impacts. The final EMPr provides strategies to be used to address the roles and responsibilities of environmental management personnel on site, and a framework for environmental compliance and monitoring.

Text Box 1: EMPr content

The EMPr includes the following:

(a) details of-
- *(i) the EAP who prepared the EMPr; and*
- *(ii) the expertise of that EAP to prepare an EMPr, including a curriculum vitae;*

(b) a detailed description of the aspects of the activity that are covered by the EMPr as identified by the project description;

(c) a map at an appropriate scale which superimposes the proposed activity, its associated structures, and infrastructure on the environmental sensitivities of the preferred site, indicating any areas that should be avoided, including buffers;

(d) a description of the impact management objectives, including management statements, identifying the impacts and risks that need to be avoided, managed and mitigated as identified through the environmental impact assessment process for all phases of the development including-
- *(i) planning and design;*
- *(ii) pre-construction activities;*
- *(iii) construction activities;*
- *(iv) rehabilitation of the environment after construction and where applicable post closure; and*
- *(v) where relevant, operation activities;*

(e) a description and identification of impact management outcomes required for the aspects contemplated in paragraph (d);

(f) a description of proposed impact management actions, identifying the manner in which the impact management objectives and outcomes contemplated in paragraphs (d) and (e) will be achieved, and must, where applicable, include actions to-
- *(i) avoid, modify, remedy, control or stop any action, activity or process which causes pollution or environmental degradation;*
- *(ii) comply with any prescribed environmental management standards or practices;*
- *(iii) comply with any applicable provisions of the Act regarding closure, where applicable; and*
- *(iv) comply with any provisions of the Act regarding financial provisions for rehabilitation, where applicable;*

(g) the method of monitoring the implementation of the impact management actions contemplated in paragraph (f);

(h) the frequency of monitoring the implementation of the impact management actions contemplated in paragraph (f);

(i) an indication of the persons who will be responsible for the implementation of the impact management actions;

(j) the time periods within which the impact management actions contemplated in paragraph (f) must be implemented;

(k) the mechanism for monitoring compliance with the impact management actions contemplated in paragraph (f);

(l) a program for reporting on compliance, taking into account the requirements as prescribed by the Regulations;

(m) an environmental awareness plan describing the manner in which-
- *(i) the applicant intends to inform his or her employees of any environmental risk which may result from their work; and*
- *(ii) risks must be dealt with in order to avoid pollution or the degradation of the environment; and*

(n) any specific information that may be required by the competent authority.

1.3 Concurrent Licencing Processes

1.3.1 Water Use Licence

The purpose of the National Water Act (No 36 of 1998) ('the National Water Act")(as amended) is to provide for fundamental reform of the law relating to water resources; to repeal certain laws; and to provide for matters connected therewith.

In terms of section 21, the water uses that are recognised for purposes of the National Water Act include the following:

Text Box 2: Water uses according to Section 21 of the National Water Act

Section 21 of the National Water Act
Section 21(a) – Taking water from a water resource;
Section 21(b) – Storing water;
Section 21(c) – Impeding or diverting the flow of water in a watercourse;
Section 21(d) – Engaging in a stream flow reduction activity contemplated in section 36 (currently only the use of land for afforestation which has been or is being established for commercial purposes);
Section 21(e) – Engaging in a controlled activity identified as such in section 37(1) (which includes the intentional recharging of an aquifer with any waste or water containing waste) or declared under section 38(1);
Section 21(f) – Discharging waste or water containing waste into a water resource through a pipe, canal, sewer, sea outfall or other conduit;
Section 21(g) – Disposing of waste in a manner which may detrimentally impact on a water resource;
Section 21(h) – Disposing in any manner of water which contains waste from, or which has been heated in, any industrial or power generation process;
Section 21(i) – Altering the bed, banks, course or characteristics of a watercourse;
Section 21(j) – removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of people; and
Section 21(k) – using water for recreational purposes.

In terms of the definitions contained in section 1 of the National Water Act, "water resource" includes a watercourse, surface water, estuary, or aquifer. "Aquifer" means a geological formation which has structures or textures that hold water or permit appreciable water movement through them.

"Watercourse" 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.

Furthermore, in terms of the definitions contained in section 1 of the National Water Act, "waste" "includes any solid material or material that is suspended, dissolved or transported in water (including sediment) and which is spilled or deposited on land or into a water resource in such volume, composition or manner as to cause, or to be reasonably likely to cause, the water resource to be polluted".

****It is important to note that a separate WULA process will be undertaken by the Applicant at a later stage. A pre-application meeting will be held with the Department of Water and Sanitation once the Department of Energy (DoE) has accepted the proposed project. During the WUL application process all findings within this EIA study will be used to support the Water Use Licencing Application Process.**

1.3.2 Zoning

Solafrica has indicated that a zoning application for agriculture as well as special use (solar power plant) is in the process of being undertaken at the !Kheis Local Municipality. This application will be applicable to the entire Sand Draai farm.

1.4 Details of the Environmental Assessment Practitioner

Royal HaskoningDHV is the service provider appointed by Solafrica to provide independent Environmental Assessment Practitioner (EAP) services in the undertaking of appropriate environmental studies for this proposed project.

The professional team of Royal HaskoningDHV have considerable experience in the environmental management and EIA fields. Royal HaskoningDHV has been involved in and/or managed several of the largest Environmental Impact Assessments undertaken in South Africa to date. A specialist area of focus is on the assessment of multi-faceted projects, including the establishment of linear developments (national and provincial roads, and power lines), bulk infrastructure and supply (e.g. wastewater treatment works, pipelines, landfills), electricity generation and transmission, the mining industry, urban, rural and township developments, environmental aspects of Local Integrated Development Plans (LIDPs), as well as general environmental planning, development and management.

The particulars of the EAP are presented in Table 4 below.

Table 4: Details of the EAPs

Details	
Consultant:	Royal HaskoningDHV
Contact Persons:	Johan Blignaut and Malcolm Roods
Postal Address	PO Box 867 Gallo Manor 2052
Telephone:	011 798 6000
Facsimile:	011 798 6010
E-mail:	johan.blignaut@rhdhv.com / malcolm.roods@rhdhv.com
Expertise:	Malcolm Roods is a Principal at Royal HaskoningDHV specialising in Environmental Impact Assessments (EIA) for electricity supply (generation, transmission and distribution), road infrastructure, residential developments as well as water management projects. This builds on a broad government background, which has made him particularly flexible. His past experience includes 6 years public service which included policy development, environmental law reform and EIA reviews. His experience also includes 8 years of environmental consulting in the field of Impact Assessment and Authorisation Applications, with a focus on legislative requirements and business management. He has a HeD and a BA (Hons) in Geography and Environmental Management. Johan Blignaut is a Junior Environmental Consultant who is responsible for a number of duties, including monitoring the implementation of Environmental Authorisations (EAs) and the Environmental Management Programme (EMPr) during the construction phase of projects, serving as a liaison between property owners and contractors, writing of ECO, BA, EIA and EMPr reports and conducting public participation processes. He has a BSc in Zoology, Geography and Tourism as well as a BSc (Hons) in Environmental Management. Prashika Reddy is a Principal Associate (Pr Sci Nat 400133/10) with a BSc Honours in Geography and Botany. Ms Reddy has 14 years experience in various environmental fields including: environmental impact assessments, environmental management plans/programmes, public participation and environmental monitoring and auditing. She has worked on a diversity of projects mainly in the petro-chemical industry as well as various large-scale power generation projects. She has established good working relationships with key clients and has undertaken many flagship projects on their behalf (e.g. Sasol and Eskom Underground Coal Gasification).

CVs of the EAPs are attached in **Appendix C**.

2 PROJECT DESCRIPTION

2.1 Site Locality

Solafrica intends constructing a CSP plant using parabolic trough technology and associated infrastructure with a maximum generation capacity of 150 MW on the farm Sand Draai 391. The footprint of the proposed plant is approximately 700 ha in total. The facility will also include ancillary infrastructure in support of the power plant including water abstraction and management systems, waste management systems, power lines, roads, storage facilities, administration and operation buildings, construction laydown areas and temporary housing facilities. The site locality as well as land owner detail is provided in Table 5. A locality map is included in **Appendix A**.

Table 5: Site details

Site details	
Farm details	Sand Draai 391
Zoning	Agriculture (Sand Draai), Agriculture + Special: Solar Power Plant (Bokpoort)
SG 21 digit code	C02800000000039100000
Landowner details	Johannes Willem Jacobus Fourie +27 (0)82 789 6207 fouriefarm@gmail.com
Co-ordinates: (Sand Draai farm corner points)	28°38'11.35''S; 22°0'33.03''E; 28°39'28.23''S; 22°1'30.18''E; 28°46'54.82''S; 21°54'44.74''E; 28°47'10.02''S; 21°53'14.92''E; 28°46'16.08''S; 21°52'56.30''E
Co-ordinates: Parabolic Trough Site Alternative 1	Center point - 28°39'27.57"S; 22° 0'21.66"E
Co-ordinates: Parabolic Trough Site Alternative 2	Center point - 28°42'34.17"S; 21°57'30.46"E
Co-ordinates: Corridor 1	28°45'53.81"S; 21°53'15.88"E 28°41'48.93"S; 21°57'8.08"E 28°38'35.59"S; 22° 0'11.05"E
Co-ordinates: Corridor 2	28°46'55.04"S; 21°54'43.83"E 28°42'37.95"S; 21°58'35.53"E 28°39'43.33"S; 22° 1'15.97"E
Co-ordinates: Abstraction point	28°45'30.84"S; 21°52'5.80"E

2.2 Detailed Design of the CSP Plant using Parabolic Trough Technology

A CSP plant using parabolic trough technology consists of parabolic trough-shaped collectors that concentrate sunlight onto thermally efficient receiver tubes running through the trough's focal line. The collectors are usually designed to track the sun along one axis, predominantly north-south. A thermal transfer fluid, such as synthetic thermal oil, is circulated in these tubes. The fluid is heated to approximately 400°C by the sun's concentrated rays and then pumped through a series of heat exchangers to produce superheated steam. The steam is converted to electrical energy. The process flow diagram is presented in (Figure 4).

The principal components of CSP using parabolic trough technology are described in further detail in the following sections. It should be reiterated that detailed design information will be provided once an Engineering Procurement and Construction (EPC) Contractor is appointed to prepare final detailed designs of the proposed CSP plant.

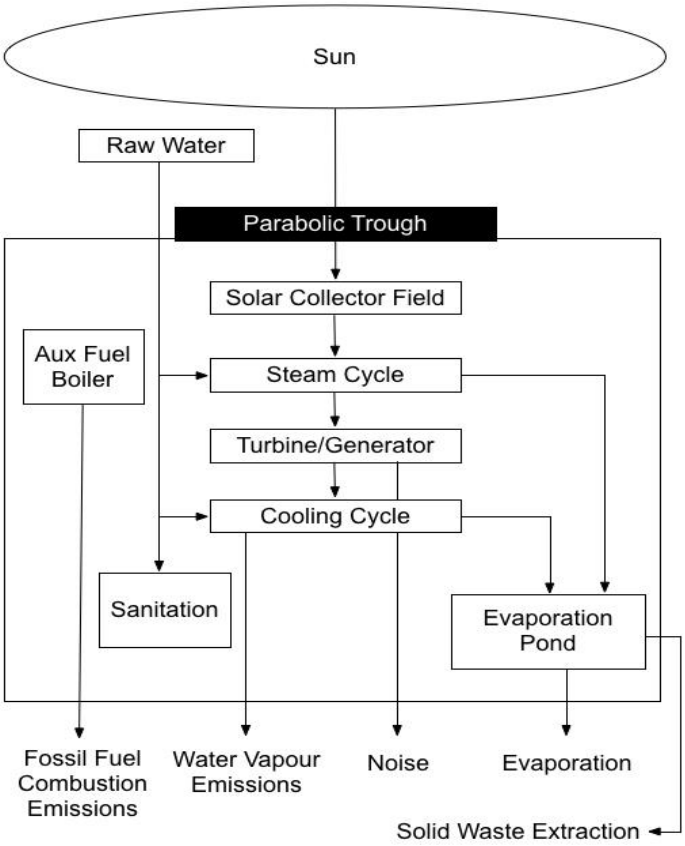


Figure 4: Overview of the parabolic trough technology

The key components of the CSP plant using parabolic trough technology will consist of:

- solar collector field consisting of parabolic trough collectors;
- power block;
- heat transfer fluid (HTF) system; and
- ancillary infrastructure (evaporation ponds; access roads; power line; water pipeline linked to water abstraction system; raw water storage (regulation) ponds; administration building; construction camp and laydown areas).

The proposed layout of the CSP plant as well as ancillary infrastructure is presented in Figure 5.

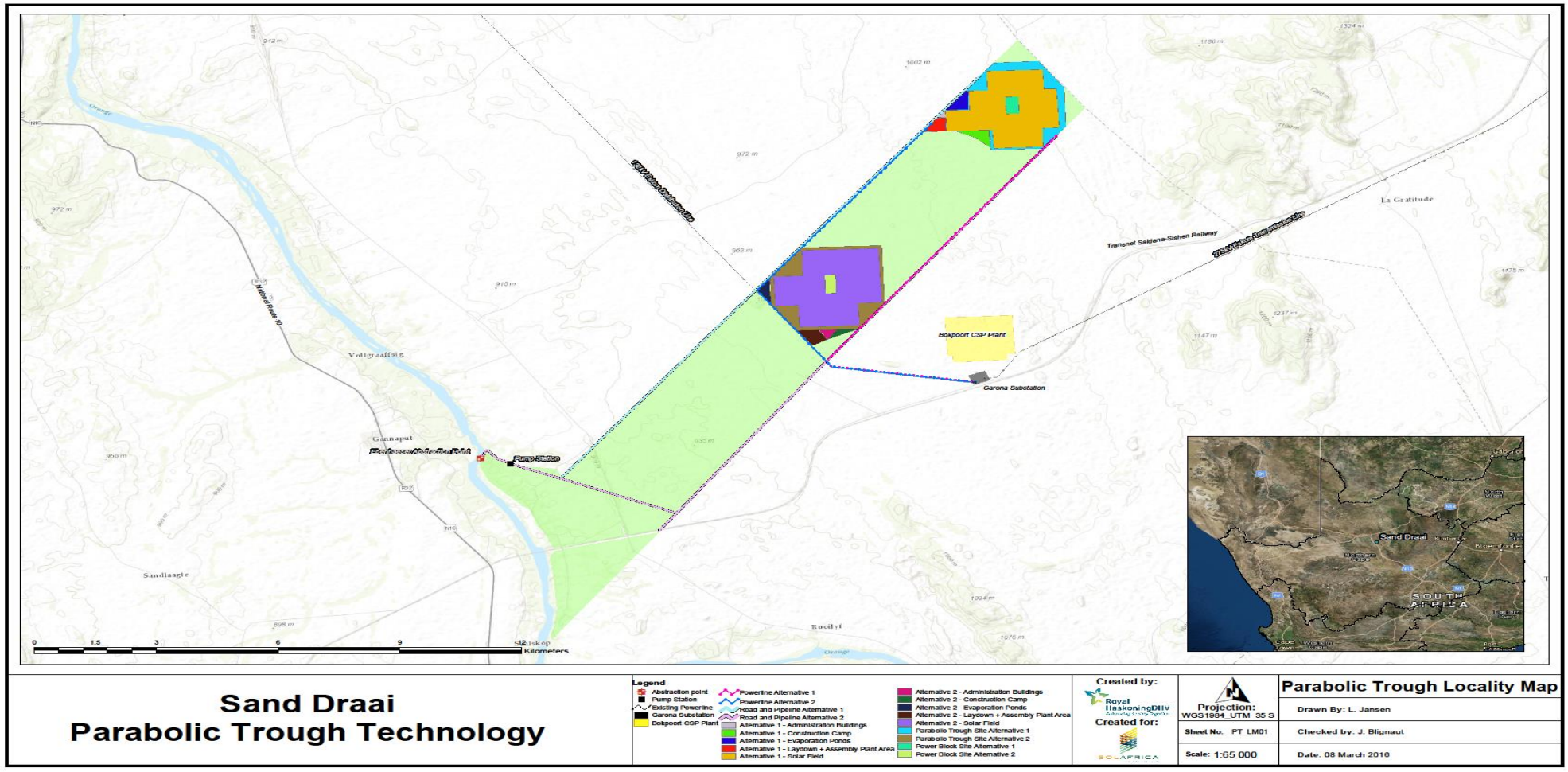


Figure 5: **Proposed layout of the CSP plant using parabolic trough technology**

2.2.1 Solar Collector Field Parabolic Trough Systems

2.2.1.1 Parabolic Trough Collectors

The collectors used in parabolic trough systems are shaped mirrors (see Figure 6) which are curved to create a focal point within a linear array. Mirrors need to be highly reflective to avoid losses and durable to resist the adverse environmental conditions. The majority of mirrors currently used are of glass type with a reflective backing. Mirrors can be manufactured from thick or thin glass; however, thick glass mirrors are currently the most commonly used. Thick glass mirrors are typically constructed of 3 – 5 mm thick tempered glass or float glass (glass made by floating molten glass on a bed of molten metal), which due to the high curvature required is normally pre-curved during manufacturing. The mirrors are typically fixed directly on to the parabolic trough supporting structure.

The solar collector field will consist of approximately 2300 cylindrical-parabolic collectors (dependent on the individual size) that are approximately 150 m in length and between 6 – 10 m high, covering a footprint of approximately 700 ha. The parabolic trough solar collector will have a total aperture of approximately 1 700 000 m^2.

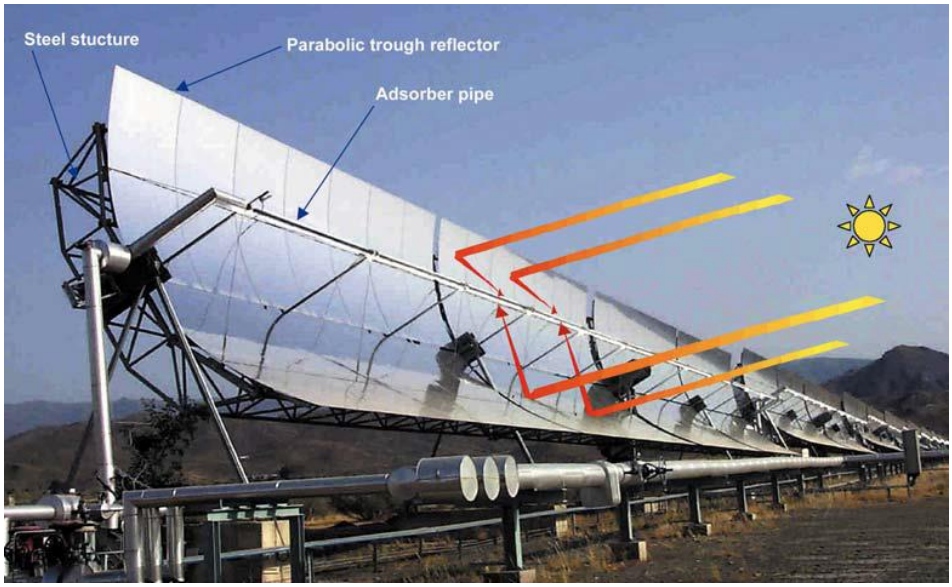


Figure 6: Elements of a parabolic trough system

2.2.1.2 Receiver Tube

Receiver tubes are mounted at the focal point of the parabolic trough collectors and serve as the first step in transferring the captured heat from the solar field to the power generation block. Receiver tubes are made of a steel tube with a solar active surface treatment. The surface treatment maximizes the absorption of solar radiation and minimizes the emission of radioactive losses by means of a selective coating. The steel tube is surrounded by a glass tube with an internal vacuum to protect the selective coating from the effects of the ambient environment. Due to the differing expansion properties of steel and glass an expansion bellows connecting the outer and inner tubes are required. This ensures the vacuum between the tubes is maintained.

2.2.1.3 Base Frame, Connecting Elements, Tracking and Control System

A structure is required to support the collectors and allow the mechanism to track the daily path of the sun as it moves across the sky. Throughout the day, the parabolic troughs collectors are normally set on tracking

mode by electric motors driving through gearboxes, or directly by hydraulic drives. Hydraulic drives, which provide mechanical energy to move the collector, are currently the most common tracking mechanism used.

The proposed CSP plant will use a north-south axis to allow collectors to track the sun's azimuth over each day, hence maximizing annual output. Figure 7 shows a north-south layout of the troughs at the SEGS plant in California.

Figure 7: Parabolic field layout at the SEGS Plant

2.2.2 Power Block

The function of the power block is to turn the stored solar energy into electrical energy. This will be achieved through a conventional Rankine Cycle, as used at most thermal power plants worldwide.

The process starts with water which is fed from a condensate tank and a make-up source into a de-aerator which removes all traces of oxygen or entrapped gases from the water. The water is then pressurized with feed pumps and fed through a number of heat exchangers to transfer as much as possible of the energy from the HTF to the steam cycle. Superheated steam (at ±540ºC and 116 bar) is then passed through the high pressure turbine. There after the steam is reheated and then passed through the intermediate and low pressure turbine stages. The turbine spins at very high revolutions and drives the electrical generator in order to deliver electricity to the plant's substation. Steam exiting the low pressure turbine is directed through coolers which condense the steam back to water.

The main components of the power block are described in more detail below. Steam is generated by means of a steam generator with an intermediate re-heating application.

2.2.2.1 Pre-heating System

The pre-heating system can be defined as the cycle in which the condensate is heated to the optimum temperature for steam generation purposes. The system comprises of the following:

- Low pressure water/steam pre-heaters - three low pressure pre-heaters are positioned in sequence. These pre-heaters use steam from various specific extraction points on the steam turbine to pre-heat the condensate before it enters the de-aerator.

- De-aerator - the CSP plant is equipped with a de-aerator in order to remove oxygen and any other entrapped gases within the feedwater of the steam cycle. The de-aerator uses extraction steam from the steam turbine for heating and to aid the de-aeration process. The process also serves to preheat the condensate and to store it as source of supply to the steam generator feed pumps. Deionized cycle makeup water is introduced at the inlet of the de-aerator to allow for heating and de-aeration.
- Feedwater pumps - the feedwater pumping system will deliver feedwater to the steam generator and comprises of three horizontal centrifugal pumps, each with a 50% capacity. The pumps will draw feedwater from the de-aerator tank and transfer it to the steam generator by passing it through the three feedwater heaters. These are powerful pumps which need to deliver water at very high pressures.
- Feedwater-heaters - from the outlet of the de-aerator the heated condensate is pressurized via feedwater pumps and then passed through three (3) high-pressure feedwater heaters in series. The first two (2) heaters are heated with steam extracted from specific extraction points on the high pressure and intermediate pressure turbines, while the third is heated with steam from the steam drums within the steam generator.

2.2.2.2 Steam Generator System

The steam generation system is the core of the steam supply system for the power block and consists of an economizer, evaporator, two superheaters, and two re-heaters. High pressure feedwater enters the system from the feedwater heaters, passes through the economizer, the steam drum, through the evaporator, back to the steam drum, and leaves as saturated steam that subsequently flows to the superheaters. Superheated steam passes through the high pressure steam turbine and is exhausted to the re-heaters. Reheat steam is then directed to the inlet of the intermediate pressure turbine. Heated HTF is pumped through a series of heat exchangers from which the heat is transferred to generate high-pressure, superheated steam. After passing through the HTF side of the solar heat exchangers, the cooled HTF is re-circulated through the solar field.

2.2.2.3 Steam Turbine Generator

The steam turbine generator system consists of a multi-stage, reheat, condensing steam turbine generator (STG) with extraction, a gland seal steam system, lubricating oil system, hydraulic control system, and steam admission and control valving. Once the pressurized steam has reached the optimum temperature in the superheater, it flows to the steam turbine, which converts thermal energy in the steam into mechanical power (rotation), driving an attached power generator. Superheated steam is expanded through the high-pressure stages of the turbine, is routed back to the steam generation system where it is reheated, and then returned to expand through the intermediate and low-pressure turbine sections. On exiting the turbine, the steam is directed into the air cooled condenser.

The steam generation system is supported by various auxiliary services (control and shut down valves; lubrication and hydraulic oil systems; gear box; steam sealing system; turbine and generator control system and earthing system and electric protection equipment) which need to be maintained. The turbine set as well as the auxiliary systems will be equipped with its own control system, which is to be integrated into the distributed control system (DCS) of the plant. The control system will be a standard control system and will be obtained from the turbine suppliers.

In the event of the turbine being not operational or having tripped for some reason, the steam generated by the steam generation process will be fed into a bypass steam circuit. This bypass circuit sends the steam directly to the condenser, bypassing the turbine.

2.2.2.4 Air Cooled Condenser

Air cooled condensers are used to cool and condensate steam exiting the low pressure steam turbine. The air cooled condenser is designed to cool the steam cycle with ambient air which is forced across its radiators. As

steam output is air cooled, a difference in air temperature and pressure will be recorded. The steam output will vary according to ambient temperature and the air flow in the air cooler.

The CSP plant will be equipped with a closed circuit cooling system for all auxiliary components. The primary inputs of the cooling system will be a mixture of demineralised water and propylene glycol.

Vitally important to the plant is the fact that the primary cooling system is a dry-based cooling system, which requires significantly less water than the alternative wet-cooled option. The auxiliary cooling system, however includes a wet surface air-cooler, and is used for the cooling of all equipment i.e. pumps, alternators etc. that does not form part of the output cycle of the turbine.

The aforementioned infrastructure will be constructed on a carbon steel base structure which is designed to bear the full weight of the equipment. These will then be cast onto a concrete foundation.

2.2.2.5 Generator/Synchronous Motor

A synchronous self-exciting brushless generator will be employed, that is suitable for parallel operations. The generator functions by means of an armature winding when excited by a poly-phase (3 phase) supply, creating a rotating magnetic field inside the motor. The field winding locks in with the rotating magnetic field and rotates alongside it.

During operation the motor is said to be in synchronisation once the field locks in with the rotating magnetic field. These types of motors are not self-starting and only start functioning once power is supplied to the motor.

2.2.2.6 Heat Transfer Fluid (HTF)

The HTF is a eutectic mixture of about 73.5% diphenyl oxide and 26.5% biphenyl, with a density of 694kg/m^3 at 400°C and a specific heat of 2.6kJ/kg K. It freezes at 12°C and is flammable and toxic so measures are required in the design and operation of the plant to mitigate freezing, fire and contamination risks. Over time HTF degrades into low and high boiling fractions, and these must be removed. Small volumes will continuously be bled off with new fluid being introduced into the system. Spent HTF will be stored in small volumes and periodically removed by a third party services provider for disposal at a registered waste management facility.

2.2.3 Auxiliary Facilities/Infrastructure

Over and above the infrastructure and equipment requirements directly related to the operations of the CSP plant, several auxiliary facilities and infrastructure also needs to be constructed and implemented. These facilities and infrastructure will support the daily operations of the CSP plant by their various operation-related functions, by producing inputs i.e. water, treating products generated by the plant, facilitating or housing of operations staff etc.

2.2.3.1 Water Abstraction System

Water is proposed to be obtained from an abstraction point (Ebenhaeser) located in the Orange River. The water provision system will consist of various components that deal with the abstraction, transportation, filtration, and storage of raw water for supply to the CSP plant.

From an in-stream intake system the water will be pumped via an underground pipeline first through a pump station (indicated by the green block - 28°45'37.99"S; 21°52'33.06"E in Figure 8) and then on to a raw water storage pond located along the border of the plant's solar field. Once abstracted from the Orange River, raw water is transferred to a sand-trap tank where debris and oversized particulates are removed. From there the

water is run through a suction deposit within the pump station, via a pipeline, and later elevated to the plant site where it is held in a raw water storage pond before use (Figure 9).

The main water pipe (high density polyethylene HDPE up to 0.4 m diameter) will be sited in pipe trenches along its route. The pipeline will have a total length of between 20 – 25 km (depending on the final site selected) from the river to the storage (regulation) pond. Approximately 750 000 m^3 of water is required during the construction phase and 350 000 m^3 of water per annum during the operations phase.

Process water will be pumped from the regulation ponds to the power block. An auxiliary pump station will be located close to the ponds.

The plant will also have an emergency water tank with an anticipated capacity of approximately 2 500 m^3. This water will be reserved for fire fighting requirements.

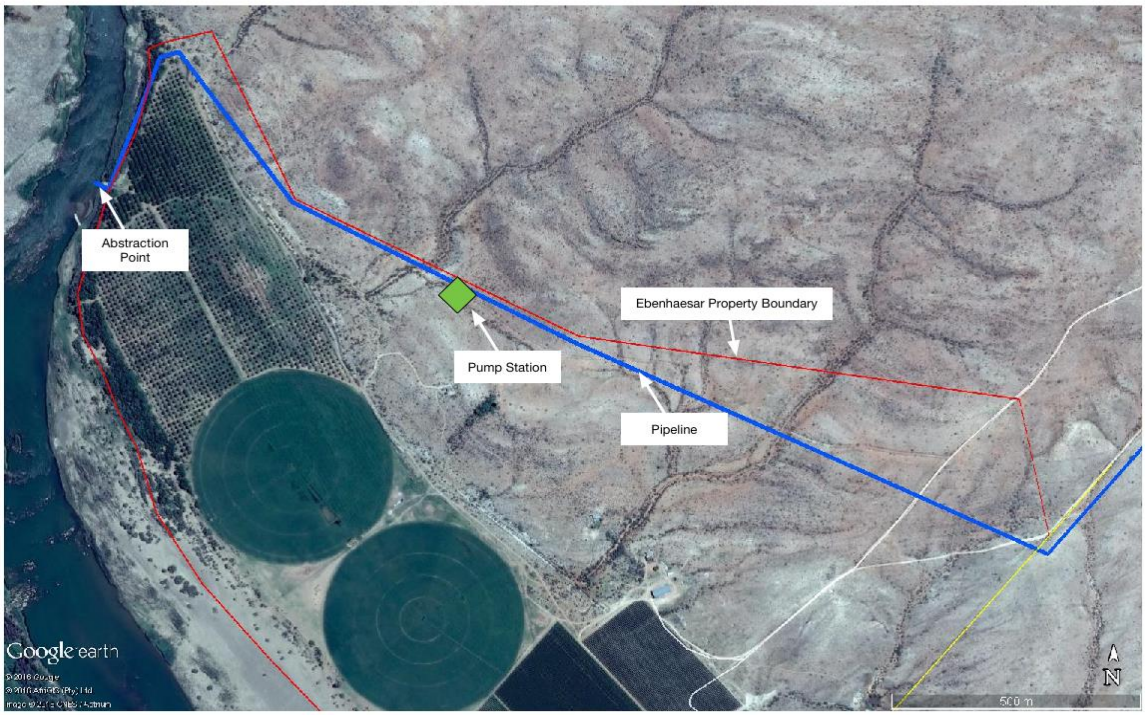


Figure 8: Google Earth image of the proposed pump station

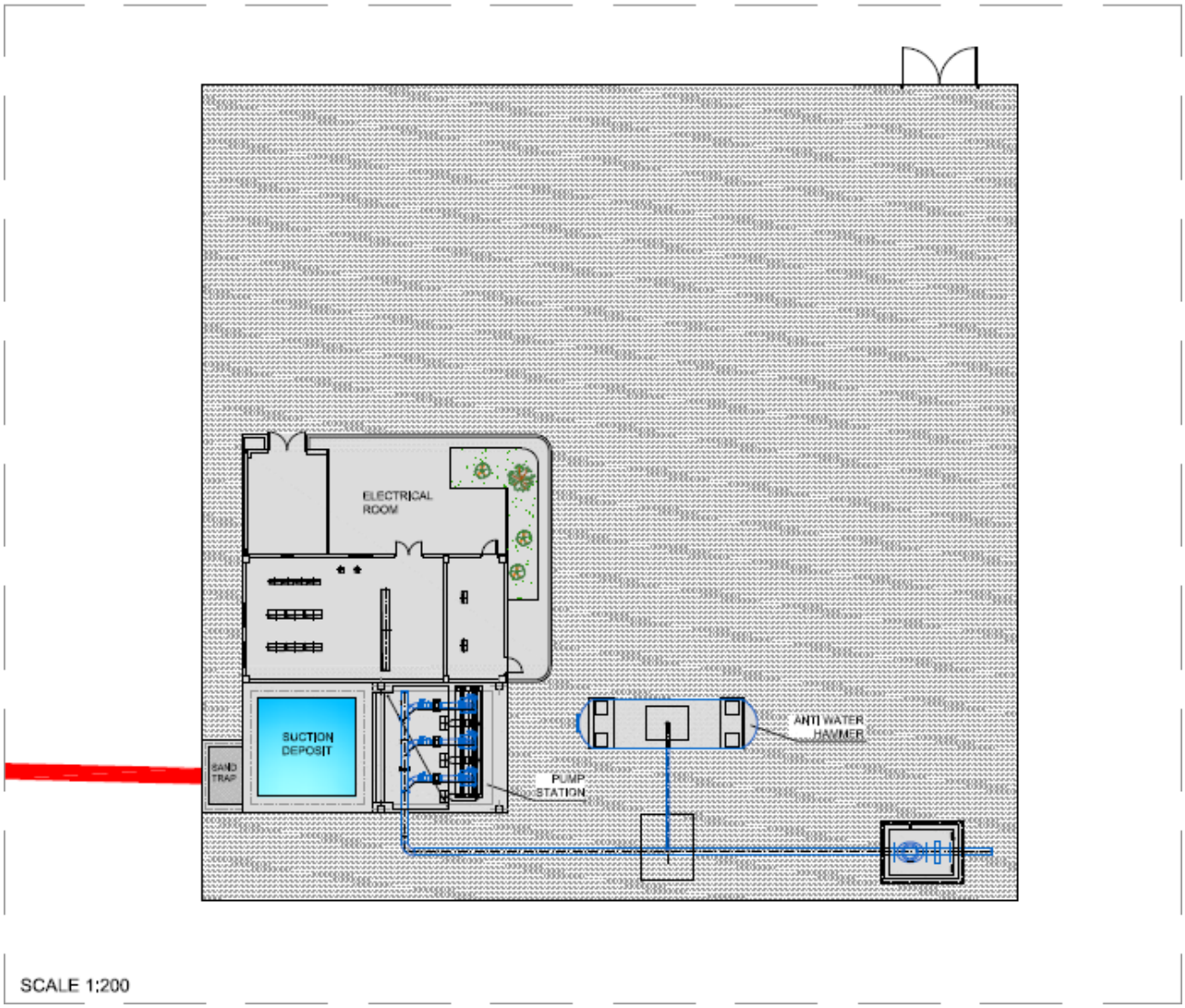


Figure 9: Conceptual (example) pump station drawing

2.2.3.2 Water Storage (Regulation) Ponds

There will be two ponds with the same dimensions (50% capacity each) and arranged in parallel. Unit volume will rise up to 37.000 m^3 (useful capacity 47.500 m^3). Preliminary design gives a total height of 6 m (water level at 5 m).

Design storage capacity is estimated to be sufficient to supply the plant for a period of 30 days in case of a failure from the pump system, specific problems of water quality, or even a low flow season, when it is not possible to supply raw water to the ponds.

The coronation of the wall height will be 950 m. The total area occupied by the two ponds will be approximately 30 m^2. The ponds are arranged on a flat surface, creating a gradient of 0.25% towards the water sump. The outer slope has a gradient of 3 H/1 V so waterproof sheeting can support without slipping and without producing hazardous traction. The inner slope is projected at 2 H/1 V, contributing to pond stability.

The ponds will be filled from the river. It is proposed that the ponds are fitted over a layer of clay 0.30 m thick, on the embankments and on the base.

Impermeability of the ponds is accomplished through the use of a high density polyethylene (HDPE) geo-membrane sheet 1.5 mm thick. The sheet will have appropriate overlaps at the joins to guarantee correct laying. Special attention will be paid to the finishes where the sheet joins concrete items, where control will be stressed even more. The sheet will be braced at the top and bottom of the embankment.

This sheet will be laid over a geo-drain made from a 300 g/m^2 non-woven geo-textile sheet on the upper part in contact with the geo-membrane, and with a draining layer below. Underneath the geo-drain, a layer of clay to protect from sub-pressure that will act as an impermeable (or quasi-impermeable) layer will be laid. This material must be permeable to a degree no less than 10-6 cm/s.

Beneath the layer of clay, a 300 gm/m^2 non-woven geo textile sheet will be laid over the whole pond which will be in contact with the excavated base.

Detail of the typology of some storage ponds constructed at other solar power complexes is provided in Figure 10.

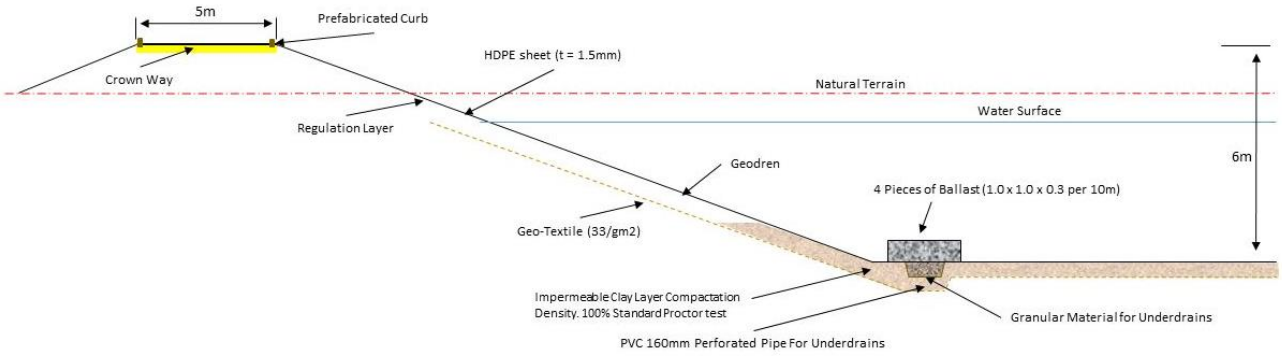


Figure 10: Conceptual (example) design of storage pond

2.2.3.3 Water Treatment Infrastructure

The technology used for the CSP plant is highly sensitive and requires that all water used during operations conform to a rigorous water specification. As all raw water entering the plant must be treated prior to use in the plant a water treatment plant will have to be constructed. The main water treatment subsystems will include the following components:

- Multimedia Filter (MMF) - the MMF contains multiple types of media with the coarse media layers in the top of the tank to trap large particles, and successively smaller particles trapped in the finer layers of media deeper in the bed. A coagulant will be introduced before the MMF inlet to capture fine particles for ease of filtration in the MMF. The multi-media filter is backwashed using reverse or upward flow of water through the filter bed.
- Reverse Osmosis (RO) – the RO system is a filtration process that works by using pressure to force water through a membrane, retaining the contaminants on one side and allowing the pure water to pass to the other side. The RO will include an additional concentration step for RO serving to treat the waste from the main lines and reduce by a maximum the final waste from the system An anti-scalant and de-chlorinator will be injected upstream of the RO skids to reduce the cleaning cycle of the membranes.

- Electrodeionization (EDI) - is a continuous and chemical-free process of removing ionized and ionizable species from the water using DC power. EDI is used to polish the RO permeate and to replace conventional mixed bed ion exchange, which eliminates the need to store and handle hazardous chemicals used for resin regeneration and associated waste neutralization requirements.

In order to treat the raw water to be used in the CSP plant several key facilities and infrastructure will have to be constructed and installed.

The auxiliary equipment needed for water treatment include –
- Reagent-dispensing systems;
- Pumps with filters;
- Filters, filter washing pump, blowers for washing filters;
- Cartridge filters and high-pressure pumps;
- Measurement systems: flow meters and pressure gauges;
- Reverse osmosis support frame;
- Membrane cleaning system;
- Electro-deionisation module; and
- Storage tanks for water of different qualities (stabilised, filtered, osmotically-treated and demineralised waters).

2.2.3.4 Access Roads

Appropriate access roads (temporary and permanent) will be constructed to link the proposed power plant with the nearby existing road network. These routes have been assessed as corridors from which alignments will be designed. A 200 m corridor has been provided for linear infrastructure (i.e. road, water pipeline and power line). The corridors cater for temporary (to be used during construction) and permanent (to be used during operation) access and site roads. Two proposed corridors have been identified for possible roads for access to and from the proposed sites. The access roads have been aligned within the proposed corridors along the northern and southern borders of the farm Sand Draai. The proposed road will be gravel and approximately 8 m in width and 14 km in length. These access roads will tie in with the existing N8/N14 gravel road.

2.2.3.5 Power Line

The exact length and route of the alignment of the proposed 132 kV transmission line is estimated to be between 10 – 15 km in length. The proposed power line has been aligned within corridors along the northern and southern borders of the farm Sand Draai (Figure 5). The proposed power line will connect with Eskom's Garona distribution line. The Garona substation (Figure 11) forms part of the national transmission network which will enable the supply of electricity to Eskom's distribution network running from the Garona substation to the Upington region in addition to the transmission network running from Garona substation to the Ferrum substation (near Sishen). The route of transmission line will be largely informed by the layout of the proposed CSP plant.

Figure 11: Garona substation

2.2.3.6 Waste Generation (Liquid Effluent)

The CSP plant will generate several forms of liquid effluent as part of operations. The primary effluents sources generated include –

- Wastewater from the evaporation ponds;
- Contaminated surface water i.e. stormwater and rainwater;
- Sewage effluent; and
- Brine blowdown water.

The wastewater purification plant will source the wastewater from four independent intake (feeder) systems as per the different types of wastewater.

- System 1 will collect all the containment surface water (stormwater).
- System 2 will be responsible for transporting all sewage effluent to the biological treatment system. This treatment system consists of a septic tank and biological filter.
- System 3 will transport the wastes generated during the evaporation process to a wastewater treatment plant.
- Lastly, a system will be designed to collect stormwater (surface water), which will be sent to a drainage pool before it is discharged.

The treatment options for the four (4) systems are based on the types of effluent to be treated. The following treatment options have been defined for each source of effluent –

- Contaminated water treatment system will be installed to separate both clean and dirty surface water where after the different types of grease/hydrocarbon products will be treated and clean surface runoff diverted away from site.
- A biological treatment system will be implemented to treat the sewage effluent from the offices.

2.2.3.7 Evaporation Ponds

Three evaporation ponds will be located outside but nearby the solar field. Access to the ponds will be created by the centre line of the heliostat circle that runs in a straight line from the power block. The access road will have a gravel surface. The effluent will be piped or channelled to the evaporation ponds as the western side of the power field is at a lower position than the plant and therefore a gravity feed can be achieved.

The evaporation ponds will consist of three (3) compartments that would enable maintenance on any of the three (3) compartments without disrupting the normal operations of the CSP plant. The three (3) compartments will have a small emergency overflow to each of the other compartments. The flow to each of the compartments will be controlled via a splitter box at the top end of the evaporation ponds. A limited amount of silt is to be expected to enter the ponds as no surface water will enter the system. Oil will be separated out of the effluent stream before it reaches the evaporation ponds. The evaporation ponds will not be shared amongst the various plants.

- Size of each evaporation pond = 160 m x 175 m x 6 m = 168 000 m^3
- Number of evaporation ponds = 3
- Total area for the evaporation ponds = 8.5 hectares

The selected typology for the standard cross-section is for a height of 1.5 m. The ponds will be allowed to fill to a depth of 0.3 m, with a reserve of 0.50 m to the crown on the least favourable side. The inner and outer embankments of the ponds are 2.5 H:1 V.

The ponds will not be filled from any other sources than those regulated from the plant and any direct rainfall over the surface area. In order to eliminate excesses, an overflow with an effluent threshold will drain into a perimeter channel.

Impermeability of the ponds is accomplished through the use of a high density polyethylene (HDPE) geo-membrane sheet 1.5 mm thick, laid over a geo-textile sheet. The sheet will have appropriate overlaps at the joins to guarantee correct laying thereof and special attention will be paid to the finishes where the sheet joins concrete items, where control will be stressed even more. The sheet will be braced at the top and bottom of the embankment. Under the HDPE and the geotextile sheets, a compound is used to protect against the ground. The compound is a geosynthetic coating made of bentonite clay (Figure 12).

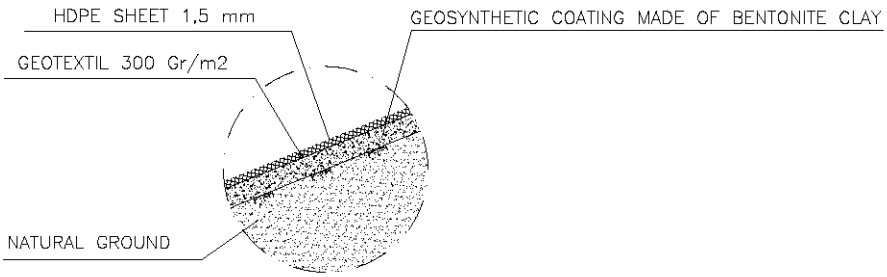


Figure 12: Proposed evaporation pond barrier system (example)

This solution should satisfy the standard requirements of an evaporation pond under the applicable local regulations in South Africa.

Filling of the ponds is expected to a depth of 0.30 m. A 1 m wide overflow is designed.

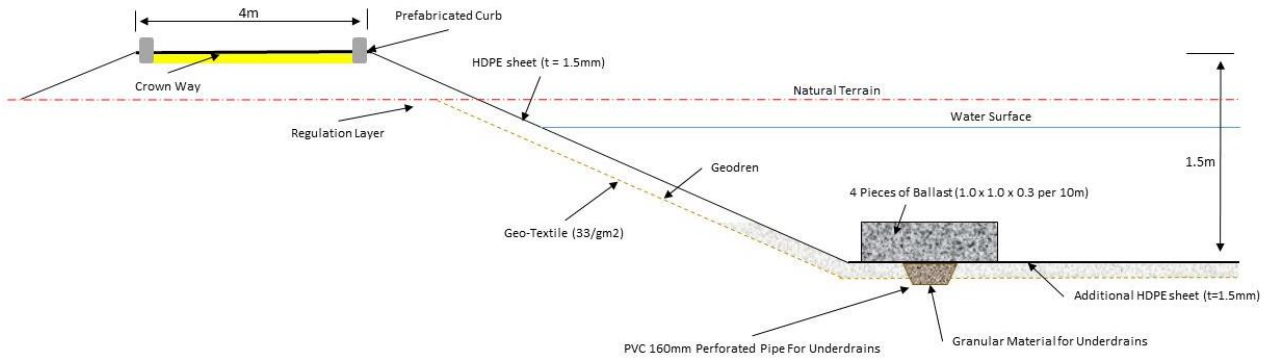


Figure 13: Conceptual (example) design of evaporation pond

The design conditions are as those given as the same regulation ponds. The most relevant characteristics are provided in Figure 13. The design will be confirmed in later design stages.

2.2.3.8 Sanitary Waste

The CSP plant will create sanitary waste streams at both the administrative building and at the operations building and maintenance areas. Each area will have a kitchen as well as the requisite quantity of toilets and or showers to support the crew size. This will only be during construction activities and will be adequate for the number of people on the site. At these locations, a septic tank and leach field will be used to capture and treat the flows. As and when required, the septic tank (solids holding tank) will be cleaned out by a vacuum truck and the wastes will be trucked and disposed at a licenced facility (e.g. Holfontein, Rietfontein). This activity will adhere to the plant safety program as administered by plant personnel.

With respect to the handling and treatment design and operations of the proposed effluent treatment plant the following philosophy will be put in place –

- A closed loop system will be introduced and implemented with regards to the handling, treatment and reuse of treated water. It is proposed that all treated effluent be removed off site and disposed of at an appropriate facility.
- Effluent treatment of sewage/sanitation water will be done in such a manner that the treated effluent will adhere to the general limit effluent standards.

As the proposed design of the CSP plant using parabolic trough technology is dependent on EPC Contractor designs and subject to a procurement process, no detail design is available for sewage handling and treatment and for the purpose of this EIR it is however deemed accurate that all sewage will be removed via an external service provider.

2.2.3.9 Solid Waste Generation

The CSP plant will produce maintenance and plant wastes typical of power generation operations (see Table 6). All waste to be generated on site will be subject to the principle of "reduce, reuse and recycle" as far as possible before disposal is regarded as an option. Solid wastes will be temporarily kept on site (within the laydown area) and trucked off-site for recycling or disposal at a licenced recycling facility or licenced landfill site in the vicinity (e.g. Holfontein, Rietfontein).

Table 6: Types of waste generated by the project

Types of Waste	Source	Quantity (peak quantity per day and not continuous)	On-site Recovery, Reuse, Recycling, Treatment, or Disposal	Off-site Recovery, Reuse, Recycling, Treatment, or Disposal	Off-Site Disposal
			Method & Location	**Method, Location and Contractor**	
Hazardous					
Spent HTF	HTF system	900 kg			Off-site disposal in hazardous landfill
Used oil	Power block	2000 kg			Off-site disposal in hazardous landfill
Spent oil filters	Power block	1000 kg		Off-site recycling	Off-site disposal in hazardous landfill
Spent solvents	Power block	500 kg		Off-site recycling for large volumes	Disposal at hazardous landfill for small volumes
Old or outdated chemicals from the water treatment system	Water system	750 kg			Off-site disposal in hazardous landfill
Old paints	General	500 kg			Off-site disposal in hazardous landfill
Chemical cleaning wastes	HTF system	7.5 m^3			Off-site disposal in hazardous landfill

Types of Waste	Source	Quantity (peak quantity per day and not continuous)	On-site Recovery, Reuse, Recycling, Treatment, or Disposal	Off-site Recovery, Reuse, Recycling, Treatment, or Disposal	Off-Site Disposal
Non-Hazardous					
Broken and rusted metal and machine parts	General	200 m^3	On-site sorting of waste for reusables	Sale of recyclables	Disposal of non-recyclables in local municipal landfill
Defective or broken electrical materials	General		On-site sorting of waste for reusables and sale of recyclables	Sale of recyclables	Disposal of non-recyclables in local municipal landfill
Empty containers and typical refuse generated by workers	General		Basic treatment in on-site septic tanks	Wet waste taken to compost heap / worm farm	Dry waste disposed of in local municipal landfill

2.2.3.10 Storeroom(s), Laydown Area, Construction Camp and Assembly Plant

The proposed location of the storeroom(s), laydown area and construction camp are indicated in Figure 5. This infrastructure will be shared between the CSP plant using parabolic trough technology as well as the proposed CSP plant using central receiver technology.

A summary of the CSP plant using parabolic trough technology specifications is provided in Table 7.

Table 7: Parabolic trough plant specifications

CSP Plant using Parabolic Trough Technology
Solar Collector Field
▪ Parabolic trough collectors with a total aperture of approx. 1 700 000 m^2 ▪ Collectors between 6 – 10 m high and 150 m in length ▪ Approximately 700 ha overall plant footprint ▪ Solar field will consist of 2300 trough collectors (dependent on the individual size)
Ancillary Facilities
▪ Laydown area will be approximately 15ha ▪ Assembly plant will be approximately 3000m^2 (200m x 15m) ▪ Two liquid gas/diesel auxiliary burners for start-up ▪ Two-tank molten salt energy storage system (8 hours) ▪ Two emergency diesel generators ▪ Construction camp – accommodation and sanitation facilities for approximately 250 people. With respect to the construction of the plant it is estimated that up to 1500 direct jobs will be created ▪ Administrative and office buildings
Power Block
▪ Pre-heating system (low pressure water/ steam pre-heaters; de-aerator; feedwater pumps and heaters) ▪ Steam generator system (economizer; evaporator; superheaters and re-heaters) ▪ Steam turbine generator including auxiliary systems; control system and steam bypass system ▪ Air cooled condenser ▪ Auxiliary cooling system ▪ Generator/ Synchronous motor ▪ Two 25 MW liquid gas auxiliary burners (or diesel boilers - possibly one large one) may be used for start-up ▪ Two emergency diesel generators ▪ Above ground diesel storage tanks within the power block – up to1000 m^3 with a throughput of less than 50000 m^3/annum ▪ HTF is a eutectic mixture of about 73.5% diphenyl oxide and 26.5% biphenyl, with a density of 694 kg/m^3 at 400°C and a specific heat of 2.6 kJ/kg K

CSP Plant using Parabolic Trough Technology
Ancillary Facilities to be shared with the proposed Central Receiver CSP Plant
▪ Laydown area will be approximately 15 ha ▪ Assembly plant will be approximately 3000 m^2 (200 m x 15 m) ▪ Construction camp – accommodation and sanitation facilities for up to 250 people with an estimated size of 20 ha With respect to the construction of the plant it is estimated that up to 1500 direct jobs will be created ▪ Administrative and office buildings
Water Usage
▪ Approximately 750 000 m^3 during the construction phase and 350 000 m^3 of water per annum during the operations phase. ▪ Fire-fighting water requirements - 2 500 m^3 emergency storage as needed
Water Treatment
▪ The water treatment process includes two multi-stage reverse osmosis units, and electrodeionization equipment ▪ Pure demineralized water from the process is pumped into a separate demineralized water storage tank. Demineralized water is added to the de-aerator for steam plant makeup, for steam cycle blowdown quench water, and for heliostat washing ▪ Wastewater from water treatment system, including 1st pass reverse osmosis reject and electrodeionization, as well as a portion of the steam cycle blowdown are discharged to the evaporation ponds ▪ Three evaporation pond consisting of three compartments with a combined area of approximately 8.5 ha is proposed to completely contain all rejected water from the water treatment system and the steam cycle
▪ The CSP plant will generate several forms of liquid effluent as part of operations. The primary effluents sources generated include: – Wastewater from the water treatment plant – Contaminated surface water, i.e. stormwater and rainwater – Sewage effluent – Blowdown water ▪ Total volume of discharge, inclusive of sewage water and evaporation system discharge is expected to be between 130 000 and 150 000 m^3 per annum ▪ Hazardous waste generated include: spent HTF; used oil; spent oil filters; spent solvents; old chemicals from the water treatment system; old paints and chemical cleaning wastes ▪ Non-hazardous waste generated include: broken and rusted metal and machine parts; defective of broken electrical material and empty containers and typical waste generated by workers

2.3 Operations

The project will operate (generate electricity) an average of about 12 - 18 hours per day, 7 days a week (with approximately 8 hours of energy storage) throughout the year, with the exception of scheduled shutdowns for maintenance.

3 PROJECT ALTERNATIVES

In terms of the EIA Regulations (2014) GN R.982, Appendix 2: Section 2 (h) (i) all alternatives are required to be considered as part of the environmental investigations. In addition, the obligation that alternatives are investigated is also a requirement of Section 24(4) of the National Environmental Management Act (No 107 of 1998) (as amended). An alternative in relation to a proposed activity refers to the different means of meeting the general purpose and requirements of the activity (as defined in GN R.982 of the EIA Regulations, 2014), which may include alternatives to:

a) The property on which or location where it is proposed to undertake the activity – **Section 3.1**
b) The type of activity to be undertaken – **not applicable to this study**
c) The design or layout of the activity – **Section 3.3**
d) The technology to be used in the activity – **not applicable to this study**
e) The operational aspects of the activity – **not applicable to this study**
f) The option of not implementing the activity – **Section 3.1**

3.1 Site Alternatives

3.1.1 Site Alternatives identified within the Northern Cape Province for the Establishment of the new CSP Plant

In determining the most appropriate sites for the establishment of the new concentrating solar power plant, various options were investigated. This site selection process considered the following criteria:

- The availability and accessibility of primary resources required for the operation of the power plant, such as sun (i.e. the required Direct Normal Insolation) and water;
- Availability of land to locate the site and associated infrastructure;
- The availability and accessibility of infrastructure for the provision of services, manpower and social structure for the construction and operation of the power plant;
- The ease of integration of the new power plant into the existing National Transmission network/grid and the environmental impacts associated with this integration; and
- General environmental acceptability in terms of social impacts, water utilisation, general ecology, etc.

Through a series of feasibility and high-level screening studies undertaken, the Northern Cape Province is ranked as the most favourable area for the establishment of the new concentrating solar power plants. This analysis considered technical, economic and environmental criteria. From the sensitivity analysis[4] it was concluded that there was the potential to establish a new CSP plant in the Groblershoop area. In order to ensure the ease of integration of the new power plant into the existing National Transmission network/grid and considering the environmental impacts associated with this integration, it was determined that the most feasible site would be close to the existing power lines and water resources.

[4] Bohlweki Environmental (on behalf of Eskom Holdings Limited). 2006. *Environmental Impact Assessment for the establishment of a New Concentrating Solar Power (CSP) plant and associated infrastructure in the Northern Cape Province.*

3.1.2 Consideration of the Sand Draai Farm for the Development of the new CSP Plant using Parabolic Trough Technology

As indicated in Section 1.1, between 2013 – 2014, Solafrica, embarked on a feasibility study to develop another Solar Thermal Farm in the Upington area consisting of two CSP plants (central receiver and parabolic trough technology) and a PV plant on the farm Sand Draai 391 with an electricity generation capacity of between 125 and 150 MW each.

In 2015, an independent feasibility study was conducted on Sand Draai and from a technical/engineering perspective, the Sand Draai farm displayed the following key desirable traits for the development of a CSP plant:

- Sand Draai 391 (based on the nearby Bokpoort site measurement) has an average DNI of ~ 2 680 kWh/m^2/year with over 330 days of sunshine.
- Development of a solar project is most ideal on lands that are relatively flat, with minimal slopes across the site. No additional grading of the site is expected.
- An existing 132 kV/225 kV Garona substation at approximately 6 km to the south east corner of the site is adequate for power evacuation. The Garona substation has one 132 kV and one 275 kV spare bay available for future connection.
- Water is available from the Orange River. The river flow is controlled upstream year round and water level is maintained. There is also a commitment to use dry-cooled CSP technology to conserve water usage.
- The site is served by the national highway N10 connecting Upington to Groblershoop. The N10 is connected to major cities and ports through South Africa's National Highway system.

As part of the ESS, a sensitivity analysis was undertaken to determine areas of low, moderate, high and very high sensitivities within the farm. A combined sensitivity map (Figure 14) was created by using data that was collected during each of the specialist assessments. Four (4) zones were identified for the development of the CSP project using parabolic trough technology:

- Preferred zone (low) – indicated in dark green;
- Acceptable zone (moderate) – indicated in light green;
- High sensitivity zone (high) – indicated in orange; and
- Critical sensitivity zone (very high) – indicated in red.

The preferred zone is considered ideal for the development of the CSP plant. The acceptable zones were also considered favourable for the development of the plant, although suitable mitigation and management measures will be proposed during the construction and operational phases of the project.

Whilst, the high and critical sensitivity zones were avoided as far as possible, the proposed CSP plant and linear infrastructure (water pipeline; access roads and power line) corridors will traverse these areas (refer to Figure 14). Suitable management efforts and mitigation measures will be afforded to these areas to minimise potential impacts.

