DRAFT BASIC ASSESSMENT REPORT

PROPOSED ACWA POWER SOLARRESERVE REDSTONE SOLAR PHOTOVOLTAIC POWER PLANT ON THE REMAINING EXTENT OF THE FARM NO. 469, HAY REGISTRIATION DIVISION IN THE NORTHERN CAPE PROVINCE

Prepared for ACWA Power SolarReserve Redstone Solar Thermal Power Plant RF (Pty) Ltd

DEA File Reference Number:

May 2018

DOCUMENT NAME	Draft Basic Assessment Report
APPLICANT	ACWA Power SolarReserve Redstone Solar Thermal Power Plant RF (Pty) Ltd
PROJECT NAME	The proposed ACWA Power SolarReserve Redstone Solar Photovoltaic Power Plant on the Remaining Extent of the Farm NO. 469, Hay Registration Division in the Northern Cape Province
EAP ORGANISATION	Environmental Management Assistance (Pty) Ltd.
DEA FILE REF NO.	
LOCATION	Tsantsabane Local Municipality, Northern Cape Province

COMPILED BY: Taryn Bigwood (Pri. Sci. Nat)

SIGNATURE: _____

OPPORTUNITY FOR REVIEW

The Draft Basic Assessment Report and Draft Environmental Management Programme (EMPr) are made available to all Interested and Affected Parties (I&APs) and stakeholders for a 30 - day review period extending from the 4th of May 2018 to the 5th of June 2018. All comments received during the review of the Draft Basic Assessment Report will be incorporated into the Final Basic Assessment Report and EMPr which will be submitted to the Department of Environmental Affairs (DEA) for decision-making.

All comments on the Draft Basic Assessment Report and Draft EMPr are to be submitted to Environmental Management Assistance (Pty) Ltd, for the attention of Taryn Bigwood. Detail provided below:

EAP – Taryn Bigwood (declaration Appendix 1)

Environmental Management Assistance (Pty) ltd.

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LIST OF ABBREVIATIONS & ACRONYMS

ARC-ISCW	Agricultural Research Council - Institute for Soil, Climate and Water
ARI	Acute Respiratory Infections
BID	Background Information Document
CAGR	Compounded Annual Growth Rate
CAR	Co-ordinated Avifaunal Road-count
COPD	Chronic Obstructive Pulmonary Disease
CSP	Concentrated Solar Power
CWAC	Co-ordinated Waterbird Count
DEA	Department of Environmental Affairs
DNI	Direct Normal Irradiance
DTEEA	Department of Economic Development, Tourism and Environmental Affairs
DMR	Department of Mineral Resources
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
EC	Electrical Conductivity
ECO	Environmental Control Officer
EDI	Electro-deionization
EHS	Environmental, Health and Safety
EIA	Environmental Impact Assessment
EIR	Environmental Impact Report
EMPr	Environmental Management Programme Report
EP	Environmental Practitioner
ERM	Environmental Resources Management
GDP	Gross Domestic Product
GHG	Green House Gas
GN	Government Notice
GRU	Groundwater Resource Units

I&APs	Interested & Affected Parties
IDP	Integrated Development Plan
IPP	Independent Power Producer
LED	Local Economic Development Strategy
MPRDA	Mineral and Petroleum Resources Development Act, 2002 (Act 28 of 2002)
NEMA	National Environmental Management Act, 1998 (Act 107 of 1998)
NEMAQA	National Environmental Management Air Quality Act, 2004 (Act 39 of 2004)
NEMWA	National Environmental Management Waste Act, 2008 (Act 59 of 2008)
NERSA	National Energy Regulator of South Africa
NGOs	Nongovernmental Organizations
NGDB	National Groundwater Database
NWA	National Water Act, 1998 (Act 36 of 1998)
PPP	Public Participation Process
PV	Photovoltaic
QDGS	Quarter Degree Square
RO	Reverse Osmosis
SAHRA	South African Heritage Resources Agency
SANBI	South African Biodiversity Institute
SANS	South African National Standards
SDF	Spatial Development Framework
ToR	Terms of Reference
SHE Manager	Safety, Health and the Environmental Manager (from the Sasol Mining Environmental Division)
WML	Waste Management Licence

LIST OF DEFINITIONS

Alternative:

A possible course of action, in place of another, that would meet the same purpose and need (of the proposal). Alternatives can refer to any of the following but are not limited to: alternative sites for development, alternative projects for a particular site, alternative site layouts, alternative designs, alternative processes and alternative materials.

Cumulative Impacts:

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

Direct impacts:

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

'Do nothing' alternative:

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

Environment:

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

- the land, water and atmosphere of the earth;
- micro-organisms, plant and animal life;
- any part or combination of (i) and (ii) and the interrelationships among and between them; and
- the physical, chemical, aesthetic and cultural properties and conditions of the foregoing that influence human health and well-being. This includes the economic, social, cultural, historical and political circumstances, conditions and objects that affect the existence and development of an individual, organism or group.

Environmental Assessment:

The generic term for all forms of environmental assessment for projects, plans, programmes or policies. This includes methods/tools such as environmental impact assessment, strategic environmental assessment, sustainability assessment and risk assessment

Impact:

The positive or negative effects on human well-being and / or on the environment. Environmental

Management:

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

Environmental Management Programme:

An operational programme that organizes and coordinates mitigation, rehabilitation and monitoring measures in order to guide the implementation of a proposal and its on-going maintenance after implementation.

Indirect impacts:

Indirect or induced changes that may occur as a result of the activity (e.g. the reduction of water in a stream that supplies water to a reservoir that supplies water to that 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.

Interested and Affected Parties (I&APs):

Individuals, communities or groups, other than the proponent or the authorities, whose interests may be positively or negatively affected by the proposal or activity and/or who are concerned with a proposal or activity and its consequences.

Lead Authority:

The environmental authority at the national, provincial or local level entrusted in terms of legislation, with the responsibility for granting approval to a proposal or allocating resources and for directing or coordinating the assessment of a proposal that affects a number of authorities.

Mitigate:

The implementation of practical measures to reduce adverse impacts or enhance beneficial impacts of an action.

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.

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 judgments and science-based criteria (i.e. biophysical, social and economic).

Stakeholder engagement:

The process of engagement between stakeholders (the proponent/applicant, authorities and I&APs) during the planning, assessment, implementation and/or management of proposals or activities.

EXECUTIVE SUMMARY

The ACWA Power SolarReserve Redstone Solar Thermal Power Plant RF (Pty) Ltd, the Applicant, proposes the development, construction and operation of the ACWA Power SolarReserve Redstone Solar Photovoltaic Power Plant (the "PV Power Project") on The Remaining Extent of The Farm No. 469, Hay Registration Division in The Northern Cape Province ("Project Site"). ACWA Power SolarReserve Redstone Solar Thermal Power Plant RF (Pty) Ltd, (the Applicant), has received an environmental authorisation to construct and operate a Concentrated Solar Power Plant (CSP) on the Remaining Extent of the Farm No. 469 the Hay Registration Division (the "Project Site"), called the ACWA Power SolarReserve Redstone Solar Thermal Power Plant (Redstone CSP Project) (authorised by the Department of Environmental Affairs, DEA reference number 12/12/20/2316). The PV Power Project will be used to supply the auxiliary power load requirements of the Redstone CSP Project. The PV Power Project will have a generation capacity of up to 20 MW Peak (DC) which is a design capacity of ~15MWAC, with up to 30MWhours of battery storage, on the Remaining Extent of the Farm 469, Hay District. The planned PV Power Project will be located approximately 30 km east of the town Postmasburg in the Northern Cape Province, adjacent to the Redstone CSP Project.

The PV power Project EA is required by the Redstone CSP project in order to reach financial close. The Redstone CSP project signed the Power Purchase Agreement on 4 April 2018 and financial close as stipulated by the Department of Energy is to be reached by 15 July 2018.

The Project Site is located within the governing boundaries of the Tsantsabane Local Municipality and the ZF Mgcawu District Municipality. The PV Power Project is designed to allow the Redstone CSP Project to generate renewable green energy for self-consumption in order to operate and run the auxiliary load requirements of the Redstone CSP Project.

The Basic Assessment was conducted on previously assessed areas for the CSP Power Project and the following specialist studies were updated:

- Heritage
- Biodiversity
- Wetlands
- Hydrology
- Avifauna
- Visual
- Socio Economic

The Draft Report together with all specialist Reports we be placed in the public domain for a period of 30 days, through public consultation with the following stakeholders will take place:

- Landowners
- Provincial Authorities
- Neighbours (farmers and local communities)
- Ward Councillors

- Any interested parties

The Applicant has appointed an independent environmental consultant, Environmental Management Assistance (Pty) Ltd, to conduct the Environmental Impact Assessment (Basic Assessment Process), from hereunto referred to as EMA, for the proposed PV Power Project PV Power Project. The Environmental Management Programme (EMPr) is included in this report (Part 2) as a requirement in terms of National Environmental Management Act of 1998 (Act No. 107of 1998) NEMA Regulation GN.R 982 of 2014 as amended in 2017. A Basic Assessment (BA) application, is to be lodged with the Department of Environmental Affairs (DEA) in terms of NEMA and the EIA Regulations (GN.R 982, 983, 984 and 985) as promulgated in 2014 and amended in 2017.

The Specialists findings were as follows:

- Heritage: The HIA completed in 2011 (PGS) had shown that the area between Postmasburg and Daniëlskuil generally referred to as the Ghaap plato has a rich history of occupation from the Stone Age with hunter gatherers to the Thlaping and Thlaro during the Iron Age period. The 1800's saw the rise of the Griqua people in the area and their loss of sovereignty after 1880 to Cape rule. The field work of 2011 identified a total of 25 heritage sites of which none are impacted by the proposed additional PV options of this application. The overall impact of the development on heritage resources is seen as acceptably low and can impacts can be mitigated to acceptable levels.
- Biodiversity: Based on available information and a brief evaluation of the proposed spatial arrangements, neither of the options are expected to cause severe and unacceptable impacts within the biological receiving environment, with the understanding and assumption that the applied mitigation strategy incorporate all recommendation presented in this as well as the principal ecological reports. Specifically, the exacerbation of cumulative impacts is expected to be minor as the proposed PV Power Project will constitute a fairly insubstantial portion of the Redstone CSP Project. Based on results and recommendations presented in this ecological impact statement, we regard the project as acceptable.
- Wetlands: The proposed PV Power Project will be located outside the delineated riparian habitat on site and will not result in any direct impact to riparian areas or associated watercourses. Indirect impacts to watercourses could result as a consequence of changes in runoff volume, velocity and quality from the development footprint. Mitigation measures proposed are to be implemented.
- Hydrology: The hydrological impacts associated with the development of the PV Power Project are medium to low without mitigation. When including mitigation, these impacts are reduced to low for all assessed areas. Since mitigation of impacts is possible, either of the two options are

suitable based on this hydrological desktop study, bearing in mind the exclusion zone associated with the intersecting non-perennial watercourse.

- Avifauna: Based on a thorough desk based study and a site visit by the avifaunal specialist, it can be concluded that the proposed Redstone PV project site has a low sensitivity in terms of avifauna. While some key red-listed species have been recorded in the area, e.g. the Critically Endangered White-backed Vulture and the Endangered Martial Eagle, it is unlikely that these (or many of the potentially present Red Data species) would be negatively impacted upon by the proposed PV project. Species of more concern are those likely to be displaced or suffer collision from PV panels or fences, such as Korhaans, coursers, francolins and various passerines. Although a relatively diverse number of species and a high number of Red Data species were found to be potentially present after examining the SABAP data, many of these species were not recorded by monitoring, and many are unlikely to occur on the project site due to unsuitable habitat. In most cases the frequency of records and the activity (especially flight activity) of priority species and Red Data species was low.

  Commercial scale solar farms are relatively new in South Africa and little information therefore exists on the potential impacts of these technologies on South African avifauna, but what is generally known and accepted is that PV technologies are likely to have the lowest negative effect. The Impact Assessment showed that after the application of mitigation measures, all residual impacts of the PV plant were rated as Low significance.

  Cumulatively, (i.e. considering all large scale solar projects within a 50 km radius) these impacts are likely to have a moderate significance rating. If all the recommendations and mitigations in this report are implemented as well as those given by the specialists for the other projects considered (in the cumulative assessment), then the cumulative impacts on avifauna are likely to be considered acceptable.

  Generally the impacts are not viewed as being of an extent or significance so as to preclude development, and the project may proceed subject to all recommendations (including operational phase monitoring) and proposed mitigations in this report being implemented.

- Visual: The PV Project will have a minor cumulative impact on the visual and aesthetic environment and that the specialist assessments conducted for the original application (NLA 2011) and subsequent Addendum (NLA 2015) are still valid. No additional mitigation measures to those recommended in the original report are required for the current PV Project. It is the opinion of the author that all aspects of the PV Project, from a potential visual impact perspective, should be approved provided that the mitigation/management

measures are effectively implemented, managed and monitored in the long term.

- Socio-Economic: The proposed project will be located on the same farm portions as Redstone CSP Project, which has already received environmental authorisation under the NEMA 107 of 1998 by the DEA Ref. Nr 12/12/20/2316 (AM7). Since the Google Imagery suggests that the changes in activities and land uses on the respective farm portions and in the area surrounding only included the establishment of two Solar PV facilities south-west, south and south-east of the site, the socio-economic impacts exerted by the PV Power Project will not be greater or equal to those identified and analysed for Redstone CSP Project in 2011. In many instances some of these impacts will not change since the proposed facility will be significantly smaller than Redstone CSP Project and will be sharing the workforce and on-site services with it.

  As a result, the review of socio-economic impacts that are expected to ensue from the proposed PV Power Project revealed that the project will not lead to any negative impacts and will not notably change the positive effects that have previously been identified for Redstone CSP Project. Importantly, no meaningful and important cumulative effects are expected to ensue, and no residual risks have been identified to be associated with the proposed activity. Furthermore, the six potential socio-economic impacts identified to be relevant to the proposed project are positive in nature. Therefore, it can be concluded that from a socio-economic perspective the proposed PV Power Project should be considered for authorisation.

It is in the considered opinion of the EAP that the basic assessment was conducted according to all legal requirements and the findings suggest that an EA should be awarded.

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1 PART A: DETAILS OF THE INSTITUTIONAL ARRANGEMENTS

1.1 PRACTITIONER, SPECIALISTS AND PROPONENT

1.1.1. Name and contact details of EAP's organisation

Table 1: Contact details of EAP's organisation

Contact details of the EAP's organisation	
Business name:	Environmental Management Assistance (Pty) ltd.
Postal address:	PO Box 386, Sundra, 2200
Fax:	086 226 7324
Cell:	076 398 2391
E-mail:	taryn.bigwood@emassistance.co.za

Environmental Management Assistance (Pty) Ltd (EMA) has appointed Ms Taryn Bigwood as a registered Professional Environmental Scientist: SACNASP 116865 and a registered associate of Landscape and Rehabilitation Society of South Africa: 0663 to be the lead EAP on this project. A detailed portfolio of the team members associated to the management of this project can be found as ***Appendix 1***. .

Table 2: Names, details and expertise of EAP

Names of EAP	Education Qualifications	Professional affiliations	Relevant experience (years)
Taryn Bigwood	M. Geography	LaRSSA	15

1.1.2. Names and expertise of specialists

Table 3: Names and details of expertise of each specialist that has contributed to the report

Name of Specialist	Title of specialist report/ s as attached in Appendix D.	Company
Wouter Fourie	Heritage Impact Assessment	PGS Heritage
Andrew Pearson (Pri.Sci.Nat)	Avifauna Assessment	Arcus Consultancy Services South Africa (Pty) Limited
Riaan Bathusi	Wetland and Biodiversity Assessment	Bathusi Environmental

		Consulting
Luke Wills	Hydrological Assessment	Highlands Hydrology (Pty) Ltd
Marianne Strohbach	Terrestrial Ecological Walk through assessment	Vegetation Research and Eco-consulting
Graham A Young	Visual Impact Assessment	Newtown Landscape Architects cc
Elena Broughton	Socio Economic Assessment	Urban-Econ cc

1.1.3. Contact details of proponent

Table 4: Contact details of the proponent

Contact details of the proponent	
Contact person:	Krishnan Moonsamy (Terence) Govender
Business name:	ACWA Power SolarReserve Redstone Solar Thermal Power Plant RF (Pty) Ltd
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2 PART B: ACTIVITY INFORMATION

2.1 ACTIVITY BACKRGOUND

The ACWA Power SolarReserve Redstone Solar Thermal Power Plant RF (Pty) Ltd, the Applicant, proposes the development, construction and operation of the ACWA Power SolarReserve Redstone Solar Photovoltaic Power Plant (the "PV Power Project") on the Remaining Extent of the Farm No. 469, Hay Registration Division in the Northern Cape Province ("Project Site"). ACWA Power SolarReserve Redstone Solar Thermal Power Plant RF (Pty) Ltd, (the Applicant), has received an environmental authorization to construct and operate a Concentrated Solar Power Plant (CSP) on the Remaining Extent of the Farm No. 469 the Hay Registration Division (the "Project Site"), called the ACWA Power SolarReserve Redstone Solar Thermal Power Plant (Redstone CSP Project) (authorised by the Department of Environmental Affairs, DEA reference number 12/12/20/2316). The PV Power Project will be used to supply the auxiliary power load requirements of the Redstone CSP Project.

The PV Power Project will have a generation capacity of up to 20 MW Peak (DC) which is a design capacity of ~15MWAC, with up to 30MWhours of battery storage, on the Remaining Extent of the Farm 469, Hay District. The planned PV Power Project will be located approximately 30 km east of the town Postmasburg in the Northern Cape Province, adjacent to the Redstone CSP Project. For avoidance of doubt, the PV power Project is to supply the auxiliary load power requirements for the Redstone CSP Project.

2.2 PURPOSE OF THE BASIC ASSESSMENT REPORT

The main purpose of this report is to:

- Determine the policy and legislative context within which the activity is located and how the activity complies with and responds to said policy and legislation;
- State the need and desirability of the proposed activity;
- Provide a description of the receiving environment that would be affected by the proposed activity;
- Identify the preferred site through a detailed site selection process, which includes an impact and risk assessment process inclusive of cumulative impacts and a ranking process of all the identified alternatives focusing on the geographical, physical, biological, social, economic and cultural aspects of the environment;
- Provide a summary of the specialist studies that will be conducted as part of the BA process;
- Determine the significance, duration and probability of the impacts that will occur to inform the technology and micro-sitting of the activity on the site;

- Identify the most compatible micro-sitting for the activity;
- Identify, assess and rank the significant impacts and risks that the activity will impose on the preferred site through the lifetime of the activity;
- Identify suitable measures to avoid, reverse, mitigate or manage identified impacts;
- Identify residual risks that need to be managed and monitored;
- Outline the public participation process that was undertaken; and
- Provide recommendations for the competent authority to make an informed decision

2.3 LOCATION OF THE ACTIVITY

The proposed Project Site is located within the institutional boundaries of the Tsantsabane Local Municipality and the ZF Mgcawu District Municipality. Refer to **Figure 1** for the locality of the proposed project and to **Appendix 2** for the Locality Maps

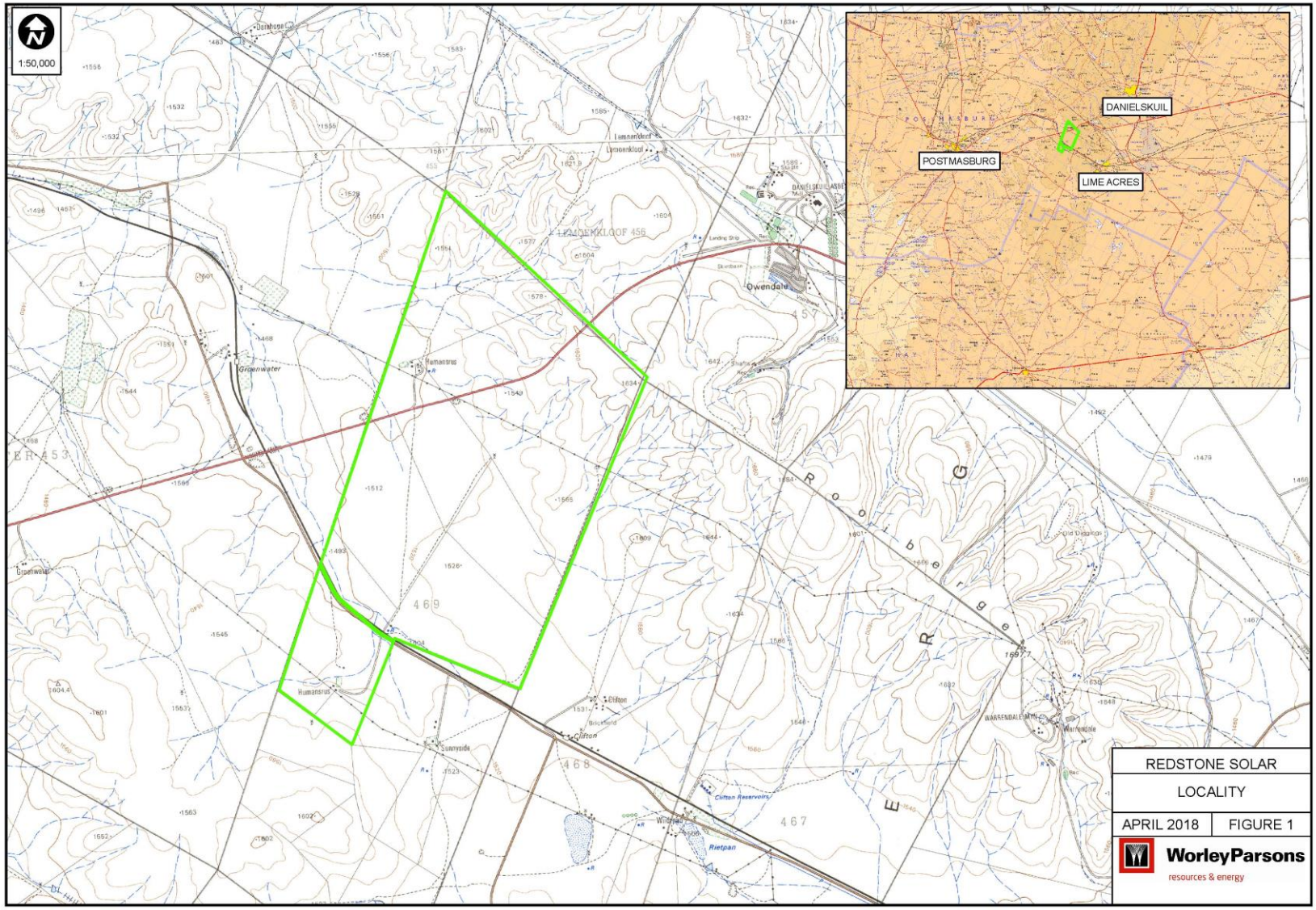


Figure 1: Locality Map of the proposed activities

2.4 PROPERTY DESCRIPTION

The property impacted by the proposed construction of the PV Power Project is reflected in **Table 6** below.

Table 6: Property associated with the proposed PV Power Project.

Farm Name:	The Remaining Extent of the Farm No. 469, Hay Registration Division in The Northern Cape Province
Application area (Ha)	~20ha
Magisterial District	ZF Macawu District Municipality
Distance and Direction from nearest Town	32km east from Postmasburg
21 Digit Surveyor General code for each farm Portion	C 03100000000046900000

2.5 ACTIVITY DESCRIPTION

2.5.1 Project description

The ACWA Power SolarReserve Redstone Solar Thermal Power Plant (RF (Pty) Ltd, (Redstone CSP Project)proposes the development, construction and operation of a Photovoltaic (PV) Power Plant with the generation capacity of up to 20 MW, with up to 30MW hours storage, for the auxiliary load requirements, on the Remaining Extent of the Farm 469, Hay District. The planned PV Power Plant will be located approximately 30 km east of the town Postmasburg in the Northern Cape Province, adjacent to the Redstone CSP Project.

The proposed Project Site (Appendix 4) is located within the governing boundaries of the Tsantsabane Local Municipality and the ZF Mgcawu District Municipality. The Project is designed to allow the ACWA Power SolarReserve Redstone Solar Thermal Power Plant RF (Pty) Ltd to generate renewable green energy for self-consumption in order to operate and run the Redstone CSP Projects auxiliary load

requirements. The Redstone CSP Project was authorised under the National Environmental Management Act 107 of 1998 (NEMA) by the Department of Environmental Affairs (DEA) Ref. Nr 12/12/20/2316 (AM7).

Option A: The PV Power Plant is proposed on the western boundary of the Project Site, adjacent to the ACWA Power SolarReserve Redstone Solar Thermal Power Plant (RF (Pty) Ltd, CSP Facility, for ease of access to the power block/substation.

Option B: The PV Power Plant is proposed within the heliostat field of the ACWA Power SolarReserve Redstone Solar Thermal Power Plant (RF (Pty) Ltd, CSP Facility, for ease of access to the power block/substation.

Total construction and development costs of the plant are estimated at approximately US$20million. Details on the proposed power generating technology; auxiliary services and infrastructure; and project phases and associated activities are provided below.

Table 7 Overview:

Description of affected farm Portion	Remaining Extent of the Farm 469, Hay District Tsantsabane Local Municipality ZF Mgcawu District Municipality
Geographical coordinates	Option A North West Corner 28°17'17.66"S; 23°21'24.07"E North East Corner 28°17'13.55"S 23°21'43.68"E South East Corner 28°18'30.25"S 23°21'29.86"E South West Corner 28°18'3.92"S 23°21'4.76"E Option B North West Corner 28°17'14.05"S 23°21'22.24"E Norther Corner 28°17'2.31"S 23°22'14.91"E Eastern Corner 28°17'38.39"S 23°23'32.43"E Southern Corner 28°19'23.65"S 23°22'42.66"E Western Corner 28°18'19.00"S 23°20'55.16"E
Photographs of the area that provide a visual perspective of the entire site	Refer to Appendix 4
Generation capacity	Up to 20MWp
Type of technology	Crystalline - fixed or tracking

Structure heights	3 – 5m above ground (PV Module)
Surface area to be covered	Less than 20ha
Structure orientation	North facing PV power blocks with inverter and transformer collection
Laydown area dimensions	Not applicable – the PV Power Plant will share infrastructure with the ACWA Power SolarReserve Redstone Solar Thermal Power Plant (RF (Pty) Ltd, CSP Plant. No new areas required for this purpose.
Supplementary facilities and services	Substations and electrical systems Access and security services Operational power supply and use Water supply and use Procurement, storage and use of consumables Maintenance and repair to operational equipment Waste management Emissions management Storm-water management infrastructure Management and administration Staff facilities Fire protection

Scope of proposed activities

PHOTOVOLTAIC POWER TECHNOLOGY

The proposed PV Power Plant utilises proven technology which produces energy by directly converting solar irradiation into electricity. Power is generated by the solar cells as long as they are exposed to sunlight. PV cell technology has been in continuous operation on earth as well as in space (satellites) for over 30 years. The technology is commercially proven and large multi-megawatt generation plants have been operating since the 1990s. With reference to the process flow diagram and illustrations in **Figure 1** and **Figure 2**, respectively, the PV plant will comprise the following key process components:

PV PANEL FIELD

A PV system consists of PV panels that encase the solar cells. Solar cells are solid-state semiconductor devices that convert light into direct-current electricity. The top layer of the panels is made from a mixture of silicon and phosphorous mixture, which gives it a negative charge. The inner layer, which constitutes the majority of the panel, is a mix of silicon and boron, giving it a positive charge. Where these negative and positively charged layers meet, an electric field (called a junction) is created. A top protective and anti-reflective layer of glass is applied to the surface of the PV panels, to protect the sensitive PV layers below and to prevent photons from reflecting off of the panel resulting in lost energy. As the sun's light (photons) hits the solar cell, they are absorbed into the junction,

which “pushes” electrons in the silicon out of the way. When sufficient photons are absorbed, the electrons are pushed past the junction and flow freely to an external circuit.

The panels will be mounted on metal frames with a height of approximately 3-5 m above the ground, supported by rammed, concrete or screw pile foundations, and they will face north in order to capture the optimum amount of sunlight. The facility will either be a fixed PV plant where the solar panels are stationary; or a tracking PV plant where the solar panels rotate to track the sun’s movement (the exact type of PV plant system will be determined following on-site solar resource modelling and detailed development design). This will only be determined once the project has reached Final Engineering Design stages.

PV panels are typically up to 6 m2 in size and will be situated in long rows called arrays, usually made up of approximately 100 m sections extending across the proposed site. The length of the rows and the optimal design and layout will be determined during the Final Engineering Design stages. The general arrangement of the panel arrays may be based on [1 - 5 MW] power blocks or more depending on the final engineering design. A panel surface area of less than 20 hectares is required for the project to generate the required auxiliary load of up to 20MW.

ELECTRICAL INVERTERS AND TRANSFORMERS

The PV cells described above produce Direct Current (DC) electricity which will need to be converted into Alternating Current (AC) electricity prior to integration with the internal grid network. In this regard, approximately [40 - 50 separate inverters, one (1) per power block], may be required. The AC power from the inverters may be stepped-up to approximately 33 kV via pad-mounted transformers located at each inverter station. The inverters may be installed outdoors on concrete pads and under sunshades (to prevent the inverter temperatures exceeding manufacturer’s recommended operating conditions), or the inverters may be placed in a prefabricated container that will keep the inverter in a climate controlled environment.

STORAGE

The use of renewable energy on a large or utility scale leads to new challenges for grid stability and supply of power during demand periods. Energy storage is a fundamental and critical part of renewable energy systems. This application stabilises power supply, which will allow high quality uninterrupted power supply to the national grid. A modular storage solution is proposed for the Proposed Project. Batteries and control electronics will be housed inside a modular container type structure/unit or within a built structure. These facilities will be constructed in conjunction with each inverter station and will be approximately 15 x 4 m in size, within the assessed development footprint.

The required power and capacity will be achieved through parallel connection of several solar storage units, which will be adapted to the project’s particular requirements and based on the final engineering designs. The integration of the cabinets into containerised enclosures allow for safe operations – environmentally and for its operators. Batteries that are commonly used for storage include (but not limited to): lead-acid, lithium-ion, vanadium redox etc. and will only be determined upon final engineering design stages. Each battery type will be evaluated by the engineering team in order to assess the advantages and disadvantages of the each storage system with respect to the project’s requirements on a technical level. The storage units/facility will be fitted with appropriate air-conditioning systems to ensure optimum operation at extreme ambient temperatures along with battery

management units, solar central inverters, Switchgear, medium-voltage transformer, measuring and monitoring components, and data communication capabilities.

An effective technique combining a PV energy storage system with a unique smoothing strategy known as the Single Moving Average (SMA) may be applied in order to reduce PV power fluctuations but to also produce power during peak demand. A ramp rate limiter may be used to smooth power fluctuations as part of optimisation. The battery bank (battery blocks) may be placed in a prefabricated container that will keep the storage batteries in a climate controlled environment. Battery storage of up to 30MW hours has been considered for the Proposed Project.

AUXILIARY INFRASTRUCTURE AND SERVICES [Shared CSP Infrastructure]

In addition to the key process components/systems described above, the proposed project will require input resources such as water, will generate various waste outputs and will require of a number of support services and facilities such as site access and transportation, electrical systems and network integration, storage and use of consumables, general management and maintenance, safety and security, as well as other general supportive activities. It is further noted that construction-specific services and facilities will be necessary. The decommissioning and closure phase, should the plant not be refurbished once the electricity conversion capacity of the solar cells degrades beyond economic viability, would also involve decommissioning specific services and facilities.

ELECTRICAL SYSTEMS

PV POWER BLOCK WIRING CONFIGURATION

Subject to the final design, a typical power plant includes PV panels that may be wired together in groups of around 24 (dependent on the configuration of the plant), in a series configuration (called module strings) to maintain a DC voltage level always within the maximum power point tracking (MPPT) window of the inverter. The module strings are then paralleled for input into approximately 38 circuit, combiner boxes, distributed throughout the PV field for aggregated input into inverters. These module strings may be harnessed to the PV panel mounting structures, and are usually connected in parallel to meet the DC input requirements of the outdoor-rated, fused combiner boxes pole-mounted onto the mounting structures. The combiner boxes may include current monitoring and fault detection on each of the combiner box inputs and a local disconnect switch. Approximately 12 combined DC power feeds from combiner boxes will be underground cabled to the line side of each inverter unit. An estimated 36 of these strings are typically brought together in a single junction box in parallel configuration. 12 junction boxes would then feed to each central inverter station which delivers a maximum of 2 MW of AC power. Two step-up transformers may be located adjacent to each central inverter station.

