



Cape Environmental Assessment Practitioners (Pty) Ltd

Reg. No. 2008/004627/07

Telephone: (044) 874 0365
Facsimile: (044) 874 0432

17 Progress Street, George
PO Box 2070, George 6530

Web: www.cape-eaprac.co.za

ENVIRONMENTAL MANAGEMENT PROGRAMME

for

HUMANSRUS SOLAR 3 PV FACILITY

on

A portion of Farm 147, Humansrus, Northern Cape

In terms of the

**National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended &
Environmental Impact Regulations 2014**



Prepared for Applicant: Humansrus Solar 3 (Pty) Ltd

By: Cape EAPrac

Report Reference: SIY402/13

Department Reference: 14/12/16/3/3/2/888

Case Officer: Ms Thabile Sangweni

Date: 24 May 2016

APPOINTED ENVIRONMENTAL ASSESSMENT PRACTITIONER:

Cape EAPrac Environmental Assessment Practitioners

PO Box 2070

George

6530

Tel: 044-874 0365

Fax: 044-874 0432

Report written & compiled by: **Melissa Mackay** (BTech & ND Nature Conservation) who has ten years' experience as an environmental practitioner.

PURPOSE OF THIS REPORT:

For implementation by EPC & O&M contractor

APPLICANT:

Humansrus Solar 3 (Pty) Ltd

CAPE EAPRAC REFERENCE NO:

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ENVIRONMENTAL MANAGEMENT PROGRAMME

in terms of the

National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended &
Environmental Impact Regulations 2010

Humansrus Solar 3 PV Facility

A portion of the Farm 147, Humansrus, Northern Cape

Submitted for:

Stakeholder Review & Comment

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Report Issued by:

Cape Environmental Assessment Practitioners

Tel: 044 874 0365

PO Box 2070

Fax: 044 874 0432

17 Progress Street

Web: www.cape-eaprac.co.za

George 6530

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ENVIRONMENTAL MANAGEMENT PROGRAMME LEGISLATIVE REQUIREMENTS

The table below serves to confirm the content requirements of the EMPr, as specified in the Acceptance of the Final Scoping Report & Plan of Study for the Environmental Impact Assessment, issued by the national Department of Environmental Affairs on 4 April 2016.

Table 1: EMPr compliance with conditions of the Final Scoping Report.

Requirement	Description
i. All recommendations and mitigation measures recorded in the EIR and the specialist studies conducted.	This is captured as Section 4 of the EMPr, it is further dealt with throughout the EMPr.
ii. The final site layout map	Attached in Appendix A of the EMPr.
iii. Measures as dictated by the site layout map and micro siting.	Attached in Appendix A of the EMPr.
iv. An environmental sensitivity map indicating environmental sensitive areas and features identified during the EIA process.	The environmental sensitivity map is attached in Appendix A of the EMPr.
v. A map combining the final layout map superimposed on the environmental sensitivity map.	The sensitivity overlays are attached in Appendix A of the EMPr.
vi. An Alien Invasive Management Plan to be implemented during construction and operation of the facility.	An Alien Invasive Management Plan is included in the EMPr as Appendix F .
vii. A plant rescue and protection plan which allows for the maximum transplant of conservation important species from areas to be transformed.	A Plant Rescue and Protection Plan is included in the EMPr as Appendix D .
viii. A re-vegetation and habitat rehabilitation plan to be implemented during construction and operation	A Re-vegetation and Rehabilitation plan is included in the EMPr as Appendix E .
ix. An open space management plan to be implemented during the construction and operation of the facility	An Open Space Management Plan is included in the EMPr as Appendix G .
x. A traffic management plan for the site access roads to ensure that no hazards would result from the increased truck traffic and that traffic flow would not be adversely impacted.	A traffic management plan is included in the EIAR in Appendix C .
xi. A transportation plan for the transport of components, main assembly cranes and other large pieces of equipment.	A Transportation plan is included in the EIAR in Appendix C .
xii. A stormwater management plan to be implemented during the construction	A Stormwater, Erosion and Washwater Management Plan is included in the EMPr

Requirement		Description
	and operation of this facility.	as Appendix B.
xiii.	A fire management plan to be implemented during the construction and operation of the facility.	Fire management requirements are included in Section 6.13 of the EMPr.
xiv.	An erosion management plan for monitoring and rehabilitating erosion events associated with the facility.	A Stormwater, Erosion and Washwater Management Plan is included in the EMPr as Appendix B.
xv.	An effective monitoring system to detect any leakage or spillage of all hazardous substances during their transportation, handling, use and storage.	The development and operation of this facility does not include the transport, handling or use of any hazardous substances.
xvi.	Measures to protect hydrological features such as streams, rivers, pans, wetlands, dams and their catchments.	The Aquatic specialist has made recommendations to protect the hydrological resources on site. These recommendations are included in the EMPr in Section 4.4 and summarised throughout the report where applicable.

Appendix 4 of Regulation 982 of the 2014 EIA Regulations contains the required contents of an Environmental Management Programme (EMPr). The checklist below serves as a summary of how these requirements were incorporated into this EMPr.

Table 2: EMPr compliance with Appendix 4 of Regulation 982

Requirement	Description
<p>Details of the EAP who prepared the EMPr; and;</p> <p>The expertise of the EAP to prepare an EMPr, including a curriculum vitae.</p>	<p>This EMPr was prepared by Melissa Mackay of <i>Cape EAPrac</i> who has 10 years' experience as an Environmental Assessment Practitioner. A company profile of Cape EAPrac as well as the CV of the EAP is attached in Appendix H.</p>
<p>A detailed description of the aspects of the activity that are covered by the EMPr as identified by the project description.</p>	<p>This EMP covers all aspects of the project as authorised.</p> <p>This includes the construction and operation of a photovoltaic (PV) solar facility with a generation capacity of 75MW, including</p> <ul style="list-style-type: none"> • Inverter stations; • an on-site substation (including a feed-in transformer to allow the generated power to be connected to Eskom's electricity grid); • A132kV overhead powerline connecting to the project to the Upington MTS via the Sirius Substation (This powerline will be subjected to its own EMPr) • auxiliary buildings, including: • administration / office & security (gate house), • control room & workshop, • visitor centre, • ablution / change room and • warehouse / storeroom. • a laydown area of approximately 3ha; • internal electrical reticulation network (underground cabling); • an internal road / track network ; • An access road of approximately 7.5m wide within a 15m servitude; • 10 x 10kLt rainwater tanks; and • electrified perimeter fencing around the solar facility, including security cameras.
<p>A map at an appropriate scale which superimposes the proposed activity, its associated structures, and infrastructure on the environmental sensitivities of the preferred site, indicating any areas that should be</p>	<p>The Site Development Plan attached in Appendix A, includes the sensitive features identified by participating specialists and indicates how these have been incorporated.</p> <p>The "exclusion areas" identified on this SDP</p>

Requirement	Description
avoided, including buffers	as well as all areas outside of the perimeter fencing are considered as no go areas for construction activities.
<p>A description of the impact management objectives, including management statements, identifying the impacts and risks that need to be avoided, managed and mitigated as identified through the environmental impact assessment process for all the phases of the development including –</p> <ul style="list-style-type: none"> (i) Planning and design; (ii) Pre-construction activities; (iii) Construction activities; (iv) Rehabilitation of the environment after construction and where applicable post closure; and (v) Where relevant, operation activities. 	Section 4 of this EMPr.
A description and identification of impact management outcomes required for the aspects contemplated above.	Table 21 in section 2 of the EMPr
<p>A description of the proposed impact management actions, identifying the manner in which the impact management objectives and outcomes contemplated above will be achieved and must, where applicable include actions to –</p> <ul style="list-style-type: none"> (i) Avoid, modify, remedy control or stop any action, activity or process which causes pollution or environmental degradation; (ii) Comply with any prescribed environmental management standards or practises; (iii) Comply with any applicable provisions of the Act regarding closure, where applicable; and (iv) Comply with any provisions of the Act regarding financial provisions for rehabilitation, where applicable. 	Throughout the report. Summarised in Section 4 and Table 21 of the EMPr.
The method of monitoring the implementation of the impact management actions contemplated above.	Section 9.
The frequency of monitoring the implementation of the impact management	Section 9.

Requirement	Description
actions contemplated above.	
An indication of the persons who will be responsible for the implementation of the impact management actions.	Figure 1 & Figure 2 and Section 9
The time periods within which the impact management actions must be implemented.	Throughout the EMPr
The mechanism for monitoring compliance with the impact management actions.	Section 9
A program for reporting on compliance, taking into account the requirements as prescribed in the Regulations.	Section 9
<p>An environmental awareness plan describing the manner in which –</p> <ul style="list-style-type: none"> (i) The applicant intends to inform his or her employees of any environmental risk which may result from their work; and (ii) Risks must be dealt with in order to avoid pollution or the degradation of the environment. 	Section 5.6, 5.10, 6.12, 6.14, 6.15, 6.16 7.3 and 7.6
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ABBREVIATIONS

AC	Alternating Current
Alt.	Alternative
BGIS	Biodiversity Geographic Information System
CARA	Conservation of Agricultural Resources Act (43 of 1983)
CBA	Critical Biodiversity Area
cctv	Closed Circuit Television (camera)
CDSM	Chief Directorate Surveys and Mapping
cm	Centimetre
DAFF	Department of Agriculture, Forestry & Fisheries
DEA	Department of Environmental Affairs (national)
DEA&DP	Department of Environmental Affairs & Development Planning (Western Cape)
DEANC	Department of Environmental Affairs & Nature Conservation (Northern Cape)
DEIR	Draft Environmental Impact Report
DME	Department of Minerals and Energy
DoE	Department of Energy
DWS	Department of Water and Sanitation
EA	Environmental Authorisation
EAP	Environmental Impact Practitioner
ECA	Environmental Conservation Act (73 of 1989)
ECO	Environmental Control Officer
ECR	Environmental Control Report
EHS	Environmental, Health & Safety
EIA	Environmental Impact Assessment
EIP	Environmental Implementation Plan
EIR	Environmental Impact Report
ELC	Environmental Liaison Committee
ER	Engineer Representative
ESA	Environmental Site Agent / Ecological Support Area
EMPr	Environmental Management Programme
FPA	Fire Protection Association
GPS	Global Positioning System
ha	Hectare
HIA	Heritage Impact Assessment
I&APs	Interested and Affected Parties
IDP	Integrated Development Plan
IPP	Independent Power Producer
ISO	International Organisation for Standardisation (ISO 9001)
KI / Klit	Kilo Litre
Km	Kilometre
Km/h	Kilometres per hour
kV	Kilo Volt
LLRC	Low Level River Crossing
lt	Litre
LUDS	Land Use Decision Support
LUPO	Land Use Planning Ordinance
m	Metre

m²	Metres squared
m³	Metres cubed
MW	Mega Watt
NCHRA	Northern Cape Heritage Resources Authority
NCNCA	Northern Cape Nature Conservation Act (9 of 2009)
NEMA	National Environmental Management Act (107 of 1998, as amended in 2006)
NEMBA	National Environmental Management: Biodiversity Act (10 of 2004)
NERSA	National Energy Regulator of South Africa
NFA	National Forest Act (84 of 1998)
NHRA	National Heritage Resources Act (25 of 1999)
No.	Number
NSBA	National Spatial Biodiversity Assessment
NVFFA	National Veld and Forest Fire Act (101 of 1998)
NWA	National Water Act (36 of 1998)
pH	Potential of Hydrogen
PIA	Paleontological Impact Assessment
PM	Post Meridiem; "Afternoon"
PV	Photovoltaic
PVC	Polyvinyl Chloride (piping)
REDs	Road Environmental Dust Suppressant
SAHRA	South African National Heritage Resources Agency
SANBI	South Africa National Biodiversity Institute
SANS	South Africa National Standards
SDF	Spatial Development Framework
S&EIR	Scoping & Environmental Impact Reporting
SAPD	South Africa Police Department
WULA	Water Use Licence Application

1. INTRODUCTION

Cape EAPrac has been appointed by the Applicant, Humansrus Solar 3 (Pty) Ltd, as the independent **Environmental Assessment Practitioner (EAP)** responsible for compilation of the **Environmental Management Programme (EMPr)** for the Humansrus Solar 3 PV Facility on a portion of Farm 147, Humansdorp near Copperton in the Northern Cape.

Humansrus Solar 3 (Pty) Ltd. have an option to sub-lease a portion of Farm 147, Humansrus from the landowner, **Mrs Christina Human**, for the purposes of developing the proposed solar facility. A copy of a letter from Mrs Human providing consent for the continuation of the EIA is attached in Annexure J1 of the Environmental Impact Report. Prior to construction, the abovementioned option agreement will be replaced by a Notarial Deed of lease.

The proposed Humansrus Solar 3 PV Facility is to consist of solar photovoltaic panels with a generation capacity of 75MW_{AC} (MegaWatts - Alternating Current) ($86.25\text{MW}_{\text{DC}}$ Direct Current), as well as associated infrastructure, which will include:

- On-site switching-station / substation
- Auxiliary buildings (gate-house and security, control centre, office, warehouse, canteen & visitors centre, staff lockers etc.)
- Inverter-stations, transformers and internal electrical reticulation (underground cabling);
- Access and internal road network;
- Laydown area;
- Overhead electrical transmission line / grid connection (connect to existing Kronos Substation);
- Rainwater tanks; and
- Perimeter fencing

The key purpose of this EMPr is to ensure that the remedial and mitigation requirements identified during the Scoping & Environmental Impact Reporting process as well as the conditions of the Environmental Authorisation are implemented during the lifespan of the project (design to decommissioning). The EMPr is thus a management tool used to minimise and mitigate the potential environmental impacts, while maximising the benefits.

A detailed description of the proposed project and a description of the affected environment are provided in the Environmental Impact Report (EIR) which should be referred to where necessary.

1.1 EMPr Approval & Revisions

This EMPr once authorised becomes a legally binding document and contravention with this document constitutes a contravention with the Environmental Authorisation.

The supplementary plans annexed to this EMP (Stormwater, Erosion and Washwater Management Plan, Transport Study and Traffic Management Plan, Plant rescue and protection plan, Re-vegetation and Restoration Plan, Alien Vegetation Management Plan and Open Space Management Plan.) must be read in conjunction with this EMPr and their legal status

The EMPr may however require amendment at certain stages through the lifespan of the project. The incidences which may require the amendment of this document include:

- Incorporation of conditions of approval contained in an amendment to the Environmental Authorisation (if initiated into the future);
- Changes in environmental legislation;
- Results of post-construction monitoring and audit;

- Per instruction from the competent authority; and
- Changes in technology and best practice principles.

Should a significant amendment to this EMPr be required, an application for this must be submitted to the competent authority and approved before such changes are implemented.

1.2 Contractual Obligation

This EMPr must be included in ALL tender and contract documentation associated with this project. It must be noted that this EMPr is relevant and binding not only on the activities associated with the construction of the solar project, but also for all associated infrastructure upgrades required in order for this development to be undertaken, namely access road, substation, auxiliary buildings and internal roads).

1.3 Organisational Requirements

In order to ensure effective implementation of the EMPr, it is necessary to identify and define the organisational structure for the implementation of this document.

The proposed organisational structure during **construction** is as follows:

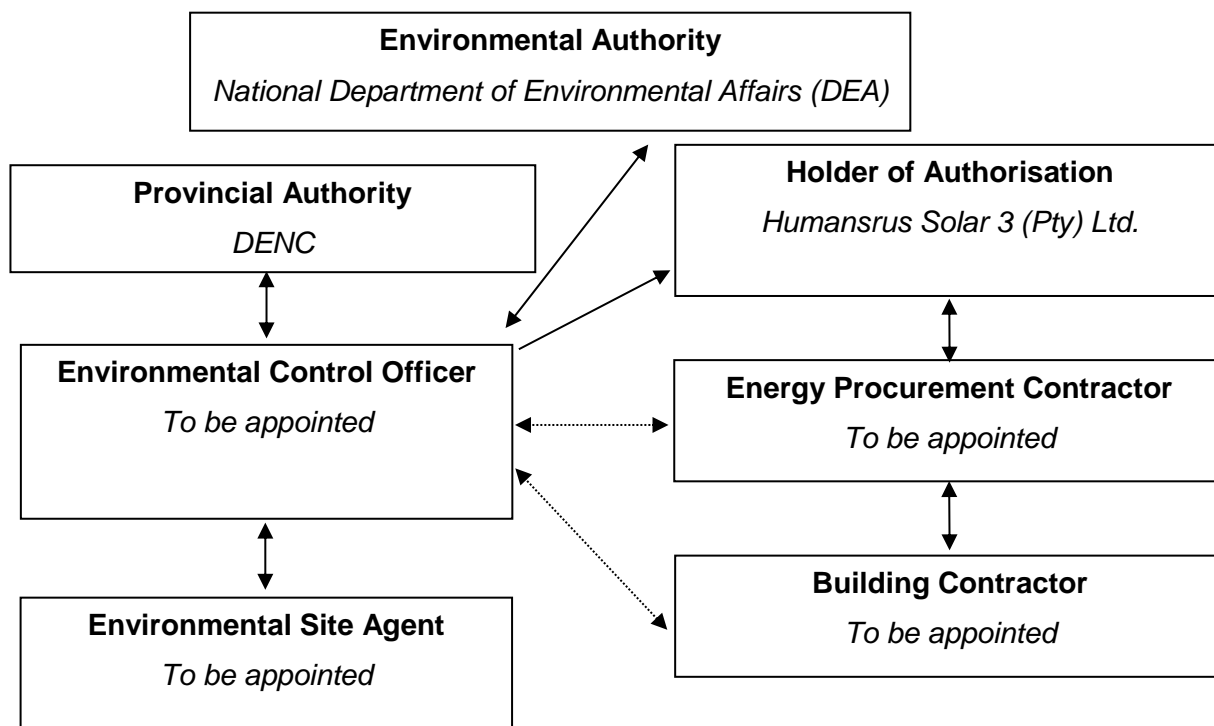


Figure 1: EMPr organisational structure during the construction phase

The proposed organisational structure during the **operation** of the facility is as follows:

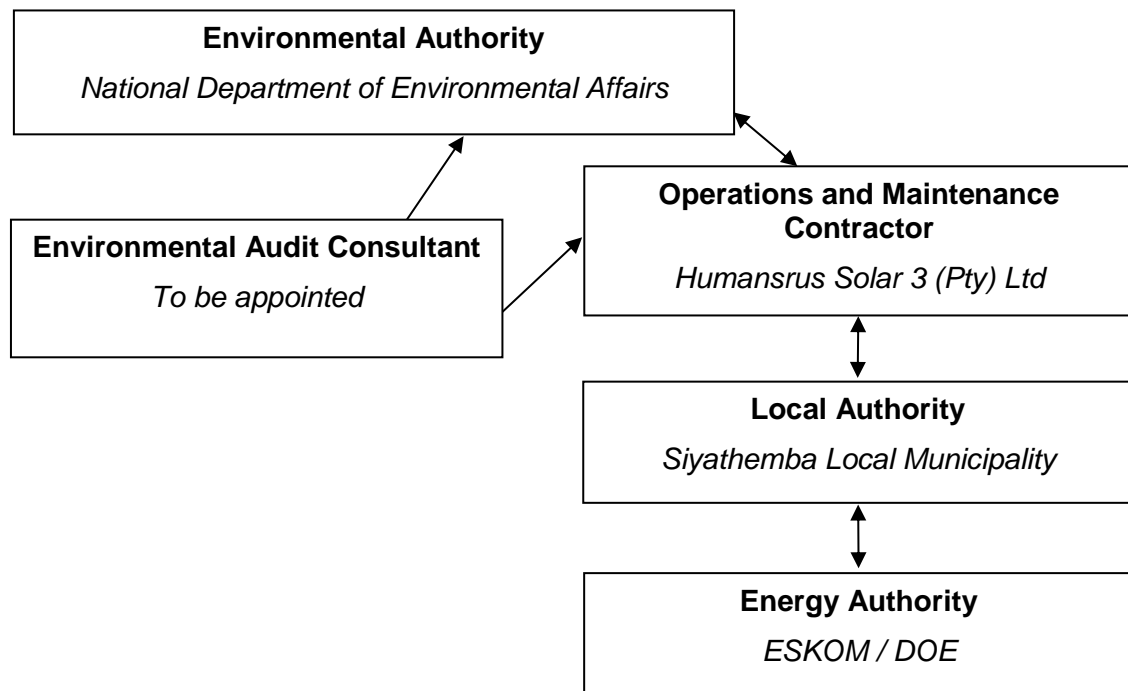


Figure 2: EMPr organisational structure during the operation phase.

Details regarding the roles and responsibilities of the various parties in these organisational structures are included in Section 2 below.

1.4 Project Proposal

The proposed Humansrus Solar 3 PV Facility is to consist of solar photovoltaic panels with a generation capacity of 75MWAC (MegaWatts - Alternating Current) (86.25MWDC Direct Current), as well as associated infrastructure, which will include:

- On-site switching-station / substation
- Auxiliary buildings (gate-house and security, control centre, office, warehouse, canteen & visitors centre, staff lockers etc.)
- Inverter-stations, transformers and internal electrical reticulation (underground cabling);
- Access and internal road network;
- Laydown area;
- Overhead electrical transmission line / grid connection (connect to existing Kronos Substation);
- Rainwater tanks; and
- Perimeter fencing.