Based on the sensitivity assessment, two site alternatives were proposed for the development of the CSP plant. Parabolic trough Site Alternative 1 is located in the north-eastern portion of the Sand Draai farm, whilst Parabolic trough Site Alternative 2 is located towards the southern portion of the farm closer to the Orange river. Two servitudes of 200m were identified that will each accommodate a planned access road, a water pipeline (to provide water from the Ebenhaeser abstraction point) and a power line that will connect the selected site to the Garona substation. The proposed servitudes are situated on northern and southern boundaries of the Sand Draai farm (Figure 14).

3.2 Technology Alternatives

This EIA study focuses only focuses on parabolic trough technology as provided in the Project Description (Chapter 2).

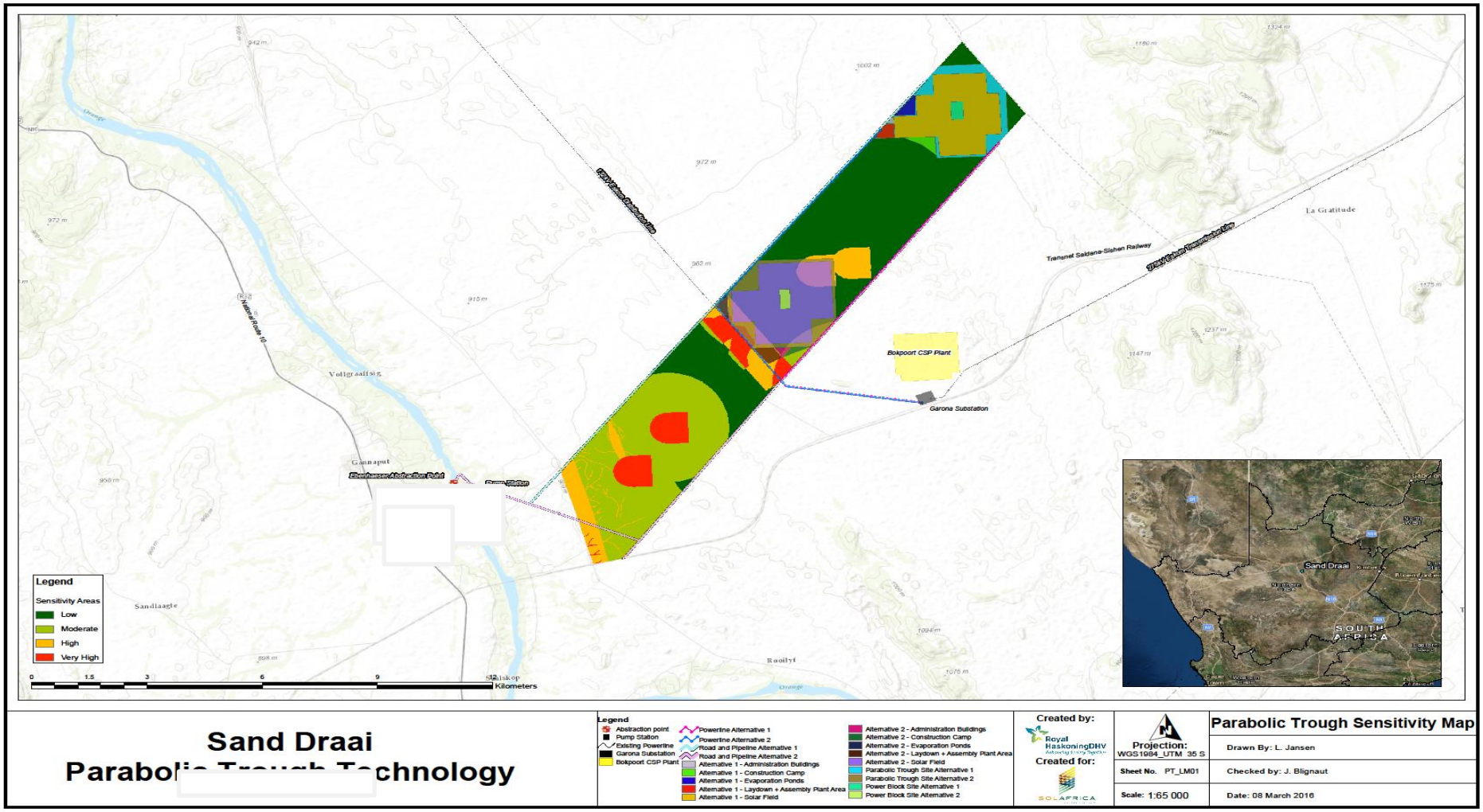


Figure 14: Sensitivity map with the proposed CSP parabolic trough site alternatives

3.3 Design/Layout Alternatives

During the Scoping phase, potential layouts were proposed for the CSP based on parabolic trough technology. It is important to note that these alternative power plant layouts were informed by the findings and recommendations of the baseline specialist assessments that were undertaken during the Scoping phase of the project.

Figure 14 illustrates the layout options of two site alternatives within the Sand Draai farm and the connection of these sites to the grid through the existing power line on site using proposed power line route options. Each of the alternative sites will also be connected to a water pipeline depending on the option that is preferred.

Access to the site is proposed from the south-western corner of the property and the road will follow the proposed water pipeline route alignment options.

3.3.1 Linear Infrastructure Corridors

Two corridors/servitudes of 200 m were identified that will each accommodate a planned access road, a water pipeline (to provide water from the Ebenhaeser abstraction point) and a power line that will connect the selected site to the Garona substation.

3.3.1.1 Water Supply Pipelines

Water is proposed to be obtained from an abstraction point located on the Orange River. A permanent water pipeline will be constructed from the abstraction point. The length of the proposed pipeline is estimated to be between 20 – 25 km, depending on the final site selected. The proposed water pipeline has been aligned within proposed corridors along the northern (Alternative 1) and southern borders (Alternative 2) of the farm Sand Draai. An assessment of the proposed alignments has been undertaken during this EIA phase from the sources of water to the point of usage.

3.3.1.2 Access Roads

Appropriate access roads (temporary and permanent) will be constructed to link the proposed power plant with the nearby existing road network. These routes have been assessed as corridors from which alignments may be designed. The corridors cater for temporary (to be used during construction) and permanent (to be used during operation) access and site roads. Two proposed corridors have been identified for possible roads for access to and from the proposed sites. The proposed access roads have been aligned within proposed corridors along the northern (Alternative 1) and southern borders (Alternative 2) of the farm Sand Draai. The proposed road will be gravel and approximately 8 m in width and 14 km in length. These access roads will tie in with the existing N8/N14 gravel road.

3.3.1.3 Power (Transmission) Line

The exact length and route of the alignment of the proposed 132 kV transmission line is estimated to be between 10 - 15 km in length. The proposed power line has been aligned within corridors along the southern (Alternative 1) and northern (Alternative 2) borders of the farm Sand Draai and adjacent to the Eskom 132 kV line across the farm Bokpoort that leads to the Garona substation. Each proposed power line will connect with Eskom's Garona distribution and transmission substation. The Garona substation forms part of the national transmission network which will enable the supply of electricity to Eskom's distribution network running from the Garona substation to the Upington region in addition to the transmission network running from Garona substation to the Ferrum substation (near Sishen). The route of transmission lines will be largely informed by the layout of the proposed CSP plant.

3.4 No-Go Alternative

The ‘do-nothing’ alternative is the option of not establishing new concentrating solar power plant at the identified site in the Northern Cape Province.

South Africa currently relies almost completely on fossil fuels as a primary energy source (approximately 90%) with coal providing 75% of the fossil fuel based energy supply[5]. Coal combustion in South Africa is the main contributor to carbon dioxide emissions, which is the main greenhouse gas that has been linked to climate change.

An emphasis has therefore been placed on securing South Africa's future power supply through the diversification of power generation sources. Furthermore, South Africa would have to invest in a power generation mix, and not solely rely on coal-fired power generation, to honour its commitment made under the Copenhagen Accord and to mitigate climate change challenges. Under the Accord, the country committed to reduce its carbon dioxide emissions by 34% below the "business as usual" level by 2020.

With an increasing demand in energy predicted and growing environmental concerns about fossil fuel based energy systems, the development of large-scale renewable energy supply schemes such as Concentrating Solar Power is strategically important for increasing the diversity of domestic energy supplies and avoiding energy imports in the country.

Without the implementation of this project, the use of renewable options for power supply will be compromised in the future. This has potentially significant negative impacts on environmental and social well-being. Therefore, the no-go option is not considered as a feasible option on this proposed project.

[5] Department of Minerals and Energy. 1999. *Digest of South African Energy Statistics*, compiled by CJ Cooper.

4 PROJECT NEED AND DESIRABILITY

The subsequent section addresses the project's need and desirability according to the DEA's Guideline on Need and Desirability[6]. A number of questions are presented in the Guideline, which assists in the identification of the project's need and desirability. These key questions and answers are presented in Table 8 and further serve as confirmation that the proposed project is in line with the planning requirement of the Municipality and that reasonable measures have been taken to determine the best practicable environmental option for the proposed site.

Table 8: Project need and desirability

Need and Desirability
1. Is the activity permitted in terms of the property's existing land use rights? No
The proposed CSP plant, based on parabolic trough technology - will be constructed in a preferred area on the farm Sand Draai 391, Portion 0. The overall footprint of the area is approximately 700 ha and the portion of the farm is currently zoned as agriculture. Whilst the activity is not permitted in terms of the property's current zoning, the proximity of the CSP plant and a consolidation of impacts on the farm Sand Draai 391, and a zoning application will be lodged with the Municipality.
2. Will the activity be in line with the planning requirements (i.e. Integrated Development Plan – IDP and Spatial Development Framework - SDF) of the Local Municipality? Yes
According to the !Kheis Local Municipality (KLM) SDF (2014), the proposed project is located within an area that is earmarked for the construction, operation and launching of solar power projects. The proposed activity is therefore in line with the KLM planning requirements.
3. Is the land use (associated with the activity being applied for) considered within the timeframe intended by the existing approved SDF agreed to by the relevant environmental authority (i.e. is the proposed development in line with the projects and programmes identified as priorities within the credible IDP)? Yes
According to the !Kheis Local Municipality (KLM) SDF (2014), the proposed project is located within an area that is earmarked for the construction, operation and launching of solar power projects. The proposed land use is therefore best suited to the area selected for the development of the solar power projects in the area.
4. Would the approval of this application compromise the integrity of the existing environmental management priorities for the area and if so, can it be justified in terms of sustainability considerations? No
It is not envisioned that the proposed project will compromise the integrity of any existing environmental management priorities for the area. It should also be reiterated that the proposed project is located in an area that has been earmarked for the construction, operation and launching of solar power projects and related uses (KLM SDF) and therefore the existing environmental priorities for the area will not be compromised.
5. Does the community/area need the activity and the associated land use concerned (is it a societal priority)? (This refers to the strategic as well as local level (e.g. development is a national priority, but within a specific local context it could be inappropriate.) Yes
The KLM SDF indicates that with a range of new solar power projects being developed in the area, and the region has to urgently embark on a new economic trajectory to address the growing unemployment, poverty and despair many of its people have to endure on a daily base. It is also estimated that the project could create up to 1500 direct jobs.
6. Are the necessary services with adequate capacity currently available (at the time of application), or must additional capacity be created to cater for the development? No
It was indicated by the Municipal Manager, Teresa Scheepers, that infrastructure like medical facilities, water, sewage etc. would need to be expanded to accommodate the influx of people to the area. For the construction of the CSP plant using parabolic trough technology, water would need to be abstracted form the Orange River to be used on site. Waste (general and hazardous) generated on site will not be removed by Municipal services and the local Municipality does not have any

[6] Department of Environmental Affairs. (2014). Guideline on Need and Desirability in terms of the Environmental Impact Assessment Regulations, 2010.

Need and Desirability
registered waste sites. External waste removal services will have to be used as is the current situation with the Bokpoort CSP plant. It is therefore foreseen that additional capacity would need to be created to accommodate future developments.
7. Is this development provided for in the infrastructure planning of the municipality, and if not what will the implication be on the infrastructure planning of the municipality (priority and placement of services and opportunity costs)? No
The proposed project is not specifically provided for in the IDP however, the proposed area for the project is indicated in the KLM SDF as an area for the expansion of solar and related uses. The proposed project will be on "solar property" and there are solar plants being developed on adjacent farms in the area (e.g. Bokpoort).
8. Is this project part of a national programme to address an issue of national concern or importance? Yes
South Africa has a high level of renewable energy potential and to this end the South African Government has set a target of 10 000 GWh renewable energy contribution to final energy consumption by 2013, to be produced mainly from biomass, wind, solar and small-scale hydro. The renewable energy is to be utilised for power generation and non-electric technologies such as solar water heating and bio-fuels. This relates to approximately 4% (1 667 MW) of the projected electricity demand for 2013 (41 539 MW). In 2010, South Africa released its Integrated Resource Plan which outlines the country's energy build-out strategy to 2030. Under the plan the country seeks to increase its power capacity from 43GW to 89.5GW, with renewables making up as much as 20% of the mix. Wind and solar PV make up the largest portions of the renewables mix, receiving 9.2GW and 8.4GW, respectively. To contribute towards this target and towards socio-economic and environmentally sustainable growth, and kick start and stimulate the renewable energy industry in South Africa, the Renewable Energy Independent Power Producers Programme (REIPPPP) was initiated by the Department of Energy (DoE) to facilitate the generation of 3 725 MW of renewable energy by 2016 by independent power producers (IPPs) as set out in the Integrated Resource Plan (IRP) 2010-2030. Since the IRP was initiated in March 2010, the Department of Energy (DoE) has entered into a significant number of agreements under Bid Window 1 and 19 agreements under Bid Window 2. Two CSP plants were awarded in the first Bid Window i.e. Khi Solar One and the Kaxu Solar One (Abengoa Solar). The Bokpoort CSP is a concentrated solar power project (Solafrica and ACWA Power) that was selected as the only CSP plant in the second round of the REIPPPP. The plant will have a net generation capacity of 50 MW with 9.3 hours of thermal energy storage. Once completed, it will have the longest amount of thermal storage of any parabolic trough CSP power plant in the world. South Africa ran three REIPPP tenders in 2014: the Round 3b for solar thermal in March, the small-scale programme in April and Round 4 of the programme in August. Round 3b saw 200MW of solar thermal capacity up for grabs, which was awarded in January 2015. The small-scale programme commenced in April 2014 and will have four submission windows of 50MW each for projects between 1-5MW. Round 4 submissions opened in August 2014 with 1.1GW available; wind received 590MW of the available capacity and PV 400MW. South Africa's expansion of renewable capacity grew further in 2015, when the government awarded 2.2GW of renewables under the Round 4 bidding window and announced it will be running an expedited bidding window to procure a further 1.8GW. In April 2015, the government announced it would seek to procure a further 6.3GW of renewables, predominantly made up of wind and solar. With the addition of this South Africa is on track to reach its 2030 target under the Integrated Renewables Plan.
9. Do location factors favour this land use (associated with the activity applied for) at this place? (This relates to the contextualisation of the proposed land use on this site within its broader context.) Yes
As indicated in Point 2 above, the proposed project is located within an area that is earmarked for the construction, operation and launching of solar power projects.
10. Is the development the best practicable environmental option for this land/site? Yes
A site selection analysis was conducted in the Pre-Feasibility and Feasibility Phases for the proposed project to determine the site location of the proposed solar plants. Having considered the advantages and disadvantages for the two site alternatives options as well as the ancillary infrastructure, the current site (Site Alternative 1) is the preferred location as it will have a cumulative impact.
11. Will the benefits of the proposed land use/development outweigh the negative impacts of it? Yes
It is envisioned that the positive impacts of the proposed project will outweigh the negative impacts. The proposed project will assist will job creation and provide a massive boost to the local economy. The project also falls in line with the REIPPPP (see above) and the National Development Plan for 2030.

Need and Desirability
12. Will the proposed activity/ies contribute to any of the 17 Strategic Integrated Projects (SIPS)? Yes
The proposed project will contribute to SIP 9. SIP 9: Electricity generation to support socio- economic development. Accelerate the construction of new electricity generation capacity in accordance with the IRP2010 to meet the needs of the economy and address historical imbalances.
13. How does the project fit into the National Development Plan for 2030?
The proposed project involves diversification of electricity production fuel sources, improved efficiency in electricity production, a decrease in the quantity of fossil fuel burned, a decrease in greenhouse gas (GHG) emissions and a decrease in a number of other aerial pollutant emissions. This is in line with Government's commitment to reduce the country's emissions by 34% by 2020 and 42% by 2025 with financial and technical support from the international community. The project can therefore be seen as making a contribution to improving the sustainability of development in South Africa. Hence, the proposed plant is likely to qualify for registration as a Clean Development Mechanism (CDM) project. This allows so-called carbon credits to be sold from the project. If the project is formally registered with the Executive Board of the CDM, managed by the United Nations Framework Convention on Climate Change, these reductions in GHGs can be registered as Certified Emission Reductions (CERs). CERs, the formal name for carbon credits, can then be sold to buyers who need these credits for compliance purposes in developed countries.
14. Have the general objectives of Integrated Environmental Management as set out in section 23 of NEMA been taken into account. Yes
The EIA study for the proposed project, had the following key objectives: ▪ Undertake an assessment of the social and biophysical environments of the affected area by the proposed project; ▪ Undertake a detailed assessment of the site alternatives in terms of environmental criteria including the rating of significant impacts as well as cumulative impacts (Section 9); ▪ Identify and recommend appropriate mitigation measures (included in **Appendix G**- EMPr) for potentially significant environmental impacts; and ▪ Undertake a fully inclusive public participation process to ensure that Interested and Affected Party (I&AP) issues and concerns were recorded and commented on and addressed in the EIA process (refer to **Appendix E**). All of these objectives have been met and this has culminated in the formulation of an Environmental Impact Statement by the EAP.
15. Describe how the principles of environmental management as set out in section 2 of NEMA have been taken into account.
▪ Regulatory and statutory compliance: the objectives of the proposed project are to ensure compliance with applicable legislation, guidelines, regulations and standards. ▪ Environmentally: The results of the impact assessment indicate that the most significant impacts as a result of the proposed project would include impacts on biodiversity, avifaunal, geohydrology, surface water, aquatics, socio-economic, traffic, noise and visual. These impacts can be successfully mitigated through the measures and recommendations proposed by the various specialist disciplines and the EMPr (refer to **Appendix G**). ▪ Public Participation (PP) - One of the general objectives of integrated environmental management laid down in Section 23(2)(d) of NEMA is to "ensure adequate and appropriate opportunity for public participation in decisions that may affect the environment". A comprehensive PP process has been undertaken for the project (refer to **Appendix E**) that started during the Scoping Study and carried through to the EIA Study, to meet this objective.

5 LEGISLATION

In order to protect the environment and ensure that this development is undertaken in an environmentally responsible manner, there are a number of significant pieces of environmental legislation that will need to be complied with. They include the following:

5.1 National Environmental Management Act (No 107 of 1998)

The National Environmental Management Act (No 107 of 1998) [NEMA] as amended provides the overarching legislative framework for environmental governance in South Africa. Several Specific National Environmental Management Acts (SEMAs) have now been promulgated, all of which fall under the overarching NEMA (discussed below). The point of departure of NEMA is a set of National Environmental Management Principles that inform any subsequent environmental legislation, implementation of that legislation and formulation and implementation of environmental management plans at all levels of government.

NEMA gives expression to the Bill of Rights, within the Constitution of South Africa (No 108 of 1996), which states that everyone has a right to a non-threatening (safe and healthy) environment and requires that reasonable measures are applied to protect the environment. This protection encompasses preventing pollution and promoting conservation and environmentally sustainable development. These principles are embraced in NEMA and given further expression.

5.1.1 EIA Regulations (2014)

In December 2014, the new EIA Regulations were promulgated in order to revise the procedure and criteria relating to environmental authorisations for the commencement of activities in order to avoid detrimental impacts on the environment or, where it cannot be avoided, to mitigate and effectively manage these impacts and optimise positive environmental impacts. These Regulations and a revised set of Listed Activities (Listing Notices 1, 2 and 3) came into force on 08 December 2014.

The proposed project triggers the following EIA Regulation (2014) listed activities:

Table 9: EIA Regulations (2014) listed activities

Activity Number	Applicability	Activity as per the Listing Notice
LISTING NOTICE 1 (GN R.983)		
Activity 9	A water supply pipeline will be associated with the proposed project. The EIA study assesses two corridors for the proposed water supply pipeline. It is estimated that the pipeline will be between 20-25 km in length and 0.4 m diameter.	The development of infrastructure exceeding 1,000 m in length for the bulk transportation of water or storm water— (i) with an internal diameter of 0.36 m or more.

Activity Number	Applicability	Activity as per the Listing Notice
LISTING NOTICE 1 (GN R.983)		
Activity 11	A 132 kV overhead power line is proposed to be constructed. The exact length and route of the alignment of the proposed 132 kV transmission lines is estimated to be between 10-15 km in length. The proposed power line has been aligned within alternative corridors along the northern and southern borders of the farm Sand Draai. The preferred power line will connect with Eskom's Garona distribution line.	The development of facilities or infrastructure for the transmission and distribution of electricity outside urban areas or industrial complexes with a capacity of more than 33 but less than 275 kV.
Activity 12	The proposed access road and pipeline development will traverse watercourses (a number of smaller ephemeral / episodic watercourses) and riparian areas associated with the Orange River. In addition, water will be abstracted from the Orange River.	The development of— (xii) infrastructure or structures with a physical footprint of 100m^2 or more; where such development occurs— a) within a watercourse;
Activity 19	Construction of road and pipeline across and within the watercourses will require the removal of material and clearing of the riparian areas associated with the Orange River.	The infilling or depositing of any material of more than 5m^3 into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 5m^3 from a watercourse.
Activity 24	Access roads to the site and within the site will be required to be constructed. Appropriate access roads (temporary and permanent) will be constructed to link the proposed power plant with the nearby existing road network. The proposed access roads have been aligned within proposed corridors along the northern and southern borders of the farm Sand Draai. The proposed road will be gravel and approximately 8 m in width and 14 km in length. These access roads will tie in with the existing N8/N14 gravel road.	The development of a road with a reserve wider than 13.5 m, or where no reserve exists where the road is wider than 8 m.
LISTING NOTICE 2 (GN R.984)		
Activity 1	It is estimated that the CSP plant using parabolic trough technology would have a maximum generation capacity of 150 MW.	The construction of facilities or infrastructure for the generation of electricity where the electricity output is 20 megawatts or more.

Activity Number	Applicability	Activity as per the Listing Notice
LISTING NOTICE 1 (GN R.983)		
Activity 4	Diesel will be stored in aboveground storage tanks within the power block – storage up to1000 m^3 with a throughput of less than 50000 m^3/annum.	The development 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 500m^3.
Activity 16	The project will require water storage (regulation) ponds. Preliminary design gives a total height of 6 m (water level at 5 m). Approximately 750 000 m^3 is required during the construction phase and 350 000 m^3 of water per annum during the operations phase.	The development of a dam where the highest part of the dam wall, as measured from the outside toe of the wall to the highest part of the wall, is 5 m or higher or where the high-water mark of the dam covers an area of 10 ha or more.
Activity 25	Wastewater generated by the process will undergo treatment at a wastewater treatment plant. The water treatment process includes two multi-stage Reverse Osmosis (RO) units, and electrodeionization (EDI) equipment. Wastewater from water treatment system, including 1st pass RO reject and EDI, as well as a portion of the steam cycle blowdown are then discharged to the evaporation ponds.	The development and related operation of facilities or infrastructure for the treatment of effluent, wastewater or sewage with a daily throughput capacity of 15,000m^3 or more.

5.2 National Environmental Management: Waste Act (No 59 of 2008)

The National Environmental Management: Waste Act (No 59 of 2008) and Regulations, reforms the law regulating waste management in order to protect health and the environment by providing reasonable measures for the prevention of pollution and ecological degradation and for securing ecologically sustainable development; to provide for institutional arrangements and planning matters; to provide for national norms and standards for regulating the management of waste by all spheres of government; to provide for specific waste management measures; to provide for the licencing and control of waste management activities; to provide for the remediation of contaminated land; to provide for the national waste information system; to provide for compliance and enforcement; and to provide for matters connected therewith.

On 03 July 2009, under section 19 (1) of the National Environmental Management: Waste Act (No 59 of 2008), a list of waste management activities (GN 921) which have, or are likely to have a detrimental effect on the environment were published in November 2013. No person may commence, undertake or conduct a waste management activity listed GN 921 unless a licence is issued in respect of that activity. GN 921 makes reference to three categories of licencing i.e. Category A, B and C. Category A activities require a Basic Assessment, Category B activities require a full scoping and EIA. Category C activities do not require a Waste Management Licence but must be registered with the Competent Authority and must comply with relevant requirements or standards determined by the Minister.

This list of applicable waste activities requiring a Waste Management Licence for this project, in terms of the NEM: WA is presented in Table 10.

Table 10: Listed activities according to Category A and C of NEM:WA, GN 921

Category & Activity	Description	Applicability
Category A, 1	The storage of general waste in lagoons.	Three evaporation ponds consisting of three compartments with a combined area of approximately 8.5 ha is proposed, to completely contain all rejected water from the water treatment system and the steam cycle.
Category A, 12	The construction of a facility for a waste management activity listed in Category A of this Schedule (not in isolation to associated waste management activity).	Linked to Activity 1 above.
Category C, 2	Waste materials will be generated on site by the project. These include: • Used oils; • Oily rags; • Spent oil filters; • Fluorescent tubes, etc.	The storage of hazardous waste at a facility that has the capacity to store 80m3 of hazardous waste at any one time, excluding the storage of hazardous waste in lagoons or temporary storage of such waste.

5.3 The National Water Act (No 36 of 1998)

The purpose of the National Water Act (No 36 of 1998) ('the National Water Act")(as amended) is to provide for fundamental reform of the law relating to water resources; to repeal certain laws; and to provide for matters connected therewith.

In terms of section 21, the water uses that are recognised for purposes of the National Water Act include the following:

- ***Water Uses***
  - **Section 21(a) – Taking water from a water resource;**
  - **Section 21(b) – Storing water;**
  - **Section 21(c) – Impeding or diverting the flow of water in a watercourse;**
  - **Section 21(g) – Disposing of waste in a manner which may detrimentally impact on a water resource;**
  - **Section 21(h) – Disposing in any manner of water which contains waste from, or which has been heated in, any industrial or power generation process;**
  - **Section 21(i) – Altering the bed, banks, course or characteristics of a watercourse;**

In terms of the definitions contained in section 1 of the National Water Act, "water resource" includes a watercourse, surface water, estuary, or aquifer. "Aquifer" means a geological formation which has structures or textures that hold water or permit appreciable water movement through them.

"Watercourse" 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.

Furthermore, in terms of the definitions contained in section 1 of the National Water Act, "waste" "includes any solid material or material that is suspended, dissolved or transported in water (including sediment) and which

is spilled or deposited on land or into a water resource in such volume, composition or manner as to cause, or to be reasonably likely to cause, the water resource to be polluted".

This EIA study will be used to support the Water Use Licencing Application (WULA) process.

5.4 National Environmental Management: Air Quality Act (No 39 of 2004)

The National Environmental Management: Air Quality Act (No 39 of 2004) has shifted the approach of air quality management from source-based control to receptor-based control. The main objectives of the Act are to:

- Give effect to everyone's right 'to an environment that is not harmful to their health and well-being'
- Protect the environment by providing reasonable legislative and other measures that (i) prevent pollution and ecological degradation, (ii) promote conservation and (iii) secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development.

The Act makes provision for the setting and formulation of national ambient air quality standards for 'substances or mixtures of substances which present a threat to health, well-being or the environment'. More stringent standards can be established at the provincial and local levels.

The control and management of emissions in AQA relates to the listing of activities that are sources of emission and the issuing of emission licences. Listed activities are defined as activities which 'result in atmospheric emissions and are regarded to have a significant detrimental effect on the environment, including human health'. Listed activities have been identified by the Minister of the Department of Environmental Affairs and atmospheric emission standards have been established for each of these activities. These listed activities now require an atmospheric emission licence to operate. The issuing of emission licences for Listed Activities is the responsibility of the metropolitan and district municipalities.

In addition, the Minister may declare any substance contributing to air pollution as a priority pollutant. Any industries or industrial sectors that emit these priority pollutants will be required to implement a Pollution Prevention Plan. Municipalities are required to 'designate an air quality officer to be responsible for co-ordinating matters pertaining to air quality management in the Municipality'. The appointed Air Quality Officer is responsible for the issuing of atmospheric emission licences.

5.5 Hazardous Substance Act (No 15 of 1973) and Regulations

The purpose of the Act is:

- To provide for the control of substances which may cause injury or ill-health to or death of human beings by reason of their toxic, corrosive, irritant, strongly sensitizing or flammable nature or the generation of pressure thereby in certain circumstances, and for the control of certain electronic products;
- To provide for the division of such substances or products into groups in relation to the degree of danger;
- To provide for the prohibition and control of the importation, manufacture, sale, use, operation, application, modification, disposal or dumping of such substances and products; and
- To provide for matters connected therewith.

5.6 Other Relevant Acts, Guidelines, Department Policies and Environmental Management Instruments

Table 11: Legislative requirements in terms of other Acts, Policies and Plans

Legislation	Relates to
National Forests Act (No 84 of 1998) and Regulations	No person may cut, disturb, damage or destroy any indigenous, living tree in a natural forest, except in terms of a licence issued under section 7(4) or section 23; or an exemption from the provisions of this subsection published by the Minister in the Gazette. These sections deal with protected trees, with the Minister having the power to declare a particular tree, a group of trees, a particular woodland, or trees belonging to a certain species, to be a protected tree, group of trees, woodland or species. In terms of section 15, no person may cut, disturb, damage, destroy or remove any protected tree; or collect, remove, transport, export, purchase, sell, donate or in any other manner acquire of dispose of any protected tree, except under a licence granted by the Minister.
Fencing Act (No 31 of 1963)	Any person erecting a boundary fence may clean any bush along the line of the fence up to 1.5 meters on each side thereof and remove any tree standing in the immediate line of the fence. However, this provision must be read in conjunction with the environmental legal provisions relevant to protection of flora.
Northern Cape Nature Conservation (No 9 of 2009)	Red listed plant species like Aloe species occurring in the Northern Cape are protected under the this Act and may not be disturbed or re-located without a valid Flora Permit from the provincial Department of Environment and Nature Conservation (DENC)
National Environmental Management: Biodiversity Act (No 10 of 2004)	These sections deal with restricted activities involving alien species; restricted activities involving certain alien species totally prohibited; and duty of care relating to listed invasive species. These sections deal with restricted activities involving listed invasive species and duty of care relating to listed invasive species.
Occupational Health and Safety Act (No 85 of 1993) and Regulations	General duties of employers to their employees. General duties of employers and self-employed persons to person other than their employees.
Other Acts, Provincial Policies and Guidelines	
Northern Cape Provincial Growth and Development Strategy. 2004 – 2014 **Z.F. Mgcawu Municipality Integrated Development Plan 2011/2012 (5 Year Plan)** **South African Millennium Development Goals** **National Development Plan (NDP) 2030** **Renewable Energy Independent Power Producers Programme (REIPPPP)** **Integrated Resource Plan (2010)** **South African Renewable Energy Feed-in Tariff (REFIT)** **!Kheis Local Municipality Spatial Development Framework (2014)**	

Legislation	Relates to
!Kheis Local Municipality Integrated Development Plan (2014 - 2019)	
!Kheis Local Municipality By-Laws	

6 PUBLIC PARTICIPATION

One of the general objectives of integrated environmental management laid down in Section 23(2)(d) of NEMA is to "*ensure adequate and appropriate opportunity for public participation in decisions that may affect the environment*". An inadequate and non-transparent Public Participation Process (PPP) has the potential to provide a negative decision and perception regarding the proposed project.

The EIA Regulations (2014) places a lot of emphasis on the public participation process and have been revised to contain comprehensive guidelines to involve the public in the EIA study. The primary aims of the public participation process include:

- Meaningful and timeous participation of Interested and Affected Parties (I&APs);
- Identification of issues and concerns of key stakeholders and I&APs with regards to the proposed development, i.e. focus on important issues;
- Promotion of transparency and an understanding of the proposed project and its potential environmental (social and biophysical) impacts;
- Accountability for information used for decision-making;
- Serving as a structure for liaison and communication with I&APs;
- Assisting in identifying potential environmental (social and biophysical) impacts associated with the proposed development; and
- Inclusivity (the needs, interests and values of I&APs must be considered in the decision-making process).

The minimum requirements for public participation as contained in Chapter 6 of the EIA Regulations (2014) are contained hereunder and are discussed in detail in subsequent sections:

Public Participation Requirements according to Section 40 - 44 of GN R.982	Specific Actions to Ensure Compliance
Section 41 (2) (a) – Fixing a notice board at a place conspicuous to and accessible by the public at the boundary, on the fence of the site or any alternative site applicable to the application	The notice board according must – (a) give details of the application subject to public participation (b) state – i. whether basic assessment or scoping procedures are being applied for ii. the nature and location of the activity to which the application relates iii. where further information on the application can be obtained iv. the manner in which and the person to whom representation in respect of the application may be made The notice board must be – (c) of a size of at least 60cm by 42cm (d) Display the required information in lettering and in a format as may be determined by the competent authority
Section 41 (2) (b) – The person conducting a public participation process must give written notice to the occupiers of the site and the owner or person in control of the site; owners and occupiers of land adjacent to the site; municipal councillor; municipality; municipality having jurisdiction; and any organ of state having jurisdiction in respect of any aspect of the activity	Compile introductory letters to adjacent landowners, municipal councilor/s, municipality and organs of state

Public Participation Requirements according to Section 40 - 44 of GN R.982	Specific Actions to Ensure Compliance
Section 41 (2) (c) & (d) – Place an advert in one local newspaper or official Gazette and or placing an advertisement in at least one provincial newspaper or national newspaper, if the activity has or may have an impact that extends beyond the boundaries of the metropolitan or district municipality	An advert will be placed in the local newspapers (the Gemsbok) to advertise the availability of the ESR and EIR for review and public meeting information
Section 42 (1) – A proponent or applicant must ensure the opening and maintenance of a register of interested and affected parties and submit such a register to the competent authority, which register must contains the names, contact details and addresses of – (a) All persons who as a consequence of the PPP have submitted written comments or attended meetings with proponent, applicant or EAP (b) All persons who have requested the proponent or applicant in writing for their names to be placed on a register (c) All organs of state which have jurisdiction in respect of the activity to which the application relates	Comprehensive I&AP database/register will be opened and maintained
Section 43 (1) a registered I&AP is entitled to comment, in writing, on all reports or plans submitted to such party during the PPP and to bring to the attention of the proponent or applicant any issues which that party believes may be of significance to the consideration of the application, provided that the I&AP discloses any direct business, financial, personal or other interest which that party may have in the approval or refusal of the application	According to Section 40 (1) a period of 30 days is provided to I&APs to submit comments on the EIR as well as the report contemplated in regulation 32 if such reports or plans are submitted at different times
Section 43 (2) any State department that administers a law relating to a matter affecting the environment must be requested to comment within 30 days	According to Section 40 (1) a period of 30 days is provided to State Departments to submit comments on the EIR as well as the report contemplated in regulation 32 if such reports or plans are submitted at different times

6.1 Consultation with Competent Authorities

The competent authority and commenting authorities issuing decisions regarding the project as well as consultation throughout the EIA process are presented in Table 12 below.

Table 12: Competent and Commenting Authority associated with the project

Authority	Role	Licence / Approval	Consultation to date
Department of Environmental Affairs (DEA)	Competent Authority for Integrated Environmental Authorisation application	Environmental Authorisation & Waste Management Licence	▪ Integrated Environmental Authorisation application form received on 17 August 2015 ▪ Submission of the Final Consultation ESR on 30 September 2015 ▪ Approval of the Final Consultation ESR on 11 November 2015
Northern Cape Department of Environment and Nature Conservation (NCDENC)	Commenting Authority	(Comments on the documentation, no formal approval given)	▪ Submission of the ESR on 3 July 2015 for comment

Authority	Role	Licence / Approval	Consultation to date
Northern Cape Department of Agriculture, Forestry and Fisheries	Commenting Authority	(Comments on the documentation, no formal approval given)	▪ Letter received from DAFF on 7 August 2016 ▪ Letter received from DAFF on 19 April 2016
Department of Water and Sanitation (DWS)	Commenting & Competent Authority for water use licencing process	Water Use Licence	▪ Submission of the ESR on 3 July 2015 for comment
SAHRA	Authority for protection of South Africa's cultural heritage	(Confirmation that a Heritage Assessment is needed)	▪ Heritage Report was loaded on SAHRIS on the 1 September 2015 for comment Case ID8370 ▪ Comments received on 8 February 2016 from SAHRA requesting a paleontological assessment to be undertaken

6.2 Consultation with other Relevant Authorities and Key Stakeholders

Consultation with other relevant authorities and key stakeholders was undertaken through telephone calls and written correspondence in order to actively engage these stakeholders from the outset and to provide background information about the project. A list of these stakeholders is provided in **Appendix E**.

6.3 I&AP Database

All I&AP information (including contact details), were recorded within a database (**Appendix E**). This database was being updated on an on-going basis throughout the project, and acts as a record of the communication/involvement process.

6.4 Identification of Interested and Affected Parties

I&APs and key stakeholders were identified during the ESS phase of the project. The identification of I&APs and key stakeholders continued in the EIA phase of the project as the PPP is was a continuous process that ran throughout the duration of the EIA study.

6.5 Advertising

Advertisements on the availability of the EIR and final EMPr for public review and the public meetings was placed in the *Gemsbok* newspaper (**Appendix E**).

6.6 Issues Trail

All issues, comments and concerns raised during the public participation process to date are included in **Appendix E**.

A summary of the issues raised to date is presented in Table 13.

Table 13: Summary of issues raised to date

Issue/s	Response
▪ Noise impacts on animals.	▪ In review of the results calculated from the propagation model, it indicates that the cumulative effects of the operations are minimal on the surrounding environment and the majority of noise will be localised to the source.
▪ Dust generation through the cleaning panels and mirrors.	▪ The mirrors require periodic cleaning, varying typically between fortnightly to weekly, depending on the local conditions which affect the rate of dust deposition on the mirrors. The water used for mirror cleaning will be demineralised, it is crucial that the cleaning water be pure, to avoid abrasion of the front surfaces of the mirrors while using the high pressure cleaning equipment. Water abstraction, treatment and usage will need to be authorised through a WUL and WML.
▪ Phasing of construction.	▪ The projects comprising the solar farm will be phased. As far as possible infrastructure will be shared between the plants within the solar farm.
▪ Traffic impacts and irresponsible use of the roads.	▪ Traffic control measures will be incorporated into the EMPr. A complaints register will also be maintained during the construction and operational phase of the project.
▪ Issues relating to the state of roads in terms of: o Dust generated through traffic on the gravel road between the N8 & N14. o Increased wear and tear on existing roads.	▪ The Air Quality Assessment indicated that the use of southern Gariep Road would be preferred as it has less of an impact during the generation of dust. ▪ In addition, the Proponent has met with ACWA Power and the Northern Cape Department of Transport with a possible memorandum of understanding in this regard. The cost of tarring a part of the identified gravel road (+- 20 km) has a cost implication of R100 million, which would make competitive bidding for the CSP project very difficult. However with the 4-5 planned future solar plants, in the area, a co-operative effort is being explored. ▪ The access route to the plant site will consist of 3 distinct sections from the N8 turn-off into the Gariep road: 1. the stretch of Gariep Road extending from the N8 to the end of the Transnet bridge (Section 1); 2. the stretch of Gariep Road extending from the end of the Transnet bridge to the Sand Draai road entry point (Section 2); and 3. a new road to be constructed through the Sand Draai farm (Section 3). Section 1 is the same route that was used by the Bokpoort CSP project during its construction phase and will continue to be used by Bokpoort CSP through the 20-year operation phase. The Applicant is of the view that the current gravel surface of Section 1 is not suitable for the construction and operation requirement of the project. The Applicant understands that Bokpoort CSP will consider implementing measures in the short-term that may improve the quality of Section 1. In addition to Bokpoort CSP, multiple other project developers are actively pursuing solar power and potentially other large-scale infrastructure developments in the vicinity of the project and for their purposes will be traversing Section 1 as well. A coordinated approach will therefore be required to ensure that any short-term and/or permanent solutions that will be implemented on Section 1 will be suitable for the planned infrastructure as well as other stakeholders including Eskom, Transnet, the Department of Roads and Public Works, local farmers, and citizens that regularly travel this route. The Applicant will engage with all stakeholders towards identifying feasible solutions that are suitable to all stakeholder groups. Certain improvements

Issue/s	Response
	may require the commitment of all stakeholders; in these cases the entire burden cannot reasonably be undertaken by the Applicant on it's own. The Applicant is aware of, and will continue to participate in, a Basic Assessment process being undertaken by Environmental Impact Management Services to assess the need for improvement of Section 1 and make recommendations towards the most appropriate and necessary measures that will be required for the road. Section 2 will receive the same treatment as Section 1. Section 3 represents a new private road that will be constructed for the sole purpose of access to the plant across the Sand Draai farm. This road will be constructed according to a specification that will be developed by the EPC contractor as adequate for construction and long-term operational purposes.
▪ A detailed Climatological study must be conducted in the EIA study. The impact that the new CSP plant would have on the climate or the micro-climate of the surrounding area needs to be investigated. The possibility of all the solar plants generating a 'heat island" must also be investigated.	▪ It is expected that during the day at a height of 2.5 m above the array, an increase in temperature is noted to reach up to 1.9°C warmer than the surrounding ambient air, with the thermal increase having completely dissipated 11.5 m above the array. It is likely that by a distance of 300 m from the edge of the array, the temperature is approximately 0.3°C above ambient temperature. It is foreseen that the proposed project will not have any effect on the micro-climate of the surrounding area.
▪ Visual impacts and the direct/indirect effect on tourism.	▪ Overall, the degree of visual intrusion associated with the parabolic trough arrays at both alternative sites is likely to be low at worst, with the distance between most of the receptor locations and the alternative sites being the greatest contributing factor. The plants are thus very unlikely to result in the creation of a visual impact, or perceptions of visual impact by residents and other viewers in the Orange River valley, especially if the Alternative 1 site is selected for development.
▪ Impact on avifauna.	▪ The negative impact of the proposed Sand Draai parabolic trough facility on local priority avifauna will be medium to high, depending on the nature of the impact and the level of mitigation which is applied. ▪ The cumulative impact of the facility on regional priority avifauna will range from medium to low, depending on the level mitigation which is applied.
▪ Removal and relocation of protected tree species.	▪ DAFF permits will be applied for and will specify the procedures to be followed when protected trees need to be removed and relocated. The floral specialist will also be requested to identify any best practice methods to ensure successful relocation of protected trees. These methods will form part of the application process.
▪ Impact on value of farms in the study area.	▪ In the short term, and based on an unsurfaced Gariep Road, the economic assessment revealed that the land values of neighbouring farms, and some of the farms alongside the Gariep Road will be negatively impacted because any rational buyer will want a discount for perceived inconvenience. ▪ The economic assessment also indicated that farm values in the study area will recover if the Gariep Road had been surfaced, or the construction phases of all the potential projects had been completed, whichever comes first.
▪ Negative social impacts (crime, alcohol and substance abuse, woman abuse HIV/AIDs etc.)	▪ Has been taken into consideration during Social Impact Assessment and mitigation measures and recommendations have been incorporated into the EMPr.

Issue/s	Response
▪ Impact on service delivery.	▪ The project will include budgets for Socio-Economic Development initiatives as well as Enterprise Development initiatives. The ultimate committee appointed to manage these budgets can work with the Municipality to identify Municipal projects that may be included as supported initiatives.
▪ Is there a way to assure financial accountability can be monitored to foresee better outcomes for South African solar farms?	▪ The South African Department of Energy has been careful to limit and monitor the deployment of solar power projects over the first 5 years of the DOE Renewable Energy IPP programme. This cautious approach allows the DOE to monitor progress and the merits of solar power as well as ensuring that they do not overcommit to long-term procurement in terms of their financial capabilities.
▪ Should the project be abandoned due to financial shortfalls, what measures are available to ensure no further environmental degradation takes place? Who would be responsible?	▪ A cease in the project would result in decommissioning and rehabilitation activities being fast-tracked. The Proponent would still be responsible to ensure that the decommissioning and rehabilitation activities are carried out in compliance with the approved EMPr and Integrated Environmental Authorisation.

6.7 Review of the Environmental Impact Assessment Report and Final Environmental Management Programme

The EIR and final EMPr was made available for public review for a 30 day review period from **14 March** to **15 April 2016**. All I&APs registered on the proposed project's database was notified of the availability of the EIR and draft EMPr.

The report was available in electronic format on the Royal HaskoningDHV's website (http://www.rhdhv.co.za/pages/services/environmental/current-projects.php). Hard copies of the report will be made available for review at the following public places:

- !Kheis Public Library/Openbare Biblioteek (97 Oranje Street, Groblershoop);
- !Kheis Municipal Offices/Munisipale Kantore (97 Oranje Street, Groblershoop); and
- //Khara Hais Public Library/Openbare Biblioteek (Market Street, Upington)

Hard copies of the reports were also forwarded to:

- Department of Water and Sanitation;
- Northern Cape Department of the Environment and Nature Conservation (NCDENC).

6.8 Public Meeting

During the EIR and draft EMPr review period, a public meeting was held, on the 29th of March 2016, with the broader public and community members interested in the proposed project. The public meeting provided I&APs with the opportunity to be informed of the environmental findings as per the EIR, the mitigation measures proposed and allowing them the opportunity to raise any issues / concerns on the project.

6.9 Submission of the Final Consultation Environmental Impact Assessment Report for Decision-making

After the public review period, the Final Consultation EIR document was finalised and will be submitted to DEA for review and decision-making. The DEA has 107 days to grant or refuse authorisation of the application.

6.10 Announcement of Decision

On receipt of the Integrated Environmental Authorisation for the project, I&APs registered on the project database will be informed, through letters and e-mails, within 14 days of the acquisition.

7 DESCRIPTION OF THE RECEIVING ENVIRONMENT

The purpose of this chapter is to provide a general description of the study area environment suitable for the development of the CSP plant. The Northern Cape Province is a sparsely populated and a relatively isolated semi-desert area of South Africa. The area is therefore considered to be an area suitable for the establishment of solar energy infrastructure in South Africa. Suitable potential areas for the development of the CSP plant have been identified near Upington and Groblershoop.

7.1 Biophysical Environment

7.1.1 Locality

The study area is situated within the Z.F. Mgcawu District Municipality, in the Northern Cape Province adjacent to the Orange River. The Z.F. Mgcawu District Municipality covers an area of 103 771 square kilometres with its northern borders aligned with Botswana and Namibia. The district is traversed by the Orange River from the east to its west. Along the banks of the Orange River intensive agriculture has developed including vineyards and domestic food farms. Upington town is the main urban area for the region and serves as both an administrative and commercial centre as well as a stopover into the area's hinterland. This region attracts tourists travelling to Namibia and local reserves, such as Witsand (approximately 40 km north of Sand Draai) and the Augrabies National Park west of Upington.

The N14 and the N10 are the primary roads in the region and are the main link between the economic centres in Gauteng and Namibia. The population distribution is primarily concentrated in and around the small towns along the Orange River, and specifically in Upington. Other towns/settlements in relative close proximity to the proposed farms are, Keimoes, Kanoneiland, Louisvale, Oranjevallei, Klippunt, Grootdrink, Groblershoop, Hendriksdal and Boegoeberg.

The potential site (farm) that have been identified to establish the new CSP plant and associated infrastructure are: Sand Draai (S28°39'44.96", E22°0'6.88"). The site occurs within the !Kheis Local Municipality.

7.1.2 Climate

The climatic conditions of this region of the Northern Cape are typical of conditions characteristic of a semi-desert and the southern Kalahari. Upington is generally accepted as the hottest town in South Africa, with summer temperatures varying between 30°C and 40°C[7].

The region is characterised by fluctuating temperatures, low and unpredictable rainfall and high evaporation rates. The low annual rainfall (average of 170 – 240 mm in Upington or even lower in some surrounding areas) is significantly lower than the evaporation rate which creates the dry and arid environment. Rainfall usually occurs during the late spring and summer months with long and dry winters.

The area experiences high temperatures especially in the summer months, where daily maximums of >42°C are experienced. The annual evaporation in the area is high at approximately 2281 mm. Winter temperatures can drop to below 4°C. Frost is rare, but occurs occasionally in most years, though usually not severely.

[7] http://www.southafrica-travel.net/kalahari/e6kala01.htm

The table below indicates the average temperature profile experienced at the site for the Jan 2011 - Dec 2013 monitoring period. Daily average summer temperatures ranged between 27 – 29°C, with a maximum temperature range of 21 - 37°C. The average temperature range during the winter months ranged between 11.4 -13.4°C.

Table 14: Average monthly temperatures and humidity for the Upington area (2011 - 2013)

		Temperature	Temperature	Temperature
		Average	Max	Min
		°C	°C	°C
January		29.0	37.0	21.0
February		27.0	35.0	20.0
March		26.0	34.0	18.1
April		20.0	28.0	12.0
May		16.0	25.0	8.4
June		11.4	21.0	4.2
July		11.2	21.0	4.0
August		13.4	23.0	5.0
September		17.2	27.0	8.0
October		21.3	30.0	12.2
November		25.0	34.0	16.0
December		27.0	35.0	19.0
Annual	**Average**	20.3	29.0	12.2
Winter		16.2	25.1	9.0
Summer		24.3	33.0	16.0

7.1.2.1 Wind

Wind roses comprise of 16 spokes which represents the direction from which the winds blew during the period under review. The colours reflect the different categories of wind speeds. The dotted circles provide information regarding the frequency of occurrence of wind speed and direction categories. Based on an evaluation of the site specific meteorological data obtained from the South African Weather Services in Upington, Northern Cape, the following deductions regarding the prevailing wind direction and wind frequency can be presented.

Based on below, the predominant wind direction for the area under review is multidirectional, with primary winds originating from the south-west and northern region. Secondary winds originated mainly from the north western and western regions Figure 15.

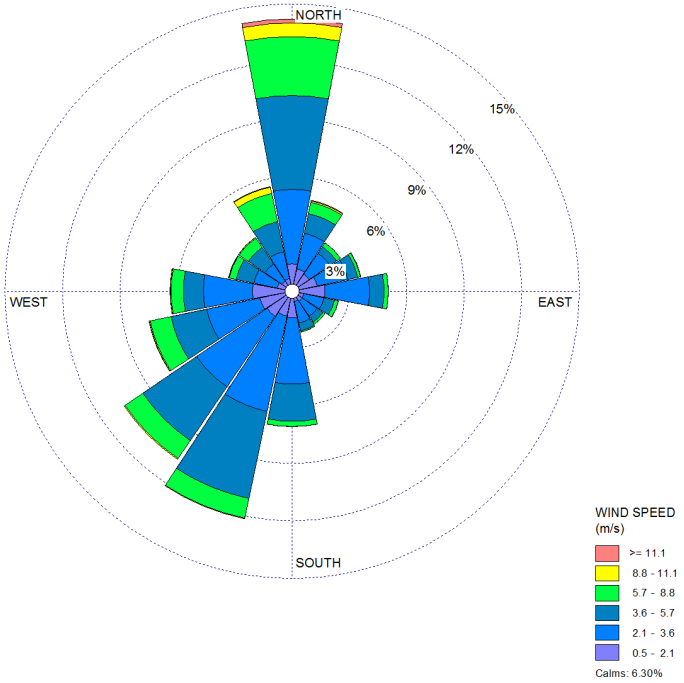


Figure 15: Wind rose for the Jan 2011 – Dec 2013 monitoring period

Calms wind (<0.5 m/s) were experienced 6.30% of the time. High wind speed of 5.7 - 8.8 m/s occurred less frequently than wind speeds of 3.6 - 5.7 m/s which occurred for 25.5% of the time. The most frequent wind speed of 2.1 - 3.6 m/s were experienced for 36.6% of the time, while wind speeds of 0.5 -2.1 m/s were experienced for 18.8% of the time (Figure 16).

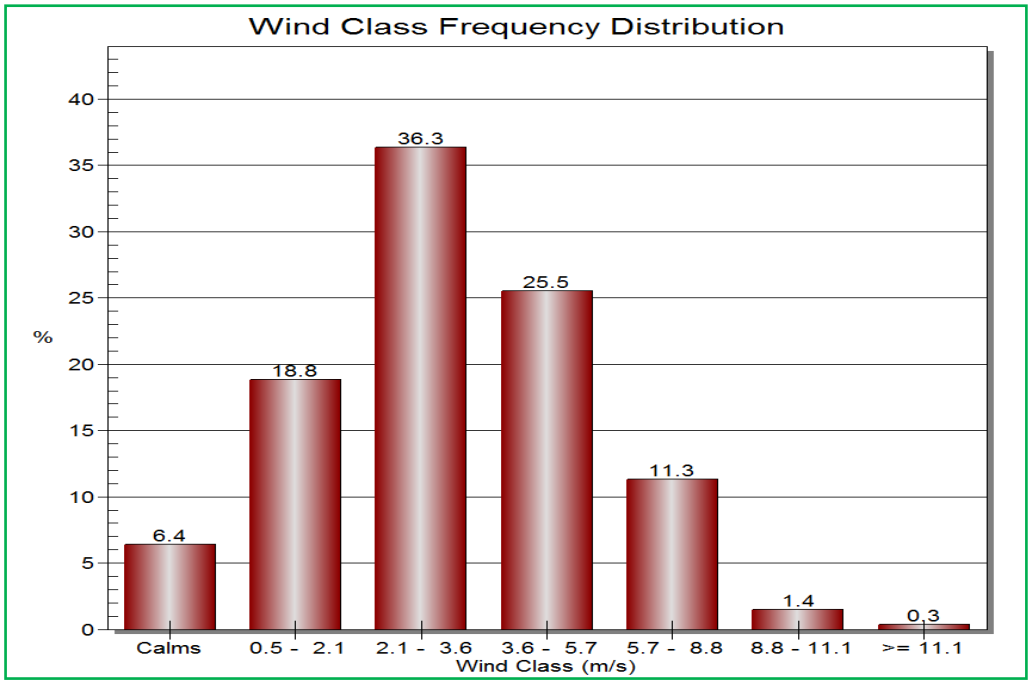


Figure 16: Wind class frequency distribution

7.1.2.2 Atmospheric Stability

Atmospheric stability is commonly categorised into one of seven stability classes. These are briefly described in Table 15 below. The atmospheric boundary layer is usually unstable during the day due to turbulence caused by the sun's heating effect on the earth's surface. The depth of this mixing layer depends mainly on the amount of solar radiation, increasing in size gradually from sunrise to reach a maximum at about 5-6 hours after sunrise. The degree of thermal turbulence is increased on clear warm days with light winds. During the night a stable layer, with limited vertical mixing, exists. During windy and/or cloudy conditions, the atmosphere is normally neutral. A neutral atmospheric potential neither enhances nor inhibits mechanical turbulences. An unstable atmospheric condition enhances turbulence, whereas a Stable atmospheric condition inhibits mechanical turbulence.

Table 15: Atmospheric stability class

A	Very unstable	calm wind, clear skies, hot daytime conditions
B	Moderately unstable	clear skies, daytime conditions
C	Slightly Unstable	moderate wind, slightly overcast daytime conditions
D	Neutral	high winds or cloudy days and nights
E	Slightly Stable	moderate wind, slightly overcast night-time conditions
F	Moderately stable	low winds, clear skies, cold night-time conditions
G	Very stable	Calm winds, clear skies, cold clear night-time conditions

The site experienced mostly neutral atmospheric conditions (22%) which are characteristic of high winds or cloudy days and nights. 17.3% of the time was attributed to moderately stable wind conditions which are characteristic of low winds, clear skies and cold night time conditions (Figure 17).

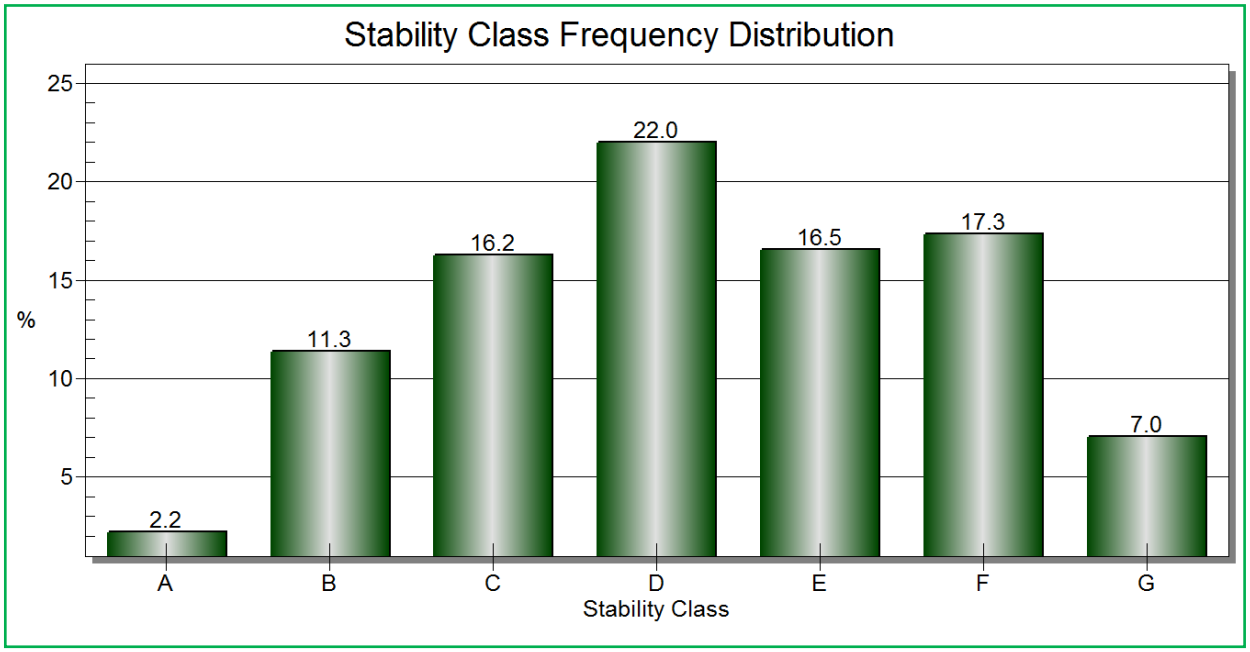


Figure 17: Atmospheric stability class for the Sand Draai area

7.1.3 Geology

According to the 1:250 000 geological map sheet, Postmasburg (2822), the geology of the area is generally characterised by the metamorphosed sediments and volcanics intruded by granites and is known as the Namaqualand Metamorphic Province. The proposed CSP plant alternatives are sited on red, coarse grained brown windblown sands of the Gordonia Formation, Kalahari Group. Dune ridges occur in the northern portions of the site and are characterised by NNW-SSE orientation. Quartz-muscovite schist, quartzite, quartz-amphibole schist and greenstone outcrops approximately 5 km south west of the proposed plant area, as well as in the southern section of the site. Calcrete also outcrops in the southern section of the site approximately 8 km southwest from the proposed plant area (Figure 18).