The output generated by the PV Power plant will be fed into an underground AC-network taking the power to the site substation/power block from where it will be absorbed and utilised by the ACWA Power SolarReserve Redstone Solar Thermal Power Plant (RF (Pty) Ltd, CSP Facility for its auxiliary loads.

PROJECT SUBSTATIONS

The project design will include an 11kV step-up substation that will allow the facility to be connected into the on-site Noko substation/power block connection point.

NETWORK INTEGRATION AND SWITCHING YARD

The output generated by the PV Power plant will be fed from the PV step up substation via 11kV underground/surface cablingAC-network to the power to the site substation/power block from where it will be absorbed and utilised by the ACWA Power SolarReserve Redstone Solar Thermal Power Plant (RF (Pty) Ltd, CSP Facility. Two routing options have been selected for the integration of the power generated by the PV Power Plant:

Route 1: Power to be evacuated via 11kV underground cables/surface cabling within the reserve of the ACWA Power SolarReserve Redstone Solar Thermal Power Plant (RF (Pty) Ltd, CSP Facility ring-road, to the Noko-Olien Substation and the Power Block.

Route 2: Power to be evacuated via 11kV underground cables/overhead power lines within the reserve of the ACWA Power SolarReserve Redstone Solar Thermal Power Plant (RF (Pty) Ltd, CSP Facility power block access roads, to the Noko-Olien Substation and the Power Block.

Please note: the PV Power Plant is designed to provide auxiliary load power to the ACWA Power SolarReserve Redstone Solar Thermal Power Plant (RF (Pty) Ltd, CSP Facility.

CONTROL AND INSTRUMENTATION SYSTEM: [Shared CSP Infrastructure]

The substation which contains the plant switch gear may also contain a pre-engineered power distribution centre (PDC), approximately 3 x 7.5 m, which would house the metering, communication, and Supervisory Control and Data Acquisition (SCADA) equipment. These systems would manage the PV string, mounting structure, combiner and junction box and inverter/transformer unit monitoring, as well as overall system status. The control room may also be equipped with an Ethernet network for inter- and intranet connections and communications.

EARTHING NETWORK [Shared CSP Infrastructure]

An earthing system is required in order to prevent injury to staff as well as damage to equipment. The plant switchyard may incorporate a ground grid for personnel and equipment protection in accordance with IEEE standards. Earthing designs will ensure that the step and contact voltage levels will not be exceeded, whether by staff exposure or external exposure due to voltage transfer. In terms of the PV panel field, earthing may be done by means of grouping and earthing. Overhead tie-lines may include an optical ground wire (OPGW) for lightning protection. The earthing system network will be designed in accordance with SANS 62305 (1-4) & SANS10313.

AUXILIARY INFRASTRUCTURE [Shared CSP Infrastructure]

The PV Power Plant will be serviced by internal gravel roads approximately 3m wide in between the PV arrays. As the PV Power Plant is proposed to act as an auxiliary power supply for the existing ACWA Power SolarReserve Redstone Solar Thermal Power Plant (RF (Pty) Ltd, CSP Facility, additional infrastructure and services requirements will be acquired from

ACWA Power SolarReserve Redstone Solar Thermal Power Plant (RF (Pty) Ltd, CSP Facility as approved under EA DEA Ref. No.: 12/12/20/2316 (AM7) –

- Substations and electrical systems
- Access and security services
- Water supply, treatment, storage and use
- Procurement, storage and use of consumables
- Maintenance and repair to operational equipment
- Waste management
- Storm-water management infrastructure
- Management and administration
- Staff facilities
- Fire protection for plant services and infrastructure
- Auxiliary power supply

CONSTRUCTION ACTIVITIES AND FACILITIES

The construction phase will involve the construction and assembly of the PV panels, electrical systems, buildings, and other infrastructure required for the operation of the plant. In this regard, the activities and/or facilities relevant to the construction phase are listed below, with further details provided thereafter.

- Site establishment and the construction of access roads and services
- Site clearing and earthworks
- Bulk material laydown and consumable stores – shared service CSP
- Refuelling and maintenance – shared service CSP
- Power supply and use – shared service CSP
- Water supply and use – shared service CSP
- Construction camp – shared service CSP
- Staff facilities – shared service CSP
- Management and administration – shared service CSP
- Waste management – shared service CSP

The construction period for the PV Power Plant will take approximately 2 – 6 months.

OPERATIONAL AND MAINTENANCE ACTIVITIES AND FACILITIES

The operational phase will involve the generation of power using the PV technology and electrical systems as described as well as the day-to-day management and maintenance of associated support services and infrastructure. In this regard, the activities and/or facilities relevant to the operational phase are listed below, with further details provided thereafter.

- Access and security services – shared service CSP
- Generation of electricity using PV technology
- Operational power supply and use
- Water supply, storage and use – shared service CSP

- Procurement, storage and use of consumables – shared service CSP
- Maintenance and repair to operational equipment – shared service CSP
- Waste management – shared service CSP
- Storm-water management infrastructure – shared service CSP
- Management and administration facilities – shared service CSP
- Fire protection for plant services and infrastructure – shared service CSP

The operational period for the PV Power Plant will is linked with that of the Redstone CSP Project Power Purchase Agreement of 25 years.

2.5.2 Activities according to Listing Notice 1 of the EIA regulations of 2014 (as amended in 2017)

The proposed PV power plant project triggers Listed Activities as stipulated in the EIA Regulations, as amended (2014) promulgated in terms of the National Environmental Management Act, 1998 (Act 107 of 1998) (NEMA) as amended under Government Notice No. 983.

Table 8: Summary of listed activities according to Listing Notice 1

NAME OF ACTIVITY	**AERIAL EXTENT OF THE ACTIVITY** **Ha or m²**	**LISTED ACTIVITY**	**APPLICABLE LISTING NOTICE** **(*GN.R 983, 984 or 985)***
Construction of a Photovoltaic plant to generate 10 Megawatt to supply in the auxiliary load requirements of the Redstone CSP Project to avoid the usage of an external power source.	19.9ha	1	GN.R 983: (1) The development of facilities or infrastructure for the generation of electricity from a renewable resource where— (i)the electricity output is more than 10 megawatts but less than 20 megawatts; or (ii) the output is 10 megawatts or less but the total extent of the facility covers an area in excess of 1 hectare; excluding where such development of facilities or infrastructure is for photovoltaic installations and occurs— (a) within an urban area; or (b) on existing infrastructure.
PV Plant surface area layout	19.9ha	1	GN.R 983 (27) The clearance of an area of 1 hectares or more,

NAME OF ACTIVITY	AERIAL EXTENT OF THE ACTIVITY Ha or m^2	LISTED ACTIVITY	APPLICABLE LISTING NOTICE (*GN.R 983, 984 or 985)*
			but less than 20 hectares of indigenous vegetation, except where such clearance of indigenous vegetation is required for— (i)the undertaking of a linear activity; or (ii)maintenance purposes undertaken in accordance with a maintenance management plan.
Placement of solar panels as per the Biodiversity impact assessment (***Appendix 9***)	19.9ha	1	GN.R 985 (30) Any process or activity identified in terms of section 53(1) of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004).
Placement of solar panels as per the Biodiversity impact assessment (***Appendix 9***)	19.9ha	3	GN.R 985 (12) The clearance of an area of 300 square metres or more of indigenous vegetation except where such clearance of indigenous vegetation is required for maintenance purposes undertaken in accordance with a maintenance management plan.

2.5.3 Other authorisations

No other authorisations have been identified for this specific project however the CSP Power Project that this project feeds into, has an authorisation (12/12/20/2316) and a water use licence.

2.6 POLICY AND LEGISLATIVE CONTEXT

CONSTITUTION OF SOUTH AFRICA ACT 108 (ACT. NO 108 OF 1996)

In terms of the Constitution of South Africa Act 108 of 1996 (Constitution), every person has a right to enjoy an environmental that is not harmful to their health and well-being and government is responsible to protect the environment through reasonable legislative and other measures that prevent polluting and ecological degradation,

promote conservation and secure ecological sustainable development by promoting justifiable economic and social development. The promulgation of the National Environmental Management Act 107 of 1998 (NEMA) has given legal effect to this Constitutional requirement. Together with NEMA, a number of subordinate environmental acts (SEMA) has been promulgated i.e. National Environmental Management Waste Act (Act No. 59 of 2008) NEMWA, the National Environmental Management Biodiversity Act (Act No.10 of 2004) (NEMBA), the National Environmental Management Air Quality Act (Act No. 39 of 2004)(NEMAQA), the National Environmental Management Protected Areas Act (Act No. 15 of 2009) (NEMPA), the National Environmental Management Integrated costal management Act (Act. No 24 of 2008) (NEMICMA) and the National Water Act (Act No.46 of 1999) (NWA). Although the mining activities are controlled in terms of the Mineral Resources and Petroleum Development Act (MRPDA) no 28 of 2002, all activities associated with the ACWA Power SolarReserve Redstone Solar Photovoltaic Power Plant must be in accordance with the aforementioned legislation.

NATIONAL ENVIRONMENTAL MANAGEMENT ACT

The relevant legislation pertaining to the Environmental Authorisation for development projects and this application in particular is the National Environmental Management Act (NEMA) (Act No. 107 of 1998) as amended, and the EIA Regulations of 2014 as amended and promulgated under NEMA. NEMA requires that activities be investigated that may have a potential impact on the environment, socio-economic conditions and cultural heritage. Various activities of the proposed project will impact on the environment and requires assessment by means of a Basic Assessment (BA). The results of the BA must be reported to the relevant authority. Procedures for the investigation and communication of the potential impact of activities are contained in Section 24 (7) of the Act.

Section 24(C) of the Act defines the competent decision-making authority which is normally the provincial environmental department. However, as set out in Section 4.1 of the Guideline on Environmental Impact Assessments for Facilities to be included in the Electricity Response Plan', GN 162 of 2010, all BA applications from Independent Power Producers (IPPs) or those involving co-generation, where these are included in the National Energy Resource Plan (NERP), the Department of Environmental Affairs (DEA) shall be the competent authority.

EIA REGULATIONS

On 18 June 2010 new EIA Regulations (Government Notice No R.982, 983, 985 and 986) were promulgated in terms of Section 24(5) of NEMA. These Regulations came into effect on 2 August 2010and was further corrected in December 2010, superseding the regulations of 21 April 2006. The Regulations will determine whether a Basic Assessment or EIAR is applicable to a proposed project based on the listed activities in the Regulations. In relation to the proposed project will be required due to certain listed activities in the EIA Regulations.

ACTIVITIES APPLIED FOR IN TERMS OF THE NEMA

In terms of Government Notices No. R544, R545 and R546 promulgated in 2014 and amended in 2017 of the National Environment Management Act, 1998 (Act No. 107 of 1998) an Environmental Impact Assessment Process is required for the above- mentioned project in the form of a Basic Assessment. The following listed activities are being applied for: Applicable legislation that is relevant to the proposed Redstone PV Power Project is captured in the table below.

Table 95: Legislation related to the proposed PV power plant project

APPLICABLE LEGISLATION AND GUIDELINES USED TO COMPILE THE REPORT (A description of the policy and legislative context within which the development is proposed including an identification of all legislation, policies, plans, guidelines, spatial tools, municipal development planning frameworks and instruments that are applicable to this activity and are to be considered in the assessment process);	**REFERENCE WHERE APPLIED (i.e. Where in this document has it been explained how the development complies with and responds to the legislation and policy context)**	**HOW DOES THIS DEVELOPMENT COMPLY WITH AND RESPOND TO THE POLICY AND LEGISLATIVE CONTEXT (E.g. In terms of the National Water Act:-Water Use Licence has/has not been applied for).**
National Legislation and regulations		
The Constitution of South Africa Act no. 108 of 1996	Part A: EIA (BA) process followed Part B: Requirements included in the EMPr	Adherence with all legislation and regulations that prevents pollution and ecological degradation, promotes conservation, and secures an ecological sustainable development and use of natural resources while promoting justifiable economy and social development.
The Minerals and Petroleum Resources Development Act, 2002, Act No. 28 of 2002 (MPRDA) Section 53	Surface Right Application	Submission of an application to DMR for this area is included in the larger Redstone CSP Power Project.
National Environmental Management Act 107 of 1998 (NEMA)	Part A: EIA(BA) process followed Part B: Requirements included in the EMPr	Development of an EMPr for the proposed activities. Application for authorisation resulting in the submission of this document. Including emergency response procedures within the submitted EMPr. Ensuring compliance with a monitoring and audit schedule and plan.
The following regulations in terms of NEMA are applicable:		
GN R. 982: National Environmental Management Act (107/1998): Environmental Impact Assessment Regulations, 2014 amended in 2017	Part A: EIA process followed Part B: Requirements included in the EMPr	Independent EAP appointed to ensure adherence with the EIA procedure.

(2014 EIA regulations)		
GN R. 983: Listing notice 1	Part A: EIA process followed Part B: Requirements included in the EMPr	Application for authorisation of listed activities submitted followed by the submission of the BAR, and EMPr.
GN R. 985: Listing notice 1	Part A: EIA process followed Part B: Requirements included in the EMPr	Application for authorisation of listed activities submitted followed by the submission of the BAR, and EMPr.
National Environmental Management: Air Quality Act 39 of 2004 (NEMAQA)	Part A: EIA process followed Part B: Requirements included in the EMPr	Requirements as stipulated in the Act are incorporated with the EMPr submitted for approval.
The following regulations in terms of NEMAQA are applicable:		
GN 893: List of activities which result in atmospheric emissions	Part A: EIA process followed Part B: Requirements included in the EMPr	Requirements incorporated in the EMPr.
GN R. 827: National dust control regulations	Part A: EIA process followed Part B: Requirements included in the EMPr	Requirements incorporated in the EMPr.
GN R. 283: National atmospheric emissions reporting regulations	Part A: EIA process followed Part B: Requirements included in the EMPr	Requirements incorporated in the EMPr.
GN R. 1210: National ambient air quality standards	Part A: EIA process followed Part B: Requirements included in the EMPr	Requirements incorporated in the EMPr.
Atmospheric Pollution Prevention Act of 1965 **GN R. 1651:** Regulations concerning the control of noxious or offensive gasses emitted by diesel-driven vehicles	Part A: EIA process followed Part B: Requirements included in the EMPr	Requirements incorporated in the EMPr.
National Environmental Management: Waste Act 59 of 208 (NEMWA)	Part A: EIA process followed Part B: Requirements included in the EMPr	All waste management activities associated to the proposed operation must comply with the requirements set out by the Act. These requirements have been incorporated into the EMPr.
The following regulations in terms of NEMWA are applicable:		
GN R. 634: Waste classification and management regulations	Part A: EIA process followed Part B: Requirements included in the EMPr	Requirements incorporated in the EMPr.
Environmental Conservation Act of 1989 **(ECA)** **GN R. 425:** Waste tyre regulations	Part A: EIA process followed Part B: Requirements included in the EMPr	Requirements incorporated in the EMPr.

GN R. 341: Regulations for the prohibition of the use, manufacturing, import and export of asbestos and asbestos containing materials		
National Water Act 36 of 1998 (NWA)	Part A: EIA process followed Part B: Requirements included in the EMPr	A water Use Licence Has been issued for the CSP Power Project and the PV Project will utilise water from the CSP.
The following regulations in terms of NWA are applicable:		
Hazardous Substances Act 15 of 1973	Part A: EIA process followed Part B: Requirements included in the EMPr	Requirements incorporated into the EMPr. And the Health and Safety management plan.
Petroleum Products Act of 1977 **GN R. 627:** Regulations regarding petroleum products specification and standards	Part A: EIA process followed Part B: Requirements included in the EMPr	Throughout the construction, operation, and decommissioning phase of the proposed activities petroleum products will be used. These requirements have been included in the EMPr.
National Road traffic Act of 1996 **GN R. 225:** National road traffic regulations	Part A: EIA process followed Part B: Requirements included in the EMPr	The requirements set in these regulations have been incorporated into the EMPr.
National Health Act, 2003 –	Part A: EIA process followed Part B: Requirements included in the EMPr	Requirements incorporated into the EMPr. Requirements to be incorporated into the Health and Safety management plan.
Fertilizers, farm feeds, agricultural remedies and stock remedies Act 36 of 1947	Part A: EIA process followed Part B: Requirements included in the EMPr	The requirements specifically related to the use of herbicides and pesticides have been incorporated into the EMPr.
Conservation of Agricultural Resources Act 43 of 1983 (CARA) **GN R. 1048:** Declared Weeds and Invader plants	Part A: EIA process followed Part B: Requirements included in the EMPr	The requirements have been incorporated into the EMPr and final site layout plan.
National Environmental Management: Biodiversity Act, 2002 **(NEMBA)**	Part A: EIA process followed Part B: Requirements included in the EMPr	Requirements incorporated into the EMPr. However, before the commencement of site clearance an application must be lodged for the removal of protected species as

		identified in the Biodiversity assessment (***Appendix 9***).
National Veld and Forest Fire Act 101 of 1998	Part A: EIA process followed Part B: Requirements included in the EMPr	Measures to prevent the spreading of fires are incorporated into the EMPr.
National Forest Act 84 of 1998	Part A: EIA process followed Part B: Requirements included in the EMPr	Requirements incorporated into the EMPr. However, before the commencement of site clearance an application must be lodged for the removal of protected species as identified in the Biological impact assessment (***Appendix 9***).
National Heritage Resources Act 25 of 2000	Part A: EIA process followed Part B: Requirements included in the EMPr	The BAR & EMPr document complies with section 38(8) of the NHRA that stipulates that a Heritage Resources Management (HRM) process must be implemented if an evaluation of the impact of a development on heritage resources is required in terms of the NEMA, the integrated environmental management guidelines issued by the Department of Environment Affairs (DEA), or any other legislation. The consenting authority must ensure that the evaluation fulfils the requirements of the South African Heritage Resources Agency (SAHRA) and / or the Provincial Heritage Resources Authority of Northern Cape (PHRA-NC) in terms of section 38(3) of the NHRA. The HIA report completed for the project complies with the aforementioned section. A destruction permit has been granted for the CSP Power Plant, attached in ***Appendix 3***.
Occupational Health and Safety Act (Act 85 of 1993) **GN R.1248**:	Part A: EIA process followed Part B: Requirements included in the EMPr	Requirements to be incorporated in the Health and Safety plan.
Government Policies		

Waste Management policies	Part A: EIA process followed Part B: Requirements included in the EMPr	In terms of waste management in South Africa, there are two main policies that have been considered in the development of the EMPr. The two main policies considered were regarding the management and disposal of fluorescent tube disposal and the management of sewage sludge. Best practice principles were incorporated into the EMPr.
National Environmental Health Policy	Part A: EIA process followed Part B: Requirements included in the EMPr	This policy document is intended as a 'broad guideline for the effective implementation and rendering of Environmental Health Services in South Africa'. It incorporates the philosophy of Environmental Health includes principles such as primary prevention, transparency, polluter pays, precautionary principle and cradle to grave.
SANS Standards		
Hazardous substances management	Part A: EIA process followed Part B: Requirements included in the EMPr	The following two SANS standards were incorporated into the EMPr: SANS 10089-1:2008 - Specifications for above-ground storage facilities for petroleum products SANS 310: 2011 - Storage tank facilities for hazardous chemicals: Above-ground storage tank facilities for flammable, combustible and non-flammable chemicals.
Provincial Legislation		
Northern Cape Planning and Development Act No. 7 of 1998	Part A: EIA process followed Part B: Requirements included in the EMPr	Requirements incorporated in the EMPr.

2.7 THE NEED AND DESIRABILITY FOR THE PROPOSED PROJECT

The Guideline on Need and Desirability in terms of the Environmental Impact Assessment (EIA) Regulations, 2010 – GN 891 issued in October 2014 in GG 38108 has been used to inform and provide structure for the Need and Desirability.

The concept of "need and desirability" relates to, amongst others, the nature, scale and location of the development being proposed, as well as the wise use of land. Need and desirability are inter-related and the two have been considered in an integrated and holistic manner.

The proposed PV power project is seen to have regional importance and forms part of the clean energy strategy but also, by default, form part of South Africa's clean energy strategies (Renewable energy targets).

Table 10: Needs and desirability summary tables

NEED AND DESIRABILITY OF THE PROPOSED PROJECT After the Need and Desirability Guideline Published in terms of the Environmental Impact Assessment Regulations, 2010. Notice 792 of 2012	
PART I: NEED	
Question	**Answer**
Is the land use associated with the activity being applied for considered within the timeframe intended by the existing approved Spatial Development Framework agreed to be the relevant environmental authority?	The Project Site, the Remaining Extent of the Farm No. 469, Hay Registration Division has been rezoned in accordance with the Tsantsabane Local Municipal Town Planning scheme and the Northern Cape Legislation on Development and Planning, Act 7 of 1998, to Special: Solar Power Plant" use. The inclusion of the PV Power plant on the property thus aligns with the zoning of the greater property, for which three (3) Environmental Authorisations Attached in Appendix 3 have already been issued for renewable energy generation facilities.
Should the development, or if applicable, expansion of the town/area concerned in terms of this land use occurs here at this point in time?	Not applicable. The Project Site does not fall within the urban boundaries of a town.
Does the community/area need the activity and the associated land use concerned? This refers to the strategic as well as local level.	The Tsantsabane IDP 2017/2018 has highlighted extension of infrastructure for electricity as Key Performance Area (KPA2) for the presiding period,

	with the situational analysis supporting this KPA based on the issues raised by the various Wards of the LM regarding the limitations in terms of access to this service/infrastructure for the region. South Africa as a whole, is in need of the proposed power generation activity from a renewable resource. The South African electricity sector has faced many challenges in the last decade spanning from rolling blackouts due to maintenance of its aging and quickly deteriorating baseload power supply stations in 2008 up to coal feedstock restrictions threatening yet again with rolling blackouts in 2018. The addition of a power generation facility that is reliant on a free renewable resources rather than a market dependent non-renewable resource will add great benefit not only to the local community but also the country as a whole. The addition of this facility will allow the already permitted ACWA Power SolarReserve Redstone Solar Thermal Power Plant RF (Pty) Ltd (Redstone CSP Project) to operate 100% off grid – not being reliant on drawing power for auxiliary services from the national grid. Over and above the addition of clean renewable energy to the grid to aid in South Africa's potential electricity shortage the facility will not draw electricity for its day to day operation from the already strained grid.
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?	The Proposed Project will not require any additional services as all auxiliary infrastructure and services requirements will form part of the shared services and infrastructure provided by the "Redstone CSP Project". Services/infrastructure to be shared with the "Redstone CSP Project include, but is not limited to – - Sanitation & effluent management - Waste management - Site access - Electricity (self-generated) - Stormwater management

	- Water provision Where applicable the relevant approvals have been secured for the services and infrastructure requirements.
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 the services and opportunity cost)?	The Project Site is not serviced by the Tsantsabane Local Municipality and the facilities proposed will be "self-contained". All infrastructure and services requirements will be managed and hosted by the Redstone CSP Project. The Redstone CSP Project where applicable the relevant approvals have been secured for the services and infrastructure requirements, such as water provision, stormwater management, wastewater and water treatment facilities etc. In essence it is not expected that the facility will add additional strain on the Tsantsabane Local Municipality service provision abilities over and above waste disposal – which will be managed by a duly authorised contractor with the required municipal approvals in place.
Is the project part of a national programme to address an issue of national concern or importance?	The Proposed Project forms part of a larger development, the Redstone CSP Project which is a Strategic Infrastructure Project – SIP 9 Electricity Generation to support socio-economic development. The Proposed Project is designed to allow the Redstone CSP Project to generate renewable green energy for self-consumption in order to operate and run the Redstone CSP Project, as authorised under DEA Ref. Nr 12/12/20/2316 (AM7), thus furthering the objective of SIP 9.
PART II: DESIRABILITY	
Is the development the best practicable environmental option for this land/site?	The NEMA defines "best practicable environmental option" as the option that provides the most benefit and cause the least damage to the environment as a whole at a cost that is acceptable to society not only short term but also in the long term.

	Seeing that the Project Site is already being used for the generation of electricity via the Jasper -and Lesedi PV Power Projects, and the Redstone CSP Project which will commence with construction in 2018, it can be stated that the Proposed Project provides for a practicable and environmentally acceptable application to the Project Site. Consolidation of activities in one centralised location will reduce the regional impacts on the receiving environment and land use character. The establishment of clean renewable energy power generation facilities furthermore will have substantial benefits in the long run as it provides not only diversification of the South African energy mix, reducing our reliance on fossil fuels, but also provides an electricity source that is not subject to volatile commodities markets for its inputs, thus being able to provide electricity with a much more stable cost than conventional coal and gas fired power stations. Renewable energy power plants furthermore provide a multitude of environmental benefits such as a carbon neutral footprint, minimal to no emissions, efficient and economical use of water by means of hybrid and dry cooling system and a reduced surface footprint when compared to conventional power generation stations. The activities proposed along with the environmental impacts identified as part of the BA process can be managed and mitigated to acceptable levels should the mitigation measures proposed be implemented and monitored. Considering the aforementioned it can thus be stated that the inclusion of the Proposed Project on the Project Site does provide for a practicable and acceptable environmental solution.
Would the approval of this application compromise the integrity of the existing approved and credible IDP and SDF as agreed to by the relevant authorities?	The Proposed Project aligns very well with the spatial vision approved of the ZF Mgcawu District Municipality Spatial Development Framework (2012) - *“An exciting mix of:*

	• *Tourism: Cultural, wilderness, floristic, river tourism ranging from the Kgalagadi international trans frontier park to the culture of the Riemvasmak community to river tourism on the mighty Orange River ;* • *Mining and mining beneficiation;* • *Agriculture: river bank vineyards and expansive stock and game farming in the Kalahari; and* • ***Renewable energy technology opportunities."*** The Tsantsabane IDP 2017/2018 has highlighted extension of infrastructure for electricity as Key Performance Area (KPA2) for the presiding period. The application proposed thus will not compromise the integrity of the current and approved IDP and SDF of the Tsantsabane Local Municipality and is strongly supported by the District SDF as well.
Would the approval of this application compromise the integrity of the existing environmental management priorities for the area (e.g. as defined in EMFs), and if so, can it be justified in terms of sustainability considerations?	The Project Site is highly transformed – housing the Lesedi and Jasper PV Power projects, with construction proposed to commence in 2018 for the Redstone CSP Project. One of Development Objectives of the Tsantsabane 2015 SDF aims for the consolidation of existing areas rather than creating new development areas. The construction of the Proposed Project on the Project Site as per the Site Layout Diagram, thus aligns with this objective and strategic proposal of consolidation. The District EMF identified two proposed conservation areas in Tsantsabane LM – of which both is to the west of the town Postmasburg, away from the Project Site. The Project Site furthermore falls within Control Zone 1 – low control zone, which is considered the least sensitivity with no special parameters, except those already implemented or required by law, are proposed for this zone. Considering the aforementioned, the application proposed will not compromise the existing

	environmental priorities of the Tsantsabane LM or the larger District[1].
Do location factors favour this land use at this place? (this relates to the contextualization of the proposed land use on this site within its broader context).	Location factors do favour this portion of Project Site due to the surrounding power generation facilities already approved and/or operational on the larger property.
How will the activity of the land use associated with the activity being applied for, impact on sensitive natural and cultural areas (built and rural/natural environment)?	Option A: There will be no cumulative impact or increased impacts. There will be not change or impact on the cultural areas for Options A or B, however in terms of Option A, no additional sensitivities outside of what was determined in the CSP project were determined as the PV facility will be between the panels in the heliostat field. In option B (the preferred option) the footprint of the project will be located in an indigenous vegetation zone with high levels of disturbance (as per the ecologist) (outside of the Heleostat fields), extending the development footprint of the Redstone project, which will cause an increase of the impact on sensitive receptors such as vegetation and watercourses. A walkthrough survey for the ecological aspect recorded additional protected plants over the area (which can be rescued) and the hydrologist recorded a watercourse in the northern extent of the site, which will not be affected as it has been allocated as a no go area (even though it has been cut off from the source by the existing road). The avifauna specialist said that habitat loss will be slightly elevated, and the visual specialist stated that the CSP causes the largest visual impact thus the impact from the PV will not be significant. I, as the EAP, is confident that, after considering all potential impact, and mitigation measures, including cumulative impacts, Options A and B, do not pose a significant threat to the environment.
How will the development impact on people's health and well-being? (E.g. In terms of noise, odours, visual character and sense of place, etc.)?	Firstly, it needs to be noted that the impact on health and well-being is largely dependent on mitigations and

	management measures put in place to avoid, reduce or mitigate potential health/well-being related impacts. It is not expected that the Proposed Project will have an impact on the health and well-being of the surrounding communities with respect to noise, odour as the facility will generate no noise or odour during its operational phase. During construction the Proposed Project will generated minimal noise with respect to onsite construction vehicles and construction activities but this will be for a limited time (2 -6 months) and will be far exceeded by that of the Redstone CSP Project. The Proposed Project is however, likely to have a visual impact, albeit an insignificant impact in comparison to the Redstone CSP Project. It is unlikely to affect character or sense of place of the location taking the Project Site context into consideration as the larger property already houses two (2) operational PV facilities and is subject to the construction of an additional plant (Redstone CSP Project) in 2018. It is important to understand that there are certain regulatory and management standards (air quality, water quality, occupational health and safety) that would need to be adhered to and provide a benchmark for the Proposed Project.
Will the proposed activity or the land use associated with the activity being applied for, result in unacceptable opportunity costs.	The Project Site is already being used for the generation of renewable energy via the Jasper -and Lesedi PV Power Projects, as well as the Redstone CSP Project which will commence with construction in 2018. The Project Site was evaluated in terms of its agricultural potential (2011 EIA, ACWA Power SolarReserve Redstone Solar Thermal Power Plant RF (Pty) Ltd), as this was the primary activity practiced on the Project Site prior to 2011, which found the largest impact to be the loss of arable land due to the construction of infrastructure, on an otherwise untransformed site. The study however found that this impact would be of limited significance, as the soils posed a very low agricultural potential and the

	prevailing climate was not suited for agricultural practices of large/commercial scale. The study furthermore concluded that as the construction activities do not propose deep excavations or large-scale topsoil removal) this impact will be further reduced. The portion of the Project Site proposed for the undertaking of the PV Project/ Power generation activity is for this reason not viewed as imposing unacceptable opportunity costs on to the receiving environment and community – as this portion would have had no economic function/alternative use was it not used for the purpose of power generation.
Will the proposed land use result in unacceptable cumulative impacts?	No, this development is small and will add to the already existing infrastructure on the property, cumulatively the specialists have stated that there will be a cumulative impact however it is marginal and insignificant and therefore there is no reason not to let this project proceed.

2.8 FEASIBLE AND REASONABLE ALTERNATIVES

Alternatives are defined in the Regulations as "different means of meeting the general purpose and requirements of the activity". In terms of the NEMA EIA Regulations (2014) alternatives must be assessed and evaluated by the EAP at a scale and level that enables adequate comparison with the proposed development. The EAP must provide opportunities for stakeholder input in terms of the identification and evaluation of alternatives. When considering alternatives, the criterion to be taken into account is "any feasible and reasonable alternatives to the activity and any feasible and reasonable modifications or changes to the activity that may minimise harm to the environment".