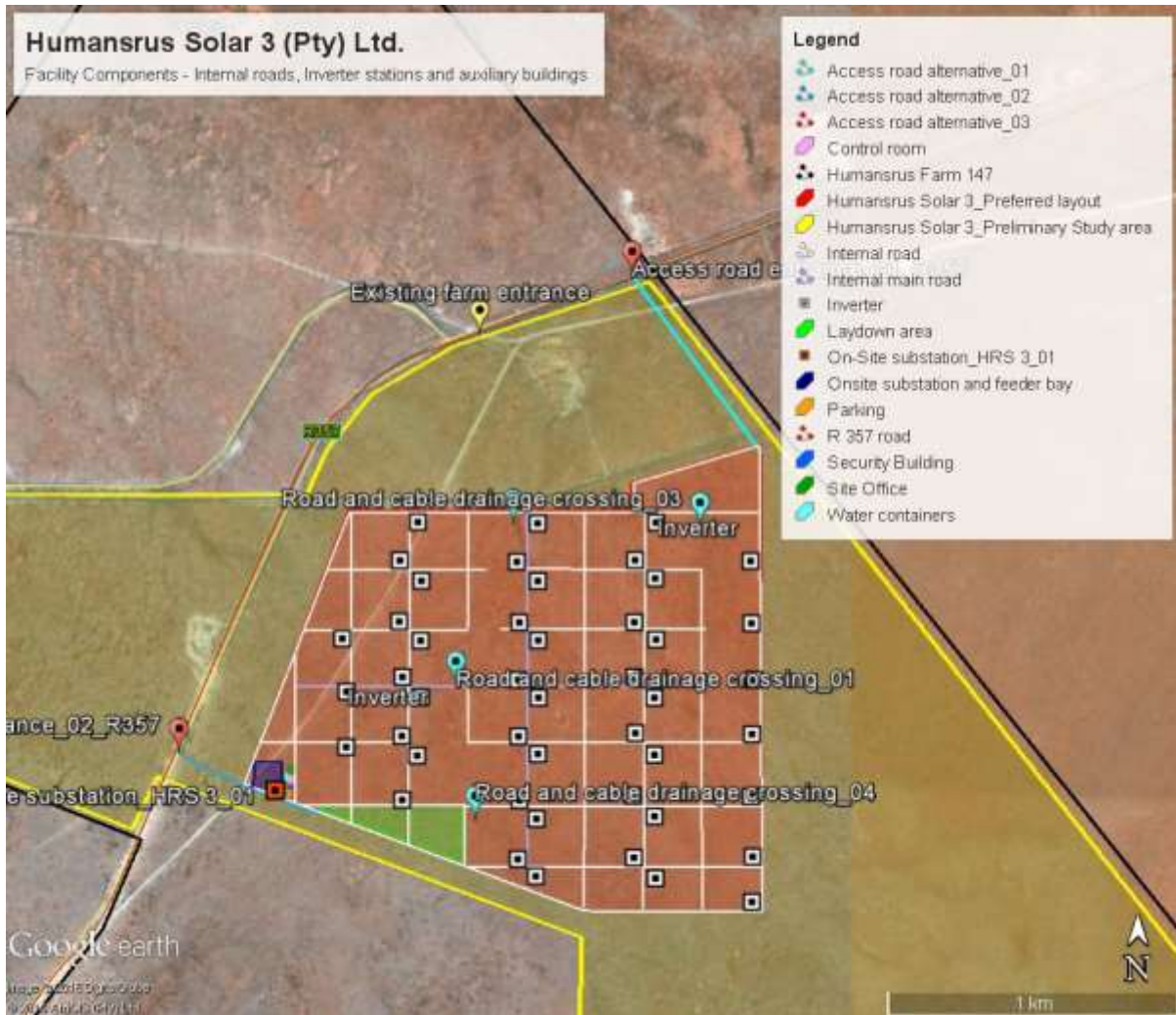


Figure 3: Site Development Plan (Solek, 2015)

This layout was developed to follow a risk adverse approach whereby the sensitive areas were eliminated from the layout. Please refer to the SDP attached in **Appendix A** that shows the development area overlaid on to the sensitive areas.

1.5 Approach to the EMPr

This EMPr addresses the environmental management of the four key phases of the project, namely:

- The design and pre-construction phase;
- The construction phase;
- The operation phase; and
- The closure and decommissioning phase.

These four phases can be generally categorised as follows.

1.5.1 Pre-construction Phase

The pre-construction phase of the development refers to the final layout design considerations and the site preparation (fine-scale design and placement, survey of development site and associated infrastructure, demarcation of no-go areas, establishment of site camp and laydown area, vegetation clearing for establishment of internal road network). The pre construction design considerations are driven by the findings and recommendations of the specialists during the EIA phase.

1.5.2 Construction Phase

The construction phase of the development refers to the earthworks and the actual construction of the civil works (installation of the PV panel arrays, construction of internal roads, stormwater structures and auxiliary buildings and on site substation), as well as the external infrastructure such as power lines, access roads and gate house. The construction phase will end with the perimeter fencing of the facility, landscaping and re-vegetation / rehabilitation of the site and surrounding areas and handover of the site for operational purposes.

1.5.3 Operation Phase

The operational phase commences once the facility starts providing power into the national grid. There may be a stage where both construction and operation activities overlap i.e. occur on site at the same time. The operation phase includes the monitoring and maintenance activities required for the efficient functioning of the facility (e.g. cleaning and repair of solar panels, brush-cutting of vegetation etc.), as well as health and integrity of the surrounding environment (e.g. removal alien vegetation, removal of obstacles from drainage lines, management of erosion etc.).

1.5.4 Closure and Decommissioning Phase

Closure and decommissioning refers the decommissioning of the panel arrays at the end of their operational lifespan. For the purpose of this report, two possible scenarios are considered, namely:

- The re-use, repair &/ upgrade of the facility for alternative power generation;
- The total decommissioning of the solar facility.

Solar panels that are found to be functional (albeit it less efficient) after the upgrade or decommissioning of the facility could be re-used for other purposes (e.g. at local rural schools and clinics or other primary service providers).

2. ROLES AND RESPONSIBILITIES

Throughout the lifespan of this project, a number of individuals and entities will fulfil various roles and responsibilities to ensure the effective implementation of this EMP. The key roles and responsibilities are detailed in the table below.

Table 3: Roles and responsibilities with regard to the implementation of this EMP.

Role	Responsibility
Environmental Authority – National Department of Environmental Affairs.	
The National Department of Environmental Affairs (DEA) is the competent / delegated authority responsible for compliance with the relevant environmental legislation.	<ul style="list-style-type: none"> • Ensure overall compliance with the Environmental Authorisation (EA) & EMP. • Review this document and any revisions thereof. • Undertake site audits at their discretion. • Review ECO Reports. • Review Audit Reports • Review Incident Reports. • Enforce legal mechanisms for contraventions of this EMP and EA.
Holder of the Authorisation – Humansrus Solar 3 (Pty) Ltd.	
The holder of the Authorisation is generally responsible for ensuring compliance with all statutory requirements relating to the Solar facility.	<ul style="list-style-type: none"> • Ensuring compliance with the conditions set out in the Environmental Authorisation issued in terms of the NEMA, as well as those prescribed by other relevant legislation and guidelines. • Compliance with the requirements set out in this EMP. • Ensuring all other permits, permissions and licences from all other statutory departments are in place. E.g.: Permit from provincial Department of Environmental Affairs & Nature Conservation (DEANC) to translocate or remove <i>protected</i> plant species.

Role	Responsibility
Environmental Control Officer (ECO) – To be appointed	
<p>The ECO fulfils an advisory role to monitor, guide and report compliance with the EMPr.</p>	<ul style="list-style-type: none"> • Revise, update and amend the EMPr if necessary and submit the amendments to the competent authority for consideration. • Ensure all relevant persons have a copy of the EMPr and any amendments thereof. • Advise the employer’s representative on any additional environmental authorisations and permits that may be required. • Facilitate the Environmental Education / Induction Training with the contract staff. • Review and comment on Method Statements relevant to environmental management and make recommendations to the employer’s representative. • Report any non-compliance with the EMPr or EA to the employer’s representative and competent authority if necessary. • Undertake regular site inspections in compliance with this EMPr. • Monitor, audit and verify that all works comply with the EA and the EMPr. • Keep record of EMPr implementation, monitoring and audits, including a full photographic record of works. • Comply and submit regular Environmental Control Reports to the competent authority, as well as employer’s representative &/ holder of the authorisation. • Report any environmental incidents or environmental impacts immediately to the employer’s representative and the competent authority if necessary. • Assist the contractor and employer’s representative planning for and implementing environmentally sensitive problem solving. • Advise the employer’s representative on suggested “stop work” orders.
Environmental Site Agent (ESA) – To be appointed	
<p>To assist the ECO with the day to day implementation and monitoring of the environmental management actions that are taking place on site.</p>	<ul style="list-style-type: none"> • Day to day environmental control of contractors on site during the construction phase. • Monitoring of construction management activities during the construction phase. • Weekly reporting to the ECO.
Employers Representative – To be appointed	
<p>The Employer’s representative role is likely to be fulfilled by the project engineer and assumes overall delegated responsibility for compliance with this EMPr, the EA, the conditions of the Planning Approval, Conditions of the WULA and all applicable legislation for the duration of the construction phase.</p>	<ul style="list-style-type: none"> • Issue site instructions to the contractor based on the advice of the ECO. • Ensure that all detailed design incorporates the requirements of the EMPr and EA. • Ensure that the EMPr is included in all tender documents issued to prospective contractors and sub-contractors. • Ensure the EMPr is included in final contract documents. • Ensure that the Tenderers/Contractors adequately provide for compliance with the EMPr in their submissions. • Ensure that the EMPr is fully implemented by the relevant persons. • Ensure the contractor provides the necessary method statements. • Be accountable, to the competent authority for any contravention or non-compliance by the Contractor. • Assist the contractor with input from the ECO in finding environmentally responsible solutions to problems. • Undertake regular site audits, site visits and inspections to ensure that the requirements of the EMPr are implemented • Give instructions on any procedures and corrective actions on advice from the ECO.

Role	Responsibility
	<ul style="list-style-type: none"> • Report environmental incidents or non-compliance with the EA or EMPr to the environmental authority. • Issue spot fines, penalties or 'stop-work' orders for contravention of the EMPr and give instructions regarding corrective action.
Building Contractor – To be appointed	
<p>The Contractor (main contractor) is responsible for the implementation of all construction activities associated with the Solar Facility.</p>	<ul style="list-style-type: none"> • Overall project delivery for the construction of the Solar Facility to the satisfaction of the authorities and consultants. • Ensuring compliance with the Health & Safety requirements for the project. • Ensuring compliance with this Environmental Management Programme. • Promoting job safety and environmental awareness with Employees. • Ensure that all sub-contractors comply with this EMPr and all other statutory requirements.
Landowner – Mrs Christina Human	
<p>The landowner is responsible for compliance with legislation applicable to the management of the remainder of the property as a whole.</p>	<ul style="list-style-type: none"> • E.g.: In terms of the National Veld & Forest Fires Act (101 of 1998) - an owner on whose land is subject to a risk of veldfire or whose land or part of it coincides with the border of the Republic, must prepare and maintain a firebreak on his or her land as close as possible to the border.

3. LEGISLATIVE FRAMEWORK

Several pieces of legislation were considered during the development of this EMPr. The holder of the EA must ensure compliance with all relevant legislation including those detailed below and any others that may be relevant to the works to be undertaken.

3.1 The Constitution of the Republic of South Africa

The Constitution of the Republic of South Africa (Act 108 of 1996) states that everyone has a right to a non-threatening environment and that reasonable measures are applied to protect the environment. This includes preventing pollution and promoting conservation and environmentally sustainable development, while promoting justifiable social and economic development. The underpinning principles of NEMA’s Duty of Care section reflects these principles of the Constitution.

3.2 National Environmental Management Act (Nema, Act 107 of 1998, as amended)

The National Environmental Management Act (NEMA, Act 107 of 1998, as amended), makes provision for the identification and assessment of activities that are potentially detrimental to the environment and which require authorisation from the competent authority (in this case, the national Department of Environmental Affairs) based on the findings of an Environmental Impact Assessment (EIA). It also embraces the notion of sustainable development as contained in the Constitution of South Africa (Act 108 of 1996) in that everyone has the right:

- to an environment that is not harmful to their health or well-being; and
- to have the environment protected for the benefit of present and future generations through reasonable legislative and other measures.

NEMA requires that measures are taken that “*prevent pollution and ecological degradation; promote conservation; and secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development.*” In addition:

- That the disturbance of ecosystems and loss of biological diversity are avoided, or where they cannot be altogether avoided, are minimised and remedied;

- That a risk-averse and cautious approach is applied, which takes into account the limits of current knowledge about the consequences of decisions and actions; and
- Sensitive, vulnerable, highly dynamic or stressed ecosystems, such as coastal shores, estuaries, wetlands, and similar systems require specific attention in management and planning procedures, especially where they are subject to significant human resource usage and development pressure.

NEMA aims to provide for co-operative environmental governance by establishing principles for decision-making on all matters relating to the environment and by means of Environmental Implementation Plans (EIP) and Environmental Management Programmes (EMPr).

The Applicant may not undertake activities listed in terms of the NEMA without prior authorisation.

In compliance with **Section 24N** of NEMA, this EMPr must contain the following (over and above the content requirements listed in the Table 1 above):

Table 4: Compliance with Section 24N of NEMA

EMPr Provision	Report Reference
Information on any proposed management, mitigation, protection or remedial measures that will be undertaken to address the environmental impacts that have been identified in a report contemplated in subsection 24(1A), including environmental impacts in respect of planning & design .	This is addressed in Sections 4 ,
Information on any proposed management, mitigation, protection or remedial measures that will be undertaken to address the environmental impacts that have been identified in a report contemplated in subsection 24(1A), including environmental impacts in respect of pre-construction and construction activities .	This is addressed in Sections 4 .
Information on any proposed management, mitigation, protection or remedial measures that will be undertaken to address the environmental impacts that have been identified in a report contemplated in subsection 24(1A), including environmental impacts in respect of the operation or undertaking the activity in question.	This is addressed in Sections 6
Information on any proposed management, mitigation, protection or remedial measures that will be undertaken to address the environmental impacts that have been identified in a report contemplated in subsection 24(1A), including environmental impacts in respect of the rehabilitation of the environment.	This is addressed in Section 6 & 7 of this EMPr – It has also been dealt with under construction requirements for the specific reason that these works must take place during the construction phase.
Information on any proposed management, mitigation, protection or remedial measures that will be undertaken to address the environmental impacts that have been identified in a report contemplated in subsection 24(1A), including environmental impacts in respect of closure , if applicable	This is dealt with in Section 7 of the EMPr.
Details and expertise of the person who prepared the EMPr.	These details are included at the beginning of the report (after cover page and report conditions).
A detailed description of the aspects of the activity that are covered by the EMPr.	This is dealt with under the introduction in Section 1 , this EMPr.
Information identifying the persons who will be responsible for the implementation of the measures addressed in the EMPr.	This is dealt with in Section 2 , of this EMPr.
Information in respect of mechanisms proposed for monitoring compliance with the EMPr and for reporting on the compliance.	This is dealt with in Section 8 of this EMPr.
Measures to rehabilitate the affected environment.	This is dealt with in Sections 5 & 6 of this EMPr as well as in Appendix D-G.
Description of the manner in which pollution will be prevented and remedied.	This is dealt with throughout the EMPr, but specifically in Sections 5 & 7
The EMPr must furthermore, where appropriate;	

EMPr Provision	Report Reference
Set out time periods within which measures must be implemented.	This is dealt with in throughout of the EMPr and summarised in section 13.
Contain measures regulating responsibilities for any environmental damage.	This is dealt with is 14 of this EMPr.
Develop an environmental awareness plan describing the manner in which the applicant intends to inform his or her Employees of any environmental risks and how to deal with these risks in order to avoid pollution or degradation of the environment.	This is dealt with in Sections 4.3 & 4.4 of the EMPr.

In addition to the above, the Holder of the Authorisation is bound by “Duty of Care”, as described in Section 28 of NEMA (107 of 1998, as amended), which “...obliges every person who causes, has caused or may cause significant environmental degradation to take reasonable measures to prevent such degradation from occurring, continuing or recurring”. Thus, all mitigation measures recommended by the relevant authorities and specialists must be implemented to avoid occurrence, continuation or repeat of environmental degradation.

3.3 National Environmental Management: Biodiversity Act (NEMBA) (Act 10 of 2004)

This Act controls the management and conservation of South African biodiversity within the framework of NEMA. Amongst others, it deals with the protection of species and ecosystems that warrant national protection, as well as the sustainable use of indigenous biological resources. Sections 52 & 53 of this Act specifically make provision for the protection of critically endangered, endangered, vulnerable and protected ecosystems that have undergone, or have a risk of undergoing significant degradation of ecological structure, function or composition as a result of human intervention through threatening processes.

Unfortunately, no broad- or fine-scale spatial biodiversity planning for the Northern Cape exists. This is major limitation as without a systematic conservation plan for the region, evaluating the significance of the development site within the broader context and broad-scale impacts, are difficult.

The NEM:BA list of threatened terrestrial ecosystems supersedes the information regarding terrestrial ecosystem status in the National Spatial Biodiversity Assessment (NSBA) 2004. In terms of the EIA regulations, a basic assessment report is required for the transformation or removal of indigenous vegetation in a critically endangered or endangered ecosystem regardless of the extent of transformation that will occur. **However, all of the vegetation types on both the study sites are classified as Least Threatened.** Please see the **ecological impact assessment** attached in **Annexure E2** in the Final Environmental Impact Report for further information.

NEMBA also deals with endangered, threatened and otherwise controlled species. The Act provides for listing of species as threatened or protected, under one of the following categories:

- **Critically Endangered:** any indigenous species facing an extremely high risk of extinction in the wild in the immediate future.
- **Endangered:** any indigenous species facing a high risk of extinction in the wild in the near future, although it is not a critically endangered species.
- **Vulnerable:** any indigenous species facing an extremely high risk of extinction in the wild in the medium-term future; although it is not a critically endangered species or an endangered species.
- **Protected species:** any species which is of such high conservation value or national importance that it requires national protection. Species listed in this category include,

among others, species listed in terms of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

Certain activities, known as Restricted Activities, are regulated by a set of permit regulations published under the Act. These activities may not proceed without environmental authorization.

According to the national vegetation map (Mucina & Rutherford 2006), the site straddles two vegetation types, **Bushmanland Arid Grassland** in the east and **Bushmanland Basin Shrubland** in the west. These are both extensive vegetation types that have not been impacted to a large degree by transformation and are classified as **Least Threatened**.

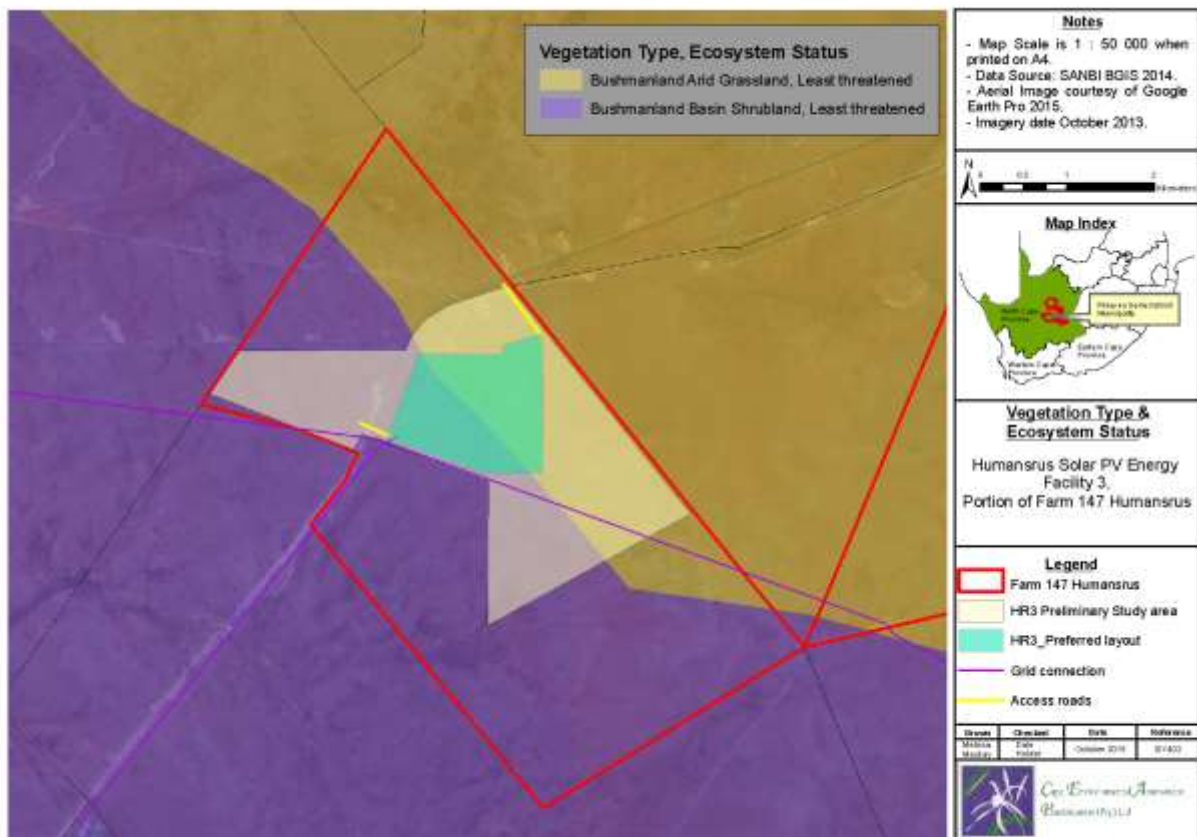


Figure 4: Vegetation type & ecosystem status

3.4 Northern Cape Nature Conservation Act (NCNCA) (No. 9 of 2009)

The Northern Cape Nature Conservation Act provides inter alia for the sustainable utilisation of wild animals, aquatic biota and plants as well as permitting and trade regulations regarding wild fauna and flora within the province. In terms of this act the following section may be relevant with regards to any security fencing the solar development may require.

Manipulation of boundary fences: 19. No Person may –

- (a) erect, alter, remove or partly remove or cause to be erected, altered, removed or partly removed, any fence, whether on a common boundary or on such person’s own property, in such a manner that any wild animal which as a result thereof gains access or may gain access to the property or a camp on the property, cannot escape or is likely not to be able to escape therefrom.

According to the SIBIS database, only two red data-listed plant species are known from the area, *Hoodia gordonii* which is listed as DDD (data deficient, insufficient information) and *Salsola apiciflora* which is listed DDT (Data Deficient – Taxonomically Problematic). There are however a

variety of nationally or provincially protected species present in the area which have been observed during previous site visits to the area.

Perhaps the most common is the nationally protected tree species *Boscia albitrunca* which is particularly common in the rocky hills but occurs scattered on the plains as well. *Harpagophytum procumbens* is associated with red sands in the area and may be present at the site. This species is protected at the national and provincial level on account of its' popularity as a medicinal plant. It is however not rare and the population is estimated at several million plants. O

ther protected species observed during previous studies in the area include *Hoodia gordonii*, *Hoodia flava*, *Lithops halli*, *Titanopsis calcarea*, *Pachypodium succulentum*, *Mestoklema tuberosum*, *Aloe claviflora*, *Avonia ustulata* and *Boscia foetida*. Many of these species are associated with certain habitats such as quartz or calcrete patches and their presence at the site would depend largely on the presence of these features.

This can only be verified in the field, but it is unlikely that many of these species occur at the site as previous visits to the area suggest that the site is not likely to fall within a highly sensitive area.

3.5 National Forests Act (NFA) (No. 84 of 1998):

The National Forests Act provides for the protection of forests as well as specific tree species, quoting directly from the Act: "*no person may cut, disturb, damage or destroy any protected tree or possess, collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree or any forest product derived from a protected tree, except under a licence or exemption granted by the Minister to an applicant and subject to such period and conditions as may be stipulated*".