7.1.4 Topography

The area is characterized by flat terrain and is, in general, an area of little topographical relief. Isolated hills and mountains can be found in the area. The area surrounding Upington can be described as large sandy plains with windblown sand dunes and low hills breaking the flat relief. The area to the south of Upington becomes more mountainous as one travels to Groblershoop.

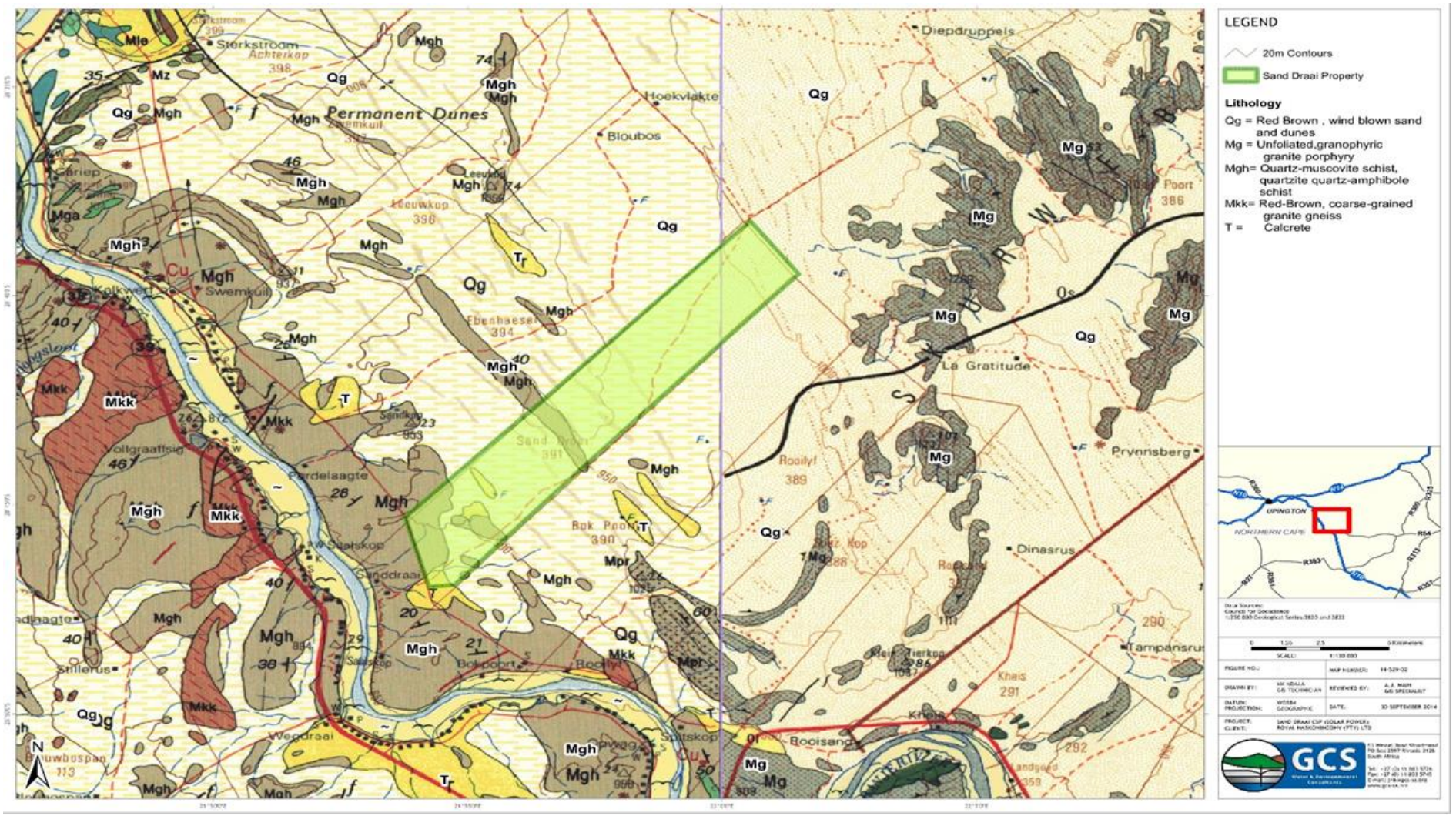


Figure 18: Geology map

7.1.5 Agricultural Potential

Most areas in the study area have a low agricultural potential, except few portions in the alluvial zones close to the Orange River, where irrigation is practiced. In addition to the soil quality, there are severe climatic restrictions to agricultural potential. Rainfall is very low, while evaporation is extremely high, due to the high temperatures. For this reason, even the best soils are unsuited for dryland agriculture.

7.1.6 Groundwater Resources (Hydrogeology)

According to the 1:500 000 Hydrogeological Map 2714 Upington/Alexander Bay, the proposed site alternatives are associated with fractured aquifers based on the geology. The average borehole yields associated with these aquifers, range from 0 to 0.2 l/s.

The Sand Draai farm is currently used for cattle and sheep farming as well as raisin production. No groundwater abstraction is currently being utilized by the farm. Water is pumped directly from the Orange River situated approximately 2.3km west of the site. Landowners situated further away from the river, utilise groundwater for stock watering and household uses.

7.1.7 Surface Water and Aquatic Ecology

The project is located in the Northern Cape, a highly arid part of South Africa. In this context drainage systems and their associated riparian zones are highly sensitive and environmentally important. Although not typically characterised by active flow of water or the presence of hydric (wetland) soils, riparian zones of watercourses in this area are a critical component of the surface water drainage environment, as they are distinct from the surrounding Karoo veld in terms of their species composition and physical vegetative structure. In the context of a semi-arid environment, these riparian environments are extremely sensitive as they are typically characterised by relatively high levels of biodiversity and are critical for the sustaining of ecological processes as well as human livelihoods through the provision of water for drinking and other human uses.

The survey area is located on the northern banks of the Orange River near the town of Groblershoop (near the crossing). The area falls within the Mixed Karoo region with a rainfall of less than 200 mm per annum, with the majority of the precipitation falling within the late summer season. The Orange River forms a greenbelt through this predominantly otherwise desert/arid region and supports a riparian vegetation floral community as well as a thriving commercial agricultural sector. Further afield from the riparian zones, the surrounding area is largely open, natural veld, with the land use being dominated by livestock (low density) or game farming.

A formal irrigation scheme, supporting a large commercial agricultural sector, makes commercial agriculture the dominant land use within the areas adjacent to the river. The riparian zones are largely transformed to accommodate this land use. Agricultural fields are often protected from flood events by earth embankments, which have necessitated large scale transformation and landscaping of much of the riparian zones. Infrastructure along the river and within the riparian zones incorporate farm pumping equipment and buildings stations, surface water (stormwater) drains and access roadways.

The Orange River represents the only perennial watercourse and therefore the only permanent aquatic habitat within the region. The Orange River is regarded as a C-Class Present Ecological State (PES) river, which translates to a moderately modified system. This is due to modification of the hydrology of the system brought about by the occurrence of major impoundments located upstream of the site (Gariep Dam and Van Der Kloof Dam). These impoundments attenuate minor flooding events (therefore decrease the regular occurrences of floodwaters that would normally function for channel maintenance) and increase base flows (water is released from the impoundments for electricity generation and to satisfy demand for irrigation within the majority of the

Orange River Valley area). The Orange River was historically classified as a non-perennial system, but remains as a perennial system since the construction of the dams and the inclusion of the watercourse within the Lesotho Highlands Scheme. Further factors that drive ecological transformation of the river include water quality impacts emanating mostly from agrochemicals. The Orange River provides the irrigation water for formal irrigation that is the dominant land use throughout the vast majority of the Orange River Valley, downstream of the impoundments. Riparian vegetation transformation to accommodate formal agriculture as well as exotic vegetation encroachment into the riparian zones are also major drivers of ecological change within the region.

The close proximity to the Orange River means the proposed development area incorporates relatively steeper gradients, which enhances the formation of drainage channels that directs surface water run-off toward the valley of the Orange River. Besides the Orange River, no other permanent watercourses occur and the channels that are present would allow for only brief persistence of surface waters. This may be enough within isolated areas to support some aquatic macro-invertebrates for a short period, but this would be under exceptional circumstances.

7.1.7.1 Surface Water Typology

Wetlands and surface water features can be found all across the landscape. The landscape can be divided up into a number of units, each of which can contain wetlands. Wetlands occurring on these different terrain units typically differ in terms of their formative processes and hydrological inputs, and thus differ in terms of their functionality.

Table 16: Tiered classification for the different types of surface water features along the proposed alignments

	Level 1 – System	Level 3 – Landscape Unit	Level 4 – HGM Unit	Level 4B – River longitudinal zonation	Level 5A – Hydrological Regime	Level 6 – Other descriptors
Orange River	Inland	Valley Floor	River	Lowland River	Perennial	▪ Natural ▪ Salinity – Freshwater ▪ Substratum Type – Mix of bedrock and alluvial material
Ephemeral Water-courses				Transitional	Ephemeral / Episodic	

A number of surface water features can be classified as rivers rather than wetlands, due to the nature of their hydrology which is characterised by flow within a defined channel with limited or no diffuse flow and limited lateral water inputs, with overtopping of the channel occurring during large spate / flow events.

Rivers are classified in terms of the classification system by a number of sub-level descriptors, of which the most important are the level 4 river longitudinal zonation and the hydrological regime. Under the hydrological regime only the Orange River is perennial whilst all other watercourses on the study site are non-perennial in character.

The ephemeral watercourses are too small to appear on the DWS rivers base, but are best described as fitting into the transitional longitudinal class as they display a channel (with a mix of bedrock-dominated substrate and alluvial material) and occur within confined valley heads, although in terms of their stream order would theoretically be classified as mountain headwater streams.

7.1.7.2 The Orange River

The primary surface water feature on the site is the Orange (Gariep) River, which runs in a north-south orientation adjacent to the development site. This river is the largest river in South Africa and one of the larger rivers on the southern African subcontinent. The river drains a very large catchment comprising of much of the interior plateau of South Africa, rising in the highlands of Lesotho just west of the continental divide.

Although the Orange River in the study area forms part of a longer reach that is not meandering, two meanders occur just north of the Sand Draai farm. These two meanders have resulted in the creation of a westward-eroding outer bank between the Saalskop (on the western bank) and Sand Draai farmsteads and associated depositional area (slip-off slope) on the opposite (eastern bank). This has resulted in the development of extensive sand flats partly colonised by *Phragmites australis* reedbeds on the eastern bank of the river from the railway bridge north onto the neighbouring Ebenhaeser property. The river then turns back eastward, incising into the resistant outcropping strata.

The riparian zone of the river is located beyond the active channel. The cross-sectional profile of the riparian zone of the river varies, depending on whether the point along the reach is located on an inner or outer bed. In the part of the reach near the Sand Draai farmstead, the riparian zone is characterised by a wide, flat flood bench (sand flats referred to above) located just beyond the active channel. This flood bench consists of alluvially-deposited silt, with little mature riparian thicket vegetation (Figure 19), rather open areas and silt banks or areas of dense *Phragmites australis* reedbeds. Where the river bends back in an eastward direction to the north of the Sand Draai farmstead, the riparian zone becomes much narrower and more steeply sloping from the edge of the active channel, rising up from a much narrower flood bench characterised by reedbeds (that is even absent in certain places) through a series of steeper slopes and terraces to the top (outer edge) of the macro-channel bank. Beyond this macro-channel bank a wide alluvial terrace is located on which cultivation and orchards have been established. The current edge of the riparian zone ends at the start of this terrace (where the orchards and fields start), but under natural conditions the riparian zone is likely to have extended onto the floodplain terrace, which has now been completely transformed.

Figure 19: Typical structure of the upper part of the riparian zone close to the current Ebenhaeser abstraction point where the riparian zone is narrow and more sloping, characterised by riparian thickets on alluvially-deposited material

7.1.7.3 Ephemeral Watercourses

Away from the Orange River, no surface water drainage features characterised by perennial flow are encountered in the study area. Thus all surface water drainage features (watercourses) are episodic or ephemeral in nature, being characterised by highly intermittent flows of short duration that are directly related to precipitation events of sufficient volume and intensity to result in surface flows. Such precipitation events do not commonly occur in the study area due to the arid climate.

Very importantly the presence of surface water drainage on the development site is strongly dependent on slope and substrate. Surface water drainage was observed to be most pronounced in the south-western-most quarter of the site characterised by rocky terrain that rises from the alluvial terrace within the Orange River valley bottom. A number of first order watercourses of short length with very small catchments rise in this incised terrain located behind (to the east and north of the Sand Draai farmstead) and flow down to the Orange River valley bottom. These watercourses are narrow features that are typically characterised by a very shallow channel that has eroded into the underlying rocky substrate, with a poorly to moderately developed riparian zone depending on the size of the catchment of the watercourse; along the smaller first order watercourses the channels are flanked by *Senegalia (Acacia) mellifera* shrubs with no larger trees that characterise the larger watercourses with larger catchment areas in flatter terrain (such as are found on the Sand Draai farm to the south of the rail bridge). Along the slightly larger lower order watercourses more developed riparian vegetation is encountered with a dense but narrow zone of *Senegalia (Acacia) mellifera* shrubs and scattered *Ziziphus mucronata* trees along the bank. The channels of these larger watercourses are characterised by a sandier, more defined channel.

These downstream ends of these watercourses have been significantly physically modified as they enter the zone of intense cultivation within the Orange River valley bottom. The larger watercourses have been channelised as they drain through the cultivated fields and vineyards, with extensive to near-complete removal of the naturally-occurring riparian vegetation, and reworking of the banks of the watercourses. A number of the smaller watercourses have been modified even further, with the natural structure of the drainage line on the valley bottom terrace (whether a channel or alluvial fan-type depositional feature) having been completely modified / removed. These watercourses now ‘terminate’ at the outer edge of the cultivated alluvial terrace, being physically blocked at this point, and no drainage structure remains in the cultivated zone between the edge of the footslopes and the current edge of the Orange River riparian zone. One such watercourse of more natural morphological structure within the Orange River valley bottom terrace was encountered. As it enters the terrace in the outer part of the valley bottom, it became increasingly incised as it neared the Orange River riparian corridor, with evidence of deposition of fluvially-transported material in the exposed bank profiles.

A number of these watercourses in this rugged south-western part of the development site are crossed by the proposed pipeline and road alternative alignments, as these alternatives are aligned parallel to the Orange River valley.

A major change in drainage density and occurrence was noted on the majority of the site located at a further distance from the Orange River. As described above most of the site to the north-east of the Gariep Road is comprised of flatter topography than the area closer to the river, comprising of duneveld and certain areas of flat calcrete plains. As described above the duneveld is comprised of low, parallel-aligned dunes, with intervening flat areas of sandy substrate covered in a grassy vegetation cover. No surface water drainage was observed in this duneveld, except in the vicinity of the ridge in the central part of the site as described below. The combination of a highly permeable substrate (sandy material), flatter topography and the presence of parallel-aligned dunes prevents the development of surface drainage features that would under normal circumstances be aligned westwards / south-westwards towards the Orange River valley bottom. The dunes are aligned perpendicularly to the natural direction of drainage and thus block surface water drainage towards

the valley bottom. Where flat calcrete plains are located (in the northern third of the development) no visible surface water features were encountered. No pans or depressions were noted on the site either.

Only in the vicinity of the ridge along which the existing power line servitude is aligned is surface water drainage present in the central part of the development site. A small drainage line of similar characteristics to the smaller drainage lines encountered in the rugged terrain closer to the Orange River as described above was noted. The presence of this drainage line is due to the sloping terrain of the ridge hillslope which naturally promotes surface flows and accompanying incision. It is important to note that this course of this watercourse is short, as it drains into a flat area lying behind a dune, and dissipates as it reaches the dune. It should be noted that no components of the CSP layout are located in this central part of the site and thus these short watercourses are unlikely to be physically affected. However the alignment of the proposed power line crosses these watercourses but these will be able to be spanned.

7.1.7.4 Hydrology and Morphology of Ephemeral Watercourses in the Study Area

No evidence of active surface water flow was noted along any of the watercourses assessed in the field away from the Orange River, and all are likely to be strictly episodic, flowing only in response to rainfall events of sufficient duration and intensity. Evidence of periodic flow along these watercourses is provided primarily by the presence of wrack that is deposited on the upstream side of obstacles in the path of the watercourse, in particular the fence lines along which most of both pipeline alternative route run. In this context, wrack is the (primarily vegetative) material washed down river courses during flood / spate flow events, and which is trapped behind branches and other obstacles, remaining in situ after the flood has passed. The evidence of wrack beyond the active channel indicates that these areas were inundated by flood waters and gives a good indication of the extent of higher / spate flows along the rivers in the study area. Although the presence of wrack does not provide an indication of the frequency of flooding, it does give an indication that a spate flow did occur along the watercourse, and the position of the wrack horizontally away from the channel, and vertically above the channel bed indicates the extent of the flooding and the volume of water that passed along the system, and is a reliable indicator of the extent of maximum hydrological activation and as such is a good indicator of the lateral extent of the riparian zone.

Rainfall events of sufficient intensity are associated with significant run-off, and results in flows along the river systems for short periods of time. Once overland flow from the catchment area drops off, surface flows typically respond by decreasing and ceasing. Surface water is typically transpired into alluvial sediments, or is lost to evaporation. This hydrological regime of no surface baseflow punctuated by short-lined flow events in response to rainfall is typical of ephemeral watercourses, as found across the study area.

There is likely to be an interrelationship between groundwater and surface water in the watercourses of this semi-arid area. Although no extensive alluvial deposits were observed along any of the ephemeral watercourses in the study area, there is likely to be some form of hydrological connection between the watercourses and groundwater, albeit on a small scale.

In a hydromorphological context most of the watercourses assessed in the field contained a main (active) channel, a feature of most fluvial systems. The high stream order of certain of the watercourses crossed by the pipeline alternatives is indicated by the relatively lack of incision and lateral extent of most of the channels of the watercourses crossed. The largest watercourse crossed was characterised by a relatively un-incised central channel. Fluvial channels were not noted to be subject to significant degrees of channel bank erosion. Active channels were characterised by a sandy, alluvial substrate with little vegetative cover, or alternatively areas of bedrock outcropping. This alluvial substrate is likely to shorten the period of flow within the system following a rainfall event, as it would enhance the ability of overland flow entering and flowing down the system to permeate into the substrate.

The reaches of ephemeral watercourses along the pipeline / road route were not noted to be morphologically impacted by any anthropogenic factors except for certain areas that are crossed by farm access roads or by the Gariep Road, contrary to the high state of modification closer to the Orange River valley. A short section of the affected reach of these watercourses has been transformed by the track / road.

7.1.8 Vegetation

The proposed site is mainly located within the Savanna Biome, with a small northern portion situated within the Nama Karoo Biome. The study sites are located within the Kalahari variation of the Savanna Biome, which although referred to as a desert, is not a true desert as it does not approximate the extreme aridity of a true desert. This area is covered by sparse grass layer and scattered shrubs and trees. Any areas of high biophysical sensitivity within the study area are mostly associated with wetland and riparian habitats and are closely linked to the Orange River located to the south of both sites.

The Sand Draai farm is located within four vegetation types as defined by Mucina & Rutherford (2006) namely the Bushmanland Arid Grassland (NKb3), Gordonia Duneveld (SVkd1), Kalahari Karroid Shrubland (NKb5), and the Lower Gariep Alluvial vegetation (AZa3) situated within the floodplain of the Orange River (Figure 20).

The proposed CSP Parabolic trough Site Alternative 1 is situated on the north-eastern portion of the farm and falls mainly within the Kalahari Karroid Shrubland (NKb5) whilst Site Alternative 2 is situated within Gordonia Duneveld (SVkd1) within the central portions of the Sand Draai site. The ancillary infrastructure comprising pipelines, power lines and access roads fall within the Kalahari Karroid Shrubland (NKb5), Gordonia Duneveld (SVkd1) as well as Bushmanland Arid Grassland (NKb3) on the south-western portions of the site.

Of all the vegetation types only the Lower Gariep Alluvial Vegetation has a conservation status of Endangered and is therefore regarded to have a high biophysical sensitivity. This vegetation type is associated with the alluvial areas of the Orange River and is therefore under developmental pressure for use in agriculture.

The farm Sand Draai, comprises of different habitat types and characteristics, but exhibit similar ecological sensitivities. The farm is characterised by the presence of dune habitat and extensive rocky outcrops in the northern sections, representing the sensitive areas of this particular site, but also comprises riparian areas in the south.

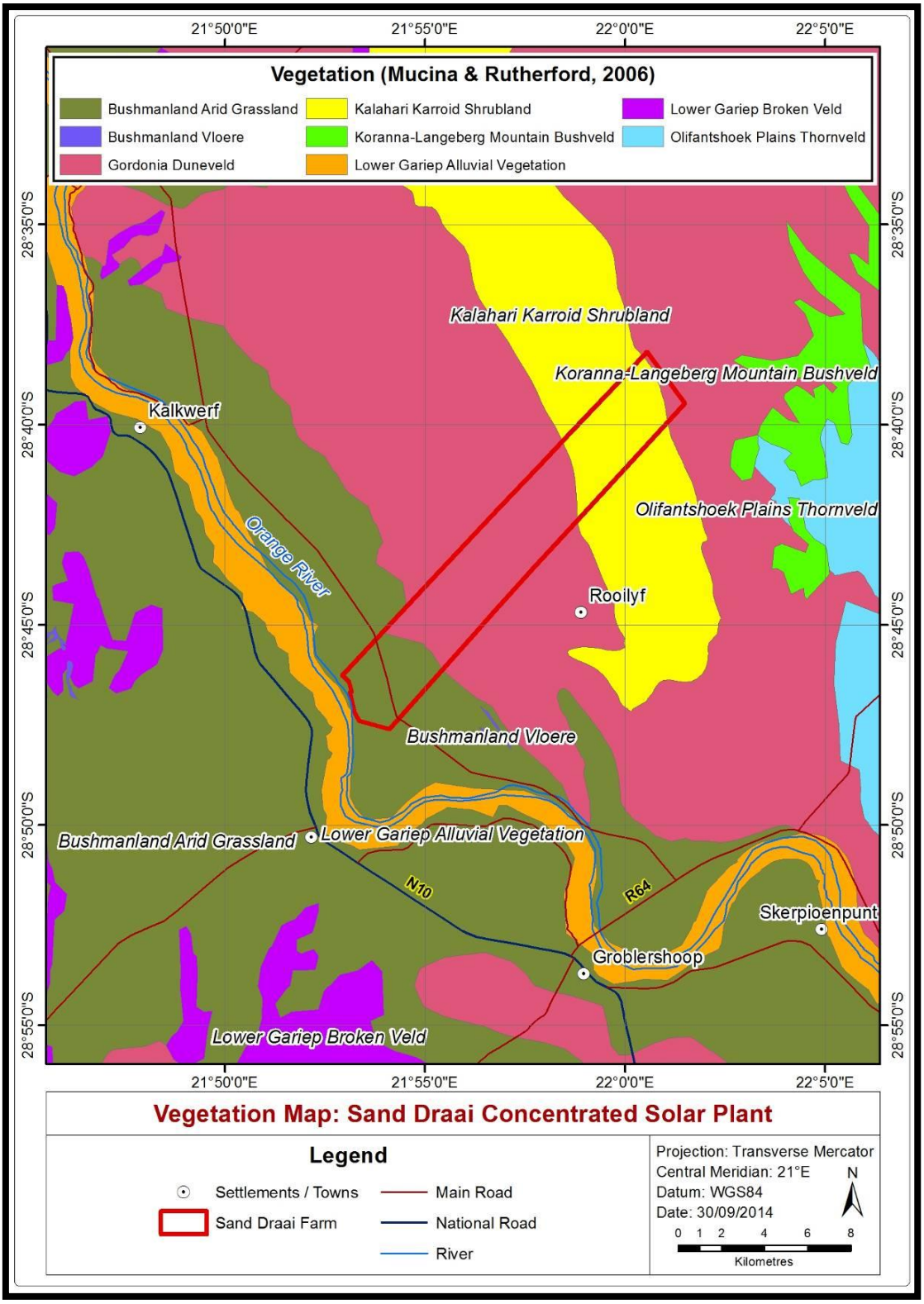


Figure 20: Vegetation map of the Sand Draai farm

7.1.9 Fauna

7.1.9.1 Mammals

The Nama-Karoo and Succulent Karoo, now almost devoid of large wild ungulates, holds some 10 million sheep (*Ovis aries*) and Goats (*Capra hircus*). The once plentiful and diverse set of nomadic herbivores has been replaced by large encamped herds of small livestock with specialist feeding habits. Prolonged heavy grazing is considered to suppress shoot/root formation and flowering in the Nama-Karoo and Succulent-Karoo flora, which leads to compositional changes and depletion and thinning out of the vegetation, particularly those components that the sheep find palatable.

7.1.9.2 Reptiles

Reptile lists require intensive surveys conducted for several years. Reptiles are extremely secretive and difficult to observe even during intensive field surveys conducted over several seasons. The majority reptile species are sensitive to severe habitat alteration and fragmentation. Due to current agricultural activities in the area coupled with increased habitat degradation (overgrazing, soil erosion) and disturbances are all causal factors in the alteration of reptile species occurring in these areas.

Rocky hills and rocky outcrops or koppies occur on and around the proposed Sand Draai farm and provide favourable refuges for certain snake and lizard species (rupicolous species). Reptile species likely to occur within the rocky hills and koppies included Variegated Skink (*Trachylepis variegata*), Western Three-striped Skink (*Trachylepis occidentalis*), Western Rock Skink (*Trachylepis sulcata sulcata*), Southern Rock Agama (*Agama atra*) and Ancheita's Agama (*Agama anchietae*). Suitable habitat occurs for the Karoo Girdled Lizard (*Karusasaurus polyzonus*) in the rocky hills and koppies, inhabiting fissures between rocks and under loosely embedded ro.

Trees such as the protected large Camel Thorns (*Vachellia erioloba*) and Grey Camel Thorn (*Vachellia haematoxylon*) offer suitable habitat for arboreal reptile species, such as the Karasburg Tree Skink (*Trachylepis sparsa*). Moribund (old abandoned or dead mounds) termite mounds offer important refuges for numerous frog, lizard and snake species. Large number of species of mammal, birds, reptiles and amphibians feed on the emerging alates (winged termites). These mass emergences coincide with the first heavy summer rains and the emergence of the majority of herpetofauna. Termite mounds also provide nesting site for numerous snakes, lizards (varanids) and frogs.

- ***Amphibians***

Breeding in African frogs is strongly dependent on rain, especially in the drier parts of the country where surface water only remains for a short duration. The majority of frog species in the Northern Cape Province can be classified as explosive breeders. Explosive breeding frogs utilise ephemeral or seasonally inundated grassy pans for their short duration reproductive cycles. The amphibians of the area belong to the Kalahari assemblage whose boundaries conform closely to those of the Kalahari savannas of the Northern Cape and North-West provinces. The Kalahari is distinguished especially by its deep sandy substrates, and this feature has a marked effect on the availability of surface water. This is likely to be the key factor in the biogeography of amphibians. It is significant that the sole listed indicator species is a terrestrial breeder namely the Bushveld Rain Frog (*Breviceps adspersus*). The Kalahari assemblage has low species richness, with total species accounts not exceeding 10 species per grid cell anywhere in the assemblage. Only one endemic species, the Karoo Toad *Vandijkophrynus* (*Bufo*) *gariepinus*, enters the assemblage peripherally, and no range restricted species present.

Only two frog species namely Guttural Toad (*Amietophrynus gutturalis*) and Bubbling Kassina (*Kassina senegalensis*) were recorded during the previous South African Frog Atlas Project. Both these species are common and have a wide distribution range. A probable amphibian species list is presented in the Ecological Assessment report (**Appendix D1**).

7.1.10 Avifauna

An estimated 113 species could potentially occur in the study area. Of these, 9 are South African Red Data species, 14 are southern African endemics and 23 are near-endemics. This means that 8% of the species that occur could potentially occur in the study area are Red Data species, and almost 33% are southern African endemics of near-endemics. Overall, the study area potentially contains a total of 37 endemics and near-endemics, which is 23% of the total southern African endemics and near-endemics.

7.2 Social Environment

7.2.1 The Northern Cape's Social and Economic Challenges

According to the Northern Cape Provincial Growth and Development Strategy (NCPGDS) [8], the province's share of South Africa's gross domestic product (GDP) was 2 % in 2002, the lowest contribution of the nine provinces. Although the Northern Cape has the smallest economy of the nine provinces, gross domestic product of the region (GDPR) per capita is higher than the national average[9]. The economy of the province is heavily dependent on the primary sectors of the economy, which in 2002 made up 31.0 % of the GDPR. Economic advantages which create a positive environment for the province include:

- Abundant mineral and natural resources;
- Infrastructure;
- Unique climate conditions;
- Unique tourism destination;
- Abundant land for economic growth planning; and
- Manageable demographic proportions for economic growth planning.

The most significant challenge that the NCPGDS recognises is that of the reduction of poverty. The strategy notes that most of the other challenges faced by the province emanates largely from the effects of poverty. While addressing poverty, attention needs to be given to a range of societal problems that includes:

- Reducing the backlog of basic needs such as water, sanitation and housing;
- Improving and increasing access to health, education and social services;
- Decreasing the prevalence rate of HIV and AIDS;
- Creating opportunities for employment;
- Reducing crime; and
- Targeting vulnerable groups.

In addition to poverty reduction, unemployment is of concern in the Province. In the Northern Cape the total labour force was estimated to consist of approximately 313 000 or 38 % of the total population with an aggregate of a third of the total labour force being unemployed in 2001. A direct comparison between the 2001 census data relating to unemployment and the 2007 Community Survey was not possible, as unemployment was not considered in depth for the latter survey.

[8] Northern Cape Provincial Growth and Development Strategy. 2004 – 2014. South Africa. Government Printer

[9] Northern Cape Provincial Growth and Development Strategy. 2004 – 2014. South Africa. Government Printer

Data gleaned from the NCPGDS Strategy helps to render a social and economic perspective on the Northern Cape Province. These are found below:

- The Province is mostly rural in nature,
- It has a low population density and relative inadequate infrastructure, especially in the remote rural areas,
- The Province has inherited an enormous backlog in basic service delivery and maintenance, and it will take time to eradicate these,
- The population is predominantly poor with high levels of illiteracy and dependency that seriously affect their productivity and ability to compete for jobs,
- The Province is faced with HIV/Aids as a social and economic challenge,
- Available resources are unevenly distributed and offer limited potential for improved delivery of services and growth; and
- Job creation and poverty eradication together with the low level of expertise and skills, stand out as the greatest challenges to be resolved

The graph below shows the contribution of various sectors to the provincial GDP within the Northern Cape in 2013. The electricity sector is by far the smallest, at 1.4%.

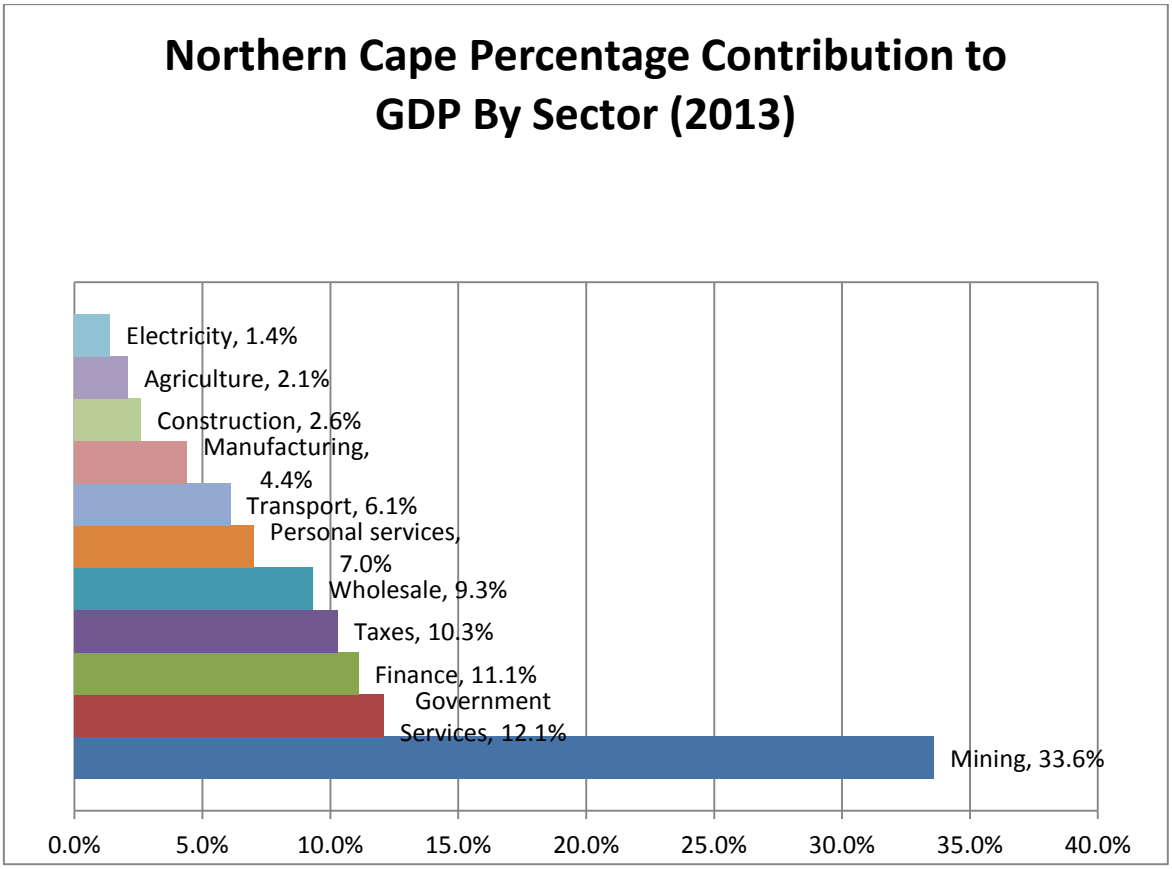


Figure 21: Sector Contribution to The Northern Cape GDP in 2013

7.2.2 Social and Economic Characteristics of the !Kheis Local Municipality

!Kheis Local Municipality falls within the Z.F. Mgcawu District Municipality in the Northern Cape province. !Kheis is a Khoi name meaning "a place where you live" or "your home". The !Kheis municipal area was initially inhabited by the Khoisan people, who were also the first permanent inhabitants of South Africa. The San, who lived a nomadic life, migrated through the area. !Kheis Municipality was established from the former Groblershoop Municipality, from settlements that were previously part of the ZF Mgcawu (Siyanda) and Karoo District Municipalities. These municipalities administrated these settlements and provided them with services up until the demarcation in November 2000. Roads in the !Kheis municipal area are mainly gravel, although national roads also traverse the municipality, including the N8 and N10 which link Groblershoop to Griekwastad and Upington respectively. !Kheis Local Municipality was established from the former Groblershoop Municipality, including the following settlements: Boegoeberg, Gariep, Grootdrink, Kleinbegin, Opwag, Topline, and Wegdraai.

The proposed project will include the installation of solar electricity technology, namely a CSP plant using parabolic trough technology and the associated electricity, bulk water, and road access infrastructure. The area available for the proposed development is approximately 5200 hectares in extent, although it must be noted that only a small portion of this area will be developed (i.e. approximately 700 ha). The proposed plant is located approximately 14 km northwest of the town of Groblershoop, within the Z.F. Mgcawu District Municipality, and the !Kheis Local Municipality of the Northern Cape province. The proposed development area also falls within the jurisdiction of Ward 3 of the !Kheis Local Municipality (Figure 22).

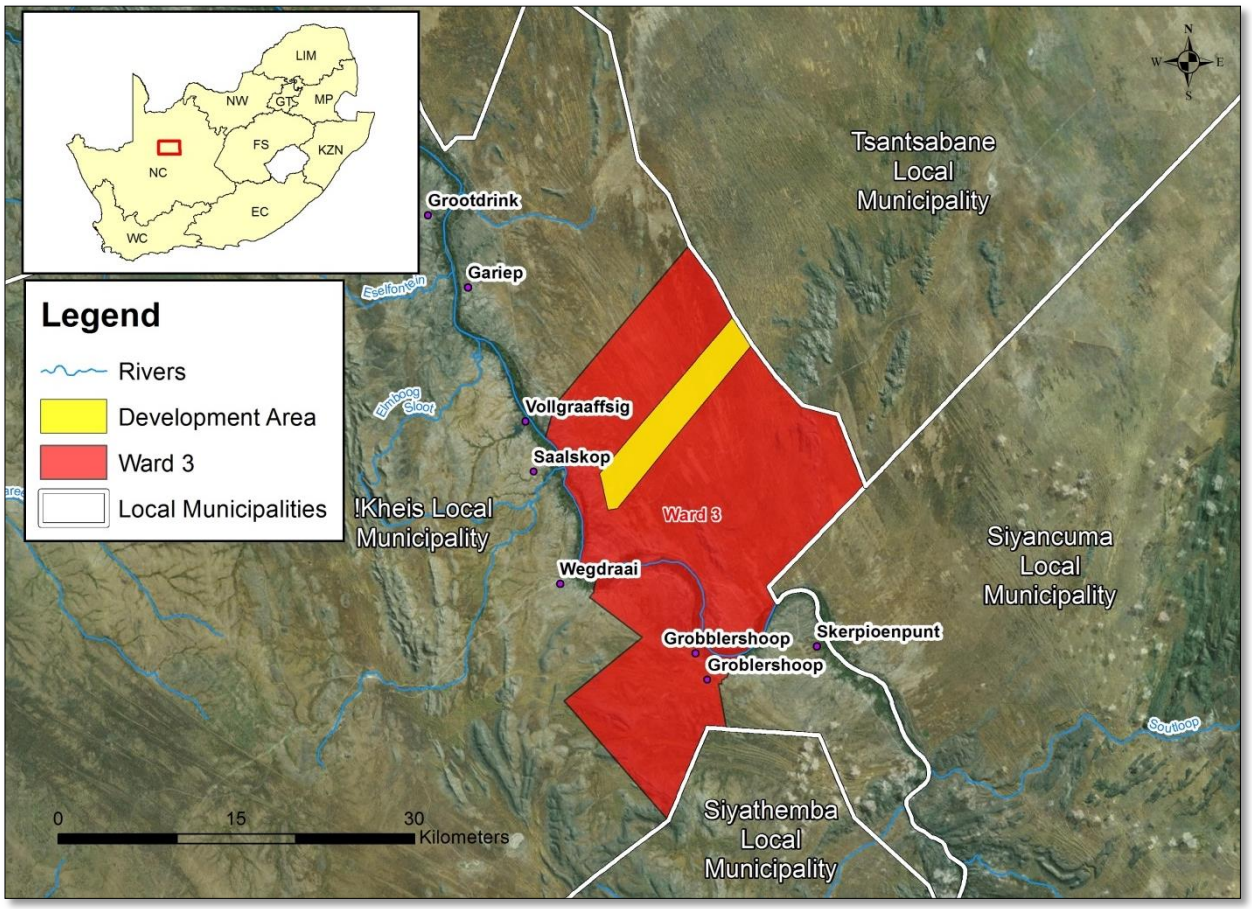
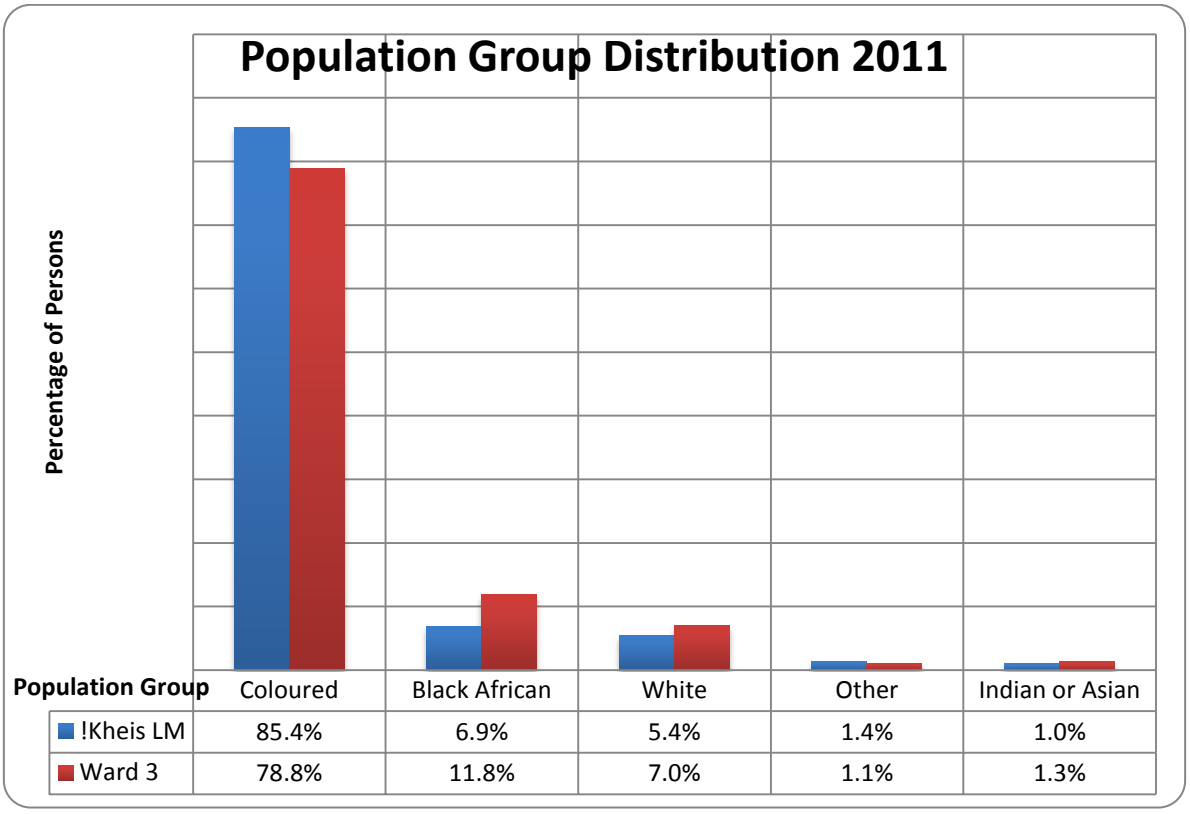


Figure 22: Site map indicating local municipality and ward details

7.2.3 Population, Gender and Age

The majority population group within both Ward 3 and the !Kheis Local Municipality in 2011 was Coloured (85% and 78% respectively), followed by Black African (7% and 12% respectively), and White (5% and 7% respectively). 'Other' and Indian or Asian were minorities in both Ward 3 and the !Kheis Local Municipality in 2011 at approximately 1% each (Figure 23).

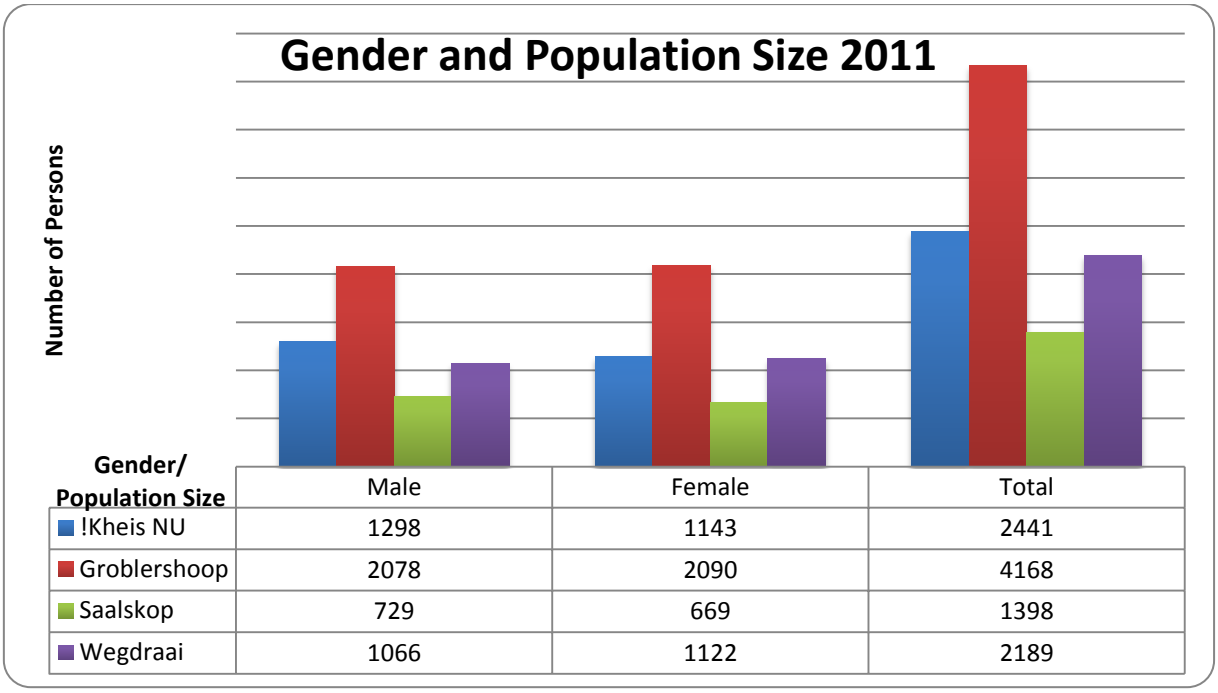


Population Group	Coloured	Black African	White	Other	Indian or Asian
!Kheis LM	85.4%	6.9%	5.4%	1.4%	1.0%
Ward 3	78.8%	11.8%	7.0%	1.1%	1.3%

Figure 23: Population groups in !Kheis LM and Ward 3 (2011)[10]

The total male population is at 51% in these statistical areas, with females at 49% (Figure 24). Groblershoop supports at least 40% of the overall population due to its denser settlement pattern (as opposed to !Kheis non-urban (NU), Saalskop and Wegdraai) Saalskop supports a mere 13% of the total population (10 196 people).

[10] Source: Statistics South Africa Census 2011.



Gender/ Population Size	Male	Female	Total
!Kheis NU	1298	1143	2441
Groblershoop	2078	2090	4168
Saalskop	729	669	1398
Wegdraai	1066	1122	2189

Figure 24: Local area's gender and population size[11]

Figure 25 shows the age distribution and sex ratios for the !Kheis Local Municipality in 2011. The emergent trend in terms of age structure is that the municipality is dominated by a young population (0-19 years). The fact that persons aged 60 to 85+ accounted for a mere 7.9% of the total population in 2011 is indicative of a low life expectancy. Sex ratios within the municipality are uniform for the most part, with the exception of the 30-34 age group, where 4.2% of the male population occurred as opposed to 3.5% of the female population.

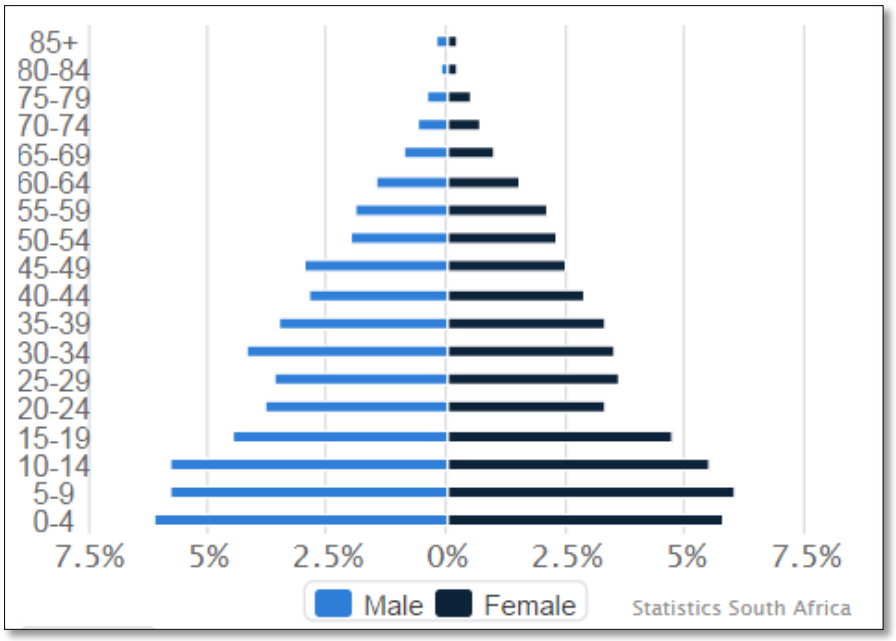


Figure 25: Age distribution in !Kheis LM[12]

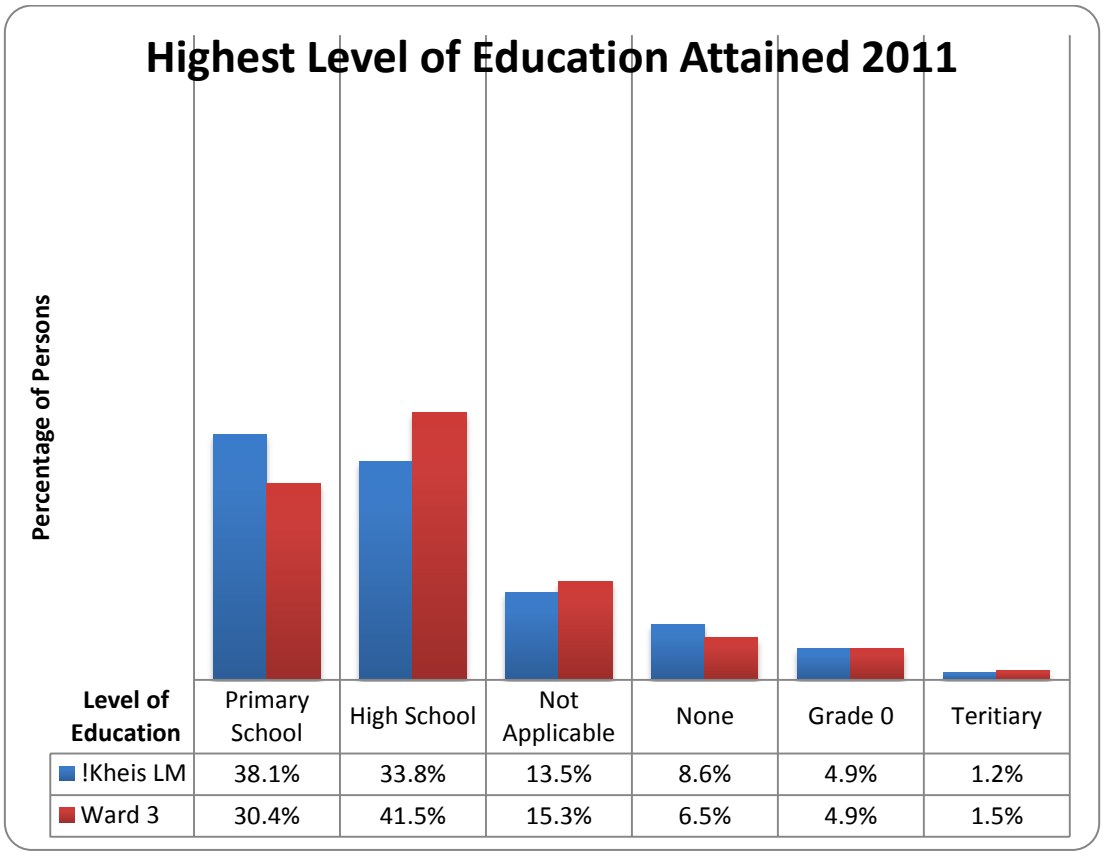
[11] Source: Statistics South Africa Census 2011.

[12] Source: Statistics South Africa Census 2011.

The 0-19 year age category is typically reflective of the school going population, and are usually also identified as dependent populations as they are unable to generate an income due to not officially being part of the working population. The !Kheis NU shows that almost 37% of its entire population is in such a category, while Wegdraai shows a high number of 'children,' at almost 49%. Practically, a healthier economy is dominated by a larger number of people in the 20-64 year age category, which is also termed the 'working age category.' This is the case in !Kheis NU, which has almost a 60% working age category[13]. The 65 -120 year age category is also indicative of a dependent population. The Census data shows that the dependent population in this category remains between 4.3% and 5.3% across the four statistical areas.

7.2.4 Education

In terms of the highest level of education attained by people within Ward 3 and the !Kheis Local Municipality in 2011, the majority of respondents within Ward 3 finished high school (41%), while within the !Kheis Local Municipality as a whole, the majority indicated primary school as their highest level of education attained (Figure 26). The high percentage of 'not applicable' respondents as well as the low levels of tertiary education in both Ward 3 and the !Kheis Local Municipality is also noted.



Level of Education	Primary School	High School	Not Applicable	None	Grade 0	Teritiary
!Kheis LM	38.1%	33.8%	13.5%	8.6%	4.9%	1.2%
Ward 3	30.4%	41.5%	15.3%	6.5%	4.9%	1.5%

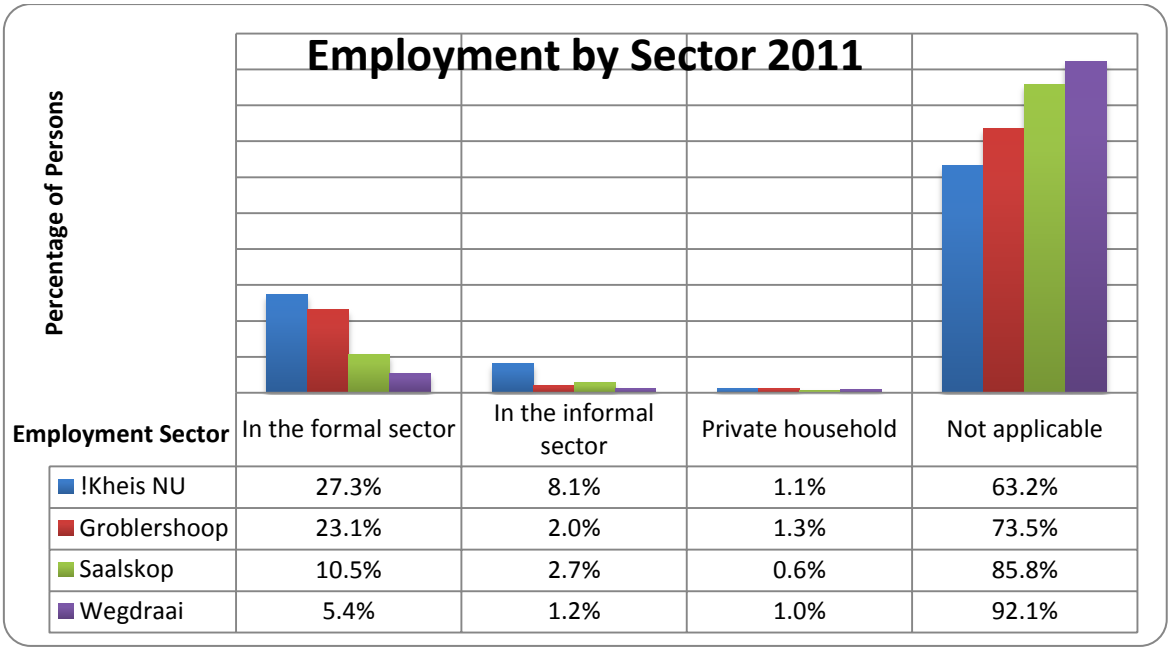
Source: Statistics South Africa Census 2011

Figure 26: Highest level of education attained in 2011 in the !Kheis LM and Ward 3

[13] The percentage within this category is by no means a reflection of the number of people that are actually employed.

7.2.5 Employment

A mere 16.6% of the employable population are actually employed in the formal sector in the said statistical areas. 3.5% are working in the informal sector and an overwhelming 79% have responded to the Census as 'not applicable.' This may denote these individuals do not see themselves as wanting to be part of the formal or informal employment sectors. See Figure 27, below.

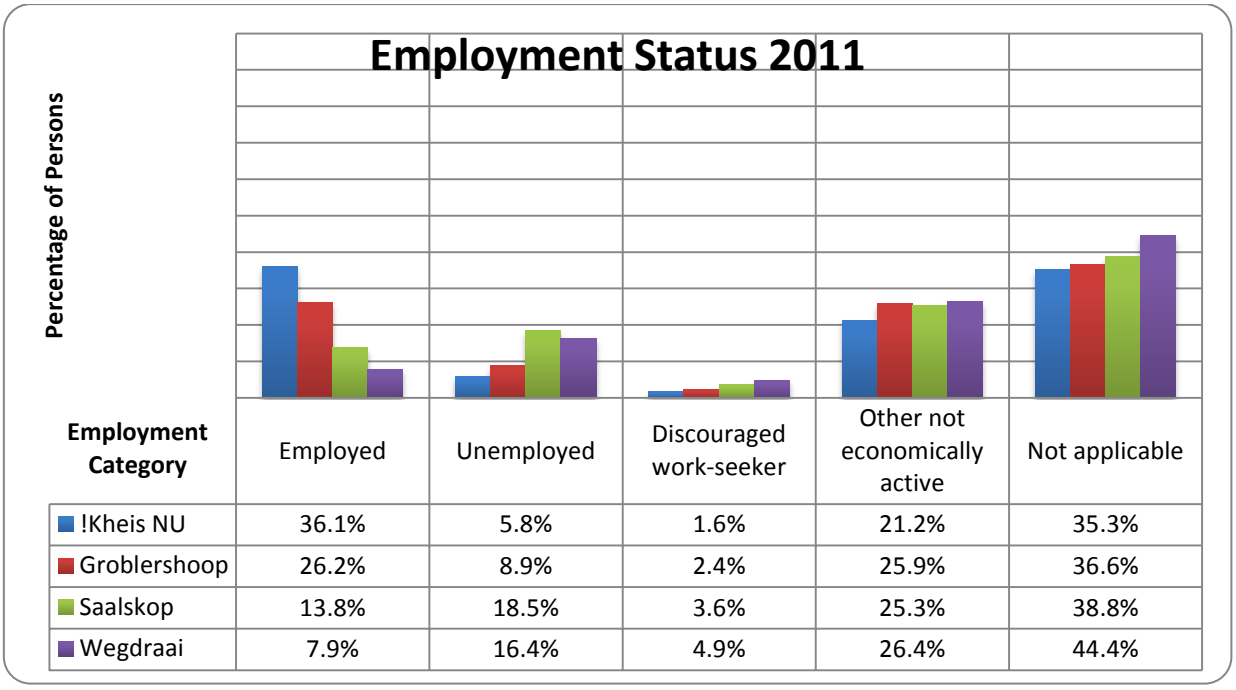


Employment Sector	In the formal sector	In the informal sector	Private household	Not applicable
!Kheis NU	27.3%	8.1%	1.1%	63.2%
Groblershoop	23.1%	2.0%	1.3%	73.5%
Saalskop	10.5%	2.7%	0.6%	85.8%
Wegdraai	5.4%	1.2%	1.0%	92.1%

Figure 27: Local areas employment by the formal/ informal sector[14]

Collectively 21% of all employable people, are actually employed. The remaining individuals that fall within the categories 'unemployed, discouraged work seekers, and not economically active' add up to a further 40%. This generally means that the 40% that could have been 'providers' in a home, have now become dependents, thus lending to the economic vulnerability of the household (Figure 28).