2.8.1 Preferred Site Alternative

All specialists indicated that both Option A and B are acceptable sites but, Option A is the preferred alternative and considered feasible and reasonable for the following reasons:

- Alternative in the form of Option A (outside the Heleostat field) and option B (within the heliostat field) were appropriate for the development of the PV facility as both options would be considered low impact and sustainable, however due to the technical evaluation of Option B, developing within the heliostat field will be technically impossible. See **Appendix 5**. The greatest challenges to develop Option B were as follows:

  - Clearance between each row of heliostats are barely sufficient to allow access for wash and maintenance trucks as described in later section, therefore if more space is taken for the PV Power Project it would be difficult to access the panels.
  - The Heliostats will shadow the PV panels and therefore cause a reduction in energy harvesting from the sun.
- When considering Option B, it is important to highlight that all potential impacts from Option A and B were similar except that Option A has an extended footprint which therefore increases the development footprint on the project site. The ecological walk through evaluation and the biodiversity assessment discovered that Option A is free of wetlands, is seen as a disturbed landscape because of previous mining activity and had fewer protected plant species to relocate than within the area allocated to Option B. Therefore, Option A is considered as the preferred option, given the environmental and technical aspects considered. Incorporation of the PV modules in the collector field would have to be in the far field section in between heliostats in a distributed manner. This would essentially limit access in the radial direction, leaving access only azimuthally along the circumference of each row and increase the area needed for the PF plates.

2.8.2 Preferred Design or Layout Alternative

No development footprint alternatives have been considered as the photovoltaic layout is dictated by solar irradiance economics and the layout is already designed for most economic energy “capture” per square meter. Thus the layout is designed to ensure highest energy “capturing” over the smallest area and is considered most feasible as it is.

2.8.3 Preferred Alternative Technologies

There is a few renewable energy technologies, of which the most common around the world are wind, solar (concentrated solar plants (CSP) and photovoltaic power plants (PV)), hydro and geothermal. The municipality has, through its energy strategy, set targets and projections on how to achieve energy reduction through improving energy usage and supply. On the energy supply side, studies was done to determine the most sustainable replacement of certain energy sources for transport, residential, commercial and industrial uses. Solar formed a critical part of the strategy to replace the energy supply and form a cleaner energy mix. The potentials for hydro and wind power is low and not feasible and therefore the renewable energy replacement rest decidedly on solar, and therefore photovoltaics’ (PV’s) and/or concentrated solar plants (CSP’s). CSP‘s have been found feasible in the Northern Cape, however this project is to be the auxiliary power supply to the greater CSP Power Plant and therefore PV is the only technology viable for this project.

2.8.4 Alternative Operational Aspects

Alternative operational aspects will be considered in the management plan related to PV module wet or dry cleaning and the replacement of potential hazardous materials with non-hazardous material, where possible.

2.8.5 No-go Alternative

If this project does not receive environmental authorisation the Redstone CSP Power Project will not achieve financial close and will not be built. Not building the CSP will compromise the IDP objective for green energy and also loos the great economic investment into the area from the CSP facility.

3 PART C: PUBLIC PARTICIPATION

3.1 DETAILS OF THE PUBLIC PARTICIPATION PROCESS FOLLOWED

Consultation with the public forms an integral component of the environmental authorisation process and is to address Section 23 of NEMA. The Public Participation Process (PPP) has been structured to provide I&APs with an opportunity to gain more knowledge about the proposed project, to provide input through the review of documents/reports, and to voice any issues or concern at various stages throughout the EIA process. This process includes all I&AP's:

- National and Provincial Government Representatives:
- Department of Environmental Affairs (DEA);
- Department of Water Affairs (DWA)
- Department of Agriculture, Forestry and Fisheries (DAFF);
- South African Heritage Resources Agency (SAHRA); and
- Relevant Northern Cape Provincial Authorities (e.g. Environment & Conservation, Agriculture).
- Relevant Local and District Municipalities:
    - Siyanda District Municipality;
    - Tsantsabane Local Municipality; and
    - Kgatelopele Local Municipality.
    - Parastatals – Eskom, Civil Aviation Authority;
    - Neighbours
- Affected and surrounding landowners;
- Environmental Non-Governmental Organizations (e.g. Wildlife Society of South Africa, BirdLifeSA);
- Community based organisations; and
- Other (i.e. Sedibeng Water. Air Traffic and Navigation Systems, Lime Acres Mine)

All I&AP information (including contact details), together with dates and details of consultations and a record of all issues raised are recorded within a comprehensive project database. This database will be updated on an on-going basis throughout the project, and will act as a record of the communication/public consultation process. All comments, concerns, or suggestions will be included in an Issues and Response Report, that will form part of the Final BAR.

The PPP will be managed to meet these objectives throughout the BA. The approach followed for the PPP is according to Chapter 6 of the EIA Regulations, 2014 published in Government Notice No. 982 of 4 December 2014 as amended in 2017.

Table 116: Summary of the PPP undertaken to date

Task	Details	Date
I&AP notification (relevant authorities and I&APs)		
I&AP identification	An I&AP database was developed for the project by establishing the jurisdiction of organisations, individuals and businesses in proximity to the project site or within an interest in the proposed development. The database of I&APs includes the landowner, the adjacent landowners, relevant district and local municipal officials, relevant national and provincial government officials, and organisations. This database is being augmented via chain referral during the BA process and will be continually updated as new I&APs are identified throughout the project lifecycle. The current list of potential I&APs is attached in ***Appendix 7***.	Continuous process
Site notices	Site notices with a size of 600 mm x 420 mm were erected at strategic points to inform the general public of the proposed projects and the PPP. Photos of the site notices have been included in ***Appendix 7*** of the draft Basic Assessment Report (DBAR).	23 April 2018
Initial Notification	Initial notification letters were sent to various stakeholders including affected farm owners and organs of state **(*Appendix 7*).** Emails were sent to the identified I&APs, notifying them of the availability of the Background Information Document (BID) **(*Appendix 7*)** for the proposed project for perusal and comment. Authorities and I&APs were given 30 days within which to register and submit initial comments on the proposed project.	24 April 2018
Media Adverts	The Diamond Field Advertiser and Kalahari Bulletin newspapers were used to advertise the project ***(Appendix 7***)	26 April 2018
Comments received	The comments received from the landowners to date, are captured in the Issues and Response Report.	Continuous
Land owner consultation	Land owners will be visited during the 30 days PPP period. Which ones? Details? Is this the additional activities that you referred to earlier?	

Task	Details	Date
Comment on DBAR and EMPr	All the relevant stakeholders were notified of the availability of the DBAR and EMPr to provide their comments as outlined in Appendix 7..	04 May 2018

3.2 SUMMARY OF ISSUES RAISED BY I &AP'S

No comments have been received to date. A number of people have been registering as I&AP's.

Table 2: Summary of comments and responses report

Interested and affected parties **List the names of persons consulted in this column, and mark with an X where those who must be consulted were in fact consulted**	**Date Comments received**	**Issues Raised**	**EAP's Response to issues as mandated by the applicant**	**Section and paragraph reference in this report where the issues and or response were incorporated**
AFFECTED PARTIES				

4 PART D: BIOPHYSICAL AND SOCIAL ATTRIBUTES ASSOCIATED WITH THE ALTERNATIVES

4.1 ENVIRONMENTAL AND SOCIAL ATTRIBUTES ASSOCIATED WITH THE ALTERNATIVES

4.1.1 Details of the alternatives considered

Alternatives in this proposed project have been termed as options as the two alternatives are within the same farm portion, and already authorised footprint of the Redstone CSP Power Project.

The alternatives considered are:

Option A: The PV Power Plant is proposed on the western boundary of the Project Site, adjacent to the ACWA Power SolarReserve Redstone Solar Thermal Power Plant (RF (Pty) Ltd, CSP Facility, for ease of access to the power block/substation.

Option B: The PV Power Plant is proposed within the heliostat field of the ACWA Power SolarReserve Redstone Solar Thermal Power Plant (RF (Pty) Ltd, CSP Facility, for ease of access to the power block/substation

4.1.2 Issues raised for all options during the Public Participation Process

See public participation information in Part C.

4.1.3 Baseline environment

4.1.3.1 Topography

The Project Site is generally flat, gently sloping and lies at a height of approximately 1 500 metres above sea level (although small areas of slightly steeper topography occur close to the north-eastern boundary).

4.1.3.2 Geology

The Project Site is located in a north-west – south-east running valley with two semi-parallel ranges of hills occurring on the western and eastern sides of the property. This valley is controlled by faults on the two flanks with the eastern hills formed by hard, weather-resistant banded ironstone and jaspilite. The eastern hills form part of the Asbestos Hills stretching from Kuruman in the north to Prieska in the south. The greater Project Site is located on the eastern flank of the Dimoten Syncline striking in a general north-south direction. The geological map (SRK, 2011) indicated that significant parts of the study area was covered by deposits of mainly windblown sand, occurring mainly along the valleys in the area and are normally thin, seldom exceeding 10 m in vertical thickness. A borehole drilled by SRK, north of the Groenwater settlement, intersected argillaceous, loose and well weathered material up to 30 mbgl, however this is an anomaly and likely linked to a lineament. However, on the eastern side of the Asbestos Hills the Recent deposits are much thicker and comprise of windblown sand, rubble and surface calcrete deposits. A borehole drilled by the DWS east of Lime Acres intersected 60 m of surface calcrete and calcified gravel before intersecting dolomite bedrock. The eastern part of the study area is underlain

by rocks of the Daniëlskuil Member of the Asbestos Hills Formation, which forms part of the Griquatown Group of the Griqualand West Sequence. These rocks consist mainly of brown jaspilite and crocidolite and form the prominent hills on the eastern side of the greater Project Site.

The Asbestos Hills Formation is followed by the Makganyene Formation, which forms part of the lower Postmasburg Group. The Makganyene Formation contains a variety of rock types including diamictites, sandstones, shales andbanded ironstone, which were deposited after a period of erosion forming an unconformity in this specific area. The upper part of this Formation consists of a 1–3 m thick tuffaceous unit that characteristically separates the diamictites of the Makganyene Formation from an overlying 900 m thick succession of basaltic andesitic lavas of the Ongeluk Formation. This Makganyene Formation displays extreme thickness variations, from 3 m near the Orange River, to 70 m near Kuruman and to 500 m in a borehole near Postmasburg (Visser, 1971). In the study area outcrops of the thin tuffaceous unit could not be located, likely due to the limited extend thereof, weathering and weak outcrops of the Makganyene Formation.

The Ongeluk Formation, consisting of amygdaloidal andesitic lava with interbeds of tuff, agglomerate, chert and red jasper, rests conformably on the Makganyene Formation. This formation covers most of the study area including the area where the STEP Plant is proposed. Limited outcrops of lavas occur on the eastern side of the greater Project Site (at Humansrus homestead and south-east thereof).

Several structural features such as lineaments, faults and dykes are mapped in the greater study area. Most significant are the two semi-parallel faults that control the valley on the Project Site, with the area between these faults has apparently been displaced downwards to form a graben structure.

4.1.3.3 Geohydrological Baseline

Groundwater in this greater study area occurs mainly in secondary aquifers (semi-confined fractured-rock aquifers), which are formed by the jointing and fracturing of the otherwise solid bedrock by compressional and tensional forces that operates in the Earth's crust from time to time. The fractures are formed by faulting, folding, cooling of magma outflows, intrusion of dolerite dykes and other geological forces. Generally the harder rocks (banded ironstone, jaspilite and lava) fracture more easily under stress to form superior aquifers compared to the softer sediments such as shale and mudstone, which rather deform than fracture under stress.

Some primary aquifers (unconfined interganular aquifers) occur in the vicinity of the Groenwater Spruit on the north-western side of the Project Site. This area is subject to shallow groundwater levels within the unconfined unconsolidated alluvial sediments and weathered zone. The alluvial deposits in this area are normally limited in the vertical and horizontal extend and form pockets of clay, silt, sand and pebbles. All these result in a poorly developed primary aquifer that is very vulnerable to droughts.

4.1.3.4 Climatic Conditions

The climate of the District is regarded as typical of the Northern Karoo interior, with a low, generally summer rainfall distribution, warm to hot summers and cold to very cold winters (Koch & Kotze, 1986). Daily summer temperatures

within the District range between ~18.5 °C and ~25.4°C averaging at around 21.3 °C, whilst winter temperatures drop to between ~8.7 °C and ~17.5 °C, averaging at around ~12.4 °C for a season. The highest maximums temperature recorded in the District range from 39.9 °C to 41.2 °, with the coldest recorded temperature, 10.6 °C, recorded in the Koopmansfontein area. Very warm temperatures (>42oC) may be experienced in summer, while frost in winter (end of March to early September) is not uncommon, and may be severe on occasion.

Precipitation cleanses the air by washing out particles suspended in the atmosphere (Kupchella and Hyland, 1993). It is calculated that precipitation accounts for about 80-90% of the mass of particles removed from the atmosphere (CEPA/FPAC Working Group, 1999). The District falls in the South African summer rainfall region receiving an average total annual rainfall of ~484 mm.

4.1.3.5 Palaeontological, Heritage & Archaeological Baseline

Palaeontological Baseline

The south-western and north-eastern portions of the study area are underlain by Late Precambrian (Early Proterozoic) sediments of the Late Precambrian Transvaal Supergroup within the Prieska Subbasin. The Daniëlskuil Formation (Vad) of the Ghaap Group (Asbestos Hills Subgroup) consists of some 200m of banded iron formations (BIF) that are almost 2.5 billion years old (Eriksson et al. 2006 and references therein). The only fossils that are likely to occur here are microbial assemblages embedded within finer-grained cherts or forming stromatolites (microbial mounds; Almond & Pether 2008).The fossil record of the Early Proterozoic Postmasburg Group of the Transvaal Supergroup is very sparse (Almond & Pether 2008). Stromatolitic bioherms (microbial reef mounds) up to 5m long and 3m thick that are made up of manganese-rich laminated carbonates are recorded from the glacially-influenced Makganyene Formation (Vm) by Polteau et al. (2006). These carbonate rocks are interbedded with glacial diamictites in the Prieska Subbasin. The intimate association of warm-water carbonates and cold-water glacial deposits at low palaeolatitudes is of palaeoclimatic significance (See also Polteau 2000, 2005).

No fossils are recorded from the overlying Ongeluk Formation (Vo), dated at approximately 2.2 Ga (billion years) which consists largely of basaltic and andesitic lavas that were erupted both subaerially and under water (Eriksson et al. 2006). The central part of the study area is largely blanketed by unconsolidated aeolian (i.e. wind-blown) sands of the Quaternary Gordonia Formation (Kalahari Group) (Qs), the geology of which is reviewed by Partridge et al (2006).

The palaeontological baseline for the Project Site requisites no further palaeontological studies.

Archaeology: Stone Age Baseline

Based on empirical evidence (Henderson, 2000), it is proposed that the San people occupied the interior regions of South Africa. The empirical evidence described, includes stone tool, scatter and rock engravings near water course and/or sources such as springs; engravings are also noted as a common feature in small Koppies that define the landscape of the interior regions of South Africa. Similar finds were made in the study area in an initial

study conducted in the survey area in 2010 by Webley, which was corroborated by the field work, which found concentrations of Stone Age material around the dry pan in the southern section of the study area. Other material culture found in the region that point to the presence of San include remains of ostrich shell-beads and ostrich egg-shell that were used by the San people to carry water and as drinking vessels.

The Northern Cape is well known for its rock art in the form of rock painting and engravings, with the archaeological databases at the National Museum in Bloemfontein and the McGregor Museum in Kimberley containing hundreds of documented rock art sites with archaeological field work on projects such as transmission line construction leading to the discovery of new sites (PGS, 2010). Known engraving sites close to the study area are at:

- Daniëlskuil: Ouplaas (Morris & Beaumont, 1994), Townlands (Collins, 1973; Wilman, 1933);
- Lime Acres: Carter Block (Morris, 2008; Wilman, 1933); and
- The farm Lemoenkloof just north of the study area (pers. Comms with Mst. Scholtz).

Numerous areas where low density scatters of Middel and Later Stone Age lithics were identified on the Project Site, with the majority of finds located where pebble layers were exposed – mostly along dry river beds and pans that occur in the study area. No context and in situ preservation were identified and sites were classified as having a low heritage significance and rated as Generally Protected C.

PGS06 - situated on a low rise in a clearing between the shrub and grass land on the western side of the Redstone CSP Project development footprint, is characterised as a medium density of MSA flakes ,cores and waste are present in situ. Being situated away from dry river beds and pans and points to a localised Stone Age site with indications of napping (production of lithics), the position of the site points to a possible hunting/lookout base. Heritage significance of the site is seen as of Medium significance and rated as Generally Protected B.

PGS06 was documented through surface collection and test excavation, inclusive of mapping of the lithic distribution as well as analysis of the lithic assemblage where after it was permitted for destruction.

Archaeology: Iron Age Baseline

Iron Age expansion southwards past Kuruman in to the Ghaap plato and towards Postmasburg is dated to the 1600's (Humphreys, 1976 and Thackeray, 1983). Definite dates for Tswana presence in the Postmasburg area are around 1805 when Lichtenstein visited the area and noted the mining activities of the Tswana (probably the Thlaping) tribes in the area. The area of Daniëlskuil was named by the Thlaro as Thlaka la tlou (reeds of the elephant) and with the Thlaping they settled the area from Campbell in the east to Postmasburg and towards the Langeberg close to Olifantshoek in the west before 1770 (Snyman, 1988). The Korana expansion after 1770 started to drive the Thlaro and Thlaping further north towards Kuruman (Shillington, 1985)

Several burial areas and/or informal cemeteries dating back to 1913 are present on the Project Site, outside the proposed PV Project development footprint, albeit in proximity of the neighbouring PV Projects – Jasper and Lesedi PV Projects to the east and south of the development footprint.

Archaeology: Post 1800's

Ouzman (2005) traces the Korana to what he calls "pre-colonial Kora" in the Cape Province and their father (of "frontier Korana") to James Bloem, a 'white' Prussian from Thuringa who immigrated to the Cape in 1780, escaping to Namaqualand after accusations of murdering his wife.

Archaeology: Humansrus Farm History

The survey diagram of the general area (SG3296/1878) (Webley, 2010) identifies the adjoining farms Groenwater and Lemoenkloof but Humansrus is not named suggesting it acquired its name after 1878. Webley (2010) indicates that the current owner's (Mr. Scholtz) grandfather purchased the portion of the farm on which the old Humansrus house is located, during the 1940's. No other information on the Human family other than the headstone in the family graveyard close to the ruins of the original farmstead is available - Hester G. Schoeman (ne Human) born 23 September 1877 - died 28 May 1913.

Geology

Interpretation of the regional geology considering the Witwatersrand, Transvaal Supergroup, Dwyka and Ecca groups its likely to encounter andesite, shale, diabase and/or dolomite geology. The colloidal fraction (*particles <0,002mm*) of the Bainsvlei, Hutton and Mispah soils is predominantly 1:1 layer silicates, *i.e.* kaolinite with oxides and hydroxides of Fe and Mn under fluctuating aerobic and anaerobic soil moisture conditions. Considering Bowen's reaction series the soils weathered from intermediate andesitic, felsic or granitic geology from biotite and/or muscovite mica. If the geology is dolomite the soils would be wind / water transported, because due to the absence of Si in $CaMgCO_3$ no soil can form from dolomite by normal weathering processes.

4.1.3.6 Avifaunal Baseline

Six vegetation types are present in the areas surrounding the Project Site, Ghaap Plateau Vaalbosveld, Kuruman Mountain Bushveld, Kuruman Thornveld, Olifantshoek Plains Thornveld, Southern Kalahari Mekgacha, and Southern Kalahari Salt Pans. The Project Site itself represents two vegetation types Olifantshoek Plains Thornveld and Kuruman Mountain Bushveld, with the former representing the majority of the Project Site. The Project Site does not fall within an Important Bird Area (IBA), nor were any IBA's identified within close proximity to the Project

Site. Three CWAC sites are situated to the east of the Project Site, namely Danielskuil Pan, Great Pan, and Rooipan.

The Project Site is characterised by several micro-habitats, relevant to avifauna, which include –

- Drainage lines and wetlands.
    - A wetland with associated riparian habitat is situated parallel to the rail line at the south west side of the Project Site.
    - Drainage lines and wetlands are an important form of habitat to numerous species. Drainage lines are often surrounded by natural grasslands, which may provide habitat for species such korhaans, cranes, larks and pipits. Various waterfowl, such as ducks and geese, may make use of these areas.
- Man-made dam(s)
    - Artificially constructed dams are considered important attractants to various bird species with numerous waterfowl frequenting these areas and crane species often use dams to roost in communally. Birds such as flamingos and African Spoonbills may make use of these areas.
- Grasslands.
    - The majority of the site is classified as Olifantshoek Plains Thornveld grasslands, which represent a significant feeding area for many bird species such as Blue Crane, Secretarybird, Kori Bustard and Northern Black Korhaan. Grassland patches are a favourite foraging area for game birds such as francolins and Helmeted Guineafowl, as well as small mammals such as Suricates. The presence of small mammals in turn may attract large raptors because of both the presence and accessibility of prey.
- Bushveld and thicket patches
    - Small Acacia thickets and bushes are present on site, located in close proximity to disturbed areas such as homesteads and kraals. These small thicket areas attract smaller passerine

species such as Robins and Shrikes. The trees are used by weavers and Sparrow-weavers for nesting and by Raptors for perching.

- Water through points
    - Albeit the vegetation around these points be overgrazed and minimal, small species such as robins and wagtails are attracted to the water trough itself to drink, while the open, short grassy areas are favoured by terrestrial species such as coursers and lapwings.

4.1.3.7 Biodiversity Baseline

The Northern Cape region is one of the most arid areas in southern Africa, with the Project Site situated within the Savanna Biome, the largest Biome in southern Africa, occupying 46% of its area. The Kalahari savanna is a sandy, arid region in the western interior. Within the Kalahari savanna system, seven major vegetation types have been described. Two of these vegetation types are present within the study area, namely:

- Kalahari Plain Thorn Bushveld (Olifantshoek Plains Thornveld) - This vegetation is characterised by rolling hills with gentle to moderate slopes and hill pediment areas with an open shrubveld with Lebeckia macrantha prominent in places with a well-developed grass layer. The conservation status of this unit is set at Least Threatened, but none of this vegetation type is formally conserved in statutory conservation areas. The transformation status is low, but some parts are heavily utilised for grazing purposes. Species of conservation importance that are present in this vegetation type include the Griqualand West Endemics Lebeckia macrantha, Justicia puberula, Tarchonanthus obovata, Euphorbia wilmaniae, Digitaria polyphylla, Sutera griquensis and the Endemic Euphorbia planiceps; and

- Kalahari Mountain Bushveld (Kuruman Mountain Bushveld) - This vegetation type comprises the pediment areas of the major mountains in the region as well as some of the ridges to the west. The vegetation comprises very wide and diverse units on plains with usually open tree and shrub layers with Acacia luederitzii, Boscia albitrunca and Searsia tenuinervis. The grass layer is typically poorly developed and sparse. Red aeolian sands characterise the substrate. The conservation status of this vegetation type is set at Least Threatened, with only 0.3% statutorily conserved in the Witsand Nature Reserve. Only about 1% of the area has been transformed and erosion is low. Species of conservation importance that are present in this vegetation type include the Kalahari and Griqualand West Endemics Acacia luederitzii var. luederitzii, Lebeckia macrantha, Hermannia burchelli,

Justicia puberula, Putterlickia saxatilis, Tarchonanthus obovata, Anthephora argentea, Sutera griquensis and the Endemic Amphiglossa tecta.

Floral Baseline

The Project Site (Bathusi Environmental Consulting, 2011) is largely representative of the regional vegetation. The savanna physiognomy of woodland and shrubland habitat of the Project Site is indicated by the structural dominance of woody species. The interplay between rocky areas and low-lying grasslands with intermittent drainage lines is typical of the region, resulting in clearly defined communities. Although not unique, slight variations do occur, which become important on a local scale, such as the Olea Woodland and localised rock sheets in the Floodplain habitat type. Olea woodland variations occur in small patches in the larger region, but it is by no means a frequent occurrence. A diverse composition of grasses and forbs are present in the grassland habitat types, with the floristic diversity dominated by Poaceae. Rock sheets associated with shallow gravely soils in the close vicinity of drainage lines and floodplains are important in terms of the occurrence of succulent species.

The remainder of the Project Site is characterised by open shrubveld to the west, closed shrubveld to the east, as well as drainage lines with associated floodplains and grassland plains. These habitat types are well defined and clear boundaries exist, mostly driven by the presence/ absence of rocky/ stony soils and slopes. Grazing practices have resulted in slight deterioration of the status of particularly the grassland areas, resulting in the influx of low shrub species. No Threatened plant species are known to occur in this particular-degree grid, but four protected tree species are known to occur in the region, of which three were confirmed present on the Project Site, which include –

- Acacia erioloba
- Boscia albitrunca
- Olea europaea subsp. africana

During the 2011 Survey, the largest portion of the Project Site was classified as having a medium sensitivity, where the loss of these areas is not expected to result in severe impacts on the floristic environment when considered on a regional scale.

4.1.3.8 Faunal Baseline

- Fifty-six Red Data species are known to occur in the Northern Cape Province (mammals, reptiles, amphibians and invertebrates) with forty-one species confirmed to occur in the study area.
- Forty-one species having low probability of occurrence on the Project Site.
- Ten species having a moderate probability of occurrence on the Project Site.
- Two species having a high probability of occurring, namely *Tatera leucogaster* (Bushveld Gerbil, DD) and *Manis temminckii* (Pangolin, VU).
- This composition is regarded typical of an area the size of the study site i.e. the larger property, situated within the Eastern Kalahari Bioregion, given the mixture of habitat types present on the Project Site.

During the 2011 Survey, three species, *Mellivora capensis* (Red), *Atelerix frontalis* (NT), *Suncus varilla* (DD) and *Hyaena brunnea* (NT) were confirmed present on the Project Site.

4.1.3.9 Socio Economic Baseline

This section examines key socio-economic characteristics of the study area. This is essential as it provides both qualitative and quantitative data related to the economies under observation. It should be noted that where possible information is provided for 2011, which is an estimate based on the historical trends and available statistics. The following socio-economic indicators are analysed:

- Population size and growth;
- Average household size;
- Income and Expenditure patterns;
- Labour Market dynamics;
- Production;
- Gross Domestic Product per Region, and
- Service delivery and access to tenure.

Population Size

The population of any geographical area is the cornerstone of the development process, as it affects the economic growth through the provision of labour and entrepreneurial skills, and determines the demand for the production output. Examining population dynamics is essential to gaining an accurate perspective of those who are likely to be affected by any prospective development or project. This sub-section describes the status quo of the study area's population as estimated for 2011.

Table 13: Population Size and Growth Rate

Study area	2011	Historical growth rates			
		1995-2000	2000-2005	2005-2010	1995-2011
South Africa	50 430 328	1.7%	1.3%	1.1%	1.4%
Northern Cape	1 101 318	1.2%	0.4%	0.3%	0.6%
Siyanda DM	247 611	1.4%	0.5%	0.4%	0.8%
Tsantsabane LM	29 150	0.7%	0.9%	1.2%	0.9%

As indicated in the table above, the Compounded Annual Growth Rate (CAGR) of the primary study area's population between 1995 and 2011 was 0.9%. It was higher than the CAGR of the Siyanda DM and the provincial population during the same period, but lower than that of South Africa's population. Whilst the population of the

Siyanda DM, Northern Cape and South Africa experienced a slowdown in their growth rates, the primary study area's population growth rate has been increasing. This could be explained due to the fact that mines constitute a prominent land use in the area, which is home to the Assmang Iron Ore Mine at Beeshoek and the newly established Kolomela under Kumba.

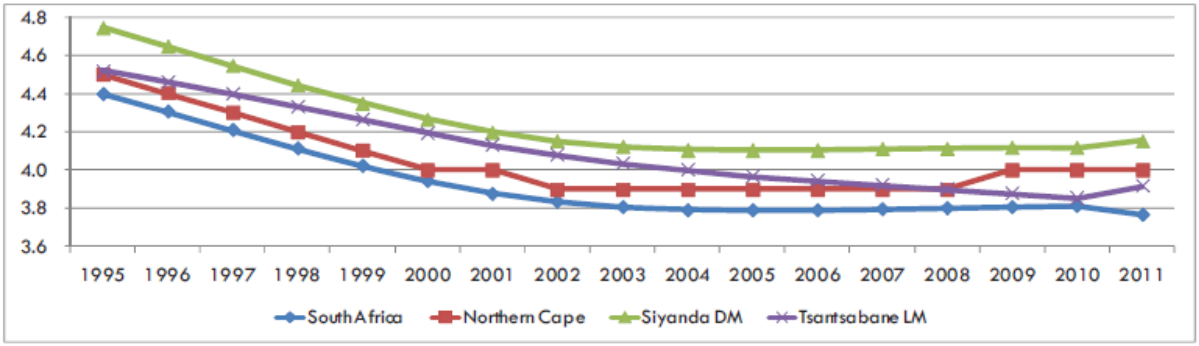
Average Household Size

Household data enables a richer interpretation of the results of socio-economic impact analyses. A large increase in household numbers coupled with the increase in disposable income levels result in greater consumption, which in turn stimulate local production and as a result the economy. In addition, knowledge of the size of the study areas in terms of households is useful for interpretation of the magnitude of the economic impact that could be created by the proposed activity. South Africa have 13 385 517 households, which means that the average household size in the country is 3.8. The Northern Cape is estimated to have above 281 015 households and a bigger average household size than in the country. The Siyanda DM has 61 453 households and the biggest average household size in all of the study areas. The primary study area is expected to have 7 485 households and almost the same average household size (3.9) as the rest of the Province and country.

Table 14: Household details

Study area	HH number	Average HH size	Household number historical growth rates			
			1995/00	2000/05	2005/10	1995/11
South Africa	13 385 51	3.8	4.0%	2.1%	1.0%	2.3%
Northern Cape	281 015	4.0	3.6%	1.1%	-0.2%	1.5%
Siyanda DM	61 453	4.1	3.5%	1.3%	0.3%	1.7%
Tsantsabane LM	7 485	3.9	2.3%	2.0%	1.8%	2.0%

Over the years, as indicated in Table xx, the rates at which the numbers of households in the secondary and tertiary study areas were increasing have been slowing down, which mirrors the trend observed with respect to population dynamics in these study areas. In the primary study area, the trend though was different – with the population growth rate increasing, the household growth rate was also slowing down. When compared with population growth rates, it could be noted that the household growth rate in South Africa was on par with the population growth rate between 2005 and 2010. In the Northern Cape and the Siyanda DM, household growth rates were however significantly lower than their population growth rates, which means that the average household size in these areas has been slightly increasing. The main factors that affect the household growth include, besides the population increase, the change in age structure and incidence rate, or the likelihood of people of a certain age to start a new household. The significant difference between a household growth rate and a population growth rate, though, is usually attributed to the change in age structure. Household size is also influenced by many other factors such as culture, traditions, education levels, income levels, etc. Over the years, it has been observed that the size of an average household in the country has been declining.



As illustrated in table xx, the average household size in South Africa in 1995 was 4.4, whilst in 2011 it was 3.8. In the secondary and primary study areas, the average household size also dropped significantly between 1995 and 2011, although it should be noted that in the Northern Cape, the Siyanda DM and the Tsantsabane LM, the average household size was slightly higher than in South Africa. In the last three years, a slight increase in the average household size in all areas is observed, which could suggest that the trend of the sharp decline in the household size observed between 1995 and 2002 has been reversed.

Income and expenditure patterns

Income distribution is one of the most important indicators of social welfare, as income is a primary means by which people are able to satisfy their basic needs such as food, clothing, shelter, health, services, etc. Changes in income inflict changes in the standard of living, more specifically: a positive change in income can assist individuals, households, communities and countries to improve living standards.

There is a direct linkage between the household expenditure and economic growth. Increase in household expenditure means a greater demand for goods and services, which means an increase in production and positive change in the size of an economy. As has been seen in 2005-2006 in South Africa, robust increase in disposable income coupled with low interest rates in the country stimulated an increase in consumption by households, in particular durable and semi-durable goods, which in turn had a positive impact on the country's economy. Knowledge of the volume of the disposable income and the expenditure patterns of households, therefore, can provide vital intelligence with respect to the sectors that are most dependent on the household income and therefore would be most affected in the case of change in household income. More recent data, unfortunately, are not available, whilst historical information is not robust and reliable enough to escalate the latest figures and estimate the situation in 2011 with great confidence. Based on the 2007 figures it could be concluded that the household income situation mirrored some of the patterns observed in the Northern Cape and in the rest of the country. First of all, the percentage of households earning less than R3 200 per month (R38 400 per annum) in the Tsantsabane LM area was slightly higher than in the Siyanda DM and the Province, but lower than in the rest of the country in 2007. Overall, more than half of households earned less than R3 200 per month in all the study areas and the country in 2007. At the same time, though the percentage of households without any income at all was significantly higher in the primary study area than in any other study area analysed. From an average

household income perspective, an average household in the primary study area earned more or less the same as an average household in the Siyanda DM, what means that there are more households in the Tsantsabane LM with a higher income, but this average household income is significantly less than households in the Northern Cape and South Africa.