According to Todd (2016), there are a variety of nationally or provincially protected species present in the area which have been observed during previous site visits to the area. Perhaps the most common is the nationally protected tree species *Boscia albitrunca* which is particularly common in the rocky hills but occurs scattered on the plains as well. *Harpagophytum procumbens* is associated with red sands in the area and may be present at the site. This species is protected at the national and provincial level on account of its' popularity as a medicinal plant. It is however not rare and the population is estimated at several million plants. Other protected species observed during previous studies in the area include *Hoodia gordonii*, *Hoodia flava*, *Lithops halli*, *Titanopsis calcarea*, *Pachypodium succulentum*, *Mestoklema tuberosum*, *Aloe claviflora*, *Avonia ustulata* and *Boscia foetida*. Many of these species are associated with certain habitats such as quartz or calcrete patches and are not likely to occur at the site and were not observed on the previous site visits to the study area.

Please refer to the **Ecological Impact Assessment Report** in **Annexure E2** of the EIAR for a detailed description of the plant species found to occur in the area.

3.6 National Veld & Forest Fire Act (NVFFA) (Act 101 of 1998)

The purpose of the National Veld and Forest Fire Act is to **prevent and combat veld, forest and mountain fires** throughout the Republic of South Africa and to provide institutions, methods and practices for achieving this purpose. Institutions include the formation bodies such as **Fire Protection Associations** (FPA's) and Working on Fire. The Act provides the guidelines and constitution for the implementation of these institutions, as well as their functions and requirements.

Every owner on whose land a veldfire may start or bum or from whose land it may spread must prepare and **maintain a firebreak on his or her side of the boundary between his or her land and any adjoining land**. The procedure in this regard and the role of adjoining owners and the fire protection association are dealt with within this Act. An owner on whose land is subject to a

risk of veldfire or whose land or part of it coincides with the border of the Republic, must prepare and maintain a firebreak on his or her land as close as possible to the border.

The proposed solar site is arid and given the sparse, succulent nature of the vegetation, it is highly unlikely that fires are a normal occurrence in the area, and thus fires at the site are not considered to be a significant risk. However, under exceptional circumstances, such as following years of very high rainfall, sufficient biomass may build up to carry fires, especially in the fenced-off areas. Therefore, **management of plant biomass within the site** should be part of the management of the facility. Given the risk that this would pose to the development, it would be in the operators' interests to manage plant cover at an acceptable level through grazing or alternative management practice (brush-cutting).

3.7 Conservation of Agricultural Resources Act – CARA (Act 43 of 1983):

CARA provides for the regulation of control over the utilisation of the natural agricultural resources in order to promote the conservation of soil, water and vegetation and provides for combating weeds and invader plant species. The Conservation of Agricultural Resources Act defines different categories of alien plants:

- Category 1 - prohibited and must be controlled;
- Category 2 – must be grown within a demarcated area under permit; and
- Category 3 - ornamental plants that may no longer be planted, but existing plants may remain provided that all reasonable steps are taken to prevent the spreading thereof, except within the flood lines of water courses and wetlands.

The abundance of alien plant species on the Humansrus Solar 3 site is very low, which can be ascribed firstly to the aridity of the site.

In terms of soil and water resources, the seasonal washes and several pans highlighted as sensitive and have been excluded from the development footprint. In order to comply with the requirements of the CARA, the holder of the EA must adopt and implement the Alien Vegetation Management Plan attached in **Appendix F**.

3.8 National Heritage Resources Act (NHRA) (Act 25 of 1999)

The protection and management of South Africa's heritage resources are controlled by the National Heritage Resources Act (Act No. 25 of 1999). South African National Heritage Resources Agency (SAHRA) is the enforcing authority in the Northern Cape, and is registered as a Stakeholder for this environmental process.

In terms of Section 38 of the National Heritage Resources Act, SAHRA will comment on the detailed Heritage Impact Assessment (HIA) where certain categories of development are proposed. Section 38(8) also makes provision for the assessment of heritage impacts as part of an EIA process.

The National Heritage Resources Act requires relevant authorities to be notified regarding this proposed development, as the following activities are relevant:

- *the construction of a road, wall, power line, pipeline, canal or other similar form of linear development or barrier exceeding 300m in length;*
- *any development or other activity which will change the character of a site exceeding 5 000 m² in extent;*
- *the re-zoning of a site exceeding 10 000m² in extent.*

Furthermore, in terms of Section 34(1), no person may alter or demolish any structure or part of a structure, which is older than 60 years without a permit issued by the SAHRA, or the responsible resources authority.

Nor may anyone destroy, damage, alter, exhume or remove from its original position, or otherwise disturb, any grave or burial ground older than 60 years, which is situated outside a formal cemetery administered by a local authority, without a permit issued by the SAHRA, or a provincial heritage authority, in terms of Section 36 (3).

In terms of Section 35 (4), no person may destroy, damage, excavate, alter or remove from its original position, or collect, any archaeological material or object, without a permit issued by the SAHRA, or the responsible resources authority.

An Integrate Heritage Impact Assessment (HIA), including heritage, archaeology, palaeontology and visual studies were undertaken for the proposed development. A copy of the HIA is attached in **Annexure E5** of the Final EIR.

The contractor and holder of the Environmental Authorisation are responsible for ensuring compliance with the recommendations contained in this report, as well as any authorisations granted by SAHRA.

3.9 National Water Act (NWA), NO 36 OF 1998

Water use in South Africa is controlled by the NWA and the enforcing authority is the DWS. The NWA recognises that water is a scarce and unevenly distributed national resource in South Africa. Its provisions are aimed at achieving sustainable and equitable use of water to the benefit of all users and to ensure protection of the aquatic ecosystems associated with South Africa's water resources. The provisions of the Act are aimed at discouraging pollution and waste of water resources.

In terms of the Act, a land user, occupier or owner of land whereon which an activity that causes, or has the potential to cause pollution of a water resource, has a duty to take measures to prevent pollution from occurring. If these measures are not taken, the responsible authority may do whatever is necessary to prevent the pollution or remedy its effects, and to recover all reasonable costs from the responsible person.

Section 21 of the NWA specifies a number of water uses, including taking water from a water resource, the storing of water, impeding or diverting the flow of water in a watercourse, discharging waste or water containing waste into a water resource through a pipe, canal, sewer, sea outfall or other conduit, disposing of waste in a manner which may detrimentally impact on a water resource, disposing in any manner of water which contains waste from, or which has been heated in, any industrial or power generation process, discharging water from underground for the safety of people, and altering the bed, banks, course or characteristics of a watercourse. These water uses requires licencing in terms of Section 22 (1) of the Act, unless it is listed in Schedule 1 of the NWA, is an existing lawful use, the water use falls under a General Authorisation issued under Section 39 of the Act, or if the responsible authority waives the need for a licence.

The majority of the Humansrus Solar 3 PV Facility and its associated infrastructure are to be constructed well away from any river / major drainage line / wetland. However, certain infrastructure such as internal roads will cross ephemeral washes for which a WULA has been submitted. A Freshwater study (**Annexure E9** of the EIAR) was undertaken for the property to inform that process. Confirmation of the submission of the WULA is included as **Annexure H2** of the EIAR.

3.10 Guidelines & Strategic Documents

The following guidelines and strategic documents were considered during the compilation of this EMP.

3.10.1 National Waste Management Strategy

The National Waste Management Strategy presents the South African government's strategy for integrated waste management for South Africa. It deals among others with: Integrated Waste Management Planning, Waste Information Systems, Waste Minimisation, Recycling, Waste Collection and Transportation, Waste Treatment, Waste Disposal and Implementing Instruments.

3.10.2 Waste Minimisation Guideline Document for Environmental Impact Assessment Review (May 2003)

This guideline, although compiled on a provincial level, was considered pertinent to this EMPr. This Guideline raises awareness to waste minimisation issues and highlights waste and wastage minimization practices. Part B of this document is of particular importance, as it addresses issues of general waste and wastage minimization during construction activities.

3.10.3 National Building Regulations

The National Building Regulations and Building Standards Act as amended must be complied with. This act addresses, inter alia:

- Specifications for draftsmen, plans, documents and diagrams;
- Approval by local authorities;
- Appeal procedures;
- Prohibition or conditions with regard to erection of buildings in certain conditions;
- Demolition of buildings;
- Access to building control officers;
- Regulations and directives; and
- Liability.

3.10.4 Other Guidelines considered

In addition to those described above, the following guidelines were also considered during the compilation of this EMPr.

- DEADP (2003). Waste Minimisation Guideline for Environmental Impact Assessment reviews. NEMA EIA Regulations Guideline & Information Series, Department Environmental Affairs & Development Planning.
- DEAT (2004). Environmental Management Plans, Integrated Environmental management, Information Series 12, Department Environmental Affairs & Tourism
- DEADP (2010). Guideline for Environmental Management Plans. NEMA EIA Regulations Guideline & Information Document Series, Department of Environmental Affairs & Development Planning.

4. ENVIRONMENTAL IMPACTS & MITIGATIONS

During the Scoping & Environmental Impact phase, several impacts were identified that may take place with the implementation of the proposal. These were assessed and where they could not be avoided, the specialists provided mitigations and recommendations that would lessen the impact on the receiving environment.

The summary of impacts below by discipline is taken from the EIAR and includes the mitigations and recommendations of the various specialists. These have been incorporated into this EMP in the various sections. Overall impacts across all disciplines range between Low to Medium with mitigation measures.

4.1 Agriculture

Overall the impacts associated with the proposed activity have been rated as low with mitigation.

Table 5: Agricultural Impact Assessment (Lubbe, 2016)

Nature of impact	Extent of impact	Duration of impact	Intensity	Probability of occurrence	Level of significance	Significance after mitigation
Loss of agricultural land	Development site	Long term	Low	Highly probable	Low	Low
Land surface disturbance, changing run-off characteristics and increasing erosion risks	Development site	Short term	Low	Highly probable	Low	Low
Loss of topsoil	Site and its immediate surroundings	Short term	Low	Improbable	Low	Low
Placement of spoil material during construction.	Site and its immediate surroundings	Short term	Low	Improbable	Low	Low
Generation of alternative farm income	Development site	Long term	Low	Improbable	Low	Low

4.1.1 Agricultural Mitigations

Ensure protection against soil erosion and loss of topsoil from wind and water at all times.

4.2 Ecological

There are no impacts associated with the development that cannot be mitigated to a **low level** and as a result, the site is considered to be a favourable location for the development.

Table 6: Summary of ecological impacts (Todd, 2016)

Phase & Impact	Without Mitigation	With Mitigation
Planning & Construction		
Impacts on vegetation and listed or protected plant species resulting from construction activities	Medium Negative	Medium-Low Negative
Direct Faunal Impacts During Construction	Medium Negative	Medium-Low Negative
Soil Erosion Risk During Construction	Medium-Low Negative	Low Negative
Operation		

Alien Plant Invasion Risk During Operation	Medium Negative	Low Negative
Soil Erosion Risk During Operation	Medium Negative	Low Negative
Faunal impacts during operation:	Medium-Low Negative	Low-Negative
Cumulative Impacts		
Impact on broad-scale ecological processes due to cumulative loss and fragmentation of habitat	Medium-Low Negative	Low Negative

4.2.1 Ecological Mitigations

4.2.1.1 Construction:

- Preconstruction walk-through of the facility in order to locate species of conservation concern that can be translocated as well as comply with the Northern Cape Nature Conservation Act and DENC/DAFF permit conditions.
- Vegetation clearing to commence only after walk through has been conducted and necessary permits obtained.
- Preconstruction environmental induction for all construction staff on site to ensure that basic environmental principles are adhered to. This includes awareness as to no littering, appropriate handling of pollution and chemical spills, avoiding fire hazards, minimizing wildlife interactions, remaining within demarcated construction areas etc.
- ECO to provide supervision and oversight of vegetation clearing activities within sensitive areas such as near drainage areas.
- Vegetation clearing to be kept to a minimum. No unnecessary vegetation to be cleared.
- All construction vehicles should adhere to clearly defined and demarcated roads. No off-road driving to be allowed outside of the construction area.
- Temporary lay-down areas should be located within previously transformed areas or areas that have been identified as being of low sensitivity. These areas should be rehabilitated after use.
- All personnel should undergo environmental induction with regards to fauna and in particular awareness about not harming or collecting species such as snakes, tortoises and owls which are often persecuted out of superstition.
- Any fauna threatened by the construction activities should be removed to safety by the ECO or appropriately qualified environmental officer.
- All construction vehicles should adhere to a low speed limit to avoid collisions with susceptible species such as snakes and tortoises.
- All hazardous materials should be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel and oil spills that occur at the site should be cleaned up in the appropriate manner as related to the nature of the spill.
- If trenches need to be dug for water pipelines or electrical cabling, these should not be left open for extended periods of time as fauna may fall in and become trapped in them. Trenches which are standing open should have places where there are soil ramps allowing fauna to escape the trench.

- Dust suppression and erosion management should be an integrated component of the construction approach.
- Disturbance near to drainage lines should be avoided and sensitive drainage areas near to the construction activities should demarcated as no-go areas.
- Regular monitoring for erosion problems along the access roads and other cleared areas.
- Erosion problems should be rectified on a regular basis.
- Sediment traps may be necessary to prevent erosion and soil movement if there are topsoil or other waste heaps present during the wet season.
- A low cover of vegetation should be left wherever possible within the construction footprint to bind the soil, prevent erosion and promote post-disturbance recovery of an indigenous ground cover.

4.2.1.2 Operation:

- Wherever excavation is necessary, topsoil should be set aside and replaced after construction to encourage natural regeneration of the local indigenous species.
- The recovery of the indigenous vegetation should be encouraged through leaving some areas intact through the construction phase to create a seed source for adjacent cleared areas.
 - Due to the disturbance at the site as well as the increased runoff generated by the hard infrastructure, alien plant species are likely to be a long-term problem at the site and a long-term control plan will need to be implemented.
 - Regular monitoring for alien plants within the development footprint as well as adjacent areas which receive runoff from the facility as there are also likely to be prone to invasion problems.
 - Regular alien clearing should be conducted using the best-practice methods for the species concerned. The use of herbicides should be avoided as far as possible.
 - All roads and other hardened surfaces should have runoff control features which redirect water flow and dissipate any energy in the water which may pose an erosion risk.
 - Regular monitoring for erosion after construction to ensure that no erosion problems have developed as result of the disturbance.
 - All erosion problems observed should be rectified as soon as possible, using the appropriate erosion control structures and revegetation techniques.
 - All cleared areas should be revegetated with indigenous perennial grasses from the local area. These can be cut when dry and placed on the cleared areas if natural recovery is slow.
 - No unauthorized persons should be allowed onto the site.
 - Any potentially dangerous fauna such snakes or fauna threatened by the maintenance and operational activities should be removed to a safe location.
 - The collection, hunting or harvesting of any plants or animals at the site should be strictly forbidden.
 - If the site must be lit at night for security purposes, this should be done with downward-directed low-UV type lights (such as most LEDs), which do not attract insects.

- All hazardous materials should be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel and oil spills that occur at the site should be cleaned up in the appropriate manner as related to the nature of the spill.
- All vehicles accessing the site should adhere to a low speed limit (30km/h max) to avoid collisions with susceptible species such as snakes and tortoises.
- If the facility is to be fenced, then the electrified strands should be on the inside of the fence as some species such as tortoises are susceptible to electrocution from electric fences as they do not move away when electrocuted but rather adopt defensive behaviour by retreating into their shells and are killed by repeated shocks.

4.2.1.3 Cumulative:

- Minimise the development footprint as far as possible and allow the retention of some natural vegetation between the rows of panels or trackers.
- The facility should be fenced off in a manner which allows fauna to pass by the facility as easily as possible. This implies not fencing-in large areas of intact vegetation into the facility and only the developed area should be fenced.

4.3 Avifaunal

The study area and more specifically the recommended development area are not considered unique habitats in the landscape and are already subject to varying degrees of transformation and degradation. Although two threatened and/or priority species were recorded on-site – Kori Bustard and Karoo Korhaan – the area is not considered critical for their conservation and the extent of habitat loss for these species would be considered low.

The proposed Humansrus 3 SEF and its associated power infrastructure has been assessed as having a **medium-low** impact to priority species and general avifauna occurring in the study area and broader impact zone of the development. The development will pose several impacts to avifauna, including: a low displacement impact caused by disturbance and habitat destruction associated with construction and maintenance activities of the proposed SEF and its associated power infrastructure; a low impact of electrocutions of birds on power infrastructure, with the implementation of mitigation measures; and a medium impact of avian collisions with power line infrastructure and solar panels.

4.3.1 Avifaunal Mitigations

4.3.1.1 Construction phase: SEF

- All construction activities must be carried out according to the generally accepted environmental best practise and the temporal and spatial footprint of the development should be kept to a minimum.
- Care must be taken in the vicinity of sensitive microhabitats such as the *Ephemeral pans* habitat unit.
- Existing roads must be used as much as possible for access during construction.
- The boundaries of the development area are to be clearly demarcated and it must be ensured that all activities remain within the demarcated footprint.
- Provide adequate briefing for site personnel.
- Any bird nests that are found during the construction phase must be reported to the Environmental Control Officer (ECO).
- The above measures must be covered in a site specific EMPr and controlled by an ECO.

- During construction, if any priority species identified in this report are observed to be roosting and/or nesting and breeding in the vicinity, the ECO must be notified.
- The construction camps and laydown areas and site offices etc. must be as close to the site as possible.
- Contractors and working staff should stay within the development area and movement outside these areas especially into sensitive avian microhabitats must be restricted.
- Driving must take place on existing roads and a speed limit of 50 km/h must be implemented on all internal roads.

4.3.1.2 Construction phase: Grid Connection

- All construction activities must be carried out according to the generally accepted environmental best practise and the temporal and spatial footprint of the development should be kept to a minimum.
- Care must be taken in the vicinity of sensitive microhabitats such as the *Ephemeral pans* habitat unit.
- Existing roads must be used as much as possible for access during construction.
- The boundaries of the development area are to be clearly demarcated and it must be ensured that all activities remain within the demarcated footprint.
- Provide adequate briefing for site personnel.
- Any bird nests that are found during the construction phase must be reported to the Environmental Control Officer (ECO).
- The above measures must be covered in a site specific EMPr and controlled by an ECO.
- Strict control must be maintained over all activities during construction, in line with an approved construction EMPr.
- During construction, if any priority species identified in this report are observed to be roosting and/or nesting and breeding in the vicinity, the ECO must be notified.
- The construction camps and laydown areas and site offices etc. must be as close to the site as possible.
- Contractors and working staff should stay within the development area and movement outside these areas especially into sensitive avian microhabitats must be restricted.
- Driving must take place on existing roads and a speed limit of 50 km/h must be implemented on all internal roads.

4.3.1.3 Operation phase: SEF

- If birds are nesting on the infrastructure of the facility and cannot be tolerated due to operational risks of fire, electrical short, soiling of panels or other problems, birds should be prevented from accessing nesting sites by using mesh or other manner of excluding them. Birds should not be shot, poisoned or harmed as this is not an effective control method and has negative ecological consequences. Birds already with eggs and chicks should be allowed to fledge their chicks before nests are removed.
- If there are any persistent problems with avifauna, then an avifaunal specialist should be consulted for advice on further mitigation.

- Contractors and working staff should stay within the development area and movement outside these areas especially into sensitive avian microhabitats must be restricted.
- Driving must take place on existing roads and a speed limit of 50 km/h must be implemented on all access roads.
- Monitor all avifaunal incidents or mortalities observed within the facility (recorded and documented with photographs to ensure correct identification).
- If there are any persistent problems with avifauna, then an avifaunal specialist should be consulted for advice.

4.3.1.4 Operation phase: Grid Connection

- If birds are nesting on the infrastructure of the facility and cannot be tolerated due to operational risks of fire, electrical short, soiling or panels or other problem, birds should be prevented from accessing nesting sites by using mesh or other manner of excluding them. Birds should not be shot, poisoned or harmed as this is not an effective control method and has negative ecological consequences. Birds already with eggs and chicks should be allowed to fledge their chicks before nests are removed.
- If there are any persistent problems with avifauna, then an avifaunal specialist should be consulted for advice on further mitigation.
- Contractors and working staff should stay within the development area and movement outside these areas especially into sensitive avian microhabitats must be restricted.
- Driving must take place on existing roads and a speed limit of 50 km/h must be implemented on all access roads.
- A “Bird Friendly” structure, with a bird perch (as per standard Eskom guidelines) should be used for the tower infrastructure.
- All relevant perching surfaces should be fitted with bird guards and perch guards as deterrents (Hunting, 2002).
- Installation of artificial bird space perches and nesting platforms, at a safe distance from energised components (Goudie, 2006; Prinsen *et al.*, 2012).
- High sensitivity sections of the power line should be marked with Bird Flight Diverters (BFDs), on the earth wire of the line, 5 metres apart, alternating black and white to increase the visibility of the power line and reduce the likelihood of collisions.
- The power line route should be scanned at least twice a month for the first year after construction to identify and locations of high impact. All mortalities along the power line route should be recorded and if there are any sites where repeated mortalities have occurred, an avifaunal specialist should be consulted for advice on additional mitigation measures to be implemented.

4.4 Aquatic

The proposed layout for the solar energy facility will have a **negligible impact** on the aquatic environment. The project has adhered to past specialist recommendations and the infrastructure that would have posed even a slight risk to water resources has been moved outside of any direct wetlands or water course areas.

Furthermore, during the site visit, no aquatic protected or species of special concern (fauna & flora) were observed within the adjacent areas that will be used. Therefore, based on the site visit the significance of the impacts assessed for the aquatic systems after mitigation would be **LOW**.

4.4.1 Aquatic Mitigations

The proposed layout should be developed to avoid as many of the smaller drainage lines as possible.

Where crossings do occur, designs will ensure that flow are not disrupted and that erosion protection is placed appropriately.

Any stormwater within the site must be handled in a suitable manner to capture large volumes of run-off, trap sediments and reduce flow velocities.

Any stormwater within the site must be handled in a suitable manner, i.e. separate clean and dirty water streams around the plant, and install stilling basins to capture large volumes of run-off, trap sediments, and reduce flow velocities (e.g. water used when washing the mirrors).

The project should also try capture and recycle any form of run-off created by the daily operations. This would minimise the amount of water required by the project, but also serve to limit the downstream impacts on the riparian systems through an increase in run-off, a situation that these systems are currently unaccustomed to.

Any stormwater within the site must be handled in a suitable manner, i.e. separate clean and dirty water streams around the plant, and install stilling basins to capture large volumes of run-off, trap sediments and reduce flow velocities (e.g. water used when washing the mirrors).