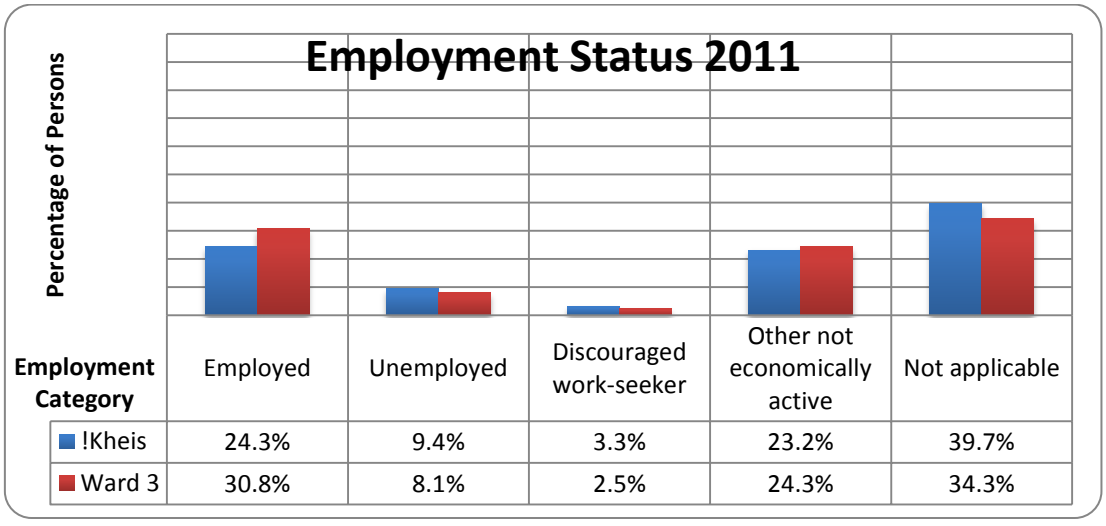
[14] Source: Statistics South Africa Census 2011.



Employment Category	Employed	Unemployed	Discouraged work-seeker	Other not economically active	Not applicable
!Kheis NU	36.1%	5.8%	1.6%	21.2%	35.3%
Groblershoop	26.2%	8.9%	2.4%	25.9%	36.6%
Saalskop	13.8%	18.5%	3.6%	25.3%	38.8%
Wegdraai	7.9%	16.4%	4.9%	26.4%	44.4%

Figure 28: Local areas employment status

The percentage of people employed within Ward 3 was higher than that of the !Kheis Local Municipality in 2011, as was the percentage of people who responded 'other not economically active' (Figure 29). This category (Other not economically active), typically points to those people that are able and willing to work, but cannot find employment of any sort. Percentages of unemployed persons and discouraged work seekers were higher in the !Kheis Local Municipality than in Ward 3 in 2011.



Employment Category	Employed	Unemployed	Discouraged work-seeker	Other not economically active	Not applicable
!Kheis	24.3%	9.4%	3.3%	23.2%	39.7%
Ward 3	30.8%	8.1%	2.5%	24.3%	34.3%

Figure 29: Employment by status in the !Kheis LM and Ward 3[15]

[15] Source: Statistics South Africa Census 2011.

7.3 Land Use

The area is predominantly agricultural. The main farming endeavour is sultana grapes. The vineyards are planted along both banks of the Orange River and are generally contained within an area close to the river (500 m to 1000 m). Other significant land uses in the area are:

- Residential:
  - The town of Groblershoop is located approximately 14 km south-east of the eastern boundary of the farm Sand Draai;
  - The urban settlement (township) of Wegdraai, which is located on the western side of the Orange River on the farm Boegoeberg 48;
  - Numerous farmhouses and farm labourer houses on the northern and southern banks of the Orange River. These are residences related mainly to the sultana grape farms;
  - The main farmhouse on Bokpoort is situated on a hill in the central portion of the farm; and
  - The main farmhouse on the farm La Gratitude is situated 5200 m east of the north-eastern corner boundary of Bokpoort.
- Educational: there is a school in Groblershoop and several farm schools in the area;
- Recreational: there is a golf course on the western side of Groblershoop; and
- Industrial: Eskom's Garona substation is located on the eastern boundary of Bokpoort 1800 m north-east of the Rooilyf siding on the Saldanha-Sishen railway line.

7.4 Visual

The study area is located within the central part of the Northern Cape Province, being located to the north-west of the town of Groblershoop and to the south-east of Upington in the !Kheis Local Municipality. The development site is rural in nature, with intensive cultivation occurring in a narrow strip alongside the Orange River. The remainder of the development site and surrounding area comprises of rangeland (used for rearing of livestock (sheep and cattle) and game that consists of sparse natural semi-desert vegetation.

The development site is uninhabited, with the only permanent human habitation being located along the Orange River corridor and its immediate surrounds, concentrated around the Sand Draai farmstead. The Bokpoort Solar Power Plant is located to the east of the site, and represents a very large-scale power generation development that is resulting in development of large-scale industrial infrastructure over a large footprint and the concomitant transformation of the affected area from a natural state.

A number of linear infrastructure features are located in the vicinity of the development site; a district road – the Gariep Road – that runs from the N8 highway (located to the south of the development site), running east of the Orange River to the N14 highway bisects the south-western part of the development site. This road provides local access to properties on the eastern bank of the Orange River as it flows northwards towards Upington. The Sishen-Saldanha Iron Railway runs through part of the development site, crossing the Orange River close to the Sand Draai farmstead. Lastly a 132 kV power line bisects the southern part of the development site, running in an east-west orientation.

In order to identify receptor locations in the study area, a radius of 5 km beyond the boundaries of the site has been used. This radius has been utilised, as beyond 5 km, even a large structure would be difficult to differentiate from the surrounding landscape.

As can be seen in Figure 30 below, a cluster of receptor locations exists in the south-western part of the study area. The static receptor locations are typically located around farmsteads, with the presence of two small residential settlements of clustered housing being present within the study area. The receptors are located around the following farmsteads and locations (Figure 30):

- Saalskop Farmstead (west of the Orange River)
- Gannaput Farmstead (west of the Orange River)
- Sanddraai Farmstead (east of the Orange River on the development site)
- Bokpoort Farmstead South (close to the Orange River corridor, east of the river)
- Farmsteads along the Opwag (farm access) Road (west of the Orange river)
- Wegdraai Settlement
- Saalskop Settlement
- Bokpoort Farmstead North (located away from the Orange River corridor)
- Ebenhaeser Farmstead (located away from the Orange River corridor)

Three public access 'right of ways' are present in the area:

- The Gariep Road that bisects the development site
- The Opwag (farm access) Road within the Orange River corridor
- The N10 national road west of the Orange River

It is important to note that apart from the Bokpoort North and Ebenhaeser farmsteads that are located to the north, away from the Orange River corridor, all receptor locations are either located within the Orange River Corridor, or to the west of the river. North-east of the Sand Draai farmstead cluster of receptors and the Gariep Road, no receptors are located on the development site.

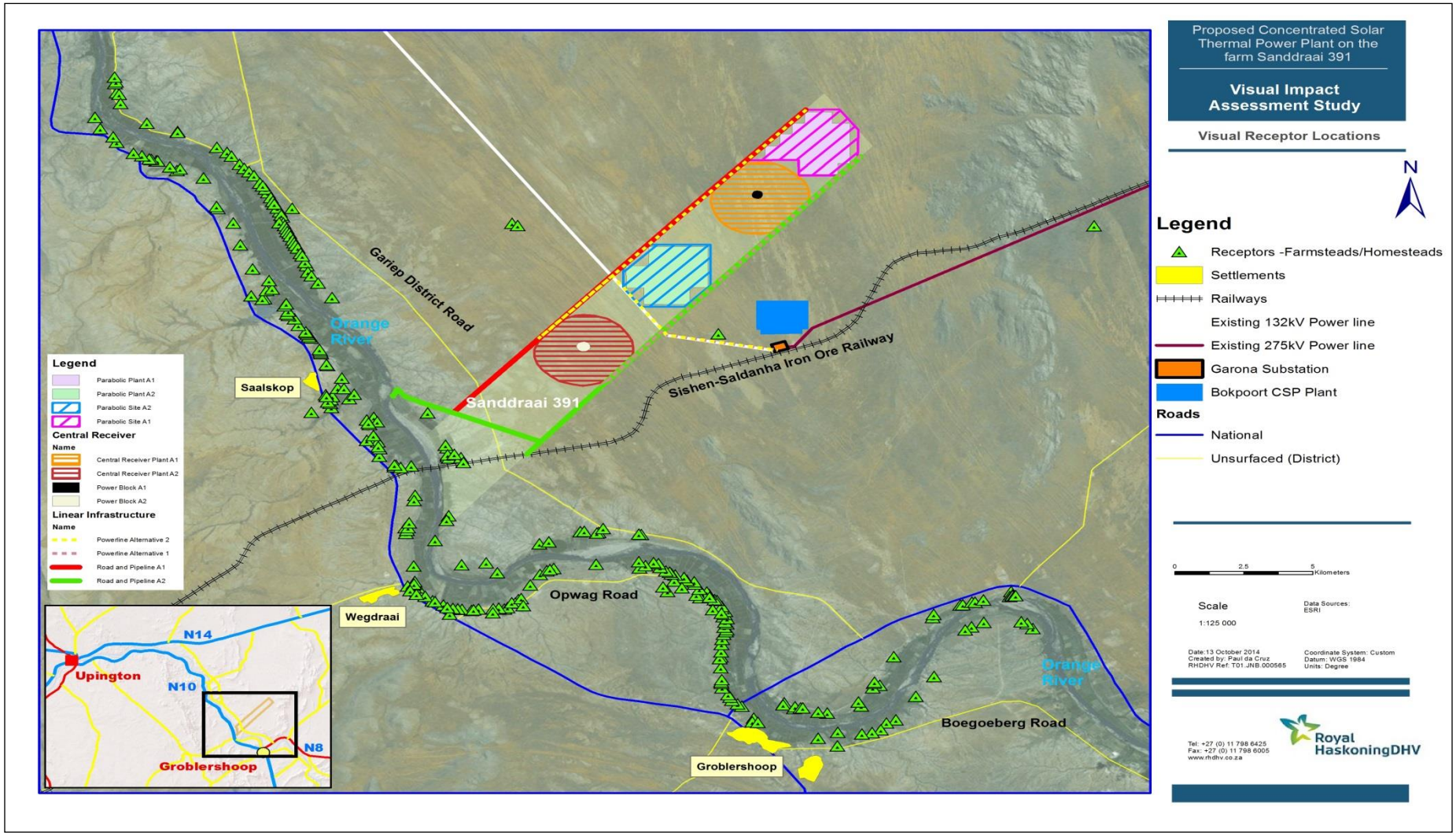


Figure 30: Receptor locations within the study area

7.5 Noise

The assessment found some sources of noise in the existing environment that could be calculated and modelled in the propagation software. Other sources such as wildlife, birdcalls, insect noise, are excluded from the calculation in the baseline.

7.5.1 Roads

Roads in the region identified to be included in the soundscape are:

- National Route 10 (N10) – The road travels from Groblershoop to Upington all along the banks of the Orange River. The road has a large number of small vehicles.
- Unnamed Road 01 (Road turning off from N8) – This gravel road is the main access route to the site and is currently utilised by all the construction vehicles travelling to Bokpoort.
- Unnamed Road 02 (access road to Bokpoort) – turning off from the main access road, across the bridge over the rail way is a service road following the railway line, this road also is used as the main access road to Bokpoort.

7.5.2 Railway Line

The Saldanha-Sishen railway line is aligned in a north-east to south-west direction through the central sector of the neighbouring farm Bokpoort (the farm on which the Bokpoort plant is undergoing construction). There is a cross-over siding (Rooilyf Siding) for the ore trains just south of the location of Bokpoort (Loop 16). There are 3 trains per day on this line (data obtained from Transnet Freight Rail) the speed of the train travelling is no more than 50 km/hr.

7.5.3 Identified Sensitive Receptors

Figure 31 indicates the sensitive areas, based on the information gathered from cadastral maps (2821DB, 2821DD, 2822CA & 2822CC), Google Earth and other Aerial Photography conducted in the past. It is noted that some of the information is old and that houses could have been constructed recently. The sensitive areas were established to the best available information at hand and experience gained during the site visit.

As these areas are spread out over the region, therefore there are only a few sensitive areas located close to the boundary of the farm. Table 17, (Figure 31), below, present the relevant sensitive areas selected for detailed analysis.

Table 17: List of receivers used in modelling analysis

Site_ID	Name	Latitude	Longitude	SANS 10103 Maximum allowable noise limit (dBA)		
				Day Night (24 hour cycle)	Day (06:00 – 22:00)	Night (22:00 – 06:00)
REC_01	Sand Draai farm gate	-28.7787	21.90311	45	45	35
REC_02	Eskom substation	-28.740887	21.994887	45	45	35
REC_03	Loop16 North	-28.7086	22.0275	45	45	35
REC_04	Sand Draai North	-28.653739	22.011702	45	45	35
REC_05	Bokpoort farmhouse	-28.73776	21.97593	45	45	35
REC_06	Bokpoort contractors offices	-28.73397	22.00043	45	45	35

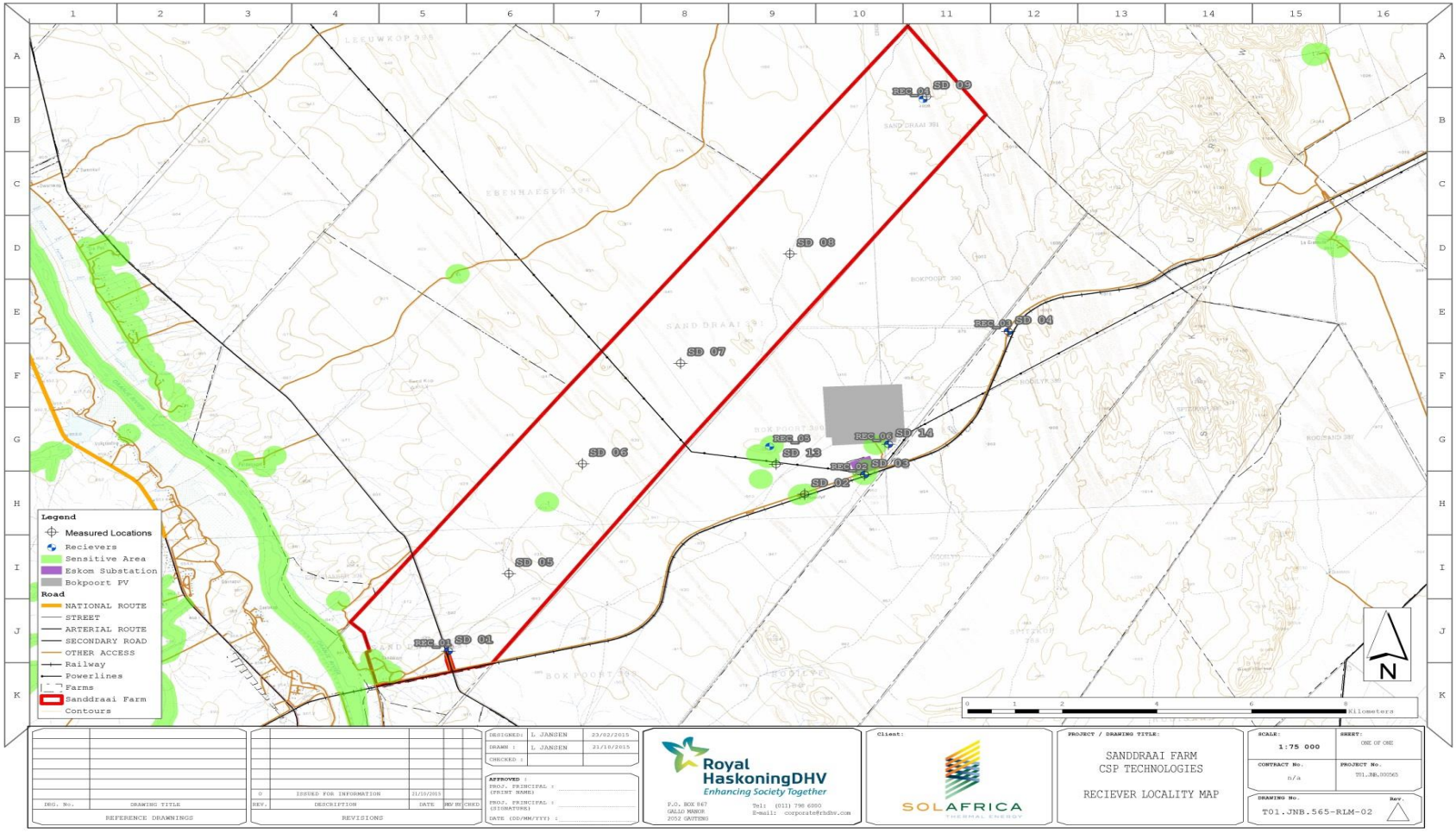


Figure 31: Map illustrating the locations of the identified receptors

7.6 Heritage and Historical Background

The //Khara Hais Municipality has a rich heritage and it encompasses the different cultures of the Nama, Koranna, settlers, missionaries, farmers, etc. The main town of Upington dates back to the mid-19th century. According to history, in those days the remote northern reaches of the Cape Colony were home to cattle rushers, gun-runners, river pirates and outlaws of all kinds. Among the most sought-after hideouts were the densely-wooded islands in the Gariep River around the present-day Upington. At the time of Reverend Schröder, the early settlement of Upington was known to the hunters and traders as Olyvenhoutsdrift because of the wild olive trees ('olienhoutbome') growing around the mission station and along the river[16].

The Kheis Municipal Area was initially inhabited by the Khoi-San people. The San, who lived a nomadic life, migrated through the area. The Korannas (Khoi group) arrived in the area during the 18th century. They were widely spread over the "Benede Oranje" area and consisted of various tribes, each with its own captain (leader). The groups who lived in the Kheis area, were under leadership of Captain Willem Bostander and Klaas Springbok. Many of their descendants still live in the area today. Other Khoi-groups, such as the Griekwas, also migrated through the area and intermarried with the Korannas. Later Coloured stock farmers, as well as white hunters and farmers arrived.

Compared to other parts of the Northern Cape, it seems that not much is known about the archaeology of the 18th and 19th century history of the Langeberg region. A number of heritage investigations refer to Stone Age material from the area[17]. Pelser & Lombard[18] mentions graves and lithic material at a site 15km north of Postmasburg and close to the Beeshoek mine on rocky ridges and on the flood plain along the Orange River. Rock engravings are also mentioned from both Beeshoek Mine and Paling farm. The Paling site is probably associated with a cave shown on a map dating from 1881.

A basic assessment along the Groblershoop - Marydale power line, revealed a single site of cultural heritage significance. A few other stone tools were also identified out of context.

Beaumont and Boshier[19] describe ancient specularite mines around Postmasburg and Beeshoek and refer particularly to finds at Doornfontein, 16 km north-west of Postmasburg. The farm Paling is also mentioned as to have Stone Age material from all phases, mentioning artefacts such as core flakes, blades, segments and scrapers made out of Silcrete, jasper, quartzite, horn fells and banded iron stone.

7.7 Traffic

The Z.F. Mgcawu District Municipality covers an area of 103 771 square kilometres with its northern borders aligned with Botswana and Namibia. The district is split by the Orange River from the east to west. Along the banks of the Orange River intensive agricultural activities are prevalent including vineyards and domestic food farms. Upington town is the main urban area for the region and serves as both an administrative and commercial centre as well as a stopover into the area's hinterland. This region attracts tourists travelling to Namibia and local reserves, such as Witsand (approximately 40 km north of Sand Draai) and the Augrabies National Park west of Upington.

[16] Erasmus, B.P.J. 2004. *On Route in South Africa.* Jonathan Ball Publishers: Cape Town.
[17] Groenwald, G. 2013. Palaeontological Desktop Assessment of the Farm Gloria 266, near Hotazel Town in the John Toalo Gaetsewe District Municipality in the Northern Cape Province.
[18] Pelser, A.J. & Lombard, M. 2013. A report on the archaeological investigation of Stone Age finds on the Paling 434, Hay Magisterial District, near Postmasburg in the Northern Cape Province. EIA Report for Kia Batla Holdings, Craighall.
[19] Beaumont, P. & Boshier, A.K. 1974. Report on test excavations in a prehistoric pigment mine near Postmasburg, Northern Cape. S. Afr. archaeol. Bull. 29 (113-114):41-59.

The N14 and the N10 are the primary roads in the region and are the main links between the economic centres in Gauteng and Namibia. The population distribution is primarily concentrated in and around the small towns along the Orange River, and specifically in Upington. Other towns/settlements in relatively close proximity to the proposed farms are, Keimoes, Kanoneiland, Louisvale, Oranjevallei, Klippunt, Grootdrink, Groblershoop, Hendriksdal and Boegoeberg.

7.7.1 General Description of the Surrounding Road Network

7.7.1.1 National Route 10 (N10)

The National Route 10 (N10) is a national freeway in South Africa under the jurisdiction of the South African National Roads Agency (SANRAL) which connects Port Elizabeth on the Eastern Cape coast with the Namibian border at Nakop. The N10 traverses through the towns of Cradock, De Aar and Upington as it journeys from the eastern seaboard to the Namibian border. The N10 traverses on the eastern side of Upington in the Northern Cape, where it crosses the Orange River, and then traverses to south-east through Prieska and De Aar. The N10 is a vital link to the success of this project as it will be extensively used to transport materials, equipment and personnel to the proposed site during the construction and operational phases.

The N10 is a single carriageway road with one lane in each direction (Figure 32). The lanes on this road are approximately 3.7 m wide with gravel shoulders present on both sides of this road. The vehicle speed limits on this section of the N10 oscillates between 100 km/hr and 120 km/hr. The horizontal alignment of this road within the study area ranges from fairly gentle to moderately winding in some sections. The vertical alignment of this road ranges from fairly flat in some sections to rolling in other sections. As such, the general geometric design of this road is conducive to the movement of heavy vehicle traffic.

Since this road is a national road, it is prudent to assume that this road was built to fairly high structural standard. As such, the road pavement will have the structural strength to convey the additional volumes of heavy vehicles that will be generated by this project without showing signs of any major structural distress. The current pavement condition on the N10 within the study area ranges from good to fair throughout its length within the study area.

The general road safety conditions on the N10 within the study area are good as no road safety hazards were observed during the site visit. There was very little pedestrian activity and no cyclist activity observed this section of the N10.

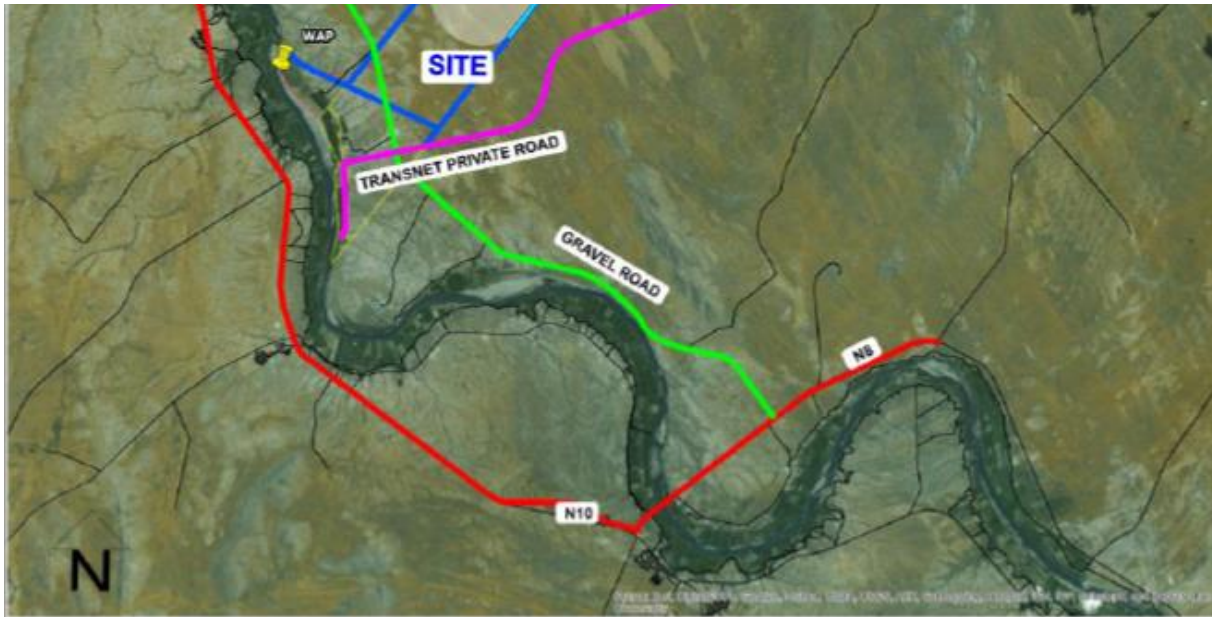


Figure 32: Road network surrounding the proposed CSP plant

7.7.1.2 National Route 8 (N8)

The National Route 8 (N8) is also a national freeway that falls under the jurisdiction of SANRAL. The N8 commences at Groblershoop in the Northern Cape, at an intersection with the N10 (Figure 32). It traverses in an easterly direction towards Griquastown and Kimberley. From Kimberley it traverses in a south-easterly direction into the Free State province, on a recently upgraded stretch of road, to Bloemfontein. From Bloemfontein, the N8 traverses through Thaba Nchu and Ladybrand until it reaches the Lesotho border at Maseru Bridge where it ends. The N8 is also a vital link to the success of this project as it will be extensively used to transport materials, equipment and personnel to the proposed site during the construction and operational phases.

The N8 freeway within the study area is a single carriageway road with one lane in each direction. The lanes on this road are approximately 3.7 m wide with paved shoulders present on both sides of this road. The vehicle speed limits on this section of the N8 fluctuates between 100 km/hr and 120 km/hr. The horizontal and vertical alignments of this road within the study area is generally good and therefore is conducive to the movement of heavy vehicle traffic. This road also was built to a fairly high structural standard and as such the road pavement will have the structural strength to convey the additional volumes of heavy vehicles that will be generated by this project without suffering any major degradation. The current pavement condition on the N8 within the study area ranges from good to fair.

The general road safety conditions on the N8 within the study area are good as during the site visit no road safety hazards were observed. There was no pedestrian activity and no cyclist activity observed on this section of the N8. Although no animals were observed during the site visit, motorists still need to be aware of stray animals and wild game which are known to roam these parts of the province.

7.7.1.3 Gravel Road

Approximately 3 km from the start of the N8, there is an existing gravel road that commences at the intersection with the N8. This road falls under the jurisdiction of the Northern Cape Department of Transport. This gravel road is approximately 10 m wide for most of its length (Figure 32). This road is in a fair to poor condition for most its length. The horizontal alignment is moderately winding in some sections but can be described as gentle for most other sections. The vertical alignment can described as rolling given the

topography of the area however no excessively steep slopes were encountered that will hinder the movement of heavy vehicles. The riding quality of this road is poor as there is a lot of loose gravel lying on the surface of the road which poses traction problems for vehicles using this road. It is recommended that this road is re-bladed by the road authority to remove the loose gravel from the surface of the road. In the absence of speed restriction signs on this road, it is envisaged that the speed limit on this road is 60 km/hr as speeds beyond this will be dangerous to motorists. There was no pedestrian activity and nor any cyclist activity observed on this road.

7.7.1.4 Private Transnet Road

The final leg of the journey to the proposed site is via a private gravel road that belongs to Transnet. This road traverses parallel to the rail line for its entire length (Figure 32). It is apparent that the intended purpose of this road is to provide access for Transnet Freight Rail staff to access the rail line to undertake maintenance and repairs to the line. This gravel road is approximately 10 m to 11 m wide for most of the length. The horizontal alignment is fairly gentle for most of its length. The vertical alignment can be described as fairly flat with slight gradients encountered on some sections of this road. This road is in a relatively poor condition for most its length as there is a lot of loose gravel lying on the surface of the road which significantly reduces the riding quality of this road. It is recommended that this road is rebladed to remove the loose gravel from the surface of the road. In the absence of speed restriction signs on this road, it is envisaged that the speed limit on this road is 60km/hr. There was no pedestrian activity and nor any cyclist activity observed on this road.

7.7.1.5 Existing Pedestrian and Cyclist Activity

Only a few pedestrians were observed on the surrounding during the site visit. These pedestrians were observed using the wide verges which adequately accommodate pedestrian movements within the study area. Pedestrians do not impede on the flow of traffic as no conflicts between pedestrians and vehicles were observed during the site visit. No cyclists were observed on the road network in the immediate vicinity of the plant.

7.7.1.6 Existing Road Safety Conditions

The observed road safety conditions within the study area are generally acceptable. The observed vehicle speeds and driver behaviour within the study area are generally good, with the occasional vehicle exceeding the speed limit on the N10. No inherent road safety hazards were observed on the road network within the study area.

8 SUMMARY OF SPECIALIST FINDINGS

The findings and recommendations of the specialists and reports of specialised processes have been incorporated in this chapter. The following studies have been undertaken as part of this EIA process:

- Fauna and Flora & Bat Opinion (**Appendix D1**)
- Avifauna (**Appendix D2**)
- Hydrogeology (**Appendix D3**)
- Surface Water (**Appendix D4**)
- Aquatic Ecology (**Appendix D5**)
- Socio-economic (**Appendix D6**)
- Visual (**Appendix D7**)
- Noise (**Appendix D8**)
- Air Quality (**Appendix D9**)
- Waste (**Appendix D10**)
- Traffic (**Appendix D11**)
- Palaeontology (**Appendix D12**

8.1 Ecology

8.1.1 Vegetation

As mentioned in Section 7.1.8, four vegetation units were observed within the Sand Draai farm (Figure 33).

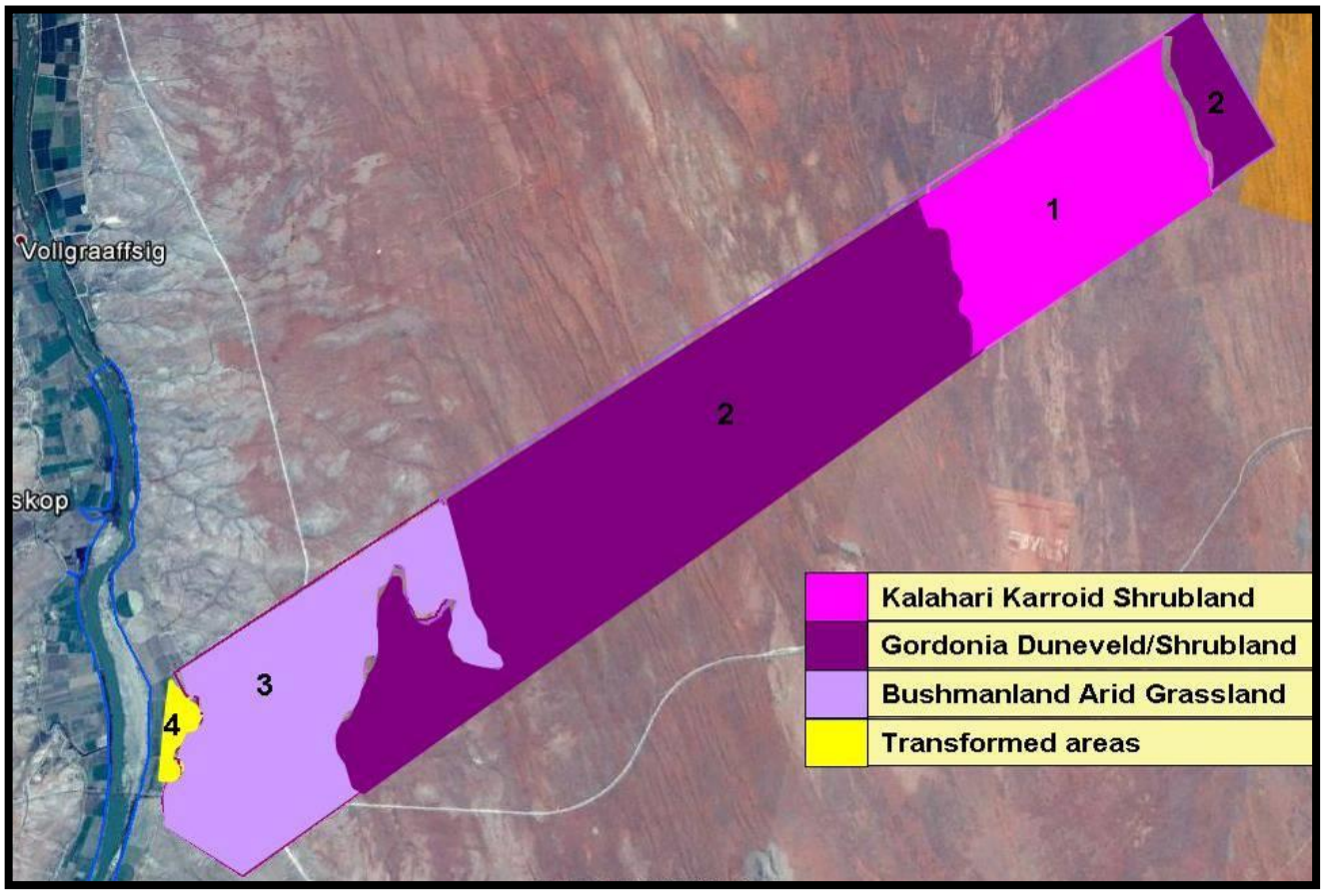


Figure 33: Vegetation units observed within the Sand Draai farm

8.1.1.1 Open Shrub Plains or Kalahari Karroid Shrubland (NKb5)

The Kalahari Karroid Shrubland is dominated by low karroid shrubland on flat, gravel plains situated on the southern portions of the Parabolic trough Site Alternative 1 (Figure 34). The vegetation is characterised by low karroid shrubs and is indicative of a transition zone between the deep Kalahari sand and the Karoo shrublands.

Two protected tree species were recorded including scattered Shepherd's Trees (*Boscia albitrunca*) as well as Camel Thorn (*Vachellia erioloba).* The latter is also a Red Data species.

Figure 34: Open shrub plains or Kalahari Karroid Shrubland present on site

8.1.1.2 Open Shrubland or Gordonia Duneveld (SVkd1)

The Gordonia Duneveld (SVkd1) consists of parallel dunes on deep Aeolian sand underlain by superficial silicretes and Calcretes of the Cenzoic Kalahari Group with flat areas between the dunes, the latter between 3-8 m above the plains. The proposed eastern portions of the Parabolic trough Site Alternative 1 and the entire Site Alternative 2 are situated within open shrubland and dunes comprising Gordonia Duneveld (SVkd1) (Figure 35).

Two protected tree species were recorded including several Shepherds Trees (*Boscia albitrunca*) as well as Camel Thorn (*Vachellia erioloba*).

One Red Data species namely the Camel Thorn (*Vachellia erioloba*) was found scattered as single medium-sized individuals within this open dune shrubland.

Figure 35: Open shrubland or Gordonia Duneveld present on site

8.1.1.3 Bushmanland Arid Grassland (NKb3)

The Bushmanland Arid Grassland is characterised by extensive to irregular plains on slightly sloping plateau vegetated grassland dominated by white grasses (*Stipagrostis* spp.) giving the vegetation type the character of semi-desert 'steppe' (Figure 36). In places low shrubs of *Salsola sp.* change the vegetation structure. In years of abundant rainfall rich displays of annual herbs can be expected. This vegetation type occurs on freely drained, red-yellow apedal soil, with a high base status and <300 mm deep and is sparsely vegetated and consists of irregular and slightly sloping plateau and plains grasslands. Very little of this vegetation type has been transformed and the area is mostly used for grazing by domestic livestock and game.

Two protected tree species were recorded including several Shepherds Trees (*Boscia albitrunca*) as well as Camel Thorn (*Vachellia erioloba*).

One Red Data species namely the Camel Thorn (*Vachellia erioloba*) was found scattered within this open dune shrubland.

Figure 36: Bushmanland Arid Grassland (NKb3) present on site

8.1.1.4 Transformed Areas

Situated on the southern boundary of the site are transformed areas including existing residential homesteads, workshops as well as grape vineyards. There are no other developments except for the water extraction pipeline (Figure 37). Parabolic trough Site Alternative 2 is proposed within this transformed area which has a low conservation potential as well as low ecosystem functioning. Several alien invasive *Prosopis glandulosa* were observed around the homesteads.

Figure 37: Transformed areas present on site

8.1.1.5 Lower Gariep Alluvial Vegetation (AZa3)

The vegetation of the Lower Gariep Alluvial vegetation (AZa3) type comprises alluvial terraces and small riverine "islands" with riparian thickets mostly dominated by *Ziziphus mucronata, Vachellia karroo, Salix mucronata, Euclea pseudebenus* and *Phragmites australis* (Figure 38). Due to the unpredictable flooding events the riparian areas have a high disturbance regime and soil movement. Grass cover varies both spatially and temporally. A number of alien plants occur along these riparian embankments.

Figure 38: Lower Gariep Alluvial vegetation present on site

8.1.2 Protected Tree Species

In terms of the National Forests Act 1998 (No 84 of 1998) the Camel Thorn (*Vachellia erioloba*), Grey Camel Thorn (*Vachellia haematoxylon*) and Shepherd's Tree (*Boscia albitrunca*) have been identified and declared as protected. The Department of Water Affairs and Forestry (now Department of Forestry and Fisheries) developed a list of protected tree species. In terms of Section 15(1) of the National Forests Act, 1998, no person may cut, disturb, damage or destroy any protected tree or possess, collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree or any forest product derived from a protected tree, except under a licence or exemption granted by the Minister to an applicant and subject to such period and conditions as may be stipulated. Trees are protected for a variety of reasons, and some species require strict protection while others require control over harvesting and utilization. The Department of Agriculture, Forestry and Fisheries (DAFF) will have to be approached to obtain the required permits for the removal of any protected tree species.

Regarding the protected Wild Ebony or Ebony Quarri Tree Euclea pseudebenus none were observed within the effected sections of the riparian zone of the Gariep River. Specimens were observed downstream from the Sand Draai site towards Grobblershoop. The entire riparian zone has been classified as High Sensitivity as it is situated within an 'Endangered' vegetation type.

8.1.3 Red Data/Endemic Species

A list of Red Data and endemic species for the Northern Cape Province is included in the Ecological Assessment (**Appendix D1**) also a list of possible red data species for the study area is included in the biodiversity assessment. One red listed species was recorded during the current field survey namely the "Declining" Camel Thorn (*Vachellia erioloba*). A species is listed as 'Declining' when it does not meet or nearly meet any of the five IUCN criteria and does not qualify for Critically Endangered, Endangered, Vulnerable or Near Threatened, but there are threatening processes causing continuing decline of the species.

8.1.4 Medicinal Species

Three medicinal plant species, have been identified within the study area. These plants occur throughout the southern African region on various soil types and areas none are threatened species.

Table 18: Medicinal species identified on site

Plant name	Medicinal use
Gomphocarpus fruticosus	Treatment of headaches, stomach pain and tuberculosis
Vachellia karroo	Diarrhoea & dysentery Gum: colds, oral thrush and haemorrhage.
Ziziphus mucronata	Cough and chest problems; diarrhoea; pain relief

8.1.5 Land Degradation

The study area is located within an area where soil erosion is regarded as insignificant with low to medium veld degradation. Most of these areas are flat while deep sand occurs on the duneveld areas. As a result little erosion is present. The smaller drainage channels or non-perennial drainage lines that occur scattered throughout the south-western portions of the site contribute somewhat to erosion especially during (infrequent) flash floods. The areas are mostly utilised for grazing by game and domestic animals including sheep and goats, thus in some areas signs of overgrazing are evident, though not large areas. The riverine areas belonging to the Lower Gariep Alluvial vegetation (AZa3) are the areas that are mostly affected by agricultural activities with close to 50% of the area transformed. The Lower Gariep Alluvial vegetation (AZa3) unit falls within an "Endangered" ecosystem.

8.1.6 Faunal Aspects

8.1.6.1 Mammals

A preliminary survey of small mammals was undertaken by using systematic trapping along transects. Occurrence of species within different habitat types was determined by setting a series of fifty Sherman traps within the interior of each vegetation community and along the edges of the vegetation community. Transects consisted of trap stations approximately 15- 20 m apart, but this may vary with terrain features. Due to time constraints the trap-lines were run for only two consecutive nights.

During field assessments, three specimens of the Striped Mouse (*Rhabdomys pumilio*) were captured in the five Sherman Traps situated on a dune slope. During the small mammal trapping (using baited small mammal live traps), the Red Data "Date Deficient" (DD), Bushveld *Gerbil Tatera leucogaster* (DD) was captured in the Open Shrub Duneveld of the study area. The species is relatively widespread in the region of the study area and burrows in the sandy soil areas. A single Striped Mouse (*Rhabdomys pumilio*) was captured in the five Sherman Traps situated on a dune slope. Trapping success of small mammals was low throughout the large site; perhaps due to the low vegetative cover which is typical of the site where although vegetation grows on rich soils, plant growth is limited by climate.

Visual observations of Slender Mongoose (*Galerella sanguinea*), Ground Squirrels (*Xerus inauris*). Small Grey Mongoose (*Galerella pulverulenta*), Yellow mongoose (*Cynictis penicillata*), Scrub Hares (*Lepus saxatilis*) and Cape Hare (*Lepus capensis*). Evidence of larger burrowing mammals was very evident in the more sandy areas, mostly associated with the sandy plains between the dunes. Species present include the Aardvark (*Orycteropus afer*), Porcupines (*Hysterix africaeaustralis*) and Bat eared foxes (*Octocyon megalotis*).

No evidence of any of the threatened mammal species were observed during the two site visitations. Honey Badgers have been recorded from the neighbouring Bokpoort farm to the south of the site. The destruction of vegetation within the Parabolic trough plant site will not have a significant impact on the larger mammal species which will be able to move away from the area and establish new territories. The clearing of the vegetation as well as soil disturbances will have a high impact the smaller mammal species which occur in the area.

No sensitive or endangered mammals were recorded within the project site.

No information is available for the impact of parabolic trough technology on bat mortality in South Africa.

8.1.6.2 Reptiles

Favourable habitat exists throughout most of the study area for various snake species. Indiscriminate killing of all snake species is likely to have resulted in the disappearance of the larger and the more sluggish snake species within the study area. Several terrestrial or ground-living lizards species were observed including Spotted Sandveld Lizard (*Pedioplanis lineocellata*) were observed darting between small shrubs within red sand dunes and Western Striped Skink (*Trachylepis sulcata sulcata*) within the low-lying quartzite and calcrete hills.

According to the outdated Branch (1988b)[20] Red Data Book as well as the updated South African Reptile Conservation Assessment virtual museum; no threatened species of reptile occurs within the study area. The destruction of approximately 700 ha for the parabolic trough plant will have a medium; short to long term impact on the reptile species occurring within the shrub plains and dunes. No development is proposed for the low-lying quartzite and calcrete rocky hills.

8.1.6.3 Amphibians

Extremely limited historic data exists for frog species occurring within the 2822CA, 2821CD, 2821DD Quarter Degree Grid Squares. Only two frog species namely Guttural Toad (*Amietophrynus gutturalis*) and Bubbling Kassina (*Kassina senegalensis*) were recorded during the previous South African Frog Atlas Project. Both these species are common and have a wide distribution range. Four frog species were recorded during the current survey. Approximately 40 mm of rainfall was recorded during a downpour which resulted in the emergence of several Guttural toads (*Amietophrynus gutturalis*) as well as Western Olive toad (*Amietophrynus poweri*). Several Bushveld rain frogs (*Breviceps adspersus*) were observed calling from burrows situated within the red sand plains as well as dunes. A Queckett's River frog (*Amietia quecketti*) was flushed from the edge of an irrigation dam adjacent to the Orange River. A probable amphibian species list is presented in the Ecological Assessment (**Appendix D1**).

No Giant Bullfrogs were observed on the site as well as along the N10 after heavy downpours in March 2015.

[20] Branch, W.R. (1988b). South African Red Data Book-Reptiles and Amphibians. South African National Scientific Programmes, Report No. 151

8.1.7 Sensitive Habitats

From the initial site visitations as well as desktop study using inter alia aerial photographs and Google Earth™ imagery the following four sensitivity categories were identified:

- **High:** Areas with high species richness and habitat diversity comprising natural indigenous plant species. These areas are ecologically valuable and important for ecosystem functioning. These areas should be avoided wherever possible.
- **Medium:** An area with a relatively natural species composition; not a threatened or unique ecosystem; moderate species and habitat diversity. Development could be considered with limited impact on the vegetation / ecosystem.
- **Low-medium:** Areas with relatively natural vegetation, though a common vegetation type. Could be developed with mitigation and expected low impact on ecosystem
- **Low:** A totally degraded and transformed area with a low habitat diversity and ecosystem functioning; no viable populations of natural plants. Development could be supported with little to no impact on the natural vegetation / ecosystem.

The following sensitive habitats were identified in the study area during the field investigation:

- **The Gariep (Orange) River and Riparian Zone and Non-Perennial Drainage Line**
  Rivers and streams/drainage lines are longitudinal systems with impacts affecting both upstream and downstream habitat. The entire seasonally inundated or non-perennial drainage lines and their associated indigenous dominated riparian vegetation must be considered as sensitive habitats. Any impact on the riverine area within the study area is therefore also likely to impact on upstream and downstream areas. Riparian zones have the capacity to act as biological corridors connecting areas of suitable habitat in birds, mammals, reptiles and amphibians. Riparian zones may act as potential refugia for certain fauna and could allow for possible re-colonisation of rehabilitated habitats. The riparian vegetation plays a vital role in the re-colonisation of aquatic macro-invertebrates as well as reptiles and amphibians.

  All rivers including the Gariep (Orange) River as well as several smaller non-perennial drainage lines must be considered as a High sensitive habitats due to ecological functioning as well as providing suitable habitat as well as biological or dispersal corridors for remaining faunal species. The Gariep (Orange) River and Lower Gariep Alluvial vegetation (AZa3) type comprises alluvial terraces and small riverine “islands” with riparian thickets mostly dominated by *Ziziphus mucronata, Vachellia karroo, Salix mucronata, Euclea pseudebenus* and *Phragmites australis*. Grasslands occurring on the flat alluvial are periodically flooded and also forms part of this complex vegetation type. These grasslands are mostly dominated by *Cynodon dactylon, Setaria verticillata* and *Cenchrus cilliaris*. The entire riparian zone has been classified as an ‘Endangered’ vegetation type (Figure 39).

Figure 39: Orange River and riparian zone

- **Low-lying Quartzite and Calcrete Rocky Hills**

  The low-lying quartzite and calcrete rocky hills (Figure 40) must be considered as Medium sensitive habitats which provides important habitat for birds and rupicolous reptile and mammal species. For example, a wide variety of bird groups utilize ridges, koppies and hills for feeding, roosting and breeding. These groups include some owls, falcons, nightjars, swifts, swallows, martins, larks, chats, thrushes, cisticolas, pipits, shrikes, starlings, sunbirds, firefinches, waxbills, buntings, canaries, bustards and eagles.

Figure 40: Low-lying Quartzite and Calcrete rocky hills

8.1.8 Potential Impacts

Any development will have a negative effect on the natural ecosystem in particular the vegetation thereof. The vegetation of areas where the parabolic trough plant development and building of structures will take place will destroy all vegetation present on the specific area where the parabolic trough plant structures are planned to be erected. Due to the effect of soil tillage and the complete removal of indigenous vegetation these areas will be totally transformed or destroyed. The effect on the ecosystem and surrounding areas will depend on the planned development activity.

The proposed linear infrastructure alignments are located within four different vegetation types. Three of the vegetation types namely the Bushmanland Arid Grassland (NKb3), Gordonia Duneveld (SVkd1), Kalahari Karroid Shrubland (NKb5) that are not regarded as being threatened. The Lower Gariep Alluvial vegetation (AZa3) situated within the floodplain of the Gariep River is classified as an “Endangered” vegetation type. No major developments are proposed within this sensitive habitat except for the proposed water abstraction pipeline. It is imperative that construction activities are restricted to the pipeline servitude within the riparian zone of the Gariep River. Vegetation clearance should be restricted to alien invasive sections preventing the removal of any indigenous riparian tree species. The landscape is mostly low flat to undulating areas with sandy plains, dunes and low-lying rocky hills present in some areas.

Large portions of the Sand Draai site are used for grazing by domestic stock (sheep) and game. Although representative of the natural vegetation, none of the units are regarded as very sensitive with large patches of these vegetation types available in other parts of the Northern Cape region. One does however have to ensure that no unnecessary disturbance of the adjacent natural vegetation occurs so as to eliminate an edge effect of the parabolic trough plant. None of the impacts assessed for the different vegetation units will have a high negative effect on the adjacent environment.

The Red Data ‘declining’ tree *Vachellia erioloba* is present in all of the vegetation units. It plays an important role in the ecosystem by providing food, shelter and shade to various animal and bird species. Protected tree species recorded on the site included Camel Thorn (*Vachellia erioloba*), Grey Camel Thorn (*Vachellia haematoxylon*) and Shepherd’s Tree (*Boscia albitrunca*). It is imperative that these trees are not unnecessarily removed from the ecosystem. If single individuals of these species have to be removed, a permit from the Department of Agriculture, Fisheries and Forestry (Forestry Branch) and Nature Conservation will have to be obtained for this purpose. It is recommended that once the final linear infrastructure and parabolic trough plant site have been decided on and pegged that a walk down by a qualified plant ecologist is done to determine how many of these protected species must be removed.

The proposed parabolic trough plant and associated linear infrastructure including pipelines, power lines and access roads and associated increased vehicular traffic may impact on the terrestrial fauna in various ways. The major impacts occurring during the construction phase involve the loss and fragmentation of habitats, with a consequent loss of biodiversity, some ecosystem functioning and possibly loss of remnant faunal species or of plant species of conservation concern. This may result from direct land clearance, or occur indirectly via loss or changes in habitats due to consequent changes in drainage patterns, increased fire risk, or secondary impacts associated with socio-economic factors resulting from changes in surrounding land use. During the operational life of the parabolic trough plant and access road, small accumulative impacts would also occur, including ongoing road mortalities, increased disturbance (noise and light), dust generation, air pollution, chemical contamination from petroleum and rubber products, increased litter, changes in the incidence of fire (more frequent), and the introduction of a corridor for alien vegetation. All of these factors may impact the surrounding fauna and ecological processes in different ways.

The potential impact of fauna colliding with the infrastructure as well as possible burning by parabolic trough is not known and would be restricted mainly to birds (refer to the Avifaunal Assessment – **Appendix D2**) as well as bats foraging on insects.

No information is available for the impact of parabolic trough plants on bat mortality in South Africa. It is therefore proposed that a bat specialist is appointed to do a site visit (walk-through) prior to construction. If bat roosts are found, construction activities in that area will halt until a suitable mitigation has been discussed with a bat specialist and agreed upon by the Applicant. Mitigation measures for bat impacts are incorporated in the EMPr (**Appendix D1**).

8.2 Avifauna

8.2.1 Transect Counts

A total of 3263 individual birds were recorded during walk transect counts at the CSP site. Of the total amount of birds counted, only 14 individuals were priority species. The remaining 3249 individuals were all non-priority species.

An Index of Kilometric Abundance (IKA = birds/km) was calculated for each species recorded during walk transects. Table 7-2 of the Avifaunal Assessment (**Appendix D2**) shows the relative abundance of species recorded during the pre-construction monitoring through walk transects. Table 7-3 of the Avifaunal Assessment (**Appendix D2**) lists all the priority species that could potentially occur at the site and the potential impact on the respective species by the solar energy infrastructure.

8.2.2 Vantage Point (VP) Watches

A total of 72 hours of vantage point watches (12 hours per survey per vantage point) was completed in order to record flight patterns of priority species at the site. In the two sampling periods, priority species were recorded flying over the VP areas for a total of 34 minutes and 45 seconds. A total of only 7 individual flights were recorded, containing a total of 13 individual birds. Of these, 2 (28.5%) flights were at low altitude (0 - 20 m), 1 (14.3%) was at medium altitude (20 – 250 m) and 4 (57.1%) were at a high altitude (>250 m). The passage rate for priority species over the VP area (all flight heights) was 0.18 birds/hour. See Figure 41 below for the duration of flights within the VP area for each priority species, at each height class[21].

[21] Flight duration was calculated by multiplying the flight time with the number of individuals in the flight e.g. if the flight time was 30 seconds and it contained two individuals, the flight duration was 30 seconds x 2 = 60 seconds.

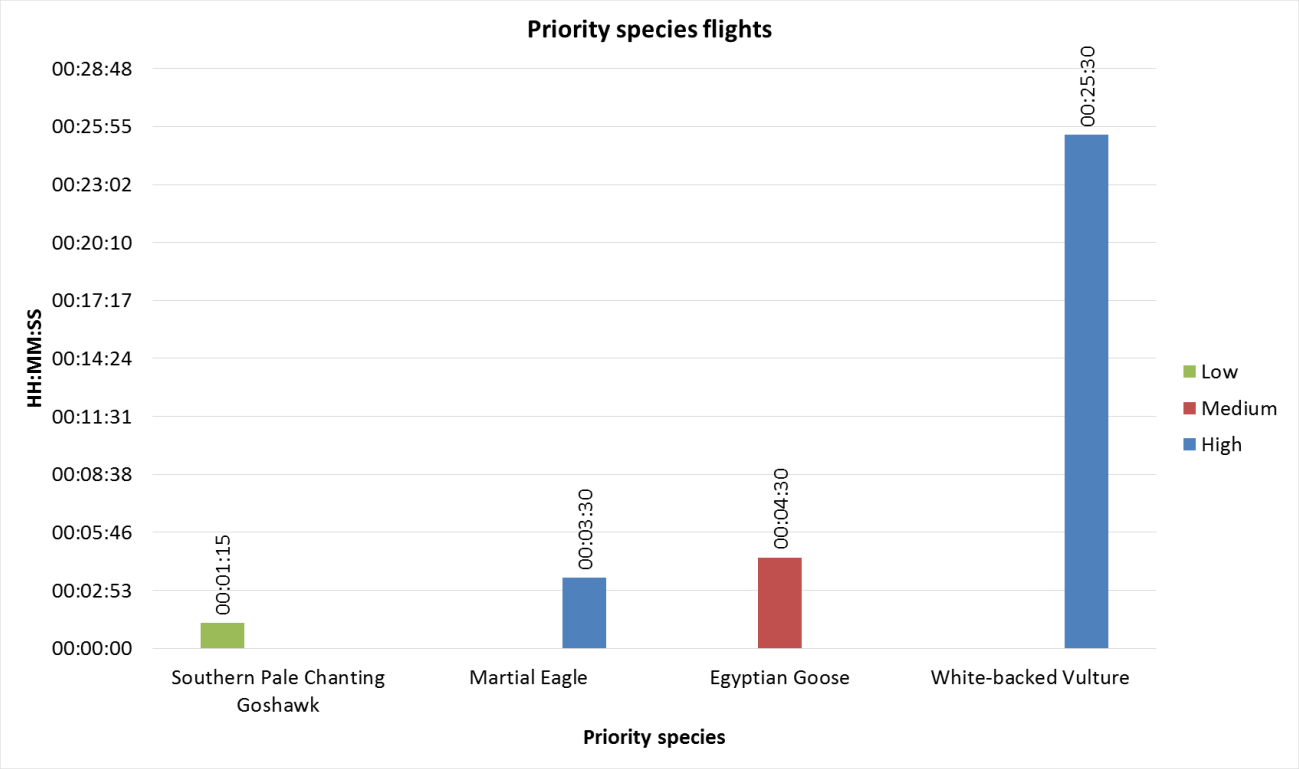


Figure 41: Flight duration and heights recorded for priority species

8.2.3 Spatial Distribution of Flight Activity

Flight maps were prepared, indicating the spatial distribution of passages containing flights of priority species flights observed from the three vantage points (see Figure 42 - Figure 45 below). This was done by overlaying a 100 m x 100 m grid over the survey area. Each grid cell was then given a weighting score taking into account the duration and distance of individual flight lines through a grid cell and the number of individual birds associated with each flight crossing the grid cell. High altitude flights are indicated in shades of blue, medium height flights are indicated in shades of yellow, orange and red, and low altitude flights are indicated in shades of green.