Table 15:Income

Income category (per annum)	South Africa		Northern Cape		Siyanda DM		Tsantsabane LM	
No income	8.2%		6.8%		4.9%		11.4%	
R1 - R4 800	5.0%		3.5%		2.0%		3.1%	
R4 801 - R9 600	9.0%	60.2%	7.9%	58.2%	9.3%	57.9%	7.9%	59.4%
R9 601 - R19 200	18.9%		20.2%		22.1%		16.7%	
R19 201 - R38 400	19.1%		19.8%		19.6%		20.3%	
R38 401 - R76 800	11.4%		13.2%		12.3%		15.3%	
R76 801 - R153 600	7.6%		8.0%		6.8%		8.9%	
R153 601 - R307 200	5.3%		4.7%		3.7%		3.6%	
R307 201 - R614 400	2.8%		2.2%		1.7%		2.5%	
R614 401 - R1 228 800	0.9%		0.6%		0.6%		0.6%	
R1 228 801 - R2 457 600	0.3%		0.2%		0.1%		0.3%	
More than R2 457 600	0.2%		0.2%		0.1%		0.1%	
No response	11.1%		12.6%		16.8%		9.4%	
TOTAL	100%		100%		100%		100%	
Weighted av. (2011 prices)	R8 920		R8 048		R6 938		R6 509	

Labour Markets

The composition of the labour force in the primary study area, Siyanda DM, Northern Cape and the country as reported by the Labour Force Survey is detailed in Table 2-4. Unfortunately, though, since the latest Labour Force survey does not report on the data for the District Municipalities, information for the study areas is sourced from the Quantec database and represents 2009 figures. This allows for a comparison between the study areas.

Table 16: Labour Market

Indicators	South Africa	Northern Cape	Siyanda DM	Tsantsabane LM
Working age population	31 496 936	704 615	163 008	18 707
Non-EA	15 131 133	329 386	71 740	7 811
Labour Force	16 365 803	375 229	91 268	10 896
Employed	*12 260 902*	*271 688*	*68 166*	*6 851*
Unemployed	*4 104 901*	*103 541*	*23 101*	*4 044*
Unemployment rate	25.1%	27.6%	25.3%	37.1%
LF participation rate	52.0%	53.3%	56.0%	58.2%

Economic Production and GDP

Interpretation of economic impacts requires a sound understanding of the size of the economy and its dynamics in the past. A number of indicators exists that can describe the economy of a region or an area. The most common variables that are used for the analysis include production and Gross Domestic Product per Region (GDP-R). The former represents the total value of sales of goods and services, or the turnover of all economic agents in a region; whilst the latter, using the output approach, means the sum of value added created by all residents within a certain period of time, which is usually a year.

The trend at which the GDP-R has been changing in the past is also referred to as economic growth indicator. It is a measure of both the performance of an area and the well-being of the citizens of an area. Faster economic growth than population growth is taken as an indicator of a healthy economy and an improvement in citizens' well-being, in this area that is on a decline.

Structure of the Economy

The structure of the economy provides valuable insight into the dependency of an area on specific sectors and its sensitivity to fluctuations of global and regional markets. Knowledge of the structure and the size of each sector are also important for the economic impact results' interpretation, as it allows the assessment of the extent to which the proposed activity would change the economy, its structure and trends of specific sectors. It should be noted that the calculation of the structure of the economy in current and constant prices provides different results. This is due to the fact that prices on goods and services do not change proportionally over years. Prices on goods of one sector could grow faster than prices on goods or services in other sectors. The indication of the structure of the economy in basic prices or prices of 2005 as was done in this case illustrates the relative composition of the economy, but excludes the benefits or dis-benefits of that economy that might have been experienced due to price effects. This is why, the presentation of results in nominal prices is also important as it allows the illustration of the economy's structure taking into account the current market prices and therefore the effects thereof on the income or Gross Operating Surplus. The comparison of the structure of the economy in terms of basic and nominal prices also provides valuable insight into the sensitivity of that economy with respect to changes of commodity prices. An economy that generates a significant share of its GDP-R from certain commodities will most likely have a significantly different structure when compared between nominal and basic prices.

Structure of Employment

The employment structure presented largely corresponds with the structure of the economy with the tertiary sector making the largest contribution towards employment creation in all areas under analysis. More than two thirds of the people employed in South Africa work in the tertiary sector, in particular the community and government services sector and the trade sector. Agriculture, which accounted for 3% of the national GDP-R in 2011, on the other hand, provided 6.4% of all employment opportunities; whilst the contribution of the mining industry towards the employment in the country was smaller than its contribution towards GDP-R. Nevertheless, both of the sectors are labour-intensive and create a notable number of employment opportunities in the country, particularly in rural

areas. Employment structure in the Northern Cape is dominated by the number of people who are working in the tertiary sector, specifically in the trade, community and government services. Its secondary sector creates 9.0% of jobs in the Province, whilst its primary sector creates 24.8%. Most of the people employed in the Siyanda DM are working in the tertiary sector too, specifically in the community and government services, trade and finance sector. Its secondary sector creates 10.1% of jobs, whilst its primary sector creates 36.9%. The employment composition in the Tsantsabane LM is quite similar to that of the Northern Cape with the sectors providing the largest numbers of jobs being the community and government services, mining and quarrying, trade, and finance sectors. The mining sector, which contributes 53.6% to the GDP-R (in nominal prices), provides only 18.2% of employment opportunities in the area. At the same time, the trade, community and government sector's employment contribution is greater than its contribution towards GDP-R.

4.1.3.10 Soils and Agriculture Baseline

The land use related to the Project Site is no longer considered to conform to the extensive untransformed habitat it was associated with in 2011, but no falls within the limited areas characterised by development, agriculture, mining and power generation resultant in large scale habitat transformation.

The Project Site is covered by three (3) land types –

- Ae214 – Hutton 36 and Hutton 33 (Red structure-less soils, high base status)
- Characterised as Red, sandy loam to sandy clay loam soils on hard rock
- Agricultural potential based on soil composition/characteristics: Low 51.7%
- Ae215 – Hutton 33 and Hutton 30 (Red structure-less soils, high base status)
- Characterised as Red, very sandy soils on hard rock and calcrete
- Agricultural potential based on soil composition/characteristics: Moderate 92.5%
- Ib237 Rock and Hutton 33 and Hutton 30 (Rocky areas with shallow soil).
- Characterised as Red, sandy top soils on rock
- Agricultural potential based on soil composition/characteristics: Moderate 86.0%

The central largest portion of the Project Site comprises moderately deep to deep soils (AE215) (300-1 200+ mm deep) onto rock, while the remainder of the Project Site has more shallow soils or rock (AE214 and Ib237 respectively). Albeit that the Project Site is characterised by moderately deep to deep soils, the low rainfall in the District means that the potential for cultivation is extremely low due to the location of the Project Site. The climatic

restrictions classifies this part of the Northern Cape Province more suited for grazing, with the grazing carrying capacity estimated at 15-20 ha/large stock unit (ARC-ISCW, 2004) – a very low carrying capacity.

The Project Site used to be zoned as Agricultural Zoning, but was rezoned in 2012 to Special: Solar Power Park for the purpose of developing solar power projects.

4.1.3.11 Visual Baseline

The study area can be divided into a number of primary "landscape types" each with its unique landscape characteristic, sense of place and aesthetic value. These include:

- Kalahari Mountain Bushland;
- Rolling grassland with drainage lines;
- Rural villages;
- Urban areas;
- Infrastructure and utilities; and
- Mining activities**.**

The Project Site falls within the Kalahari Mountain Bushveld Savannah biome, which is typically found on rocky, shallow soils on the hills at an altitude of 450 mm to 1 250 m. It is an open savannah dominated by shrubs and a tree layer. The tree layer on the Project Site is poorly developed and individuals of Wild Olive (*Olea europaea* subsp. africana) and Black Thorn (*Acacia mellifera* subsp. *detinens*) are widely scattered. The grass layer is moderately developed and largely dependent on the rockiness of the area and the prevalent livestock farming practices on the Project Site.

The interior of the larger Project Site, where the Redstone CSP Project is proposed, comprises of open grasslands situated in between two small ridge lines to the west and east, which merge into a general ridgeline north of the site. These ridges have a reasonably developed savannah cover of small shrubby material. To the south of the Project Site the valley is split by a small rise in topography that extends to the south east and the Lime Acres mining complex and town. The areas to the south of the Project Site are generally flatter, more open and dominated by grasslands, used mostly for grazing. The grasslands extends to the north of the Project Site and the R385 and eventually transform into ridges and hills that extend further north.

The following manmade infrastructure is present in the study area - railway, road and electricity infrastructure smaller towns and settlements such as Lime Acres, Owendale and Daniëlskuil as well as mining infrastructure.

4.1.3.12 Hydrology Baseline

The study area falls within the upper reaches of the Orange Primary Catchment area more specifically quaternary catchment D73A. A non-perennial stream is present in the south western part of the Project Site, adjacent the railway line and road – the Groenwater Spruit, which drains this catchment. In addition to the presence of this non-perennial stream, there is several small drainage features situated in the north and north east of the PV Power

Project Site (Option A). The study area is generally classified as relative dry and the ecological functionality of these areas would therefore be important on a local and regional scale on a temporary basis.

No significant wetlands, estuaries, Ramsar Sites or major dams are present within the immediate vicinity of the Project Site – over and above the Groenwater Spruit.

4.1.3.13 Wetland Baseline

The study area falls within the upper reaches of the Orange Primary Catchment area more specifically quaternary catchment D73A. A non-perennial stream is present in the south western part of the Project Site, adjacent the railway line and road – the Groenwater Spruit, which drains this catchment. In addition to the presence of these non-perennial stream, there is several small drainage features situated in the north and north east of the Project Site, which originate higher up in the hills and ridges before petering out on the flat central plain of the larger Land parcel.

The Wetland Impact Assessment (July 2011) revealed that only the Groenwater Spruit and its tributary have associated riparian habitat, calculated to cover approximately 31.7ha of the greater Project Site (comprising 2.5% of the larger Project Site). In addition to the riparian habitat, a small farm dam constructed along the Groenwater Spruit was also identified. The reach of the Groenwater Spruit located upslope of the railway line and gravel road is characterised by a clearly defined, incised channel characterised by a rocky substrate. The upper reaches of the Groenwater Spruit and its tributary flow along a poorly defined channel – where the riparian habitat is completely devoid of trees and is dominated by various grass species. The lower reaches of the Groenwater Spruit is characterised by a clearly defined, incised channel, broad and fairly shallow. Once again the riparian habitat is tree-less and dominated by grass species. Soils along this section of the riparian zone were typical of terrestrial soils with no signs of seepage into the stream channel. The channel was also completely dry downslope of the railway crossing.

The additional drainage lines represent low points within the landscape along which water is expected to flow only occasionally following heavy storm events, but which do not differ in vegetation structure or composition from the adjacent vegetation, and do not have a defined channel. The soils within these areas also showed no hydromorphic features and were typical reddish brown terrestrial soils

5 PART E: IMPACT ASSESSMENT

5.1 IDENTIFIED IMPACTS AND RISKS

This section summarises the potential impacts associated with the phases of the proposed PV power project activities. The potential impacts and risks are explored by investigating each aspect (i.e. air quality, soil quality, water quality etc.) associated to the proposed activities. The significance of each potential impact

are then rated by considering the probability, the duration of the impact / activity, the extend of the impact, and the severity according to the methodology described in section **5.2.1** below.

For the purpose of this section, the mitigation measures recommended will only summarise the approach taken to manage each risk. A detailed mitigation plan is provided in **Part F** of this report.

5.1.1 Methodology used in determining and ranking the impacts and risks

5.1.1.1 Impact characterisation (Methodology used for ranking impacts)

In this assessment, the impacts are described in terms of their characteristics, including the impact's spatial and temporal features (namely extent, duration, probability and magnitude). While an impact assessment typically focuses on the negative impacts, an impact can also be positive. The definitions of the terms used in this BA are described in **Table 13** below.

Table 17: Impact Characteristics

Characteristic	Definition	Terms	Scoring
Duration	The time period over which a resource / receptor is affected.	**Temporary** - (period of less than 1 year - negligible/ pre-construction/ construction) **Short term** - period of less than 5 years ie commissioning/operational period **Medium term** - period of less than 15 years ie operational period **Long term** - period of less than 20 years ie life of project **Permanent** - a period that exceeds the life of project– ie irreversible.	Temporary – 1 Short term – 2 Medium term – 3 Long term – 4 Permanent – 5
Extent	The reach of the impact (ie physical distance an impact will extend to)	**On-site** - impacts that are limited to the Project site. **Local** - impacts that are limited to the Project site and adjacent properties. **Regional** - impacts that are experienced at a regional scale, ie Gauteng. **National** - impacts that are experienced at a national scale. **Trans-boundary/International** - impacts that are experienced outside of South Africa.	On-site – 1 Local – 2 Regional – 3 National – 4 International – 5
Probability	Measure of the probability with which the impact	**Unlikely -** probably will not happen **Improbable -** some possibility, but low likelihood	Unlikely – 1 Improbable – 2 Probable – 3

Characteristic	Definition	Terms	Scoring
	is expected to occur	**Probable -** distinct possibility) **Highly probable -** most likely **Definite -** impact will occur regardless of any prevention measures	Highly probable – 4 Definite – 5
Magnitude	A measure of the damage that the impact will cause if it does occur	**No effect** - will have no effect on the environment **Minor** – minor and will not result in an impact on processes **Low** – low and will cause a slight impact on processes **Moderate** – moderate and will result in processes continuing but in a modified way **High** - processes are altered to the extent that they temporarily cease **Very high** - results in complete destruction of patterns and permanent cessation of processes	No effect – 0 Minor – 2 Low – 4 Moderate – 6 High – 8 Very high – 10

The significance (quantification) of potential environmental impacts identified during the Basic Assessment have been determined using a ranking scale, based on the following (terminology has been taken from the Guideline Documentation on EIA Regulations, of the Department of Environmental Affairs and Tourism, April 1998):

Occurrence

- Probability of occurrence (how likely is it that the impact may occur?)
- Duration of occurrence (how long may it last?)

Severity

- Magnitude (severity) of impact (will the impact be of high, moderate or low severity?)
- Scale/extent of impact (will the impact affect the national, regional or local environment, or only that of the site?)

The environmental significance of each potential impact is assessed using the following formula:

Significance Points (SP) = (Magnitude + Duration + Extent) x Probability

The maximum value is 100 Significance Points (SP). Potential environmental impacts were rated as high, moderate or low significance on the following basis:

- < 30 significance points = **LOW** environmental significance.
- 30- 60 significance points = **MODERATE** environmental significance
- >60 significance points = **HIGH** environmental significance

5.1.1.2 Determination of impacts

For the purposes of the impact identification process the following important definitions has been used in line with global EMS standards:

Aspects - an element of an organization's activities, products or services that can interact with the environment (Either positively or negatively). *Eg. Release of sediment from runoff during site clearance*

Impacts - any change to the environment, whether adverse or beneficial, wholly or partially resulting from an organization's environmental aspects. *Eg. Water contamination (Silting/sedimentation)*

Our impact determination process followed basic EMS impact assessment processes. The process is as follow (See also **Figure 8** below):

1. In order to identify all of the activities we first develop **process flows**. The process flows forces the assessor to go through the entire project systematically, from beginning to the end, which reduce the possibility of gaps and ensures all activities are identified.
2. During the process flow each identified activity forms a unit process. Following the development of the process flows, all the **inputs and outputs** associated with the unit processes of the process flow are identified. Inputs and outputs are simply any resource (water, soil, etc.), material (Liquid, solid, gas, or other elements) or effect (financials (economy), etc.) that enters or leaves a unit process / activity unit. *Eg. Particulates (As an output (Air pollution group))*
3. After the inputs and outputs have been identified, all the **aspects** that cause the inputs and outputs are then identified and listed. Following the listing of the aspects, the **impact** the aspect cause to the environment when they interact, is then identified. Simply put, the organization's activities, products or services that interact with the environment (called aspects) can, through inputs (Use FROM the environment) and outputs (Emission TO the environment), cause a change to the environment. That part or manner in which the environment is changed is called the impact (See definition above) and is then identified and classified. *Eg. Increase in particulate matter in air (PM10 and PM2.5). Grouped as air pollution*
4. After all of the impacts have been identified for each aspect, the impacts are grouped into **impact groups** (See **Table 19-** 24 below). This is done to better assess the collective impact group risk, as the smaller subdivision of impacts per aspect might isolate assessment of the risk to that specific aspect. This means that an impact might be small or medium for a few related aspects (eg. Air quality) if they are assessed in isolation. But when they all occur at the same time (Collectively), they might cause a concentration and push the collective impact to high. *Eg. Dust emissions from loading (One front end loader and one truck working in isolation) compared to dust emissions from loading, hauling,*

dumping, levelling, excavation (One front end loader, three dumptrucks, one bulldozer, two excavators working simultaneously).

5. Each of these impact groups is then assessed using the **risk characterisation** methodology as explained above in section 5.1.1.1. The risk characterisation will then outline the risk's significance. The **pre-mitigation** scenario entails the worst case in which nothing is done to mitigate the impact. The same risk characterisation process is followed for the **post-mitigation** scenario in which the impact is assessed assuming the mitigations are implemented fully.

For this report, the risk reporting is done as per **Table 19-24** below, with the impacts identified based on the respective impact grouping. The impact groupings identified are the following:

1. Air quality
2. Noise
3. Terrestrial habitat
4. Water quality and resources
5. Landscape and visuals
6. Traffic
7. Heritage
8. Socio economic
9. Unplanned events
10. Cumulative impacts

For each impact grouping, the construction and operational impacts will be identified and then assessed. The assessment will entail the pre-mitigation scenario, assuming no measures are taken to mitigate the impact. The Mitigation measures will then be identified and the impact will be re-assessed with these mitigations assumed fully implemented, and the residual risk significance will then be determined.

Table 19: Possible biophysical and socioeconomic aspects identified and associated impact groupings

Impact grouping	Potential aspects
Air quality	• Dust emissions from earthworks, moving machinery and vehicles • Dust emissions from dry PV module cleaning • Engine emissions from construction vehicles
Noise	• Noise emissions from the use of vehicles and machinery during the construction phase
Terrestrial habitat	• Removal of vegetation (habitat) and associated fauna. • Loss of topsoil and associated soil resources • Destruction of Avifauna
Water quality and water resources	• Sediment release from runoff due to site clearance and removal of vegetation • Release of hazardous substances into runoff from spillages • Destruction of wetlands and watercourses
Landscape and visual	• Visual effects as a result of the project
Traffic	• Increase in vehicles on public roads due to the construction and operation activities
Heritage	• Loss of or damage to heritage resources
Socio-economic	**Community health, safety and security**: • Noise and vibration 'emissions' (Sound waves) during construction and operation • Movement of materials and workers during construction and operation
	Worker health and safety: • Hazardous construction, operational or decommissioning activities
	Local and Macro Economy: • Procurement of goods and services required by the project during construction and operation (Positive impact) • Global Domestic Product (GDP) • National taxation
Unplanned events	• Accidental releases of hazardous chemicals during construction and operation activities (Could impact on soil and water resources) • Creation of fires and explosions due to the presence of combustible materials (Fuel, oils, gases)
Cumulative impacts	A cumulative impact is defined as an impact that results from incremental changes caused by other past, present or reasonably foreseeable actions together with the Project. The cumulative impact assessment will consider the impact of the Project along with the impacts of other industrial developments in the area that may also impact on the same receptors and resources The following cumulative impacts may result from the proposed development: • Habitat destruction and/or change (Cumulatively with surrounding development activities and historical mining and residential activities); • Emissions to surface water runoff (Siltation and possible contamination cumulatively from surrounding old mining and residential activities)

	• Destruction of Heritage Resources (graves and artifacts)

5.1.1.3 Specialists Impacts Identified:

The identified impacts on environmental and social receptors arising from the proposed development include direct, indirect, cumulative and residual impacts. Impacts are also linked to the different stages of the project which are identified as Design and pre-construction, construction, operation, decommissioning and rehabilitation. During the basic assessment process, discussions were held with DEA reagrding the specialist studies. DEA stated that the studies from the CSP project in Appendix 10 would need to be updated and suggested that this assessment focusses only on the potential significant impacts identified. Therefore the following reports were updated, by each individual specialist, as they were likely to have significant potential impacts:

- Heritage Impact Assessment
- Visual Impact Assessment
- Biodiversity Impact Assessment
-
- Avifauna Impact Assessment
- Wetland Impact Assessment, and
- Socio Economic Impact Assessment

The impacts tables from the specialists are as follows:

5.1.1.3.1 Heritage

Phase Construction (Direct Impact)					
Aspect:	**Heritage**				
Activity:	Site and vegetation clearing				
Impact:	**Direct impact on chance finding of heritage resources during site clearing**				
Significance rating:	**Duration**	**Extent**	**Magnitude**	**Probability**	**Significance**
Pre-Mitigation	5	1	10	2	**32**
Post-Mitigation	5	1	10	1	**16**
Mitigation Measures:	Demarcate find and manage through management guidelines in section 6 of this HIA Through the National Heritage Resources Act (NHRA)				

Phase Construction (Cumulative Impact)					
Aspect:	**Heritage**				
Activity:	Site and vegetation clearing				
Impact:	**Cumulative Impacts on heritage resources during site clearing**				
Significance rating:	**Duration**	**Extent**	**Magnitude**	**Probability**	**Significance**
Pre-Mitigation	5	1	6	2	**24**
Post-Mitigation	5	1	6	1	**12**
Mitigation Measures:	Manage through management guidelines in section 6 of this HIA in Appendix 9A Through the National Heritage. Resources Act (NHRA)				

5.1.1.3.2 Visual

Phase: Construction					
Aspect:	**Type: Visual**				
Activity:	Construction activities are visible				
Impact:	**Physical Presence of PV Project and impact of sensitive views:** The proposed VP Project is located in a landscape of moderate value partially tolerant of change. The construction activities are visible from less than half the zone of potential influence. Views from the R385, nearby farmsteads, the Groenwater community and dirt road west of the site are the most sensitive. Some project activities will be visible from these areas although visual issues had not been raised as a concern by these communities. **Cumulative Impacts:** Construction activities will cause a minor change in landscape characteristics over localized area resulting in minor changes in key views in the short term and have a cumulative negative effect on the visual quality of the area				
Significance rating:	**Duration**	**Extent**	**Magnitude**	**Probability**	**Significance**
Pre-Mitigation	1	2	4	3	**21**
Post-Mitigation	1	2	4	2	**14**
Mitigation Measures:	Described in the mitigation section.				

Phase: Operation

Aspect:	**Type: Visual**				
Activity:	Operational activities are visible				
Impact:	**Physical Presence of PV Project and impact of sensitive views:** The operation activities are visible from less than half the zone of potential influence; Views from the R385, nearby farmsteads, the Groenwater community and dirt road west of the site are the most sensitive. Some project activities will be visible from these areas although visual issues have not been raised as a concern by these communities; Operation activities will cause a minor change in landscape characteristics over localized area resulting in minor changes in key views in the long term and have a high negative effect on the visual quality of the area. **Cumulative Impacts:** Operational activities will cause a minor change in landscape characteristics over a localized area resulting in minor changes in key views in the short term and have a cumulative negative effect on the visual quality of the area.				
Significance rating:	**Duration**	**Extent**	**Magnitude**	**Probability**	**Significance**
Pre-Mitigation	4	2	4	3	**30**
Post-Mitigation	4	2	4	2	**20**
Mitigation Measures:	See mitigation section				

Phase: Decommissioning and Rehabilitation		
Aspect:	**Type: Visual**	
Activity:	Construction activities are visible	
Impact:	**Physical Presence of PV Project and impact of sensitive views:** The proposed VP Project is located in a landscape of moderate value partially tolerant of change; The decommissioning activities are visible from less than half the zone of potential influence; Views from the R385, nearby farmsteads, the Groenwater community and dirt road west of the site are the most sensitive. Some decommissioning activities will be visible from these areas although visual issues had not been raised as a concern by these communities.	

	Cumulative Impacts: Decommissioning activities will cause a minor change in landscape characteristics over localized area resulting in minor changes in key views in the short term and have a cumulative positive effect on the visual quality of the area once / if all structures etc. have been removed and rehabilitation of the site is successful and managed in the long term.				
Significance rating:	**Duration**	**Extent**	**Magnitude**	**Probability**	**Significance**
Pre-Mitigation	1	2	4	3	**21**
Post-Mitigation	1	2	2	1	**5**
Mitigation Measures:	See explanation.				

5.1.1.3.3 Avifauna

Activity:	Construction of the PV Power Project and all associated infrastructure				
Impact:	Removal of habitat used by birds resulting in displacement and possible reduced breeding success.				
Significance rating:	**Duration**	**Extent**	**Magnitude**	**Probability**	**Significance**
Pre-Mitigation	5	1	4	5	**50**
Post-Mitigation	5	1	2	3	**24**
Mitigation Measures:	• Existing roads and farm tracks should be used where possible; • The minimum footprint areas of infrastructure should be used wherever possible, including road widths and lengths; • Environmental Control Officer to oversee activities and ensure that the site specific construction environmental management plan (CEMP) is implemented and enforced; • Following construction, rehabilitation of all areas disturbed (e.g. temporary access tracks and laydown areas) must be undertaken and to this end a habitat restoration plan is to be developed by a specialist and included within the Construction Environmental Management Plan (CEMP).				

Activity:	Construction of the PV Power Project and all associated infrastructure				
Impact:	Disturbance of birds (particularly breeding birds that may abandon a breeding attempt), resulting in permanent or temporary displacement.				
Significance rating:	**Duration**	**Extent**	**Magnitude**	**Probability**	**Significance**
Pre-Mitigation	1	2	8	4	**44**
Post-Mitigation	1	2	4	2	**14**
Mitigation Measures:	• A site specific Construction Environmental Management Plan (CEMP) must be				

	implemented, which gives appropriate and detailed description of how construction activities must be conducted. All contractors are to adhere to the CEMP and should apply good environmental practice during construction. • Prior to construction commencing, the appointed Environmental Control Officer (ECO) must be trained by an avifaunal specialist to identify the potential Red Data species as well as the signs that indicate possible breeding by these species. The ECO must then, during audits/site visits, make a concerted effort to look out for such breeding activities of Red Data species, and such efforts may include the training of construction staff (e.g. in Toolbox talks) to identify Red Data species, followed by regular questioning of staff as to the regular whereabouts on site of these species. If any of the Red Data species are confirmed to be breeding (e.g. if a nest site is found), construction activities within 500 m of the breeding site must cease, and an avifaunal specialist is to be contacted immediately for further assessment of the situation and instruction on how to proceed.

Activity:	Various operational and maintenance activities e.g. grass cutting and cleaning.				
Impact:	Disturbance of birds (particularly breeding birds that may abandon a breeding attempt), resulting in permanent or temporary displacement.				
Significance rating:	**Duration**	**Extent**	**Magnitude**	**Probability**	**Significance**
Pre-Mitigation	4	1	4	3	**27**
Post-Mitigation	4	1	2	2	**14**
Mitigation Measures:	• A site specific Operational Environmental Management Plan (OEMP) must be implemented, which gives appropriate and detailed description of how operational and maintenance activities must be conducted to reduce unnecessary disturbance. All contractors are to adhere to the OEMP and should apply good environmental practice during all operations. • The on-site facilities manager (or a suitably appointed Environmental Manager) must be trained by an avifaunal specialist to identify the potential Red Data species as well as the signs that indicate possibly breeding by these species. If a priority species or Red Data species is found to be breeding (e.g. a nest site is located) on or within 1 km of the operational facility, the nest/breeding site must not be disturbed and the avifaunal specialist must be contacted for further instruction. • Operational phase bird monitoring, in line with applicable guidelines, must be implemented.				

Activity:	Operation of the PV Power Project				
Impact:	Collison of birds with the PV panels resulting in death or injury.				
Significance rating:	**Duration**	**Extent**	**Magnitude**	**Probability**	**Significance**
Pre-Mitigation	4	1	6	3	**33**
Post-Mitigation	4	1	4	2	**18**
Mitigation Measures:	• Where possible, infrastructure should be located away from known bird flight paths				

	or features which are attractive to birds, e.g. natural or man-made open water areas or agricultural fields. • To limit bird traffic across the site, perchable structures should be avoided where possible. • Lighting should be kept to a minimum to avoid attracting insects and birds and light sensors/switches should be utilised to keep lights off when not required, where possible. • Lighting fixtures should be hooded and directed downward, to minimize the skyward and horizontal illumination which could attract night-flying birds (Ledec et al., 2010), where possible. • Where possible, lighting should be intermittent or flashing-beam lights. • Careful selection of and modifications to solar facility equipment should be made where possible. • Develop and implement an operational monitoring programme for birds in line with applicable guidelines. • Frequent and regular review of operational phase monitoring data and results by an avifaunal specialist. • The above reviews should strive to identify sensitive locations at the development including that may require additional mitigation. If unacceptable impacts are observed (in the opinion of the bird specialist and independent review), the specialist should conduct a literature review specific to the impact and provide updated and relevant mitigation options to be implemented. As a starting point for the review of possible mitigations, the following may need to be considered: • Assess the suitability of using deterrent devices to reduce collision risk.

Activity:	Operation of the PV Power Project				
Impact:	Collision of birds with or entrapment by fencing resulting in death or injury				
Significance rating:	**Duration**	**Extent**	**Magnitude**	**Probability**	**Significance**
Pre-Mitigation	4	1	6	3	**33**
Post-Mitigation	4	1	4	2	**11**
Mitigation Measures:	• A single fence should be used, which can be electrified and animal proofed. • Develop and implement an operational monitoring programme for birds in line with applicable guidelines. • Frequent and regular review of operational phase monitoring data and results by an avifaunal specialist. • If collision with fences occurs, the specialist should consider the need to implement mitigation in the form of visual bird flight diverters attached to the fence to increase its visibility to birds.				

Activity:	Operation of the PV Power Project

Impact:	Electrocution on electrical infrastructure resulting in death or injury				
Significance rating:	**Duration**	**Extent**	**Magnitude**	**Probability**	**Significance**
Pre-Mitigation	4	1	6	3	**33**
Post-Mitigation	4	1	4	2	**11**
Mitigation Measures:	• All electrical installations and infrastructure should be properly insulated to prevent any chance of electrical faulting caused by birds where practically possible.				

Activity:	Operation of the PV Power Project				
Impact:	Chemical Pollution				
Significance rating:	**Duration**	**Extent**	**Magnitude**	**Probability**	**Significance**
Pre-Mitigation	1	3	6	3	**30**
Post-Mitigation	1	1	2	2	**8**
Mitigation Measures:	• A site specific Operational Environmental Management Plan (OEMP) must be implemented, which gives appropriate and detailed description of how operational and maintenance activities must be conducted to reduce and avoid chemical pollution. All contractors are to adhere to the OEMP and should apply good environmental practice during all operations. • All cleaning products used on the site should be environmentally friendly and bio-degradable. • Operational phase bird monitoring, in line with applicable guidelines, must be implemented.				

Activity:	Decommissioning of the PV Power Project and all associated infrastructure				
Impact:	Habitat destruction				
Significance rating:	**Duration**	**Extent**	**Magnitude**	**Probability**	**Significance**
Pre-Mitigation	1	1	6	3	**24 (Low)**
Post-Mitigation	1	1	4	2	**12 (Low)**
Mitigation Measures:	• A site specific Decommissioning Environmental Management Plan (DEMP) must be implemented, which gives appropriate and detailed description of how decommissioning activities must be conducted to reduce unnecessary destruction of habitat. All contractors are to adhere to the DEMP and should apply good environmental practice during construction. • Existing roads and farm tracks should be used where possible; • The minimum footprint areas of infrastructure should be used wherever possible, including road widths and lengths; • Environmental Manager to oversee activities and ensure that the site specific decommissioning environmental management plan (DEMP) is implemented and enforced; • Following decommissioning, rehabilitation of all areas disturbed (e.g. temporary access tracks and laydown areas) must be undertaken and to this end a habitat				

	restoration plan is to be developed by a specialist and included within the Decommissioning Environmental Management Plan (DEMP).