4.5 Integrated Heritage

4.5.1 Cultural Landscape

From a regional and natural landscape perspective, the proposed development site forms part of a highly-transformed landscape altered through mining activities as well as high concentration of proposals for development of several renewable energy (solar) facilities.

While the proposal would relate to a landscape modification, **we do not consider that it would alter any natural or cultural landscape of cultural significance.**

4.5.2 Visual

It is the findings of this report that all of the alternatives are suitable for development with mitigation. It was found that the proposed alternatives **would not constitute a significant visual impact** to the characteristic landscape.

4.5.3 Archaeology

Indications are that in terms of archaeological heritage the proposed activity is viable; **impacts are expected to be limited and controllable.** Construction of the proposed solar facility may proceed. Either layout (Alternative 1 and Alternative 2) is acceptable.

4.5.4 Palaeontological

There is no preference on palaeontological heritage grounds for the preferred or alternative layout of the solar facility. Given the generally low palaeontological sensitivity of the Copperton region (based on several recent field studies in the area), the cumulative impact of the proposed solar facility as well as several other local alternative energy developments is assessed as low.

4.5.5 Integrated Heritage Mitigations / Recommendations

Table 7: HIA Recommendations

	Recommended Conditions of Approval
VS-1	That a 75m No-go buffer from the R357 and Copperton roads be maintained.
VS-2	To reduce visual intrusion from the possible multiple power lines linking up to different proposed PV projects in the vicinity, it is recommended that the power lines as much as possible follow existing transmission line corridors.
VS-3	The lay down should be located away from the main roads (as much as possible).
VS-4	Dust control measures should be implemented when required.
VS-5	Lights at night have the potential to significantly increase the visual exposure of the proposed project. It is recommended that mitigations be implemented to reduce light spillage (refer to Addendum for general guidelines).
AIA-1	Indications are that in terms of archaeological heritage the proposed activity is viable; impacts are expected to be limited and controllable.
AIA-2	Due to potential cumulative impacts in the area, some limited sampling of artefactual material should occur prior to construction.
AIA-3	If during ground clearance or construction, any dense accumulations of stone tools, particularly if they are associated with ostrich eggshell fragments, are uncovered then the ECO should report this to SAHRA (Tel: 021 462 4502).
AIA-4	If any human remains are uncovered during construction, the ECO should have the area fenced off and contact SAHRA (Tel: 021 462 4502) immediately.
PIA-1	It is therefore recommended that, pending the discovery of significant new fossils remains before or during construction, exemption from further specialist palaeontological studies and mitigation be granted for the proposed Humansrus Solar 3 alternative energy development on Farm Humansrus 147 near Copperton.
PIA-2	Should any substantial fossil remains (e.g. well-preserved stromatolites, mammalian bones and teeth) be encountered during excavation, however, these should be safeguarded, preferably in situ, and reported by the ECO to SAHRA, i.e. The South African Heritage Resources Authority, as soon as possible (Contact details: SAHRA, P.O. Box 4637, Cape Town 8000. Tel: 021 462 4502 so that appropriate action can be taken by a professional palaeontologist, at the developer's expense. Mitigation would normally involve the scientific recording and judicious sampling or collection of fossil material as well as associated geological data (e.g. stratigraphy, sedimentology, taphonomy) by a professional palaeontologist.

4.6 Geotechnical

The whole property (Humansrus 147) is underlain by surface calcrete and Dwyka Tillite bedrock on a gentle undulating landscape with no major drainage features. The proposed development area for Humansrus Solar 3 Energy Facility is also expected to be underlain by a shallow soil profile with hardpan calcrete overlying bedrock, requiring pre-drilled rammed foundations and result in intermediate to hard excavatability for trenches. No problem soils are expected, no mining activities (past or present) will impact the site and no shallow groundwater conditions is expected.

4.6.1 Geotechnical Mitigations

It is recommended that a detailed geotechnical site investigation be conducted to determine the detailed founding conditions for the site.

4.7 Traffic

It can be concluded that there are no evident problems to be expected while hauling freight along any of the transport routes to site. However, it is advised that routes must be adapted in situations of unforeseen events occurring.

The following recommendations were drawn according to the investigation on the Traffic Impact Assessment and Management Study for Humansrus 3:

- 'Access Road Entrance_2 Preferred' shall be considered the preferred option to site unless stated otherwise;

- Legal limits for normal heavy Vehicle freight will be required;
- All imported elements shall be delivered to the P.E. Port/Coega and transported to site. However, if this Port is unavailable, Saldanha Bay Port will be used as back up;
- All basic materials (concrete, road materials, etc.) shall be provided from nearby towns such as Prieska or Kimberley;
- All material required for transport from the manufacturing centres will occur predominately from Pinetown, KZN and Johannesburg, Gauteng;
- All permitting for abnormal loads, vertical height clearance, etc. shall be acquired prior to transit of elements;
- Toll fees will need to be met on particular transport route coming mainly from Pinetown, KZN;
- Routes will predominately occur on National and Provincial Roads with suitable standards for transport of container freight;
- There is limited risk of delays for normal routine pending maintenance work of the time of transit and scheduling of road contract.

4.8 EMI/RFI Path Loss

Based on the current SKA location information, a first order impact analysis shows a **possible interference scenario** between the Humansrus Solar 3 PV Facility and the SKA installations as shown. In order **to negate the risk to an acceptable level**, all equipment to be installed on site must comply with levels of 40dB below the CISPR 11 Class A limit as the primary mitigation measure to accommodate cumulative effect of the high number of potential sources. Where equipment exceeds this threshold, additional shielding and filtering should be implemented to reduce the electromagnetic emissions from the PV facility. Shielding and filtering solutions are available to ensure the required 40dB below CISPR 11 Class A for equipment is reached. Should all equipment comply with the required 40dB below CISPR 11 Class A emissions, the total installed plant equipment emissions is expected to remain approximately 15dB below the CISPR 11 Class A limit. The compliance of the total facility to 15dB below the CISPR 11 Class A emissions is expected to result in emissions within SKA risk tolerances.

4.9 Socio-Economic

The environmental assessment framework for the assessment of impacts and the relevant criteria were applied to evaluate the significance of the potential social impacts. The proposed Humansrus Solar 3 PV Facility and associated infrastructure is **unlikely to result in permanent damaging social impacts**. From a social perspective it is concluded that the project could be developed subject to the implementation of the recommended mitigation measures and management actions contained in the SIA report.

Table 8: Summary of social impacts during construction phase (Savannah, 2016)

CONSTRUCTION PHASE				
Impact	Significance without Mitigation/ enhancement	Significance with Mitigation/ enhancement	Significance without Mitigation/ enhancement	Significance with Mitigation/ enhancement
	PREFERRED LAYOUT		ALTERNATIVE LAYOUT	
<i>Direct employment and skills development</i>	Medium Positive	Medium Positive	Medium Positive	Medium Positive
<i>Economic</i>	Low	Medium	Low	Medium

<i>multiplier effects</i>	Positive	Positive	Positive	Positive
<i>Influx of jobseekers</i>	Low Negative	Low Negative	Low Negative	Low Negative
<i>Impacts on daily living and movement patterns (traffic & nuisance impacts)</i>	Low Negative	Low Negative	Low Negative	Low Negative
<i>Safety and security risks</i>	Low Negative	Low Negative	Low Negative	Low Negative

Table 9: Summary of social impacts during operation phase (Savannah, 2016)

OPERATION PHASE				
Impact	Significance without Mitigation/ enhancement	Significance with Mitigation/ enhancement	Significance without Mitigation/ enhancement	Significance with Mitigation/ enhancement
	PREFERRED LAYOUT		ALTERNATIVE LAYOUT	
<i>Direct employment and skills development</i>	Low Positive	Medium Positive	Low Positive	Medium Positive
<i>Development of clean, renewable energy infrastructure</i>	Medium Positive	N/A	Medium Positive	N/A
<i>Benefits associated with REIPPPP socio-economic development plans and community trust</i>	Low Positive	Medium Positive	Low Positive	Medium Positive
<i>Visual and sense of place impacts</i>	Medium Negative	Low Negative	Medium Negative	Low Negative
<i>Impacts associated with the loss of agricultural land</i>	Low Negative	N/A	Low Negative	N/A

Table 10: Summary of assessment of alternatives (Savannah, 2016)

OPERATION PHASE				
Impact	Significance without Mitigation	Significance with Mitigation	Significance without Mitigation	Significance with Mitigation
	Alternative Access Road 1		Alternative Access Road 2	
<i>Assessment of the access road alternatives</i>	Low Negative	Low Negative	Low Negative	Low Negative

Table 11: Summary of cumulative social impacts (Savannah, 2016)

CUMULATIVE IMPACTS		
Cumulative Impact	Overall impact of the proposed project considered in isolation	Cumulative impact of the project and other projects in the area
Positive Cumulative Impacts		
<i>Cumulative impacts from employment, skills and business opportunities</i>	Low	Medium
Negative Cumulative Impacts		
<i>Cumulative impacts with large-scale in-migration of people</i>	Low	Medium
<i>Cumulative impacts of nuisance impacts (noise, dust & traffic)</i>	Low	Medium
<i>Cumulative impacts on the sense of place and landscape</i>	Low	Medium

4.9.1 Socio-Economic Mitigations

Based on the social assessment, the following recommendations are made:

- » It is important to appoint a **community liaison officer** from the local community to assist with the management of social impacts and to deal with community issues.
- » In terms of employment related impacts, it is important to consider that job opportunities for the unskilled and semi-skilled in the study area could create competition among the local unemployed. Introducing an outside workforce will therefore most likely worsen local endeavours to obtain jobs and provoke discontent as well as put pressure on the local services available. It is imperative that **local labour be sourced** from SLM to ensure that benefits accrue to the local communities. Efforts should be made to involve local businesses during the construction activities where possible. Local procurement of labour and services/products would greatly benefit the community during the construction and operation phases of the project.

- » **Local procurement of services and equipment** (where possible) in order to enhance the multiplier effect. This would serve to mitigate other subsequent negative impacts such as those associated with the inflow of outsiders to the area, the increased pressure on the infrastructure and services in the area, as well as the safety and security concerns.
- » Involve the community in the process as far as possible (encourage co-operative decision making and partnerships with local entrepreneurs).
- » Implement mitigation measures to reduce and avoid negative impacts.
- » Employ mitigation measures to minimise the dust pollution and damage to existing roads.
- » Safety and security risks should be taken into account during the planning/construction phase of the proposed project. Access control, security and management should be implemented to limit the risk of crime increasing in the area.
- » From a social perspective it is recommended to choose the preferred access road 2 to reduce dust pollution and impacts from wear and tear on the R357.

5. DESIGN & PRE CONSTRUCTION PHASE

The following management considerations are to be adopted and implemented during the design and pre-construction phase.

5.1 PV/CPV Panel - Micro-Siting

Micro-siting of the individual panels within the solar facility should occur when the layout is nearing its final configuration during the detailed design phase (in approximation to the layout authorised by DEA). This micro-siting exercise involves assessing the exact footprints of the PV panels in each array row in turn on site, so that all technical and environmental features can be considered with input from the participating specialists and the ECO.

The following recommendations made by the various specialists must be considered in the micro-siting exercise.

5.2 Pre Construction Ecological Requirements

The ecological specialist, Simon Todd (2016), recommended that the sensitive areas with appropriate buffers at the site (drainage line and pans) should be demarcated by an ecologist as part of the preconstruction activities for the site. In addition, contracted ecologist should undertake a preconstruction survey of the final development footprint to ascertain the identity and exact number of individuals of protected species affected by the development. A single integrated permit, which covers nationally or provincially listed plant species permitting requirements, as well as meets TOPS regulations, must be obtained from the Department of Environmental Affairs & Nature Conservation (DEANC) permit office in Kimberly prior to the any plant rescue / transplant and/or removal activities.

An Environmental Control Officer (ECO) should be present for the site preparation and initial clearing activities to ensure the correct demarcation of no-go areas, facilitate environmental induction with construction staff and supervise any flora relocation and faunal rescue activities that may need to take place during the site clearing.

5.3 Pre Construction Heritage Requirements

No specific sensitive heritage features were identified on site.

5.4 Pre Construction Freshwater Requirements

The following pre construction mitigation measures were proposed by Colloty for consideration in the pre-construction detailed design.

Project component/s	Site selection with regard minimising the overall impact on the functioning of the riparian environment
Potential impact	Loss of important habitat and fragmentation of the riverine systems
Activity risk source	Placement of hard engineered surfaces (PV plants)
Mitigation: Target / Objective	Select a favourable site, having the least impact or within an area that is least sensitive, i.e. not within the mains stem systems.
Mitigation: Action/control	Minimise the loss of riparian habitat – physical removal and replacement by hard surfaces by avoiding as many of the sensitive (High) water courses possible as is shown in Figure 4
Responsibility	Developer
Timeframe	Planning and design phase
Performance indicator	N/A
Monitoring	N/A

- The proposed layout should be developed to avoid as many of the smaller drainage lines as possible.
- Care should however be taken that if any clearing is done, that this area is monitored for plant re-growth, firstly to prevent alien plant infestations and to ensure no erosion or scour takes place.
- Where crossings do occur, designs will ensure that flow is not disrupted and that erosion protection is placed appropriately.
- Strict control over the behaviour of construction workers.

5.5 Pre-Construction environmental compliance workshop

It is recommended that a pre-construction environmental compliance workshop be undertaken before any construction commences on site. This workshop can be combined with a site handover meeting, but must take place before any activities take place on site and before any plant is moved onto site. The purpose of this workshop is to ensure that all relevant personnel are familiar with the provisions of the EMPr, as well as the conditions of the Environmental Authorisation.

The following people must be present at this Environmental Compliance Workshop:

- The ECO;
- The Main Civil Contractor (including contract manager, site agent and foreman);
- The Electrical Contractor (including contract manager, site agent and foreman);
- The Consulting Engineers (electrical, civil and structural, whichever applicable); and
- Project Management.

Provision should be made in contract and tender documentation to attend a 6 hour workshop that will be chaired by the ECO.

5.6 Environmental Induction Training & Environmental Education

The ECO, in consultation with the contractor and engineer, shall ensure that all construction workers receive an induction presentation, as well as on-going environmental education & awareness, on the importance and implications of the EMPr and the environmental requirements it prescribes. The presentation shall be conducted, as far as is possible, in the Employees' language of choice. The contractor should provide a translator from their staff for the purpose of translating, should this be necessary.

There are a number of listed and **protected species** present in the area and there is a possibility that some of these could be impacted by the development. Further plant species may well be

identified by the ecological specialist to occur within the proposed development area during the pre-construction survey. It is important that the ECO and all construction staff be made aware of these species and how to identify them, so that they can be suitably avoided and/or protected where possible (see Section **Error! Reference source not found.** of the EMPr for photographs and description of important plant species). Section **Error! Reference source not found.** provides details of the alien plant species that will need to be removed from site on a systematic basis. It is the ECO's responsibility to print enlarged posters of these photographs and descriptions for use in the Environmental Induction / Education training sessions. It is also the ECO's responsibility to ensure that the required permit be obtained from the Kimberly DEANC office prior for the transplant and/or removal of protected plant species, as well as to provide instruction on and guide all plant rescue, transplant and rehabilitation activities (i.e. plants must be carefully removed and transplanted outside the development area as directed by the ecological specialist and/or the ECO).

As further plant species of conservation value, as well as archaeological occurrences, are likely to occur in proximity of the major **drainage lines and pans** nearby, these must be **demarcated as NO-GO** areas and must be avoided by all staff.

As a minimum, induction training should include:

- Explanation of the importance of complying with the EMPr;
- Explanation of the importance of complying with the Environmental Authorisation;
- Discussion of the potential environmental impacts of construction activities;
- The benefits of improved personal performance;
- Employees' roles and responsibilities, including emergency preparedness (this should be combined with this induction, but presented by the contractors Health and Safety Representative);
- Explanation of the mitigation measures that must be implemented when carrying out their activities;
- Explanation of the specifics of this EMPr and its specification (no-go areas, etc.); and
- Explanation of the management structure of individuals responsible for matters pertaining to the EMPr.

Furthermore, the induction training must ensure that construction workers/staff understand that **no form of wildlife poaching, collecting (plant or animal) or other form of disturbance will be permitted** on the construction site or the adjacent areas.

Should the staff turnover be high and with additional appointment of sub-contractors, it may be necessary to conduct additional induction training sessions, as well as regular environmental education debriefings. This is at the discretion of the ECO.

The contractor must keep records of all environmental training sessions, including names, dates and the information presented. Details of the environmental induction are also to be included in the environmental control reports.

5.7 Demarcation of No-Go Areas

The demarcation of no-go areas is of extreme importance to ensure that disturbance is restricted to the future developed area and that areas outside this demarcated area are protected and not damaged unnecessarily.

The process for this is as follows:

- The exact footprint of the construction area, including panel foundations and all roads (including access, haul and internal roads which must make use of the final road layout) and infrastructure are to be surveyed and pegged before any physical construction commences on site.

- All sensitive hydrological features as identified by Colloty must be demarcated for exclusion.
- The contractor, in conjunction with the ECO, must walk the areas determined and mark the full extent of the area to be disturbed (allowing sufficient space for the construction activity);
- All areas beyond these demarcated areas are considered as “no-go” areas (i.e. the drainage line and pans); and
- Construction staff must be briefed as part of the environmental induction on the requirements regarding the no-go areas.

5.8 Construction Phasing

There are a number of important aspects of the construction phasing that must be implemented to ensure that the potential impact on the environment is kept to a minimum. The contractor must consider the following requirements regarding phasing, when developing the construction programme. This construction programme must be approved by the engineer’s representative with input from the ECO.

- The road network to access the panel arrays should be established first and then all vehicular movement must be restricted to within this road network - This will minimise the impact of construction traffic on the undeveloped portion of the property.
- Sites that will be temporarily disturbed by the construction activities (e.g. material loading, temporary storage, turning circles, etc.) must also be included in the road access network.

5.9 Establishment of Contractors Site Camp

The Contractors Site Camp must be established in consultation with the ECO. The site camp may not be erected on any areas considered sensitive as defined by the participating specialists. The following points are applicable:

- The Contractors Site Camp must be situated within the development area. Site Camps that are allowed off-site may only be erected once written permission from the landowner is obtained and any other necessary authorisations are in place;
- Topsoil from the site camp area must be stripped and stockpiled for re-use during rehabilitation. This must be done to ensure no contamination of the topsoil while the site camp is in use;
- The site camp must be fenced off with shade netting;
- All construction material must be stored in the site camp, unless otherwise approved by the ECO. This may exclude PV panel mounting structures and panel components which will be stored at each of the assembly point, as per the manufacturer plans;
- No personnel may overnight in the site camp, except in the case of a night watchman / security;
- Fires for cooking and/or heating are only allowed within the site camp after consultation with the Health and Safety Representative;
- Fuel may only be stored in the camp site;
- Storage of waste must take place within the site camp and must be removed on a regular basis; and
- The site camp must be provided with sufficient ablution facilities (chemical toilets and potable water) of which the content must be disposed of regularly and at the suitable facilities.

5.10 Water Conservation in Infrastructure

The following recommendations must be considered in the design and construction of the associated structures / infrastructure (on-site substation, auxiliary buildings etc.) to be constructed as part of the PV solar development:

5.10.1 Ablution / Sanitation Facilities

The on-site substation, control and workshop buildings should be fitted with rainwater collection and storage systems to supply water to the all taps and toilets in these buildings, as well as any outdoor requirements (landscaping, washing etc.).

All toilets should be fitted with dual flush systems. Conservative estimates have shown that a saving of more than 22 000 litres per household (this could apply to the workshops that are occupied by day and night staff) can be achieved annually with the installation of dual flush toilets (Aquanotion, 2008).

All taps to be installed in the control / substation / workshop buildings must be fitted with low-flow faucets. Low flow faucets use aerators to reduce the flow of the water. These can either be built into the faucet or added as an aftermarket product. The faucets in bathrooms should have a peak flow of less than 10 litres per minute.

5.10.2 Water Demand

Relatively little work has been carried out to date on water sustainability on construction sites, More cogniscance is given to water sustainability during the operational phase of a project. However, as water moves up the political and environmental agenda due to increasing pressure on water resources, it is anticipated that this will change. Taking this into consideration and applying the principles of Best Practice, it is recommended that the contractor must take a sustainable approach to the use of water during construction. The following table (Waylen et al, 2011) provides practical actions which can be implemented to minimise water use on site.

It is recommended that a water demand plan be put in place before water use on site commences.

Table 12: Water using processes & actions to reduce consumption (Source: Waylen et al, 2011)

Key:	High water using processes			
Use of Water on Site (Processes/ Activities)	Procedures/ Systems	Estimated proportion of current water use on sites	Behaviours	Technologies
Design Stage Considerations (relating to water use impact of completed development)		N/A		Water efficient bathroom products and taps should be installed.
Site Camps				
Toilets, catering, washing (personnel)	Monitoring via meter readings etc. Rainwater collection and use		Site inspections for leaks, wastage / increase awareness through briefing	Eco-cabins (e.g. rainwater harvesting, waterless or low or sensor activated flush urinals, water saving devices [taps] and

Use of Water on Site (Processes/ Activities)	Procedures/ Systems	Estimated proportion of current water use on sites	Behaviours	Technologies
			and posters, notices. Awareness raising – toolbox talks / posters etc.	effluent management system), composting, water meter adaptors to facilitate fitment of water meter to improve quality of data. Water meter adapter / add-on
General site activities				
Tool washing Rinsing	Site inspections all to include checking for water leaks & use practices		Use toolbox talks to ensure operatives understand need to conserve water. Use buckets etc. to wash tools rather than running water. Dedicated tool washing areas.	Auto shut-off taps. Ensure water supply able to be switched off at point of use e.g. through trigger guns on hoses.
Wet Trades				
Brick/blockwork				On-site mortar silos as opposed to batch mixing
Screeding				
Concreting	Concrete mix design		Use water from settled concrete wash out area to clean equipment	On-site batching using closed-loop water recycling
Plastering				
Core Boring				Dry core
Lightweight Roofing				
Ceramic Tile				
Bentonite mixing				On-site batching using closed-loop water recycling

Use of Water on Site (Processes/ Activities)	Procedures/ Systems	Estimated proportion of current water use on sites	Behaviours	Technologies
Rendering				
Groundworks				
Grouting				Auto shut-off taps (e.g. trigger type hoses/taps)
Drilling/Piling	Flushing water / coolant			
Dust Suppression				
General, site roads, wheel washes	Water spraying bowzers (using water diffusers to create mist as more effective at capturing dust) Rainwater collection Early hardstanding (or stone) site roads, car parks etc. (reduce requirement for damping down)	Considered to be the largest 'wasteful' use of water on sites.	Licensed water abstraction (surface water / boreholes)	Use temporary settlement lagoons and look at early construction of lagoons so that they can be utilised early. Closed-loop water recycling for drive-through wheel-washes. Admixtures for dust suppression reduces damping frequency. Source dust suppression agents that are biodegradable and binds together dust and floating parts to reduce damping.
Hydrodemolition with high pressure water		(High on sites where this is used)		Closed-loop water recycling
Cleaning				
Cleaning tools and small equipment			Use buckets as opposed to running water	
Plant & equipment				Closed loop systems
Lorry wash out				Recovery of water for re-use
Ready mixed concrete wagons	Wash out into segregated area			Wash out pit with recirculation system to

Use of Water on Site (Processes/ Activities)	Procedures/ Systems	Estimated proportion of current water use on sites	Behaviours	Technologies
				reuse water in concrete mixes
Site / general cleaning				
Specialist / high pressure cleaning				
Paintbrush washing				Wash in closed containers such as Dulux EnviroWash System
Commissioning & Test				
Building plant/ services	Capture and re-use of commissioning water			

The following information should be captured on site to provide water usage data during the construction period. It is suggested that this data is included the required monthly information for the ECO.