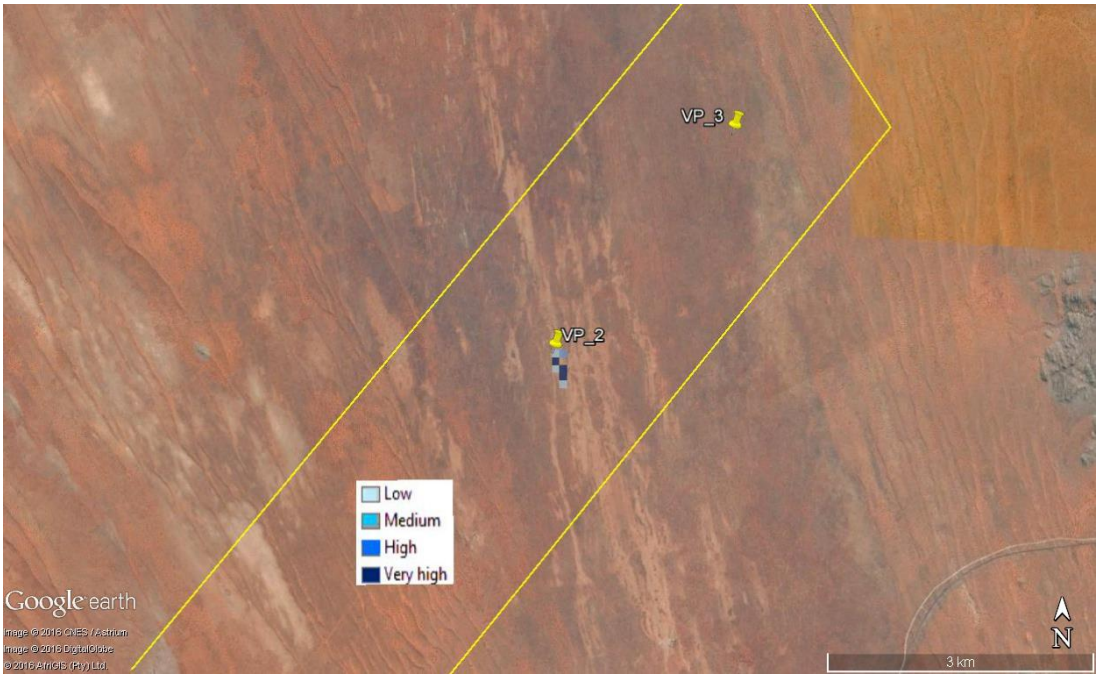


Figure 42: Spatial distribution and weighting scores of flights for Martial Eagle (only high height flights were recorded)

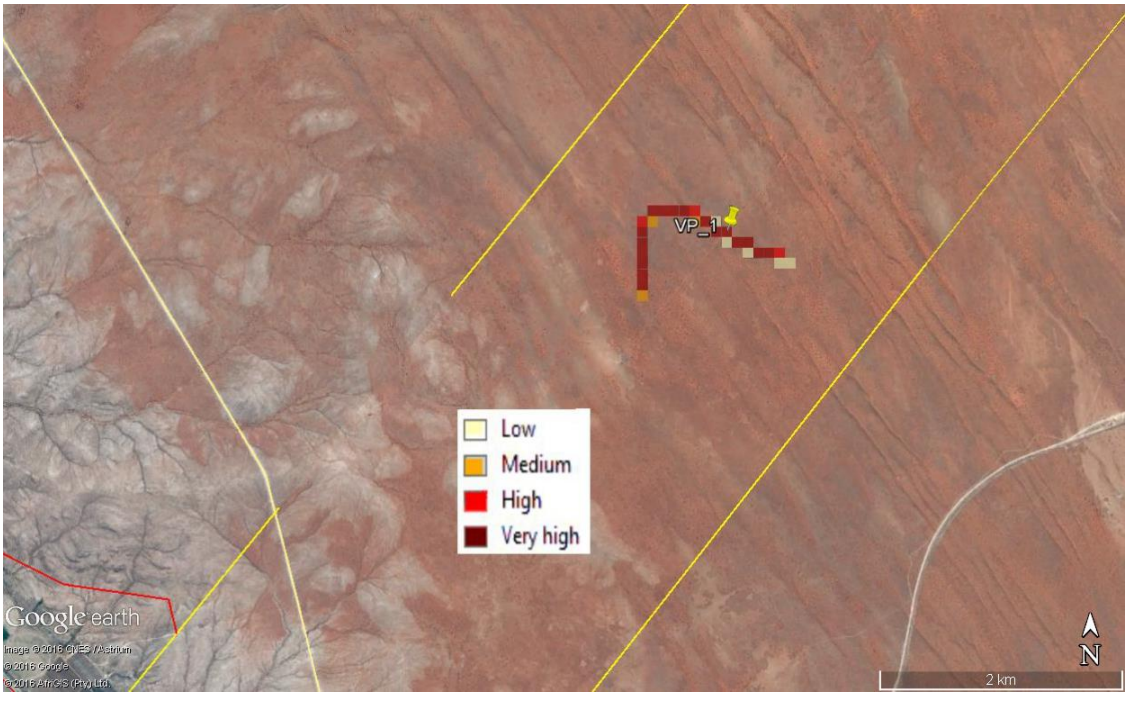


Figure 43: Spatial distribution of flights and weighting scores for Egyptian Goose (only medium height flights were recorded)

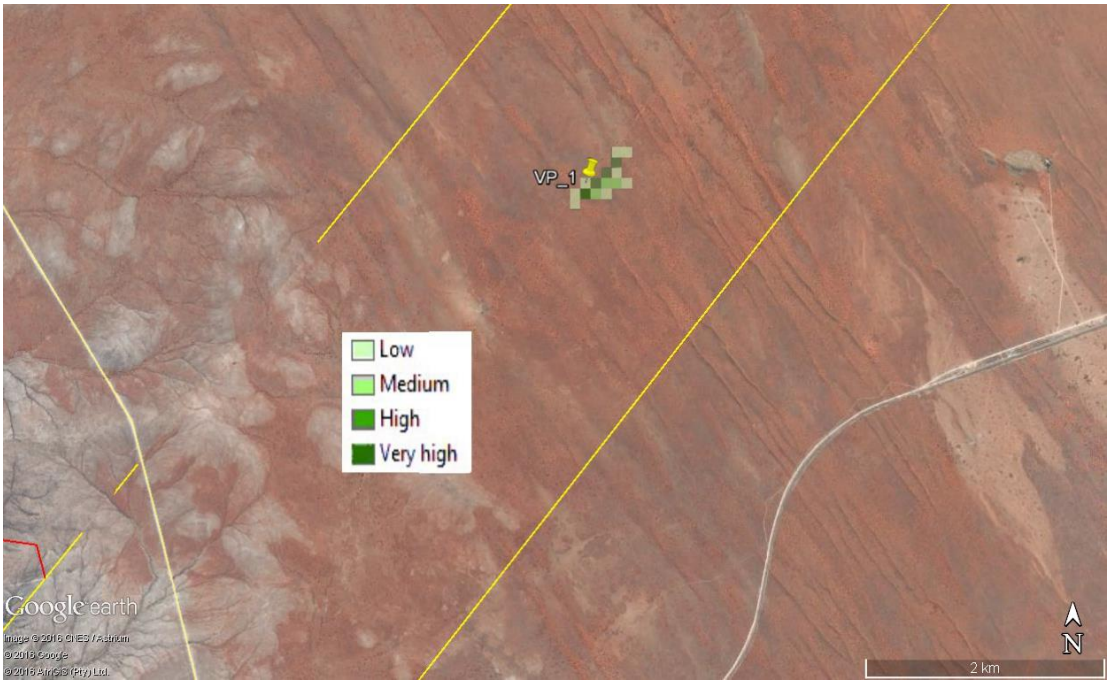


Figure 44: Spatial distribution of flights and weighting scores for Southern Pale Chanting Goshawk (only low height flights were recorded)

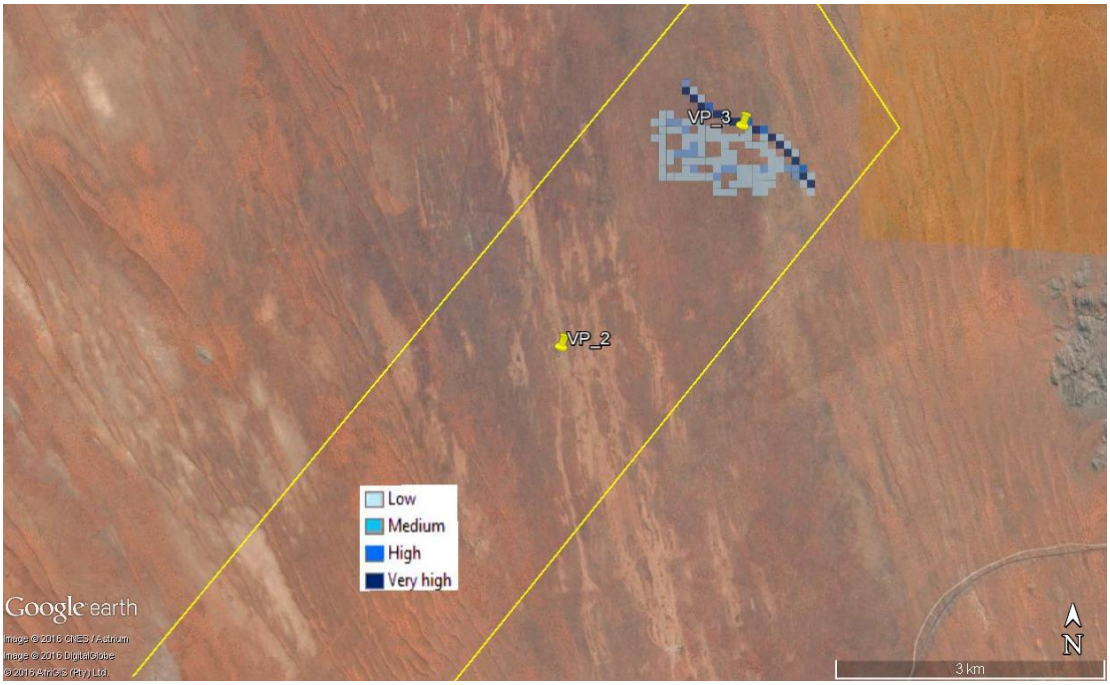


Figure 45: Spatial distribution of medium height flights and weighting scores for White-backed Vulture (only high height flights were recorded)

8.2.4 Potential Impacts

The full spectrum of impacts of solar facilities on birds is only now starting to emerge from compliance reports at solar facilities. These can be summarised as follows:

- Temporary displacement due to disturbance associated with the construction of the solar plant and associated infrastructure;
- Collisions with the heliostats or solar panels;
- Burning due to solar flux (only relevant to CSP plants, not relevant for PV plants);
- Permanent displacement due to habitat transformation; and
- Collisions with the associated power lines resulting in mortality.

8.2.4.1 Displacement due to Disturbance (Construction and Decommissioning)

The construction (and decommissioning) of the CSP plant and associated infrastructure (pipeline, road and power line) will result in a significant amount of movement and noise, which will lead to displacement of avifauna from the site. It is highly likely that most priority species listed in the Avifaunal Assessment (refer to **Appendix D2**) will vacate the area for the duration of these activities.

The Red listed Martial Eagles breeding on tower 22 of the existing Garona-Gordonia 132 kV line is the most important factor to consider from a potential displacement perspective. Martial Eagles are very sensitive birds and may abandon the nest temporarily or even permanently if they are chronically disturbed. This should effectively remove the potential of disturbance by placing the infrastructure at least 3.4 km away from the nest (see Figure 46).

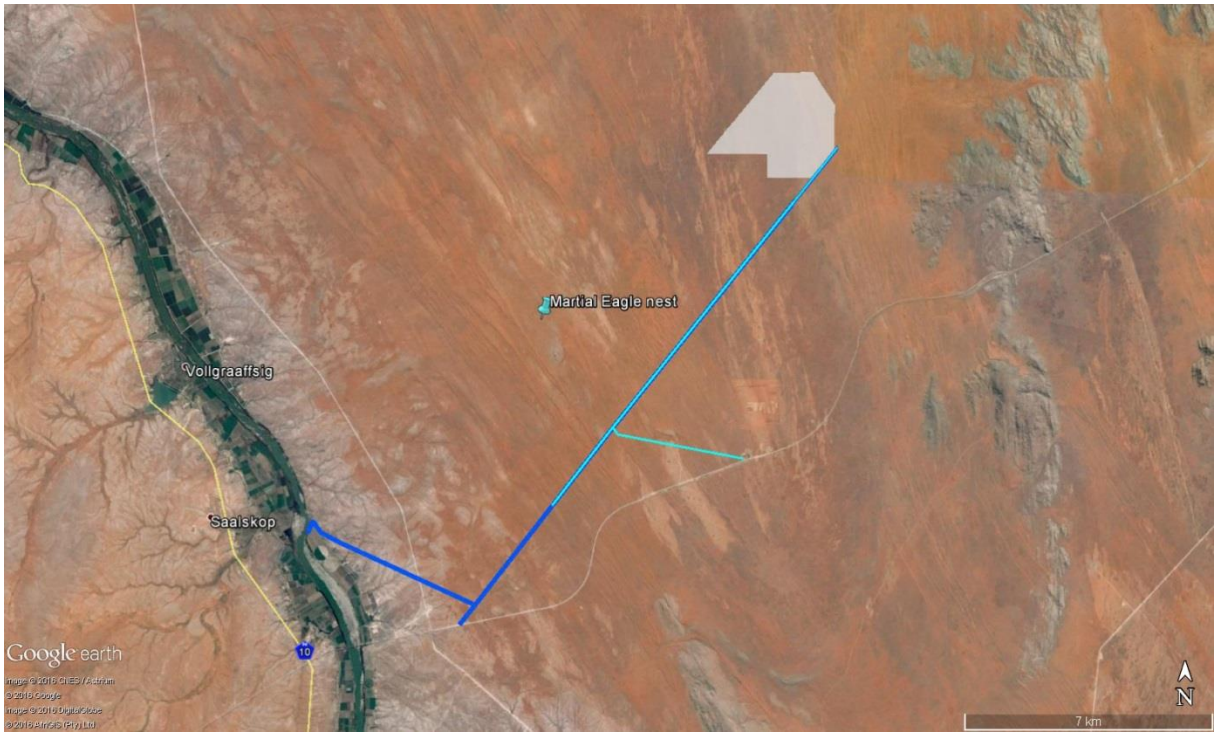


Figure 46: Recommended layout to minimise disturbance impact on pair of Martial Eagles breeding on tower 22 of the Garona-Gordonia 132kV power line

8.2.4.2 Displacement due to Habitat Transformation associated with the CSP plant and associated Road, Power line and Pipeline (Operations)

The construction of the CSP plant and associated infrastructure will result in the radical transformation of the existing natural habitat. The vegetation will be cleared prior to construction commencing. Once operational, the construction of the parabolic troughs will prevent sunlight from reaching the vegetation below, which is likely to result in stunted vegetation growth and possibly complete eradication of some plant species. The natural vegetation is likely to persist in the concentrators, but it will be a fraction of what was available before the construction of the plant, and it will contain few shrubs as this will most likely have been cleared prior to construction.

The Avifaunal Assessment (see **Appendix D2**) lists the priority species that could potentially be affected by this impact. Small birds are often capable of surviving in small pockets of suitable habitat, and are therefore generally less affected by habitat fragmentation than larger species. It is, therefore, likely that many of the smaller passerine species will continue to use the habitat available within the solar facility albeit at lower densities. This will however differ from species to species and it may not be true for all of the smaller species. Larger species which require contiguous, un-fragmented tracts of suitable habitat (e.g. large raptors, korhaans and bustards) are more likely to be displaced entirely from the area of the proposed plant although in the case of some raptors (e.g. Southern Pale Chanting Goshawk, Lanner Falcon and Pygmy Falcon) the potential availability of carcasses or injured birds due to collisions with the heliostats may actually attract them to the area. The significance of the potential displacement impact is difficult to assess at this stage and will only become clear through operational phase surveys. There will be no material difference in the level of displacement due to habitat transformation associated with the two CSP site alternatives.

8.2.4.3 Collisions with the Parabolic Troughs (Operations)

The so-called “lake effect” could act as a potential attraction to some species and it is expected that flocking species which were recorded in large numbers i.e. Grey-backed Sparrow-lark, Namaqua Sandgrouse, Sociable Weaver, Yellow Canary and several species of doves as well as other seedeaters would be most susceptible to this impact as they habitually arrive in flocks at water holes to drink. Multiple mortalities could potentially result from this, which in turn could attract raptors e.g. Tawny Eagle, Southern Pale Chanting Goshawk, Lanner Falcon and Pygmy Falcon which will feed on dead and injured birds which could in turn expose them to collision risk, especially when pursuing injured birds. In addition, the “lake effect” produced by the troughs may potentially draw various water birds to the area. The unusually high number of waterbird mortalities at facilities which are all situated in extremely arid environments i.e. Desert Sunlight facility (44%), Genesis (19%) and Ivanpah (10%) is noted in this respect. The presence of evaporation ponds and the proximity of the Orange River with its large populations of waterbirds to the Sand Draai site may be an aggravating factor, e.g. Egyptian Goose was recorded during monitoring. The evaporation ponds, in combination with the “lake effect” might attract Greater and Lesser Flamingo. However, it is not possible to tell whether this will actually happen until post-construction monitoring reveals actual mortality at the site.

8.2.4.4 Collisions with the Earthwire of the 132 kV Power Line (Operations)

The most likely priority species candidates for collision mortality on the proposed 132kV power line are medium to large terrestrial species i.e. Karoo Korhaan, Kori Bustard, and Secretarybird which have all been recorded at the site. Other non-priority species that could potentially be impacted through collisions are Northern Black Korhaan, Red-crested Korhaan and Namaqua Sandgrouse. Greater and Lesser Flamingo could also be impacted, should they be attracted to the evaporation ponds and by the “lake effect”.

8.2.4.5 Other Impacts

Cape Sparrows and other small birds will very likely attempt to nest underneath the troughs to take advantage of the shade, but this should not adversely affect the operation of the equipment. The troughs are probably too low for Sociable Weavers to nest on them, but they might attempt to build their giant nests on other infrastructure. Another impact that could potentially materialise is the pollution of the troughs by large birds defecating on them, particularly Pied Crows and raptors, if they get to perch regularly on the troughs. It is expected that the regular cleaning and maintenance activities will prevent this from becoming a problem, but close monitoring will still be required.

8.3 Hydrogeology (Groundwater)

8.3.1 Groundwater Levels

8.3.1.1 National Groundwater Archive (NGA)

Borehole information derived from the Department of Water and Sanitation (DWS), National Groundwater Archive (NGA) allowed for an assessment of the hydrogeology, aquifers and water levels in the area.

Three NGA (National Groundwater Archive) boreholes are present within an 8 km radius of the site (Figure 47). Water level data and water use were not available for boreholes, BH3 and BH7. Groundwater levels were obtained for BH8 in 1978, 1982 and 1983 and ranged from 37 to 65 mbgl.

Borehole BH3 is located on the Sand Draai farm but was unfortunately not in use as the windmill pump was broken. Water is currently pumped from the Orange River. No water level could be measured in BH3 due to the limited space between the windmill pump and the casing of the borehole. Borehole BH7 was situated on the Bokpoort farm, within the game farm portion (owned by Mr. Chris Honiball). BH8 is situated on the premises of Mr. Martin Compion. According to Mr. Compion, the farm was classified as a dry farm in 1972.

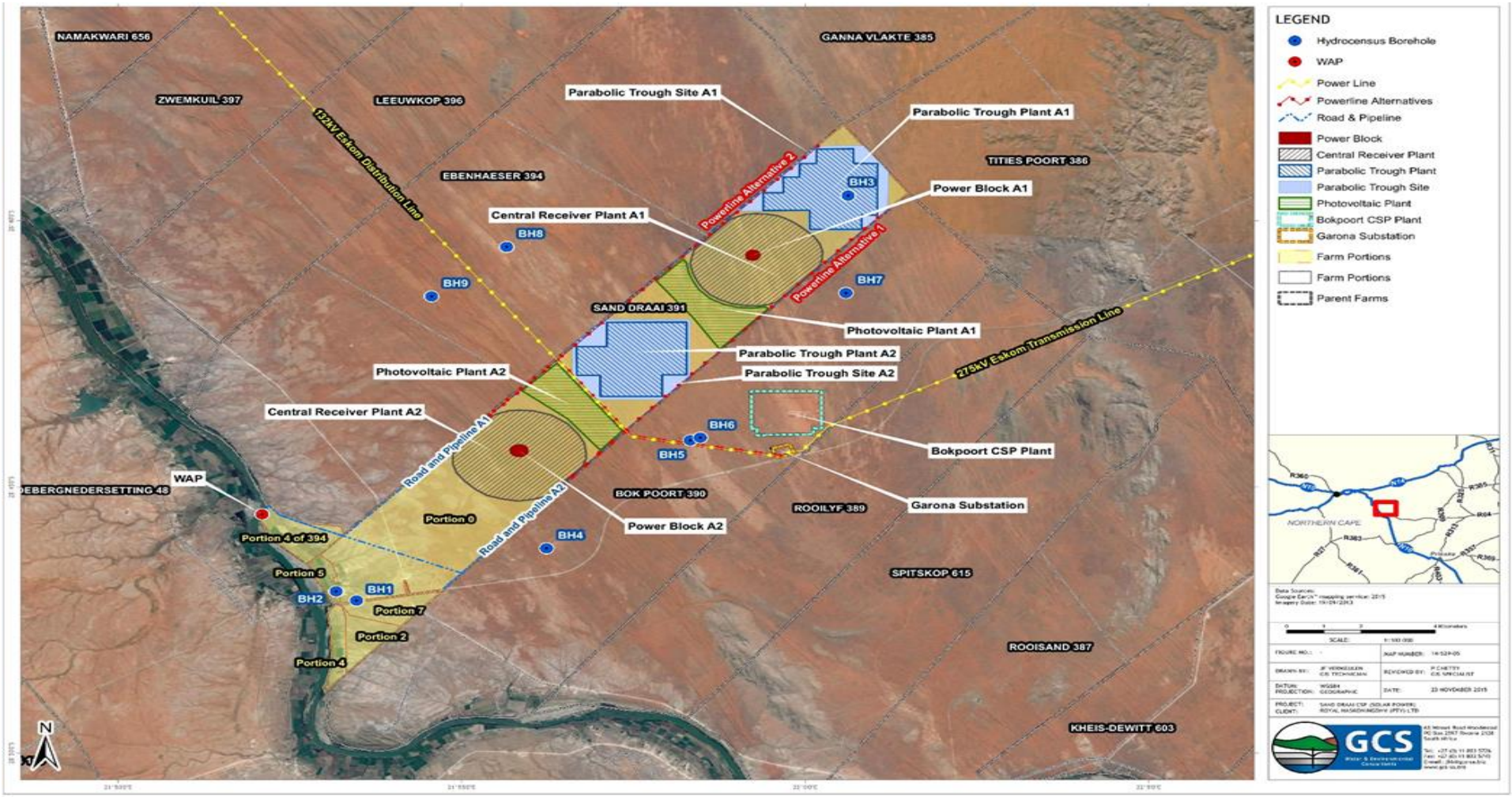


Figure 47: Hydrocensus borehole location and proposed infrastructure

8.3.2 Hydrocensus

The farms abstract water from the Orange River for irrigation purposes, even though the river water requires some treatment before it is suitable for domestic use. Groundwater use occurs on the farms located further away from the river in close proximity to the site. Nine boreholes were identified within a 2 km radius of the site.

Several of these boreholes were equipped with windmill pumps or submersible pumps whilst others were not in use. Groundwater on these farms is mainly used for domestic purposes and livestock (cattle and sheep) farming. Water level measurements could not be measured in the farm boreholes due to limited space between the casing of the borehole and the windmill pumps.

The three boreholes, BH1, BH2 and BH3 located on site are not currently in use. Water from the Orange River is currently used as potable source and for all household purposes such as washing and sanitation. Water on site is currently pumped into tanks where the water is treated prior to being distributed to farmworkers.

8.3.3 Potential Impacts

Although the impacts identified indicate medium to high risks, the following factors must also be taken into account. This reduces the risk of surface contamination negatively affecting the underlying aquifer:

- No groundwater abstraction is anticipated on site;
- Deep water levels on site which would indicate very long travel times for surface contamination to reach and negatively affect the aquifer; and
- The area experiences low rainfall and therefore low recharge which will also minimise the probability of surface contamination affecting the underlying aquifer.

8.3.3.1 Construction Phase – Hydrocarbon Contamination

During the construction phase, hydrocarbon contamination is possible due to accidental spills of diesel/oils, etc. from the usage of heavy machinery and construction vehicles on site. Spillages may occur which may impact both the soil and groundwater environment. The impacts are costly and difficult to clean up, however, only small amounts envisaged.

An auxiliary heating system/boiler is required on site to maintain the temperature of the heat transfer fluid above the freezing point in the CSP plant as well as for co-firing in order to supplement the thermal power and to maintain a minimum temperature during winter. Fuel used for co-firing and to heat the HTF will be stored in tanks on site.

Diesel will also be required to power a generator during the construction phase and potentially a standby generator during the operational phase. This fuel will also be stored on site. Potential hydrocarbon contamination may arise due to leaking tanks or accidental spillages during transport or handling of the product. All fuel storage tanks must be bunded on site.

8.3.3.2 Contamination from the Heat Transfer Fluid (HTF)

Heat transfer fluid is a synthetic thermal oil or water which is circulated through the thermal plant and absorbs the collected energy and is subsequently heated to around 400°C which is then circulated through the system continually until the water side of the system is heated enough to produce steam. The cooled heat transfer fluid is pumped to the parabolic trough tubes where the cycle repeats. This is a closed system and loss of HTF will be minimal. However, small volumes of the fluid will be lost and will need replacement. Used HTF will be stored in small volumes on site and removed occasionally and disposed of at an appropriate waste disposal

facility. It is the minor loss/accidental spillages of HTF during circulation as well as the small volumes which will be stored on site which may pose a threat of groundwater contamination.

8.4 Surface Water

8.4.1 Riparian Vegetative State

The state of surface water features affected by the proposed road and pipeline has been assessed. The VEGRAI EcoStatus Tool has been used to calculate an ecological category for the eastern bank of the riparian corridor of the affected reach of the Orange River, as well as collectively for the ephemeral watercourses. The ephemeral watercourses crossed by the road and pipeline have been collectively assessed due to their physical and vegetative homogeneity, which is due mainly to their location at the head of small catchments (thus being small first order drainage lines).

The following riparian zone characteristics (as relevant to the VEGRAI assessment) were noted as part of the assessment:

8.4.1.1 Orange River Riparian Zone

- Agricultural cultivation is the prominent land use within the Orange River valley bottom that has historically, and continues to exert a significant impact on the riparian zone of the river. Along the outer part of the riparian zone of the affected reach cultivation (orchards) has resulted in an extreme degree of modification of this part of the riparian corridor that would naturally be expected to extend slightly beyond the edge of the macro channel bank onto the wide flood terrace. In this area all natural vegetation has been removed and this part of the riparian corridor has been totally transformed.
- The vegetative and physical structure of the remainder of the riparian zone appears to be largely intact, except for parts invaded by alien invasive plants and the existing farm abstraction point (where the proposed abstraction point is located) where the riparian vegetation has been cleared and the slope graded and concreted (to form a ramp) down to the river.
- Alien invasive vegetation was present in the riparian zone; coverage of alien species was estimated to be approximately 30% along the reach assessed.
- The marginal zone is comprised of the active channel of the river. A narrow lower zone is comprised of *Phragmites australis* reedbeds. Most of the lateral extent of the riparian zone of the eastern bank of the river is comprised of the upper zone which is characterised by dense riparian thickets. A high degree of coverage of woody vegetation characterises the upper zone of the riparian corridor.

8.4.1.2 Ephemeral Watercourses

- Stock farming is the prominent land use that would potentially affect the riparian zones of ephemeral watercourses along the proposed alignments. It is difficult to fully assess the degree of impact of stock farming on riparian zones without having a more comprehensive understanding of current levels of rainfall; however this land use appeared to have a relatively low impact footprint in the context of altering the vegetative composition and morphological structural integrity of riparian zones, with current drought conditions being the main driver of vegetative state.
- An almost complete absence of alien invasive vegetation was noted along the alignment (in terms of the ephemeral watercourses), which is a very important factor in the overall state of these watercourses.
- The marginal zone was limited to the central active channel of the respective watercourses, as the channel is the part of the riparian corridor most likely to be hydrologically activated when surface flow occurs along these systems. The other parts of the riparian zone would only be hydrologically activated in significant flood events, thus being delineated as the non-marginal zone (i.e. a combination of the upper and lower zones).

- The channels were found to be largely devoid of vegetation, with no woody vegetation present
- Lastly, an assessment of the reference state needed to be made, in relation to the above factors.

Overall, the findings of the assessment was that the reaches of the watercourses assessed were relatively undisturbed and thus not greatly altered from a reference state, although the very dry conditions prevalent at the time of the site visit had limited the coverage of non-woody (annual) vegetation.

8.4.2 Ecological Importance and Sensitivity (EIS) and Hydrological Importance

Scores (out of 4) for ecological importance and sensitivity (EIS) and hydrological / functional importance have been assigned to the reach of the Orange River riparian zone (eastern bank) and the ephemeral watercourses on the site (collectively). Refer to **Appendix D5** (Aquatic Assessment) for the scoring.

The ecological importance and sensitivity score of 2.7 assigned to the reach of the Orange River riparian zone reflects a riparian zone of moderately high ecological importance and sensitivity. All riparian corridors are ecologically important, due to the ecological linkage provided and due to the ecological processes related to the interface of aquatic and terrestrial habitats that occur within these habitats. The reach assessed displays a relatively higher ecological importance and sensitivity rating for a number of reasons:

- The location of the riparian zone of the river in a highly arid location; the presence of a large perennial river has allowed the development of mature riparian thicket as the predominant habitat type, as well as other habitat types that provide sustained moisture, foraging, breeding and shelter opportunities for fauna. This has allowed a faunal assemblage to be present that would not otherwise be present in this location.
- Relatively intact riparian habitat with a relatively low disturbance factor and high PES score.
- The location of the riparian zone within the Lower Gariep Alluvial Vegetation Ecosystem, which is listed as being nationally endangered.

These factors underlie the ecological importance of the riparian corridor. The riparian corridor is nonetheless sensitive to changes in hydrology as the non-marginal zones of the corridor are highly dependent on flooding that occurs periodically and which deposits fertile sediment within the upper parts of the riparian zone, as well as being dependent on a high water table which sustains the larger trees.

The ephemeral watercourses have been assigned a lower EIS score as the hydrology of these drainage systems is highly episodic and as a result they mostly display a poorly-defined riparian zone in terms of vegetative structure. Nonetheless these systems are still important as movement corridors and do provide foraging, breeding and shelter opportunities for fauna, albeit to a lesser degree than that of the Orange River riparian corridor. The low degree of disturbance to which the assessed reaches of these watercourses have been subjected is another factor that raises the ecological importance of these drainage systems.

8.4.3 Potential Impacts

8.4.3.1 Impacts associated with the proposed CSP (Parabolic Trough) Infrastructure

Impacts associated with the proposed CSP (using parabolic trough technology) infrastructure on surface water features are limited to a certain part of the development site – the south-western part of the site located east of the Orange River (including the Orange River itself) and towards the Gariep Road. The nature of topography (characterised by linear sand dunes and flat calcrete plains) has not been conducive to the development of surface water features in other parts of the site.

The CSP parabolic trough plant site alternatives are both located in areas of the Sand Draai farm in which no surface water features are located. The development of either of the site alternatives will accordingly have no physical (footprint) impact on any surface water features.

The associated linear infrastructure, i.e. the road and water pipeline will however exert a physical impact on surface water features located closer to the Orange River valley bottom and on the riparian corridor of the Orange River itself.

8.4.3.2 Impacts associated with the Proposed Water Pipeline and Access Road

The linear infrastructure associated with the solar power plant (i.e. the proposed water pipeline and service road which are proposed to run in parallel) will impact a number of ephemeral watercourses and will traverse a section of the Orange River riparian corridor and will thus be the aspect of the proposed development that will have an impact on surface water features. As these two linear developments will run in parallel, their assessments are combined below.

- Ephemeral Watercourses
  The primary impact associated with the proposed road and pipeline is the disturbance of watercourses and associated riparian zones through excavation of the pipeline and through the laying of the road. The pipeline will be buried, and thus a pipeline trench will need to be excavated across the affected watercourses. This will result in the disturbance of substrate within and immediately adjacent to the watercourses. A trench line and adjacent working right of way will need to be established, thus vegetation in the riparian zone within the footprint of the works will need to be cleared. The creation of a working right of way for machinery and the excavation of a trench would result in the felling and removal of all vegetation, in particular woody vegetation. It is not certain whether the working right of way for the pipeline will be used as the road alignment; if not the development of the road running in parallel would effectively widen the footprint of the affected (cleared) area. This clearing of vegetation would leave the servitude devoid of vegetation after construction, which is important for a number of reasons.

  The felling of all vegetation impacts negatively on the structural integrity of the riparian zone. The removal of (woody) vegetation from the servitude is one of the most important impacts on riparian zones that can occur, as it alters the vegetative composition in the affected reach of the watercourse, and exposes the underlying substrate to the risk of erosion – both by water and wind. There would be a low risk of water-borne erosion due to the semi-arid nature of the climate and the highly irregular occurrence of rainfall events. Although the watercourses along the pipeline rarely flow, when flow does occur along these watercourses it is possible that flows of high volume and velocity, although brief in duration, would occur along the watercourses. Such flows would be associated with a relatively high degree of erosive force and this would be greatly exacerbated if vegetation in the servitude was removed, leaving the sandy substrate highly vulnerable to erosion. The occurrence of a flow event through such an un-vegetated area could initiate a 'knickpoint' which may lead to development of gulley (donga) erosion into the upstream part of the watercourse or into the adjacent riparian corridor.

Importantly the clearing of vegetation introduces another potential impact, that of the invasion of the riparian zone by alien invasive vegetation. This introduces the edge effect which can have an important effect on biota within the riparian zone, and create a very convenient 'entry point' into the riparian zone and wider riverine corridor for alien invasive vegetation – such human-related disturbances further exacerbate the natural susceptibility of riparian ecosystems to invasion by alien plants, as the transformed habitat is highly suitable for colonisation by alien invasives, and is less suitable for the less aggressive indigenous riparian species.

Riparian corridors are particularly vulnerable to invasion by alien plants due to their dynamic hydrology and opportunities for recruitment following floods. Although the actual spatial area of the cleared servitude is likely to be relatively small in the context of the wider riparian corridor, this could create a convenient foothold for the invasion of wider areas of the riparian corridor, and initiate an impact over a much wider area than simply the cleared servitude. No alien invasive vegetation was noted along any of the ephemeral watercourses traversed by the proposed pipeline (with the exception of crossing Alt1-2_2, in the Surface Water Assessment (**Appendix D4**), that is located just outside the edge of the Orange River riparian corridor in which alien

vegetation was encountered) and the risk of this impact is deemed to be low, nonetheless this is an impact that could materialise, especially with respect to alien species such as *Prosopis* spp.

The ephemeral nature of these watercourses and the relatively shallow depth of the pipeline trench or road foundations is unlikely to result in the presence of any shallow water tables that would result in seepage in the trench or works area, as it often is in the case of construction through water features. It is unlikely that seepage water will be encountered within the trench or roads work area, as such shallow groundwater is unlikely to be present unless construction occurs immediately following a large flow event.

Apart from the transformative impact of the pipeline and road's footprint as discussed above, the road component could exert a hydrological impact on the watercourses crossed if no culverts or culverts of insufficient diameter are installed in the crossing structure. Due to the ephemeral / episodic nature of the watercourses crossed and due to their physical characteristics as small, high order drainage features, it would seem likely that the road crossing structure would be a drift-type structure, as opposed to a spanning feature. It would be important that such structures allow flow to bypass or underpass them through culverts that are included in the design. Should culverts not be included flows occurring in the watercourse could be impounded behind the structure, not allowing flows into the downstream part of the watercourse. In spite of the high infrequency of surface flows, this could have a significant adverse localised impact as these ephemeral watercourses are likely to depend on flow inputs that drain into the substrate, thus sustaining riparian vegetation. Too few culverts within a crossing structure may have a scouring impact on the downstream channel, although the highly infrequent flows along these systems are likely to obviate the likelihood of such an impact from materialising.

The other potential impact associated with the proposed road, especially if the road is tarred, is the risk of pollutants spilled on the road surface draining into the watercourses crossed. As the road would be used by vehicles, such pollutants are most likely to be hydrocarbons such as oil or petroleum. If such pollutants entered the watercourse and the underlying permeable sandy substrate, this would adversely affect habitat integrity and may pollute shallow groundwater.

A number of factors will determine the intensity of the impact of the pipeline and road construction on each watercourse; the length of the works through each riparian zone affected, the width of the works area, and the physical (especially vegetative) characteristics of the affected riparian zone, and possibly most importantly the current state of modification of the respective watercourses. Most of the ephemeral watercourses crossed are narrow, high order drainage systems that do not display a prominent riparian vegetative structure. The largely absent surface water flow and the absence of a distinctive and broad riparian corridor would lessen the intensity of the impact of the road and pipeline on these watercourses. However overall the potentially affected reaches of these watercourses were assessed to be in a largely undisturbed state and thus any impacts (even localised impacts) could adversely affect the state of these drainage systems.

The re-instatement of vegetation within the riparian corridor of the watercourse after the pipeline trench has been reinstated and the road becomes operational is a critical factor in the prevention of impacts during the operational phase on the affected surface water feature. If vegetation is not re-instated after construction, soils would remain exposed. This is exacerbated by the likely operational practice of keeping the pipeline servitude free of large deep-rooted woody shrubs and trees that may damage the pipeline through their roots. This is likely to preclude the reestablishment of the larger trees and shrubs over the pipeline trench, i.e. *Senegalia (Acacia) mellifera* and *Ziziphus mucronata*. The inability to re-establish a woody vegetation layer could hinder efforts to re-establish an understorey of grass and other shrubs, although coverage of woody vegetation is not high and the non-woody species that occur in the riparian zones are tolerant of exposure to full sun. Reinstatement of non-woody vegetation within the footprint of the works area and in the road servitude is a very important priority once the pipeline trench has been reinstated. The use of spoil rock in the road reserve,

rather than vegetation in the context of the aridity of the climate could be considered as these measures could be more affective to stabilise embankments and other slopes.

Lastly, the incorrect reinstatement of the channel bed and banks within the pipeline servitude could have an impact on the integrity of the riparian zone, and could result in an important hydrological impact. If the channel and banks of the drainage features, as well as features such as flood terraces were not restored to a pre-construction state, this could lead to a permanent alteration of the hydromorphological state of the watercourse and associated vegetation composition. It is important that the cross-sectional channel structure be restored to a pre-construction state as far as possible.

8.4.3.3 Impacts on the Orange River Riparian Zone

As described above there is an existing abstraction point at the locality at which the abstraction for the plant from the Orange River is proposed, being used for abstraction to supply the local farming (cultivation) activities. As such the riparian zone has been physically modified, with a concreted access to the river having being cut through the macro-channel bank. The placement of an extra pump and associated piping within this modified area is unlikely to further impact the Orange River riparian corridor. However a section of the proposed road and pipeline has been aligned from this point through the Orange River riparian corridor (running northwards), presumably so as to avoid having an impact on the orchards located adjacent to the riparian zone. The road and pipeline would thus exert a physical footprint over the section of the riparian corridor. This would result in loss of riparian habitat (i.e. the loss / transformation of a certain area of largely indigenous vegetation) and the likely re-profiling of certain parts of the affected section of the riparian corridor where the topography within the riparian corridor is not flat.

The presence of a road with vehicles accessing the abstraction point would increase noise levels and thus the disturbance factor for fauna sensitive to disturbance, and would constitute a hard barrier separating the riparian corridor from the area behind it. The impacts of the proposed pipeline on the riparian vegetation would be very similar to that on the riparian corridors of the ephemeral watercourses, as discussed above. The practice of keeping the servitude clear of woody vegetation would be very significant in the context of the Orange River riparian corridor, as this would retain the servitude in a state of permanent vegetative transformation and would be highly conducive for the proliferation of alien invasive vegetation in this part of the riparian corridor.

Although this impact would be localised and restricted to the length of the section of the pipeline and road through the riparian corridor, it would in reality be of greater significance for two reasons. Firstly this would constitute part of a cumulative impact on this reach of the river's riparian corridor, considering the likely loss (transformation) of a component of the outer part of the upper zone due to the historical creation of orchards on the flood terrace of the river. An increased area of riparian habitat along the reach would thus be physically and irreversibly transformed. Secondly this impact would take on a great significance as it would affect an *endangered* ecosystem - the Lower Gariep Alluvial Vegetation Type (AZa 3) is listed as an Endangered Ecosystem. In this context it is critical that consideration be given to moving the alignment of both the pipeline and the road away from the current boundary of the riparian zone into the adjacent orchard.

8.4.3.4 Other Potential Construction Related Impacts

The process of constructing the pipeline and road through watercourses could potentially impact these features in other ways through a series of construction-related impacts. The following impacts on surface water features can result from construction activities along the pipeline servitude:

- The uncontrolled interaction of construction workers with watercourses that could lead to the pollution of these watercourses, e.g. dumping of construction material into the drainage system, washing of equipment (in the case of the Orange River) etc.

- The lack of provision of adequate sanitary facilities and ablutions on the servitude may lead to direct or indirect faecal pollution of surface water resources.
- Leakage of hazardous materials, including chemicals and hydrocarbons such as fuel, and oil, which could potentially enter nearby surface water resources through stormwater flows, or directly into the sandy soils within watercourses. This may arise from their incorrect use or incorrect storage. This is not only associated with a risk of pollution of surface water, but with a risk of the pollution of shallow groundwater within the riparian zone due to the presence of typically highly permeable alluvial substratum.
- The incorrect mixing (batching) of cement could lead to siltation and contamination of watercourses, as described above.
- Inadequate stormwater management and soil stabilisation measures in cleared areas could lead to erosion that could cause the loss of riparian vegetation and which would lead to siltation of nearby watercourses.

8.5 Aquatic Ecology

8.5.1 Present Ecological State

Various indices were utilised to assign the river reach in question a baseline PES rating, which included the River Index of Habitat Integrity (River-IHI), MIRAI (Macro-invertebrate Response Assessment Index) and VEGRAI (Vegetation Response Assessment Index). The results from these various components are summarised in Table 19 and Table 20 below, where the overall EC (Ecological Category) is also provided.

Between the 2014 and 2015 surveys, there was a slight increase in overall PES, which is partially due to improved fish survey ratings. These differences are, however, insignificant and show that the system is relatively stable. This is expected as the surveys were undertaken under comparable seasonal conditions. Habitat ratings remain similar for both surveys.

The Ecostatus is C i.e. Moderately modified (Loss and change of natural habitat and biota have occurred, but the basic ecosystem functions are still predominantly unchanged).

Table 19: Summary of the EcoStatus results for the river reach associated with the proposed pump site (Sept 2014 survey)

Component	EC (%)	Ecological Category
Index of Habitat Integrity		
Instream IHI	79.3%	B/C
Riparian IHI	66.8%	C
Macro-invertebrate Response Assessment Index	65.8%	C/D
Vegetation Response Assessment Index	73.3%	C
Fish Response Assessment Index	64.3%	C/D
ECOSTATUS		**C (Confidence: 4)**

Table 20: Summary of the EcoStatus results for the river reach associated with the proposed pump site (Sept 2015 survey)

Component	EC (%)	Ecological Category
Index of Habitat Integrity		
Instream IHI	79.3%	B/C
Riparian IHI	66.8%	C
Macro-invertebrate Response Assessment Index	70.1%	C
Vegetation Response Assessment Index	73.3%	C
Fish Response Assessment Index	70.2%	C
ECOSTATUS		**C (Confidence: 4)**

8.5.2 Aquatic Biodiversity

The actual survey site was within the riffles beneath the railway bridge, located just upstream of the actual proposed pumping site. This site was chosen due to it including all the required habitat types to undertake the field protocols. The close proximity to the actual pumping site means that results can be meaningfully derived.

8.5.2.1 Fish

The DWA provides a reference list of fish species that would be expected to occur at the site. There is a DWA reference site located upstream of the site near Boegoeberg Dam. There are 11 indigenous species expected to occur at the site, namely *Austroglanis sclateri, Barbus anoplus, Labeobarbus aeneus, Labeobarbus kimberleyensis, Barbus paludinosus, Barbus trimaculatus*, *Clarias gariepinus*, *Labeo capensis*, *Labeo umbratus*, *Pseudocrenilabrus philander* and *Tilapia sparrmanii.* It was assumed that these species would all occur within the river reach associated with the site.

Two of these species are regarded as being of conservational concern, namely *Labeobarbus kimberleyensis* and *Austroglanis sclateri*. Both of these species are known to occur within the river reach, but only *Austroglanis sclateri* was collected during the survey. It is assumed, however, that the proposed development activities will not pose a significant impact to the ongoing conservation of these species within the region.

Seven of the 11 fish species were sampled during the field survey in relatively good numbers. These included *Austroglanis sclateri, Labeobarbus aeneus, Barbus paludinosus, Clarias gariepinus*, *Labeo capensis* and *Tilapia sparrmanii.* These results are indicative of a system that has retained a relatively good overall ecological integrity in terms of fish species composition.

8.5.2.2 Aquatic Macro-Invertebrates

The aquatic macro-invertebrates recorded from the site are generally all commonly occurring and widely distributed within rivers of suitable water quality and habitat availability. No protected aquatic macro-invertebrate species have been recorded from the river reach.

Invertebrate taxa known to be intolerant of water pollution were noted, which include Heptageniidae, more than two species of Baetidae, and Leptophlebiidae. Other taxa that are indicators of relatively good water quality included Atyidae, Tricorythidae. Results of the SASS5 survey revealed an overall SASS5 score of 104, from the collection of 19 taxa. This results in an average score per taxon (ASPT) of 5.5. This translates to a B ecological category for aquatic macro-invertebrates at the site.

8.5.2.3 Drivers of Ecological Change

- Instream IHI

The instream IHI was rated relatively good (79.3% B/C). This is largely due to the presence of a diversity of habitat types (biotopes). A limiting feature is thought to be that the marginal vegetation is predominantly reeds. Another driver of ecological change is the presence of major upstream barriers within the system that regulate the river flow, attenuate much of the flooding events and influence seasonality.

- Riparian IHI

The riparian IHI was also rated relatively good (66.8% C). Limiting factors to this feature was the clearing of adjacent terrestrial areas to accommodate agriculture, informal roadways that occur within the edges of the riparian zones, occurrence of the exotic species *Prosopis glandulosa* and *Nicotiniana glauca* and the clearing of vegetation for other various reasons (infrastructure development, agriculture, etc.).

- Fish

The reference data for fish is recorded from an area relatively close to the survey site. The open connectivity of the river reach, habitat availability and the generally good water quality leads to the assumption that the survey site would have a similar species community structure as that of the reference site. The presence of migratory barriers within the larger river system means that fish diversity and population sizes would be impacted, but, in general, fish species composition were seen to be in a near natural state.

- Aquatic macro-invertebrates

The results of the aquatic macro-invertebrate survey also yielded relatively good results. Instream habitat integrity was noted as being good, as was the general water quality parameters. It is assumed, however, that pesticide usage within the agricultural areas that contaminates the watercourse, impacts on the macro-invertebrates and can be regarded as a limiting factor.

8.5.3 Ecological Importance and Sensitivity (EIS)

The use of biotic data in the assessment of the EIS considers the presence of rare and endangered species, unique species and species (including various life-history stages) with a particular sensitivity to flow (and flow-related water quality aspects) in combination with other ecological information on the study area. The EIS of a river is an expression of its importance to the maintenance of ecological diversity and functioning on local and wider scales. Ecological Sensitivity refers to the ability of the system ability to tolerate disturbance and its resilience once an impact has taken place. The EIS of the system is regarded as being High. The most important and relevant points are summarised in the Aquatic Assessment (**Appendix D5**).

8.5.4 Water Quality

The results of the 52-element scan are presented in Aquatic Assessment (**Appendix D5**) for both the September 2014 and September 2015 surveys. No elements tested for occurred in concentrations that would be deleterious to overall aquatic health during September 2014. Elements contained within the water are what would be expected for the catchment area and characteristics of the watercourse. Elevated levels of potassium, magnesium, and other trace elements are typical of a system that has a strong association with formal agriculture. These water quality values were then used as a benchmark to compare the results from September 2015. The only noteworthy trends include an increase in aluminium, (Al), silicone (Si), titanium (Ti) as well as sodium (Na). None of these elements were in concentrations high enough to have any impacts to the system.

8.5.5 Potential Impacts

The following potential impacts are anticipated:

- The construction of the abstraction infrastructure will lead to a certain level of aquatic habitat destruction. The proposed site already accommodates an agricultural water pump, with an established concrete jetty and electrical installations. Further localized infrastructure development is therefore not going to impose significant habitat change/destruction.
- Soil disturbances aggravating soil erosion - soil erosion may result from disturbed areas on steeper slopes. Severe soil erosion may result in impacts to the surface water resources within the area especially within the steeper-sloped riparian areas. Erosion of unprotected stockpiles of soil will lead to erosional features and smothering of surrounding habitat.
- Soil contamination - pollution of soils due to oil/fuel leaks and wastes may affect biodiversity. This will impact surface water resources within the area.
- Modification of hydraulic conditions to accommodate the abstraction infrastructure will potentially alter the aquatic biodiversity species community structures. This is a localized development that will be located at the edge of the watercourse. Poor designs could alter hydraulic conditions to the extent that substantive habitat transformation does occur.
- Poorly maintained equipment (pumps, etc.) could lead to fluid leaks that pose a threat to water quality. Hydrocarbon (fuels and oils) are a significant source of contamination of surface water resources and therefore any fluid spills or leaks should be avoided.
- Inadequate site reinstatement and landscaping may lead to aggravation of soil erosion over the long term. This is pertinent at areas with relatively steeper slopes (e.g. the areas toward the riparian zones of the river) and will lead to habitat modification and degradation of water quality.
- Disturbances of the flora will lead to transformation of the vegetation structures, potentially enhancing the encroachment of exotic species, pioneering species and plagioclimax population structures.

8.6 Socio – Economic

8.6.1 Results of the Economic and Agricultural Specialist Engagement Exercises

From an alternative land-use perspective, it is evident that the solar plant development project is significantly positive from a sustainable development perspective. The Gross Geographic Product (GGP) and employment positives are significant in both the short and long term. The development's biggest positive lies in its strategic economic value, where it supports directly immense economic value creation.

The negative impacts are only present in the construction phase of the project, which is set to last up to 30 months. In this regard, the biggest negative impact is the value of farm land, both for neighbouring farmers, and possibly farmers along the unpaved road that leads to the entrance of the Sand Draai development. In the short term if the entrance road is not sufficiently surfaced, a buyer would want a discount for perceived uncertainty in income and capital value of any of such affected farms. The most affected farms are the ones closest to the Sand Draai project, where the dust fall-out is highest, even though this fall-out is not materially more than the national averages.

The impact on agricultural yields based on the agricultural specialist's opinion, is not likely to be material as the study was unable to detect any permanent damage caused by dust at the surrounding farms. A 5-10 m area next to the road with heavy dry dust particles was found, but the dust particles did not deposit any further than that sphere. Such a limited area of impact by dust, is also corroborated by the scientific air quality study undertaken. Most of the dust deposits were within the road boundaries – thus it did not materially fall on farm land. Cognisance is taken that stakeholders mentioned that animals do not feed close to the roads.

Another key finding is that there seems to be outstanding issues between the Contractor and farmers in the area. There is a perceived lack of respect and undisciplined behaviour from the mainly Spanish contractors. Many of the road accidents and the three reported fatalities, have been attributed to the farmers opinion that the Contractors do not follow road usage protocol (or law in terms of maintaining the speed limit), and consequently are the main perpetrators of accidents. Additionally, women-based gender abuse (prostitution and rape) of the local (mainly farm labourer population) are accusatory allegations that have also been levelled at the mainly Spanish Contractors.

8.6.2 Summary of Stakeholder Concerns

Upon reflecting on the interviews and site visits with the abovementioned stakeholders, as well as informal discussions with business owners, the following key issues should be noted:

- Most stakeholders welcome the solar plant developments because it obviously creates wealth in the form of compensation for local labour, and business income thanks to local procurement of the newly established solar plants;
- The biggest issue for neighbouring stakeholders is dust, as the increase in dust for them will lead to a fall in property values, a fall in agricultural yields, and a deterioration of their current quality of life.
- The concerns with respect to foreign contractor road usage is noted;
- Social pathologies such as increased crime, prostitution, and others are noted, but falls outside the scope of an economic alternative land-use analysis;
- Road accidents that have occurred, are mainly related to the dust due to the current road surface and road conditions;
- Other concerns such as noise, and an increase in temperature are minor concerns; and
- The Economic and Agricultural specialist assessments based on the Air Quality Assessment deduced that there is no impact on agricultural land yield as the dust does not exceed national averages (as per Regulations). The specialists support a mitigation strategy to surface the southern part of the Gariep Road to the extent that dust suppression meets the expectations of neighbouring farmers and road users, because this is without doubt in keeping with the values of sustainable development.

8.6.3 Potential Impacts

The following potential impacts are anticipated:

- Potential loss of cultivated areas due to pipeline and road routing;
- Restricted access (residents and workers) to currently utilised roads;
- Sourcing of equipment and machinery locally;
- Local Gross Geographic Product (GGP) increase;
- Inconvenience and danger to proximate residents through increased road traffic, dust and noise, including the development of new access roads through the development site;
- Local job creation opportunities;
- Influx of migrant labour;
- Perceived preferential access to a finite number of jobs;
- Increased social ills in Groblershoop and surrounding small villages;
- Potential increase in criminal activity in the development footprint and nearby surrounding villages;
- Additional pressure on basic services provision (education, housing and healthcare);
- Increase in HIV/AIDS cases and associated vulnerabilities;
- Chance find of heritage items/sites;
- Impact on agricultural yields along Gariep Road;
- Impact on farm values of neighbouring farms;
- Impact on farm values of Gariep Road farms;

- Grievance channel development;
- Difference in water flow in the Orange River potentially affecting downstream farmers and potentially causing economic displacement;
- Potential loss of farm labourer jobs on neighbouring farms affected by differential water flow;
- Potential tourist appeal;
- Impact on Gariep Road users and neighbours;
- Potential visual impact of the parabolic trough plant on the general public;
- Increase in South Africa's power producing independence; and
- Grievance channel continuation.

8.7 Visual

8.7.1 Analysis of the Degree of Visual Intrusion caused by the Parabolic Trough Plant at Receptor Locations in the Study Area

Each of the proposed components of the solar power plant have been assessed separately. The most intensive and greatest magnitude impacts will be associated with the parabolic trough plant.

The visual phase scoping study undertook an analysis of potential visual exposure of the proposed solar power facility based on a number of zones of differing visual exposure (from high to marginal / negligible) visual exposure, based on the proposed location of the proposed solar facility development area (as provided by the applicant), and based on the typical degree of visibility of an object with distance.

The alteration of the proposed development footprint (in particular with the creation of an alternative site for the parabolic trough plant relatively close to the Gariep Road) has implications for the degree of visual intrusion on the receptor locations, as assessed in the scoping phase visual study.

In order to assess the potential visual impacts of the parabolic tough arrays at the two alternative sites, viewsheds have been generated for both alternative sites. The viewshed for each site was based on a number of points within each alternative site, and the viewshed thus represents the parts of the study area which can view any part of the uppermost part of the heliostats (which are 15m high). The viewshed thus represents a worst-case scenario.

The Parabolic trough Site Alternative 1 site is located in the far north-eastern part of the development site, and is thus the part of the site that is located furthest from the majority of the receptor locations in the study area that are located along the Orange River, at a distance of approximately 18 km from the river. This is a significant distance, and a distance within which topography would be able to screen the site and the objects developed on the site from view. A low ridge than runs over part of the site is located between the plant and the receptor locations and would partly block the arrays from view for certain of the receptors. As can be seen from Figure 48 below, the vast majority of the receptor locations in the study are would not be able to view the parabolic trough array at all, and this part of the solar power plant would effectively not be visible, taking into account the distance factor which would render it very difficult for viewers at these receptor locations to discern the presence of the plant against the surrounding wider landscape. The level of visual intrusion associated with the parabolic trough array would thus effectively be nil.

The Parabolic Site Alternative 2 is located somewhat closer to the Orange River valley and the majority of the receptor locations, being located approximately 11 km from the receptor locations on the western side of the river. This shorter distance is still significant making it difficult for viewers to easily pick out objects at this distance (Figure 49). The plant is similar to Site Alternative 1 located to the north-east of the low ridge on the site that would assist in shielding the plant from view from certain receptor locations. The viewshed for Site

Alternative 2 (Figure 49) indicates that a slightly greater number of receptor locations within the Orange River valley would be able to view the upper parts of the heliostats, including a number around the settlement of Saalskop and certain receptors along the Opwag local road in the vicinity of the Wegdraai Settlement. The distance factor would still render the heliostat array difficult to discern against the surrounding landscape from the distant receptor locations, and the degree of visual intrusion of the array is likely to be low. The two closer receptor locations (the Bokpoort farmstead and Ebenheaser farmstead) would be able to view the heliostats at Site Alternative 2 due to their closer proximity to the site.

For the certain receptor locations in the Saalskop area there would be a possibility that any potential visual impacts associated with Site Alternative 2 would be obviated by the shielding effect and visual intrusion factor of the central receiver component (if developed – please refer to the non-development recommendation in the Central Receiver component Visual Report – 14/12/16/3/3/3/204), if the central receiver component were to be developed at the Central Receiver Site Alternative 2 that is located closer to the Orange River valley than the parabolic trough site. For the receptors in the Saalskop area the development components would line up behind each other, and the heliostats of the central receiver component (being of similar height to those of the parabolic heliostats and being located closer) are likely to shield part or all of the parabolic trough arrays. For receptors to the north and south of the Saalskop area, the components would appear to be located adjacent to one another and not behind one another. However the high visual intrusion effect of the central receiver tower could easily dwarf any visual impact associated with the parabolic troughs at these locations.

Overall, the degree of visual intrusion associated with the parabolic trough arrays at both Parabolic trough site alternatives is likely to be low at worst, with the distance between most of the receptor locations and the alternative sites being the greatest contributing factor. The plants are thus very unlikely to result in the creation of a visual impact, or perceptions of visual impact by residents and other viewers in the Orange River valley, especially if Parabolic trough Site Alternative 1 is selected for development. The potential for colour contrast as caused by the parabolic trough arrays is also likely to be negligible due to the distance of the bulk of receptor locations that are able to view it from Site Alternative 2. This potential impact is not applicable to Site Alternative 1 as the vast majority of receptor locations will not be able to view the plant at this site. The potential glint and glare-related impact is explored below.