Activity:	Decommissioning of the PV Power Project				
Impact:	Disturbance of birds (particularly breeding birds that may abandon a breeding attempt), resulting in permanent or temporary displacement.				
Significance rating:	**Duration**	**Extent**	**Magnitude**	**Probability**	**Significance**
Pre-Mitigation	1	2	8	4	**44**
Post-Mitigation	1	2	4	2	**14**
Mitigation Measures:	• A site specific Decommissioning Environmental Management Plan (DEMP) must be implemented, which gives appropriate and detailed description of how decommissioning activities must be conducted. All contractors are to adhere to the DEMP and should apply good environmental practice during decommissioning. • Prior to decommissioning commencing, the appointed Environmental manager must be trained by an avifaunal specialist to identify the potential Red Data species as well as the signs that indicate possible breeding by these species. The Environmental Manager must then, during audits/site visits, make a concerted effort to look out for such breeding activities of Red Data species, and such efforts may include the training of construction staff (e.g. in Toolbox talks) to identify Red Data species, followed by regular questioning of staff as to the regular whereabouts on site of these species. If any of the Red Data species are confirmed to be breeding (e.g. if a nest site is found), decommissioning activities within 500 m of the breeding site must cease, and an avifaunal specialist is to be contacted immediately for further assessment of the situation and instruction on how to proceed.				

5.1.1.3.4 Biodiversity

Phase Construction	
Aspect:	Ecology/ Biodiversity (Flora and Fauna)
Activity:	PV Power Project
Impacts:	Direct Impacts: o Direct impacts on threatened flora species o Direct impacts on protected tree species o Direct impacts on threatened fauna species o Loss, or disruption of mammal migration routes on a local scale o Direct impacts on sensitive/ pristine habitat types of the study area o Direct impacts on common fauna species occurring on the study area
	Indirect Impacts:

	o Faunal interactions with structures, servitudes and personnel o Impacts on surrounding habitat/ species, including ecosystem functioning				
	Cumulative Impacts: o Impacts on SA's conservation obligations & targets (VEGMAP vegetation types) o Increase in local and regional fragmentation/ isolation of habitat o Increase in environmental degradation, pollution (air, soils, surface water)				
	Residual Impacts: o Sterilised landscapes with low biodiversity/ ecological value				
Significance rating:	**Duration**	**Extent**	**Magnitude**	**Probability**	**Significance**
Pre-Mitigation	5	2	6	4	**52**
Post-Mitigation	3	1	2	3	**18**
Mitigation Measures:	Search and relocation, minimize land clearance, limit extent of habitat transformation				
	Ensure the absence of CI species, particularly sessile faunal species, through a thorough walkdown (search and rescue) of development footprint Ensure the absence of larger animals through frequent patrols, particularly prior to land clearance. Restrict losses of natural habitat to footprints, avoid peripheral or unnecessary losses of natural habitat; ensure proper rehabilitation of areas outside development footprints (where accidental habitat degradation occurred). Worker/ contractor awareness programmes, ensuring minimal conflict situation. Control of human movement in adjacent natural habitat, frequent patrols, biological monitoring programmes, animal control (vervet monkeys, feral cats, rats, baboons, dogs, etc) Implement generic monitoring programme and mitigation measures that are aimed at identifying and preventing the uncontrolled spread of impacts into adjacent areas of natural habitat				
	Refer to mitigation measures included in principal ecological report, Section 5				

Phase Construction	
Aspect:	Ecology/ Biodiversity (Flora and Fauna)
Activity:	PV Power Project
Impacts:	Direct Impacts: o Direct impacts on threatened flora species o Direct impacts on protected tree species

	o Direct impacts on threatened fauna species o Loss, or disruption of mammal migration routes on a local scale o Direct impacts on sensitive/ pristine habitat types of the study area o Direct impacts on common fauna species occurring on the study area				
	Indirect Impacts: o Faunal interactions with structures, servitudes and personnel o Impacts on surrounding habitat/ species, including ecosystem functioning				
	Cumulative Impacts: o Impacts on SA's conservation obligations & targets (VEGMAP vegetation types) o Increase in local and regional fragmentation/ isolation of habitat o Increase in environmental degradation, pollution (air, soils, surface water)				
	Residual Impacts: o Sterilised landscapes with low biodiversity/ ecological value				
Significance rating:	**Duration**	**Extent**	**Magnitude**	**Probability**	**Significance**
Pre-Mitigation	5	1	2	1	**8**
Post-Mitigation	3	1	2	1	**6**
Mitigation Measures:	Search and relocation, minimize land clearance, limit extent of habitat transformation				
	Ensure the absence of CI species, particularly sessile faunal species, through a thorough walkdown (search and rescue) of development areas. Ensure the absence of larger animals through frequent patrols, particularly prior to land clearance. Restrict losses of natural habitat to footprints, avoid peripheral or unnecessary losses of natural habitat; ensure proper rehabilitation of areas outside development footprints (where accidental habitat degradation occurred). Worker/ contractor awareness programmes, ensuring minimal conflict situation, control of human movement in adjacent natural habitat, frequent patrols, biological monitoring programmes, animal control (vervet monkeys, feral cats, rats, baboons, dogs, etc) Implement generic monitoring programme and mitigation measures that are aimed at identifying and preventing the uncontrolled spread of impacts into adjacent areas of natural habitat				
	Refer to mitigation measures included in principal ecological report, Section 5				
Phase Operation					
Aspect:	Ecology/ Biodiversity (Flora and Fauna)				
Activity:	PV Power Project				
Impacts:	Direct Impacts: o Direct impacts on threatened fauna species o Loss, or disruption of mammal migration routes on a local scale o Direct impacts on sensitive/ pristine habitat types of the study area				
	Indirect Impacts: o Faunal interactions with structures, servitudes and personnel o Impacts on surrounding habitat/ species, including ecosystem functioning				
	Cumulative Impacts:				

	o Impacts on SA's conservation obligations & targets (VEGMAP vegetation types) o Increase in local and regional fragmentation/ isolation of habitat o Increase in environmental degradation, pollution (air, soils, surface water)				
	Residual Impacts: o Sterilised landscapes with low biodiversity/ ecological value				
Significance rating:	**Duration**	**Extent**	**Magnitude**	**Probability**	**Significance**
Pre-Mitigation	3	1	2	2	**12**
Post-Mitigation	2	1	2	1	**5**
Mitigation Measures:	Control peripheral impacts of project on adjacent areas of natural habitat				
	Ensure the absence of larger animals through frequent patrols, particularly prior to land clearance. Restrict losses of natural habitat to footprints, avoid peripheral or unnecessary losses of natural habitat; ensure proper rehabilitation of areas outside development footprints (where accidental habitat degradation occurred). Worker/ contractor awareness programmes, ensuring minimal conflict situation, control of human movement in adjacent natural habitat, frequent patrols, biological monitoring programmes, animal control (vervet monkeys, feral cats, rats, baboons, dogs, etc) Implement generic monitoring programme and mitigation measures that are aimed at identifying and preventing the uncontrolled spread of impacts into adjacent areas of natural habitat				
	Refer to mitigation measures included in principal ecological report, Section 5				
Phase Decommissioning					
Aspect:	Ecology/ Biodiversity (Flora and Fauna)				
Activity:	PV Power Project				
Impacts:	Direct Impacts: o Direct impacts on threatened fauna species o Loss, or disruption of mammal migration routes on a local scale o Direct impacts on sensitive/ pristine habitat types of the study area				
	Indirect Impacts: o Faunal interactions with structures, servitudes and personnel o Impacts on surrounding habitat/ species, including ecosystem functioning				
	Cumulative Impacts: o Increase in local and regional fragmentation/ isolation of habitat o Increase in environmental degradation, pollution (air, soils, surface water)				
	Residual Impacts: o Sterilised landscapes with low biodiversity/ ecological value				
Significance rating:	**Duration**	**Extent**	**Magnitude**	**Probability**	**Significance**
Pre-Mitigation	2	1	2	1	**5**
Post-Mitigation	2	1	1	1	**4**
Mitigation Measures:	Minimize losses of untransformed land/ adjacent habitat				
	Ensure the absence of larger animals through frequent patrols, particularly prior to land clearance.				

	Restrict losses of natural habitat to footprints, avoid peripheral or unnecessary losses of natural habitat; ensure proper rehabilitation of areas outside development footprints (where accidental habitat degradation occurred). Worker/ contractor awareness programmes, ensuring minimal conflict situation, control of human movement in adjacent natural habitat, frequent patrols, biological monitoring programmes, animal control (vervet monkeys, feral cats, rats, baboons, dogs, etc) Implement generic monitoring programme and mitigation measures that are aimed at identifying and preventing the uncontrolled spread of impacts into adjacent areas of natural habitat
	Refer to mitigation measures included in principal ecological report, Section 5

Biodiversity Summary

Summary Table of Impacts associated with PV Power Project			
Development Phase	*Construction Phase*	*Operational Phase*	*Decommissioning Phase*
Option 1 (Outside heliostat field)			
Pre Mitigation	52	20	16
Post Mitigation	18	12	5
Option 2 (Inside heliostat field)			
Pre Mitigation	8	12	5
Post Mitigation	6	5	4

5.1.1.3.5 Surface Hydrology

Increased Runoff	Option A (New Development Area)		Option B (CSP Circle)	
	Without Mitigation	**Residual Impact (with Mitigation)**	**Without Mitigation**	**Residual Impact (with Mitigation)**
Construction, Operating and Decommissioning Phase				
Type	Negative	Negative	Negative	Negative
Magnitude	6	2	8	2
Duration	4	4	4	4
Extent	2	1	2	1
Probability	4	2	4	2
Significance	**Medium (48)**	**Low (14)**	**Medium (56)**	**Low (14)**
Mitigation	• The project infrastructure footprint and associated area of disturbance should be minimised as far as practically possible with adequate spacing between panels to encourage shrubland growth. • The development of the PV Power Project should be done considering the potential for subsequent increase in surface runoff with stormwater management implemented as necessary. This may include			

	'soft' engineering solutions such as vegetated buffer strips or swales alongside service roads, underneath solar panels or downslope of a range of panels. 'Hard' engineering solutions such as detention basins or soakaways can be implemented if 'soft' solutions are inadequate based upon the runoff rate/volume generated. • Any vegetated buffer strips or swales will need to be maintained with a healthy shubland cover that promotes infiltration.
Residual Impact	The implementation of the mitigation measures above should mean that there is little residual impact.
Cumulative Impact	The Redstone CSP Project and associated infrastructure is already authorised while existing PV installations are noted to the south of the site as illustrated in Appendix 2 and 9. There is consequently a cumulative impact due to these authorised/existing facilities and their potential to increase runoff at site scale and streamflow collectively in neighbouring watercourses. A greenfield runoff rate/volume should consequently be sought from the proposed PV Power Project such that any increases in streamflow are not further enhanced.

Increased Runoff	Option A (New Development Area)		Option B (CSP Circle)	
	Without Mitigation	**Residual Impact (with Mitigation)**	**Without Mitigation**	**Residual Impact (with Mitigation)**
Construction, Operating and Decommissioning Phase				
Type	Negative	Negative	Negative	Negative
Magnitude	6	2	6	2
Duration	4	4	4	4
Extent	2	1	2	1
Probability	4	1	4	1
Significance	**Medium**	**Low**	**Medium**	**Low**
Mitigation	• The project infrastructure footprint and associated area of disturbance should be minimised as far as practically possible with adequate spacing between panels to encourage shrubland growth. • The clearing of vegetation and disturbance of soils should be done considering the potential for subsequent erosion. • Site rehabilitation should aim to restore surface drainage patterns, natural soil and vegetation as far as is feasible. • An erosion control management plan should be utilised to prevent erosion. This may include erosion control measures such as silt fences (for areas of works) and gravel strips at the impact zone where water falls from the solar panels onto the soil surface (due to deterioration in natural shrubland because of poor maintenance or lack of solar radiation) • The development of the PV Power Project should be done considering the potential for erosion as part of the overall storm water management of the site which will also facilitate slowing of runoff or settling of sediment. This may include 'soft' engineering solutions such as vegetated buffer strips or swales alongside service roads, underneath solar panels or downslope of a range of panels. 'Hard' engineering solutions silt traps can be implemented if 'soft' solutions are found to be inadequate.			

	• Any vegetated buffer strips or swales will need to be maintained with a healthy shrubland cover that can effectively intercept sediment suspended in runoff.
Residual Impact	The implementation of the mitigation measures above should mean that there is little residual impact.
Cumulative Impact	The Redstone CSP Project and associated infrastructure is already authorised while existing Lesedi and Jasper PV installations are noted to the south of the site as illustrated in Appendix 9. There is consequently a cumulative impact due to these authorised/existing facilities and their potential to increase the sediment load into adjacent watercourses. Effective erosion control and maintenance on the site will not exacerbate any existing water quality issues.

Deterioration of a water course	Option A (New Development Area)		Option B (CSP Circle)	
	Without Mitigation	**Residual Impact (with Mitigation)**	**Without Mitigation**	**Residual Impact (with Mitigation)**
Construction, Operating and Decommissioning Phase				
Type	Negative	Negative	Negative	Negative
Magnitude	6	2	6	2
Duration	4	4	4	4
Extent	2	1	2	1
Probability	4	1	4	1
Significance	**Medium (48)**	**Low (7)**	**Medium (48)**	**Low (7)**
Mitigation	• The project infrastructure footprint and associated area of disturbance should be minimised as far as practically possible with adequate spacing between panels to encourage shrubland growth. • The clearing of vegetation and disturbance of soils should be done considering the potential for subsequent erosion. • Site rehabilitation should aim to restore surface drainage patterns, natural soil and vegetation as far as is feasible. • An erosion control management plan should be utilised to prevent erosion. This may include erosion control measures such as silt fences (for areas of works) and gravel strips at the impact zone where water falls from the solar panels onto the soil surface (due to deterioration in natural shrubland because of poor maintenance or lack of solar radiation) • The development of the PV Power Project should be done considering the potential for erosion as part of the overall storm water management of the site which will also facilitate slowing of runoff or settling of sediment. This may include 'soft' engineering solutions such as vegetated buffer strips or swales alongside service roads, underneath solar panels or downslope of a range of panels. 'Hard' engineering solutions silt traps can be implemented if 'soft' solutions are found to be inadequate. • Any vegetated buffer strips or swales will need to be maintained with a healthy shrubland cover that can effectively intercept sediment suspended in runoff.			
Residual Impact	The implementation of the mitigation measures above should mean that there is little residual impact.			

Cumulative Impact	The Redstone CSP Project and associated infrastructure is already authorised while existing Lesedi and Jasper PV installations are noted to the south of the site as illustrated in Appendix 9. There is consequently a cumulative impact due to these authorised/existing facilities and their potential to increase the sediment load into adjacent watercourses. Effective erosion control and maintenance on the site will not exacerbate any existing water quality issues.

Surface Water Flooding	Option A (New Development Area)		Option B (CSP Circle)	
	Without Mitigation	**Residual Impact (with Mitigation)**	**Without Mitigation**	**Residual Impact (with Mitigation)**
Construction, Operating and Decommissioning Phase				
Type	Negative	Negative	Negative	Negative
Magnitude	4	2	4	2
Duration	5	5	5	5
Extent	2	2	2	2
Probability	3	1	4	1
Significance	**Medium (33)**	**Low (9)**	**Medium (44)**	**Low (9)**
Mitigation	• Flow points from non-perennial rivers to the east of the site should be identified/verified to enable an assessment of the expected catchment area and associated flow rates/volumes. Mitigation of surface water flooding can consequently be incorporated into the stormwater management plan of the site with water routed around sensitive infrastructure. The design of any diversions should use the 1:50 year storm event at minimum. • A minimum exclusion zone of 32m should be used around all 1:50,000 topographical map watercourses as illustrated in Figure 2-4, specifically in association with the non-perennial river which intersects the site. A larger buffer of 100m is the preferred exclusion zone as it accounts for more uncertainty with regards to any possible flooding. It should be noted, however, that the significance of the intersecting watercourse, non-perennial is uncertain (based upon this desktop study) and clarification as to the nature of this watercourse is possible using a more detailed investigation during a high rainfall period (e.g. March).			
Residual Impacts	The implementation of the mitigation measures above should mean that there is little residual impact.			
Cumulative Impact	The Redstone CSP Project and associated infrastructure is already authorised and will have the same surface water flood risk when considering Option B. The Redstone CSP Project will, however, not exacerbate surface water flooding with regards to the rate/volume of water routed by the non-perennial rivers towards the site as the potential flood response is independent of this development.			

5.1.1.3.6 Wetlands

Phase:	**Construction**
Aspect:	**Wetlands & Riparian Areas**

Activity:	1. Site establishment, clearing and earthworks				
Impact:	**Direct Impact:** None **Indirect:** Increased surface runoff from bare soil areas leading to increased sediment transport into adjacent watercourses and increased risk of erosion. Water quality likely to be impacted by increased turbidity and suspended solids. **Cumulative Impacts:** A further increase in impervious surfaces on site will result in increased runoff. **Residual Impacts:** Erosion will result in a loss of soil from the receiving water resources and changes in geomorphology.				
Significance rating:	**Duration**	**Extent**	**Magnitude**	**Probability**	**Significance**
Pre-Mitigation	2	2	6	4	**40**
Post-Mitigation	2	1	4	3	**21**
Mitigation Measures:	A minimum buffer area of 32m should be maintained between the proposed PV Power Project development area and the Groenwater Spruit riparian zone. If possible, this buffer zone should be increased further. The buffer zone must be maintained as a fully vegetated buffer strip between the development and the riparian habitat. No intrusion into the buffer should be allowed. A construction stormwater management plan must be developed and implemented prior to the commencement of large scale vegetation clearing activities or construction activities and be maintained until the end of the construction phase. Such a plan should aim to minimise the transport of sediment off site as well as prevent the discharge of high velocity flows into downslope wetlands. Sediment traps and sediment barriers should be installed where necessary, and discharge points should be protected against erosion and incorporate energy dissipaters. To minimise the impact of increased runoff and sediment transport into adjacent watercourses, vegetation clearing and soil stripping should be concentrated in the dry season. Erosion within the construction site must be minimised through the following: o Limiting the area of disturbance and vegetation clearing to as small an area as possible; o Where possible, undertaking construction during the dry season; o Phasing vegetation clearing activities and limiting the time that any one area of bare soil is exposed to erosion; o Control of stormwater flowing onto and through the site. Where required, stormwater from upslope should be diverted around the construction site; o Prompt stabilisation and re-vegetation of soils after disturbance and construction activities in an area are complete; and o Protection of slopes. Where steeper slopes occur, these should be stabilised using geotextiles or any other suitable product designed for the purpose. Sediment transport off the site must be minimised through the following: o Establishing perimeter sediment controls. This can be achieved through				

	the installation of sediment fences along downslope verges of the construction site. Where channelled or concentrated flow occurs, reinforced sediment fences or other sediment barriers such as sediment basins should be used (refer to US EPA guidelines on Stormwater Pollution Prevention); o Discharge of stormwater from the construction site into adjacent grassland rather than directly into wetland habitat. Discharged flows must be slow and diffuse; and o Regular inspection and maintenance of sediment controls

Phase:	**Operation**				
Aspect:	**Wetlands & Riparian Areas**				
Activity:	1. Operation of the PV Power Project and day to day maintenance activities				
Impact:	**Direct Impact:** None **Indirect:** Discharge of stormwater generated on site. **Cumulative Impacts:** A further increase in impervious surfaces on site will result in increased runoff. Stormwater discharges could impact on water quality within receiving watercourses. **Residual Impacts:** Erosion will result in a loss of soil from the receiving water resources and changes in geomorphology.				
Significance rating:	**Duration**	**Extent**	**Magnitude**	**Probability**	**Significance**
Pre-Mitigation	4	2	4	4	**40**
Post-Mitigation	4	1	2	2	**14**
Mitigation Measures:	A minimum buffer area of 32m should be maintained between the proposed PV Power Project development area and the Groenwater Spruit riparian zone. If possible, this buffer zone should be increased further. The buffer zone must be maintained as a fully vegetated buffer strip between the development and the riparian habitat. No intrusion into the buffer should be allowed. A stormwater management plan must be developed and implemented for the proposed PV Power Project. Stormwater discharge points must be protected against erosion. No stormwater discharges directly into the Groenwater Spruit, but rather into vegetated terrestrial areas adjacent to the riparian habitat. Strict controls must be placed on the sue of potential contaminants on site, e.g. hydrocarbons, cleaning materials etc. Potential contaminants must be stored in suitable bunded areas and handled according to environmental best practice guidelines as per the DWS Integrated Environmental Management Series.				

5.1.1.3.7 Socio Economic

Phase: Construction	
Aspect:	**Type: Socio-economic**
Activity:	**Investment into the development and construction of the Solar PV Facility**
Impact:	**Impact on production and Gross Domestic Product (GDP)**

	Direct Impact: Expenditure on goods and services within South Africa required for the construction and development of the facility **Indirect: I**ncrease in business sales of South African companies supplying goods and services and those that provide inputs to these suppliers **Cumulative Impacts:** Added stimulus to the domestic economy and specifically industries and sectors participating in the renewable energy industry value chain **Residual Impacts:** None identified				
Significance rating:	**Duration**	**Extent**	**Magnitude**	**Probability**	**Significance**
Pre-Mitigation	1	4	6	4	**44**
Post-Mitigation	1	4	6	4	**44**
Mitigation Measures:	• Identify and explore opportunities to procure goods and services from local and domestic suppliers that do not jeopardise bankability of the PV Power Project				

Aspect:	**Type: Socio-economic**				
Activity:	**Investment into the development and construction of the Solar PV Facility**				
Impact:	**Impact on national government revenue** **Indirect:** Expenditure on goods and services required for the development and establishment of the PV Power Project will lead to the payment of taxes by the companies involved in the upstream value chain. **Cumulative Impacts:** Increased revenue collection by the respective entities leading to the greater allocation of funds towards public service provision at different government levels **Residual Impacts:** None identified				
Significance rating:	**Duration**	**Extent**	**Magnitude**	**Probability**	**Significance**
Pre-Mitigation	1	4	4	4	**36**
Post-Mitigation	1	4	4	4	**36**
Mitigation Measures:	None required				

Phase: Operation					
Aspect:	**Type: Socio-economic**				
Activity:	**Expenditure on operation of the proposed PV Power Project**				
Impact:	**Impact on production and Gross Domestic Product (GDP)** **Direct Impact:** Expenditure on goods and services within South Africa necessary to maintain the operations of the PV Power Project and associated support services and facilities **Indirect:** Increase in business sales of South African companies supplying goods and services and companies where inputs to produce these goods and services are purchased from **Cumulative Impacts:** Growth of the domestic economy **Residual Impacts:** None identified				
Significance rating:	**Duration**	**Extent**	**Magnitude**	**Probability**	**Significance**
Pre-Mitigation	4	4	3	3	**33**
Post-Mitigation	4	4	3	3	**33**

Mitigation Measures:	• Identify and explore opportunities to procure goods and services to maintain the PV Power Project during the operation phase above and beyond those that would be done as part of Redstone CSP Project

Activity:	**Payment of rates and taxes**				
Impact:	**Impact on national and local government revenue** **Direct:** The operation of the PV Power Project may increase the usage of water and may increase the payment of local rates, which will lead to the increase of local government revenues and in turn improve the ability of local government to deliver its services; the increase in revenue derived from the operation of the PV Power Project will also lead to the growth of company tax payments and VAT payments collected by the national authorities **Indirect:** Expenditure on goods and services necessary for the maintenance of the PV Power Project and associated infrastructure will also lead to the payment of VAT and company taxes by the companies along the power Project's supply value chain **Cumulative Impacts:** Increased revenue collection by local and national government and ability of various public entities to deliver and improve on the delivery of their services **Residual Impacts:** None identified				
Significance rating:	**Duration**	**Extent**	**Magnitude**	**Probability**	**Significance**
Pre-Mitigation	4	4	2	4	**40**
Post-Mitigation	4	4	2	4	**40**
Mitigation Measures:	None required				

Phase: Decommissioning					
Aspect:	**Type: Socio-economic**				
Activity:	**Expenditure on decommissioning activities and recovery of valuable resources through recycling (i.e. copper cables, steel and aluminium structures, storage tanks, pipes, etc.)**				
Impact:	**Impact on production, Gross Domestic Product (GDP) and metallic and non-metallic materials inventory** **Direct Impact:** Expenditure on demolishing and decommissioning activities, which will result in the increase of turnover of companies directly involved in the process **Indirect:** Recovery of valuable metallic and non-metallic materials that on one hand lead to the generation of revenue for the owner and on the other hand allows for savings in production costs of companies that will use the recovered materials in their processes **Cumulative Impacts: I**mproved resource utilisation **Residual Impacts:** None expected				
Significance rating:	**Duration**	**Extent**	**Magnitude**	**Probability**	**Significance**
Pre-Mitigation	1	4	4	3	**27**
Post-Mitigation	1	4	4	3	**27**
Mitigation Measures:	• Develop and implement a material recovery strategy to optimise the use of valuable				

	metallic and, where applicable, non-metallic materials comprising various components of the PV Power Project

Aspect:	**Type: Socio-economic**				
Activity:	**Expenditure on decommissioning activities and resale of recovered metallic and non-metallic materials**				
Impact:	**Impact on national government revenue** **Indirect:** Expenditure on goods and services required for the decommissioning of the PV Power Project will lead to the payment of taxes by the companies involved in the process of demolishing and recycling of the project's physical assets, as well as rehabilitation of the site **Cumulative Impacts:** Increased revenue collection by the respective entities leading to the greater allocation of funds towards public service provision at different government levels **Residual Impacts:** None identified				
Significance rating:	**Duration**	**Extent**	**Magnitude**	**Probability**	**Significance**
Pre-Mitigation	1	4	3	3	**21**
Post-Mitigation	1	4	3	3	**21**
Mitigation Measures:	None required				

Post Mitigation

Impact	**Status**	**Significance before mitigation**	**Mitigation**	**Significance after mitigation**
Impact on production and Gross Domestic Product (GDP)	Positive	44 (Medium)	• Identify and explore opportunities to procure goods and services from local and domestic suppliers that do not jeopardise bankability of the project	44 (Medium)
Impact on national government revenue	Positive	36 (Medium)	• None required	36 (Medium)
Impact on production and Gross Domestic Product (GDP)	Positive	33 (medium)	• Identify and explore opportunities to procure goods and services to maintain the PV Power Project during the operation phase above and beyond those that would be done as part of Redstone CSP Project	33 (medium)

Impact on national and local government revenue	Positive	40 (Medium)	• None required	40 (Medium)
Impact on production and material recovery	Positive	27 (Low)	• Develop and implement a material recovery strategy to optimise the use of valuable metallic and, where applicable, non-metallic materials comprising various components of the PV Power Project	27 (Low)
Impact on national government revenue	Positive	21 (Low)	• None required	21 (Low)

5.1.1.4 Cumulative Impacts

Heritage: The cumulative impact by addition of the proposed PV field on the existing heritage resources within the development is rated as LOW pre-mitigation and further reduced with the implementation of management measures Appendix 9A.

Visual: Construction activities will cause a minor change in landscape characteristics over localized area resulting in minor changes in key views in the short term and have a cumulative negative effect on the visual quality of the area however it is low refer to Appendix 9F. The original VIA report (NLA 2011) investigated the larger Project Site and proposed activities and concluded that the Redstone CSP Project would have a moderate negative effect on the visual and aesthetic environment. It identified and rated the impact and made recommendations regarding management measures. The original findings stated:

Visual resource impacts would result from the construction, operation, and maintenance of the proposed Redstone CSP Project. Specifically, impacts would result from project components being seen from potentially sensitive viewpoints and from effects to the scenic values of the landscape. The visual impacts that could result from the project would most likely be direct, moderately adverse and long-term.

The study area has aesthetic value, albeit compromised to some degree through current man made mining and agricultural activities. Is has also been established that whilst the landscape's scenic value is rated moderate, it is not unique within the sub-region, nor would it evoke a strong sense of place amongst locals or people visiting the study area. The region is a known mining area and no tourism activities are known within the study area. However, the visual impacts that would result from the construction and operation of the proposed Redstone CSP Project will have an adverse effect on the character of the landscape and on the visual environment of people living in, working and visiting the area. However, to date visual issues have not been raised as a concern by the community. Visual impacts would result from the construction and operation of the proposed Redstone CSP Project. The significance of visual impact is moderate for people living in and visiting the area during both of these phases but would perhaps be more severe

during the construction phase due to all the activities and the generation of potential dust in a very dry environment. This would be especially so during the period when major earthworks are being carried out.

Mitigation measures, in the form of a visual buffer along the northern boundary of the site, are feasible and can reduce the impact of the Redstone CSP Project on foreground views from the R385. Good housekeeping and the introduction of a visitor's center could negate any potentially negative reactions to the visual aspects of the project and even turn the project into a tourist attraction for the region.

The VIA Addendum A report (NLA 2015) found that:

The proposed height change, from 200 m to 250 m, of the central receiving tower will increase the visibility of the tower slightly. It will remain visible for less than half the zone of potential influence as was the case in the original 200 m design. Also, the greatest increase in visibility and exposure occurs in what would be background to distant views i.e. views greater than 12 km from the Project Site.

Very few sensitive viewer locations are being affected. The most affected area occurs along the R385 east of the site but from this distance (over 15km), the tower, even at 250m height, would barely be visible. The visual exposure of the higher tower would affect foreground and middle ground views but this would not result in a substantive change to the receptor i.e. the visual impact (rated as moderate negative in the original VIA report) will not increase.

Mitigation measures, as proposed in the original VIA, remain valid and will successfully buffer most of the project's components from foreground and middle ground views.

These findings remain valid for the Redstone CSP project. The proposed PV Power Project will have a minor cumulative effect on the visual and aesthetic environment. Sensitive views along the R385 and the local road to the west of the PV Power Project will be the most affected. However, the impacts will remain within the viewing envelope that already includes existing PV sites (introduced subsequent to the original 2011 study but which were in place when the 2015 study was undertaken) and will include the proposed Redstone CSP Project. A comparative analysis of current aerial photographs (Google Earth) with the original situation indicates that surrounding land-uses and visual sensitivities related to viewer location remain essentially the same.

It is clear in the aerial views of the proposed PV Power Project that the small scale of its installation relative to the Redstone CSP Project, would be absorbed into existing views of the PV installations (Lesedi and Jasper PV Power Projects, currently operational on the Project Site) as well as future views of the Redstone CSP Project. This effect is illustrated in the simulations in Appendix 9x, of panoramic views to the project site from the R385. Therefore, the visibility of the PV Power Project, from sensitive viewing sites, would be much the same as the visibility of the original Redstone CSP Project i.e. visibility would not increase due to the installation of the PV Power Project due to the dominant nature of the Redstone CSP Project.

Using visual intrusion criteria (refer to Appendix 9x) the cumulative impact of the PV Power Project is rated low because the PV Power Project:

- Has a minimal additional effect on the visual quality of the landscape;
- Contrast minimally with the patterns or elements that define the structure of the landscape; Is mostly compatible with land use, settlement or enclosure patterns (existing and future); Is 'absorbed' into the existing and future planned elements in the landscape.

The severity or magnitude of impact of the PV Power Project will also be low when considered against operational PV developments and the Redstone CSP Project because the project will cause a minor loss of or alteration to key characteristics of the baseline i.e. the pre-development landscape or view and/or the introduction of the PV Power Project elements are not uncharacteristic when set within the attributes of the receiving landscape, which includes existing operational PV installations and the (approved) Redstone CSP Project.

Avifauna: All of the above mentioned impacts, and particularly those associated with the operational phase of the proposed project, may be intensified to some degree due to the potential cumulative impacts of a number of proposed commercial scale solar energy projects within 50 km of the project site Appendix 9B.