Mandatory data includes:

- Mains water where the contractor is responsible for billing / metering;
- Licensed water abstractions;
- Water transported to sited (bowsers / tankers);
- Value of work (i.e. allocation of use) that the water data relates to.

Optional information:

- Workforce that the water data relates to (direct and subcontracted staff);
- Details of initiatives or good practice to reduce potable water consumption (e.g. rainwater recycling, other water recycling etc.);
- Estimated water saved via initiatives / good practice.

Exclusions:

- Water provided and paid for by the customer;
- Rainwater collected on site, e.g. lagoons, rainwater harvesting systems.

Refer to **Appendix L** for a water demand data sheet template.

5.11 Environmental Control Officer

It is recommended that a suitably qualified Environmental Control Officer (ECO) be appointed for this project. This appointment must take place during the pre-construction phase before the commencement of any of the authorised activities, including site preparation.

The ECO will be responsible for monitoring, reviewing and verifying compliance by the EPC Contractor with the environmental specifications of this EMPr and the conditions of the Environmental Authorisation.

The appointed ECO must be independent of the EPC contractor and must be suitably qualified and have experience of environmental monitoring and control on similar scale projects. The holder of the EA must provide the name and contact details of the ECO to the Director: Compliance and Monitoring at DEA.

The responsibilities of the ECO include but are not limited to the following:

- Provide environmental induction training to contractors on site prior to commencing of construction activities;
- Be fully knowledgeable of all the licences and permits issued to the site.
- Review, maintenance and update of the EMPr;
- Liaison between the Project Proponent, Contractors, Authorities and other lead stakeholders on all environmental concerns, including the implementation of the EMPr;
- Compilation of Environmental Control Report/s (ECR) to ensure compliance with the EMPr and authorisations. Reports should be submitted to the relevant authority on a monthly basis;
- Compilation of the Environmental Audit Report or Environmental Completion Statement, six months after completion of construction. Reports should be submitted to the National and Provincial environmental authority as well as the holder of the EA and EPC contractor;
- Monitor compliance with this EMPr;
- Monitor compliance with the Environmental Authorisation;
- Monitor implementation of the mitigation and rehabilitation measures and recommendations referred to in the Environmental Authorisation, Final Environmental Impact Report, participating specialists and this EMPr.
- Recommend the issuing site instructions to the Contractor for corrective actions required (formal site instructions are to be issued by the Engineers Representative with input from the ECO);
- The ECO should be on site for the duration of site establishment and preparation.
- ECO site inspections should then be undertaken once a month to ensure compliance with the EMPr. The duration of these visits may be increased or decreased at the discretion of the ECO in consultation with the Engineers Representative. The Environmental Site Agent as described below should be on site daily and be in communication with the ECO on a daily basis.
- Attendance of contractors site meetings;
- Maintain a record of environmental incidents (e.g. spills, impacts, legal transgressions etc.) as well as corrective and preventative measures taken. This information must also be included in the ECR;
- Maintain a public complaints register in which all complaints and action taken / responses must be recorded. This information must also be included in the ECR;
- Keep Record of all activities on site, problems identified, transgressions noted and a task schedule of tasks undertaken by the ECO; and
- Engineers Representative on advice from the ECO, has the authority to stop work on site if he / she consider that any actions of excessive non-compliance of the EMPr, authorisations or General Duty of Care are taking place.

5.11.1 Environmental Site Agent (ESA)

An environmental site agent should be appointed for the duration of the construction period of the solar project. This ESA must be appointed in the pre-construction phase, prior to the

commencement of construction activities. The Terms of Reference for the Environmental Site Agent (ESA) include, but are not limited to the following:

- To ensure compliance with the Environmental Management Plan and Environmental Authorisation;
- The ESA is required to be on site daily, which may be reviewed by the ECO and resident engineer as construction requirements dictate;
- Assisting the contractor with environmental induction of the contractors;
- Attending all on site construction meetings (including, but not limited to, technical and contractors meetings);
- Providing the ECO with a weekly compliance report in a format defined by the ECO;
- Developing and maintaining a detailed photographic site record throughout the construction phase of the project;
- Maintaining a register of all site instructions;
- Maintaining file records of all method statements provided by the contractors;
- Management and ensuring contractor implementation with the environmental rehabilitation plan;
- Revision and updating the EMPr in conjunction with the ECO, if and when required;
- Maintain a record of environmental incidents (e.g. spills, impacts, legal transgressions etc.) as well as corrective and preventative measures taken. This information must also be included in the weekly reports;
- Maintain a public complaints register in which all complaints and action taken / responses must be recorded. This information must also be included in the ECR;
- In the event that the ESA observes non-compliance that requires a “stop work” order, the ECO must immediately be informed and will request the Engineers Representative to issue such an order if necessary.

5.11.2 ECO and ESA competency

The ECO must have a minimum of a tertiary level qualification in the natural sciences field, as well as at least 8 years’ experience and proven competency as an ECO, preferably with experience on similar scale Developments.

The ESA must have a minimum of a tertiary level qualification, as well as at least 2 years’ experience and proven competency as an ESA.

5.12 Plant Rescue and Protection

A Plant Rescue and Protection Plan is attached in **Appendix D**. The following pre-construction requirements are relevant to this plan.

- Identification of all listed species which may occur within the site, based on the SANBI SIBIS database as well as the specialist EIA studies for the site and any other relevant literature.
- A walk-through of the final development footprint by a suitably qualified botanist/ecologist to locate and identify all listed and protected species which fall within the development footprint. This would need to happen during the peak flowering season at the site which depending on rainfall is likely to be during late summer to autumn (March-April).
- A walk-through report following the walk-through which identifies areas where minor deviations to roads and other infrastructure can be made to avoid sensitive areas and important populations of listed species. The report should also contain a full list of localities where listed species occur within the development footprint and the number of affected

individuals in each instance, so that this information can be used to comply with the permit conditions required by the authorization as well as provincial requirements.

- Search and rescue operation of all listed species suitable for translocation within the development footprint that cannot be avoided. Affected individuals should be translocated to a similar habitat outside of the development footprint and marked for monitoring purposes. Those species suitable for search as rescue should be identified in the walk-through report. It is important to note that a permit is required to translocate or destroy any listed and protected species even if they do not leave the property. Some plants can also be offered to national collections such as the National Botanical Gardens, but no plants should be allowed to go to private collectors unless this is approved by the provincial conservation authorities.

6. CONSTRUCTION PHASE ENVIRONMENTAL MANAGEMENT

The items contained in this section of the EMPr must be implemented during the construction phase of the development of the Humansrus Solar 3 PV Facility.

6.1 Water Supply

The contractor must ensure a supply of water is available on site for sanitation, drinking, dust suppression etc.

Water used for dust suppression on gravel roads must be of a quality compliant with the General Special Effluent Standards (31/03/2009): Temperature: max.25⁰C, pH: between 5.5 & 7.5 and conductivity: not be increased more than 15% above the intake water & not exceed 250 milli-Siemens per metre (determined at 25⁰C). The water used for dust suppression is likely to be borehole water / municipal water, and not treated effluent. This item is specific to water supply during the construction phase. Water supply for the washing of panels is discussed under the operational phase requirements.

The holder of the EA must ensure compliance with the conditions of the WULA with regard to Water Supply during the construction Phase.

6.2 Topsoil Handling

This section must be read in conjunction with the Re-vegetation and Restoration Plan in **Appendix E**.

Effective topsoil management is a critical element of rehabilitation, particularly in arid and semi-arid areas where soil properties are a fundamental determinant of vegetation composition and abundance. Although some parts of the site consist of exposed bedrock, most parts of the site have at least some topsoil. Where any excavation or topsoil clearing is required, the topsoil should stockpiled and later used to cover cleared and disturbed areas once construction activity has ceased.

- Topsoil is the top-most layer (0-25cm) of the soil in undisturbed areas. This soil layer is important as it contains nutrients, organic matter, seeds, micro-organisms fungi and soil fauna. All these elements are necessary for soil processes such as nutrient cycling and the growth of new plants. The biologically active upper layer of the soil is fundamental in the maintenance of the entire ecosystem.
- Topsoil should be retained on site in order to be used for site rehabilitation. The correct handling of the topsoil is a key element to rehabilitation success. Firstly it is important that the correct depth of topsoil is excavated. If the excavation is too deep, the topsoil will be mixed with sterile deeper soil, leading to reduction in nutrient levels and a decline in plant performance on the soil.

- Wherever possible, stripped topsoil should be placed directly onto an area being rehabilitated. This avoids stockpiling and double handling of the soil. Topsoil placed directly onto rehabilitation areas contains viable seed, nutrients and microbes that allow it to revegetate more rapidly than topsoil that has been in stockpile for long periods.
- If direct transfer is not possible, the topsoil should be stored separately from other soil heaps until construction in an area is complete. The soil should not be stored for a long time and should be used as soon as possible. The longer the topsoil is stored, the more seeds, micro-organisms and soil biota are killed.
- Ideally stored topsoil should be used within a month and should not be stored for longer than three months. In addition, topsoil stores should not be too deep, a maximum depth of 1m is recommended to avoid compaction and the development of anaerobic conditions within the soil.

6.3 Transport & Traffic Management

The Transport Study and Traffic Management plan as compiled by AEP is attached in **Appendix C** and forms an integral part of this EMP. During the construction of the access points to site, the route off the R357 will need to be upgraded in order to meet SANRAL standards. A T-Junction will need to be constructed at the access point. This construction will need to adhere to Traffic Accommodation as per Standards set by the Department of Transport and Public Works. All temporary road signs will need to comply with that of the South African Road Traffic Signs Manual.

As per this plan, the following traffic management requirements are applicable to the construction phase of the project.

6.3.1 Transport of project components to site

The following requirements for permits / licenses are likely to be required during the transport of components to site:

- Toll segments are on all 3 routes from Pinetown's manufacturing centre.
- An Abnormal permit will be required for the transport of the transformer from P.E. Port/Coega. Estimated cost of this permit is R7000-R9000/trip depending on what vehicle configuration will be used.
- Maximum vertical clearance for most routes is 5,2m for abnormal load. However, if the elements imported comes close to this height (exceeds 4,2m), a permit will need to be issued where a preferred route will be stated in the permit conditions.
- Possible periodic maintenance roadworks by SANRAL could occur, particularly on the N10 and R357. However, no contracts to do so are currently in circulation.
- The current limitations on road freight transport are:
 - Axle load limitation of 7,7t on front axle, 9,0t on single rear axles.
 - Axle unit limitations are 18t for dual axle unit and 24t for 3 axle unit.
 - Bridge formula requirements to limit concentration of loads and to regulate load distribution on the vehicle.
 - Gross vehicle mass of 56t. This means a typical payload of about 30t.
 - Maximum vehicle length of 22m for interlinks, 18,5m for horse and trailer and 13,5m for a single unit.
 - Width limit of 2,6m.
 - Height limit 4,3m.

All necessary permits / licenses must be in place timeously.

6.4 Concrete Management

Proper concrete management is of utmost importance. Concrete works are likely to be limited to the construction of the on-site sub-station and auxiliary buildings, and are not likely to be extensive

(the preferred alternative for the panel support structures will make use of a technology that does not require concrete footings, due to rammed piles/earth screws/rock anchors). However in instances where rammed piles/earth screws or rock anchors will not be practically possible and for other concrete work associated with the substation and inverter stations, the following requirements in terms of concrete management should take place.

Cement powder has a high alkaline pH that may contaminate and adversely affect both soil pH and water pH negatively. A rapid change in pH can have consequences on the functioning of soil and water organisms, as well as on the botanical component.

The use of ready-mix trucks delivering concrete directly to site is recommended. Mass batching of concrete on site should be limited as far as possible.

The following must be implemented regarding the delivery of concrete to site:

- Trucks should deliver pre-mixed concrete to the site and pour the concrete directly into the prepared excavations.
- When concrete trucks have unloaded, there is a requirement to wash out the inside of the concrete drum. Water can be provided to the trucks for this purpose (at the discretion of the contractor). Concrete suppliers may **NOT** dispose of this wash water anywhere on site. Trucks should return to their depot for this purpose; and
- Any spillages of concrete outside of the excavations (including haulage routes) must be cleaned up immediately by the supplier.

Where small batching of concrete or plaster takes place on site, the following must be implemented:

- Concrete batching may only take place in areas approved by the ECO (preferably in the Site Camp);
- Concrete mixing areas must have bund walls or a settling pond in order to prevent cement run off;
- Once the settling ponds dry out, the concrete must be removed and dispatched to a suitable disposal site. Ideally, all concrete batching should take place on an area that is to be hard surfaced as part of the development (building floor, road or paved area);
- In order to avoid resource contamination, concrete batching should not be located within 60m of a drainage line / watercourse, within a watercourse flood plain or where there is a potential for any spilled concrete to enter a watercourse or groundwater (boreholes).
- If an area outside of the site camp is identified for batching it must first be approved by the ECO and all topsoil must be stripped and stockpiled for re-use.
- Batching at satellite sites must be done on a batching plate i.e. wood or metal sheet, to prevent soil contamination.

6.5 Cable Trenches

Electric cables required to connect the inverters to the on-site substation (i.e. AC cables) within the boundaries of the Humansrus Solar 3 Solar development area will be installed underground, **within or parallel to the internal road network and/or paths between the panel rows**, as far as possible. Please refer to the SDP included in **Appendix A** showing all AC cabling running parallel to the internal roads. There will also be limited trenching associated with the DC cabling (although the majority of this will be aboveground – mounted to the panel arrays.)

Cable trench excavation, cable laying and backfill must be carried out in a systematic and continuous operation, **minimising the length of trench open at any one time** in order to reduce the risk of runoff. Cable trenches must be backfilled in such a manner as to prevent the trench from acting as a ditch or a conduit for water flow. In this regard, cable trenches, as with the internal road network, should follow the contours of the land as far as possible.

The following measures must be implemented by the contractor:

- Trenching shall be kept to a minimum through the use of single trenches for multiple service provision (including communication cabling and AC cabling in the same trenches);
- The planning and selection should be done in approximation to the SDP and cognisance shall be given to minimising the potential for soil erosion;
- Trench routes with permitted working areas shall be clearly defined and marked with prior to excavation;
- The stripping and separation of topsoil and subsoil shall occur as stipulated by the ER. Soil shall be stockpiled for use as backfilling as directed by the ER with input from the ECO;
- Trench lengths shall be kept as short as practically possible before backfilling and compacting;
- Trenches shall be backfilled to the same level as (or slightly higher to allow for settlement) the surrounding land surface to minimise erosion. Excess soil shall be stockpiled in an area approved by the ER with input from the ECO;
- Stockpiled topsoil must be replaced at the top of excavated trenches; and
- The ER with input from the ECO may require the planting of additional vegetation along trench routes in order to speed up rehabilitation (particularly in areas that may be prone to erosion).
- Open trenches must be inspected daily for faunal entrapment (small mammals and reptiles). These are to be removed before backfilling of the trenches.

6.6 Management of archaeological resources

Should any archaeological and/or paleontological remains, including (but not limited to) fossil bones, fossil shells, coins, indigenous ceramics, colonial ceramics, marine shell heaps, stone artefacts, bone remains, rock art, rock engravings and any antiquity be discovered during construction, the ECO should safeguard these (preferably *in situ*) and report the find immediately to the South African Heritage Resources Council (SAHRA) and the Northern Cape Heritage Resources Authority (NCHRA), so that they are not disturbed further until the necessary guidance and approval have been obtained and the appropriate action (e.g. recording, sampling or collection) can be taken by a professional archaeologist or palaeontologist.

6.7 Noise Management

Although the proposed development is located outside of an urban area, the following noise management requirements are applicable to the construction phase of the Humansrus Solar 3 PV Facility due to its proximity to farm homesteads:

- It is recommended that noise generation be kept to a minimum and that construction activities be confined to normal working hours (08:00 - 17:00 on workdays). Should the Contractor / Engineer wish to deviate from these work hours, this must be discussed during the Pre-Construction / Initial Environmental Compliance Workshop with the ECO and recorded in the necessary Method Statements;
- Provide baffle and noise screens on noisy machines as necessary;
- Provide absorptive linings to the interior of engine compartments;
- Ensure machinery is properly maintained (fasten loose panels, replace defective silencers);
- Switch off machinery immediately when not in use; and
- Reduce impact noise by careful handling.

The Contractor shall be responsible for compliance with the relevant legislation with respect to noise *inter alia* Section 25 of ECA (73 of 1989) and standards applicable to noise nuisances in the Occupational Health and Safety Act (No. 85 of 1993).

6.8 Dust Control & Management

Every effort to minimize dust pollution on the site must be undertaken. The contractor must implement the following measures with regards to the management of dust on site:

The most important dust control measure is achieved by maintaining as much of the vegetative cover as possible (the method of securing panels with minimal excavations supports this measure). The recommendations made with regards to the demarcation of no-go areas are important in this regard.

- Construction vehicles must adhere to speed limits and minimization of haul roads must be implemented;
- During dry, dusty periods haul roads should be kept dampened to prevent excess dust. No potable water may be used for damping haul roads;
- All vehicles used to deliver or remove loose material (sand, soil, gravel etc.) to and from site must be covered with a 60% shade cloth to avoid dust blowing from the vehicle.
- As an alternative, products such as Road Environment Dust Suppressants (REDS) would be recommended in order to minimize the use of water to control dust pollution. This is to be determined by the ECO during construction as required; and
- Exposed stockpile materials must be adequately protected against wind (covered), and should be sited in consideration of the prevailing wind conditions.

Apart from those measures detailed above, the following additional measures must be implemented:

- Dust nuisances shall comply with the applicable standards according to the Occupational Health and Safety (Act No. 85 of 1993). The contractor shall be solely responsible for the control of dust arising from the contractor's operations and for any costs against the Employer for damages resulting from dust;
- The contractor shall take all reasonable measures to minimise the generation of dust as a result of construction activities to the satisfaction of the Engineer's Representative (ER);
- Removal of vegetation shall be avoided until such time as soil stripping is required and similarly exposed surfaces shall be re-vegetated or stabilised as soon as is practically possible;
- Excavation, handling and transport of erodible materials shall be avoided under high wind conditions or when a visible dust plume is present;
- During high wind conditions the site manager, with input from the ECO, must evaluate the situation and make recommendations as to whether dust damping measures are adequate, or whether work should cease altogether until the wind speed drops to an acceptable level.
- Where possible, soil stockpiles shall be located in sheltered areas where they are not exposed to the erosive effects of the wind. Where erosion of stockpiles becomes a problem, erosion control measures shall be implemented at the discretion of the site manager.
- Vehicle speeds shall not exceed 40km/h along dust roads or 20km/h when traversing unconsolidated and non-vegetated areas.
- Appropriate dust suppression measures shall be used when dust generation is unavoidable, e.g. dampening with water or use of REDS, particularly during prolonged periods of dry weather in summer. Such measures shall also include the use of temporary stabilising measures (e.g. chemical soil binders, straw, brush packs, clipping etc.).
- Straw stabilisation shall be applied at a rate of one bale per 10m² and harrowed into the top 100mm of top material for all completed earthworks (i.e. all those areas that are not hard surfaced as part of the Solar Facility). This is only relevant to areas disturbed through the construction activities (such as cable trenches) and not areas where vegetation remains intact.
- Should water be used for dust suppression on gravel roads, it must be of a quality compliant with the General Special Effluent Standards (31/03/2009): Temperature: max.25⁰C, pH: between 5.5 & 7.5 and conductivity: not be increased more than 15% above the intake water &

not exceed 250 milli-Siemens per metre (determined at 25°C). The water used for dust suppression must be sourced from a licenced resource.

6.9 Security Fencing

During construction it may be necessary to fence in the Contractor's Site Camp (to avoid theft of construction equipment and materials) and the PV Laydown Area/s (to avoid theft of the solar panels and associated infrastructure). These temporary fencing will be restricted to these areas and be removed at the end of the construction phase. The completed solar facility will be fenced with a permanent perimeter electrified fence in order to prevent theft of infrastructure during operation. Recommendations made by the ecologist applicable to the erection of this permanent fence are as follows:

- The fencing should be constructed in manner which allows for the passage of small and medium sized mammals, at least at strategic places, such as along drainage lines or other areas of dense vegetation. Steel palisade fencing (20cm gaps minimum) is a good option in this regard as it allows most medium-sized mammals to pass between the bars, but remains an effective obstacle for humans. Alternatively, the lowest strand or bottom of the fence should be elevated to 15 cm above the ground at least at strategic places to allow for fauna to pass under the fence.
- Electrified strands should not be within 20cm of the ground, because tortoises retreat into their shells when electrocuted and eventually succumb from repeated shocks.
- Only the facility itself should be fenced-off.
- Any security lighting associated with the fencing should be kept to a minimum and be of the low-UV emitting kind that attracts fewer insects.
- The final fencing plan should be submitted to the ECO for comments and approval.