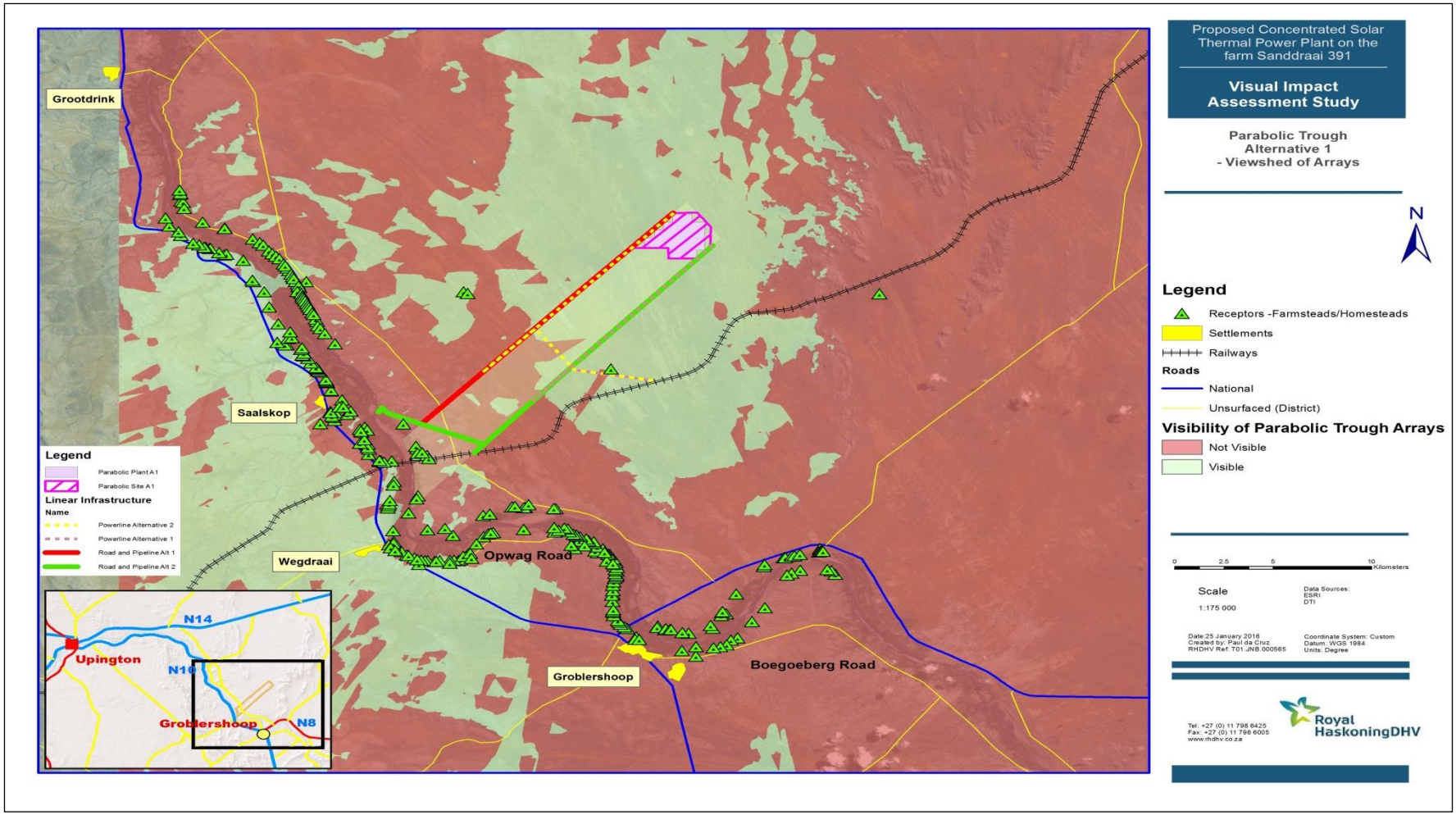


Figure 48: Viewshed of the upper part of the parabolic trough site alternative 1

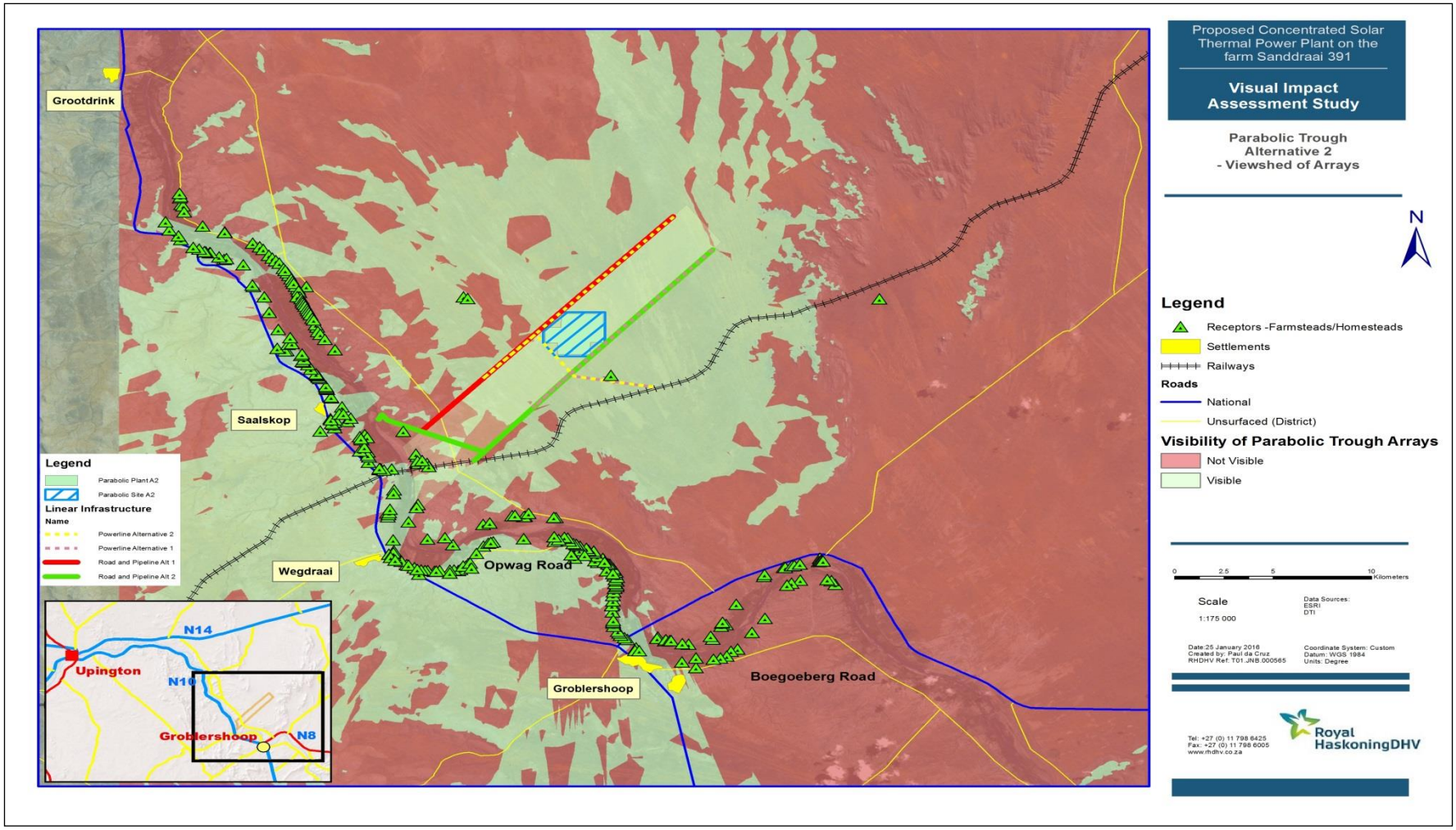


Figure 49: Viewshed of the upper part of the parabolic trough site alternative 2

8.7.1.1 Glint and Glare Analysis of the Parabolic Trough Components

As described in the Assessment (**Appendix D7**), glint and glare can become problematic aspects of the heliostats associated with the parabolic trough component of a solar power plant. As evident in Figure 48 above, the Parabolic trough Site Alternative 1 will not be visible to the vast majority of receptor locations in the study area and thus will not create any glint or glare impacts. Site Alternative 2 is located closer to the Orange River valley and thus would be able to be viewed by certain higher-lying receptor locations. Glint from the sun reflected in the absorber tubes or from heliostats could be visible. This glint over a wide area could make the parabolic troughs more visible and more easily identified within the wider landscape. However the distance of the majority of the receptor locations from the plant (a minimum of 11 km) would result in any glint or glare generated being rendered relatively non-invasive, especially when atmospheric conditions such as haze or pollution from smoke is considered. In addition, the shielding effect and great visual intrusion capacity of the central receiver component discussed in the Visual Assessment (see **Appendix D7**) would be likely to further obviate any glint or glare-related impacts. Thus for the majority of the receptor locations, glint and glare associated with either of the parabolic trough site alternatives is unlikely to be a factor.

8.7.1.2 Assessment of Lighting Impacts associated with the Parabolic Trough Components

In order to assess the impact of lighting at the proposed solar power station facility, it is necessary to explore the nature of the night-time environment in the study area.

Most parts of the study area are highly rural in nature with a very low density of human settlement. Accordingly the night-time environment within the wider area is thus characterised by few sources of artificial lighting. Where these occur, these are highly localised. The location of the viewer is important as viewers located in low-lying terrain settings (such as in the Orange River valley) would not be able to view the lights in the surrounding area. However viewers in higher lying settings, such as certain of the receptor locations on higher-lying ground closer to the N10 national road west of the Orange River valley would be able to see a greater area, and thus see the light sources in this area.

The primary sources of lighting are floodlights that illuminate on a permanent (nightly) basis in a number of the small settlements located along the N10 including Wegdraai, Saalskop and Grootdrink to the north as well as in certain parts of Groblershoop and the settlement of Boegoeberg to the south. A number of these very tall floodlights provide general illumination for these respective settlements in the absence of (lower) street lighting. The height of these lights makes them highly visible in an otherwise dark night-time context. When viewed from a high point the effect is of 'islands of light' in an otherwise very dark, unlit night-time context.

The Bokpoort Solar Power Plant has introduced a further set of lights into this dark environment, and is the only really visible source of light on the eastern side of the Orange River (when viewed from afar). The Bokpoort Solar Power Plant is located relatively far from the Orange River and cannot be discerned from the higher points on the western side of the Orange River during the day. However a set of lights at the power plant is visible from higher-lying terrain to the west of the river. A collection of lights is visible at the plant's location. These lights are likely to be tall, floodlight-type lights in order to be viewed from the higher lying areas to the west of the river. This set of lights adds to the few sources of lighting visible in the wider area.

It should be noted that it is not known what type of lighting is planned at the proposed facility. However if similar type of lighting was developed at the proposed facility, the relative proximity of the proposed facility to the Bokpoort Solar Power Plant when viewed from the area to the west would effectively add to the cluster of lighting that is already visible in this part of the study area. The number of lights as visible could more than double, especially if lighting was placed at both the parabolic and central receiver sites. The degree of visibility of lighting would depend on the height of the lights, the degree of illumination (strength) and their orientation. It is important to note that lighting at the proposed plant may not become a permanent feature of the light time

environment if it is not operated on a permanent (nightly) basis, and only used in case of emergency maintenance requirements.

8.7.2 Visual Impact of Ancillary (Linear) Infrastructure

8.7.2.1 Roads and Pipeline

As the road and pipeline will run in parallel, these new features could form a visible linear 'band' in the landscape, especially as the alignment along the boundary is a straight alignment for a considerable distance. Most of the Sand Draai farm and the area to the east of the Orange River away from the river valley bottom corridor is uninhabited, and thus there will be few receptor points within this area away from, and to the east of the river. The other pertinent factor in a visual assessment context is the height of the road and pipeline, which are not raised features, and unlike other components of the development would not be visible over a greater area by virtue of their height.

Accordingly the most likely nature of visual impact potentially associated with the proposed road is the creation of a visible linear band in the landscape to the east of the Orange River, as viewed from receptor locations to the west of the river. The road would either be tarred or unsurfaced, creating a black or white surface respectively. The pipeline servitude running in parallel would be kept free of naturally-occurring woody vegetation and would thus be a different colour (matching the colour of the substrate) from the surrounding areas of sparse acacia thicket

.

The portions of the respective alignments that are aligned along the Sand Draai property boundary, and which run up (and roughly parallel) away from the Orange River valley bottom are most likely to be visible from the receptor locations to the west. The nature of the terrain, however, would block much of the road and pipe alignments along the farm boundary, especially the majority of the alignment that is located within the flatter dunefields north-east of an area of locally-high lying topography immediately to the north-east of the Gariep Road. The shielding effect of topography for most of the receptor locations along the Orange River corridor and N10 corridor is evidenced by the viewshed analysis undertaken for the parabolic trough sites that indicates that these areas will not able to be viewed by receptors within the Orange River valley and those located to the west of the valley.

Beyond the localised high ground immediately north-east of the Gariep Road, the road and pipeline servitude along Road and water pipeline Alternative 1 would be visible from the receptor locations west of the Orange River as it crosses the low ridge along which the existing 132 kV power lines are aligned, however this ridge is located at a sufficient distance from these receptor locations (approximately 10.5 km) to make it very hard for the viewer to discern these features in the context of the surrounding landscape.

For the portions of the road that are visible, and which are located between the Gariep Road and the Orange River, the presence of vehicles moving along the road if it were unsurfaced thus creating a dust cloud, would be the feature of the road that would be most visible, drawing attention to the road. This visual aspect is valid for the Gariep Road, which is currently unsurfaced.

8.7.2.2 Power Line

A new power line is proposed to run from the existing 132 kV power line (that bisects the development site (Sand Draai property) to the north-east of the Gariep Road) along either of the longitudinal boundaries of the Sand Draai property to link up with solar power plant components located to the north-east or-south-west of it. The exact alignment and length of the proposed power line will depend on which solar power generation component alternatives are selected, and on which of the respective alignment alternatives along the boundaries are ultimately selected.

Visual impacts associated with power lines typically relate to two factors – firstly that the towers are large structural objects and thus highly visible, and secondly that power lines are often perceived to be incongruous in the context of a natural setting.

The cluster of receptor locations concentrated along the Orange River, in particular those to the west of the river on higher-lying ground will be the closest receptor locations which would be potentially exposed to a view of these new power lines. There is a sizeable distance however between the closest receptors on the western side of the river to the closest point of the proposed power line alternatives (at the point at which the power line alternatives would link into the CSP Central Receiver Site Alternative 2) – approximately 7 km for Power line Alternative 2 and 8.5 km for Power line Alternative 1. This distance factor would render the closest part of the line very difficult to discern from the surrounding landscape (and would be dwarfed by the central receiver tower if it was developed on Site Alternative 2). The existing 132 kV power lines are impossible to discern with the naked eye from the western side of the valley and accordingly the majority of the alignment of the power lines along either of the alignments would exert little to no visual impact on the majority of the receptor locations in the study area.

There are two sets of receptor locations situated closer to the road alignment - the Bokpoort farmstead and the Ebenhaeser farmstead that are located 2 km and 3.7 km from the closest visible point of the lines respectively. However these receptor locations are both located in an area from which the solar power station components (including that of the Bokpoort Solar Power Plant in the case of the Bokpoort farmstead) would be highly prominent. The associated power lines would arguably be insignificant in the context of the scale and area of the solar power plant components, and thus unlikely to affect these two receptor locations in a context of these structural features.

8.7.3 Potential Impacts

8.7.3.1 Construction

The total clearing of the site would be conducive to the creation of large clouds of dust that with the movement of machinery that would be visible from a wide area.

Heavy vehicles traveling to the site along the Gariep Road will create large dust clouds that will be able to be viewed from a relatively great distance.

8.7.3.2 Operations

The parabolic trough heliostats would not be visible to the vast majority of the receptor locations in the study area, and thus would not cause any visual impact for the majority of the study area.

8.7.3.3 Decommissioning

The parabolic troughs and heliostats would remain as large objects in the landscape if it was not physically removed.

8.8 Noise

8.8.1 Construction Phase

Table 21 and Figure 50 below contains the results of the modelled construction activities that are expected during the construction of the facility. The noise generated by the activities does not extent to the allocated receivers for this project (Modelled Scenario Results column), concluding that the area is unlikely to be impacted by the construction activities.

Table 21: Construction phase sensitive receptor results summary

CODE ID	Baseline Noise Level (calculated)			Modelled Scenario Results			Cumulative Noise Levels *(Baseline + Modelled Results)*			Difference in noise level based on baseline scenario		
	Day	Night	Day/Night	Day	Night	Day/Night	Day	Night	Day/Night	Day	Night	Day/Night
	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA
REC_01	45.2	35.1	45.2	0.00	0.00	0.00	45.20	35.10	45.17	n.r.	n.r.	n.r.
REC_02	47.3	47.7	53.7	0.00	0.00	0.00	47.30	47.70	53.66	n.r.	n.r.	n.r.
REC_03	35.0	23.4	34.5	0.00	0.00	0.00	35.00	23.40	34.53	n.r.	n.r.	n.r.
REC_04	34.1	23.4	33.9	50.80	0.00	49.00	50.89	23.40	49.13	**16.79**	n.r.	**15.25**
REC_05	34.4	23.7	34.2	24.00	0.00	22.20	34.78	23.70	34.45	**0.38**	n.r.	**0.27**
REC_06	47.4	31.7	46.2	0.00	0.00	0.00	47.40	31.70	46.19	n.r.	n.r.	n.r.

8.8.2 Operational Phase

Table 22 and Figure 51 below contain the results of the modelled operational activities that are expected during the lifetime of the facility. The noise generated by the activities does extent to the allocated receivers for this project (Modelled Scenario Results). The amount of sound received by the different receivers, range from 0.00 dBA to 23.00 dBA, which is low, due to the distance from source. The largest increase in the future expected sound level is +0.95 dBA during the night.

Table 22: Operational phase sensitive receptor results summary

CODE ID	Baseline Noise Level (calculated)			Modelled Scenario Results			Cumulative Noise Levels *(Baseline + Modelled Results)*			Difference in noise level based on baseline scenario		
	Day	Night	Day/Night	Day	Night	Day/Night	Day	Night	Day/Night	Day	Night	Day/Night
	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA
REC_01	45.2	35.1	45.2	0.00	0.00	0.00	45.20	45.20	45.20	n.r.	n.r.	n.r.
REC_02	47.3	47.7	53.7	0.00	0.00	0.00	45.20	45.20	45.20	n.r.	n.r.	n.r.
REC_03	35.0	23.4	34.5	0.00	0.00	0.00	45.20	45.20	45.20	n.r.	n.r.	n.r.
REC_04	34.1	23.4	33.9	51.50	51.50	51.50	51.58	51.51	51.57	**17.48**	**28.11**	**17.69**
REC_05	34.4	23.7	34.2	22.90	22.90	22.90	34.70	26.33	34.49	**0.30**	**2.63**	**0.31**
REC_06	47.4	31.7	46.2	0.00	0.00	0.00	45.20	45.20	45.20	n.r.	n.r.	n.r.

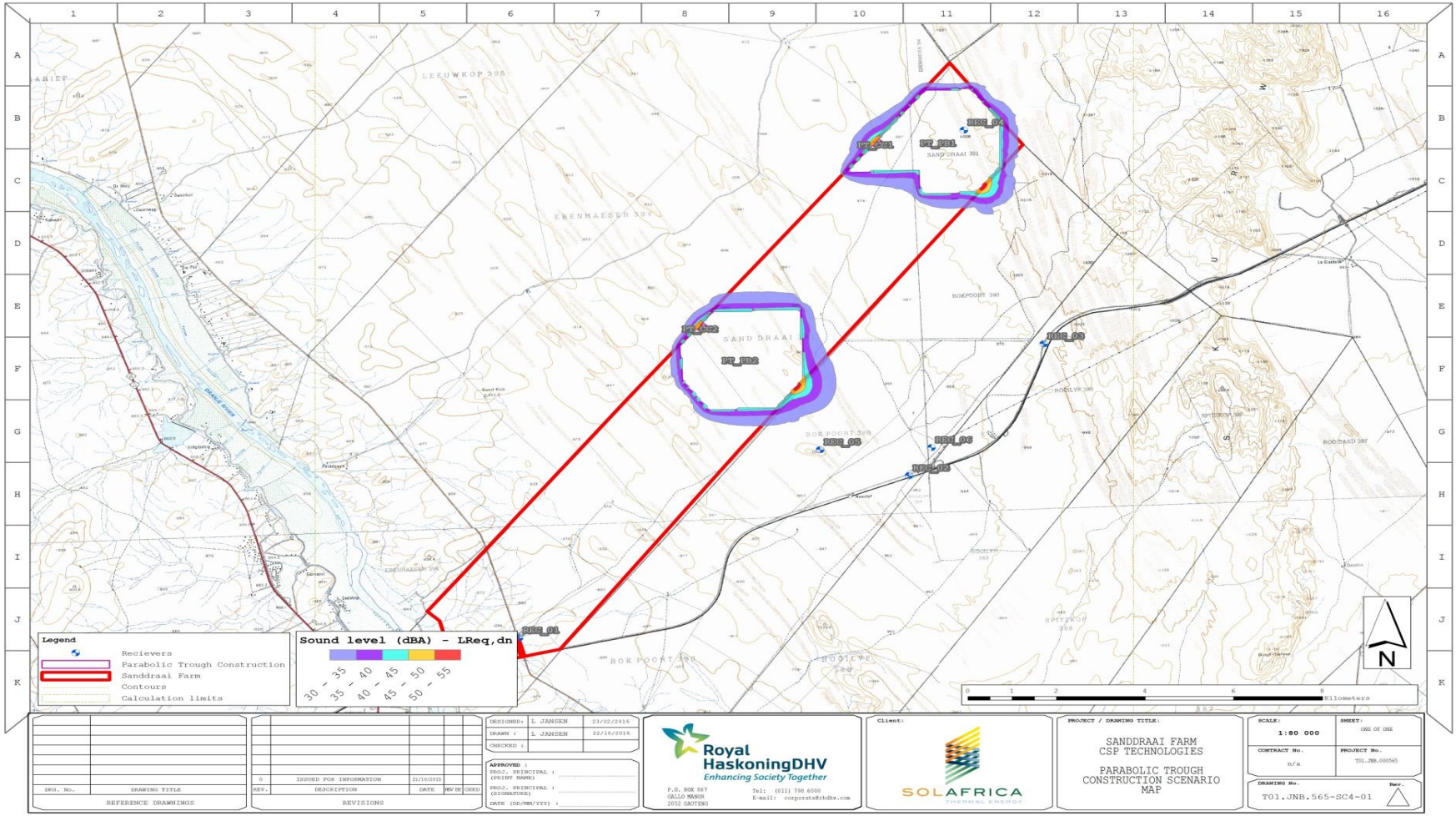


Figure 50: Illustrated construction phase modelling results

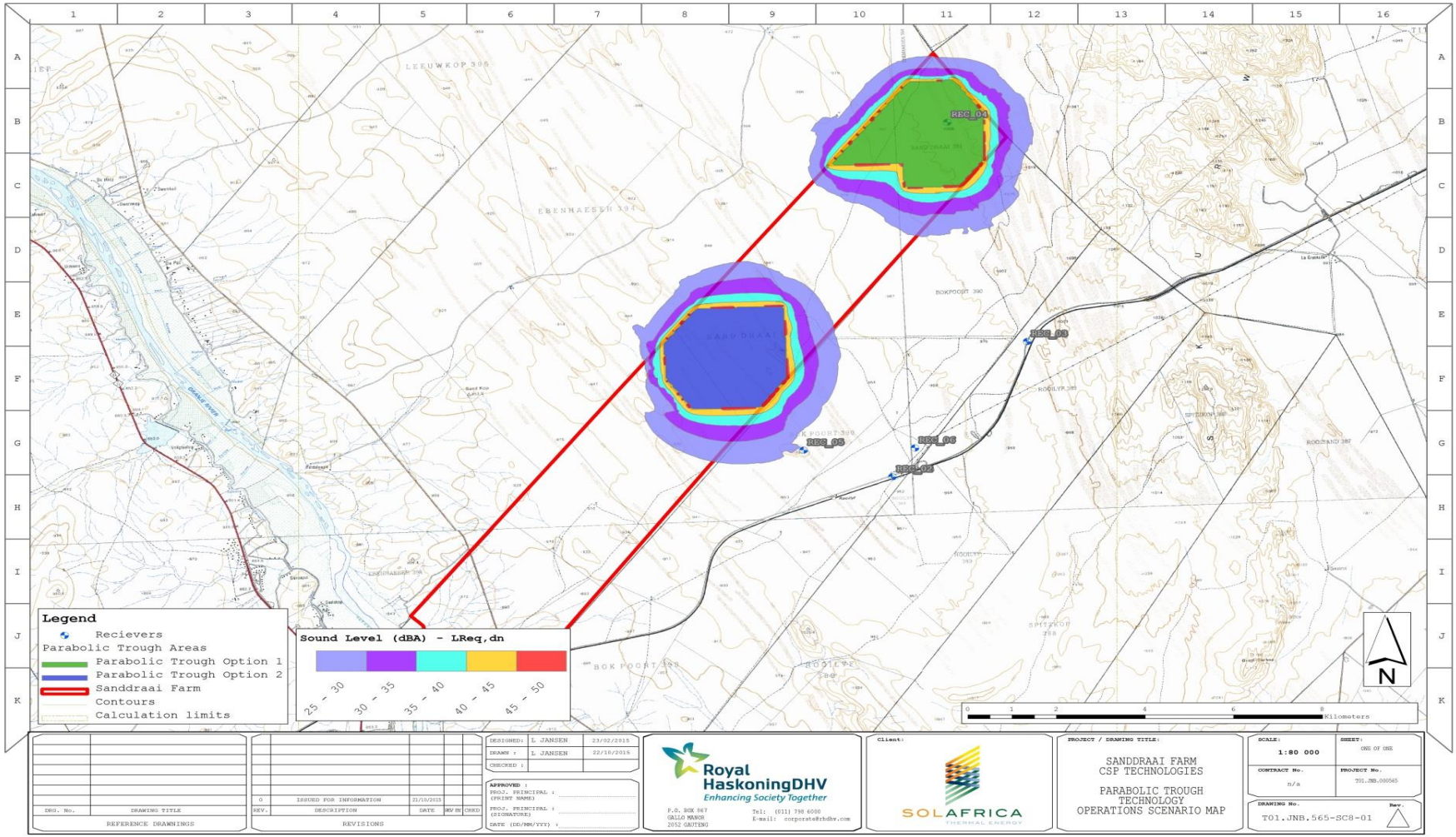


Figure 51: Illustrated operational phase modelling results

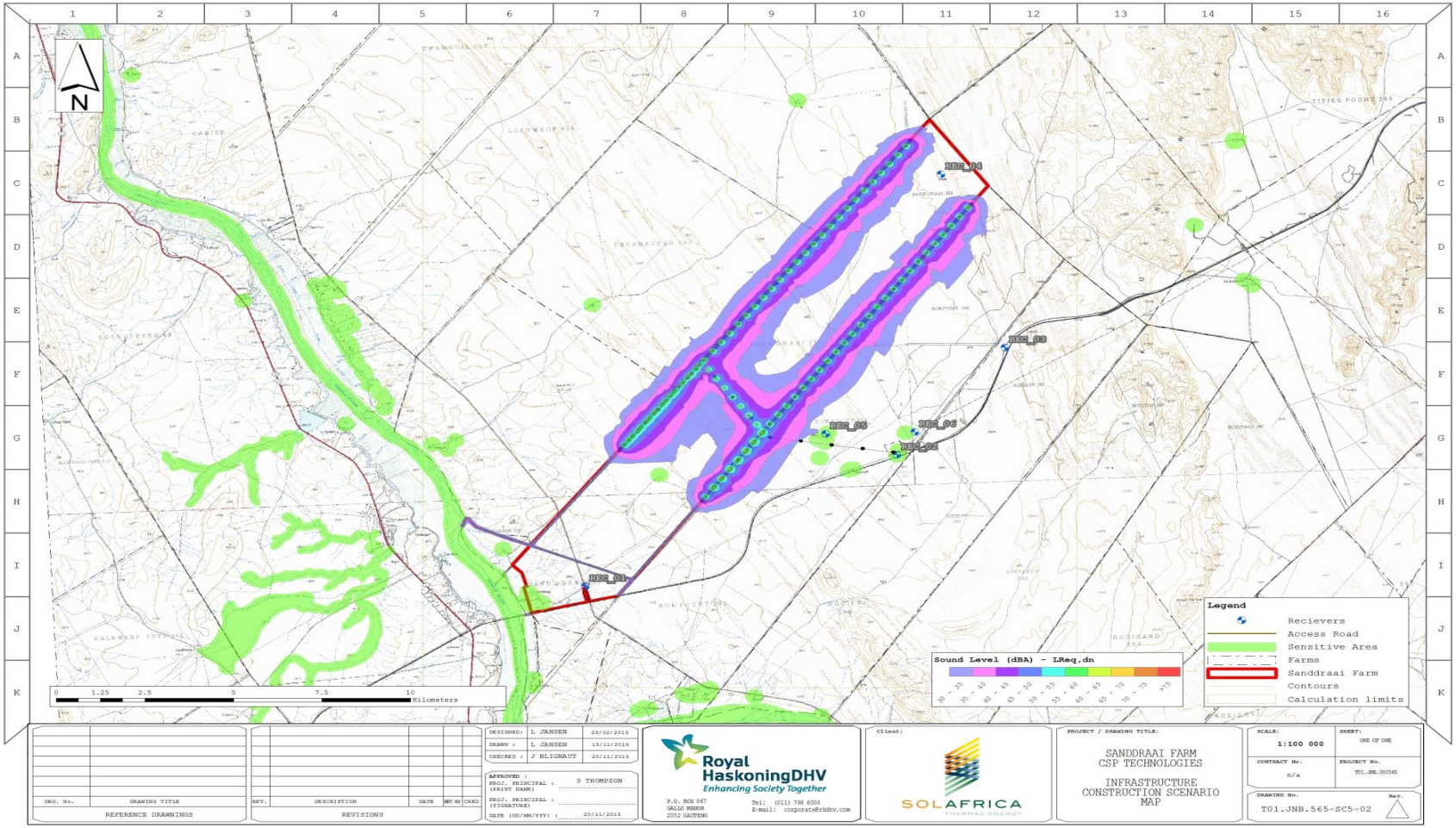


Figure 52: Illustration of the infrastructure modelling results

8.8.3 Infrastructure Construction

The construction scenario of the different infrastructures is based on the information within the Sound Power Level Inventory, both options for the project was modelled together (Table 23 and Figure 52). Only the construction phase scenario was investigated, as the operational phase of infrastructure are included in Section 8.8.2.

Table 23: Infrastructure construction receptor results summary

CODE ID	Baseline Noise Level (calculated)			Modelled Scenario Results			Cumulative Noise Levels *(Baseline + Modelled Results)*			Difference in noise level based on baseline scenario		
	Day	Night	Day/Night	Day	Night	Day/Night	Day	Night	Day/Night	Day	Night	Day/Night
	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA
REC_01	45.2	35.1	45.2	9.70	0.00	7.90	45.20	45.20	45.17	**+0.01**	n.r.	**+0.01**
REC_02	47.3	47.7	53.7	0.00	0.00	0.00	45.20	45.20	45.20	n.r.	n.r.	n.r.
REC_03	35.0	23.4	34.5	0.00	0.00	0.00	45.20	45.20	45.20	n.r.	n.r.	n.r.
REC_04	34.1	23.4	33.9	25.60	0.00	23.80	34.67	45.20	34.29	**+0.57**	n.r.	**+0.41**
REC_05	34.4	23.7	34.2	28.10	0.00	26.40	35.31	45.20	34.85	**+0.91**	n.r.	**+0.67**
REC_06	47.4	31.7	46.2	0.00	0.00	0.00	45.20	45.20	45.20	n.r.	n.r.	n.r.

8.8.4 Potential Impacts

8.8.4.1 Construction Phase

The typical noise that would be generated by the construction activities are all from heavy machinery and impact noises from incidents (such as falling pipes, equipment, etc.) – it should be noted that blasting activities are excluded from this investigation. The work hours of the construction phase will be limited to daylight hours. The loudest hour will be in the morning, once all the workers report at the site and the machinery is started up before work commences. The same is likely to occur, when the work day stops and all mobile equipment and machinery return to the construction camp.

During the hours of the working day, the noise is difficult to accurately determine due to the unpredictability and mobility of the noise sources onsite. The modelled results attempted to determine the noise generated from the power block construction and installation.

8.8.4.2 Construction of Ancillary Infrastructure

Similar to the power plant development all workers will commute between the site and the nearby town each day. The noise will not all happen at once along the proposed areas, but will pass along the areas through the phase's lifetime. All construction will be limited to daylight hours. As the area of construction consists out of a varying list of equipment and unknown times and location of activity it is difficult to accurately determine the noise generated along the construction area.

The loudest infrastructure noise source is the pile driving for the construction of the different pylons for the power line.

8.8.4.3 Operational Phase

The operational phase of the project will commence after the successful installation and testing of the technology. Similar to the construction phase, all workers will be based off site and the workers will commute to the site everyday.

8.9 Air Quality

8.9.1 Construction Phase

During this phase it is expected that, the main sources of impact will result from the construction of infrastructure such as roads, building sites, and clearing of land for heliostat installation etc. These predicted impacts cannot be directly quantified, primarily due to the lack of detailed information related to scheduling and positioning of construction related activities. Instead a qualitative description of the impacts has been provided and this involves the identification of possible sources of emissions and the provision of details related to their impacts.

Construction is commonly of a temporary nature with a definite beginning and end. Construction usually consists of a series of different operations, each with its own duration and potential for dust generation. Dust emission will vary from day to day depending on the phase of construction, the level of activity, and the prevailing meteorological conditions.

The following possible sources of fugitive dust have been identified as activities which could potentially generate dust during construction operations at the site:

- Building sites;
- Roads; and
- Land clearing for heliostat installation.

8.9.1.1 Building Sites

Material removed from the surface where building and construction will be taking place, can increase wind blown dust from the site, as well as add to entrained dust for vehicles. To avoid these emissions only the minimum possible area should be disturbed and cleared. This will ensure that local vegetation remains intact and aids in dust suppression.

8.9.1.2 Creation and Grading of Access Roads

Access roads are typically constructed by the removal of overlying topsoil, whereby the exposed surface is graded to provide a smooth compacted surface for vehicles to drive on. Material removed is often stored in temporary piles close to the road edge, which allows for easy access once the road is no longer in use, whereby the material stored in these piles can be re-covered for rehabilitation purposes. Often however, these unused haul roads are left as is in the event that sections of them could be reused at a later stage.

A large amount of dust emissions are generated by vehicle traffic over these temporary unpaved roads. Substantial secondary emissions may be emitted from material moved out from the construction/clearing area during grading and deposited adjacent to roads. Passing traffic can thus re-suspend the deposited material. To avoid these impacts material storage piles deposited adjacent to the road edge should be vegetated, with watering of the pile prior to the establishment of sufficient vegetation cover. Piles deposited on the verges during continued grading along these routes should also be treated using wet or chemical suppressants depending on the nature and extent of their impacts.

A positive correlation exists between the amount of dust generated (during vehicle entrainment) and the silt content of the soil as well as the speed and size of construction vehicles. Additionally, the higher the moisture content of the soil the lower the amount of dust generated.

8.9.1.3 Land Clearing

Material removed from the surface where construction will be taking place, specifically in the areas where heliostats will be installed, can increase wind blown dust from the site, as well as add to entrained dust for vehicles.

8.9.1.4 Overview of Potential Impacts

The following components of the environment may be impacted upon during the construction phase:

- ambient air quality;
- local residents and neighbouring communities;
- employees;
- the aesthetic environment; and
- possibly fauna and flora.

The impact on air quality and air pollution of fugitive dust is dependent on the quantity and drift potential of the dust particles. Large particles settle out near the source causing a local nuisance problem. Fine particles can be dispersed over much greater distances. Fugitive dust may have significant adverse impacts such as reduced visibility, soiling of buildings and materials, reduced growth and production in vegetation and may affect sensitive areas and aesthetics. Fugitive dust can also adversely affect human health. It is important to note that impacts will be of a temporary nature, only occurring during the construction period.

Given the short duration and low level of activity expected during construction, but bearing in mind that no quantitative emission figures exist, no long term adverse impacts are anticipated on these receptors. Impact of fugitive dust emissions on employees on site could however be significant during the construction phase, but will vary between phases, with level of activity and meteorological conditions.

8.9.2 Operational Phase

The proposed project can be defined as a solar thermo-electric power plant that is embodied in the form of a CSP plant based on parabolic trough technology. The electricity generation process can be summarised as follows:

- Heliostats reflect the solar radiation towards the tubes where a large.
- The fluid within the tubes is heated to approximately 400 ^{0}C by the sun's concentrated rays and then pumped through a series of heat exchangers to produce superheated steam.
- A molten salt mixture is pumped from the cold salt thermal storage tank to the parabolic trough system where it is circulated in the heat exchanger until the temperature reaches 566ºC.
- The molten salt concentration is then transported to the hot salt thermal storage tank.
- Hot salt is pumped from the hot salt storage tank to the steam generator where heat is transferred from the salt to water in order to generate high pressure steam.
- The highly pressurised steam is then passed through a steam turbine, which is linked to an electric generator to generate electricity.

During the commissioning process, diesel/LPG will be trucked in and used for plant commissioning and the salt melting process. During the operational phase, diesel/fuel/trucked in LPG gas will be used for the initial salt heating process and oil for operating of the salt pumps. A diesel operated stand-by generator will be implemented on site, however it is not expected that this will be used. Fuel consumption estimations for a 150 MW plant are as follow:

- It is estimate that 50 to 70 days are required for initial salt melting for the 150 MW plant. During this period an estimated 35 400 m^3 of natural gas (final volume of fuel to be confirmed) will be consumed for the melting process.
- It is estimated that roughly 15 000 m^3/hour of natural gas is required for auxiliary heating of the salt, with an added 2 015 litres of fuel per day for operating the molten salt pumps.

NOx will not be generated during operation of the CSP. However, during plant commissioning, the initial melting, heating, and conditioning of the salt will result in limited NOx emissions. For the melting and heating segments of the process, two small boilers each employing ultra low NOx burners and flue gas recirculation, will be used to mitigate emissions from the combustion of LPG or natural gas. For the salt conditioning process, a multi-stage wet scrubber will be used to limit NOx emissions from the decomposition of magnesium nitrate inherent in the salt mixture. This series of operations is limited to a one-time event, resulting in a closed loop system of liquid salt storage and circulation. At no other time will NOx be generated during the operation of the CSP.

8.9.2.1 Potential Impacts at Start-up

Start-up is expected to last between 50 and 70 days depending on weather and salt conditions. During this time natural gas and diesel fuel will be used to heat and melt the salt and begin pumping the salt through the system until the plant has reached its operational temperatures and pressures. During this time the emissions from the fuels will result in an increased pollution load within the atmosphere. As mentioned this process is not expected to last more than 70 days, and therefore the model has been adjusted to take this into consideration. Figure 53 provides a graphic illustration as to the movement of pollutants through the atmosphere once generated and in the natural environment.

Table 24 below indicates the maximum predicted ambient concentrations as a result of the start-up of the site. Ambient standards are presented in Table 25. Figure 53 provides a graphic illustration as to the movement of pollutants through the atmosphere once generated and in the natural environment.

Table 24: Maximum predicted offsite concentrations for the CSP Auxiliary boiler (µg/m³)

	1 Hour		24 Hour		Annual	
	Alt 1	**Alt 2**	**Alt 1**	**Alt 2**	**Alt 1**	**Alt 2**
Particulate Matter	107.33	120.62	32.01	11.69	1.23	0.48
Oxides of Nitrogen	70.54	109.97	4.65	6.14	0.46	0.39
Methane	325.33	507.17	27.27	35.43	1.29	1.46

Table 25: Respective ambient standards (µg/m³)

	1 Hour	24 Hour	Annual
Particulate Matter		75	40
Oxides of Nitrogen	200		40
Methane			5

8.9.2.2 Potential Impacts once Operational

Once start-up is complete no fuels are required to ensure the on-going operations of the CSP plant, therefore all emissions as identified above will no longer be produced and the plant should continue to run on solar power. Should the plant be shut down in its entirety then emissions as described above will resume during start-up.

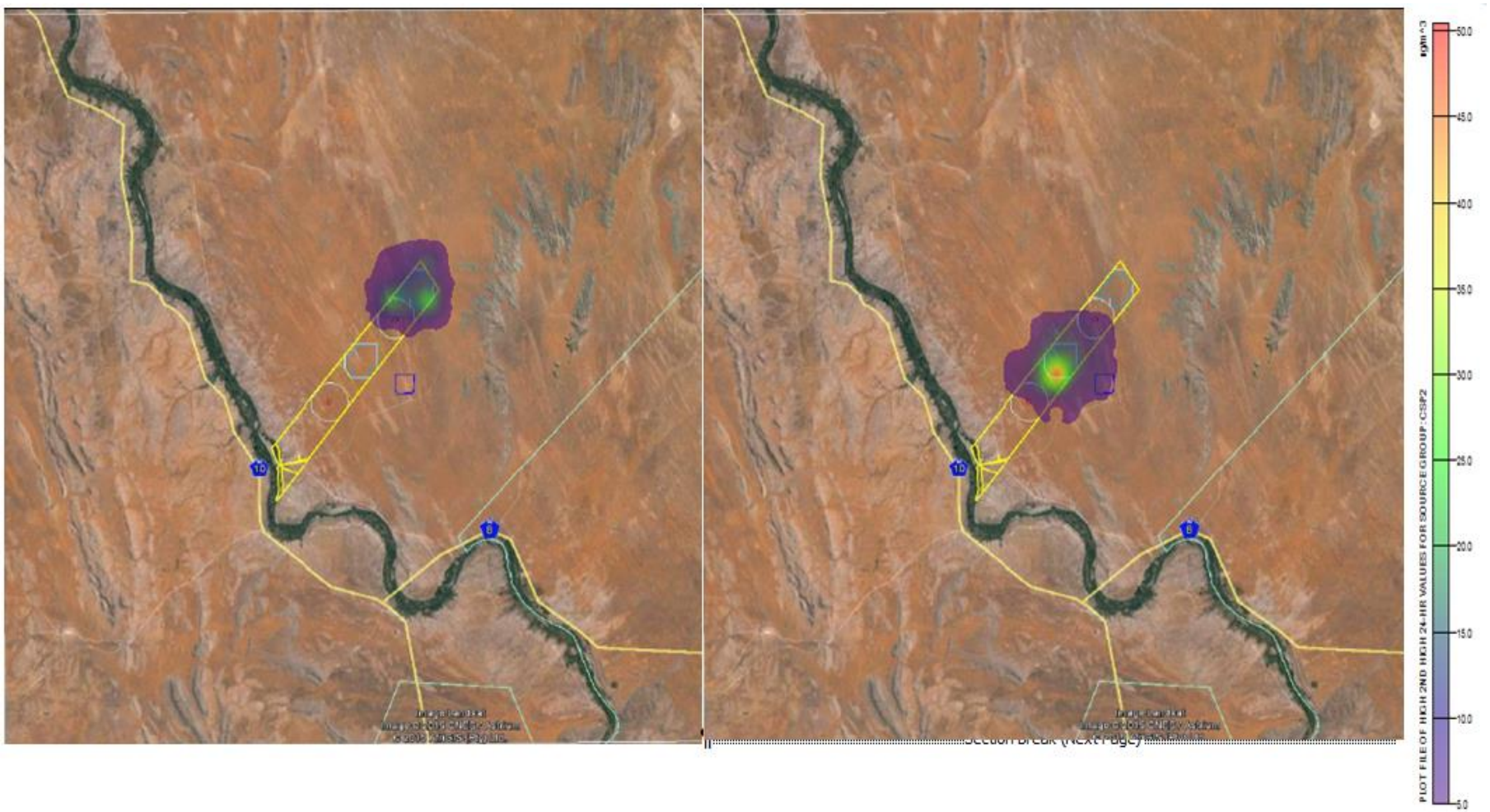


Figure 53: CSP auxiliary boiler alternative locations

8.9.3 Heat Island Development

The development of a heat island has been noted to occur in areas where the natural environment "grasslands specifically" has been replaced by infrastructure for solar projects. This is particularly noted in projects of 50 MW and greater.

It is expected that during the day at a height of 2.5 m above the array, an increase in temperature is noted to reach up to 1.9°C warmer than the surrounding ambient air, with the thermal increase having completely dissipated 11.5 m above the array. It is likely that by a distance of 300 m from the edge of the array, the temperature is approximately 0.3°C above ambient temperature. It has also been noted that over night the array will completely cool and loose all thermal heat. Figure 54 below shows thermal modelling to indicate how heat builds up within the array, which is also wind dependant. Access routes within the array are also noted to reduce the heat build-up substantially.

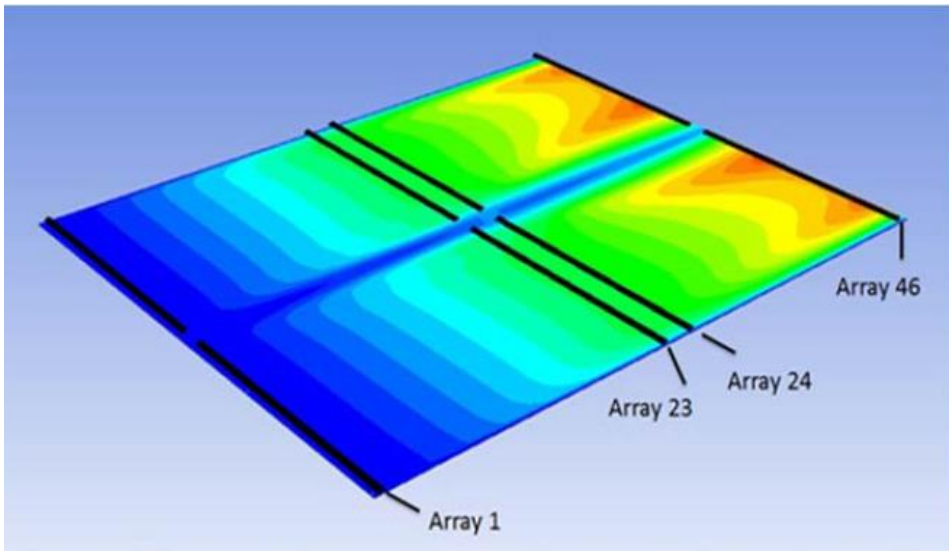


Figure 54: Thermal modelling for solar array indicating daily heat build-up within the array, with wind blowing from a westerly direction

8.9.4 Road Access

Road access to the site has been identified via two alternatives, the N8 route which is approximately 18 km of unpaved road and the Gariep Road via the N14, approximately 55 km of unpaved road. The maximum predicted offsite concentrations for unpaved roads are presented in Table 26.

Table 26: Maximum predicted offsite concentrations for unpaved roads (µg/m³)

	1 Hour		24 Hour		Annual	
	Alt 1	**Alt 2**	**Alt 1**	**Alt 2**	**Alt 1**	**Alt 2**
Particulate Matter	300.64	311.02	73.71	80.44	34.09	35.10
Standard			75		40	

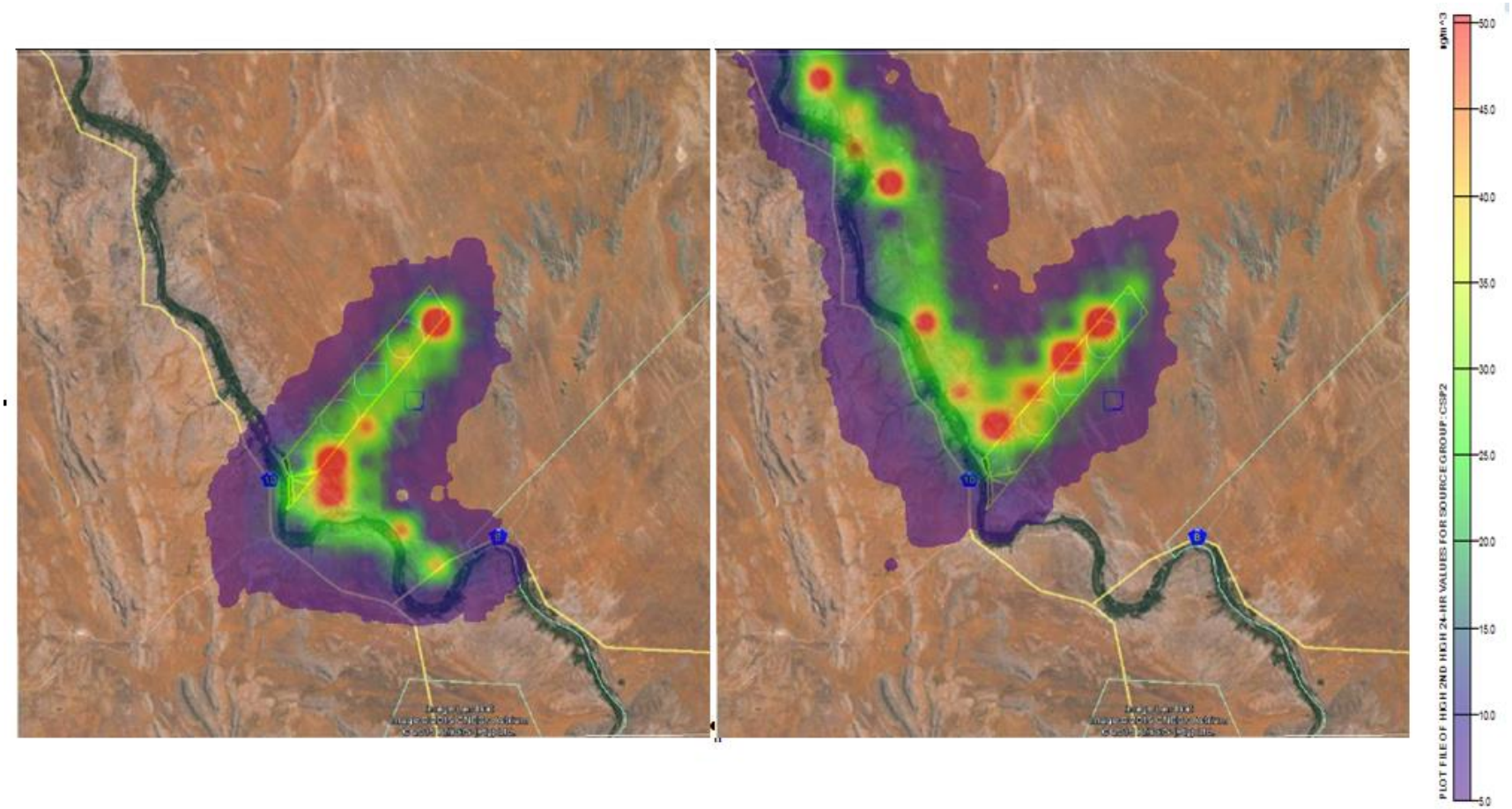


Figure 55: Route alternatives showing N8 route and Gariep Road

8.10 Waste

8.10.1 Surface Water

The CSP facility will follow a zero liquid discharge approach, meaning that no liquid waste streams will be rejected into the environment. The following water related facilities are required:

- Raw water storage and treatment;
- Stormwater detention basin;
- Firewater storage;
- Evaporation ponds (including liner and detections system);
- Septic Tank and sewage disposal facilities; and
- Water abstraction system.

Liquid wastes that will be produced by the CSP Plant must be collected within a separate network, with different streams according to the origin of the liquids that produce them.

With reference to the preceding sections, the blowdown for cooling tower will be the main effluent of the Plant under a Wet cooled condenser solution. In addition, other effluents will appear and can be classified within the following groups:

- Effluents of the process;
- Residual sanitary water;
- Effluents that may contain oily/greasy waste; and
- Reject from the wastewater treatment plant.

8.10.2 Evaporation Ponds

Three evaporation ponds will be located outside but nearby the solar field. The access road will have a gravel surface. The effluent will be piped or channelled to the evaporation ponds as the western side of the power field is at a lower position than the plant and therefore a gravity feed can be achieved.

The evaporation ponds will consist of three (3) compartments that would enable maintenance on any of the three (3) compartments without disrupting the normal operations of the CSP plant. The three (3) compartments will have a small emergency overflow to each of the other compartments. The flow to each of the compartments will be controlled via a splitter box at the top end of the evaporation ponds. A limited amount of silt is to be expected to enter the ponds as no surface water will enter the system. Oil will be separated out of the effluent stream before it reaches the evaporation ponds. The evaporation ponds will not be shared amongst the various plants.

- Size of each evaporation pond = 160 m x 175 m x 6 m = 168 000 m^3
- Number of evaporation ponds = 3
- Total area for the evaporation ponds = 8.5 hectares.

8.10.3 Solid and Non-Hazardous Waste

The CSP plant will produce maintenance and plant wastes typical of power generation operations. Generation plant wastes include: oily rags, broken and rusted metal and machine parts, defective or broken electrical materials, empty containers, and other miscellaneous solid wastes including the typical refuse generated by workers. All waste to be generated on site will be subject to the principle of “reduce, reuse and recycle” as far as possible before disposal is regarded as an option. Solid wastes will be temporarily kept on site and trucked offsite for recycling or disposal at a licenced recycling facility or licenced landfill site in the vicinity. Waste

collection and disposal will be in accordance with applicable regulatory requirements to minimise health and safety effects.

The following principles will be applied to the temporary storage of solid waste at the source:

- A service provider will be appointed to adequately address the temporary storage of solid waste. This service provider will provide adequate and appropriate containers for the storage of solid waste.
- Waste will be sorted and stored within appropriate containers to allow for the implementation of "Reduce, Reuse and Recycle" as per the waste management plan.
- The site design will allow for designated waste storage areas. Each of these areas will be designed as to ensure environmental degradation does not occur – will be clearly marked and constructed appropriately.
- Waste will be collected on a regular basis (monthly).
- Waste will be stored in such a manner that it can be easily loaded and transported.
- Waste stored in containers need to adhere to the following –
  - Waste types will not be mixed;
  - Waste will be kept in a container that is of good condition – under no circumstances may waste containers be worn, corroded or have the potential to allow for environmental contamination.
  - All waste containers need to be positioned within the designated waste areas and must be labelled correctly.
  - Skips/waste containers may at no point in time overflow.
  - Skips/waste containers need to be adequately positioned and enclosed for rainy events.
- No waste product shall be burned on site or disposed of on site.
- Waste containers will be protected as to prevent scavenging.
- The waste management plan must allow for timely scheduled collection of wastes. Detailed records of these activities need to be kept.

8.10.4 Hazardous Waste

A number of hazardous wastes may be generated during the operation of the facilities. These wastes include: spent HTF, mirror cleaning chemicals, used oil, spent oil filters, spent solvents, cleaning rags, old or out of date chemicals from the water treatment system, old paints, among others.

The hazardous materials that may be used at the facility will be stored on-site in portable appropriately labelled tanks and inside containment structures to prevent exposure to the elements and reduce the potential for accidental releases. The quantities stored on-site will be evaluated to identify the required usage and maintain sufficient inventories to meet requirements without stockpiling excess volumes. These wastes will be thereafter be disposed of in permitted hazardous landfill sites (e.g. Holfontein and Rietfontein). Sites under consideration are located in Johannesburg, Port Elizabeth, and Cape Town. The disposal of hazardous materials will be carried out by a chemical cleaning contractor in accordance with applicable regulatory requirements. Dangerous goods such as Diesel fuel and Liquid Petroleum gas will be required for the daily operation of the CSP plant and will be stored on-site in SANS compliant storage facilities. Workers will be trained to handle all hazardous wastes generated at the site.

8.10.5 Sewage

The CSP plant will create sanitary waste streams at both the administrative building and at the operations building and maintenance areas. Each area will have a kitchen as well as the requisite quantity of toilets and or showers to support the crew size. These facilities will be adequate for the number of people on the site. At these locations, a septic tank and leach field will be used to capture and treat the flows. As and when required, the septic tank (solids holding tank) will be cleaned out by a vacuum truck and the wastes will be trucked and disposed at a licenced facility. This activity will adhere to the plant safety program as administered by plant personnel.

With respect to the handling and treatment design and operations of the proposed effluent treatment plant the following philosophy will be put in place:

- A closed loop system will be introduced and implemented with regards to the handling, treatment and reuse of treated water. It is proposed that the sludge from the bio-filter treatment plant be removed off site and disposed of at an appropriate facility.
- Effluent treatment of sewage/sanitation water will be done in such a manner that the treated effluent will adhere to the general limit effluent standards.

8.10.6 Drainage Network System

8.10.7 Drainage Network System

The drainage network will be designed to allow the separation of the effluents with the aim of applying the most appropriate treatment to each one. The basic function of the drainage system is to collect all water streams that are produced during the running of the plant and to send them to the specific treatment process according to the nature of these ones before the neutralization and homogenization pond. The neutralized wastewater will be delivered in the evaporation pond finally. The site will be serviced by a stormwater management system (available in separate specialist study) which aims to separate clean and dirty surface water.

An on site stormwater conveyance system will control the 50 year storm event and protect structures from the 100-year storm event. On site stormwater runoff will be collected by a surface drainage system of terrace drains and swales to collect and direct runoff to a sedimentation/retention basin.

Stormwater that collects in the power block areas of the facility will be collected in a separate drainage system and routed through an oil/water separator before being conveyed to the main wastewater management system. Spills or any potential contaminated runoff within the power block area will be directed to a wastewater disposal system.

The plant's drainage system is composed of:

- Collecting networks;
- Cooling tank for potentially hot effluent;
- Stormwater basin;
- Retention basin;
- Separator of light hydrocarbons coming from the power island;
- Separator of hydrocarbons coming from the salts;
- Neutralization and homogenization pond;
- Waste network and evaporation pond;
- Wells, manholes, drains and other typical components of a drainage network;
- Evaporation pond.

The drainage collection network is made up of the following lines that collect reject waters according to their nature, as indicated below:

- Process blowdown (potentially hot):
  - Auxiliary boiler blowdown;
  - De-areator drainage;
  - Intermittent blowdown tank overflow;
  - PSV discharge and de-areator overflow;
  - Drainage of atmospheric drainage tank from ST and BOP; and
  - High and low pressure pre-heating drainage.
- Sanitary water network:
  - Generated within the administrative building, workshop and store room; and

  - Generated within the electrical building and control room.
- Oily water network 1: rainwater containing oil or hose water used for cleaning and washing:
  - Buildings containing turbines and drainage in the condenser area;
  - Compressed air unit slab;
  - Fire protection pump room;
  - Transformer area;
  - Drainage of pavement in supply water pump area;
  - Drainage of pavement in service water pump area;
  - Drainage of pavement in make-up pump
  - Drainage of pavement in demineralized water pump; and
  - Drainage of pavement in solar field pump.
- Oily water network 2: Rainwater carrying HTF or hose water for cleaning and washing in HTF area:
  - Filter area for thermal oil;
  - Boiler pumps area;
  - Steam generation area;
  - HTF heater area;
  - Main HTF pumps area;
  - Steam generation area;
  - Basin of expansion and overflow vessels; and
  - HTF-Salt exchanger area.
- Water network:
  - Water flows from the oil-separating manhole in the transformer area;
  - Water treatment area of the plant;
  - Pre-water treatment area of the plant;
  - Sampling area;
  - Compressed air area drainage;
  - Demineralised water tank drainage and overflow;
  - Service water tank drainage and overflow;
  - Eye-washing showers;
  - Filter cleaning;
  - Chemical dosing area drainage; and
  - Cleaning water from chemical bunds (without chemical concentrates).
- Collecting concentrates:
  - Reverse osmosis concentrate from the demineralization line; and
  - Blowdown of the cooling circuit.

8.10.8 Groundwater

Groundwater resources in the Z.F. Mgcawu District are scarce due to a very deep water table. The quality of water is normally brackish and the recharge rate for the water table can be high due to a lack of rainfall in the area. The CSP facility will therefore permit for the re-treatment of waste water or process effluents. By adopting this approach, the facility will enhance the water usage efficiency of the plant and in so doing, minimise water wastage and eliminate groundwater recharge.