The avifaunal specialists undertook the following process to determine the cumulative impact of the proposed project:

- Large scale (i.e. > 10 MW) solar energy projects (proposed or developed) were identified within 50 km of the proposed project site. The size, extent, technology (e.g. PV or CSP) and distance from the proposed site were determined and considered;

The bird species potentially impacted upon by these developments were considered by the specialist. In some cases this was done by considering the specialist report/s for a project, but in most cases the specialist used his knowledge of the broader area and knowledge of four projects- having visited these sites and done work there (i.e. Arriesfontein PV, Lesedi PV, Jasper PV, and Metsimatala CSP).The findings and results of the bird surveys done on the Redstone CSP project site were considered; Approximately eight large solar energy projects in various stages of the EIA application process fall within this 50 km radius of the project site. Should five or more of these projects be constructed the cumulative impact significance of each impact identified above for the proposed PV plant, is likely to be of **moderate significance**. It does not improve a great deal post mitigation and it is hence inferred.

Biodiversity: Impacts on SA's conservation obligations & targets (VEGMAP vegetation types) (Appendix 9C);

- Increase in local and regional fragmentation/ isolation of habitat; and
- Increase in environmental degradation, pollution (air, soils, surface water).

Other, more subtle impacts on biological components, such as changes in local, regional and global climate, effects of noise pollution on fauna species, increase in acid rain, ground water deterioration, etc., are impacts that cannot be quantified to an acceptable level of certainty and is mostly subjective in nature as either little literature is available on the topic or contradictory information exist. These impacts are therefore omitted from this assessment. Impacts were placed in three categories, namely: direct, indirect and cumulative impacts and each impact were assessed in relation to the six different habitat types that were identified on site. These habitat types are:

- Closed Shrubveld Habitat Type

- Drainage Line Habitat Type
- Floodplains Habitat Type
- Grassland Plains Habitat Type
- Olea Woodland Habitat Type
- Open Shrubveld Habitat Type

The greater majority of these impacts are anticipated to occur predominantly during the construction phase of the proposed project due to the expected alteration of natural habitat or further degradation of habitat as a result of the construction activities. The positive impact of the decommissioning and rehabilitation of the site did not warrant the assessment of the impacts during this phase of the projects. In this light, the impact evaluation of the eleven impacts was not conducted per project phase but rather in the context of the three impact categories namely direct, indirect and cumulative impacts. The EMP will however address the impacts in the context of each project phase.

Fauna:

Impacts on SA's Conservation Obligations & Targets (Appendix 9C)

This impact is regarded a cumulative impact since it affects the status of conservation strategies and targets on a local as well as national level and is viewed in conjunction with other types of local and regional impacts that affects conservation areas. The importance of vegetation types is based on the conservation status ascribed to regional vegetation types and while any impact that results in irreversible transformation of natural habitat is regarded significant, no significant disruption of ecosystem functioning is assumed in least threatened vegetation types, which still have more than 80% of their original extent untransformed.

Loss of parts of the natural vegetation is expected to result in an insignificant, indirect impact on the conservation status of the regional vegetation types; which is regarded Least Concern.

Increase in Local & Regional Fragmentation/ Isolation of Habitat

Uninterrupted habitat is a precious commodity for biological attributes in modern times, particularly in areas that are characterised by moderate and high levels of transformation. The loss of natural habitat, even small areas, implies that biological attributes have permanently lost that ability of occupying that space, effectively meaning that a higher premium is placed on available food, water and habitat resources in the immediate surrounds. This, in some instances might mean that the viable population of plants or animals in a region will decrease proportionally with the loss of habitat, eventually decreasing beyond a viable population size. The danger in this type of cumulative impact is that effects are not known or is not visible with immediate effect and normally when these effects become visible, they are beyond repair. Impacts on linear areas of natural habitat affect the migratory success of animals in particular. The general region is characterised by extremely low levels of transformation and habitat fragmentation. Impacts from the proposed development are unlikely to increase regional or local levels of fragmentation and habitat isolation significantly.

Increase in Environmental Degradation

Cumulative impacts associated with this type of development could lead to initial, incremental or augmentation of existing types of environmental degradation, including impacts on the air, soil and water present within available habitat. Pollution of these elements might not always be immediately visible or readily quantifiable, but incremental or fractional increases might rise to levels where biological attributes could be affected adversely on a local or regional scale. In most cases are these effects are not bound and is dispersed or diluted over an area that is much larger than the actual footprint of the causal actor. Similarly, developments in untransformed and pristine areas are usually not characterised by visibly significant environmental degradation and these impacts are usually most prevalent in areas where continuous and long-term impacts have been experienced.

The nature of the proposed development dictates that the biological environment is unlikely to be affected since no effluents, spillages or chemical are likely to be produced or transported. However, the general region is characterised by low levels of degradation, this impact therefore becomes more important since it represents the 'thin end of the wedge'.

Impact Rating Prior to Mitigation

In estimating the significance and likelihood of impacts of the proposed development on the biological environment, cognisance is taken of all biophysical, floristic and faunal attributes that characterise the study area as well as the immediate region. It represents a subjective interpretation of the biophysical attributes, estimated sensitivities of habitat types that are present on the study area as well as taking cognisance of the larger region and how the proposed project will affect the biodiversity issues on a larger scale.

Hydrology: All mitigation was outlined in Specialists impact tables above

Wetlands: All mitigation was outlined in Specialists impact tables above

Socio economic: No knowledge of any other major developments planned for the area exists at the moment. However, the PV Power Project will be located next to Redstone CPS Project, which is to be developed concurrently with the project under review, as well as in close proximity to Lesedi and Jasper Solar PV Power Plants, which have been constructed a few years back and have been in operation for some time.

The Department of Environmental Affairs and Tourism's guidelines (DEAT, 2004) suggest that the identification of cumulative effects should focus on important and meaningful issues as "it is not practical to analyse the cumulative effects of an action on every environmental receptor". Furthermore, it is advised that the analysis should focus on "what is needed to ensure long-term productivity or sustainability of the resource" (DEAT, 2004).

In light of the above and considering the type of socio-economic impacts expected from the PV Power Project, no negative cumulative effects can be identified. As far as the positive cumulative effects are concerned none of the impacts identified to be relevant to the proposed project are envisaged to be classified as "what is needed to ensure long-term productivity or sustainability of the resource" and are therefore excluded from further assessment.

Design and Development: had no impacts due to the shared resources and actions of the larger Redstone CSP Power Project

Table 20: Significance scoring of all impacts

Activities	Impacts	Significance Score before Mitigation = (D+E+M) x P	Significance Score with Mitigation = (D+E+M (-2)) x P(-1)
Pre-Construction			
Stakeholder communication	Impacts on affected landowners and land uses surrounding the PV facility.	33	24
Construction			
Site establishment and the construction of access roads and services, (some of this are shared with the CSP facility and was evaluated in the EIA process)	Dust Generation	35	24
	Erosion	56	14
	Contamination of Surface Water	48	7
	Runoff	56	14
	Surface Water Flood	44	9
	Reduction of Grazing or agricultural land however this site has been rezoned to Special: Solar Power Generation	44	12
	Increase of Hydrocarbon Contamination	18	12
	Wetland Contamination	40	21
	Increase alien plants	85	8
	Destruction of Heritage resources (graves and historical buildings and artefacts) Average score recorded, detail can be seen in ***Appendix 9***	27	21
	Loss of biodiversity	52	18

	Loss of topsoil and a viable growth medium	50	40
	Visual impact on the receptors mentioned in the visual section of this report on the R356 and Humansrus Farm	21	14
	Views from Groenwater, Sunnyside farmstead and the dirt road west of the site	21	14
	Noise	18	12
Site clearing and earthworks	Dust Generation	35	24
	Erosion	56	14
	Contamination of Surface Water	48	7
	Runoff	56	14
	Surface Water Flood	44	9
	Reduction of Grazing or agricultural land however this site has been rezoned to Special: Solar Power Generation	44	12
	Increase of Hydrocarbon Contamination	18	12
	Wetland Contamination	40	21
	Increase alien plants	85	8
	Destruction of Heritage resources (graves and historical buildings and artefacts) Average score recorded, detail can be seen in ***Appendix 9***	27	21
	Loss of biodiversity	52	18
	Loss of topsoil and a viable growth medium	50	40

	Visual impact on the receptors mentioned in the visual section of this report on the R356 and Humansrus Farm	21	14
	Views from Groenwater, Sunnyside farmstead and the dirt road west of the site	21	14
	Noise	18	12
	Avifauna Habitat Removal	50	24
	Avifauna Disturbance	44	14
	Erosion	56	14
	Contamination of Surface Water	48	7
Bulk material laydown and consumable stores – shared service CSP and impact determined.	Dust Generation	21	10
	Erosion	12	4
	Contamination of Surface Water	48	7
	Water Resource depletion	27	14
	Increase of Hydrocarbon Contamination	18	8
	Wetland Contamination	40	21
	Increase alien plants	60	12
	Destruction of Heritage resources (graves and historical buildings)	6	4
	Loss of topsoil and a viable growth medium	56	14
	Aesthetic value decrease	12	4
	Noise	35	20

Refuelling and maintenance – shared service CSP	Any impacts will be the responsibility of the CSP facility however please see Appendix 10B for more detail	4	4
Power supply and use – shared service CSP	Any impacts will be the responsibility of the CSP facility however please see Appendix 10B for more detail	4	4
Water supply and use – shared service CSP	Any impacts will be the responsibility of the CSP facility however please see Appendix 10B for more detail	4	4
Construction camp – shared service CSP	Any impacts will be the responsibility of the CSP facility however please see Appendix 10B for more detail	4	4
Staff facilities – shared service CSP	Any impacts will be the responsibility of the CSP facility however please see Appendix 10B for more detail	4	4
Management and administration – shared service CSP	Any impacts will be the responsibility of the CSP facility however please see Appendix 10B for more detail	4	4
Waste management – shared service CSP	Any impacts will be the responsibility of the CSP facility however please see Appendix 10B for more detail	4	4
The Presence of activity on the site	Destruction of Heritage resources (graves and historical buildings and	27	21

	artefacts) Average score recorded, detail can be seen in ***Appendix 9***		
Access and security services – shared service CSP	Any impacts will be the responsibility of the CSP facility however please see Appendix 10B for more detail	4	4
Workers and local people	Government Revenue	36	36
Workers and local people	Socio Economic Impact on the GDP	44	44
Operation			
Maintenance and repair to operational equipment – shared service CSP	Any impacts will be the responsibility of the CSP facility however little repair will be needed and this could result in hydrocarbon spills but is unlikely.	4	4
Generation of electricity using PV technology	Water Utilisation	40	40
Development as a whole	Visual impact on the receptors mentioned in the visual section of this report on the R356 and Humansrus Farm	30	20
	Views from Groenwater, Sunnyside farmstead and the dirt road west of the site	30	20
Operational power supply and use	Avifauna Entrapments and Electrocutions	33	11
	Avifauna Disturbance	27	14
	Avifauna Collisions	33	18

Water supply, storage and use – shared service CSP	Any impacts will be the responsibility of the CSP facility however please see Appendix 10B for more detail	4	4
Procurement, storage and use of consumables – shared service CSP	Any impacts will be the responsibility of the CSP facility however please see Appendix 10B for more detail	4	4
Waste management – shared service CSP	Any impacts will be the responsibility of the CSP facility however please see Appendix 10B for more detail	4	4
	Avifauna Chemical Pollution	30	8
Management and administration facilities – shared service CSP	Any impacts will be the responsibility of the CSP facility however please see Appendix 10B for more detail	4	4
Fire protection for PV Power Project services and infrastructure – shared service CSP	Any impacts will be the responsibility of the CSP facility however please see Appendix 10B for more detail	4	4
The Presence of activity on the site	Destruction of Heritage resources (graves and historical buildings and artefacts) Average score recorded, detail can be seen in ***Appendix 9***	27	21
	Disturbing fauna and flora	12	5
	Wetland destruction	40	14
Employees	Impact on the GDP	33	33
	National Government revenue	40	40
Decommissioning and Rehabilitation			
Operational access roads are expected to be in good condition and be appropriate for the transit of	Dust Generation	21	10
	Erosion	24	12
	Contamination of Surface Water	28	15

decommissioning equipment (heavy cranes, special trucks, etc.).	Contamination of ground water	35	20
	Increase of Hydrocarbon Contamination	20	12
	Increase alien plants	45	28
	Loss of topsoil and a viable growth medium	50	40
	Noise	5	5
A small temporary decommissioning camp may be established with associated staff facilities.	Habitat Disturbance Avifauna	24	12
Removal of all structures	Visual impact on the receptors mentioned in the visual section of this report on the R356 and Humansrus Farm	21	5
	Views from Groenwater, Sunnyside farmstead and the dirt road west of the site	21	25
	Displacement of Avifauna	44	14
Laydown areas may be prepared as required. In this regard vegetation may require stripping and topsoil may be stockpiled for use in rehabilitation.	Biodiversity Disturbance	5	4
All waste materials and chemicals will be removed for reuse in other facilities or proper management through authorised waste management service providers.	Hydrocarbon spills while cleaning up	40	14
The elimination of all lubricants and chemical products stored in the PV Power Project will be carried out.	Hydrocarbon Spills which will contaminate soil and water.	40	14

These products may be sold or turned over to an authorised waste management service provider, as they are not the project's main components.			
Re-usable elements will be components that can be used again, i.e. are not waste. It is advantageous to find a use for these so-called sub-products, due to the reduced costs involved with the consequent economic and environmental benefits. The possible sub-products from the PV Power Project may be multiple in terms of type, quantity and volume. Thus, certain substances are not considered "usable", such as electrical system oils, other lubricants, etc. Other materials from the Project may be reusable in other such facilities, depending on their condition.	Waste Generation	48	24
The PV panels, including the mounting structures, positioners, etc. will be dismantled and either sold (if still usable) or disposed of at appropriate facilities	Waste Generation	48	24
Storage tanks, pipes and pumps may be managed by recycling or reusing.	Waste Generation	48	24
Electrical components will be removed and may be sold as second hand equipment (if usable) or for their copper content.	Waste Generation	48	24

Steel structures will be dismantled and may be sold as second hand equipment (if usable) or for their scrap value.	Waste Generation	48	24
Concrete structures and buildings (including foundations) will be demolished and the rubble will be disposed of at appropriate facilities, unless otherwise agreed for an alternative use in line with the decommissioning and closure plan.	Waste Generation	48	24
Employment	Impact on the GDP	27	27
	Impact on the National Government Revenue	21	21

5.1.1.5 Additional Mitigation Measures:

5.1.1.5.1 Heritage (As Authorised in the CSP Power Project):

- Archaeological Sites: PGS06 as indicated on the site map (Refer to the Heritage Impact Assessment Report Appendix 9)) –Each historical artifact and structure is to be documented through a surface collection and test excavation prior to construction. This will include mapping of the lithic distribution as well as analysis of the lithic assemblage.
- Cemeteries:AC02 - PGS09 and PGS13
- It is recommended that the development layout be adjusted to accommodate the cemeteries and that the cemeteries be fenced with a 10 meter buffer.
- It is further recommended that in the event that the cemeteries cannot be incorporated in to the development the graves be relocated after a full grave relocation process that includes comprehensive social consultation. The grave relocation process must include:
- A detailed social consultation process, that will trace the next-of-kin and obtain their consent for the relocation of the graves, that will be at least 60 days in length;
    - Site notices indicating the intent of the relocation

- Newspaper Notice indicating the intent of the relocation
- A permit from the local authority;
- A permit from the Provincial Department of health;
- A permit from the South African Heritage Resources Agency if the graves are older than 60 years or unidentified and thus presumed older than 60 years;
- An exhumation process that keeps the dignity of the remains and family intact;
- An exhumation process that will safeguard the legal implications towards the developer;
- The whole process must be done by a reputable company that are well versed in relocations;
- The process must be conducted in such a manner as to safeguard the legal rights of the families as well as that of the development company.

Possible infant burials at ACO013, PGS11-13 needs to be monitored during construction. However best practice would be to do test excavations to ascertain the presence of possible infant burials at each of these sites.

Further to these recommendations the general Heritage Management Guideline in Sections 6 of the Heritage Impact Assessment needs to be incorporated in to the EMP for the project.

5.1.1.5.2 Visual

Mitigation measures are feasible and can reduce the impact of the PV Power Project on sensitive views from the R385 and the local road west of the project site.

Considering mitigating measures there are three rules that must be taken into account:

- The measures should be feasible (economically);
- Effective (how long will it take to implement and what provision is made for management/maintenance);
- And acceptable (within the framework of the existing landscape and land use policies for the area);

To address these, the following principles have been established:

- Mitigation measures should be designed to suite the existing landscape character and needs of the locality. They should respect and build upon landscape distinctiveness.
- It should be recognized that many mitigation measures, especially the establishment of planted screens and rehabilitation, are not immediately effective.

Mitigation measures should be feasible and effective in reducing the visual impact on views from some surrounding landowners and roads. It is proposed that the following general actions be implemented for the PV Power Project:

Site Development

- The minimum amount of existing vegetation and topsoil should be removed. Ensure, wherever possible, all existing vegetation is retained and incorporated into the site rehabilitation.

- Good 'housekeeping' (keeping the site tidy and neat) is essential throughout all phases of the project.

Earthworks

- Dust suppression techniques should be in place at all times especially during the construction phase.
- Only the footprint and a small 'construction buffer zone' around the proposed activities should be exposed. In all other areas, the existing vegetation should be retained and access prohibited during the construction phase.

Access Roads

During construction and operational phases, access roads will require an effective dust suppression management programme, such as regular wetting and / or the use of non-polluting chemical stabilisation that will retain moisture in the road surface.

Lighting

Light pollution should be seriously and carefully considered and kept to a minimum wherever possible as light, at night, travels great distances. Security and flood lighting should only be used where absolutely necessary and carefully directed i.e. away from nearby sensitive receptors, residences and communities. Wherever possible, lights should be directed downwards so as to avoid illuminating the sky.

The negative impact of night lighting, glare and spotlight effects, can be mitigated using the following methods:

- Install light fixtures that provide precisely directed illumination to reduce light "spillage" beyond the immediate surrounds of the Project Site.
- Avoid high pole top security lighting along the periphery of the site, where possible, unless a security risk is posed and consider the use of lights that are activated on movement at illegal entry to the Project Site.

5.1.1.5.3 Avifauna: All are in the tables above

5.1.1.5.4 Biodiversity:

Mitigation Measure 1:	Exclude all areas of the Drainage line and Floodplain habitat types from the proposed development. This should be done during the planning phase of the project;
Mitigation Measure 2: -	Exclude as much of the Closed shrubveld habitat type from the proposed development as technically feasible. This should be done during the planning phase of the project;
Mitigation Measure 3:	Allow for a suitable buffer in order to provide some protection of sensitive areas against peripheral impacts, wetland related habitat types in particular. Al areas that were ascribed a High Ecological Sensitivity

	should be buffered against potential impacts. Guidelines of the wetland specialist should be implemented in this regard;
Mitigation Measure 4:	Appoint an ECO prior to start of construction. Responsibilities should include, but not be limited to, ensuring adherence to EMPr guidelines, guidance of activities, planning, reporting;
Mitigation Measure 5	Compile and implement environmental monitoring programme, the aim of which should be ensuring long-term success of rehabilitation and prevention of environmental degradation.
Mitigation Measure 6:	Limit construction, maintenance and inspection activities to dry periods in order to curb occurrence/ augmentation of erosion in areas of existing erosion, destabilizing of substrate in areas of high slopes, drainage lines, etc;
Mitigation Measure 7:	Ensure responsible storage of hazardous materials, chemicals, fuels, oils, etc. in properly designed facilities in order to prevent accidental spillage, contamination or pollution;
Mitigation Measure 8:	Develop emergency maintenance operational plan to deal with any event of contamination, pollution or spillages, particularly in sensitive areas;
Mitigation Measure 9:	Construction sites/camps need a detailed ecological assessment prior to construction;
Mitigation Measure 10:	Limit damage to protected tree species in the Olea woodland as far as possible. Adapt layout plans to avoid any excessive damage to this habitat type;
Mitigation Measure 11:	All individuals/ stands of Protected trees must be clearly and visibly marked prior to the start of construction or maintenance procedures;
Mitigation Measure 12:	Implement strict erosion monitoring and management procedures in all areas where slopes are present.

Fences & Demarcation

Mitigation Measure 13:	Demarcate construction areas by semi-permanent means in order to control movement of personnel, vehicles, providing boundaries for construction sites in order to limit spread of impacts;

Mitigation Measure 14:	No painting or marking of rocks or vegetation to identify locality or other information shall be allowed, as it will disfigure the natural setting. Marking shall be done by steel stakes with tags, if required;
Mitigation Measure 15:	Marking of plants should be done by means of semi-permanent (removable) marker tape;

Fire

Mitigation Measure 16:	Prevent all open fires;
Mitigation Measure 17:	Provide demarcated fire-safe zones, facilities and suitable fire control measures;

Roads & Access

Mitigation Measure 18:	Access is to be established by vehicles passing over the same track on natural ground. Multiple tracks are not permitted;
Mitigation Measure 19:	Vehicular traffic shall not be allowed in permanently wet areas, no damage shall be caused to wet areas. Where necessary, alternative methods of construction shall be used to avoid damage to wet areas.
Mitigation Measure 20:	Restrict the construction of new access roads to outside sensitive areas. Sensitive areas outside the construction footprint are to be demarcated and no access roads are to be constructed within these areas;
Mitigation Measure 21:	The Contractor shall select a suitable level area free of rock and large bushes as lay down area;
Mitigation Measure 22:	The Contractor shall select an area a suitable distance from any sensitive environmental feature as a construction camp;

Workers & Personnel

Mitigation Measure 23:	Provide temporary on-site ablution, sanitation, litter and waste management and hazardous materials management facilities;
Mitigation Measure 24:	Abluting anywhere other than in provided toilets shall not be permitted. Under no circumstances shall use of the veld be permitted;
Mitigation Measure 25:	Use of branches of trees and shrubs for fire making purposes is strictly prohibited;

Vegetation Clearance & Operations

Mitigation Measure 26: Removal of vegetation/ plants shall be avoided until such time as soil stripping is required and similarly exposed surfaces must be re-vegetated or stabilised as soon as is practically possible;

Mitigation Measure 27: Remove and store topsoil separately in areas where excavation/ degradation takes place. Topsoil should be used for rehabilitation purposes in order to facilitate regrowth of species that occur naturally in the area;

Mitigation Measure 28: Disturbance of vegetation must be limited to areas of construction;

Mitigation Measure 29: The removal or picking of any protected or unprotected plants shall not be permitted and no horticultural specimens (even within the demarcated working area) shall be removed, damaged or tampered with unless agreed to by the ECO;

Mitigation Measure 30: Cut vegetation (grass and shrubs) only if required. No clearing of vegetation or soil by grading machinery shall be undertaken;

Mitigation Measure 31: The establishment and regrowth of alien vegetation must be controlled after the removal of grass;

Mitigation Measure 32: All declared aliens must be identified and managed in accordance with the Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983);

Mitigation Measure 33: Ensure proper surface restoration and resloping in order to prevent erosion, taking cognisance of local contours and landscaping;

Mitigation Measure 34: Exposed areas with slopes less than 1:3 should be rehabilitated with a grass mix that blends in with the surrounding vegetation;

Mitigation Measure 35: The grass mix should consist of indigenous grasses adapted to the local environmental conditions;

Mitigation Measure 36: The revegetated areas should be temporarily fenced to prevent damage by grazing animals;

Mitigation Measure 37: Re-vegetated areas showing inadequate surface coverage (less than 30 % within eight months after re-vegetation) should be prepared and re-vegetated from scratch;

Mitigation Measure 38:	Damage to re-vegetated areas should be repaired promptly;
Mitigation Measure 39:	Exotic weeds and invaders that might establish on the re- vegetated areas should be controlled to allow the grasses to properly establish;
Mitigation Measure 40:	Monitoring the potential spread of declared weeds and invasive alien vegetation to neighbouring land and protecting the agricultural resources and soil conservation works are regulated by the Conservation of Agricultural Resources Act, No. 43 of 1983 and should be addressed on a continuous basis;

Animals

Mitigation Measure 41:	No animal may be hunted, trapped, snared or killed for any purpose whatsoever;
Mitigation Measure 42:	Conduct a search and rescue operation in all affected areas to remove animals from old termite mounds prior to the commencement of construction activities (vegetation clearing and ground levelling). Reptiles and small mammals that utilises these micro-habitat should be captured and released in suitable nearby areas;
Mitigation Measure 43:	Vehicular traffic should not be allowed after dark in order to limit accidental killing of nocturnal animals;
Mitigation Measure 44:	Dangerous animals should be handled by a competent person;
Mitigation Measure 45:	Compile a graphic list of potentially dangerous animals and present this to all workers as part of site induction; and
Mitigation Measure 46:	Ensure that a snake handler and/ or anti venom serum is available at all times, together with a competent person to administer this serum.

Protected Trees/ Conservation Important Species

Mitigation Measure 47:	Conduct a suitable assessment of the abundance and structure of protected tree species on the property to assist the client with regards to the submission of relevant applications;
Mitigation Measure 48:	Obtain necessary and required approval per application for damage/ removal/ cutting/ pruning of Protected tree species from Department of Forestry, as per National Forests Act (Act No. 84 of 1998) under Government Notice GN 1012 of 2004 and GN 767 of 2005 as well as NCDENC;

Mitigation Measure 49:	Cutting/ pruning/ damaging of any Protected tree species should not be allowed at any circumstances, unless a permit has been obtained for this purpose; and
Mitigation Measure 50:	Conduct a detailed walkthrough of moderately suitable habitat for *Lithops aucampiae* subsp. *aucampiae* var. *aucampiae.* Implement a removal and relocation programme if required.

5.1.1.5.5 Hydrology: (No additional mitigations)

5.1.1.5.6 Wetlands: (No additional mitigations)

5.1.1.5.7 Socio Economic: (No additional mitigations)

Table21: Overall Impacts table for the Planning

ASPECT AFFECTED	POTENTIAL IMPACT[2] - SIZE AND SCALE OF DISTURBANCE[3]	ACTIVITIES	MITIGATION MEASURES [4] *(modify, remedy, control, or stop through (e.g. noise measures, storm-water control, dust control, rehabilitation, design measures, blasting controls, avoidance, relocation, alternative activity etc.)* *E.g. Modify through alternative method.* *Control through noise control* *Control through management and monitoring* *Remedy through rehabilitation.*	TIME PERIOD FOR IMPLEMENTATION & RESPONSIBILITY[5]	COMPLIANCE WITH STANDARDS [6]
Final layout	Potential impact on identified sensitive areas. Scale: Entire PV development footprint	**Positioning of all the facility components** • PV Facility • Access roads • Power lines	Control through avoidance: 1. Plan and conduct pre-construction activities in an environmentally acceptable manner. 2. Obtain any additional environmental permits required. 3. Consider and incorporate design level mitigation measures recommended by the specialists (Refer to BAR and Specialist reports as appended). 4. Utilise common areas of Redstone CSP Project, i.e. laydown areas/ assembly areas, security, administration area, substation, temporary man camp, water related infrastructure (associated water storage tank/s) and other related infrastructure to minimize environmental impacts. 5. Consult a lighting engineer in the planning and placement of light fixtures for the PV Power Plant.	1. Pre-construction- Developer/Owner/ EPC Contractor	BAR and EMPr

[2] e.g. dust, noise, drainage surface disturbance, fly rock, surface water contamination, groundwater contamination, air pollution etc.
[3] Volumes, tonnages and hectares or m²
[4]describe how each of the recommendations in herein will remedy the cause of pollution or degradation and migration of pollutants
[5] Describe the time period when the measures in the environmental management programme must be implemented Measures must be implemented when required. With regard to Rehabilitation specifically this must take place at the earliest opportunity. With regard to Rehabilitation, therefore state either: Upon cessation of the individual activity or. Upon the cessation of mining, bulk sampling or alluvial diamond prospecting as the case may be.
[6] A description of how each of the recommendations herein will comply with any prescribed environmental management standards or practices that have been identified by Competent Authorities

ASPECT AFFECTED	POTENTIAL IMPACT[2] - SIZE AND SCALE OF DISTURBANCE[3]	ACTIVITIES	MITIGATION MEASURES [4] *(modify, remedy, control, or stop through (e.g. noise measures, storm-water control, dust control, rehabilitation, design measures, blasting controls, avoidance, relocation, alternative activity etc.)* *E.g. Modify through alternative method.* *Control through noise control* *Control through management and monitoring* *Remedy through rehabilitation.*	TIME PERIOD FOR IMPLEMENTATION & RESPONSIBILITY[5]	COMPLIANCE WITH STANDARDS [6]
			6. The holder of an environmental authorisation has the responsibility to notify the competent authority of any alienation, transfer and, change of ownership rights in the property on which the activity is to take place. 7. Fourteen (14) days written notice must be given to the Department that the activity will commence. The notification must include a date on which the activity will commence as well as the reference number. 8. ECO to be appointed prior to the commencement of any authorised activities. Once appointed the name and contact details of the ECO must be submitted to the Director: Compliance Monitoring at the DEA.		

Table 22: Overall Impacts table for construction phase

ASPECT AFFECTED	POTENTIAL IMPACT - SIZE AND SCALE of disturbance	ACTIVITIES	MITIGATION MEASURES	TIME PERIOD FOR IMPLEMENTATION & RESPONSIBILITY	COMPLIANCE WITH STANDARDS
Stakeholder communication	Impacts on affected landowners and land uses	All activities associate with all components under	Control through Management: 1. Implement the grievance mechanism procedure for the public (following the guidelines of the grievance	1. Developer/Owner/ EPC Contractor / O&M Contractor - Pre-construction / Pre-	BAR and EMPr

ASPECT AFFECTED	POTENTIAL IMPACT - SIZE AND SCALE of disturbance	ACTIVITIES	MITIGATION MEASURES	TIME PERIOD FOR IMPLEMENTATION & RESPONSIBILITY	COMPLIANCE WITH STANDARDS
	surrounding the PV facility.	construction and operation of the PV Power Project	mechanism in Appendix 3F) to be implemented during both the construction and operational phases of the facility. 2. Implement a grievance mechanism for the construction, operational and decommissioning phases of the Project for all employees, contractors, subcontractors and site personnel, in line with the South African Labour Law. 3. Liaison with landowners and neighbouring landowners is to be undertaken prior to the commencement of construction should they be required to plan accordingly. 4. All minor and major environmental incidences must be communicated to the ECO, including the cause, extent, future mitigation measures and time frame for which the incident will be resolved. 5. The Project Company should develop a grievance procedure to ensure fair and prompt resolution of problems arising from the project. The grievance procedure should be underpinned by following the principles and commitments (Appendix 3F) Implement a transparent grievance procedure and disseminate key information to directly impacted stakeholders. Seek to resolve all grievances timeously. Maintain full written records of each grievance case and the associated process of resolution and outcome for transparent, external reporting. The responsibility for resolution of grievances will lie with the Project Company and its contractors.	operation.	
Avifauna	Impacts on avifauna on project footprint	All activities associate with all components	1.Prior to commencement of construction commencing, ECO must be trained by an avifaunal specialist to identify the potential Red Data species as well as the signs that	2. ECO; Avifauna specialist	EMPr; Avifauna report

ASPECT AFFECTED	POTENTIAL IMPACT - SIZE AND SCALE of disturbance	ACTIVITIES	MITIGATION MEASURES	TIME PERIOD FOR IMPLEMENTATION & RESPONSIBILITY	COMPLIANCE WITH STANDARDS
	surrounding areas.	under construction and operation of the PV Power Project	indicate possible breeding by these species. The ECO must then, during audits/site visits, make a concerted effort to look out for such breeding activities of Red Data species, and such efforts may include the training of construction staff (e.g. in Toolbox talks) to identify Red Data species, followed by regular questioning of staff as to the regular whereabouts on site of these species. 2.If any of the Red Data species are confirmed to be breeding (e.g. if a nest site is found), construction activities within 500 m of the breeding site must cease, and an avifaunal specialist is to be contacted immediately for further assessment of the situation and instruction on how to proceed.		