6.10 Blasting

Due to the fact that the PV panel mountings will be drilled / rammed into the earth and will thus not require extensive excavation for foundations, it is therefore highly unlikely that blasting will be required. Should blasting be required for whatever reasons, the following measures must be implemented:

- No blasting may take place within 50m of a borehole without approval of a suitably qualified engineering geologist. Preventative mitigation actions could include installing PVC casing and screens in potentially affected boreholes before blasting, while damaged boreholes will have to be re-drilled (this scenario is however highly unlikely, as blasting will probably not take place);
- A current and valid authorisation shall be obtained from the relevant authorities and copied to the ER prior to any blasting activity;
- A method statement shall be required for any blasting related activities;
- All laws and regulations applicable to blasting activities shall be adhered to at all times;
- A qualified and registered blaster shall supervise all blasting and rock splitting operations at all times;
- The contractor shall ensure that appropriate pre-blast monitoring records are in place (i.e. photographic and inspection records of structures in close proximity to the blast area);
- The contractor shall allow for good quality vibration monitoring equipment and record keeping on site at all times during blasting operations;
- The contractor shall ensure that emergency services are notified, in writing, a minimum of 24 hours prior to any blasting activities commencing on site;
- The contractor shall take necessary precautions to prevent damage to special features and the general environment, which includes the removal of fly-rock. Environmental damage caused

by blasting / drilling shall be repaired at the contractor's expense to the satisfaction of the ER and the ECO;

- The contractor shall ensure that adequate warning is provided immediately prior to all blasting. All signals shall also be clearly given;
- The contractor shall use blast mats for cover material during blasting. Topsoil may not be used as blast cover;
- During demolition, the contractor shall ensure, where possible, that trees in the area are not damaged;
- Appropriate blast shaping techniques shall be employed to aid in the landscaping of blast areas, and a method statement to be approved by the ER, shall be required in this regard; and
- **At least one week prior to blasting, the relevant occupants/owners of surrounding land shall be notified by the contractor and any concerns addressed.** Buildings within the potential damaging zone of the blast shall be surveyed, preferably with the owner present and any cracks or latent defects pointed out and recorded either using photographs or video. Failing to do so shall render the contractor fully liable for any claim of whatsoever nature, which may arise. The contractor shall indemnify the employer in this regard.

6.11 Ramming Operations

It is envisioned that ramming will be the preferred method of installing the panel support structures. The following measures must be implemented in this regard. Please refer to the engineering report in Annexure E9 of the EIAR for further detail in this regard.

- The contractor shall submit a method statement detailing his proposals to prevent pollution (from hydraulic fluids, fuel or oil leaks) during ramming operations. This shall be approved by the ER (with input from the ECO) prior to the onset of any ramming operations;
- The contractor shall take all reasonable measures to limit dust generation as a result of ramming operations (also see Section 6.8 addressing management of dust);
- Noise and dust nuisances shall comply with the applicable standards according to the Occupational Health and Safety (Act No. 85 of 1993);
- Any areas or structures damaged by the ramming and associated activities shall be rehabilitated by the contractor to the satisfaction of the ER with input from the ECO.

6.12 Stormwater, Erosion and Wastewater Management

The Stormwater, Erosion and Wastewater Management Plan as compiled by AEP (Attached in **Appendix B**) forms an integral part of this EMP and must be adopted and implemented by the holder of the EA.

Over and above the requirements in the Stormwater management plan, the following requirements/recommendations must be considered/implemented for stormwater management and erosion control (as well as those detailed under Topsoil Handling (Section 6.2), Cable Trenching (Section 6.5) and Dust Control & Management (Section 6.8) above, as well as Protection of Hydrological Resource (Section **Error! Reference source not found.**) and the Rehabilitation Plan (**Appendix E**):

- Particularly near the **drainage lines on the property** - precautions should be taken to avoid excessive disturbance and re-vegetation should take place as soon as possible after construction to avoid water and wind erosion.
- Wherever possible, roads and tracks should be constructed so as to **run along land contours**.
- All roads and tracks running down the slope must have **water diversion structures** present to redirect runoff and dissipate the energy of the water so as to reduce erosion potential.

- Sections of the access and internal road network that are to cross the washes, should do so by way of **Low-Level-River-Crossing (LLRC) structures** (causeways or drifts).
- Any extensive cleared areas that are no longer or not required for construction activities should be **re-seeded with locally-sourced seed of locally-occurring indigenous species**. Bare areas can also be packed with brush removed from other parts of the site to encourage natural vegetation regeneration and limit erosion.
- All **construction vehicles should remain on properly demarcated roads**. No construction vehicles should be allowed to drive over the vegetation except where no cleared roads are available. In such cases a single track should be used and multiple paths should not be formed.
- A **method statement** shall be developed and submitted to the engineer to deal with erosion mitigation and prevention prior to bulk earthworks operations commencing.
- The concentration of stormwater run-off must be avoided at all costs.
- All stormwater **runoff drains** alongside the access road and internal road network which may channel runoff into nearby drainages must be constructed with “erosion-proof” outlets as designed by the engineer with input from the ECO – the engineer is to determine whether formal drainage is in fact necessary.
- During construction, the contractor shall protect areas susceptible to erosion by installing **necessary temporary and permanent drainage works**, as well as anti-erosion measures in areas susceptible to erosion (the washes and drainage line) as soon as possible and by taking other measures necessary to prevent the surface water from being concentrated in streams and from scouring the slopes, banks or other areas.
- Any **erosion channels** that develop during the construction period or during the vegetation establishment period shall be backfilled and compacted and the areas restored to a proper condition.
- The principles of **sustainable urban drainage systems** should be followed for all panel footings and hard surfaces, namely:
 - the runoff should not be concentrated by piped/trenched systems or similar, and
 - runoff should preferably be directed towards soak-aways or depressions in the ground.
- No goods, building material or equipment shall be stored in proximity to the washes / drainage lines.
- Protective measures must be installed where there are possibilities of surface water sheet flow causing erosion (compacted areas etc.).
- **Stabilisation of cleared areas to prevent and control erosion** shall be actively managed. The method of stabilisation shall be determined in consultation with the ECO and the ER. Consideration and provision must be made for the following methods (or a combination thereof):
 - Brush cut packing and/or mulch or chip cover;
 - Straw stabilising;
 - Watering;
 - Re-vegetation and/or sodding;
 - Hand seed-sowing and/or hydro seeding of locally-occurring indigenous species (see plant species list attached);
 - Soil binders and anti-erosion compounds;
 - Gabion bolsters & mattresses for flow attenuation;
 - Geofabric and/or hessian covers;
 - Log / pole fencing.
- Traffic and movement over stabilised areas shall be restricted and controlled and damage to stabilised areas shall be repaired and maintained to the satisfaction of the ECO.

- Anti-erosion compounds consist of all organic or inorganic material to bind soil particles together, and shall be environmentally friendly and effective products able to suppress dust and erosion. The application rate shall conform to the manufacturer's recommendations. The material used shall be approved by the ER with input from the ECO.
- During operation, regular monitoring for erosion must be undertaken (particularly in along the ephemeral washes) to ensure that no erosion problems are occurring at the site as a result of the roads and other infrastructure. All erosion problems observed should be rectified as soon as possible.
- All maintenance vehicles to remain on the demarcated roads.

In addition to the above, the following construction phase management requirements as defined in the stormwater, erosion and wastewater management plan are relevant to the construction phase.

6.12.1 Stormwater Management Measures

The study found that both of the peak flows for Humansrus 3 were below 1.1m³/s. These low values are due to the flat topography and lack of annual rainfall in the region. Therefore, it can be concluded that Humansrus 3 will have a low risk of flooding occurring during its project lifecycle.

However, the following recommendations are proposed in order to further reduce this risk and to also mitigate potential negative impacts from occurring on the surrounding region.

- Preventative measures are to be implemented in order to disrupt the environment as little as possible. Disruption of all existing contours and vegetation must be kept to a minimum. Where these disruptions have to occur, provisions must be made in order to guide the rainwater away from the facility, or to increase vegetation further up slope in order to decrease run-off.
- All access roads require proper drainage systems in place in order to channel water away to a culvert.
- All excavations and drainage channels must be adequately protected against potential erosion.
- Mitigation measures must be provided by all personnel that negatively affect the quality of the ground water.
- Wash water used must be chemical free or water-free options must be implemented (if feasible).
- All sewage created on site must be contained and eventually removed from site.
- All development within the watercourses must be constructed in a manner that will not disrupt the natural drainage pattern of the surrounding area.

6.12.2 Access Road

The site access road, that is to be constructed off the R357, is to be designed with road drainage systems in order to prevent excessive surface run-off. The following procedures can be implemented in order to reduce this:

- Kerbs: concrete structures used in order to divert run-off along a channel. Figure 5 shows cross section details of some typical kerbs.
- Berms: small ridges placed on top of an embankment to prevent erosion by run-off down the side of the embankment.

The outlets placed in kerbs and berms must be placed correctly in order to ensure satisfactory operation of drainage systems.

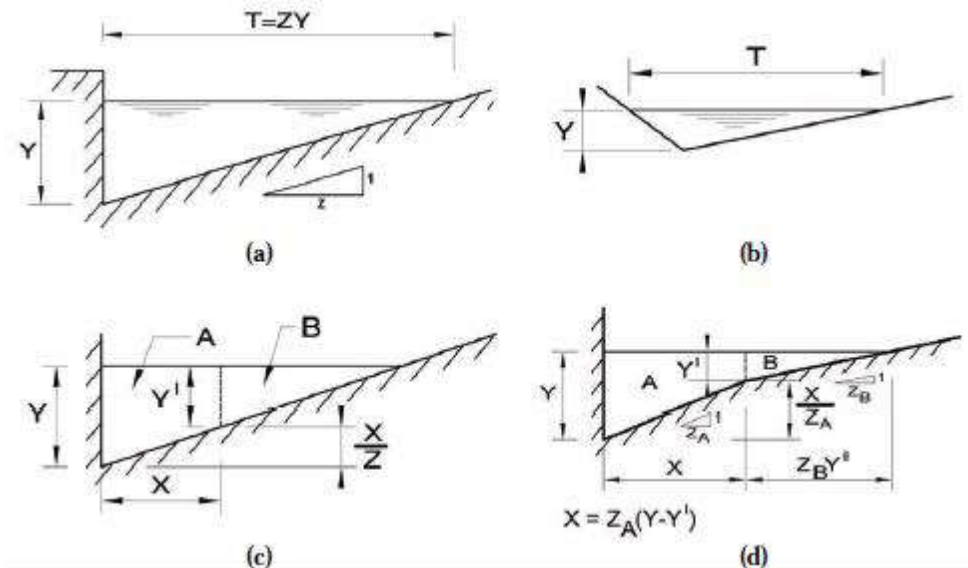


Figure 5: Cross section of typical kerbs (AEP, 2016)

6.12.3 Internal Road Network

The internal road network must be designed in order to avoid crossing of the watercourses as much as possible. However, where crossing of this watercourse will occur, the following method is proposed for construction.

- Remove all plants growing within the construction footprint;
- Excavate topsoil and store separately;
- Excavate the strip footings for the foundations of the cut-off walls;
- Cast concrete walls and place gabion mattresses;
- Build road layer; and
- Replace topsoil and plants.

In the event of rainfall occurring during construction within the watercourse, civil works within the watercourse will be stopped and temporary erosion protection measures put in place.

6.12.4 Discharge Channels

Discharge channels are open waterways with longitudinal slopes of less than 10%. These channels must be implemented in order to redirect water away from the facility and towards the natural drainage lines that would have originally received the water from the area. Figure 8 shows a stepped channel, this channel design is used to dissipate energy as the water flows downhill.



Figure 6: Stepped energy dissipater channel (AEP, 2016)

6.12.5 Installation of PV arrays

The installation of all of PV array must adhere with materials that are able to withstand the local climate constraints of the region. The following method for installation of PV array within the watercourses on site is recommended:

- Establish internal road network prior to the civil works in all watercourses and restrict vehicle access to these roads;
- Demarcate the construction footprint in watercourses and prevent access by workers to areas outside of the construction footprint in these areas;
- Undertake work during a dry season of the watercourses;
- Remove plants growing within the construction footprint;
- Excavate topsoil and store separately;
- Install foundation posts in areas where subsurface areas are hard, or
- Install poles with a length of 170 – 240 mm and a width of 50 – 60 mm with a percussion hammer;
- Assemble mechanical structure on top of poles;
- Mount and electrically connect PV modules on top of the tracking platforms; and
- Replace topsoil and plants.

In the event of rainfall occurring during construction within the watercourse, civil works within the watercourse will be stopped and temporary erosion protection measures put in place.

6.12.6 Internal reticulation & trenches

Where solar PV array is constructed within the watercourses, trenches will need to traverse these features for installation of cabling. Therefore, it is proposed that the followed method be followed for installation of all reticulation:

- Remove plants growing within the construction footprint;

- Excavate topsoil and store separately;
- Excavate subsurface material;
- Install electrical cabling in trenches;
- Replace excavated material; and
- Replace topsoil and rescued plants.

In the event of rainfall occurring during construction within the watercourse, civil works within the watercourse will be stopped and temporary erosion protection measures put in place.

6.12.7 Washwater Management

Washwater management is detailed under the operational requirements in Section 7.6.2 of the EMPr below.

6.12.8 Sewage Disposal

Sewage disposal management is detailed under the operational requirements in Section 7.3 of the EMPr below.

6.13 Fire Management and Protection

As mentioned above in Section 3.6 above, it is the landowner's responsibility to develop and maintain firebreaks as well as be sufficiently prepared to combat veld fires.

The solar development site is arid, with sparse vegetation cover and fires are not a natural phenomenon in the area. However, under exceptional circumstances, such as following years of very high rainfall, sufficient biomass may build up to carry fires. Therefore, management of plant biomass within the site should be part of the management of the facility. Grazing by livestock is the simplest and most ecologically sound way to manage plant biomass and is recommended the preferred method to manage plant biomass at the site. Alternative management practices can include brush-cutting. Utilisation of non-selective herbicides for the management of biomass is prohibited on site.

The following points must however be considered with regards to fire protection on site:

- Fires should **only be allowed within fire-safe demarcated areas** (preferably within the site camp);
- **No fuelwood collection** should be allowed on-site;
- The **total removal of all invasive alien vegetation** should take place in order to decrease the fire risk – Although there were few invasive plants identified during the environmental process, these may establish to a degree as a result of site disturbance. This must be done in accordance with the Alien Vegetation Management Plan attached in **Appendix F**;
- Cigarette butts may not be thrown in the veld, but must be disposed of correctly. The contractor, with input from the ECO, must **designate smoking areas** (in compliance with the Tobacco Products Control Amendment Act 63 of 2008) with suitable receptacles for disposal;
- In case of an emergency, the **contact details of the local fire and emergency services** must be readily available;
- Contractors must ensure that **basic firefighting equipment and suitably qualified/experienced personal** are available on site at all times, as per the specifications defined by the health and safety representative / consultant;
- The fire risk on site is a point of discussion that must take place as part of the pre-construction compliance workshop and the environmental induction training prior to commencement of construction; and
- The contractor must also comply with the requirements of the Occupational Health and Safety Act with regards to fire protection.

6.14 Sanitation During Construction

Portable chemical ablation facilities must be made available for the use by construction staff for the duration of the construction period. The following must be implemented in this regard:

- Toilet and washing facilities must be available to the site personnel at all times;
- These facilities must be situated within the site camp and away from any washes or drainage lines;
- One toilet for every 15 personnel is required;
- The facilities must be serviced on a regular basis to prevent any overflow or spillage;
- The servicing contractor must dispose of the waste in an approved manner (e.g. via the municipal waste water treatment system);
- The ECO must be provided with the service providers' details and the service schedule for the site;
- The toilets should be secured to ensure that they do not blow over in windy conditions;
- All toilet facilities must be removed from site on completion of the contract period, and;
- Should the construction period be interrupted by a builders break, the toilets should be emptied prior to the break.

6.15 Fuel Storage

The above ground storage of fuel is subject to authorization in terms of the National Environmental Management Act (NEMA EIA regulations) if more than 30m³ is stored on site at any one time.

Should a temporary storage of hazardous or toxic materials / liquids (chemicals, fuels, lubricants and oils) be required, the Contractor must ensure that he/she complies with legislation and that the following measures are in place:

- Temporary fuel storage must take place within the contractors site camp in an area approved by the ECO;
- No storage of fuel may take place on any other portion of the site;
- All hazardous materials should be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel and oil spills that occur at the site should be cleaned up immediately in the appropriate manner, as related to the nature of the spill.
- Mobile fuel units used to refuel plant on site must make use of drip trays when refuelling;
- Storage facilities may not be located within 60m of a the on-site drainage lines or where there is a potential for any spilled fuel to enter a watercourse or groundwater;
- Fuel storage facilities should be located on flat ground. No cut and fill should take place immediately on or adjacent to fuel storage areas;
- All storage tanks should be double lined and be ISO 9001 certified;
- All storage tanks must be enclosed by bund walls;
- Bund walls must be constructed to contain at least 110% of the total capacity of the storage tanks;
- Bund walls must be constructed of impermeable material or lined to ensure that petroleum products cannot escape;
- A suitable material should be placed in the base of the bund walls to soak up any accidental spillages;
- The tanks should be locked and secured when not in use;
- Automatic shut-off nozzles are required on all dispensing units;
- Storage tanks should be drained within one week of completion of activities (only unused fuel can be used by the contractor on other work sites or returned to the supplier). If the construction program extends over the builders shutdown, the contractor must ensure that storage tanks are emptied prior to this period;

- All storage tanks, containers and related equipment should be regularly maintained to ensure safe storage and dispensing of material. The Engineer is to sign off on the condition and integrity of the storage tanks;
- Defective hoses, valves and containment structures should be promptly repaired;
- Vehicle and equipment fuelling should be undertaken on a hard impermeable surface, over drip pans or bund walls to ensure spilled fuel or toxic liquids is captured and cleaned up, and;
- The area must be totally rehabilitated on completion of the contract and all contaminated material must be carefully removed and disposed of at a licensed dumping site for that purpose.
- Spill kits must be made available on-site for the clean-up of spills.

6.16 Construction Waste Management

An integrated waste management approach should be adopted on site.

Only approved waste disposal methods are allowed. The Contractor shall ensure that all site personnel are instructed in the proper disposal of all waste. The Contractor shall ensure that sufficient disposal facilities are available.

Recycling must be encouraged on site and recycling bins must be provided and clearly marked. It is recommended that local community leaders are contacted to identify groups or individuals who may benefit from the disposal of recyclable material and scrap metal.

Disposal of all waste materials must be done at suitable facilities. No dumping of any waste material on or off site is permitted.

The disposal of all general waste must take place at a landfill licensed in terms of Section 20 of the Environmental Conservation Act, 1989 (Act No. 73 of 1989) and the National Environmental Management: Waste Act, 2008 (NEM:WA, Act No 59 of 2008).

6.16.1 Solid Waste

The Contractor shall ensure that all facilities are maintained in a neat and tidy condition and the site shall be kept free of litter. Measures must be taken to reduce the potential for litter and negligent behaviour with regard to the disposal of all refuse. At all places of work the Contractor shall provide litterbins, containers and refuse collection facilities for later disposal.

Solid waste may be temporarily stored on site in a designated area approved by the ECO prior to collection and disposal. Solid waste must be removed on a weekly basis to a licensed waste disposal site. Recyclable waste should be recycled if at all possible.

Waste storage containers shall be covered, tip-proof, weatherproof and scavenger proof. The waste storage area shall be fenced off to prevent wind-blown litter.

No burning, on-site burying or dumping of waste shall occur. Used (empty) cement bags shall be collected and stored in weatherproof containers to prevent windblown cement dust and water contamination. Used cement bags may not be used for any other purpose and shall be disposed of on a weekly basis via the solid waste management system.

6.16.2 Construction Rubble and Waste

All construction rubble must be disposed of at an approved site established and registered for this purpose (no construction rubble may be spoiled anywhere on site). NO construction rubble may be used as fill in landscaping or any other areas on site.

6.16.3 Scrap Metal

Recycling of scrap metal is recommended. Scrap metal must be disposed of off-site at suitable facilities (e.g. municipal dump registered for this purpose).

6.16.4 Hazardous Waste

All hazardous waste (including chemicals, bitumen, fuel, lubricants, oils, paints etc.) shall be disposed of at an approved / registered hazardous-waste landfill site. The Contractor shall provide disposal certificates to the ECO.

Used oil and grease must be removed from site to an approved used oil recycling company. The ROSE Foundation (Recycling Oil Saves the Environment), is a national non-profit organization established to promote and encourage the environmentally responsible management of used oils and related waste in South Africa. The contact details for the ROSE foundation are included in **Appendix M**.

Under NO circumstances may any hazardous waste be spoiled on the site.

Where possible, the maintenance of construction and delivery vehicles should take place off-site.

6.17 Theft and Other Crime

An increase in crime during the construction phase is often a concern. In the case of the Humansrus Solar 3 Solar PV Facility, this is likely to be negligible due to the extremely remote nature of the site. Theft and other crime associated with construction sites is not only a concern for surrounding residents, but also the developer and the contractor. Considering this, contractors need to be proactive in order to curtail theft and crime on and resulting from the construction site. It is recommended that the contractor develop a **jobsite security plan** prior to commencement of construction. This jobsite security plan should take into account protection of the construction site from both internal and external crime elements, as well as the protection of surrounding communities from internal crime elements. All incidents of theft or other crime should be reported the South African Police Service, no matter how seemingly insignificant. A copy of the **jobsite security plan should be included in the first environmental control report to be submitted to the competent authority**.

It is likely that the Contractor's Site Camp and the PV Laydown area/s will be fenced with a temporary fence to avoid theft during construction. Additional security measures on the main perimeter fence will include cctv camera surveillance and security guards.

The following considerations are relevant in this regard:

- All portable construction equipment and material must be locked away within the Contractor's Site Camp overnight and during holiday periods;
- Fuel storages tanks must be locked when not in use;
- All unassembled / un-installed PV materials must be locked within the fenced Laydown areas overnight and during holiday periods.
- The minimum amount of lighting should be used at night and this should be of the low-UV emitting kind that attracts less insects.

6.18 Plant Rescue and Protection.

A plant rescue and protection plan is included in **Appendix D** and forms an integral part of this EMP.

The following environmental management requirements have been summarised from this plan.

6.18.1 Identification of species of conservation concern

The ToPS (Threatened and Protected Species) regulations provide for the regulation of activities which may directly or indirectly impact threatened and protected species. Such species are identified under NEMBA as well as by the National Red Data List of Plants. At a provincial level, the Northern Cape Nature Conservation Act (2009) also provides lists of species which are protected within the province. Species listed under the National Red Data List of Plants as well as those protected under the provincial legislation must be specified on permit applications required for site clearing. The only protected species observed at the site were *Boscia foetida* and *Titanopsis calcarea*, but other protected species that have been observed in the wider area which may be present at the site includes *Hoodia gordonii*, *Hoodia flava*, *Lithops halli*, *Pachypodium succulentum*, *Mestoklema tuberosum*, *Aloe claviflora* and *Avonia ustulata*. The presence of these as well as any other protected species would need to be confirmed during a preconstruction walk-through of the facility.