8.10.9 Summary of the Waste Management Process

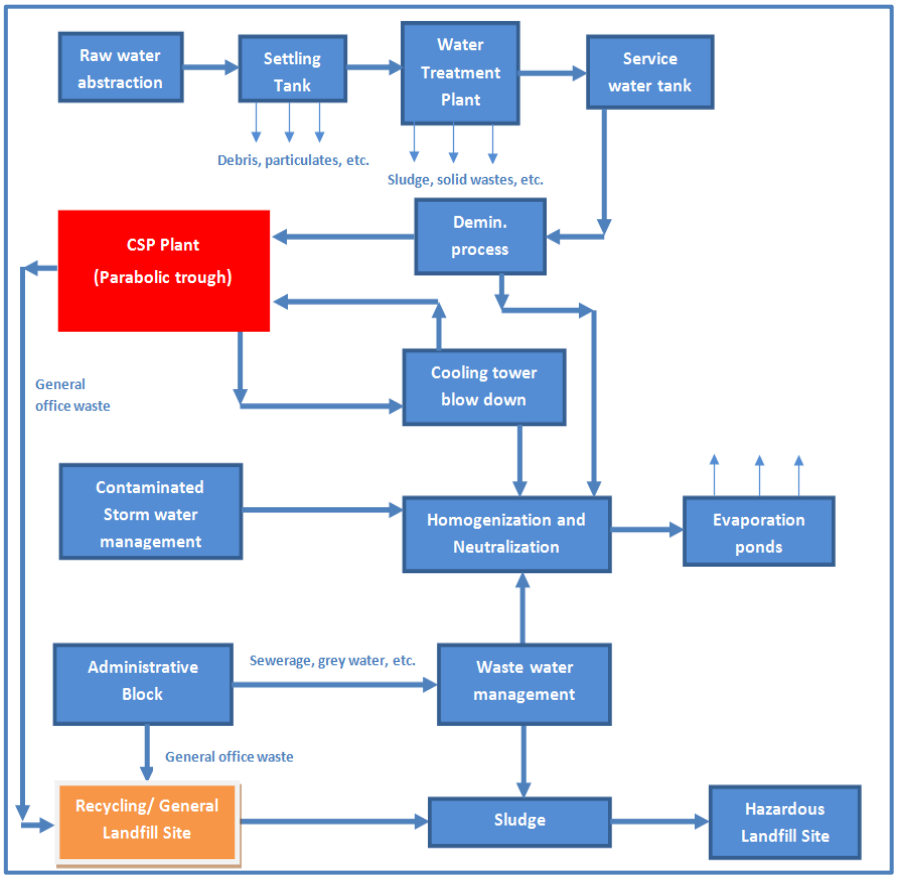


Figure 56: Waste management process for the CSP plant using parabolic trough technology

8.10.10 Potential Impacts

Waste has the likelihood of contaminating the surrounding environment especially water resource systems such as rivers, groundwater, wetland as well as soil. While solid waste may impact negatively on the ambiance of the locality, liquid waste may be result in the generation of foul odours, pollution of water resource and ecological systems and may even pose a health hazard. Waste generation will occur during the construction and operational phase of this project. These wastes are broadly categorized into solid and liquid waste. Solid wastes may include municipal waste, waste material from construction materials, excavation materials, etc. while liquid wastes may include fuels, oils, process waste water, sanitary waste, chemicals, etc.

8.11 Palaeontology

8.11.1 Geology and Palaeontology

The site for the proposed parabolic trough site alternatives lie on Quaternary alluvium (Kalahari sands) just to the north east of the Orange River (Figure 57; Table 27), and also on the Uitdaai and Groblershop Formations which comprise quartzites, sandstone and schists, i.e. of volcanic origin and also metamorphosed so they are most unlikely to contain any fossil material. Alluvium rarely contains any fossils in any useful context.

There are some reports of Stromatolites along the Orange River but much farther to the west. There are also palaeo-channels of the Orange River that cut into the basement rocks and these have been exploited for diamonds. The channels at Auchas and Arrisdrift, far to the west, also contain fossil woods and mammals of

Early Miocene age[22]. No palaeochannels have been recorded along this section of the river[23] where they could exist and be buried below the Kalahari sands.

According to the SAHRIS palaeosensitivity map there is a small area of high sensitivity (http://www.sahra.org.za/sahris/map/palaeo) in the loop of the Orange River immediately to the southeast of this site, in the region of the farm Spitzkop. The sediments on this farm are also Groblershoop Formation and Kalahari sands and there is no published record of fossils from this area[24]. It is, therefore, highly unlikely that fossils would be found on the farm to the north west, Sand Draai where the CSP parabolic trough project is planned.

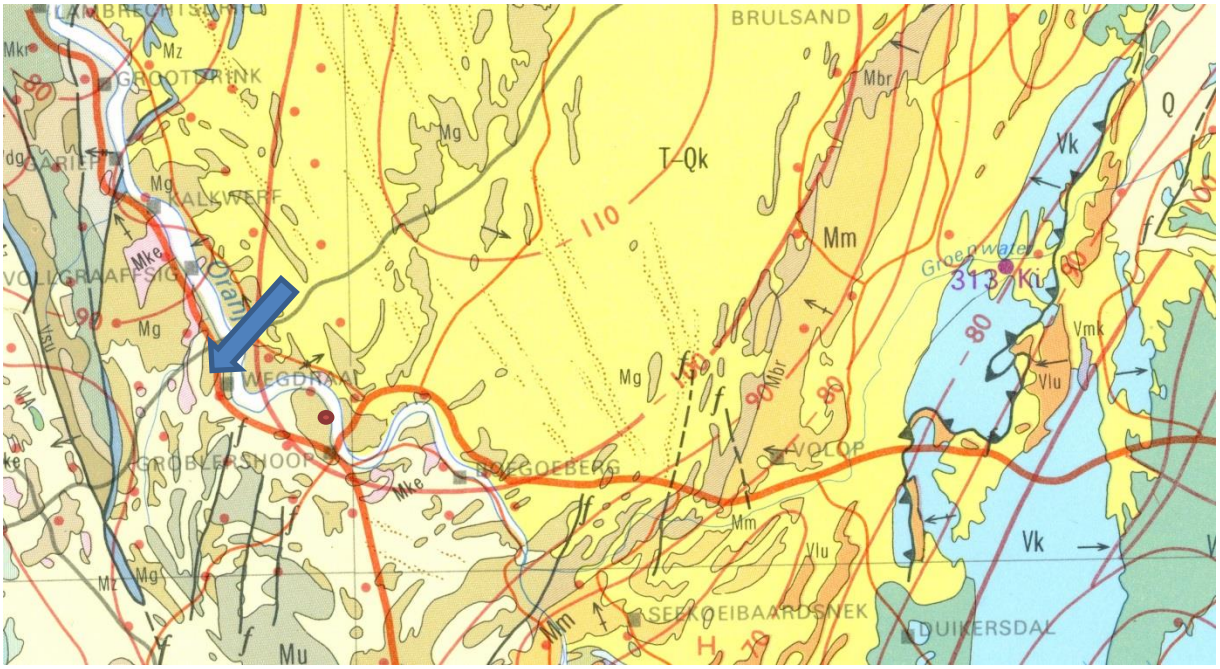


Figure 57: Geological map of the area around Groblershoop (the approximate location of the proposed parabolic plant shown in dark blue. Red dot shows position of Spitzkop (orange indication on SAHRIS palaeosensitivity map)

Abbreviations of the rock types are explained in Table 1. Map enlarged from the Geological Survey 1: 1 000 000 map 1984.

[22] Pickford, M., Senut, B., Mein, P., Morales, J., Soria, D., Neito, M., Ward, J., Bamford, M. 1995. The discovery of Lower and middle Miocene vertebrates at Auchas, southern Namibia. Comptes Rendus de l'Académie des Sciences, Paris, séries IIa, 322, 901-906.
[23] Almond, J., Pether, J., 2009. Palaeontological heritage of the Northern Cape. SAHRA Palaeotechnical Report, 143pp.
[24] Ibid Footnote 23.

Table 27: Explanation of symbols for the geological map and approximate ages[25] [26][27](Cornell et al., 2006; Johnson et al., 2006; Moen, 2006)

Symbol	Group/Formation	Lithology	Approximate Age
T-Qk	Kalahari Group	Sand, limestone	Cenozoic
Mke	Keimos suite	Undifferentiated granitoid	ca 1080 Ma
Mz	Zondehuis Fm	Phyllite, quartzite, greenstone	ca 1300 Ma
Mg	Groblershoop Fm, Brulpan Group	Schist, quartzite, metalavas	ca 1800 Ma
Mu	Uitdraai Fm, Brulpan Group	Quartzite, sandstone, schist	ca 1800 Ma
Mbr	Brulsands subgroup, Volop Group, Olifantshoek Supergroup	Arenaceous; quartzite, shale, greywacke	ca 2000-1750 Ma
Mm	Matsap subgroup Volop Group, Olifantshoek Supergroup	Subgreywacke, quartzite, metalava	ca 2000-1750 Ma
Vk	Koegas Fm, Griquatown Group, Griquatown West sequence	Mudstone, iron formation, riebeckitite	>2000 Ma

8.11.2 Potential Impacts

No impacts on palaeontological resources are envisaged. If, in the unlikely event that fossil plant or animal material is discovered during the construction of the parabolic trough plant then it is strongly recommended that a professional palaeontologist be called to assess the importance and rescue the fossils if necessary (with the relevant SAHRA permit).

If the fossil material is deemed to be of scientific interest then further visits by a professional palaeontologist would be required to collect more material. Only when the excavations for foundations have commenced will it be possible to see if there are any fossils beneath the alluvium.

8.12 Traffic Analysis

In accordance with the Department of Transport's Manual on Traffic Impact Studies (RR93/365), developments that generate over 150 vehicles per hour, in the peak hours, require a full Traffic Impact Assessment (TIA), while those developments that generate less than 150 vehicles per hour only require a Traffic Impact Statement (TIS). The difference between these two documents is that the TIA must contain recent traffic counts and the analysis of both existing and future traffic flows, whereas in a TIS, no analysis is required, instead the Traffic Engineer's professional opinion is given more emphasis.

[25] Cornell, D.H., Thomas, R.J., Moen, H.F.G., Reid, D.L., Moore, J.M., Gibson, R.L., 2006. The Namaqua-Natal Province. In: Johnson, M.R., Anhaeusser, C.R. and Thomas, R.J., (Eds). The Geology of South Africa. Geological Society of South Africa, Johannesburg / Council for Geoscience, Pretoria. Pp 325-379.
[26] Moen, H.F.G., 2006. The Olifantshoek Supergroup. In: Johnson, M.R., Anhaeusser, C.R. and Thomas, R.J., (Eds). The Geology of South Africa. Geological Society of South Africa, Johannesburg / Council for Geoscience, Pretoria. Pp 319-324.
[27] Johnson, M.R., van Vuuren, C.J., Visser, J.N.J., Cole, D.I., Wickens, H.deV., Christie, A.D.M., Roberts, D.L., Brandl, G., 2006. Sedimentary rocks of the Karoo Supergroup. In: Johnson, M.R., Anhaeusser, C.R. and Thomas, R.J., (Eds). The Geology of South Africa. Geological Society of South Africa, Johannesburg / Council for Geoscience, Pretoria. Pp 461 – 499.

Since the constructional and operational phases of the CSP plant do not generate more than 150 vehicles per hour in the peak hour, a detailed traffic analysis was not required. The Traffic Engineer instead provided a professional opinion based a qualitative assessment of observations and calculations as follows:

- It was observed during the site visit that the road network within the study area is operating at an acceptable level of service as no congestion problems, excessive queue lengths and delays were evident on the surrounding road network. The surrounding road network has capacity to handle the additional volumes of traffic that will be generated by the construction and operational phases of this proposed project without imposing any undue stress onto the road network.
- Given the low volumes of traffic that the proposed development will generate, the traffic engineer is of the opinion that the proposed CSP plant will have a negligible impact on the surrounding road network in the future.

8.12.1 Potential Impacts

- **Potential deterioration of existing traffic conditions on the external road network**

The proposed CSP plant once fully operational is expected to generate additional volumes of traffic on the surrounding road network. Whilst there will be an increase in traffic flows along these roads, the road network can easily accommodate the increased traffic flows due to the low existing volumes of traffic that utilise the road network. As observed during the site visit, the surrounding road network is operating at well below its capacity and at a good level of service. Therefore, the additional volume of traffic that will be imposed onto the road network as a direct result of this project will not cause the current operating conditions to deteriorate as there is sufficient spare capacity to handle the envisaged volumes of traffic.

- **Reduction of existing road space available for pedestrian and cyclists**

The increase in light and heavy vehicles generated by the proposed project will not impact on the existing road space available for pedestrians and cyclists as there are minimal pedestrians and no cyclists using this cordon of the road network. Given that Groblershoop is the closest village to the proposed site and that it is located a substantial distance away from this village, it is very unlikely that any of the workers from the CSP will attempt to commute to work on foot. Therefore, this project will not generate any pedestrian traffic to and from the site.

- **Deteriorating road safety conditions for all road users**

The increase in light and heavy vehicles generated by the proposed project travelling along the local and regional road network will have minimal impact on the existing road safety conditions for all road users as the generated traffic will travel on roads that are very lightly trafficked from a vehicle and pedestrian perspective.

- **Deterioration of the existing condition of the surrounding road network**

This project is expected to generate a fair volume of heavy vehicle traffic during the construction phase. This heavy vehicle traffic is unlikely to have any significant impact on the N10 and N8 as these roads are national freeways that have been built to a high structural standard to convey large volumes of heavy vehicle traffic. Therefore, these roads will not sustain any long term damage by the heavy vehicles. The two gravel roads on the other hand have not been designed to convey large volumes of heavy traffic over a lengthy period of time. Therefore, it is quite possible that these gravel roads will sustain damage during the construction period.

The operational phase of this project will not generate any heavy vehicle traffic as there will be no inputs and outputs for this proposed plant that will be transported by road during the operational phase. The only traffic that will be generated by the plant during the operational phase will be the trips made by employees travelling to and from the site.

9 POTENTIAL IMPACTS ASSOCIATED WITH THE PROJECT

9.1 Impact Assessment Methodology

To ensure a direct comparison between various specialist studies, six standard rating scales are defined and used to assess and quantity the identified impacts (Table 28). The rating system used for assessing impacts (or when specific impacts cannot be identified, the broader term issue should apply) is based on five criteria, namely:

- **Nature**: A brief written statement of the environmental aspect being impacted upon by a particular action or activity.
- **Extent**: The area over which the impact will be expressed. Typically, the severity and significance of an impact have different scales and as such bracketing ranges are often required. This is often useful during the detailed assessment phase of a project in terms of further defining the determined significance or intensity of an impact. For example, high at a local scale, but low at a regional scale;
- **Duration**: Indicates what the lifetime of the impact will be;
- **Intensity**: Describes whether an impact is destructive or benign;
- **Probability**: Describes the likelihood of an impact actually occurring; and
- **Cumulative**: In relation to an activity, means 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.

Table 28: Rating criteria

CRITERIA		DESCRIPTION			
EXTENT	**International (5)** International scale	**National (4)** The whole of South Africa	**Regional (3)** Provincial and parts of neighbouring provinces	**Local (2)** Within a radius of 2 km of the construction site	**Site (1)** Within the construction site
DURATION	**Permanent (5)** Mitigation either by man or natural process will not occur in such a way or in such a time span that the impact can be considered transient	**Long-term (4)** The impact will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter. The only class of impact which will be non-transitory	**Medium-term (3)** The impact will last for the period of the construction phase, where after it will be entirely negated	**Short-term (2)** The impact will either disappear with mitigation or will be mitigated through natural process in a span shorter than the construction phase (few months)	**Very Short-term (1)** The impact will either disappear with mitigation or will be mitigated through natural process in a span shorter than the construction phase (few days)
FREQUENCY	**Continuous (5)** Daily to a significant percentage every day	**Very Frequent (4)** Few times a week to daily	**Frequent (3)** Few times a month	**Unusual (2)** Once or twice every 5 years	**Very Rare (1)** Once or twice a decade
INTENSITY	**High (5)** Natural, cultural and social functions and processes are altered to extent that they permanently cease	**Medium High (4)** Natural, cultural and social functions and processes are altered to extent that they temporarily cease	**Medium (3)** Affected environment is altered, but natural, cultural and social functions and processes continue albeit in a modified way	**Low (2)** Impact affects the environment in such a way that natural, cultural and social functions and processes are not affected	**Very Low (1)** Impact does not affects the environment in such a way that natural, cultural and social functions and processes are not affected
PROBABILTY OF OCCURANCE	**Definite (5)** Impact will certainly occur	**Very Likely (4)** Most likely that the impact will occur	**Likely (3)** The impact may occur	**Probable (2)** Likelihood of the impact materialising is low	**Improbable (1)** Likelihood of the impact materialising is very low

Significance is determined through a synthesis of impact characteristics. Significance is also an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. The total number of points scored for each impact indicates the level of significance of the impact.

Table 29: Significance rating of classified impacts

Low impact (0 -5 points)	A low impact has no permanent impact of significance. Mitigation measures are feasible and are readily instituted as part of a standing design, construction or operating procedure.
Medium impact (6 -10 points)	Mitigation is possible with additional design and construction inputs.
Medium to High impact (11 -15 points)	The design of the site may be affected. Mitigation and possible remediation are needed during the construction and/or operational phases. The effects of the impact may affect the broader environment.
High impact (16 - 20 points)	High consequences and mitigation is essential.
Extremely High (21 – 25 points)	Permanent and important impacts. The design of the site may be affected. Intensive remediation is needed during construction and/or operational phases. Any activity which results in a "very high impact" is likely to be a fatal flaw.
Status	Denotes the perceived effect of the impact on the affected area.
Positive (+)	Beneficial impact.
Negative (-)	Deleterious or adverse impact.
Neutral (/)	Impact is neither beneficial nor adverse.
It is important to note that the status of an impact is assigned based on the status quo – i.e. should the project not proceed. Therefore not all negative impacts are equally significant.	

The suitability and feasibility of all proposed mitigation measures will be included in the assessment of significant impacts. This will be achieved through the comparison of the significance of the impact before and after the proposed mitigation measure is implemented. Mitigation measures identified as necessary will be included in an EMPr.

It should be noted:

- That for some specialist assessments, the potential impacts were applicable to both site alternatives and ancillary infrastructure. These impact tables were not repeated.
- As far as possible, impacts relating to all phases of the project's life cycle (i.e. construction, operations and decommissioning) were assessed.
- Where applicable cumulative impacts have been included.

9.2 CSP Parabolic Trough Site Alternatives

9.2.1 Fauna and Flora (Site Alternatives 1 and 2)

<table>
<tr><td rowspan="5">Construction</td><td colspan="6">Potential Impacts</td><td colspan="6">Mitigation</td></tr>
<tr><td colspan="6">▪ Habitat destruction with transformation of natural vegetation and habitats within the proposed CSP site.
▪ Destruction of suitable habitat for red listed plants and animals.</td><td colspan="6">▪ Workers must be limited to areas under construction within the CSP site and access to the undeveloped areas, especially the surrounding low-lying rocky hills, non-perennial drainage lines and Gariep River and riparian zone must be strictly regulated ("no-go" areas during construction as well as operational activities).
▪ No unnecessary destruction to surrounding vegetation especially in the adjacent natural areas situated in close proximity to the CSP site and linear infrastructure servitudes.
▪ Permits will be required for the removal of the protected tree species Camel Thorn (Vachellia erioloba), Grey Camel Thorn (Vachellia haematoxylon) and Shepherd’s Tree (Boscia albitrunca) have been identified and declared as protected. The Department of Agriculture, Forestry and Fisheries (DAFF) will have to be approached to obtain the required permits for the removal of any protected tree species.
▪ A rescue, recovery and re-location programme to be undertaken by Botanist, especially geophytes and Aloes, before construction is undertaken.
▪ Minimal disturbance to vegetation where such vegetation does not interfere with the CSP plant and the linear infrastructure servitudes.
▪ Rehabilitation of disturbed areas to be undertaken.
▪ It is therefore proposed that a bat specialist is appointed to do a site visit (walk-through) prior to construction. If bat roosts are found, construction activities in that area will halt until a suitable mitigation has been discussed with a bat specialist and agreed upon by the Proponent. Mitigation measures for bat impacts are incorporated in the EMPr.</td></tr>
<tr><td>P</td><td>F</td><td>E</td><td>D</td><td>I</td><td>Significance before mitigation</td><td>P</td><td>F</td><td>E</td><td>D</td><td>I</td><td>Significance after mitigation</td></tr>
<tr><td>-5</td><td>-1</td><td>-2</td><td>-5</td><td>-3</td><td>-16</td><td>-5</td><td>-1</td><td>-1</td><td>-5</td><td>-2</td><td>-14</td></tr>
<tr><td colspan="6">▪ Increased levels of road fatalities of dispersing animals.</td><td colspan="6">▪ Speed limits should be imposed on the proposed access roads.
▪ Fences should be erected adjacent to the access road preventing animals entering onto the road.</td></tr>
</table>

	P	F	E	D	I	Significance before mitigation						Significance after mitigation
	-4	-4	-2	-4	-2	-16	-3	-3	-1	-4	-1	-12
	▪ Erosion and sediment control from the cleared site.						▪ Implementation of erosion prevention mitigation measures like sand bags etc. must be used on site. Further mitigation measures are included in the EMPr (**Appendix X**).					
	P	F	E	D	I	Significance before mitigation						Significance after mitigation
	-1	-1	-2	-4	-2	-10	-1	-1	-1	-4	-1	-8
Cumulative	▪ During the operational life of the CSP plant and access road, Low cumulative impacts would also occur, including ongoing road mortalities, increased disturbance (noise and light), dust generation, air pollution, chemical contamination from petroleum and rubber products, increased litter, changes in the incidence of fire (more frequent), and the introduction of a corridor for alien vegetation. All of these factors may impact the surrounding fauna and ecological processes in different ways. ▪ Mitigation measures include the enforcement of speed limits during the operational phase of the project.											

9.2.2 Avifauna (Site Alternative 1)

	Potential Impacts						Mitigation					
Construction	▪ Displacement of priority species due to disturbance associated with the construction of the solar plant: – Preparation of solar panel areas for installation, including vegetation clearing, grading, cut and fill; – Construction of piers and building foundations; new dirt or gravel roads and improvement of existing roads; – Temporary stockpiling and side-casting of soil, construction materials, or other construction wastes; – Soil compaction, dust, and water run-off from construction sites; – Increased vehicle traffic; – Short-term construction-related noise (from equipment) and visual disturbance; – Maintenance of fire breaks and roads; and – Weed removal, brush clearing, and similar land management activities related to the ongoing operation of the project.						▪ Construction activities should be restricted to the immediate footprint of the infrastructure. ▪ Access to the remainder of the site should be strictly controlled to prevent unnecessary disturbance of priority species. ▪ Measures to control noise and dust should be applied according to current best practice in the industry. ▪ The recommendations of the ecological and botanical specialist studies must be strictly implemented, especially as far as limitation of the construction footprint and rehabilitation of disturbed areas is concerned.					
	P	F	E	D	I	Significance before mitigation	P	F	E	D	I	Significance after mitigation
	-4	-5	-2	-3	-3	-17	-2	-5	-2	-3	-3	-15

	Potential Impacts						Mitigation					
Operations	▪ Displacement of priority species due to habitat destruction associated with the operation of the solar plant: – Vegetation clearing, grading, cut and fill; – Maintenance of fire breaks and roads; and weed removal, brush clearing, and similar land management activities related to the ongoing operation of the project.						▪ Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum. ▪ The recommendations of the ecological and botanical specialist studies must be strictly implemented, especially as far as limitation of the construction footprint and rehabilitation of transformed areas is concerned.					
	P	**F**	**E**	**D**	**I**	**Significance before mitigation**	**P**	**F**	**E**	**D**	**I**	**Significance after mitigation**
	-5	**-5**	**-1**	**-4**	**-5**	**-20**	**-4**	**-5**	**-1**	**-4**	**-5**	**-19**
	▪ Mortality of priority species due to collisions with the heliostats: – The priority species that were recorded in the study area which could potentially be exposed to collision risk are listed in the Avifaunal Assessment (**Appendix D2**). – Multiple mortalities could potentially result from this, which in turn could attract raptors e.g. Tawny Eagle, Southern Pale Chanting Goshawk, Lanner Falcon and Pygmy Falcon which will feed on dead and injured birds which could in turn expose them to collision risk, especially when pursuing injured birds.						▪ An avifaunal specialist must be appointed to oversee all aspects of operational phase monitoring (including carcass searches) and assist with the on-going management of bird impacts that may emerge as the monitoring programme progresses. ▪ Formal operational phase monitoring should be implemented once the solar arrays have been constructed. As an absolute minimum, operational phase monitoring should be undertaken for the first two years of operation, and then repeated again in year 5, and again every five years thereafter. ▪ Carcass searches should be implemented to search the ground between arrays of troughs on a weekly basis (every two weeks at the longest) for at least one year to determine the magnitude of collision fatalities. Searches should be done on foot. Searches should be conducted randomly or at systematically selected arrays of troughs to the extent that equals 33% or more of the project area. Detection trials should be integrated into the searches. ▪ Depending on the results of the carcass searches, a range of mitigation measures will have to be considered if mortality levels turn out to be significant, including minor modifications of panel and mirror design to reduce the illusory characteristics of troughs. ▪ The exact protocol to be followed for the carcass searches and operational phase monitoring must be compiled by the avifaunal specialist in consultation with the plant operator and Environmental Control Officer before the commencement of operations.					
	P	**F**	**E**	**D**	**I**	**Significance before mitigation**	**P**	**F**	**E**	**D**	**I**	**Significance after mitigation**
	-3	**-2**	**-1**	**-4**	**-3**	**-13**	**-2**	**-2**	**-1**	**-4**	**-2**	**-11**
Cumulative	▪ The cumulative impact of collisions with heliostats at the Sand Draai site should be Medium for priority species occurring within the nine pentads around the proposed plant. With mitigation (explained above), this could probably be reduced to Low, but it must be borne in mind that mitigation for this type of impact still in an experimental phase.											

	▪ Overall, the cumulative impact of mortality due to solar flux at Sand Draai site should be Medium for priority species occurring within the nine pentads around the proposed plant. With mitigation (explained above), this could be reduced to Low. ▪ The cumulative impact of habitat transformation due to the combined Bokpoort and Sand Draai solar facilities (approximately 20 km² or 2% of the 676 km² pentad area), is likely to be relatively insignificant for most priority species, except possibly for the pair of Martial Eagles breeding near the site. The average Martial Eagle breeding territory in the Nama Karoo is approximately 280km² (Hockey et. al 2005), which means that the breeding pair of Martial Eagles at Sand Draai stands to lose about 7% of their territory due to direct habitat loss. Apart from the direct habitat loss, the activity around the solar farm might also act as a deterrent, resulting in the birds losing more than 7% of their territory in real terms. Overall, the significance of this impact is rated at Medium, and will remain so irrespective of mitigation. ▪ It is envisaged that collisions of priority species, particularly bustards but also Secretarybird, with the new Sand Draai 132 kV grid connection will have a Medium cumulative impact. If the mitigation and the recommendations of the Avifaunal Assessment (**Appendix X**) are implemented, it is envisaged that the cumulative impact of this mortality factor could be reduced to a Low level.

9.2.3 Avifauna (Site Alternative 2)

	Potential Impacts						Mitigation					
Construction	▪ Displacement of priority species due to disturbance associated with the construction of the solar plant: – Preparation of solar panel areas for installation, including vegetation clearing, grading, cut and fill; – Construction of piers and building foundations; new dirt or gravel roads and improvement of existing roads; – Temporary stockpiling and side-casting of soil, construction materials, or other construction wastes; – Soil compaction, dust, and water run-off from construction sites; – Increased vehicle traffic; – Short-term construction-related noise (from equipment) and visual disturbance; – Maintenance of fire breaks and roads; and – Weed removal, brush clearing, and similar land management activities related to the ongoing operation of the project.						▪ Refer to mitigation measures presented in Section 9.2.2 above.					
	P	**F**	**E**	**D**	**I**	**Significance before mitigation**	**P**	**F**	**E**	**D**	**I**	**Significance after mitigation**
	-5	**-5**	**-2**	**-3**	**-4**	**-19**	**-4**	**-5**	**-2**	**-3**	**-4**	**-18**

<table>
<tr><td rowspan="6">Operations</td><td colspan="6">Potential Impacts</td><td colspan="6">Mitigation</td></tr>
<tr><td colspan="6">▪ Displacement of priority species due to habitat destruction associated with the operation of the solar plant:
– Vegetation clearing, grading, cut and fill;
– Maintenance of fire breaks and roads; and weed removal, brush clearing, and similar land management activities related to the ongoing operation of the project.</td><td colspan="6">▪ Refer to mitigation measures presented in Section 9.2.2 above.</td></tr>
<tr><td>P</td><td>F</td><td>E</td><td>D</td><td>I</td><td>Significance before mitigation</td><td>P</td><td>F</td><td>E</td><td>D</td><td>I</td><td>Significance after mitigation</td></tr>
<tr><td>-5</td><td>-5</td><td>-1</td><td>-4</td><td>-5</td><td>-20</td><td>-4</td><td>-5</td><td>-1</td><td>-4</td><td>-5</td><td>-19</td></tr>
<tr><td colspan="6">▪ Mortality of priority species due to collisions with the heliostats:
– The priority species that were recorded in the study area which could potentially be exposed to collision risk are listed in the Avifaunal Assessment (Appendix D2).
– Multiple mortalities could potentially result from this, which in turn could attract raptors e.g. Tawny Eagle, Southern Pale Chanting Goshawk, Lanner Falcon and Pygmy Falcon which will feed on dead and injured birds which could in turn expose them to collision risk, especially when pursuing injured birds.</td><td colspan="6">▪ Refer to mitigation measures presented in Section 9.2.2 above.</td></tr>
<tr><td>P</td><td>F</td><td>E</td><td>D</td><td>I</td><td>Significance before mitigation</td><td>P</td><td>F</td><td>E</td><td>D</td><td>I</td><td>Significance after mitigation</td></tr>
<tr><td>-3</td><td>-2</td><td>-1</td><td>-4</td><td>-3</td><td>-13</td><td>-2</td><td>-2</td><td>-1</td><td>-4</td><td>-2</td><td>-11</td></tr>
<tr><td colspan="6">Cumulative</td><td colspan="6">▪ Refer to the cumulative impacts presented in Section 9.2.2.</td></tr>
</table>

9.2.4 Hydrogeology (Site Alternatives 1 and 2)

Construction	**Potential Impacts**						**Mitigation**					
	▪ Hydrocarbon contamination associated with heavy machinery on site and fuel storage.						▪ The mitigation measures would include secondary containment for all fuel stored on site and implementing the proposed groundwater monitoring programme.					
	P	**F**	**E**	**D**	**I**	**Significance before mitigation**	**P**	**F**	**E**	**D**	**I**	**Significance after mitigation**
	-3	-3	-1	-3	-3	-13	-2	-3	-1	-3	-2	-11
	▪ Contamination of groundwater resources with the storage of Heat Transfer Fluid (HTF).						▪ Mitigation measures would include regular inspection of the infrastructure to ensure no losses occur through the receiver tube. ▪ All records of HTF stored on site must be kept (purchased, disposal, and recycled, etc.). ▪ All HTF stored on site (both unused and used) must be stored in the appropriate containers and the area must be marked accordingly and fully bunded.					
	P	**F**	**E**	**D**	**I**	**Significance before mitigation**	**P**	**F**	**E**	**D**	**I**	**Significance after mitigation**
	-3	-3	-1	-4	-3	-14	-2	-2	-1	-4	-3	-12
Operations	**Potential Impacts**						**Mitigation**					
	▪ Hydrocarbon contamination associated with heavy machinery on site and fuel storage.						▪ The mitigation measures would include secondary containment for all fuel stored on site and implementing the proposed groundwater monitoring programme.					
	P	**F**	**E**	**D**	**I**	**Significance before mitigation**	**P**	**F**	**E**	**D**	**I**	**Significance after mitigation**
	-3	-3	-1	-4	-3	-14	-2	-3	-1	-4	-3	-13
	▪ Contamination of groundwater resources with HTF.						▪ Mitigation measures would include regular inspection of the infrastructure to ensure no losses occur through the receiver tube. ▪ All records of HTF stored on site must be kept (purchased, disposal, and recycled, etc.). ▪ All HTF stored on site (both unused and used) must be stored in the appropriate containers and the area must be marked accordingly and fully bunded.					
	P	**F**	**E**	**D**	**I**	**Significance before mitigation**	**P**	**F**	**E**	**D**	**I**	**Significance after mitigation**
	-3	-3	-1	-4	-3	-14	-2	-2	-1	-4	-3	-12

9.2.5 Socio-Economic (Site Alternatives 1 and 2)

	Potential Impacts						Mitigation					
Construction	▪ Sourcing of equipment and machinery locally.						▪ The sourcing of equipment from local regional sources is probable, specifically in the area of Upington. There should be a concerted effort made by engineers to draw up a procurement plan that will give first preference to local suppliers. This may be called a Goods and Service Procurement Policy. There would be no anticipated change in the impact significance after mitigation as it is expected that Procurement strategies would initially be aimed at local procurement. It must be noted that a large percentage of procurement for specialized technology may be sourced nationally and internationally.					
	P	F	E	D	I	Significance before mitigation	P	F	E	D	I	Significance after mitigation
	+2	+2	+3	+3	+3	+13	+2	+2	+3	+3	+3	+13
	▪ Local Gross Geographic Product (GGP) increase.						▪ The introduction of salaried workers in the local area will increase local purchase power. This in turn will be a positive spin off for retailers (businesses, including local accommodation houses) in the nearby areas, particularly the most developed one, being Groblershoop. This is noted the economic and agricultural study					
	P	F	E	D	I	Significance before mitigation	P	F	E	D	I	Significance after mitigation
	+5	+5	+3	+3	+5	+21	+5	+5	+3	+3	+5	+21
	▪ Local job creation opportunities.						▪ Job creation expectations will have to be well managed via management systems and communication mechanisms that regularly informs the local community (on site and at local community centres) of the progress and job / skills needs at the development sites. A formal job application process must be communicated (should this be a requirement). The potential is that a large number of jobs will be created for the short duration of construction.					
	P	F	E	D	I	Significance before mitigation	P	F	E	D	I	Significance after mitigation
	+4	+4	+3	+3	+3	+17	+4	+4	+3	+3	+3	+17

	▪ Job creation expectations will have to be well managed via management systems and communication mechanisms that regularly informs the local community (on site and at local community centres) of the progress and job / skills needs at the development sites. A formal job application process must be communicated (should this be a requirement). The potential is that a large number of jobs will be created for the short duration of construction. ▪ There will be a predominant perception that others (Upington and surrounds, as opposed to Groblershoop, Grootdrink, Gariep, etc.) may be afforded preferential access to work, particularly during the construction period. This is a perception that can only be thwarted by a transparent and fair recruitment process throughout the phase.						▪ Establish and maintain management systems to ensure that thorough and regular communication occurs, particularly with hopeful locals in Groblershoop, etc. A Human Resources Development Policy may be developed during the Construction phase and this can be expanded into a Human Resources Development Plan during the Operations phase.					
	P	**F**	**E**	**D**	**I**	**Significance before mitigation**	**P**	**F**	**E**	**D**	**I**	**Significance after mitigation**
	-4	**-4**	**-3**	**-3**	**-3**	**-17**	**-2**	**-2**	**-3**	**-3**	**-2**	**-12**
	▪ Increased social ills in Groblershoop and surrounding small villages.						▪ The management measure to be taken must ensure on-going work-shopping of appropriate behaviour from the labour population. This can be structured through a Construction Phase Code of Practice for Contractors. On site health and safety workshops is critical. The on -site clinic must be at the forefront of such issues. ▪ Communication with local community leaders/ spokespeople is also an important tool that will assist in monitoring such a situation. The establishment of a Resident's Forum may be a vehicle that could help achieve collaboration. It may be practical to look at the Groblershoop Interest Group, as such a vehicle as it is already in existence.					
	P	**F**	**E**	**D**	**I**	**Significance before mitigation**	**P**	**F**	**E**	**D**	**I**	**Significance after mitigation**
	-4	**-3**	**-2**	**-3**	**-3**	**-15**	**-3**	**-2**	**-2**	**-3**	**-2**	**-12**
	▪ Potential increase in criminal activity in the development footprint and nearby surrounding villages.						▪ It is recommended that the police increase patrols and crime knowledge-sharing in communities. While it is envisaged that the development site will be under 24 hour protection from a private security firm, petty crimes may still persist. Management measures dealing with transferring and sharing information about criminal activities with the local community is recommended. The establishment of a Resident's Forum (or communication via the Groblershoop Interest Group) may be a vehicle that could help achieve collaboration.					
	P	**F**	**E**	**D**	**I**	**Significance before mitigation**	**P**	**F**	**E**	**D**	**I**	**Significance after mitigation**
	-4	**-3**	**-2**	**-3**	**-3**	**-15**	**-3**	**-2**	**-2**	**-3**	**-2**	**-12**

	▪ Additional pressure on basic services provision (education, housing and healthcare).						▪ If construction workers move into the area, services such as housing provision and availability, education and healthcare services will experience increased pressure. In order to provide for mitigation, it is strongly advised that the Project Proponent and the applicable municipal government departments (perhaps even National government) liaise effectively on how to combat avoidable service delivery constraints - particularly since the highest number of workers will be on site during the construction period. It is expected that the Project Proponent will carefully screen the service delivery situation prior to recruiting construction staff. The Proponent will also have to consider what service delivery options it will put in place for its own staff - the availability of an on-site 24 hour clinic is one option.					
	P	**F**	**E**	**D**	**I**	**Significance before mitigation**	**P**	**F**	**E**	**D**	**I**	**Significance after mitigation**
	-4	**-4**	**-2**	**-3**	**-3**	**-16**	**-3**	**-3**	**-2**	**-3**	**-3**	**-14**
	▪ Increase in HIV/AIDS cases and associated vulnerabilities.						▪ A large construction workforce (particularly if the majority are single men, are likely to substantially contribute to the HIV/AIDs situation in the area, albeit unintentionally. There are various mitigation and management measures that should be pursued. Some of these are: ○ The establishment of a formal grievance management system. ○ The establishment of a Resident's forum (or use current Groblershoop Interest Group) where HIV/AID's intervention strategies could be discussed. ○ The establishment of a 24 hour clinic for construction staff (where monitoring and voluntary testing could occur). ○ Invitation to Government health representatives and local awareness building experts to render knowledge workshops to construction staff (and local communities). ○ The development and implementation of a policy on Contractor Health and Safety. ○ The development and implementation of a Contractor's Code of Conduct.					
	P	**F**	**E**	**D**	**I**	**Significance before mitigation**	**P**	**F**	**E**	**D**	**I**	**Significance after mitigation**
	-4	**-3**	**-2**	**-3**	**-3**	**-15**	**-3**	**-2**	**-2**	**-3**	**-2**	**-12**
	▪ Impact on agricultural yields along Gariep Road.						▪ While it has been established that the air quality report does not unequivocally provide scientific evidence to show that dust generated by the traffic on Gariep Road has a reach of over 5-10 km, this rating presents the worst case scenario. This is noted in the economic and agricultural study.					

	P	F	E	D	I	Significance before mitigation	P	F	E	D	I	Significance after mitigation
	-1	-2	-2	-3	-1	-9	-1	-2	-2	-3	-1	-9
	▪ Impact on farm values of neighbouring farms.						▪ A high negative impact is expected during the construction phase. This is particularly due to buyer-perception. This will improve following construction.					
	P	F	E	D	I	Significance before mitigation	P	F	E	D	I	Significance after mitigation
	-4	-5	-2	-3	-3	-17	-4	-5	-2	-3	-3	-17
	▪ Impact on farm values of Gariep Road farms.						▪ This will improve following construction, and the potential surfacing of the road.					
	P	F	E	D	I	Significance before mitigation	P	F	E	D	I	Significance after mitigation
	-3	-5	-3	-3	-1	-15	-3	-3	-2	-3	-1	-12
	▪ Grievance channel development.						▪ The ethical and principled implementation of the grievance system will only serve to enhance the company's relationship with I&APs. The grievance system embodies a channel which should be 'served by all, but owned by none.' In other words, it should lead to mutual respect and benefit, without being utilised as a corporate or political display for ulterior motives. The company will in its (grievance system) implementation, seek to be identified as a good corporate citizen, genuinely interested in the welfare of those it indirectly or directly affects.					
	P	F	E	D	I	Significance before mitigation	P	F	E	D	I	Significance after mitigation
	+3	+2	+2	+3	+2	+12	+4	+3	+2	+3	+3	+15
Operations	Potential Impacts						Mitigation					
	▪ Difference in water flow in the Orange River potentially affecting downstream farmers and potentially causing economic displacement. ▪ Potential loss of farm labourer jobs on neighbouring farms affected by differential water flow.						▪ The effect of climate change on water levels will need to be thoroughly assessed, as the impact, if severe, could change to a 'high' negative. ▪ In addition, the cumulative impact related to having all four solar plants operational at the same time in the future, must be acknowledged (that includes two in Bokpoort and the proposed development of two in Sandraai). A water flow study would be pertinent.					
	P	F	E	D	I	Significance before mitigation	P	F	E	D	I	Significance after mitigation
	-2	-3	-2	-4	-2	-13	-1	-1	-2	-1	-1	-6
	▪ Potential tourist appeal.						▪ Contrary to the negative impact, it is also possible that people will enjoy the visual display of such a feat of construction, including the regular rainbows that will be seen. ▪ Schools may organise day tours and tourist may pass just to see the spectacle. The Proponent could promote the CSP scheme by offering					

							day guided tours, perhaps even combining it with a nature hike. This in itself has the potential to increase job opportunities.					
	P	F	E	D	I	Significance before mitigation	P	F	E	D	I	Significance after mitigation
	-4	-4	-1	-3	-3	-15	-4	-4	-1	-3	-3	-15
	▪ Impact on Gariep Road users and neighbours.						▪ Recommended mitigation includes strict speed limits on site roads to prevent the liberation of dust into the atmosphere; and ▪ dust must be suppressed during vehicle movement. ▪ another mitigation includes the surfacing of the southern portion of the Gariep road					
	P	F	E	D	I	Significance before mitigation	P	F	E	D	I	Significance after mitigation
	-4	-5	-3	-4	-5	-21	-3	-3	-2	-4	-3	-15
	▪ Increase in South Africa's power producing independence.						▪ With the completion of the solar power plant and its operation at maximum, South Africa will contribute to its national electricity grid supply, thus decreasing its reliance on fossil fuels.					
	P	F	E	D	I	Significance before mitigation	P	F	E	D	I	Significance after mitigation
	+5	+5	+4	+5	+4	+23	+5	+5	+4	+5	+4	+23
	▪ Grievance channel continuation.						▪ As with the pre-construction and construction phases, the grievance channel will serve to highlight the company's continued, sincere and firm commitment to finding practical resolutions to its local challenges.					
	P	F	E	D	I	Significance before mitigation	P	F	E	D	I	Significance after mitigation
	+3	+2	+2	+3	+2	+12	+4	+3	+2	+3	+3	+15
Cumulative	▪ During the construction phase there is likely to be a cumulative impact to the inconvenience and danger to proximate residents, through increased road traffic, dust and noise. This is the case due to the development activities taking place on the nearby Bokpoort farm. ▪ During the operation phase, two potential impacts of a long term nature have been assessed. Both have the potential to negatively affect farmers and farmworkers in the farms that rely on water from the Orange River. The cumulative impact that may be experienced with global warming as the driving force, may result in changing climate patterns and lowered water flows and availability in the Orange river. The two specific impacts cited in the SIA are: o Difference in water flow in the Orange River potentially affecting downstream farmers and potentially causing economic displacement o Potential loss of farm labourer jobs on neighbouring farms affected by differential water flow											

9.2.6 Visual (Site Alternative 1)

<table>
<tr><td rowspan="3">Construction</td><td colspan="6">Potential Impacts</td><td colspan="6">Mitigation</td></tr>
<tr><td colspan="6">▪ The total clearing of the site would be conducive to the creation of large clouds of dust that with the movement of machinery would be visible from a wide area.
▪ As the tower is constructed, the cranes used to construct it would be visible from a wide area due to their height, but would not be too visually intrusive due to the significant distance between the site and the majority of the receptors in the Orange River valley.
▪ Heavy vehicles traveling to the site along the Gariep Road will create large dust clouds that will be able to be viewed from a relatively great distance.</td><td colspan="6">▪ Avoid complete clearing of the construction site, and only clear vegetation in a phased manner.
▪ It is recommended that the Gariep Road be tarred to avoid the creation of excessive dust by large numbers of construction vehicles.</td></tr>
<tr><td>P</td><td>F</td><td>E</td><td>D</td><td>I</td><td>Significance before mitigation</td><td>P</td><td>F</td><td>E</td><td>D</td><td>I</td><td>Significance after mitigation</td></tr>
<tr><td>-4</td><td>-5</td><td>-2</td><td>-3</td><td>-2</td><td>-16</td><td>-3</td><td>-5</td><td>-2</td><td>-3</td><td>-2</td><td>-15</td></tr>
<tr><td rowspan="3">Operations</td><td colspan="6">Potential Impacts</td><td colspan="6">Mitigation</td></tr>
<tr><td colspan="6">▪ The parabolic trough heliostats would not be visible to the vast majority of the receptor locations in the study area, and thus would not cause any visual impact for the majority of the study area.</td><td colspan="6">▪ Development of the Site Alternative 1 is recommended.</td></tr>
<tr><td>P</td><td>F</td><td>E</td><td>D</td><td>I</td><td>Significance before mitigation</td><td>P</td><td>F</td><td>E</td><td>D</td><td>I</td><td>Significance after mitigation</td></tr>
<tr><td>-1</td><td>-1</td><td>-2</td><td>-4</td><td>-1</td><td>-9</td><td>-1</td><td>-1</td><td>-2</td><td>-4</td><td>-1</td><td>-9</td></tr>
<tr><td rowspan="3">Decommissioning</td><td colspan="6">Potential Impacts</td><td colspan="6">Mitigation</td></tr>
<tr><td colspan="6">The parabolic trough would remain as a large object in the landscape if it was not physically removed.</td><td colspan="6">▪ The full removal of troughs.</td></tr>
<tr><td>P</td><td>F</td><td>E</td><td>D</td><td>I</td><td>Significance before mitigation</td><td>P</td><td>F</td><td>E</td><td>D</td><td>I</td><td>Significance after mitigation</td></tr>
<tr><td>-4</td><td>-5</td><td>-2</td><td>-3</td><td>-2</td><td>-16</td><td>-3</td><td>-5</td><td>-2</td><td>-3</td><td>-2</td><td>-15</td></tr>
<tr><td colspan="6">Cumulative</td><td colspan="6">▪ The part of the study area (area to the east of the Orange River, north of Groblershoop) is largely natural as viewed from the area to the west (Orange River valley and N10 corridor), thus the parabolic trough component will not create any cumulative impacts.</td></tr>
</table>

9.2.7 Visual (Site Alternative 2)

<table>
<tr><td rowspan="3">Construction</td><td colspan="6">Potential Impacts
▪ The total clearing of the site would be conducive to the creation of large clouds of dust that with the movement of machinery that would be visible from a wide area.
▪ As the troughs are constructed, the cranes used to construct it would be visible from a wide area due to their height, but would not be too visually intrusive due to the significant distance between the site and the majority of the receptors in the Orange River valley.
▪ Heavy vehicles traveling to the site along the Gariep Road will create large dust clouds that will be able to be viewed from a relatively great distance.
▪</td><td colspan="6">Mitigation
▪ Avoid complete clearing of the construction site, and only clear vegetation in a phased manner.
▪ It is recommended that the Gariep Road be tarred to avoid the creation of excessive dust by large numbers of construction vehicles.</td></tr>
<tr><td>P</td><td>F</td><td>E</td><td>D</td><td>I</td><td>Significance before mitigation</td><td>P</td><td>F</td><td>E</td><td>D</td><td>I</td><td>Significance after mitigation</td></tr>
<tr><td>-4</td><td>-5</td><td>-2</td><td>-3</td><td>-2</td><td>-16</td><td>-3</td><td>-5</td><td>-2</td><td>-3</td><td>-2</td><td>-15</td></tr>
<tr><td rowspan="3">Operations</td><td colspan="6">Potential Impacts
▪ The parabolic trough heliostats would be visible to a low number of receptor locations in the higher lying parts of the Orange River corridor. However the distance factor (>11km) would result in a low degree of visual impact for the majority of the study area. The heliostats could cause glint and glare, but the possibility of this is low as most of the receptor locations in the area would not be able to view the heliostats.</td><td colspan="6">Mitigation
▪ Development of this site will have the same impact.</td></tr>
<tr><td>P</td><td>F</td><td>E</td><td>D</td><td>I</td><td>Significance before mitigation</td><td>P</td><td>F</td><td>E</td><td>D</td><td>I</td><td>Significance after mitigation</td></tr>
<tr><td>-2</td><td>-4</td><td>-2</td><td>-4</td><td>-2</td><td>-14</td><td>-2</td><td>-4</td><td>-2</td><td>-4</td><td>-2</td><td>-14</td></tr>
<tr><td rowspan="3">Decommissioning</td><td colspan="6">Potential Impacts
▪ The parabolic trough would remain as a large object in the landscape if it was not physically removed.</td><td colspan="6">Mitigation
▪ The troughs should be fully removed.</td></tr>
<tr><td>P</td><td>F</td><td>E</td><td>D</td><td>I</td><td>Significance before mitigation</td><td>P</td><td>F</td><td>E</td><td>D</td><td>I</td><td>Significance after mitigation</td></tr>
<tr><td>-4</td><td>-5</td><td>-2</td><td>-3</td><td>-2</td><td>-16</td><td>-3</td><td>-5</td><td>-2</td><td>-3</td><td>-2</td><td>-15</td></tr>
<tr><td colspan="2">Cumulative</td><td colspan="11">• The part of the study area (area to the east of the Orange River, north of Groblershoop) is largely natural as viewed from the area to the west (Orange River valley and N10 corridor), thus the parabolic trough component will not create any cumulative impacts.</td></tr>
</table>

9.2.8 Noise (Site Alternatives 1 and 2)

<table>
<tr><td rowspan="3">Construction</td><td colspan="6">Potential Impacts</td><td colspan="6">Mitigation</td></tr>
<tr><td colspan="6">▪ The typical noise that would be generated by the construction activities are all from heavy machinery and impact noises from incidents (such as falling pipes, equipment, etc.).</td><td colspan="6">▪ Control of noise – On site
– Avoid unnecessary revving of engines and switch off equipment when not required (construction and operational phases).
– Start up plant and vehicles sequentially rather than all together (including auxiliary heater operations).
– Fitment of additional or best available exhaust silencers or acoustic canopies on engines including auxiliary heater operations).
– Where possible, attempt to enclose noise sources, if the sources enclose has a noise directivity ensure the noise is directed away from any sensitive areas; and
– Regular and effective maintenance by trained personnel is essential and will do much to reduce noise from plant and machinery.
▪ Controlling the propagation of noise:
– Minimise the length and magnitude of noise sources.
– Screening of noise sources, if it is not possible to increase the distance, the alternative measure is to screen the noise source. Screening can make use of the natural environment, existing buildings and/or screens or earth berms. These screens should be placed in the direct line of sight to effectively reduce the noise received and the sensitive location.</td></tr>
<tr><td>P</td><td>F</td><td>E</td><td>D</td><td>I</td><td>Significance before mitigation</td><td>P</td><td>F</td><td>E</td><td>D</td><td>I</td><td>Significance after mitigation</td></tr>
<tr><td>-1</td><td>-1</td><td>-1</td><td>-1</td><td>-1</td><td>-5</td><td>-1</td><td>-1</td><td>-1</td><td>-1</td><td>-1</td><td>-5</td></tr>
<tr><td rowspan="3">Operations</td><td colspan="6">Potential Impacts</td><td colspan="6">Mitigation</td></tr>
<tr><td colspan="6">▪ The typical noise that would be generated by the operational activities are all from heavy machinery and impact noises from incidents (such as falling pipes, equipment, etc.).</td><td colspan="6">▪ Refer to mitigation provided above relating to noise generated during construction activities.</td></tr>
<tr><td>P</td><td>F</td><td>E</td><td>D</td><td>I</td><td>Significance before mitigation</td><td>P</td><td>F</td><td>E</td><td>D</td><td>I</td><td>Significance after mitigation</td></tr>
<tr><td>-1</td><td>-1</td><td>-1</td><td>-1</td><td>-1</td><td>-5</td><td>-1</td><td>-1</td><td>-1</td><td>-1</td><td>-1</td><td>-5</td></tr>
<tr><td colspan="6">Cumulative</td><td colspan="6">▪ From the propagation model presented in the Noise Impact Assessment (Appendix D8) the cumulative effect of the operations are Low (minimal) on the surrounding environment and the majority of noise will be localised to the source.</td></tr>
</table>

9.2.9 Air Quality (Site Alternatives 1 and 2)

<table>
<tr><td rowspan="3">Construction</td><td colspan="6">Potential Impacts</td><td colspan="6">Mitigation</td></tr>
<tr><td colspan="6">The following activities have been identified as possible sources of fugitive dust during construction operations at the site:
▪ Dust from bare areas.
▪ Material handling.
▪ Emissions from construction machinery and equipment.
▪ Trucks transporting material.</td><td colspan="6">▪ There should be strict speed limits on site roads to prevent the liberation of dust into the atmosphere.
▪ Dust must be suppressed on the construction site, temporary dirt roads and during the transportation of material during dry periods by the regular application of water or binding chemicals. Water used for this purpose must be used in quantities that will not result in the generation of run-off.
▪ All site workers during construction will need to wear the appropriate PPE to avoid excessive exposure to dust particles.
▪ Only footprints to be cleared of vegetation when installing the troughs.</td></tr>
<tr><td>P</td><td>F</td><td>E</td><td>D</td><td>I</td><td>Significance before mitigation</td><td>P</td><td>F</td><td>E</td><td>D</td><td>I</td><td>Significance after mitigation</td></tr>
<tr><td>-4</td><td>-5</td><td>-1</td><td>-3</td><td>-2</td><td>-15</td><td>-4</td><td>-4</td><td>-1</td><td>-3</td><td>-2</td><td>-14</td></tr>
<tr><td rowspan="3">Operations</td><td colspan="6">Potential Impacts</td><td colspan="6">Mitigation</td></tr>
<tr><td colspan="6">The following activities have been identified as possible sources of fugitive dust during operations at the site:
▪ Emissions from machinery and equipment including Auxiliary Boilers.</td><td colspan="6">▪ All international best practice recommendations for the correct operation of the plant need to be followed to reduce the number of restarts to the plant, once operational.</td></tr>
<tr><td>P</td><td>F</td><td>E</td><td>D</td><td>I</td><td>Significance before mitigation</td><td>P</td><td>F</td><td>E</td><td>D</td><td>I</td><td>Significance after mitigation</td></tr>
<tr><td>-3</td><td>-2</td><td>-1</td><td>-2</td><td>-2</td><td>-10</td><td>-3</td><td>-2</td><td>-1</td><td>-2</td><td>-2</td><td>-10</td></tr>
<tr><td rowspan="3">Decommissioning</td><td colspan="6">Potential Impacts</td><td colspan="6">Mitigation</td></tr>
<tr><td colspan="6">The following activities have been identified as possible sources of fugitive dust at the site:
▪ Dust from bare areas.
▪ Material handling for rehabilitation.
▪ Emissions from construction machinery and equipment.</td><td colspan="6">▪ There should be strict speed limits on site roads to prevent the liberation of dust into the atmosphere.
▪ Dust must be suppressed on the site, temporary dirt roads and during the transportation of material during dry periods by the regular application of water. Water used for this purpose must be used in quantities that will not result in the generation of run-off.
▪ All site workers during construction will need to wear the appropriate PPE to avoid excessive exposure to dust particles.
▪</td></tr>
<tr><td>P</td><td>F</td><td>E</td><td>D</td><td>I</td><td>Significance before mitigation</td><td>P</td><td>F</td><td>E</td><td>D</td><td>I</td><td>Significance after mitigation</td></tr>
<tr><td>-4</td><td>-5</td><td>-1</td><td>-3</td><td>-2</td><td>-15</td><td>-4</td><td>-4</td><td>-1</td><td>-3</td><td>-2</td><td>-14</td></tr>
<tr><td colspan="6">Cumulative</td><td colspan="6">▪ The heat island effect has generally dissipated at a distance of 300 m and therefore it is unlikely that the impacts from surrounding solar projects will have any impact on the heat island formation or associated impact.</td></tr>
</table>

9.2.10 Waste (Site Alternatives 1 and 2)

	Potential Impacts	Mitigation
Construction	▪ Contamination of the surface and site with general and hazardous waste. – General waste produced on site includes: Office waste (e.g. food, waste, paper, plastic); Operational waste (clean steel, wood, glass); and General domestic waste (food, cardboards, paper, bottles, tins). ▪ Contamination or pollution of or effluent release into surface water, groundwater, rivers and other nearby hydrological or ecological systems with general and hazardous waste. – Hazardous waste produced on site includes: Waste sludge; Spent activated carbon; HTF, Oil and other lubricants, diesel, paints, solvent; Containers that contained chemicals, oils or greases; and Equipment, steel, other material (rags), soils, gravel and water contaminated by hazardous substances (oil, fuel, grease, chemicals or bitumen).	▪ An adequate number of general waste receptacles, including bins must be arranged around the site to collect all domestic refuse, and to minimise littering. ▪ A fenced area must be allocated for waste sorting and disposal on the site. The Developer must have a waste policy and waste management procedure. ▪ General waste produced on site is to be collected in skips for disposal at the local municipal waste site. Hazardous waste is not to be mixed or combined with general waste earmarked for disposal at the municipal landfill site. ▪ Under no circumstances is waste to be burnt or buried on site. ▪ Hazardous waste is to be disposed at a Permitted Hazardous Waste Landfill Site. A hazardous waste disposal certificate must be obtained from the waste removal company as evidence of correct disposal. ▪ In the case of a spill of hydrocarbons, chemicals or bituminous substance, the spill should be contained and cleaned up and the material together with any contaminated soil collected and disposed of as hazardous waste to minimize pollution risk and reduce bunding capacity. ▪ Neighbouring river and stream systems as well as their associated buffer areas are to be fenced off preferably with palisade fencing. This erection of the fencing should take place prior to any construction activities taking place on site. ▪ Vehicles are to be checked for leakage before and after entering the construction area. ▪ Areas where fuels are either kept or transferred are to be bunded so as to contain spillage. ▪ An inventory should be made of substances which will be used on site (both temporarily during construction and during operation) that are potentially harmful to surface water and other water related systems/bodies.