ASPECT AFFECTED	POTENTIAL IMPACT - SIZE AND SCALE of disturbance	ACTIVITIES	MITIGATION MEASURES	TIME PERIOD FOR IMPLEMENTATION & RESPONSIBILITY	COMPLIANCE WITH STANDARDS
Site establishment and Hydrology management	Hazards to landowners and public. Damage to indigenous natural vegetation, due largely to ignorance of where such areas are located.	Open excavations (foundations and cable trenches). Movement of construction vehicles in the area and on-site.	Control through avoidance: 1. Secure site, working areas and excavations in an appropriate manner, as agreed with the Site Manager and ECO. 2. Minimize vegetation clearance. The project infrastructure footprint and associated area of disturbance should be minimised as far as practically possible with adequate spacing between panels to encourage shrubland growth. 3. Compile a method statement specific to vegetation clearance. 4. The clearing of vegetation and disturbance of soils should	Duration of contract- CER / PM	Establish SABS 089: 1999

ASPECT AFFECTED	POTENTIAL IMPACT - SIZE AND SCALE of disturbance	ACTIVITIES	MITIGATION MEASURES	TIME PERIOD FOR IMPLEMENTATION & RESPONSIBILITY	COMPLIANCE WITH STANDARDS
	Loss of threatened plant species and protected tree species. Impact on heritage sites for Development footprint and surrounding areas.		be done considering the potential for subsequent erosion. 5. Site rehabilitation should aim to restore surface drainage patterns, natural soil and vegetation as far as is feasible. 6. An erosion control management plan should be utilised to prevent erosion (Refer to Appendix 3H). This may include erosion control measures such as silt fences (for areas of works) and gravel strips at the impact zone where water falls from the solar panels onto the soil surface (due to deterioration in natural shrubland because of poor maintenance or lack of solar radiation) The development of the PV Power Project should be done considering the potential for erosion as part of the overall storm water management of the site which will also facilitate slowing of runoff or settling of sediment. This may include 'soft' engineering solutions such as vegetated buffer strips or swales alongside service roads, underneath solar panels or downslope of a range of panels. 'Hard' engineering solutions silt traps can be implemented if 'soft' solutions are found to be inadequate. Any vegetated buffer strips or swales will need to be maintained with a healthy shubland cover that can effectively intercept sediment suspended in runoff. Flow points from non-perennial rivers to the east of the site should be identified/verified to enable an assessment of the expected catchment area and associated flow rates/volumes. Mitigation of surface water flooding can consequently be incorporated into the storm water management plan of the site with water routed around sensitive infrastructure. The design of any diversions should use the 1:50 year storm event at minimum. 7. A minimum exclusion zone of 32m should be used around all 1:50,000 topographical map watercourses specifically in association with the non-perennial watercourse which intersects the site. A larger buffer of 100m around all		

ASPECT AFFECTED	POTENTIAL IMPACT - SIZE AND SCALE of disturbance	ACTIVITIES	MITIGATION MEASURES	TIME PERIOD FOR IMPLEMENTATION & RESPONSIBILITY	COMPLIANCE WITH STANDARDS
			watercourses is the preferred exclusion zone as it accounts for more uncertainty with regards to any possible flooding. It should be noted, however, that the significance of the intersecting non-perennial watercourse is uncertain (based upon this desktop study) and clarification as to the nature of this watercourse is possible using a more detailed investigation during a high rainfall period (e.g. March). 8. Fluvial flood risk to the western boundary of Option A should be considered beyond the surface water flooding with additional offset potentially necessary as determined by a suitability qualified hydrologist or engineer prior to construction. 9. Minimum buffer area of 32m should be maintained between the proposed PV Power Plant development area and the Groenwater Spruit riparian zone. If possible, this buffer zone should be increased further. The buffer zone must be maintained as a fully vegetated buffer strip between the development and the riparian habitat. No intrusion into the buffer should be allowed. 10. A construction stormwater management plan must be developed and implemented prior to the commencement of large scale vegetation clearing activities or construction activities and be maintained until the end of the construction phase. Such a plan should aim to minimise the transport of sediment off site as well as prevent the discharge of high velocity flows into downslope wetlands. Sediment traps and sediment barriers should be installed where necessary, and discharge points should be protected against erosion and incorporate energy dissipaters. 11. To minimise the impact of increased runoff and sediment transport into adjacent watercourses, vegetation clearing and soil stripping should be concentrated in the dry		

ASPECT AFFECTED	POTENTIAL IMPACT - SIZE AND SCALE of disturbance	ACTIVITIES	MITIGATION MEASURES	TIME PERIOD FOR IMPLEMENTATION & RESPONSIBILITY	COMPLIANCE WITH STANDARDS
			season. 12. Erosion within the construction site must be minimised through the following: o Limiting the area of disturbance and vegetation clearing to as small an area as possible; o Where possible, undertaking construction during the dry season; o Phasing vegetation clearing activities and limiting the time that any one area of bare soil is exposed to erosion; o Control of stormwater flowing onto and through the site. Where required, stormwater from upslope should be diverted around the construction site; o Prompt stabilisation and re-vegetation of soils after disturbance and construction activities in an area are complete; and o Protection of slopes. Where steeper slopes occur, these should be stabilised using geotextiles or any other suitable product designed for the purpose. 13. Sediment transport off the site must be minimised through the following: o Establishing perimeter sediment controls. This can be achieved through the installation of sediment fences along downslope verges of the construction site. Where channelled or concentrated flow occurs, reinforced sediment fences or other sediment barriers such as sediment basins should be used (refer to US EPA guidelines on Stormwater Pollution Prevention); o Discharge of stormwater from the construction site into adjacent grassland rather than directly		

ASPECT AFFECTED	POTENTIAL IMPACT - SIZE AND SCALE of disturbance	ACTIVITIES	MITIGATION MEASURES	TIME PERIOD FOR IMPLEMENTATION & RESPONSIBILITY	COMPLIANCE WITH STANDARDS
			into wetland habitat. Discharged flows must be slow and diffuse; and o Regular inspection and maintenance of sediment controls 14. Establish the necessary ablution facilities with chemical toilets and provide adequate sanitation facilities and ablutions for workers (1 toilet per every 30 workers for each sex) at appropriate locations around the Project Site. 15. Ablution or sanitation facilities should not be located within 100 m from a 1:100 year flood line including water courses, wetlands. 16. Supply adequate weather and vermin proof waste collection bins and skips (covered at minimum with secured netting or shadecloth) at site where construction is being undertaken. Separate bins should be provided for general and hazardous waste. As far as possible, provision should be made for separation of waste for recycling. 17. Solid waste: All work sites must be kept free of waste. No solid waste may be burned or buried on site or disposed of by any other method on site or within quarries or borrows pits. 18. Liquid waste: No liquid waste, including grey water, may be discharged into any water body or drainage line. Clearly label all the containers storing hazardous substances. 19.		

ASPECT AFFECTED	POTENTIAL IMPACT - SIZE AND SCALE of disturbance	ACTIVITIES	MITIGATION MEASURES	TIME PERIOD FOR IMPLEMENTATION & RESPONSIBILITY	COMPLIANCE WITH STANDARDS
Site clearance	Impacts on natural vegetation. Impacts on soil. Loss of topsoil.	» Site preparation and earthworks. » Trenching activities. » Excavation of foundations. » Construction of site access road. » Site preparation (e.g. compaction). » Foundations or plant equipment installation. » Stockpiling of topsoil, subsoil and spoil material.	Control through avoidance and management: 1. Areas to be cleared must be clearly marked on-site to eliminate the potential for unnecessary clearing. 2. The extent of clearing and disturbance to the native vegetation must be kept to a minimum so that impact on flora and fauna is restricted. 3. Construction activities must be restricted to demarcated areas so that impact on flora and fauna is restricted. 4. All fill material must be sourced from a commercial off-site suitable/permitted source, quarry or borrow pit. Where possible, material from foundation excavations must be used as fill on-site. 5. Topsoil must be stockpiled and managed in terms of the stockpile management plan. 6. Excavated topsoil must be stockpiled in designated areas separate from base material and covered until replaced during rehabilitation. As far as possible, topsoil must not be stored for longer than 3 months. 7. Topsoil must not be stripped or stockpiled when it is raining or when the soil is wet as compaction will occur. 8. The maximum topsoil stockpile height must not exceed 2m in order to preserve micro-organisms within the topsoil, which can be lost due to compaction and lack of oxygen. 9. Topsoil recovered from site, must not be used for any construction related activities, including that of bedding for underground cabling. 10. Use of herbicides and handpicking/ slashing to control alien plants in development footprint. Disposal of alien plants must be done in a manner that cannot propagate. No alien plant should be allowed develop to a point of producing seed.	Site establishment & duration of contract- CER	Conservation of Agricultural Resources (CARA) Act 43 of 1983 - as amended/updated National Environmental Management Biodiversity Act Regulations GN.R 598, 2014 on Alien invasive Species Categories

ASPECT AFFECTED	POTENTIAL IMPACT - SIZE AND SCALE of disturbance	ACTIVITIES	MITIGATION MEASURES	TIME PERIOD FOR IMPLEMENTATION & RESPONSIBILITY	COMPLIANCE WITH STANDARDS
Loss of indigenous vegetation	Loss of indigenous natural vegetation due to construction activities, or poor behaviour on the part of the construction team-development footprint and surrounds	» Vegetation clearing. » Construction of access roads. » Construction/placement of water storage/treatment tank/s. » Chemical contamination of the soil by vehicles and machinery. » Operation of construction camps. » Storage of materials required for construction .	Control through avoidance and management: 1. Areas to be cleared must be clearly marked in the field to eliminate unnecessary clearing. 2. Limit unnecessary impacts on surrounding natural vegetation, e.g. driving around in the veld, use access roads only. 3. Driving is only allowed on access roads and within designated areas in the development footprint. If driving is required outside of the designated areas, then approval from the ECO must first be granted before the activity commences. 4. Ensure all permits from DENC are valid. If new vegetation has been identified for removal, then permits need to be updated and re-submitted. » Search and Rescue (S&R) (refer to Appendix 3D: Plant Rescue and Protection Plan) of all protected plants that will be affected by the development, especially species occurring in long term and permanent, hard surface development footprints (i.e. all buildings, new roads and tracks, lay down areas, and PV panel, substation, battery storage area positions) must take place. » All development footprints must be surveyed and pegged out as soon as possible, after which a local horticulturist or community members with Search and Rescue experience should be appointed to undertake the S&R. 5. All rescued species should be transplanted immediately or bagged (or succulents left to first air-dry before planting) and kept in the horticulturist's or a	Construction – CER	In accordance with Mucina & Rutherford 2006.

ASPECT AFFECTED	POTENTIAL IMPACT - SIZE AND SCALE of disturbance	ACTIVITIES	MITIGATION MEASURES	TIME PERIOD FOR IMPLEMENTATION & RESPONSIBILITY	COMPLIANCE WITH STANDARDS
			designated on-site nursery, and should be returned to site or land portion once all construction is completed and rehabilitation of disturbed areas is required. 6. Replanting should occur in spring to early summer once sufficient rains have fallen, in order to facilitate establishment. 7. Should transplantation not be possible, the location of the plant species should be clearly demarcated. 8. The site rehabilitation programme must be implemented 9. No one other than the ECO or personnel authorised by the ECO may disturb flora or fauna outside of the demarcated construction area/s.		
Soil degradation and erosion	Soil and rock degradation. Soil erosion. Increased deposition of soil into drainage systems. Increased run-off over the site. Contaminated run-off from the site.	» Removal of vegetation, excavation, stockpiling, compaction, and pollution of soil. » Rainfall - water erosion of disturbed areas. » Wind erosion of disturbed areas. » Concentrated discharge of water from construction activity.	Control through management and monitoring 1. Identify disturbance areas and restrict construction activity to these areas. 2. Rehabilitate disturbance areas as soon as practical when construction in an area is complete. 3. Newly rehabilitated areas must be adequately demarcated until vegetation is established. 4. Minimise removal of vegetation which adds stability to soil. 5. Soil conservation: Stockpile topsoil for re-use in rehabilitation phase, protect stockpile from erosion 6. Erosion control measures: Run-off attenuation on slopes (sand bags, logs), silt fences, stormwater catch-pits, shade nets, rip-rap, brush packing or temporary mulching over denuded area as required. 7. Top soil recovered from site or which stockpiled may not be used for any construction related activities. 8. Control depth of excavations and stability of cut faces/sidewalls.	Before and during construction: CER	BAR and EMPr

ASPECT AFFECTED	POTENTIAL IMPACT - SIZE AND SCALE of disturbance	ACTIVITIES	MITIGATION MEASURES	TIME PERIOD FOR IMPLEMENTATION & RESPONSIBILITY	COMPLIANCE WITH STANDARDS
Avifauna	Vegetation clearance and associated impacts on faunal habitats. Traffic to and from site. Loss of avifauna due to interactions with humans and site infrastructure-development footprint	» Site preparation and earthworks. » Construction-related traffic. » Foundations or plant equipment installation. » Mobile construction equipment. » Power lines and associated electrical infrastructure » Man Camp	Control through management and monitoring 1. The extent of clearing and disturbance to the native vegetation must be kept to a minimum so that impact on avifauna and their habitats are restricted. 2. Bird friendly structures must be used to prevent perching, nesting and flashovers from streamers, resulting in avifaunal injuries/ deaths. 3. PV panel support structures must not encourage avifauna to nest. 4. Implement a construction phase avifauna monitoring programme to maintain a record of bird fatalities 5. The EPC contractor must ensure that all subcontractors report avifaunal incidents to the ECO/ CER immediately. 6. All contractors are to adhere to the Construction Environmental Management Plan (CEMP) and should apply good environmental practice during construction. 7. If any of the Red Data species are confirmed to be breeding (e.g. if a nest site is found), construction activities within 500 m of the breeding site must cease, and an avifaunal specialist is to be contacted immediately for further assessment of the situation and instruction on how to proceed. 8. A faunal register must be implemented and maintained during construction by the ECO and EO, which must contain the following: » Record of all avifaunal injuries and fatalities; » Time, location and GPS co-ordinates of such incidence; » Common and species name of impacted fauna;	Site establishment & duration of contract- CER	BAR, EMPr and specialist recommendation

ASPECT AFFECTED	POTENTIAL IMPACT - SIZE AND SCALE of disturbance	ACTIVITIES	MITIGATION MEASURES	TIME PERIOD FOR IMPLEMENTATION & RESPONSIBILITY	COMPLIANCE WITH STANDARDS
			» Possible cause of incident; » Conservation status; and » Photographic evidence.		
Fauna & Flora	Loss of faunal habitats. Loss of flora. Traffic to and from site. Loss of fauna due to interactions with humans and site infrastructure- Development footprint	» Site preparation and earthworks. » Construction-related traffic. » Foundations or plant equipment installation. » Mobile construction equipment. » Power lines and associated electrical infrastructure » Vegetation clearance	Control through management and monitoring: 1. Areas to be cleared must be clearly marked in the field to eliminate unnecessary clearing/disturbance of faunal habitats. 2. The extent of clearing and disturbance to the native vegetation must be kept to a minimum so that impact on fauna and their habitats are restricted. 3. Implement a faunal removal plan/ rescue plan with designated personnel and contact numbers. 4. Ensure the absence of larger animals through frequent patrols, particularly prior to land clearance. 5. Faunal removal plan must be approved by the ECO. 6. Restrict losses of natural habitat to footprints, avoid peripheral or unnecessary losses of natural habitat; ensure proper rehabilitation of areas outside development footprints (where accidental habitat degradation occurred). 7. Competent persons must be responsible for removal of fauna. 8. Faunal injury/ fatality register must be kept on site to record all faunal related incidents. 9. Ensure the competent persons have the relevant capture, release and transportation permits issued by the DENC before site clearance and construction commences. 10. Identify farm/ land portion where fauna will be released and ensure that prior consent from land owner has been obtained.	Duration of contract/ Duration of Construction: CER	BAR, EMPr and specialist recommendation

ASPECT AFFECTED	POTENTIAL IMPACT - SIZE AND SCALE of disturbance	ACTIVITIES	MITIGATION MEASURES	TIME PERIOD FOR IMPLEMENTATION & RESPONSIBILITY	COMPLIANCE WITH STANDARDS
			11. Ensure animal capture/ removal/ transportation equipment is available on site, such as snake hooks, tongs, bags, eye shield, etc. 12. Contract services of a veterinarian or ranger with access to tranquilisers for larger fauna. 13. Ensure contact numbers of responsible persons are displayed around site. 14. Ensure signs are placed around the site indicating applicable protected and dangerous faunal species. 15. Animals that cannot flee from the affected areas by themselves (e.g. tortoises, amphibians, small mammals) must be removed from the affected areas before the start of site clearing/construction and relocated to safe areas. 16. Traffic calming or extensive use of speed limit/ warning signs must be installed along access roads to prevent/ reduce faunal mortalities. 17. Vehicle movements must be restricted to designated roadways. Movements outside of designated roadways and proposals for the construction of informal access roads must be done with the agreement of the ECO. 18. Worker/ contractor awareness programmes, ensuring minimal conflict situation. 19. Control of human movement in adjacent natural habitat, frequent patrols, biological monitoring programmes, animal control (vervet monkeys, feral cats, rats, baboons, dogs, etc) 20. Implement generic monitoring programme and mitigation measures that are aimed at identifying and preventing the uncontrolled spread of impacts into adjacent areas of natural habitat 21. A faunal register must be implemented and maintained during construction by the ECO and EO, which must contain the following:		

ASPECT AFFECTED	POTENTIAL IMPACT - SIZE AND SCALE of disturbance	ACTIVITIES	MITIGATION MEASURES	TIME PERIOD FOR IMPLEMENTATION & RESPONSIBILITY	COMPLIANCE WITH STANDARDS
			» Record of all faunal and avifaunal injuries and fatalities; » Time, location and GPS co-ordinates of such incidence; » Common and species name of impacted fauna; » Possible cause of incident; » Conservation status; and » Photographic evidence. 22. The EPC contractor must ensure that all subcontractors report faunal and avifaunal incidents to the ECO/ CER immediately		
Heritage	Heritage objects or artefacts found on site are inappropriately managed or destroyed: development footprint and surrounds	» Site preparation and earthworks » Foundations or plant equipment installation » Mobile construction equipment movement on site » Construction of power line towers	Control through management and monitoring: 1. Familiarise all staff and contractors with procedures for dealing with chance finds of heritage objects/sites i.e. stone tool scatters, artefacts or bone and fossil remains. 2. Project employees and any contract staff will maintain, at all times, a high level of awareness of the possibility of discovering heritage sites. 3. If a heritage object is found, work in that area must be stopped immediately, find cordoned off, and appropriate specialists brought in to assess to site, notify the administering authority of the item/site, and undertake due/required processes. 4. Apply for sampling permits from SAHRA for work on any archaeological sites identified as needing intervention. 5. If any graves are located on the development footprint, they should ideally be preserved in-situ or alternatively	Duration of contract: EPC Contractor in consultation with Specialist:	SAHRA guidelines: Archaeological and Palaeontological Components of Impact Assessment Reports Heritage Resources Act, Act No. 25, 1999 BAR, EMPr and Heritage Impact Assessment

ASPECT AFFECTED	POTENTIAL IMPACT - SIZE AND SCALE of disturbance	ACTIVITIES	MITIGATION MEASURES	TIME PERIOD FOR IMPLEMENTATION & RESPONSIBILITY	COMPLIANCE WITH STANDARDS
			relocated according to existing legislation. 6. If any evidence of archaeological sites or remains (e.g. remnants of stone-made structures, indigenous ceramics, bones, stone artefacts, ostrich eggshell fragments, charcoal and ash concentrations), fossils or other categories of heritage resources are found during the proposed development, SAHRA APM Unit must be alerted. If unmarked human burials are uncovered, the SAHRA Burial Grounds and Graves (BGG) Unit, must be alerted immediately. A professional archaeologist or palaeontologist, depending on the nature of the finds, must be contracted as soon as possible to inspect the findings. If the newly discovered heritage resources prove to be of archaeological or palaeontological significance, a Phase 2 heritage rescue operation may be required subject to permits issued by SAHRA.		
Visual	Visual impact of general construction activities and construction, the potential scarring of the landscape due to vegetation clearing: Development footprint and surrounds	Viewing of construction related activities by observers on or in close proximity to the site.	Control through management and monitoring: 1. Keep vegetation removal to a minimum where possible. Ensure, wherever possible, all existing vegetation is retained and incorporated into the site rehabilitation. 2. Restrict the activities and movement of construction workers and vehicles to the immediate construction site and existing access roads. 3. Ensure good housekeeping, i.e. site is neat and tidy throughout construction phase. Ensure that rubble, litter, and disused construction materials are managed and removed regularly. 4. Ensure that all infrastructure and the site and general surrounds are maintained in a neat manner. 5. Reduce and control construction dust using approved dust suppression techniques. 6. Only the footprint and a small 'construction buffer zone' around the proposed activities should be exposed. In	Duration of construction: CER	

ASPECT AFFECTED	POTENTIAL IMPACT - SIZE AND SCALE of disturbance	ACTIVITIES	MITIGATION MEASURES	TIME PERIOD FOR IMPLEMENTATION & RESPONSIBILITY	COMPLIANCE WITH STANDARDS
			all other areas, the existing vegetation should be retained and access prohibited during the construction phase. 7. Access roads will require an effective dust suppression management programme, such as regular wetting and / or the use of non-polluting chemical stabilisation that will retain moisture in the road surface. 8. As far as possible, restrict construction activities to daylight hours in order to negate or reduce the visual impacts associated with lighting. 9. Install light fixtures that provide precisely directed illumination to reduce light "spillage" beyond the immediate surrounds of the Project Site. 10. Avoid high pole top security lighting along the periphery of the site, where possible, unless a security risk is posed and consider the use of lights that are activated on movement at illegal entry to the Project Site. 11. Rehabilitate all disturbed areas, construction areas, roads, and servitudes to acceptable visual standards.		
Waste Management	Inefficient use of resources resulting in excessive waste generation Litter or contamination of the site or water through poor waste	» Packaging » Other construction wastes » Hydrocarbon and chemical use, handling and storage » Spoil material from excavation, earthworks and site preparation » Septic tanks and portable toilets	1. Construction method and materials should be carefully considered in view of the waste hierarchy, i.e. reduction, re-use, and recycling opportunities. 2. Where practically possible, construction and general wastes on-site must be reused or recycled. Bins and skips must be available on-site for collection, separation, and storage of waste streams (such as wood, metals, general refuse etc.). 3. Disposal of waste must be in accordance with relevant legislative requirements, including the use of licensed contractors. ECO to be made aware of the details of such facilities. 4. Uncontaminated waste must be removed at least weekly for disposal; other wastes will be removed for recycling/ disposal at an appropriate frequency.	Duration of Contract: EPC Contractor	SABS 089:1999 Part 1

ASPECT AFFECTED	POTENTIAL IMPACT - SIZE AND SCALE of disturbance	ACTIVITIES	MITIGATION MEASURES	TIME PERIOD FOR IMPLEMENTATION & RESPONSIBILITY	COMPLIANCE WITH STANDARDS
	management practices Increase in vermin Soil pollution Groundwater and surface water pollution: development footprint and surrounds		5. SABS approved spill kits to be available and easily accessible. 6. Daily inspection of all portable toilets and septic tanks must be performed by SHE/ environmental representatives on site. 7. All waste facilities and waste transportation contractors must be licensed and registered where necessary. 8. Upon the completion of construction, the area must be cleared of potentially polluting materials. Spoil stockpiles must also be removed and appropriately disposed of or the material re-used for an appropriate purpose. 9. Unless designated areas are provided, no vehicles or machinery are to be washed on the site.		
Stormwater Management	Poor stormwater management and the alteration surface water resources: development footprint and surrounds	» Placement of hard engineered surfaces	Control through management and monitoring 1. Reduce the potential increase in surface flow velocities and the resultant impact on the localised drainage system through construction of break water structures at the ends of stormwater drains. 2. PV panels storage units and roads should avoid the aquatic features that have been identified as being of high sensitivity and their buffers (32m). 3. The sensitive areas (i.e. the edges of the buffers around the wetlands, channel banks) not affected by construction must clearly be demarcated and fenced off (using temporary fencing and danger tape) before any construction work or site preparation begins. These are no-go areas during the construction process, except where work is occurring. 4. Appropriately plan hard-engineered bank erosion protection structures where required.	Planning and design/ Construction: Developer/Owner / EPC Contractor O&M Operator	Method statement, BAR and EMPr

ASPECT AFFECTED	POTENTIAL IMPACT - SIZE AND SCALE of disturbance	ACTIVITIES	MITIGATION MEASURES	TIME PERIOD FOR IMPLEMENTATION & RESPONSIBILITY	COMPLIANCE WITH STANDARDS
			5. Sedimentation traps should be installed along/ at the end of stormwater channels to minimise sediment flow into the hydrological systems and environment. 6. Clean and dirty stormwater systems must be installed to prevent contamination of clean stormwater systems. 7. Drainage line crossings should not trap any run-off, thereby creating inundated areas, but allow for free flowing water.		

ASPECT AFFECTED	POTENTIAL IMPACT - SIZE AND SCALE of disturbance[7]	ACTIVITIES	MITIGATION MEASURES	TIME PERIOD FOR IMPLEMENTATION & RESPONSIBILITY	COMPLIANCE WITH STANDARDS
Construction workers	Damage to indigenous natural vegetation and sensitive areas. Damage to and/or loss of topsoil (i.e. pollution, compaction etc.). Impacts on the surrounding environment due to inadequate sanitation and waste removal facilities.	» Vegetation clearing and levelling of equipment storage area/s. » Access to and from the equipment storage area/s. » Ablution facilities. » Contractors not aware of the requirements	Control through management and monitoring: 1. Rehabilitate all disturbed areas within the Project Development Footprint as soon as construction is complete within an area. 2. The terms of this EMPr and the Environmental Authorisation must be included in all tender documentation and Contractors contracts. 3. Ensure that all personnel have the appropriate level of environmental awareness and competence to ensure continued environmental due diligence and on-going minimisation of environmental harm. This can be achieved through the provision of appropriate environmental awareness training to all personnel. Records of all training undertaken must be kept. o Environmental Awareness Training o Induction Training	Duration of Construction period/ Duration of Contract: EPC Contractor and sub-contractor/s	Occupational Health and Safety Act (Act 85 of 1993 Code of Conduct

[7] volumes, tonnages and hectares or m²

ASPECT AFFECTED	POTENTIAL IMPACT - SIZE AND SCALE of disturbance[7]	ACTIVITIES	MITIGATION MEASURES	TIME PERIOD FOR IMPLEMENTATION & RESPONSIBILITY	COMPLIANCE WITH STANDARDS
	Pollution/contamination of the environment. Development footprint	of the EMPr, leading to unnecessary impacts on the surrounding environment.	○ Toolbox Talks 4. Safety representatives, managers and workers must be trained in workplace safety. The construction process must be compliant with all safety and health measures as prescribed by the relevant Act. 5. Establish the necessary ablution facilities with chemical toilets and provide adequate sanitation facilities and ablutions for workers (1 toilet per every 15 workers for each sex) at appropriate locations around the Project Site. 6. Ablution or sanitation facilities should not be located within 100 m from a 1:100 year flood line including water courses, wetlands. 7. Fire-fighting equipment and training should be provided before the construction phase commences. 8. All litter should be deposited in a clearly marked, closed, animal-proof disposal bin in the construction area. Particular attention needs to be paid to the management of food waste. 9. Ensure waste disposal facilities are maintained and emptied as and when required. 10. No one other than the ECO or personnel authorised by the ECO may disturb flora or fauna outside of the demarcated construction area/s. 11. Sub-Contractors appointed by the Contractor must ensure that all workers are informed at the outset of the construction phase of the conditions contained on the Code of Conduct, specifically consequences of stock theft and trespassing on adjacent farms.		
Method Statements	Suspend construction activities resulting in delayed construction	» Site establishment » Site Preparation	Control through management and monitoring: 1. Ensure all construction activities are undertaken with the appropriate level of environmental awareness to minimise environmental risk 2. The Method Statement must cover applicable details with	Duration of Construction period/ Duration of Contract:	EMPr

ASPECT AFFECTED	POTENTIAL IMPACT - SIZE AND SCALE of disturbance[7]	ACTIVITIES	MITIGATION MEASURES	TIME PERIOD FOR IMPLEMENTATION & RESPONSIBILITY	COMPLIANCE WITH STANDARDS
	timeframes- Development footprint	» Soil management » Excavations » water supply and usage » stormwater management » water crossings » Ablution facilities » Solid Waste Management » Liquid waste management » Dust and noise pollution » Hazardous substance storage	regard to: • Details of the responsible person/s • Construction procedures • Materials and equipment to be used • Getting the equipment to and from site • How the equipment/material will be moved while on-site • How and where material will be stored • The containment (or action to be taken if containment is not possible) of leaks or spills of any liquid or material that may occur • Timing and location of activities • Compliance/non-compliance with the Specifications, and • Any other information deemed necessary by the Site Manager. 3. The Contractor may not commence the activity covered by the Method Statement until it has been approved, except in the case of emergency activities and then only with the consent of the Site Manager. 4. Suspend an activity should it not have an approved method statement.	Contractors and Service Providers	

Table 23: Overall Impacts table for Operation phase

ASPECT AFFECTED	POTENTIAL IMPACT - SIZE AND SCALE of disturbance	ACTIVITIES	MITIGATION MEASURES	TIME PERIOD FOR IMPLEMENTATION & RESPONSIBILITY	COMPLIANCE WITH STANDARDS
Reporting	Management of facility development footprint	» Reporting » Management » Execution of activities » Roles and responsibilities	Control through management and monitoring 1. Formal responsibilities are necessary to ensure that key procedures are executed. Specific responsibilities of the Operations Manager, and Environmental Manager for the operation phase of this Project are detailed below. 2. The Project Manager will: o Ensure that adequate resources (human, financial, technology) are made available and appropriately managed for the successful implementation of the operational EMPr. o Conduct annual basis reviews of the EMPr to evaluate its effectiveness. o Take appropriate action as a result of findings and recommendations in management reviews and audits. o Provide forums to communicate matters regarding environmental management. 3. The EM will: o Develop and Implement an Environmental Management System (EMS) for the PV Power Project. o Manage and report on the PV Power Project environmental performance. o Maintain a register of all known environmental impacts and manage the monitoring thereof. o Conduct internal environmental audits and co-ordinate external environmental audits. o Liaise with statutory bodies such as the National and Provincial Department of Environmental Affairs (DEA) on environmental performance and other issues. o Conduct environmental training and awareness for the	Operational phase- all	EMPr

ASPECT AFFECTED	POTENTIAL IMPACT - SIZE AND SCALE of disturbance	ACTIVITIES	MITIGATION MEASURES	TIME PERIOD FOR IMPLEMENTATION & RESPONSIBILITY	COMPLIANCE WITH STANDARDS
			employees who operate and maintain the PV Power Project o Liaise with interested and affected parties on environmental issues of common concern. o Track and control the lodging of any complaints regarding environmental matters. 4. The EM must provide fourteen (14) days written notification the DEA that the activity operational phase will commence.		
Protection of indigenous natural vegetation, fauna and maintenance of rehabilitation	»Disturbance to or loss of vegetation and/or habitat. »Environmental integrity of site undermined resulting in reduced visual aesthetics, erosion, compromised land capability and the requirement for on-going management intervention. »Loss of protected faunal species:	» Movement of employee vehicles within and around site.	Control through management and monitoring: 1. Vehicle movements must be restricted to designated roadways. 2. Existing roads must be maintained to ensure limited erosion and impact on areas adjacent to roadways. 3. An on-going alien plant monitoring and eradication programme must be implemented, where necessary. 4. A faunal/ avifauna incident register must be maintained on site. 5. Implementation of an animal removal plan to ensure safety of workers and scavengers. 6. Ensure the absence of larger animals through frequent patrols, particularly prior to land clearance. 7. Restrict losses of natural habitat to footprints, avoid peripheral or unnecessary losses of natural habitat; ensure proper rehabilitation of areas outside development footprints (where accidental habitat degradation occurred). 8. Avoid encroachment of alien and invasive plant species. 9. Worker/ contractor awareness programmes, ensuring minimal conflict situation, control of human movement in adjacent natural habitat, frequent patrols, biological monitoring programmes, animal control (vervet	Operational: Owner O&M Operator	EMPr