6.18.2 Mitigation & avoidance options

Where listed plant species fall within the development footprint and avoidance is not possible, then it may be possible to translocate the affected individuals outside of the development footprint. However, not all species are suitable for translocation as only certain types of plants are able to survive the disturbance. Suitable candidates for translocation include most geophytes and succulents. Although there are exceptions, the majority of woody species do not survive translocation well and it is generally not recommended to try and attempt to translocate such species. Recommendations in this regard would be made following the walk-through of the facility footprint before construction, where all listed and protected species within the development footprint will be identified and located.

6.18.3 Rescue and protection requirements

The following requirements are required for the construction phase of the development lifecycle.

- ECO to monitor vegetation clearing at the site. Any deviations from the plans that may be required should first be checked for listed species by the ECO and any listed species present which are able to survive translocation should be translocated to a safe site.
- Any listed species observed within the development footprint that were missed during the preconstruction plant sweeps should be translocated to a safe site.
- Many listed species are also sought after for traditional medicine or by collectors and so the ECO should ensure that all staff attend environmental induction training in which the legal and conservation aspects of harvesting plants from the wild are discussed.
- The ECO should monitor construction activities in sensitive habitats such as near rivers and wetlands carefully to ensure that impacts to these areas are minimized.

6.19 Vegetation Clearing

The objective of mitigation for any development is to firstly avoid and minimise impacts where possible and where these cannot be completely avoided, to compensate for the negative impacts of the development on vegetation and animal habitats, and to maximise re-vegetation and rehabilitation of disturbed areas. Some loss of vegetation is an inevitable consequence of the construction of the Humansrus Solar 3 Solar PV Facility and vegetation clearing required for the PV panel laydown area, roads, buildings etc. could impact listed plant species, as well as high-biodiversity plant communities. Vegetation clearing will also lead to habitat loss for fauna and potentially the loss of sensitive faunal species, habitats and ecosystems.

The following recommendations apply to vegetation clearing activities for the solar facility:

- Preconstruction walk-through of the facility in order to locate species of conservation concern that can be translocated as well as comply with the Northern Cape Nature Conservation Act and DENC/DAFF permit conditions.
- Vegetation clearing to commence only after walk through has been conducted and necessary permits obtained.
- ECO to provide supervision and oversight of vegetation clearing activities within sensitive areas such as near drainage areas.
- Vegetation clearing to be kept to a minimum. No unnecessary vegetation to be cleared.
- Temporary lay-down areas should be located within previously transformed areas or areas that have been identified as being of low sensitivity. These areas should be rehabilitated after use.
- A low cover of vegetation should be left wherever possible within the construction footprint to bind the soil, prevent erosion and promote post-disturbance recovery of an indigenous ground cover.

6.20 Animal Rescue & Protection

Any animals (including snakes, tortoises and lizards) directly threatened by the clearing or construction activities should be removed to a safe location outside of the construction area by the ECO or other suitably qualified/experienced person.

All trenches and open excavations should be inspected on a daily basis (first thing in the morning) for any trapped fauna (particularly small mammals and reptiles). These should be removed to a safe location outside of the construction area by the ECO or other suitably qualified / experienced person.

It must be noted the **collection, hunting or harvesting of any plants or animals** at the site is **strictly forbidden**, and thus any person found undertaking any of these actions will be considered guilty of committing a crime. Any incidents of such crimes on nature must be reported to the ECO immediately.

The following specialist mitigations must be implemented:

- Preconstruction walk-through of the facility in order to locate species of conservation concern that can be translocated as well as comply with the Northern Cape Nature Conservation Act and DENC/DAFF permit conditions.
- All personnel should undergo environmental induction with regards to fauna and in particular awareness about not harming or collecting species such as snakes, tortoises and owls which are often persecuted out of superstition.
- Any fauna threatened by the construction activities should be removed to safety by the ECO or appropriately qualified environmental officer.
- All construction vehicles should adhere to a low speed limit to avoid collisions with susceptible species such as snakes and tortoises.
- If trenches need to be dug for water pipelines or electrical cabling, these should not be left open for extended periods of time as fauna may fall in and become trapped in them. Trenches which are standing open should have places where there are soil ramps allowing fauna to escape the trench.

6.21 Re-Vegetation & Habitat Restoration

A re-vegetation and rehabilitation plan is attached in **Appendix E** and is deemed to form an integral part of this EMP.

Certain of the overarching principles in this section are also contained in other sections of this EMPR, but have been reiterated here to ensure easy referencing.

6.21.1 Topsoil management

Effective topsoil management is a critical element of rehabilitation, particularly in arid and semi-arid areas where soil properties are a fundamental determinant of vegetation composition and abundance. Although some parts of the site consist of exposed bedrock, most parts of the site have at least some topsoil. Where any excavation or topsoil clearing is required, the topsoil should be stockpiled and later used to cover cleared and disturbed areas once construction activity has ceased.

- Effective topsoil management is a critical element of rehabilitation, particularly in arid and semi-arid areas where soil properties are a fundamental determinant of vegetation composition and abundance. Although some parts of the site consist of exposed bedrock, most parts of the site have at least some topsoil. Where any excavation or topsoil clearing is required, the topsoil should be stockpiled and later used to cover cleared and disturbed areas once construction activity has ceased.
- Topsoil is the top-most layer (0-25cm) of the soil in undisturbed areas. This soil layer is important as it contains nutrients, organic matter, seeds, micro-organisms, fungi and soil fauna. All these elements are necessary for soil processes such as nutrient cycling and the growth of new plants. The biologically active upper layer of the soil is fundamental in the maintenance of the entire ecosystem.
- Topsoil should be retained on site in order to be used for site rehabilitation. The correct handling of the topsoil is a key element to rehabilitation success. Firstly it is important that the correct depth of topsoil is excavated. If the excavation is too deep, the topsoil will be mixed with sterile deeper soil, leading to reduction in nutrient levels and a decline in plant performance on the soil.
- Wherever possible, stripped topsoil should be placed directly onto an area being rehabilitated. This avoids stockpiling and double handling of the soil. Topsoil placed directly onto rehabilitation areas contains viable seed, nutrients and microbes that allow it to revegetate more rapidly than topsoil that has been in stockpile for long periods.
- If direct transfer is not possible, the topsoil should be stored separately from other soil heaps until construction in an area is complete. The soil should not be stored for a long time and should be used as soon as possible. The longer the topsoil is stored, the more seeds, micro-organisms and soil biota are killed.
- Ideally stored topsoil should be used within a month and should not be stored for longer than three months. In addition, topsoil stores should not be too deep, a maximum depth of 1m is recommended to avoid compaction and the development of anaerobic conditions within the soil.

6.21.2 Mulching

- Mulching is the covering of the soil with a layer of organic matter of leaves, twigs, bark or wood chips, usually chopped quite finely. The main purpose of mulching is to protect and cover the soil surface as well as serve as a source of seed for revegetation purposes.
- During site clearing the standing woody vegetation should not be cleared and burned, removed or mixed with the soil, but should be cleared separately. The cleared vegetation should be stockpiled and used whole or shredded by hand or machine to protect the soil in disturbed areas and promote the return of indigenous species. Where there is a low shrub or grass layer, this material can be cleared and mixed as part of the topsoil as this will aid revegetation and recovery when it is reapplied.

- Mulch should be harvested from areas that are to be denuded of vegetation during construction activities, provided that they are free of seed-bearing alien invasive plants;
- No harvesting of vegetation may be done outside the area to be disturbed by construction activities;
- Brush-cut mulch should be stored for as short a period as possible, and seed released from stockpiles can also be collected for use in the rehabilitation process.

6.21.3 Seeding

In some areas the natural regeneration of the vegetation may be poor and the application of seed to enhance vegetation recovery may be required. Seed should be collected from plants present at the site and should be used immediately or stored appropriately and used at the start of the following wet season. Seed can be broadcast onto the soil, but should preferably be applied in conjunction with measures to improve seedling survival such as scarification of the soil surface or simultaneous application of mulch.

- Indigenous seeds may be harvested for purposes of re-vegetation in areas that are free of alien or invasive vegetation, either at the site prior to clearance or from suitable neighbouring sites;
- Seed may be harvested by hand and if necessary dried or treated appropriately
- Seed gathered by vacuum harvester, or other approved mass collection method, from suitable shrubs or from the plant litter surrounding the shrubs must be kept apart from individually harvested seed;
- No seed of alien or foreign species should be used or brought onto the site.

Appropriate species for use at the site for rehabilitation and revegetation include the following:

Grasses:

- *Fingerhuthia africana*
- *Stipagrostis ciliata* & *S.obtusa*
- *Eragrostis lehmanniana*
- *Cynodon dactylon*

Shrubs

- *Pentzia incana* & *P.globosa*
- *Ruschia spinosa*
- *Rosenia humilis*

6.21.4 Transplants

Also refer to the plant rescue and protection plan in **Appendix D** and the section above for further details on plant rescue.

Where succulent plants are available or other species which may survive translocation are present, individual plants can be dug out from areas about to be cleared and planted into areas which require revegetation. This can be an effective means of establishing indigenous species quickly, this is however unlikely to be a viable option at the current site as there are few suitable species present, but if the conditions are wet then most species have some probability of surviving. In addition, even if transplanted plants do not survive, they provide shelter for seedlings and more favourable microclimates.

- Plants for transplant should only be removed from areas that are going to be cleared.
- Perennial grasses, shrubs, succulents and geophytes are all potentially suitable candidates for transplant.

- Transplants should be placed within a similar environment from where they came in terms of aspect, slope and soil depth.
- Transplants must remain within the site and may not be transported off the site.
- Some species can also grow from cuttings and branches of many succulent species can be rooted in the field.

6.21.5 Use of soil savers

On steep slopes or areas where seed and organic matter retention is low, it is recommended that soil savers are used to stabilise the soil surface. Soil savers are man-made materials, usually constructed of organic material such as hemp or jute and are usually applied in areas where traditional rehabilitation techniques are not likely to succeed.

- In areas where soil saver is used, it should be pegged down to ensure that it captures soil and organic matter flowing over the surface.
- Soil saver may be seeded directly once applied as the holes in the material catch seeds and provide suitable microsites for germination. Alternatively, fresh mulch containing seed can be applied to the soil saver.
- The site is however generally flat or gently sloping and it is not likely that there would be disturbance at the site which requires the use of soil savers, but may be useful in situations where wind erosion is problematic.

6.21.6 General recommendations

Progressive rehabilitation is an important element of the rehabilitation strategy and should be implemented where feasible.

- Progressive rehabilitation is an important element of the rehabilitation strategy and should be implemented where feasible.
- Once revegetated, areas should be protected to prevent trampling and erosion.
- No construction equipment, vehicles or unauthorised personnel should be allowed onto areas that have been vegetated.
- Where rehabilitation sites are located within actively grazed areas, they should be fenced.
- Fencing should be removed once a sound vegetative cover has been achieved.
- Any runnels, erosion channels or wash ways developing after revegetation should be backfilled and consolidated and the areas restored to a proper stable condition.

6.21.7 Concluding Statement

- The most cost-effective way to reduce the cost and effort for rehabilitation is to reduce and minimize the disturbance footprint. If the panel arrays can be constructed without clearing the site, then the amount of rehabilitation required would be low and any cleared areas would quickly become revegetated.
- Where the vegetation is too tall for construction, a brush-cutter or tractor driven mower can be used to cut the bush down to a lower height, this is preferable to wholesale clearing as it leaves the soil surface intact.
- The solar panels and roads within the development represent hard surfaces that will generate a lot of runoff. As a result, effective runoff management is essential as is an effective vegetation cover to prevent widespread erosion across the site. As the majority of the site is gently sloping, the risk of erosion is moderate and retaining vegetation cover between the rows of panels during construction is strongly recommended as a general strategy to reduce the overall management requirements of the facility.

- The fire risk at the site is very low as there is not sufficient cover to carry a fire and therefore, there should not be a constraint on allowing the persistence of some vegetation within the site.

6.22 Alien Plant Management Plan

An Alien Vegetation management plan is attached **Appendix F** and is deemed to form an integral part of this EMPR.

The following is summarised from this plan

6.22.1 Alien Species Presence & Abundance

The Humansrus Solar 3 PV Facility site is currently very lightly invaded by alien species. The density of alien species within the intact vegetation is generally very low and is restricted to disturbed areas around watering points and kraal sites. Within the intact vegetation, there are few alien species of significance; however, there are occasional *Prosopis glandulosa* trees present. Should the development go ahead, then this is likely to one of the major alien species requiring control at the site. Within favourable areas *Prosopis glandulosa* can become extremely dense and dominant, to the extent that livestock may be excluded from heavily invaded areas due to the dense brush that develops. This species should be cleared from the invaded area around the watering point as it is likely to remain a persistent problem if seed input into the area is high. Disturbance within the site is also likely to encourage alien plant invasion following construction and a variety of species are likely to increase and may become problematic within the site. Species that typically become problematic within PV facilities include *Salsola kali*, *Datura ferox*, *Tribulis terrestris* and *Argemone ochroleuca*. Which species become problematic depends to some extent on which species are able to colonise the site and the nature of disturbance at the site.

Table 13: List of alien species which were observed at the Humansrus Solar 3 site or which are known from the area and are likely to become established at the site following construction (Todd, 2016).

Family	Species	English name	Afrikaans name	Category
Amaranthaceae	<i>Alternanthera pungens</i>	Paperthorn	Kakiebubbeltjie	Not Listed
Amaranthaceae	<i>Amaranthus hybridus</i>	Common Pigweed	Kaapse Misbredie	Not Listed
Amaranthaceae	<i>Amaranthus viridus</i>	Slender Amaranth	Skraal Misbredie	Not Listed
Amaranthaceae	<i>Gomphrena celosioides</i>	Globe Amaranth	Mierbossie	Not Listed
Asteraceae	<i>Xanthium spinosum</i>	Spiny Cocklebur	Boetebossie	1
Chenopodiaceae	<i>Atriplex semibaccatta</i>	Australian Saltbush	Brakbossie	Not Listed
Chenopodiaceae	<i>Chenopodium album</i>	White Goosefoot	Withondebossie	Not Listed
Chenopodiaceae	<i>Salsola kali</i>	Russian Tumbleweed	Rolbossie	Not Listed
Fabaceae	<i>Prosopis glandulosa</i>	Mesquite	Heuningprosopis	2
Papaveraceae	<i>Argemone ochroleuca</i>	Mexican Poppy	Bloudissel	1
Solanaceae	<i>Datura ferox</i>	Large Thorn Apple	Groot Stinkblaar	1
Solanaceae	<i>Nicotiana glauca</i>	Wild Tobacco	Wildetabak	1
Zygophyllaceae	<i>Tribulis terrestris</i>	Dubbeltjie	Dubbeltjie	Not Listed

Additional information on these as well as the other alien species including photographs can be found on the following website: <http://www.invasives.org.za/invasive-plants.html>

6.22.2 Recommended Management Practice & Clearing Methods

- The following general principles and observations which underlie or impact the alien management plan can be made regarding the likely trajectories of vegetation change at PV facilities during and following construction:
- There is likely to be a progression of alien species presence and abundance at the PV sites over time. Initially, alien species are likely to be a significant and persistent problem due to the high levels of disturbance present at the sites following construction. Most alien species are poor competitors and the lack of indigenous vegetation cover will encourage the growth of alien species. Provided that alien species are controlled in a sensitive manner, a cover of perennial grasses is likely to become well established with a couple of years. This should discourage alien species which, with additional control, should become considerably less conspicuous within 5 years of construction. Some more competitive alien species may become established at this time and alien control strategies may need to be adapted over time to address the new problem species.
- Alien species presence will vary from year to year in terms of abundance, density and the identity of species present. This can be ascribed largely to variation in rainfall timing and amount, which will favour a different suite of species each year. Therefore, occasional outbreaks of certain species is not likely to be cause for concern, whereas a persistent high or increasing abundance of a species is indicative of a species where control may be required.
- Management practices will impact indigenous as well as alien species. The dominant management practice at the PV facilities is likely to be mowing to control vegetation height and fire risk within the facility. Regular mowing encourages the growth of low and creeping forms and discourages tall growth forms. This principle is well demonstrated by garden lawns or sports fields where most alien species or weeds in the lawn can be eradicated simply through regular mowing.
- Even without management intervention the vegetation composition of the facilities will change over time. This is due to the shading effect of the panels and the uneven distribution of runoff from the panels. So even where PV sites have not been cleared, it is likely that the vegetation beneath the panels will stabilise at a relatively low level on account of the shading effect, while the runoff at the leading edge of the arrays will encourage the presence of taller or more dense vegetation, which is problematic as shading of the panels may occur and a high plant biomass poses a fire risk.

Without being too prescriptive as the exact methods and approaches to be used, the following general management practices should be encouraged or strived for:

- Mowing excess vegetation by hand, for example with a weedeater, generates the lowest level of associated disturbance and is identified as the preferred method for vegetation control. However, this is time consuming and more mechanical means such as using a tractor with mower is also considered acceptable.
- There is a target height to which vegetation should be cut. If the vegetation is cut too low, then recovery of the grass layer will be slow and this may encourage erosion and an increase in alien invasion. On the other hand, if the vegetation is not cut low enough, then recovery will be rapid and frequent follow-up control may be required. It is recommended that the target height for vegetation after mowing should be about 10-15cm.
- The maintenance of fire-breaks around the facilities is an important safety control and the roads around the perimeter of the facility should be maintained free of vegetation. This is best achieved by manual clearing. Within the facilities themselves, some vegetation recovery along the internal roads should be considered acceptable.
- Where dense stands of alien species have established that cannot be controlled by manual means, some use of herbicides may be acceptable. However, the associated safety precautions should be taken with regards to the appropriate application methods as well as

the use of personal safety equipment (These are outlined in greater detail below). The best-practice clearing method for each species identified should be used. The preferred clearing methods for most alien species can be obtained from the DWAF Working for Water Website. <http://www.dwaf.gov.za/wfw/Control/>

- The effectiveness of vegetation control varies seasonally and this is also likely to impact alien species. Control early in the wet season will allow species to re-grow and follow-up control is likely to be required. It is tempting to leave control till late in the wet season to avoid follow-up control. However, this may allow alien species to set seed before control and hence will not contribute towards reducing alien species abundance. Therefore, vegetation control should be aimed at the middle of the wet season, with a follow-up event towards the end of the wet season. There are no exact dates that can be specified here as each season is unique and management must therefore respond according to the state and progression of the vegetation.
- Alien management is an iterative process and it may require repeated control efforts to significantly reduce the abundance of a species. This is often due to the presence of large and persistent seed banks. However, repeated control usually results in rapid decline once seed banks become depleted.
- Some alien species such as *Opuntia* (Prickly Pear) and trees such as *Prosopis* (Mesquite) are best individually pulled by hand and in the case of *Opuntia* removed from the site.
- It is expected that regular vegetation control to reduce plant biomass within the PV field will be conducted and that this will be timed so as to coincide with the critical growth phases of the most important alien species. This will significantly reduce the cost of alien management as this should contribute towards the control of the dominant alien species and additional targeted control will be required only for a limited number of species.

6.22.3 General Clearing & Guiding Principles

- Alien control programs are long-term management projects and should include a clearing plan which includes follow up actions for rehabilitation of the cleared area.
- The lighter infested areas should be cleared first to prevent the build-up of seed banks.
- Pre-existing dense mature stands ideally should be left for last, as they probably won't increase in density or pose a greater threat than they are currently.
- Collective management and planning with neighbours may be required in the case of large woody invaders as seeds of aliens are easily dispersed across boundaries by wind or water courses.
- All clearing actions should be monitored and documented to keep track of which areas are due for follow-up clearing.

6.22.4 Clearing Methods

- Different species require different clearing methods such as manual, chemical or biological methods or a combination of both.
- However care should be taken that the clearing methods used do not encourage further invasion. As such, regardless of the methods used, disturbance to the soil should be kept to a minimum.
- Fire is not a natural phenomenon in the area and fire should not be used for alien control or vegetation management at the site.
- The best-practice clearing method for each species identified should be used. The preferred clearing methods for most alien species can be obtained from the DWAF Working for Water Website. <http://www.dwaf.gov.za/wfw/Control/>

6.22.5 Use of Herbicides for Alien Control

Although it is usually preferable to use manual clearing methods where possible, such methods may create additional disturbance which stimulates alien invasion and may also be ineffective for many woody species which resprout. Where herbicides are to be used, the impact of the operation on the natural environment should be minimised by observing the following:

- Area contamination must be minimised by careful, accurate application with a minimum amount of herbicide to achieve good control.
- All care must be taken to prevent contamination of any water bodies. This includes due care in storage, application, cleaning equipment and disposal of containers, product and spray mixtures.
- Equipment should be washed where there is no danger of contaminating water sources and washings carefully disposed of in a suitable site.
- To avoid damage to indigenous or other desirable vegetation, products should be selected that will have the least effect on non-target vegetation.
- Coarse droplet nozzles should be fitted to avoid drift onto neighbouring vegetation.
- The appropriate health and safety procedures should also be followed regarding the storage, handling and disposal of herbicides.

For all herbicide applications, the following guidelines should be followed:

Working for Water: Policy on the Use of Herbicides for the Control of Alien Vegetation.



Figure 7: A dense infestation of Stinkblaar (*Datura ferox*) growing at a South African solar PV plant shortly after construction.

A large proportion of this invasion could have been avoided if the vegetation beneath the panels had not been cleared as this vegetation would have utilised the water running off the front of the panels and limited the invasion of the *Datura*.

6.22.6 Construction Phase Activities

In order to implement the alien plant management plan, a monitoring and control schedule is required to evaluate the presence and on-going control of alien plants within the facility. This provides a guideline on the frequency with which alien plants should be monitored and what perimeter are likely to be important.

Table 14: Alien vegetation management requirements during the construction phase.