P	F	E	D	I	Significance before mitigation	P	F	E	D	I	Significance after mitigation
-4	-3	-2	-3	-3	-15	-2	-1	-1	-1	-1	-6

	Potential Impacts						Mitigation					
Operations	▪ Leakage of process wastewater, synthetic oils, lubricants, chemicals etc. onto land.						▪ Regular (annual) groundwater monitoring programme. ▪ Institute clean up protocol in accordance with section 10 of the minimum requirements for the handling, classification and disposal of hazardous waste (3rd edition, 2005) should there be a local leakage.					
	P	**F**	**E**	**D**	**I**	**Significance before mitigation**	**P**	**F**	**E**	**D**	**I**	**Significance after mitigation**
	-2	**-4**	**-2**	**-4**	**-3**	**-15**	**-2**	**-2**	**-2**	**-4**	**-2**	**-12**
	▪ Untreated water discharge into environment.						▪ The bulk of the water would be treated in the evaporation pond which is used for storage purposes until the plant becomes operational. ▪ The water treatment plant shall have a proactive service and maintenance plan in place to ensure high availability. ▪ Contaminated wastewater including hydrocarbon contaminated water must not enter any watercourse and must be managed by the site manager to ensure that the existing water resources on and off site are not polluted by the development. ▪ Institute clean up protocol should there be accidental release of untreated water.					
	P	**F**	**E**	**D**	**I**	**Significance before mitigation**	**P**	**F**	**E**	**D**	**I**	**Significance after mitigation**
	-2	**-4**	**-2**	**-4**	**-3**	**-15**	**-2**	**-2**	**-2**	**-4**	**-2**	**-12**
	▪ Treatment and proposed handling of evaporation pond feed - the feed to the evaporation pond would have to be treated such that it can be considered for reuse or discharge into the environment, if not.						▪ Contaminated wastewater must not enter any watercourse and must be managed by the site manager to ensure that the existing water resources on and off site are not polluted by the development. ▪ Continue sampling and analysis of evaporation pond feed and bulk water quality on a monthly basis under normal operating conditions. ▪ Continue sampling and analysis of the treated condensate stream for the target range of pollutants and water quality parameters. This must be done on a monthly basis under normal operating conditions. Material Safety Data Sheet (MSDS) for the condensate must be readily available. MSDS's should include information pertaining to environmental impacts and measures to minimise and mitigate against any potential environmental impacts which may result from a spill. ▪ Ongoing monitoring of the inputs and outputs for the treatment plant; Monthly reports on removal efficiencies of the pollutants of concern.					

	P	F	E	D	I	Significance before mitigation	P	F	E	D	I	Significance after mitigation
	-4	-4	-3	-4	-4	-19	-2	-1	-2	-4	-1	-10
	▪ Leakage of hydrocarbons in the CSP plant.						▪ Storm- and process water should be separated by design and operating protocols. ▪ Process water shall be directed to the water treatment plant. ▪ All major incidents shall be reported and a root cause analysis undertaken. ▪ Preventative measures shall be instituted to avoid potential hydrocarbon spillages.					
	P	F	E	D	I	Significance before mitigation	P	F	E	D	I	Significance after mitigation
	-2	-3	-2	-4	-4	-15	-2	-1	-1	-4	-1	-9
	▪ Improper disposal of admin-based waste water, solid sludge and particulates.						▪ Contaminated wastewater including hydrocarbon contaminated water must not enter any watercourse and must be managed by the site manager to ensure that the existing water resources on and off site are not polluted by the development. ▪ Measure volumes of sludge removed from site and maintain a waste manifest in terms of its ultimate disposal. The sludge shall be analysed monthly for pH, total solids, organics, ammonia and ash content. ▪ Maintain a log of solids removed. Regular monitoring of qualitative parameters in the solids. Waste manifest for solids to be documented. ▪ Waste manifest for particulates to be documented.					
	P	F	E	D	I	Significance before mitigation	P	F	E	D	I	Significance after mitigation
	-2	-2	-2	-4	-3	-13	-2	-2	-1	-2	-1	-8
Decommiss-ioning	Potential Impacts						Mitigation					
	▪ Leachate contamination to environment from evaporation ponds.						▪ The evaporation pond should have a leakage detection system with an impermeable liner. ▪ Evaporation ponds must be adequately maintained and regularly monitored for possible leaks or damage to the structure of the ponds. ▪ Measures accommodating overspill by the evaporation ponds must be incorporated into the design of the evaporation ponds.					
	P	F	E	D	I	Significance before mitigation	P	F	E	D	I	Significance after mitigation
	-3	-3	-3	-4	-3	-16	-2	-1	-1	1	-3	-8

9.3 Ancillary Infrastructure (Power Lines, Roads and Water Pipeline) Alternatives

9.3.1 Fauna and Flora (Power Line, Road and Water Pipeline Alternatives 1 and 2)

	Potential Impacts						Mitigation					
Construction	▪ Habitat destruction with transformation of natural vegetation and habitats within the proposed alignments. ▪ Destruction of suitable habitat for red listed plants and animals.						▪ Refer to mitigation measures presented in Section 9.2.1.					
	P	F	E	D	I	Significance before mitigation	P	F	E	D	I	Significance after mitigation
	-5	-1	-2	-5	-3	-16	-5	-1	-1	-5	-2	-14
	▪ Increased levels of road fatalities of dispersing animals.						▪ Speed limits should be imposed on the proposed access roads. ▪ Fences should be erected adjacent to the access road preventing animals entering onto the road.					
	P	F	E	D	I	Significance before mitigation	P	F	E	D	I	Significance after mitigation
	-4	-4	-2	-4	-2	-16	-3	-3	-1	-4	-1	-12
	▪ Erosion and sediment control from the cleared site.						▪ Implementation of erosion prevention mitigation measures like sand bags etc. must be used on site.					
	P	F	E	D	I	Significance before mitigation	P	F	E	D	I	Significance after mitigation
	-1	-1	-2	-4	-2	-10	-1	-1	-1	-4	-1	-8

9.3.2 Avifauna (Road and Water Pipeline Alternative 1)

	Potential Impacts						Mitigation					
Construction	▪ Displacement of priority species due to disturbance associated with the construction of the pipeline and access road: – Excavation/trenching for water pipeline; – Construction of new dirt or gravel road; – Temporary stockpiling and side-casting of soil, construction materials, or other construction wastes; – Soil compaction, dust, and water run-off from construction sites; – Increased vehicle traffic; – Short-term construction-related noise (from equipment) and visual disturbance.						▪ Construction activity should be restricted to the immediate footprint of the infrastructure. ▪ Access to the remainder of the site should be strictly controlled to prevent unnecessary disturbance of priority species. ▪ Measures to control noise and dust should be applied according to current best practice in the industry. ▪ Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum. ▪ The recommendations of the ecological and botanical specialist studies must be strictly implemented, especially as far as limitation of the construction footprint and rehabilitation of disturbed areas is concerned.					
	P	F	E	D	I	Significance before mitigation	P	F	E	D	I	Significance after mitigation
	-5	-5	-2	-3	-4	-19	-4	-5	-2	-3	-4	-18

9.3.3 Avifauna (Road and Water Pipeline Alternative 2)

	Potential Impacts						Mitigation					
Construction	▪ Displacement of priority species due to disturbance associated with the construction of the pipeline and access road: – Excavation/trenching for water pipeline; – Construction of new dirt or gravel road; – Temporary stockpiling and side-casting of soil, construction materials, or other construction wastes; – Soil compaction, dust, and water run-off from construction sites; – Increased vehicle traffic; and – Short-term construction-related noise (from equipment) and visual disturbance.						▪ Construction activity should be restricted to the immediate footprint of the infrastructure. ▪ Access to the remainder of the site should be strictly controlled to prevent unnecessary disturbance of priority species. ▪ Measures to control noise and dust should be applied according to current best practice in the industry. ▪ Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum. ▪ The recommendations of the ecological and botanical specialist studies must be strictly implemented, especially as far as limitation of the construction footprint and rehabilitation of disturbed areas is concerned.					
	P	F	E	D	I	Significance before mitigation	P	F	E	D	I	Significance after mitigation
	-3	-5	-2	-3	-3	-16	-2	-5	-2	-3	-3	-15

9.3.4 Avifauna (Power Line Alternative 1)

<table>
<tr><td rowspan="3">Construction</td><td colspan="6">Potential Impacts</td><td colspan="6">Mitigation</td></tr>
<tr><td colspan="6">▪ Displacement of priority species due to disturbance associated with the construction of the power line.</td><td colspan="6">▪ Construction activity should be restricted to the immediate footprint of the infrastructure.
▪ Access to the remainder of the site should be strictly controlled to prevent unnecessary disturbance of priority species.
▪ Measures to control noise and dust should be applied according to current best practice in the industry.
▪ Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum.
▪ The recommendations of the ecological and botanical specialist studies must be strictly implemented, especially as far as limitation of the construction footprint and rehabilitation of disturbed areas is concerned.</td></tr>
<tr><td>P</td><td>F</td><td>E</td><td>D</td><td>I</td><td>Significance before mitigation</td><td>P</td><td>F</td><td>E</td><td>D</td><td>I</td><td>Significance after mitigation</td></tr>
<tr><td>-4</td><td>-5</td><td>-2</td><td>-3</td><td>-3</td><td>-17</td><td>-2</td><td>-5</td><td>-2</td><td>-3</td><td>-3</td><td>-15</td></tr>
<tr><td rowspan="3">Operation</td><td colspan="6">Potential Impacts</td><td colspan="6">Mitigation</td></tr>
<tr><td colspan="6">▪ Mortality of priority species due to collisions with the earthwire of the 132 kV power line:
– The priority species that were recorded in the study area which could potentially be exposed to collision risk are listed in the Avifaunal Assessment
– The most likely priority species candidates for collision mortality on the proposed 132 kV power line are medium to large terrestrial species i.e. Karoo Korhaan, Kori Bustard, and Secretarybird which have all been recorded at the site.</td><td colspan="6">▪ The 132 kV grid connection should be inspected at least once a quarter for a minimum of three years by the avifaunal specialist to establish if there is any significant collision mortality. Thereafter the frequency of inspections will be informed by the results of the first three years.
▪ The detailed protocol to be followed for the inspections will be compiled by the avifaunal specialist prior to the first inspection.
▪ The proposed transmission line for evacuation of the electricity generated by the plant should be marked with Bird Flight Diverters (BFDs) for their entire length on the earth wire of the line, 5 m apart, alternating black and white.</td></tr>
<tr><td>P</td><td>F</td><td>E</td><td>D</td><td>I</td><td>Significance before mitigation</td><td>P</td><td>F</td><td>E</td><td>D</td><td>I</td><td>Significance after mitigation</td></tr>
<tr><td>-3</td><td>-5</td><td>-1</td><td>-4</td><td>-3</td><td>-16</td><td>-3</td><td>-5</td><td>-1</td><td>-4</td><td>-2</td><td>-15</td></tr>
</table>

9.3.5 Avifauna (Power Line Alternative 2)

<table>
<tr><td rowspan="3">Construction</td><td colspan="6">Potential Impacts</td><td colspan="6">Mitigation</td></tr>
<tr><td colspan="6">▪ Displacement of priority species due to disturbance associated with the construction of the power line:</td><td colspan="6">▪ Construction activity should be restricted to the immediate footprint of the infrastructure.
▪ Access to the remainder of the site should be strictly controlled to prevent unnecessary disturbance of priority species.
▪ Measures to control noise and dust should be applied according to current best practice in the industry.
▪ Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum.
▪ The recommendations of the ecological and botanical specialist studies must be strictly implemented, especially as far as limitation of the construction footprint and rehabilitation of disturbed areas is concerned.</td></tr>
<tr><td>P</td><td>F</td><td>E</td><td>D</td><td>I</td><td>Significance before mitigation</td><td>P</td><td>F</td><td>E</td><td>D</td><td>I</td><td>Significance after mitigation</td></tr>
<tr><td>-5</td><td>-5</td><td>-2</td><td>-3</td><td>-4-</td><td>-19</td><td>-4</td><td>-5</td><td>-2</td><td>-3</td><td>-4</td><td>-18-</td></tr>
<tr><td rowspan="3">Operations</td><td colspan="6">Potential Impacts</td><td colspan="6">Mitigation</td></tr>
<tr><td colspan="6">▪ Mortality of priority species due to collisions with the earthwire of the 132kV power line:
– The priority species that were recorded in the study area which could potentially be exposed to collision risk are listed in the Avifaunal Assessment
– The most likely priority species candidates for collision mortality on the proposed 132kV power line are medium to large terrestrial species i.e. Karoo Korhaan, Kori Bustard, and Secretarybird which have all been recorded at the site.</td><td colspan="6">▪ The 132kV grid connection should be inspected at least once a quarter for a minimum of three years by the avifaunal specialist to establish if there is any significant collision mortality. Thereafter the frequency of inspections will be informed by the results of the first three years.
▪ The detailed protocol to be followed for the inspections will be compiled by the avifaunal specialist prior to the first inspection.
▪ The proposed transmission line for evacuation of the electricity generated by the PVs should be marked with Bird Flight Diverters (BFDs) for their entire length on the earth wire of the line, 5m apart, alternating black and white.</td></tr>
<tr><td>P</td><td>F</td><td>E</td><td>D</td><td>I</td><td>Significance before mitigation</td><td>P</td><td>F</td><td>E</td><td>D</td><td>I</td><td>Significance after mitigation</td></tr>
<tr><td>-3</td><td>-5</td><td>-1</td><td>-4</td><td>-3</td><td>-16</td><td>-3</td><td>-5</td><td>-1</td><td>-4</td><td>-2</td><td>-15</td></tr>
</table>

9.3.6 Surface Water (Road and Water Pipeline Alternative 1)

<table>
<tr><td rowspan="3">Construction</td><td colspan="6">Potential Impacts</td><td colspan="6">Mitigation</td></tr>
<tr><td colspan="6">▪ Irresponsible construction practices could lead to the pollution of watercourses and rivers (e.g. faecal contamination, or pollution of surface water through hydrocarbons).
▪ Poor stormwater management could lead to the siltation (pollution) of surface waters.
▪ Temporary accesses across watercourses could cause hydrological and morphological impacts and degrade the resource quality.
▪ Excessive removal of / damage to vegetation would degrade the resource quality of the riparian zone.</td><td colspan="6">▪ Construction to be monitored by an ECO according to the stipulations of the EMPr.
▪ No batching or chemical / fuel storage areas to be located within any surface water feature or within 100 m of a surface water feature.
▪ Clearing of vegetation to be limited to the construction footprint.
▪ No temporary construction accesses (other than the construction right of way) to be constructed through any surface water feature and no machinery to enter any surface water feature unless authorised under the EMPr by the ECO as part of a construction activity.
▪ Watercourse channels and other parts of the surface water feature must be restored to as close a pre-construction state as possible.
The pipeline-road route must be aligned out of the Orange River riparian corridor as far as possible, and the construction footprint must in no way encroach into this riparian corridor. If not possible, work within the riparian areas must be subject to a WUL application.</td></tr>
<tr><td>P</td><td>F</td><td>E</td><td>D</td><td>I</td><td>Significance before mitigation</td><td>P</td><td>F</td><td>E</td><td>D</td><td>I</td><td>Significance after mitigation</td></tr>
<tr><td>-4</td><td>-4</td><td>-1</td><td>-3</td><td>-3</td><td>-15</td><td>-2</td><td>-4</td><td>-1</td><td>-3</td><td>-2</td><td>-12</td></tr>
<tr><td rowspan="3">Operations</td><td colspan="6">Potential Impacts</td><td colspan="6">Mitigation</td></tr>
<tr><td colspan="6">▪ The pipeline servitude as it crosses riparian areas will be kept cleared of most woody trees and shrubs due to the limitations relating to deep root systems, thus constituting an impact on the affected part of the riparian corridor for the entire operational length of the pipeline.
▪ Improper rehabilitation of the construction works area through riparian areas would leave such parts of the riparian zones vulnerable to erosion by water and wind.
▪ In addition, any cleared servitude through the riparian corridor will pose a risk of encroachment of alien invasive vegetation into the riparian zone due to the servitude creating favourable conditions for the establishment of alien pioneers. The risk will be even greater should operational management of the servitude not be properly undertaken.
▪ Pollutants from the road (e.g. hydrocarbons) could enter riparian corridors, causing pollution of the surface water feature.</td><td colspan="6">▪ All construction footprint areas through riparian areas must be fully rehabilitated with the re-establishment of a vegetative cover that matches pre-construction vegetative cover.
▪ Any development of erosion must be carefully monitored and managed.
▪ It is critical that all alien invasive vegetation management in the servitude be undertaken at regular intervals (at least every 6 months) for the operational life of the pipeline servitude. This must not just be undertaken for riparian areas but for servitudes in adjacent areas. As part of this management all alien invasive vegetation within the servitude must be removed.
▪ Formal stormwater measures must be incorporated into the design of the road and no stormwater must be directly discharged into the channel of any watercourse.</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>

	P	F	E	D	I	Significance before mitigation	P	F	E	D	I	Significance after mitigation
	-3	-3	-1	-4	-3	-14	-2	-2	-1	-4	-2	-11
Decommissioning	**Potential Impacts**						**Mitigation**					
	▪ The termination of servitude management through riparian corridors post-decommissioning could increase the risk of alien invasive plant encroachment into the servitude area, and thus into adjoining riparian habitat.						▪ Decommissioning to be monitored by an ECO according to the stipulations of the EMPr. ▪ No temporary accesses to be constructed through any surface water feature and no machinery to enter any wetland unless authorised under the EMPr by the ECO as part of a decommissioning activity. ▪ After decommissioning of the pipeline, management of alien invasive vegetation should continue for a period.					
	P	F	E	D	I	Significance before mitigation	P	F	E	D	I	Significance after mitigation
	-4	-4	-1	-3	-3	-15	-2	-4	-2	-3	-3	-14
Cumulative	▪ If the road-pipeline were to be developed through the Orange River riparian corridor a further (cumulative) loss of riparian habitat would occur. This would constitute a cumulative impact due to the existing loss of riparian vegetation and habitat within the Orange River due to clearing for orchards and due to other impacts. ▪ Impacts on individual surface water features across the site could result in a cumulative impact on respective catchments, although other land use-related practices are more likely to cause degradation of watercourses and their associated riparian zones. ▪ Pollutants released into more than one surface water feature through construction activities could result in downstream impacts, although this is thought to be unlikely. ▪ The mitigation measures provided in the preceding section should be adhered to.											

9.3.7 Surface Water (Road and Water Pipeline Alternative 2)

<table>
<tr><td rowspan="3">Construction</td><td colspan="6">Potential Impacts</td><td colspan="6">Mitigation</td></tr>
<tr><td colspan="6">▪ Irresponsible construction practices could lead to the pollution of watercourses and rivers (e.g. faecal contamination, or pollution of surface water through hydrocarbons).
▪ Poor stormwater management could lead to the siltation (pollution) of surface waters.
▪ Temporary accesses across watercourses could cause hydrological and morphological impacts and degrade the resource quality.
▪ Excessive removal of / damage to vegetation would degrade the resource quality of the riparian zone.</td><td colspan="6">▪ Construction to be monitored by an ECO according to the stipulations of the EMPr.
▪ No batching or chemical / fuel storage areas to be located within any surface water feature or within 100 m of a surface water feature.
▪ Clearing of vegetation to be limited to the construction footprint.
▪ No temporary construction accesses (other than the construction right of way) to be constructed through any surface water feature and no machinery to enter any surface water feature unless authorised under the EMPr by the ECO as part of a construction activity.
▪ Watercourse channels and other parts of the surface water feature must be restored to as close a pre-construction state as possible.
▪ The pipeline-road route must be aligned out of the Orange River riparian corridor as far as possible, and the construction footprint must in no way encroach into this riparian corridor. If not possible, work within the riparian areas must be subject to a WUL application.</td></tr>
<tr><td>P</td><td>F</td><td>E</td><td>D</td><td>I</td><td>Significance before mitigation</td><td>P</td><td>F</td><td>E</td><td>D</td><td>I</td><td>Significance after mitigation</td></tr>
<tr><td>-4</td><td>-4</td><td>-1</td><td>-3</td><td>--4</td><td>-16</td><td>-2</td><td>-4</td><td>-2</td><td>-3</td><td>-3</td><td>-14</td></tr>
<tr><td rowspan="2">Operations</td><td colspan="6">Potential Impacts</td><td colspan="6">Mitigation</td></tr>
<tr><td colspan="6">▪ The pipeline servitude as it crosses riparian areas will be kept cleared of most woody trees and shrubs due to the limitations relating to deep root systems, thus constituting an impact on the affected part of the riparian corridor for the entire operational length of the pipeline.
▪ Improper rehabilitation of the construction works area through riparian areas would leave such parts of the riparian zones vulnerable to erosion by water and wind.
▪ In addition, the cleared servitude through the riparian corridor will pose a risk of encroachment of alien invasive vegetation into the riparian zone due to the servitude creating favourable conditions for the establishment of alien pioneers. The risk will be even greater should operational management of the servitude not be properly undertaken.
▪ Pollutants from the road (e.g. hydrocarbons) could enter riparian corridors, causing pollution of the surface water feature.</td><td colspan="6">▪ All construction footprint areas through riparian areas must be fully rehabilitated with the re-establishment of a vegetative cover that matches pre-construction vegetative cover.
▪ Any development of erosion must be carefully monitored and managed.
▪ It is critical that all alien invasive vegetation management in the servitude be undertaken at regular intervals (at least every 6 months) for the operational life of the pipeline servitude. This must not just be undertaken for riparian areas but for servitudes in adjacent areas. As part of this management all alien invasive vegetation within the servitude must be removed.
▪ Formal stormwater measures must be incorporated into the design of the road and no stormwater must be directly discharged into the channel of any watercourse.</td></tr>
</table>

	P	F	E	D	I	Significance before mitigation	P	F	E	D	I	Significance after mitigation
	-3	-3	-1	-4	-3	-14	-2	-2	-1	-4	-2	-11
Decommissioning	Potential Impacts						Mitigation					
	▪ The termination of servitude management through riparian corridors post-decommissioning could increase the risk of alien invasive plant encroachment into the servitude area, and thus into adjoining riparian habitat.						▪ Decommissioning to be monitored by an ECO according to the stipulations of the EMPr. ▪ No temporary accesses to be constructed through any surface water feature and no machinery to enter any wetland unless authorised under the EMPr by the ECO as part of a decommissioning activity. ▪ After decommissioning of the pipeline, management of alien invasive vegetation should continue for a period.					
	P	F	E	D	I	Significance before mitigation	P	F	E	D	I	Significance after mitigation
	-4	-4	-1	-3	-3	-15	-2	-4	-2	-3	-3	-14
Cumulative	▪ If the road-pipeline were to be developed through the Orange River riparian corridor a further (cumulative) loss of riparian habitat would occur. This would constitute a cumulative impact due to the existing loss of riparian vegetation and habitat within the Orange River due to clearing for orchards and due to other impacts. ▪ Impacts on individual surface water features across the site could result in a cumulative impact on respective catchments, although other land use-related practices are more likely to cause degradation of watercourses and their associated riparian zones. ▪ Pollutants released into more than one surface water feature through construction activities could result in downstream impacts, although this is thought to be unlikely. ▪ The mitigation measures provided in the preceding section should be adhered to.											

9.3.8 Aquatic Ecology (Power Line, Road and Water Pipeline Alternatives 1 and 2)

Construction	**Potential Impacts**						**Mitigation**					
	▪ Aquatic and riparian habitat destruction through the construction of infrastructure e.g. additional pumps, or expansions to already constructed infrastructure.						▪ Limit this impact to the footprint and immediate support areas only and avoid indiscriminate destruction of habitat.					
	P	**F**	**E**	**D**	**I**	**Significance before mitigation**	**P**	**F**	**E**	**D**	**I**	**Significance after mitigation**
	-3	**-2**	**-2**	**-4**	**-2**	**-13**	**-2**	**-2**	**-1**	**-2**	**-2**	**-9**
	▪ Soil erosion may result from disturbed areas on steeper slopes. ▪ Erosion of unprotected stockpiles of soil will lead to erosional features and smothering of surrounding habitat.						▪ Soil erosion is readily mitigated for by the implementation of geotextiles and silt fencing on areas of steeper slopes, especially near aquatic habitats.					
	P	**F**	**E**	**D**	**I**	**Significance before mitigation**	**P**	**F**	**E**	**D**	**I**	**Significance after mitigation**
	-4	**-3**	**-2**	**-4**	**-3**	**-16**	**-1**	**-2**	**-1**	**-2**	**-2**	**-8**
	▪ Potential soil contamination during construction.						▪ Earthmoving and construction equipment should be serviced regularly to avoid fuel and oils leaks. ▪ Accidental spillages must be immediately reported to the ECO and clean up procedures implemented immediately. This would include the removal of the contaminated soils, which should be taken to a registered disposal facility.					
	P	**F**	**E**	**D**	**I**	**Significance before mitigation**	**P**	**F**	**E**	**D**	**I**	**Significance after mitigation**
	-3	**-3**	**-2**	**-4**	**-3**	**-15**	**-1**	**-1**	**-2**	**-1**	**-1**	**-6**
	▪ Exotic vegetation encroachment following soil disturbances.						▪ Monitoring for exotic species recruitment should be undertaken on a regular basis and managed appropriately should recruitment be noted.					
	P	**F**	**E**	**D**	**I**	**Significance before mitigation**	**P**	**F**	**E**	**D**	**I**	**Significance after mitigation**
	-5	**-4**	**-2**	**-3**	**-3**	**-17**	**-2**	**-1**	**-2**	**-2**	**-2**	**-9**
Operations	**Potential Impacts**						**Mitigation**					
	▪ Poorly maintained equipment (pumps, etc.) could lead to fluid leaks that pose a threat to water quality.						▪ Equipment must be serviced and well maintained. Servicing of equipment should not take place at the edge of the watercourse but within designated areas only.					
	P	**F**	**E**	**D**	**I**	**Significance before mitigation**	**P**	**F**	**E**	**D**	**I**	**Significance after mitigation**
	-5	**-3**	**-2**	**-4**	**-3**	**-17**	**-2**	**-2**	**-1**	**-1**	**-1**	**-7**
	▪ Potential soil contamination during operations.						▪ Earthmoving and construction equipment should be serviced regularly to avoid fuel and oils leaks. ▪ Accidental spillages must be immediately reported to the ECO and clean up procedures implemented immediately. This would include					

							the removal of the contaminated soils, which should be taken to a registered disposal facility.					
	P	F	E	D	I	Significance before mitigation	P	F	E	D	I	Significance after mitigation
	-3	-3	-2	-4	-3	-15	-1	-1	-2	-1	-1	-6
	▪ Exotic vegetation encroachment following soil disturbances.						▪ Monitoring for exotic species recruitment should be undertaken on a regular basis and managed appropriately should recruitment be noted.					
	P	F	E	D	I	Significance before mitigation	P	F	E	D	I	Significance after mitigation
	-5	-3	-2	-4	-3	-17	-2	-1	-2	-2	-2	-9
Decommissioning	Potential Impacts						Mitigation					
	▪ Excavations to remove infrastructure will result in a degree of habitat destruction.						▪ Indiscriminate destruction of habitat must be avoided, and the impacting footprint should be restricted to as small an area as practical.					
	P	F	E	D	I	Significance before mitigation	P	F	E	D	I	Significance after mitigation
	-5	-3	-2	-4	-3	-17	-2	-2	-2	-2	-2	-10
	▪ Contamination of soils from fluid leaks of construction vehicles during excavation and removal procedures.						▪ Earthmoving and construction equipment should be serviced regularly to avoid fuel and oils leaks. ▪ Accidental spillages must be immediately reported to the ECO and clean up procedures implemented immediately. This would include the removal of the contaminated soils, which should be taken to a registered disposal facility.					
	P	F	E	D	I	Significance before mitigation	P	F	E	D	I	Significance after mitigation
	-3	-3	-2	-4	-3	-15	-1	-1	-2	-1	-1	-6
	▪ Formation of soil erosion following disturbances and incorrect reinstatement.						▪ Correct site reinstatement and landscaping details need to be adhered to and erosion management structures utilized in areas of steeper slopes. This potential impact is easily mitigated for with focused effort on the part of the contractors.					
	P	F	E	D	I	Significance before mitigation	P	F	E	D	I	Significance after mitigation
	-4	-3	-2	-4	-3	-16	-1	-1	-1	-2	-2	-7
	▪ Exotic vegetation encroachment following soil disturbances.						▪ Monitoring for exotic species recruitment should be undertaken on a regular basis and managed appropriately should recruitment be noted.					
	P	F	E	D	I	Significance before mitigation	P	F	E	D	I	Significance after mitigation
	-5	-3	-2	-4	-3	-17	-2	-1	-2	-2	-2	-9

9.3.9 Socio-Economic (Power Line, Road and Water Pipeline Alternatives 1 and 2)

	Potential Impacts						Mitigation					
Construction	▪ Potential loss of cultivated areas due to pipeline and road routing. ▪ Restricted access (residents and workers) to currently utilised roads.						▪ The routing must allow for the possibility of adjustment should it be found to traverse cultivated land. The establishment of a formal grievance management system would assist in identifying challenges that require a resolution. ▪ Access by residents and workers that are currently utilising a given (legal) route should not be hindered. The establishment of a formal grievance management system would assist in identifying challenges that require a resolution.					
	P	**F**	**E**	**D**	**I**	**Significance before mitigation**	**P**	**F**	**E**	**D**	**I**	**Significance after mitigation**
	-1	-2	-2	-3	-3	-11	-1	-1	-2	-2	-2	-8
	▪ Inconvenience and danger to proximate residents through increased road traffic, dust and noise, including the development of new access roads through the development site.						▪ It is recommended that alternative routes be found at scheduled times of the day - perhaps that would help keep the roads free when school children are returning home, allowing children mobility without being hampered by large trucks utilising the same road. ▪ *A* policy on Contractor Health and Safety for the duration of their work on site, must apply, and be monitored. In addition, a Contractor's Code of Conduct (especially in terms of respecting local by-laws and specific practical community concerns on which agreement may be reached), should be applied for the duration of the construction. ▪ The project proponent should look at the feasibility (and social responsibility) related to the tarring of roads of high utilisation so that livelihoods and lifestyles will not be adversely impacted on a long term basis. ▪ Regular information sharing discussions with the Contractors must be pursued, giving farm labour residents an opportunity to voice concerns and grievances throughout the duration of project construction. The establishment of a Resident's forum to provide institutional support to such an activity is recommended. In addition, it is vitally important that a formal grievance management system be put in place (and should remain throughout the life of the solar plant/s).					
	P	**F**	**E**	**D**	**I**	**Significance before mitigation**	**P**	**F**	**E**	**D**	**I**	**Significance after mitigation**
	-4	-4	-2	-3	-3	-16	-2	-4	-2	-3	-2	-13

9.3.10 Noise (Power Line, Road and Water Pipeline Alternatives 1 and 2)

Construction

Potential Impacts	Mitigation
▪ The typical noise that would be generated by the construction activities are all from heavy machinery and impact noises from incidents (such as falling pipes, equipment, etc.).	▪ Control of noise – On site – Avoid unnecessary revving of engines and switch off equipment when not required. – Keep solar field access routes well maintained and avoid speeding. – Start up plant and vehicles sequentially rather than all together (including auxiliary heater operations). – Fitment of additional or best available exhaust silencers or acoustic canopies on engines including auxiliary heater operations). – Where possible, attempt to enclose noise sources, if the sources enclose has a noise directivity ensure the noise is directed away from any sensitive areas. – Regular and effective maintenance by trained personnel is essential and will do much to reduce noise from plant and machinery. ▪ Controlling the propagation of noise – Minimise the length and magnitude of noise sources. – Screening of noise sources, if it is not possible to increase the distance, the alternative measure is to screen the noise source. Screening can make use of the natural environment, existing buildings and/or screens or earth berms. These screens should be placed in the direct line of sight to effectively reduce the noise received and the sensitive location. ▪ It is advisable that the access road from the town to the site be paved to ensure the impact is mitigated.

P	F	E	D	I	Significance before mitigation	P	F	E	D	I	Significance after mitigation
-1	-1	-1	-1	-1	-5	-1	-1	-1	-1	-1	-5

Operations

Potential Impacts	Mitigation
▪ The typical noise that would be generated by the operational activities are all from heavy machinery and impact noises from incidents (such as falling pipes, equipment, etc.).	▪ Refer to mitigation measures presented for the construction phase.

P	F	E	D	I	Significance before mitigation	P	F	E	D	I	Significance after mitigation
-1	-1	-1	-1	-1	-5	-1	-1	-1	-1	-1	-5

9.3.11 Cumulative Air Quality Impact from Main Roads (Gariep Road and N8)

Cumulative	Potential Impacts						Mitigation					
	• Gariep Road - dust generated during the construction and operational phases. The impacts relating to road use, are likely to supersede those of the plant impacts, this is due to the plant impacts being associated with start-up and emergency conditions, and not the daily running of the plant.						▪ There should be strict speed limits on site roads to prevent the liberation of dust into the atmosphere. ▪ Dust must be suppressed during vehicle movement. ▪ All site workers will need to wear the appropriate PPE to avoid excessive exposure to dust particles.					
	P	F	E	D	I	Significance before mitigation	P	F	E	D	I	Significance after mitigation
	-4	-5	-3	-4	-5	-21	-4	-5	-3	-4	-4	-20
	Potential Impacts						Mitigation					
	▪ N8 route - dust generated during the construction and operational phases. The impacts relating to road use, are likely to supersede those of the plant impacts, this is due to the plant impacts being associated with start-up and emergency conditions, and not the daily running of the plant.						▪ There should be strict speed limits on site roads to prevent the liberation of dust into the atmosphere. ▪ Dust must be suppressed during vehicle movement ▪ All site workers will need to wear the appropriate PPE to avoid excessive exposure to dust particles.					
	P	F	E	D	I	Significance before mitigation	P	F	E	D	I	Significance after mitigation
	-4	-4	-3	-4	-5	-20	-3	-3	-4	-3	-4	-17

9.3.12 Cumulative Traffic Impacts on the Existing Road Network

Cumulative (Construction)	Potential Impacts						Mitigation					
	▪ Potential deterioration of existing traffic conditions on the external road network. ▪ Deteriorating road safety conditions for all road users.						▪ It is recommended that the existing gravel roads are re-bladed on a regular basis to ensure that this road remains operational and maintains an acceptable level of safety for the duration of the project. ▪ Furthermore, to reduce the dust that will be generated on the gravel roads it is recommended that these roads are watered down on a regular basis.					
	P	F	E	D	I	Significance before mitigation	P	F	E	D	I	Significance after mitigation
	-1	-5	-4	-2	-1	-13	-1	-5	-4	-2	-1	-13
	Potential Impacts						Mitigation					
	▪ Deterioration of the existing condition of the surrounding road network.						▪					
	P	F	E	D	I	Significance before mitigation	P	F	E	D	I	Significance after mitigation
	-4	-5	-4	-4	-2	-19	-4	-5	-4	-4	-2	-19

Cumulative (Operations)	Potential Impacts						Mitigation					
	▪ Potential deterioration of existing traffic conditions on the external road network. ▪ Deteriorating road safety conditions for all road users.						▪ It is recommended that the existing gravel roads are re-bladed on a regular basis to ensure that this road remains operational and maintains an acceptable level of safety for the duration of the project. ▪ Furthermore, to reduce the dust that will be generated on the gravel roads it is recommended that these roads are watered down on a regular basis.					
	P	F	E	D	I	Significance before mitigation	P	F	E	D	I	Significance after mitigation
	-1	-5	-4	-4	-1	-15	-1	-5	-4	-4	-1	-15
	Potential Impacts						Mitigation					
	▪ Deterioration of the existing condition of the surrounding road network.						▪ It is recommended that the existing gravel roads are re-bladed on a regular basis to ensure that this road remains operational and maintains an acceptable level of safety for the duration of the project. ▪ Furthermore, to reduce the dust that will be generated on the gravel roads it is recommended that these roads are watered down on a regular basis.					
	P	F	E	D	I	Significance before mitigation	P	F	E	D	I	Significance after mitigation
	-1	-5	-4	-2	-1	-13	-1	-5	-4	-2	-1	-13

9.4 Comparative Assessment

- During construction, impacts for Parabolic Trough Site Alternative 1 are lower after mitigation compared to Site Alternative 2.
- During operations, Parabolic Trough Site Alternative 1 impacts are lower after mitigation compared to Site Alternative 2, hence from the assessment, Parabolic Trough Site Alternative 1 is preferred.
- During construction, impacts for the Road and water pipeline Alternative 2 are lower than that of Road and water pipeline Alternative 1. Impacts for Power line Alternative 1 are lower than Power Line Alternative 2.
- During operations impacts for both the Road and water pipeline Alternative 1 and 2 are the same. During operations, impacts for Power line Alternative 1 are lower than the impacts of Power line Alternative 2.
- Decommissioning impacts are the same for all site alternatives and should be refined based on the preferred alternatives.

Table 30 provides an average of the impacts of the two site alternatives as well as the road, pipeline and power line alternative for the construction, operation and decommissioning phases of the project, without and with mitigation (WOM & WM).

The following can be deduced from the analysis:

- During construction, impacts for Parabolic Trough Site Alternative 1 are lower after mitigation compared to Site Alternative 2.

- During operations, Parabolic Trough Site Alternative 1 impacts are lower after mitigation compared to Site Alternative 2, hence from the assessment, Parabolic Trough Site Alternative 1 is preferred.
- During construction, impacts for the Road and water pipeline Alternative 2 are lower than that of Road and water pipeline Alternative 1. Impacts for Power line Alternative 1 are lower than Power Line Alternative 2.
- During operations impacts for both the Road and water pipeline Alternative 1 and 2 are the same. During operations, impacts for Power line Alternative 1 are lower than the impacts of Power line Alternative 2.
- Decommissioning impacts are the same for all site alternatives and should be refined based on the preferred alternatives.

Table 30: Comparison assessment of CSP site alternatives during the construction, operations and decommissioning phases

Construction					Operations					Decommissioning				
	CSP Alt_1 WOM	CSP Alt_1 WM	CSP Alt_2 WOM	CSP Alt_2 WM		CSP Alt_1 WOM	CSP Alt_2 WM	CSP Alt_1 WOM	CSP Alt_2 WM		CSP Alt_1 WOM	CSP Alt_2 WM	CSP Alt_1 WOM	CSP Alt_2 WM
Fauna & Flora	-14.0	-11.3	-14.0	-11.3	**Avifauna**	-17.0	-13.3	-18.0	-14.7	**Visual**	-16.0	-15.0	-16.0	-15.0
Avifauna	-17.0	-15.0	-19.0	-18.0	**Visual**	-19.0	-19.0	-20.0	-20.0	**Air Quality**	-15.0	-14.0	-15.0	-14.0
Hydrogeology	-13.5	-11.5	-13.5	-11.5	**Noise**	-5.0	-5.0	-5.0	-5.0	**Waste**	-16.0	-8.0	-16.0	-8.0
Visual	-16.0	-15.0	-16.0	-15.0	**Air Quality**	-10.0	-10.0	-10.0	-10.0	**Average**	**-15.7**	**-12.3**	**-15.7**	**-12.3**
Noise	-5.0	-5.0	-5.0	-5.0	**Waste**	-15.4	-10.2	-15.4	-10.2					
Socio-Eco	-15.7	-13	-15.7	-13	**Average**	**-13.3**	**-11.5**	**-13.7**	**-12**					
Air Quality	-15.0	-14.0	-15.0	-14.0				**-**						
Waste	-15.0	-6.0	-15.0	-6.0										
Average	**-13.9**	**-11.4**	**-14.2**	**-11.7**										

Table 31: Comparison assessment of road, water pipeline and power line alternatives during the construction, operations and decommissioning phases

Construction												
	Road Alt_1		Road Alt_2		Water Pipeline Alt_1		Water Pipeline Alt_2		Power Line Alt_1		Power Line Alt_2	
	WOM	WM	WOM	WM	WOM	WM	WOM	WM	WOM	WM	WOM	WM
Fauna & Flora	-14.0	-11.3	-14.0	-11.3	-14.0	-11.3	-14.0	-11.3	-14.0	-11.3	-14.0	-11.3
Avifauna	-19.0	-18.0	-16.0	-15.0	-19.0	-18.0	-16.0	-15.0	-17.0	-15.0	-19.0	-18.0
Surface Water	-15.0	-12.0	-16.0	-14.0	-15.0	-12.0	-16.0	-14.0				
Aquatic Ecology	-15.3	-8.0	-15.3	-8.0	-15.3	-8.0	-15.3	-8.0				
Noise	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0
Socio-Eco	-13.5	-10.5	-13.5	-10.5	-13.5	-10.5	-13.5	-10.5	-13.5	-10.5	-13.5	-10.5
Average	**-13.6**	**-10.8**	**-13.3**	**-10.6**	**-13.6**	**-10.8**	**-13.3**	**-10.6**	**-12.4**	**-10.5**	**-12.9**	**-11.2**
Operations												
	Road Alt_1		**Road Alt_2**		**Water Pipeline Alt_1**		**Water Pipeline Alt_2**		**Power Line Alt_1**		**Power Line Alt_2**	
	WOM	**WM**	**WOM**	**WM**	**WOM**	**WM**	**WOM**	**WM**	**WOM**	**WM**	**WOM**	**WM**
Avifauna									-16.0	-15.0	-16.0	-16.0
Surface Water	-14.0	-11.0	-14.0	-11.0	-14.0	-11.0	-14.0	-11.0				
Aquatic Ecology	-16.3	-7.3	-16.3	-7.3	-16.3	-7.3	-16.3	-7.3				
Noise	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0
Average	**-11.8**	**-7.8**	**-11.8**	**-7.8**	**-11.8**	**-7.8**	**-11.8**	**-7.8**	**-18.5**	**-17.5**	**-18.5**	**-18.5**
Decommissioning												
	Road Alt_1		**Road Alt_2**		**Water Pipeline Alt_1**		**Water Pipeline Alt_2**					
	WOM	**WM**	**WOM**	**WM**	**WOM**	**WM**	**WOM**	**WM**				
Surface Water	-15.0	-14.0			-15.0	-14.0						
Aquatic Ecology	-16.3	-8.0	-16.3	-8.0	-16.3	-8.0	-16.3	-8.0				
Average	**-15.6**	**-11.0**	**-16.3**	**-8.0**	**-15.6**	**-11.0**	**-16.3**	**-8.0**				

9.4.1 Site Alternative Preference

The preference of a site alternative was made based on the impact assessment included above as well as the findings of the specialist assessments:

9.4.1.1 Fauna and Flora

The Parabolic Trough Site Alternative 1 is situated within the northern portions of the site mainly within Open Shrub Plains or Kalahari Karroid Shrubland (NKb5) with a small section of Gordonia Duneveld (SVkd1). There is no preference from a vegetation perspective as the vegetation within both site are relatively homogenous with protected tree species occurring in both sites and both vegetation units been listed as 'Least-threatened'. The vegetation units are both classified as medium conservation status. Both the CSP sites offers suitable habitat for certain Red listed faunal species.

The Parabolic trough Site Alternative 1 however is situated within the northern portions of the site so additional access roads, pipelines as well as power lines will be required. For this reason, Parabolic trough Site Alternative 2 is preferred due to shorter distances for the linear infrastructure on the site as well as proposed power lines to the adjacent Garona substation. Additional roads will result in further increased road fatalities and power line collisions (birds).

The Road and pipeline Alternative 1 runs along the northern boundary and bisects Gordonia Duneveld with low-lying rocky outcrops. The Road and pipeline Alternative 2 bisects the site including non-perennial drainage lines and runs adjacent to the southern boundary of the site. Both the alternatives are preferred with a slight preference for Road and pipeline Alternative 2 as it does not bisect the low-lying rocky areas on the northern boundary and is situated adjacent to existing access roads and railway line to the south.

The Water pipeline Alternative 1 alignment bisects natural arid shrubland as well as non-perennial drainage lines. The Water pipeline Alternative 2 is preferred as it bisects a narrower section of the riparian zone as well as running adjacent to transformed agricultural lands.

Power line Alternative 1 runs on the southern boundary of the site. Power line Alternative 2 runs of the northern boundary as well as bisecting Gordonia Duneveld towards the Garona substation. Alternative 1 is preferred as it is shorter and situated adjacent to existing access roads and railway line to the south. The alternative also runs parallel to the preferred road and pipeline alignments.

9.4.1.2 Avifauna

In the case of the plant, the displacement impact due to disturbance during construction is rated as high - negative to start with, and could be reduced to medium to high after application of mitigation measures, provided Parabolic trough Site Alternative 1 is used. If Site Alternative 2 is used, the impact will remain high, primarily due to the potential impact on the breeding pair of Martial Eagles on tower 22 of the Garona – Gordonia 132 kV line. In the case of habitat transformation during operation, the displacement impact on priority species is high – negative and will remain as such after the application of mitigation measures. The impact of direct mortality of priority species due to collisions with the parabolic troughs is likely to be medium to high, and will remain so despite mitigation.

In the case of the proposed pipeline and access road, the impact of disturbance during construction will be high if Road and pipeline Alternative 1 is used, primarily due to the potential impact on the breeding pair of Martial Eagles on tower 22 of the Garona – Gordonia 132 kV line, despite mitigation. If Road and pipeline Alternative 2 is used, the impact will be medium to high.

The proposed 132 kV circuit grid connection will have a high negative collision impact on avifauna during operation which could be reduced to medium to high through the application of anti-collision mitigation measures. The impact of displacement caused by the construction of the power line will be high negative if Power line Alternative 2 is used, but it could be reduced to medium to high if Power line Alternative 1 is used, with appropriate mitigation.

9.4.1.3 Hydrogeology

From a hydrogeological perspective there is no preference for Parabolic trough Site Alternative 1 or 2. Both site alternatives will have similar impacts. The potential impacts associated with the proposed development on the groundwater environment include potential contamination due to accidental spillage and the storage of heat transfer fluid which is a synthetic oil, hydrocarbon contamination arising from spills or leaks from heavy machinery used during the construction phase and contamination from spills or leaks of hazardous products stored on site. In order to manage the risks identified, it is proposed that a groundwater monitoring plan is implemented on site and the three boreholes, namely BH4, BH5 and BH7 are sampled on an annual basis.

9.4.1.4 Surface Water

The physical characteristics of the Sand Draai development site entail that surface water features are restricted to the south-western part of the site. This has implications for the potential impact of the solar power plant on surface water as none of the power generation components will be located in parts of the site in which surface water is located.

The associated linear infrastructure (road and pipeline) is located within the south-western part of the site in which surface water features are located and a number of surface water crossings would occur. The most important potential impact would be the loss of riparian habitat (vegetation) within a reach of the Orange River riparian corridor due a section of the road and pipeline being aligned within it. This impact would be of high significance as the riparian corridor forms part of the Endangered Lower Gariep Alluvial Vegetation Ecosystem, and this reach of the riparian corridor has already been impacted by clearing of riparian vegetation for the establishment of orchards. One of the key recommendations of this study is that the road and pipeline be realigned to run outside of the riparian corridor, thus avoiding the physical disturbance of the Orange River riparian corridor.

A number of smaller ephemeral / episodic watercourses are crossed by the two road and pipeline alternatives. These crossings could exert a localised impact on the affected reaches of the watercourses, especially as the affected reaches are largely in a natural state. Road and pipeline Alternative 1 is marginally preferred, as it would run for a portion of its length in parallel to a farm track, thus the surface water crossings are already subject to a slightly greater impact than Road and pipeline Alternative 2. In addition the largest of the smaller watercourses with a more developed riparian corridor is located along Road and pipeline Alternative 2, and by avoiding the crossing of this watercourse the intensity and overall impact of the road and pipeline-related impact would be lessened.

9.4.1.5 Aquatic Ecology

It is recommended that any pump housing infrastructure be sited outside of the riparian zones of the Orange River. The proposed development will not have any significant impacts to any further watercourses, other than the Orange River, barring some erosion control measures are put into place where watercourses are to be impacted. The surface water quality throughout the survey area is considered good, with the aquatic system supporting a diversity of sensitive aquatic macro-invertebrate taxa. It is therefore imperative that the contamination of the surface waters through deleterious effluents and run-off water be avoided.

9.4.1.6 Socio-economic

The preferred routing for both powerline and pipeline alternatives are presented by Alternative 1. These routings is likely to cover less distance and range. While the area in general is uninhabited and unused for agricultural or social activities, the shorter the route distance, the least likely there will be disruptions to human activities. The expectation is that the N10 and N8 roads would be more widely used (particularly during the construction period) as opposed to any of the farm roads (located on the east bank of the Orange River). The road currently utilised stretches between the site and the N14. While it may be a somewhat shorter route, the impact on current farming activities along the east bank of the Orange River is that which may affect the current human activities on neighbouring farms. For this reason, the preferred routing remains on the opposite side of the Orange River (N10).

There are a few negative impacts that seem acute during the construction phase, but after mitigation all impacts initially regarded as 'high' downgrade into a medium-high. Ideally, these impacts should progress into a 'low-medium.' This includes impacts related to inconvenience and danger to proximate residents through increased road traffic, dust and noise, including the development of new access roads through the development site; impact on Gariep Road users and neighbours and impact on farm values.

Positive impacts that remain high (during the operation phase) include the potential increase in local gross geographic figures. The increase in local job creation activities and an increase in South Africa's power producing independence. Engagement exercises with local stakeholders show their apprehension about the fact that mitigation for the project's negative impacts will indeed be achieved. This perception has resulted from the recent CSP development taking place on the neighbouring Bokpoort farm. Many of the negative impacts experienced due to the current CSP plant in the area, has raised stakeholder's awareness to the potential increase in disruptions and inconveniences to the once-quiet farm life. While many negative impacts can be mitigated, it will require a commitment from the Project Proponent and Site Management to properly and consistently meet with EMPr compliance requirements. Much of the mitigation found within this report will be amalgamated with the EMPr for implementation during the project's construction phase.

9.4.1.7 Visual

Two alternative sites have been provided for the parabolic trough component. Parabolic trough Site Alternative 1 is situated further from the Orange River valley than Parabolic trough Site Alternative 2, and thus is located further from the bulk of the receptors in the study area, located in the Orange River valley. The analysis of the respective viewsheds of each of the alternative sites has revealed that Site Alternative 1 will not be visible for the vast majority of receptor locations. Although Site Alternative 2 has been assessed to be associated with a low degree of visual intrusion, the non-visibility of Site Alternative 1 means that this site is strongly preferred as it would not be associated with any degree of visual impact for the majority of the study area.

9.4.1.8 Noise

During the Noise Impact assessment, the findings were based on, the locality to existing infrastructure and focused on the minimisation of unnecessary, avoidable, long access roads, water pipelines and power lines. The sensitive area indicated in the area of Parabolic trough Site Alternative 2 is a man made structure (water holding dam – from a wind pump). These structures can be moved and positioned at a location so that birds are located away from the solar technology. In stating that Parabolic trough Site Alternative 2 is preferred, Parabolic trough Site Alternative 1 is also acceptable, although the long access road could pose some nuisance to the local farming community in the region.

The largest impact is during the construction phase of the project with the noise extending far beyond the Sand Draai boundary. The closest receptor indicates that there is no affect on the noise level experienced

during the life cycle of the planned solar technology. Although the modelled scenarios tend to represent the typical activities at the site, some upset conditions might arise during the life cycle of the planned technology. However, upset conditions are generally small and can be minimised by appropriate mitigation measures, including the use of best available abatement technologies.

9.4.1.9 Air Quality

The Air Quality Impact assessment found that based on the predicted model results and from the general condition of the area, there is very little difference between the Parabolic trough site alternatives with regards to the location of the auxiliary boilers, and therefore no site preference is provided. In terms of the cumulative impacts raised by I&APs, due to the distances travelled and the condition of local unpaved roads, the Gariep Road is not considered to be a suitable alternative, due to the potential for dust generation. The N8 and the alternative access route to site will need to be managed to mitigate dust. An assessment into costs for the paving of the route should also be investigated as a possible option for future works.

9.4.1.10 Waste

From a waste perspective there is no preference for Parabolic trough Site Alternatives 1 or 2. Both site alternatives will have similar impacts. It is recommended that the monitoring, analysis and reporting for the various process and effluent streams continue so that there is an adequate database of objective information to fully comprehend the impact of the proposed development.

9.4.1.11 Traffic

The proposed CSP plant once fully operational is expected to generate additional volumes of traffic on the surrounding road network. Whilst there will be an increase in traffic flows along these roads, the road network can easily accommodate the increased traffic flows due to the low existing volumes of traffic that utilise the road network. As observed during the site visit, the surrounding road network is operating at well below its capacity and at a good level of service. Therefore, the additional volume of traffic that will be imposed onto the road network as a direct result of this project will not cause the current operating conditions to deteriorate as there is sufficient spare capacity to handle the envisaged volumes of traffic.

The increase in light and heavy vehicles generated by the proposed project travelling along the local and regional road network will have minimal impact on the existing road safety conditions for all road users as the generated traffic will travel on roads that are very lightly trafficked from a vehicle and pedestrian perspective.
This project is expected to generate a fair volume of heavy vehicle traffic during the construction phase. This heavy vehicle traffic is unlikely to have any significant impact on the N10 and N8 as these roads are national freeways that have been built to a high structural standard to convey large volumes of heavy vehicle traffic. Therefore, these roads will not sustain any long term damage by the heavy vehicles. The two gravel roads on the other hand have not been designed to convey large volumes of heavy traffic over a lengthy period of time. Therefore, it is quite possible that these gravel roads will sustain damage during the construction period.

The operational phase of this project will not generate any heavy vehicle traffic as there will be no inputs and outputs for this proposed plant that will be transported by road during the operational phase. The only traffic that will be generated by the plant during the operational phase will be the trips made by employees travelling to and from the site.

It is recommended that the existing gravel roads are re-bladed on a regular basis to ensure that this road remains operational and maintains an acceptable level of safety for the duration of the project. Furthermore, to reduce the dust that will be generated on the gravel roads it is recommended that these roads are watered down on a regular basis.

The access route to the plant site will consist of 3 distinct sections from the N8 turn-off into the Gariep road:

- the stretch of Gariep Road extending from the N8 to the end of the Transnet bridge (Section 1);
- the stretch of Gariep Road extending from the end of the Transnet bridge to the Sand Draai road entry point (Section 2); and
- a new road to be constructed through the Sand Draai farm (Section 3).

Section 1 is the same route that was used by the Bokpoort CSP project during its construction phase and will continue to be used by Bokpoort CSP through the 20-year operation phase. The Applicant is of the view that the current gravel surface of Section 1 is not suitable for the construction and operation requirement of the project. The Applicant understands that Bokpoort CSP will consider implementing measures in the short-term that may improve the quality of Section 1.

In addition to Bokpoort CSP, multiple other project developers are actively pursuing solar power and potentially other large-scale infrastructure developments in the vicinity of the project and for their purposes will be traversing Section 1 as well. A coordinated approach will therefore be required to ensure that any short-term and/or permanent solutions that will be implemented on Section 1 will be suitable for the planned infrastructure as well as other stakeholders including Eskom, Transnet, the Department of Roads and Public Works, local farmers, and citizens that regularly travel this route. The Applicant will engage with all stakeholders towards identifying feasible solutions that are suitable to all stakeholder groups. Certain improvements may require the commitment of all stakeholders; in these cases the entire burden cannot reasonably be undertaken by the Applicant on it's own.

The Applicant is aware of, and will continue to participate in, a Basic Assessment process being undertaken by Environmental Impact Management Services to assess the need for improvement of Section 1 and make recommendations towards the most appropriate and necessary measures that will be required for the road.

Section 2 will receive the same treatment as Section 1.

Section 3 represents a new private road that will be constructed for the sole purpose of access to the plant across the Sand Draai farm. This road will be constructed according to a specification that will be developed by the EPC contractor as adequate for construction and long-term operational purposes.

10 ENVIRONMENTAL IMPACT STATEMENT

The results of the impact assessment indicate that the most significant impacts as a result of the proposed project would include impacts on air quality, aquatic ecology, avifauna, ecology, hydrogeology, socio-economic, surface water, noise, waste and visual environment. These impacts can be successfully mitigated through the measures and recommendations presented in this study (Sections 9.2 and 9.3) and the Environmental Management Programme – EMPr (**Appendix G**).

Based on the comparative assessment of the two site alternatives, **Parabolic trough Site Alternative 1** is preferred over Parabolic trough Site Alternative 2. The **Road and pipeline Alternative 2 (southern corridor)** and **Power line Alternative 1 (southern corridor)** are also preferred. The EAP therefore, based on the findings of this EIA study, recommends that the above be authorised and an Integrated Environmental Authorisation be granted for the development of a CSP Plant using parabolic trough technology on the farm Sand Draai 391.

10.1 Conditions

In order to achieve appropriate environmental management standards and ensure that the findings of the environmental studies are implemented through practical measures, the recommendations from this EIA study are included within an EMPr. The EMPr would be used to ensure compliance with environmental specifications and management measures.

The implementation of this EMPr for the entire life-cycle (i.e. construction, operation and decommissioning) of the project is considered to be vital in achieving the appropriate environmental management standards as detailed for this project.

In addition, it is recommended that the following key conditions should be included as part of the authorisation:

a) The proponent is not negated from complying with any other statutory requirements that is applicable to the undertaking of the activity. Relevant key legislation that must be complied with by the proponent includes inter alia:
   - Provisions of the National Water Act, 1998 (No. 36 of 1998).
   - Provision of the National Heritage Resources Act, 1999 (No. 25 of 1999).

b) The proponent must appoint a suitably experienced (independent) Environmental Control Officer (ECO) for the construction phase of the development that will have the responsibility to ensure that the mitigation / rehabilitation measures and recommendations are implemented and to ensure compliance with the provisions of the EMPr.

c) A protected trees and plant survey must be conducted prior to construction. Results of this survey will guide permitting requirements for the removal of protected trees from the selected property.

d) It is therefore proposed that a bat specialist is appointed to do a site visit (walk-through) prior to construction. If bat roosts are found, construction activities in that area will halt until a suitable mitigation has been discussed with a bat specialist and agreed upon by the Proponent. Mitigation measures for bat impacts are incorporated in the EMPr.

e) Mitigation measures which will be implemented during the operational phase of the CSP includes those that has been identified in the EMPr.

10.2 Assumptions, Uncertainties or Gaps in Knowledge

- All information provided by Solafrica (Pty) Ltd to the EAP was correct and valid at the time it was provided.
- All data from unpublished research is valid and accurate; and
- The images represented in the visual assessment are significantly reduced in scale and therefore likely "underplay" the likely actual appearance and resultant visual impact of the CSP plant.

10.3 Undertaking by EAP

The EAP hereby confirms that:

i. All information presented in this report is correct and valid. Information provided by the Client and external consultant team is considered valid and accurate.
ii. The comments and inputs from stakeholders and I&APs have been incorporated into the study.
iii. The input and recommendations from specialist reports have been incorporated into the report and the EMPr.
iv. Information provided to I&APs and responses by the EAP are captured in **Appendix E** – Public Participation Documents.

An EAP Declaration is included in **Appendix B**.

Royal HaskoningDHV

Enhancing Society Together