ASPECT AFFECTED	POTENTIAL IMPACT - SIZE AND SCALE of disturbance	ACTIVITIES	MITIGATION MEASURES	TIME PERIOD FOR IMPLEMENTATION & RESPONSIBILITY	COMPLIANCE WITH STANDARDS
	For development footprint and surrounds.		monkeys, feral cats, rats, baboons, dogs, etc) 10. Implement generic monitoring programme and mitigation measures that are aimed at identifying and preventing the uncontrolled spread of impacts into adjacent areas of natural habitat.		
Avifauna	Loss of avifauna due to interactions with humans and site infrastructure- development footprint	» Disturbance and Displacement. » Collision with or entrapment by fencing » Electrocution on electrical infrastructure » Chemical Pollution	Control through management and monitoring: 1. Where possible, infrastructure should be located away from known bird flight paths or features which are attractive to birds, e.g. natural or man-made open water areas or agricultural fields. 2. To limit bird traffic across the site, perchable structures should be avoided where possible. 3. Lighting should be kept to a minimum to avoid attracting insects and birds and light sensors/switches should be utilised to keep lights off when not required. 4. Lighting fixtures should be hooded and directed downward, to minimize the skyward and horizontal illumination which could attract night-flying birds (Ledec et al., 2010). 5. Where possible, lighting should be intermittent or flashing-beam lights. 6. Careful selection of and modifications to solar facility equipment should be made where possible. 7. Develop and implement an operational monitoring programme for birds in line with applicable guidelines. 8. Frequent and regular review of operational phase monitoring data and results by an avifaunal specialist. 9. The above reviews should strive to identify sensitive locations at the development including that may require additional mitigation. If unacceptable impacts are observed (in the opinion of the bird specialist and independent review), the specialist should conduct a	Operational: EM, ECO	EMPr; Avifauna Report

ASPECT AFFECTED	POTENTIAL IMPACT - SIZE AND SCALE of disturbance	ACTIVITIES	MITIGATION MEASURES	TIME PERIOD FOR IMPLEMENTATION & RESPONSIBILITY	COMPLIANCE WITH STANDARDS
			literature review specific to the impact and provide updated and relevant mitigation options to be implemented. As a starting point for the review of possible mitigations, the following may need to be considered: 10. Assess the suitability of using deterrent devices to reduce collision risk. 11. A single fence should be used, which can be electrified and animal proofed. 12. Develop and implement an operational monitoring programme for birds in line with applicable guidelines. 13. Frequent and regular review of operational phase monitoring data and results by an avifaunal specialist. 14. If collision with fences occurs, the specialist should consider the need to implement mitigation in the form of visual bird flight diverters attached to the fence to increase its visibility to birds. 15. All on site power cables and power lines to be buried underground. 16. All electrical installations and infrastructure should be properly insulated to prevent any chance of electrical faulting caused by birds 17. All contractors are to adhere to the Operational Environmental Management Plan (OEMP) and should apply good environmental practice during all operations. 18. All cleaning products used on the site should be environmentally friendly and bio-degradable.		
Stormwater management	Erosion will result in a loss of soil from the receiving water resources and changes in geomorphology.	» Discharge of stromwater from the site	Control through management and monitoring: 1. A minimum buffer area of 32m should be maintained between the proposed PV Power Plant development area and the Groenwater Spruit riparian zone. If possible, this buffer zone should be increased further. The buffer zone must be maintained as a fully vegetated	Operational phase: EM, ECO	Wetland specialist study

ASPECT AFFECTED	POTENTIAL IMPACT - SIZE AND SCALE of disturbance	ACTIVITIES	MITIGATION MEASURES	TIME PERIOD FOR IMPLEMENTATION & RESPONSIBILITY	COMPLIANCE WITH STANDARDS
	A further increase in impervious surfaces on site will result in increased runoff. Stormwater discharges could impact on water quality within receiving watercourses. Site and surrounds can be impacted.		buffer strip between the development and the riparian habitat. No intrusion into the buffer should be allowed. 2. A stormwater management plan must be developed and implemented for the proposed PV Power Plant. Stormwater discharge points must be protected against erosion. No stormwater discharges directly into the Groenwater Spruit, but rather into vegetated terrestrial areas adjacent to the riparian habitat. 3. Strict controls must be placed on the sue of potential contaminants on site, e.g. hydrocarbons, cleaning materials etc. Potential contaminants must be stored in suitable bunded areas and handled according to environmental best practice guidelines as per the DWS Integrated Environmental Management Series.		
Visual impacts	» Visual impact of facility degradation and vegetation rehabilitation failure. » Lighting influences from the facility on surrounding areas	» The proposed facility. » Power lines.	Control through management and monitoring: 1. Maintain the general appearance of the PV Power Project in an aesthetically pleasing way. 2. Access roads will require an effective dust suppression management programme, such as regular wetting and / or the use of non-polluting chemical stabilisation that will retain moisture in the road surface. 3. Monitor rehabilitated areas, and implement remedial action as and when required. 4. Use of light fixtures and the fitment of covers and shields will be designed to contain rather than spread light, wherever possible. o Install light fixtures that provide precisely directed illumination to reduce light “spillage” beyond the immediate surrounds of the Project Site. Limit mounting heights of lighting fixtures, or alternatively	Operational: Owner O&M Operator	EMPr

ASPECT AFFECTED	POTENTIAL IMPACT - SIZE AND SCALE of disturbance	ACTIVITIES	MITIGATION MEASURES	TIME PERIOD FOR IMPLEMENTATION & RESPONSIBILITY	COMPLIANCE WITH STANDARDS
			use foot-lights or bollard level lights. o Make use of minimum lumen or wattage in fixtures. o Make use of down-lighters, or shielded fixtures wherever possible. o Make use of Low Pressure Sodium lighting or other types of low impact lighting wherever possible. o Make use of motion detectors on security lighting. This will allow the site to remain in relative darkness, until lighting is required for security or maintenance purposes wherever possible. o Avoid high pole top security lighting along the periphery of the site, where possible, unless a security risk is posed and consider the use of lights that are activated on movement at illegal entry to the Project Site.		
Soil degradation and erosion	» Soil degradation. » Soil erosion. » Increased deposition of soil into drainage systems. » Increased run-off over the sit: » Development footprint and surrounds.	» Poor rehabilitation of cleared areas. » Rainfall - water erosion of disturbed areas. » Wind erosion of disturbed areas. » Concentrated discharge of water from construction activity	Control through management and monitoring: 1. Rehabilitate disturbance areas should the previous measures to do so be inadequate. 2. Ensure dust control on site: wetting of denuded areas or the use of an appropriate dust suppression measure. 3. Maintain erosion control measures implemented during the construction phase (i.e. run-off attenuation on slopes (sand bags, logs), silt fences, stormwater catch-pits, and shade nets).	Operational: Owner O&M Operator	EMPr

ASPECT AFFECTED	POTENTIAL IMPACT - SIZE AND SCALE of disturbance	ACTIVITIES	MITIGATION MEASURES	TIME PERIOD FOR IMPLEMENTATION & RESPONSIBILITY	COMPLIANCE WITH STANDARDS
Dust and air emissions	» Dust and particulates from vehicle movement to and on-site. » Release of minor amounts of air pollutants (for example NO2, CO and SO2) from vehicles: Development footprint.	» Re-entrainment of deposited dust by vehicle movements. » Wind erosion from unsealed roads and surfaces. » Fuel burning vehicle and construction engines.	Control through management and monitoring: 1. Roads must be maintained to a manner that will ensure that nuisance to the community from dust is not visibly excessive. 2. Appropriate dust suppressant with high moisture retention properties must be applied to the roads as required to minimise/control airborne dust. 3. Speed of vehicles must be restricted, as defined by the SHEQ Manager. 4. Vehicles and equipment must be maintained in a road-worthy condition at all times.	Operational: Owner	EMPr
Fire management plan	» Veld fires can pose a personal safety risk to local farmers and communities, and their homes, crops, livestock and farm infrastructure, such as gates and fences. In addition, fire can pose a risk to the Project infrastructure for both PV and adjacent CSP facilities.	» The presence of operation and maintenance personnel and their activities on the site can increase the risk of veld fires.	Control through management and monitoring: 1. In line with management of the Redstone CSP Project. 2. Provide adequate fire-fighting equipment on site. 3. Use Fire-fighting selected operation and maintenance staff as for Redstone CSP Project. 4. Ensure that appropriate communication channels are established to be implemented in the event of a fire. 5. Fire breaks should be established where and when required. Cognisance must be taken of the relevant legislation when planning and burning firebreaks (in terms of timing, etc.). 6. Contact details of emergency services should be prominently displayed on site.	Operational: Owner O&M Operator	EMPr and National Veld and Forest Fire Act, Act No. 101 of 1998.

ASPECT AFFECTED	POTENTIAL IMPACT - SIZE AND SCALE of disturbance	ACTIVITIES	MITIGATION MEASURES	TIME PERIOD FOR IMPLEMENTATION & RESPONSIBILITY	COMPLIANCE WITH STANDARDS
Handling and management of hazardous substances, dangerous goods and waste	» Inefficient use of resources resulting in excessive waste generation. » Litter or contamination of the site or water through poor waste management practices. »Contamination of water or soil because of poor materials management	» Transformers and switchgear – substation. » Hazardous substances and dangerous goods. » Disposal of batteries.	Control through management and monitoring: 1. Handling, storage and disposal of hazardous substances must be managed in accordance with the Redstone CSP Project.	Operational: Owner O&M Operator, waste management contractor	EMPr

Table 24: Overall Impacts table for Decommissioning and Rehabilitation phase

ASPECT AFFECTED	POTENTIAL IMPACT - SIZE AND SCALE of disturbance	ACTIVITIES	MITIGATION MEASURES	TIME PERIOD FOR IMPLEMENTATION & RESPONSIBILITY	COMPLIANCE WITH STANDARDS
Decommissioning of site	» Hazards to landowners and public. » Damage to indigenous natural vegetation, due largely to ignorance of where such areas are located. » Loss of threatened plant species and protected tree species.	» Open excavations from removal of underground cabling and foundations. » Movement of vehicles in the area and on-site.	Remedy through rehabilitation: 1. Before the commencement of decommissioning, the EMPr must be reviewed and amended by an environmental assessment practitioner (EAP). 2. Secure site, working areas and excavations in an appropriate manner, as agreed with the PM. 3. Where necessary control access, fence, and secure area. Establish the necessary ablution facilities with chemical toilets and provide adequate sanitation facilities and ablutions for workers (1 toilet per every 15 workers for each sex) at appropriate locations around the Project Site. 4. Ablution or sanitation facilities should not be located within 100 m from a 1:100 year flood line including water courses, wetlands. 5. All work sites must be kept free of waste. No solid waste may be burned or buried on site or disposed of by any other method on site or within quarries or borrows pits. Solid waste (general waste) to be disposed of at the nearest permitted municipal landfill site. 6. Supply adequate weather and vermin proof waste collection bins and skips (covered at minimum with secured netting or shadecloth) at site where decommissioning is being undertaken. Separate bins should be provided for general and hazardous waste. As far as possible, provision should be made for separation of waste for recycling. 7. Liquid waste:	Decommissioning: Owner	SABS 089: 1999 Part 1

ASPECT AFFECTED	POTENTIAL IMPACT - SIZE AND SCALE of disturbance	ACTIVITIES	MITIGATION MEASURES	TIME PERIOD FOR IMPLEMENTATION & RESPONSIBILITY	COMPLIANCE WITH STANDARDS
			○ No liquid waste, including grey water, may be discharged into any water body or drainage line. All sewage disposal to take place at a registered and operational wastewater treatment works. 8. Hazardous substances and hazardous waste: ○ Ensure compliance with all national, regional and local legislation with regard to the storage, handling and disposal of hydrocarbons, chemicals, solvents and any other harmful and hazardous substances and materials. ○ The onus is on the Contractor to identify and interpret the applicable legislation. ○ Hazardous waste to be disposed of at a registered h:H or H:H landfill site. Depending on the classification of the waste, a registered service provider with the necessary permits is to collect, transport and dispose of hazardous waste. 9. The quantity of water needed for the duration of the decommissioning phase is to be calculated and planned for in detail.		
Avifauna	Loss of avifauna	» Decommissioning of the solar energy facility. » Habitat destruction » Disturbance and Displacement	1. All contractors are to adhere to the Decommissioning Environmental Management Plan (DEMP) and should apply good environmental practice during construction. 2. Existing roads and farm tracks should be used where possible 3. The minimum footprint areas of infrastructure should be used wherever possible, including road widths and lengths 4. ECO to oversee activities and ensure that the site specific decommissioning environmental management is implemented and enforced	Decommissioning: Owner	EMPr

ASPECT AFFECTED	POTENTIAL IMPACT - SIZE AND SCALE of disturbance	ACTIVITIES	MITIGATION MEASURES	TIME PERIOD FOR IMPLEMENTATION & RESPONSIBILITY	COMPLIANCE WITH STANDARDS
			5. Following decommissioning, rehabilitation of all areas disturbed (e.g. temporary access tracks and laydown areas) must be undertaken and to this end a habitat restoration plan is to be developed by a specialist. 6. All contractors are to adhere to the Decommissioning Environmental Management Plan (DEMP) and should apply good environmental practice during decommissioning. 7. Prior to decommissioning commencing, the appointed ECO must be trained by an avifaunal specialist to identify the potential Red Data species as well as the signs that indicate possible breeding by these species. The ECO must then, during audits/site visits, make a concerted effort to look out for such breeding activities of Red Data species, and such efforts may include the training of construction staff (e.g. in Toolbox talks) to identify Red Data species, followed by regular questioning of staff as to the regular whereabouts on site of these species. If any of the Red Data species are confirmed to be breeding (e.g. if a nest site is found), decommissioning activities within 500 m of the breeding site must cease, and an avifaunal specialist is to be contacted immediately for further assessment of the situation and instruction on how to proceed.		
Fauna and flora	» Loss of indigenous vegetation and fauna	» Decommissioning of the solar energy facility. » Movement of vehicles. » Worker activities on site	Remedy through rehabilitation: 1. Undertake activities as prescribed by the legislation at the time of decommissioning and comply with all legal requirements administered by the competent authority at the time. 2. Minimise vegetation clearance or removal associated with site decommissioning activities, trim trees under supervision. Compile a method statement specific to	Decommissioning: Owner	EMPr

ASPECT AFFECTED	POTENTIAL IMPACT - SIZE AND SCALE of disturbance	ACTIVITIES	MITIGATION MEASURES	TIME PERIOD FOR IMPLEMENTATION & RESPONSIBILITY	COMPLIANCE WITH STANDARDS
			vegetation clearance. 3. Areas to be cleared must be clearly marked in the field to eliminate unnecessary clearing. 4. Limit unnecessary impacts on surrounding natural vegetation, e.g. driving around in the veld, use access roads only. 5. Driving is only allowed on access roads and within designated areas in the development footprint. 6. A site rehabilitation programme must be implemented 7. Ensure signs are placed around site indicating protected and dangerous faunal species. 8. Animals that cannot flee from the affected areas by themselves (e.g. tortoises, amphibians, small mammals) must be removed from the affected areas before the start of site decommissioning and relocated to safe areas. 9. Traffic calming or extensive use of speed limit/ warning signs must be installed along access roads to prevent/ reduce faunal mortalities. 10. Ensure the absence of larger animals through frequent patrols, particularly prior to land clearance. 11. Restrict losses of natural habitat to footprints, avoid peripheral or unnecessary losses of natural habitat; ensure proper rehabilitation of areas outside development footprints (where accidental habitat degradation occurred). 12. Avoid encroachment of alien and invasive plant species. 13. Worker/ contractor awareness programmes, ensuring minimal conflict situation, control of human movement in adjacent natural habitat, frequent patrols, biological monitoring programmes, animal control (vervet		

ASPECT AFFECTED	POTENTIAL IMPACT - SIZE AND SCALE of disturbance	ACTIVITIES	MITIGATION MEASURES	TIME PERIOD FOR IMPLEMENTATION & RESPONSIBILITY	COMPLIANCE WITH STANDARDS
			monkeys, feral cats, rats, baboons, dogs, etc) 14. Implement generic monitoring programme and mitigation measures that are aimed at identifying and preventing the uncontrolled spread of impacts into adjacent areas of natural habitat		
Handling and storage of chemicals, hazardous substances	» Release of contaminated water from contact with spilled chemicals » Generation of contaminated wastes from used chemical containers » Pollution of water and soil resources	» Vehicles associated with site infrastructure removals and earthworks. » Decommissioning activities of area and linear infrastructure. » Hydrocarbon use and storage.	Remedy through avoidance: 1. Spill kits must be made available on-site for the clean-up of spills and leaks of contaminants. 2. Corrective action must be undertaken immediately if a complaint is made, or potential/actual leak or spill of polluting substance identified. This includes stopping the contaminant from further escaping, cleaning up the affected environment and implementing preventive measures. 3. In the event of a major spill or leak of contaminants, the relevant administering authority must be immediately notified as per the notification of emergencies/incidents. 4. A bioremediation procedure and procurement plan must be drawn up prior to decommissioning to ensure prompt application in the event of a major spill. 5. In the event where more than 20 L of hydrocarbon or chemical is spilt into the environment, bioremediation must be undertaken under the discretion of the EM. 6. Any contaminated/polluted soil must be removed and stored as hazardous waste and disposed of at a licensed hazardous waste disposal facility. Contaminated soil must be stored in a sealed container as per the requirements of SABS 089:1999 Part 1. 7. Any storage and disposal permits/approvals which may be required must be obtained, and the conditions attached to such permits and approvals will be	Decommissioning: Owner	SABS 089:1999 Part 1.

ASPECT AFFECTED	POTENTIAL IMPACT - SIZE AND SCALE of disturbance	ACTIVITIES	MITIGATION MEASURES	TIME PERIOD FOR IMPLEMENTATION & RESPONSIBILITY	COMPLIANCE WITH STANDARDS
			complied with. 8. Transport of all hazardous substances must be in accordance with the relevant legislation and regulations 9. Upon the completion of decommissioning, the area must be cleared of potentially polluting materials.		
Waste Management	» Inefficient use of resources resulting in excessive waste generation » Litter or contamination of the site or water through poor waste management practices » Increase in vermin » Eutrophication of nearby water sources » Breeding ground for bacteria and viruses » Illness, viral infections » Soil pollution	» Packaging » Other decommissioning wastes » Hydrocarbon and chemical use, handling and storage » Spoil material from excavation, earthworks and site preparation » Septic tanks and portable toilets	Remedy through avoidance and management: 1. Hydrocarbon waste including contaminated soil must be contained and stored in sealed containers within a SABS 089:1999 Part 1 approved bunded area and clearly labelled. 2. Documentation (waste manifest) must be maintained detailing the quantity, nature, and fate of any regulated waste. Waste disposal records must be available for review at any time. 3. Regularly serviced chemical toilets facilities must be used to ensure appropriate control of sewage. 4. Ensure that there is at least 1 portable toilet per 15 workers for each sex. 5. Daily inspection of all portable toilets and septic tanks must be performed by SHE/ environmental representatives on site. 6. Upon the completion of decommissioning, the area must be cleared of potentially polluting materials. Spoil stockpiles must also be removed and appropriately disposed of or the material re-used for an appropriate purpose.	Decommissioning: Owner	SABS 089:1999 Part 1

ASPECT AFFECTED	POTENTIAL IMPACT - SIZE AND SCALE of disturbance	ACTIVITIES	MITIGATION MEASURES	TIME PERIOD FOR IMPLEMENTATION & RESPONSIBILITY	COMPLIANCE WITH STANDARDS
	Groundwater and surface water pollution				

5.2 IMPACT STATEMENT

The summary includes the key findings and impact statements from the specialists which includes the consideration of the cumulative impact of an additional PV facility on the Project Area and in the area:

Heritage: The HIA completed in 2011 (PGS) had shown that the area between Postmasburg and Daniëlskuil generally referred to as the Ghaap plato has a rich history of occupation from the Stone Age with hunter gatherers to the Thlaping and Thlaro during the Iron Age period. The 1800's saw the rise of the Griqua people in the area and their loss of sovereignty after 1880 to Cape rule. The field work of 2011 identified a total of 25 heritage sites of which none are impacted by the proposed additional PV options of this application (Both options are acceptable from a heritage impact perspective). The overall impact of the development on heritage resources is seen as acceptably low and can impacts can be mitigated to acceptable levels.

Visual: The PV Project will have a minor cumulative impact on the visual and aesthetic environment and that the specialist assessments conducted for the original application (NLA 2011) and subsequent Addendum (NLA 2015) are still valid. No additional mitigation measures to those recommended in the original report are required for the current PV Project. It is the opinion of the author that all aspects of the PV Project, from a potential visual impact perspective, should be approved provided that the mitigation/management measures are effectively implemented, managed and monitored in the long term.

Biodiversity: Based on available information and a brief evaluation of the proposed spatial arrangements, neither of the options are expected to cause severe and unacceptable impacts within the biological receiving environment, with the understanding and assumption that the applied mitigation strategy incorporate all recommendation presented in this as well as the principal ecological reports. Specifically, the exacerbation of cumulative impacts is expected to be minor as the proposed PV Power Project will constitute a fairly insubstantial portion of the Redstone CSP Project. Based on results and recommendations presented in this ecological impact statement, we regard the project as acceptable.

Avifauna: Based on a thorough desk based study and a site visit by the avifaunal specialist, it can be concluded that the proposed Redstone PV project site has a low sensitivity in terms of avifauna. While some key red-listed species have been recorded in the area, e.g. the Critically Endangered White-backed Vulture and the Endangered Martial Eagle, it is unlikely that these (or many of the potentially present Red Data species) would be negatively impacted upon by the proposed PV project. Species of more concern are those likely to be displaced or suffer collision from PV panels or fences, such as Korhaans, coursers, francolins and various passerines. Although a relatively diverse number of species and a high number of Red Data species were found to be potentially present after examining the SABAP data, many of these species were not recorded by monitoring, and many are unlikely to occur on the project site due to unsuitable habitat. In most cases the frequency of records and the activity (especially flight activity) of priority species and Red Data species was low.

Commercial scale solar farms are relatively new in South Africa and little information therefore exists on the potential impacts of these technologies on South African avifauna, but what is generally known and accepted is that PV technologies are likely to have the lowest negative effect. The Impact Assessment showed that after the application of mitigation measures, all residual impacts of the PV Power Project were rated as Low significance.

Cumulatively, (i.e. considering all large scale solar projects within a 50 km radius) these impacts are likely to have a moderate significance rating. If all the recommendations and mitigations in this report are implemented as well as those given by the specialists for the other projects considered (in the cumulative assessment), then the cumulative impacts on avifauna are likely to be considered acceptable.

Generally the impacts are not viewed as being of an extent or significance so as to preclude development, and the project may proceed subject to all recommendations (including operational phase monitoring) and proposed mitigations in this report being implemented.

Hydrology: The hydrological impacts associated with the development of the PV Power Project are medium to low without mitigation. When including mitigation, these impacts are reduced to low for both Option A and B. In considering Option A and Option B, Option A is the least sensitive with the impact tables showing a lower score. Option B is, however, the location of the authorised Redstone CSP Project and further development within the heliostat field would limit new areas of disturbance. Since mitigation of impacts is possible, either of the two options are suitable based on this hydrological desktop study, bearing in mind the exclusion zone associated with the intersecting non-perennial watercourse.

Wetlands: The proposed PV Power Project will be located outside the delineated riparian habitat on site and will not result in any direct impact to riparian areas or associated watercourses. Indirect impacts to watercourses could result as a consequence of changes in runoff volume, velocity and quality from the development footprint. Mitigation measures have been proposed to address these.

It is our opinion that the proposed PV Power Project, which will have a footprint of just less than 20ha, will add to the impact of the overall Redstone CSP Project by increasing the overall disturbance footprint. However, in the context of the approximate 570 ha Redstone CSP Project heliostat field and the almost 300 ha existing PV facilities, the proposed PV Power Project represents an increase of only 2.3 % to the overall disturbance area.

If the proposed mitigation measures, which aim to address the potential changes in runoff characteristics of the landscape, are fully implemented, it is our opinion that the development could be authorised. If technically feasible, the selection of Option B, i.e. the installation of the PV Power Project within the Redstone CSP Project heliostat field, is preferred. Should Option A proceed, it is recommended that a minimum 32m buffer zone of natural vegetation be maintained between the PV Power Project footprint and the Groenwater Spruit riparian habitat.

Socio Economic: The proposed project will be located on the same farm portions as Redstone CSP Project, which has already received environmental authorisation under the NEMA 107 of 1998 by the DEA Ref. Nr 12/12/20/2316 (AM7). Since the Google Imagery suggests that the changes in activities and land uses on the respective farm portions and in the area surrounding only included the establishment of two Solar PV facilities south-west, south and south-east of the site, the socio-economic impacts exerted by the PV Power Project will not be greater or equal to those identified and analysed for Redstone CSP Project in 2011. In many instances some of these impacts will not change since the proposed facility will be significantly smaller than Redstone CSP Project and will be sharing the workforce and on-site services with it.

As a result, the review of socio-economic impacts that are expected to ensue from the proposed PV Power Project revealed that the project will not lead to any negative impacts and will not notably change the positive effects that have previously been identified for Redstone CSP Project. Importantly, no meaningful and important cumulative effects are expected to ensue, and no residual risks have been identified to be associated with the proposed activity. Furthermore, the six potential socio-economic impacts identified to be relevant to the proposed project are positive in nature. Therefore, it can be concluded that from a socio-economic perspective the proposed PV Power Project should be considered for authorisation.

EAP summary: The project is seen to have a low to moderate impact on the environment and low if mitigation measures are implemented as very little additional environmental impacts will be added to this area and the cumulative impact are seen as low.

Final sensitivity map: Appendix 2

5.3 MANAGEMENT STRUCTURE

The PV Power Project has an Environmental Management System (EMS) for construction operations and decommissioning. The activities, aspects, impacts and mitigation measures for this application will form part of it and has been already outlined in the CSP Power Project and the EMPr (refer to the EMPrs for both the CSP Power Project and the PV Power Project).

EMS objectives

The objective of the EMS is to manage all the significant environmental aspects associated with the Contract by addressing, managing and controlling the environmental impacts of the work, to ensure continuous monitoring of environmental performance, and continual improvement in environmental performance throughout the duration of the Contract through:

- Implementing the Specification with its requirements to manage significant aspects;
- Measuring, controlling and monitoring relevant construction activities, significant aspects and mitigation measures;
- Prevention, minimisation and control of pollution and environmental degradation, and
- Regular compliance and efficiency auditing and management review for continual improvement.

Impact management outcomes:
The key impact management outcomes would be the efficient and environmentally responsible management of the site and rehabilitate correctly. With the successful implementation of the recommended mitigation measures and rehabilitation, the area these will be remediated to enable primary vegetation to re-establish, however if the facility is maintained and serviced the life span of the facility can exceed the expected 25 years.

5.4 ASPECTS FOR INCLUSION IN THE EA

- Any changes to, or deviations from the project description set out in this application must be approved, in writing, by the competent authority before such deviations may be affected.
- A suitably qualified Environmental Officer and Environmental Control Officer must be appointed to monitor compliance during construction and the Environmental Manager is to ensure the site has an environmental policy and procedures for operation which ensures the site is managed according to the Environmental Authorisation and the Environmental Management Program.
- The site is also to be audited every year during the life cycle of the process.
- After the site has been rehabilitated an external ecologist is to verify the condition of the area.
- Disturbed areas must be rehabilitated to a quality that matches or improves the surrounding area.

The individual critical role-players can be described as follows:

- External Auditor (EA) is to be independent and write the report according to the following criteria, as stipulated in NEMA Regulation GN.R 982 (2014 as amended in 2017)
- Environmental Control Officer (ECO)
- Internal Auditor (IA) or Environmental staff on the project

The responsibilities of these staff members are to:

- Monitor daily environmental compliance and report all findings through to DEA
- Ensure all staff are aware of the environmental requirements on site
- Undertaken toolbox talks and environmental awareness training
- Keep all records of environmental matters (Non-conformance report, (NCR) register, complaints register, incident reports, waste registers, certificates etc…)

5.5 ASSUMPTIONS

This BA is based on the following assumption(s):

- The information provided by the applicant is accurate, sufficient and unbiased, and that no information that could change the outcome of the authorisation process has been withheld.
- The information obtained from the specialist baseline studies undertaken for this project is accurate and unbiased.
- Necessary permits and licences will be obtained before the commencement of construction.
- The EAP has complied without prejudice to all NEMA requirements see Appendix 1.

5.6 COMPLIANCE WITH THE PROVISIONS OF SECTION 24(4)(A) AND (B) READ WITH SECTION 24(3) (A) AND (7) OF THE NATIONAL ENVIRONMENTAL MANAGEMENT (ACT 107OF 1998). THE BARMUST INCLUDE THE:-

The Impact Assessment highlighted that the impact from the proposed activities can be considered low with few possible moderate impacts. However, with mitigation all impacts can be considered mostly as low.

- It is recommended that prior to clearing any area, a . If any protected species are found a destruction permit must be obtained from the relevant authority for the species to be destroyed or, if one is able to relocate the species, a search, rescue and re-planting permit must be obtained for that specific species. Once the permits have been received, the proposed activities can continue.
- All activities must be managed to ensure that no water sources are polluted or negatively impacted.
- The cleared areas are to be monitored for erosion and mediated promptly to avoid degradation of the area
- Noise is to be kept to a minimum in accordance with the SANS standards for rural areas and activities are to be restricted to normal labour law working hours.
- Dust is to be monitored (visual inspection and complaints) and kept to a minimum, and addressed when required.
- All drainage lines and wetlands are to be protected and no development is to take place within 32 meters of the watercourse.

See Appendix 9 for detail from the specialist reports.

5.7 IMPACT ON THE HERITAGE RESOURCE

The heritage impact assessment was evaluated and all areas where heritage artefacts were discovered and mitigation has been put in place, the sites are to be destroyed as per the destruction permit or protected if possible. Please refer to the Maps in Appendix 2 and Appendix 3, and Heritage Impact Assessment Report on Appendix 9.

5.8 CONCLUSION AND RECOMMENDATION

In Summary the ACWA Power SolarReserve Redstone Solar Thermal Power Plant RF (Pty) Ltd, the Applicant, proposes the development, construction and operation of the ACWA Power SolarReserve Redstone Solar Photovoltaic Power Plant (the "PV Power Project") on The Remaining Extent of the Farm No. 469, Hay Registration Division in The Northern Cape Province ("Project Site"). The Applicant has received an environmental authorization to construct and operate a Concentrated Solar Power Plant (CSP) on the Remaining Extent of the Farm No. 469 the Hay Registration Division (the "Project Site"), called the ACWA Power SolarReserve Redstone Solar Thermal Power Plant (Redstone CSP Project) (authorised by the Department of Environmental Affairs, DEA reference number 12/12/20/2316).

The PV Power Project will be used to supply the auxiliary power load requirements of the Redstone CSP Project. The PV Power Project will have a generation capacity of up to 20 MW Peak (DC) which is a design capacity of ~15MWAC, with up to 30MWhours of battery storage, on the Remaining Extent of the Farm 469, Hay District. The planned PV Power Project will be located approximately 30 km east of the town Postmasburg in the Northern Cape Province, adjacent to the Redstone CSP Project.

The PV power project EA is required by the Redstone CSP project in order to reach financial close. The Redstone CSP project has signed its Power Purchase Agreement on 4 April 2018 and financial close as stipulated by the Department of Energy to be reached by 15 July 2018.

Alternatives in the form of Option A (outside the Heleostat field) and Option B (within the heliostat field) were appropriate for the development of the PV facility as both options would be considered low impact and sustainable, however due to the technical evaluation of option B, B, developing within the heliostat field will be technically impossible See Appendix 4.. When considering Option B, it is important to highlight that all potential impacts from option A and B were similar however option A used has an extended footprint which therefore increases the development footprint on the project site, however the ecological walk through evaluation and the biodiversity assessment discovered that option A was free of wetlands, was seen as a disturbed landscape from previous mining activity and had fewer protected plant species to relocate than within the area allocated to Option A, supported by all other specialist reports. Therefore, Option A is considered as the preferred option, given the environmental and technical aspects considered.

It is the considered opinion of the Environmental Assessment Practitioner that the project activities, alternatives, potential impacts, and land owner concerns, have been adequately identified and assessed. Relevant and implementable mitigation measures have also been identified. These mitigation measures will reduce the identified impacts significance to mostly low risk. Considering this, the activity can be authorised.