Action	Frequency
The ECO is to provide permission prior to any vegetation being cleared for development.	Daily
Clearing of vegetation should be undertaken as the work front progresses –	Weekly

mass clearing should not occur unless the cleared areas are to be surfaced or prepared immediately afterwards.	
Where cleared areas will be exposed for some time, these areas should be protected with packed brush, or appropriately battered with fascine work. Alternatively, jute (Soil Saver) may be pegged over the soil to stabilise it.	Weekly
Cleared areas that have become invaded can be sprayed with appropriate herbicides provided that these are such that break down on contact with the soil. Residual herbicides should not be used.	Weekly
Although organic matter is frequently used to encourage regrowth of vegetation on cleared areas, no foreign material for this purpose should be brought onto site. Brush from cleared areas should be used as much as possible. The use of manure or other soil amendments is likely to encourage invasion.	Weekly
Clearing of vegetation is not allowed within 32m of any wetland, 80m of any wooded area, within 1:100 year floodlines, in conservation servitude areas or on slopes steeper than 1:3, unless permission is granted by the ECO for specifically allowed construction activities in these areas.	Weekly
Care must be taken to avoid the introduction of alien plant species to the site and surrounding areas. (Particular attention must be paid to imported material such as building sand or dirty earth-moving equipment.) Stockpiles should be checked regularly and any weeds emerging from material stockpiles should be removed.	Weekly
Alien vegetation regrowth on areas disturbed by construction must be controlled throughout the entire site during the construction period.	Monthly
The alien plant removal and control method guidelines should adhere to best-practice for the species involved. Such information can be obtained from the DWAF Working for Water website.	Monthly
Clearing activities must be contained within the affected zones and may not spill over into demarcated No Go areas.	Daily
Pesticides may not be used. Herbicides may be used to control listed alien weeds and invaders only.	Monthly
Wetlands and other sensitive areas should remain demarcated with appropriate fencing or hazard tape. These areas are no-go areas (this must be explained to all workers) that must be excluded from all development activities.	Daily

6.22.7 Concluding Statement

As there are already a number of alien species present at the site, alien invasion following disturbance at the site is likely to occur rapidly. As a result, alien control should begin during the construction phase to ensure that the density and abundance of alien species remains manageable into the operational phase.

In the short-term, soil disturbance is likely to be the dominant driver of alien invasion at the site. While, in the long-term the distribution of runoff is likely to be a key driver as those areas which receive water will be wetter and likely to contain a higher alien abundance.

As disturbance is the major initial driver of alien species invasion, keeping the disturbance footprint to a minimum is a key element in reducing alien abundance. Wherever possible, the indigenous vegetation should be left intact as this will significantly reduce the likelihood of alien invasion.

6.23 Open Space Management

An open space management plan is attached in **Appendix G** and is deemed to be an integral part of this EMP.

The following elements are considered part of the Open Space Management Subplan

Access Control:

- Access to the facility should be strictly controlled.
- All visitors and contractors should be required to sign-in.
- Signage at the entrance should indicate that disturbance to fauna and flora is strictly prohibited.
- The fencing around the facility should consist of a single fence with electrified strands only on the inside of the fence and not the outside.

Prohibited Activities:

The following activities should not be permitted within the facility by anyone except as part of the other management programmes of EMP for the development.

- No fires within the site.
- No hunting, collecting or disturbance of fauna and flora, except where required for the safe operation of the facility and only by the Environmental Officer on duty and with the appropriate permits and landowner permission.
- No driving off of demarcated roads.
- No interfering with livestock.

Fire Risk Management:

Although fires are not a natural occurrence at the site, fires may occasionally occur under the right circumstances, such as following exceptional summer rainfall, when grass biomass may reach sufficient density to carry a fire. Ignition risk sources in the area include the following:

- Lightning strikes
- Personnel within the facility dropping cigarettes or other activities which pose a fire risk.
- Electrical shorts

The National Veld and Forest Fires Act places responsibility on the landowner to ensure that the appropriate equipment as well as trained personnel are available to combat fires. Therefore, the management of the facility should ensure that they have suitable equipment as well as trained personnel available to assist in the event of fire.

Firebreaks

Extensive firebreaks are not recommended as a fire-risk management strategy at the site. In the majority of years there is not sufficient biomass to carry a fire and the risk of fire is very low. In addition, the service roads within and around the facility will serve to break up the connectivity of the vegetation within the facility and would serve as fire breaks which would also retard the spread of fire around the site. Should a fire break around the perimeter of the facility be required, a strip of

vegetation 5-10 m wide which includes the service road can be cleared manually and maintained relatively free of vegetation through manual clearing on an annual basis. However if alien species such as *Salsola kali* colonise these areas, more regular clearing should be implemented.

Grazing Management to Reduce Fire Risk

In the absence of livestock grazing, the biomass within the facility may build up which may not be desirable for biodiversity or the management of the facility. The simplest and most ecologically sound way to reduce the biomass within the facility would be through the use of livestock grazing. Small stock such as sheep are compatible with solar energy facilities and are commonly grazed within such facilities as they do not pose a danger to the electrical or other infrastructure of the facility. In order to reduce the biomass within the facility, it could be grazed once or twice a year, depending on the rainfall. If this is not possible and the vegetation is too tall or deemed a fire hazard, the vegetation can be brush-cut to about 10-15cm of the soil, and the excess material raked up and removed if necessary.

Alien Plant Control

Alien invasive plants should be controlled according to the Alien Invasive Management Plan. However, it is important to point out that the vegetation of the facility should comprise indigenous species and that a high abundance of alien species at the site, will impact biodiversity within the site itself as well as within the surrounding areas as the site will constitute a source of alien seed and propagules. Disturbance at the site will encourage alien species and vegetation management at the site, should be done using livestock or manual clearing. In areas where vegetation height needs to be controlled, plants should not be cleared to ground level, but should be cleared to no less than 20 cm above ground level. Unless manual methods are not effective, no herbicides should be used to control alien species.

Erosion Management

The facility should be inspected every 6 months for erosion problems or more frequently in the event of exceptional rainfall events. All erosion problems should be rectified according to the Erosion Management Subplan.

Faunal Management

It is highly likely that a variety of fauna will find the facility attractive and become resident within the facility. This includes species such as ground squirrels and mongoose as well as rodents and birds. The presence of fauna within the facility should be managed to minimise negative interactions between fauna and the facility. The following should apply:

- Birds are likely to nest on various parts of the facility, some species are likely to find the back of the panels attractive and nest among the support structures, while others may prefer more open areas such as communication masts or similar structures. Bird nests can be removed annually if they pose a threat to the safe operation of the facility, but this should only take place after the breeding season has been completed. If this becomes a significant problem, then they should rather be prevented from accessing these areas by covering them with fine mesh or similar material to exclude birds.
- The presence of rodents within the facility is likely to attract snakes. Snakes encountered within the facility may pose a danger to staff and should be removed unharmed to safety by a suitably qualified person.
- It is highly likely that smaller fauna will create burrows under the perimeter fence in order to move in and out the facility. Although the size of these burrows can be limited to prevent them compromising the security of the facility, they should not be closed up entirely and should remain large enough to allow fauna to pass through. These holes can be formalised

with mesh or similar if required, but should not be smaller than about 20x20cm, which is much too small to pose a security risk.

- If there are any burrows or bird nests within the facility that might be affected by management activities, then these should be marked or cordoned off to prevent negative impact to these areas during management activities such as vegetation mowing.
- Resident fauna should not be habituated by feeding them scraps or other foodstuffs and it is not necessary to provide such species with water either as most arid fauna are independent of water.

Integrated & Adaptive Management

The management of the facility should meet with the landowner and other relevant local managers to review the management of the facility on a regular basis. Records of such meetings should be maintained including decisions and management outcomes resulting from such meetings. The Open Space Management plan should be reviewed annually for the first three years post-construction to evaluate the effectiveness of management actions so that these can be adapted as appropriate.

7. OPERATIONAL PHASE ENVIRONMENTAL MANAGEMENT

The Operational Phase of this EMPr refers to the day to day management activities that are required to ensure sustainability and the achievement of the principles and objectives of the development. The requirements are applicable to all land owners, tenants and all visitors (business or tourism) to any properties that fall under the umbrella of the development.

The following environmental requirements are to be adopted and implemented during the operation phase:

7.1 Specialist Hydrological Requirements

The following requirements were indicated by the freshwater specialist for inclusion into the EMPr:

Project component/s	Alteration of sandy substrata into hard surfaces impacting on the local hydrological regime
Potential impact'	Poor stormwater management and the alteration hydrological regime
Activity risk source	Placement of hard engineered surfaces
Mitigation: Target / Objective	Any stormwater within the site will be handled in a suitable manner, i.e. clean and dirty water streams around the plant and install stilling basins to capture large volumes of run-off, trapping sediments and reduce flow velocities.
Mitigation: Action/control	Reduce the potential increase in surface flow velocities and the impact on dry riverbeds and the localised drainage systems
Responsibility	Developer / Operator
Timeframe	Planning, design and operation phase
Performance indicator	Water quality and quantity management - "Water Use Licence Conditions"
Monitoring	Surface water monitoring plan that ensures no erosion takes place

Project component/s	The use of chemicals and hazardous substances during construction and operation
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Potential impact	These pollutants could be harmful to aquatic biota, particularly during low flows when dilution is reduced. Lime-containing (high pH) construction materials such as concrete, cement, grouts, etc., deserve a special mention, as they are highly toxic to fish and other aquatic biota. If dry cement powder or wet uncured concrete comes into contact with surface run-off or river water, these compounds can elevate the pH to lethal levels. Thus extreme care should be taken when these hazardous compounds are used near water. For fish, pH levels of over 10 are considered toxic.
Activity risk source	Accidental spillage of harmful materials and or hydrocarbons used during the construction process.
Mitigation: Target / Objective	<p>Management actions that are applicable to all the construction sites include:</p> <ul style="list-style-type: none"> • Strict use and management of all hazardous materials used on site. Considering the extremely low likelihood of surface flows, it is advised that construction activities are suspended until such contaminants are removed from the site if surface flows are observed at or adjacent to the selected site area • Strict management of potential sources of pollution (hydrocarbons from vehicles and machinery, cement during construction, etc.). • Strict control over the behaviour of construction workers. • All areas adjacent to the hard-engineered erosion-control structures provided for this project, which are (accidentally) disturbed and where riparian vegetation was destroyed during the construction activities, should to be rehabilitated using appropriate indigenous vegetation.
Mitigation: Action/control	Minimise the potential impact of pollutants entering the downstream areas
Responsibility	Developer / Operator
Timeframe	Planning, design and operation phase
Performance indicator	Water quality and quantity management - "Water Use Licence Conditions"
Monitoring	Surface water monitoring plan - elevated turbidity

7.2 Maintenance of Hydrological Resources During Operation

The following management measures associated with the on-site water resources should be implemented during the operational phase of the PV facility:

- The major drainage line, and its associated buffer area, which traverses the solar development must be maintained as a no-go area. However, alien plant monitoring must be undertaken within this drainage line every six (6) months and all alien plants removed and/or killed. In addition, the Low-Level-River-Crossings (LLRC) which allow the crossing of the drainage line by the internal road network, must be inspected on a regular basis to ensure that no erosion is occurring and that there is no obstruction of the natural water flow. Any evidence of erosion found during this inspections must be rectified immediately and the cause of erosion pro-actively sought and remedied to avoid recurrence;
- The minor overland washes that traverse the solar facility and are straddled by the solar arrays/rows must be inspected on a regular, routine basis to remove any obstructions which

could impede natural water flow or damage the solar infrastructure. As above, the LLRCs associated with the internal road network must be included in the inspections, and evidence of erosion found must be rectified immediately and the cause of erosion pro-actively sought and remedied to avoid recurrence;

- Implement practices to reduce water use i.e. conservation use of water used to clean panels etc.;
- Any wastewater generated during operation should be disposed of in a conservancy tank system and removed to a registered Wastewater Treatment Works on a regular basis; and
- The spillage of fuels, lubricants and other chemicals should be prevented by providing bunded and impervious storage areas. These will however be extremely limited, if any, due to the nature of Photovoltaic Power generation.

7.3 Operation Waste Management

The following items are to be implemented with regard to waste management during the operational phase of the project.

7.3.1 Litter management

Wind and scavenger proof bins must be installed at the maintenance / control buildings and on-site substation and must be emptied on a weekly basis.

7.3.2 Scrap Metal

Recycling of scrap metal is recommended. Scrap metal must be disposed of off-site at suitable facilities.

7.3.3 Hazardous Waste

All hazardous waste (including bitumen, fuel, oils, paints etc.) used during the operation and maintenance of the solar facility shall be disposed of at an approved/registered hazardous-waste landfill site. The Contractor shall provide disposal certificates to the Site Manager.

Used oil and grease must be removed from site to an approved used oil recycling company.

Under NO circumstances may any hazardous waste be spoiled on the site.

The servicing of operation/maintenance vehicles should take place off-site.

7.4 Plant rescue and protection.

A Plant rescue and protection plan is attached in **Appendix D**. The following requirements in terms of this plan must be adopted for the operational phase of the project lifecycle.

- Access to the site should be strictly controlled and all personnel entering or leaving the site should be required to sign and out with the security officers.
- The collecting of plants or their parts should be strictly forbidden and signs stating so should be placed at the entrance gates to the site.

7.5 Alien Vegetation Management

An Alien Vegetation Management Plan is attached in **Appendix F** of this EMPr

The following management actions are aimed at reducing the abundance of alien species within the site and maintaining non-invaded areas clear of aliens.

Table 15: Alien vegetation management requirements during operation

Action	Frequency
Surveys for alien species should be conducted regularly. Every 6 months for the first two years after construction and annually thereafter. All aliens identified should be cleared.	Every 6 months for 2 years and annually thereafter
Where areas of natural vegetation have been disturbed by construction activities, revegetation with indigenous, locally occurring species should take place where the natural vegetation is slow to recover or where repeated invasion has taken place following disturbance.	Biannually, but revegetation should take place at the start of the rainy season
Areas of natural vegetation that need to be maintained or managed to reduce plant height or biomass, should be controlled using methods that leave the soil protected, such as using a weed-eater to mow above the soil level.	When necessary
No alien species should be cultivated on-site. If vegetation is required for aesthetic purposes, then non-invasive, water-wise locally-occurring species should be used.	When necessary

7.6 PV Panel Maintenance Requirements

Due to their nature, once installed, the photovoltaic panels will not require intensive maintenance other than periodic cleaning, greasing of bearings and inspection. The key maintenance activity is the cleaning / washing of the panels in order to remove dust and maintain optimum power generation.

7.6.1 Cleaning of PV Panels

Any rainfall on the solar panels would be welcomed due to its cleaning effect, but as mentioned before, the annual predicted rainfall is very low. Water for cleaning panels should take place using water from lawful sources on site or from the rainwater collection / storage systems. To further reduce the use of water at the solar facility, the use of alternative panel cleaning methods could be investigated. The use of robotic PV cleaners or high-pressure/low volume water cleaners, as well as compressed air can be considered, should the technology become commercially viable and available during the lifespan of the project.

In compliance with the EA, only biodegradable may be used for washing purposes. Care should be taken that the wash-water does not cause any erosion (Please refer to section dealing with washwater management described below).

Indeed, water used in the cleaning process is likely to encourage the growth of natural vegetation around the panel arrays and rows, which will require routine brush-cutting / trimming / mowing to avoid vegetation shading the panels, interfering with tracking mechanisms or the risk of fires. Under no circumstances should vegetation beneath or around the panel arrays and rows be cleared / removed entirely, as this will result in significant erosion and associated sand-blasting of infrastructure. Due to stunted nature of the xerophytic vegetation, it is unlikely that this will need to be done often. Biomass produced from these trimming activities could be chipped and used as mulch under the PV panels (to increase stormwater infiltration and reduce erosion).

7.6.2 Management of Wash-water

A Stormwater, Erosion and Washwater Management Plan is attached as **Appendix B** and is deemed to form an integral part of this EMPr

After construction, the washing of the solar panels once every quarter is likely to cause nominal additional run-off. The overall effect on the natural water courses is expected to be very low, due to the high evaporation potential and low rainfall of the area. No chemicals will be used to clean the panels, only water. If required, a biodegradable soap may be used.

7.6.3 Other Operation / Maintenance Requirements

- Lubricants used to grease bearing of panel tracking systems should be conservatively used to avoid leakage or spills. Any **leaks or spills** that occur during maintenance operations must be cleaned up immediately and the contaminated soil / material disposed on at a registered disposal site for hazardous materials.
- The **tracks / pathways** (4m width) between the PV panel rows used for cleaning and maintenance of the panels, should be maintained as single tracks and regularly brush-cut and/or mowed to allow reasonable access.
- **Access roads and the internal road network** must be maintained in a condition that allows for reasonable access and minimised erosion potential. All drainage, stormwater management and erosion control structures must be maintained to ensure their proper functioning.
- **Regular monitoring for erosion** to ensure that no erosion problems are occurring at the site as a result of the roads and other infrastructure. All erosion problems observed should be rectified as soon as possible.
- All maintenance vehicles to remain on the demarcated roads.
- The **septic tank**, associated with the ablution facilities at the on-site sub-station / maintenance buildings, must be maintained in full working condition.
- The **perimeter security fence** should be routinely patrolled to ensure that it still allows for the passage of small and medium sized mammals, at least at strategic places (drainage lines etc.), and that the electrified strands are not causing animal electrocution.
- No unauthorized persons should be allowed onto the site.
- The **maintenance of the transmission line infrastructure** must retain the bird-friendly design features (bird-flappers and insulation). Any **bird electrocution and collision events** that occur should be recorded, including the species affected and the date. If repeated collisions occur within the same area, then further mitigation and avoidance measures may need to be implemented.
- Staff present during the operational phase should receive environmental education so as to ensure that that **no hunting, killing or harvesting of plants and animals** occurs.
- All **alien plants present at the site should be controlled** at least twice a year using the best practice methods for the species present.
- **Bare soil should be kept to a minimum**, and at least some grass or low shrub cover should be encouraged under the panels.
- **No pets** (cats and dogs) should be allowed within the solar facility.

8. CLOSURE & DECOMMISSIONING PHASE ENVIRONMENTAL MANAGEMENT

After the lifespan of the facility (20-25 years), there is a possibility that the entire facility will be decommissioned and closed (although other options for continuation may be investigated)

Appendix 5 of Regulation 982 of the 2014 EIA Regulations contains the required contents of a Closure Plan. The table below shows the minimum requirements for a closure plan. The operating entity for this facility must ensure that the closure plan complies with these requirements as well as any other legislative requirements that may come into effect during the lifecycle of the project.

Table 16: Legislative requirements for a closure plan

Requirement
(1) A closure plan must include -
(a) Details of - (i) The EAP who prepared the closure plan; and (ii) The expertise of that EAP.
(b) Closure objectives.
(c) Proposed mechanisms for monitoring compliance with and performance assessment against the closure plan and reporting thereon.
(d) Measures to rehabilitate the environment affected by the undertaking of any listed activity or specified activity and associated closure to its natural or predetermined state or to a land use which conforms to the generally accepted principle of sustainable development including a handover report, where applicable.
(e) Information on any proposed avoidance, management and mitigation measures that will be taken to address the environmental impacts resulting from the undertaking of the closure activity.
(f) A description of the manner in which it intends to – (i) Modify, remedy, control or stop any action, activity or process which causes pollution or environmental degradation during closure; (ii) Remedy the cause of pollution or degradation and migration of pollutants during closure. (iii) Comply with any prescribed environmental management standards or practises; or (iv) Comply with any applicable provisions of the Act regarding closure.
(g) Time periods within which the measure contemplated in the closure plan must be implemented.
(h) The process for managing any environmental damage, pollution, pumping and treatment of extraneous water or ecological degradation as a result of closure.
(i) Details of all public participation processes conducted in terms of regulation 41 of the Regulation, including – (i) Copies of any representations and comments received from registered interested and affected parties; (ii) A summary of comments received from, and a summary of issues raised by registered interested and affected parties, the date of receipt of these comments and the response of the EAP to those comments; (iii) The minutes of any meetings held by the EAP with interested and affected parties and other role players which record the views of the participants; (iv) Where applicable, an indication of the amendments made to the plan as a result of public participation processes conduction in terms of regulation 41 of these Regulations.
(j) Where applicable, details of any financial provisions for the rehabilitation, closure and ongoing post decommissioning management of negative environmental impacts.

¹Within a period of at least 12 months prior to the planned closure and decommissioning of the site a Closure Plan must be prepared and submitted to the Local Planning Authority (Siyathemba Municipality), as well as the Provincial and National Environmental Authorities (the Northern Cape Department of Environmental Affairs & Nature Conservation (DEANC) and the Department of Environmental Affairs (DEA)) for input and approval. This plan must provide detail pertaining to site restoration, soil replacement, landscaping, pro-active conservation, and a timeframe for implementation. Furthermore, Plan must comply with any additional legislation and guidelines that may be applicable at the time.

¹ Closure and decommissioning may take place after the after the term of the Purchase Power Agreement.

Two possible scenarios are considered for this decommissioning phase, as follows:

8.1 Scenario 1: Total Closure & Decommissioning of Solar Facility

If the decision is taken at the end of the project lifespan (30-years) to totally decommission the solar facility i.e. make the land available for an alternative land use, a closure plan as detailed above should be developed and should include provision for the following:

- All concrete and solar infrastructure etc. must be removed from the solar site i.e. panels, support structures etc.;
- The holes where the panel support structures are removed must be levelled and covered with subsoil and topsoil;
- Tracks that are to be utilised for the future land use operations should be left in-situ. The remainder of the tracks to be removed (ripped), topsoil replaced and brush-packed to encourage re-vegetation and minimise erosion;
- All auxiliary buildings and access points should be demolished and rubble removed, unless they can be used for/by the future land use. The competent authority may prescribe that the landscaping and underground infrastructure i.e. foundations be left *in situ*;
- The underground electric cables must be removed, if they cannot be used in the future land use;
- All material (cables, PV Panels etc.) must be re-used or recycled wherever possible. Functional panels that still produce sufficient output could be donated to local rural schools and clinics upon facility closure and decommissioning;
- The disturbed portions of the site must be brush-packed, replanted and/or seeded with locally sourced indigenous vegetation (as prescribed by the competent authorities) to allow re-vegetation and rehabilitation of the site (see plant species list attached);
- Discontinuation of Lease and Easement Agreements for main land and access roads;
- Consider whatever is economically or socially beneficial and risky for the project's Owners and other Stakeholders at this last stage
 - This could include selling equipment on secondary market, recycling of metals and modules as scrap, using some or all of the proceeds to pay the local labor for uninstallation work, etc?..
 - PV leaves no pollution and the equipment other than the modules which should be reused or recycled (There is an existing market for this).

8.2 Scenario 2: Partial Decommissioning / Upgrade of Solar Facility

Due to low variable costs and loans repaid long ago, any owner the facility may be interested in prolonging technical, functional, legal and economic lives of the plans for as long as possible, even beyond Power Purchase Agreement.

- This will require disposal of assets with shorter technical lives are critical (inverters, etc). PV modules, substructures, cables have a lifespan that should be longer than 25 yrs;
- Under this option, the O&M contractor will have to ensure that the validity period of all licences / permits and agreements is extended where necessary and that any legislation that has subsequently been promulgated is considered.

Should more advanced technology become available it may be decided to continue to use the site as a renewable energy / photovoltaic / solar facility. Should this be the case, it is likely that much of the existing infrastructure will be re-used in the upgraded facility.

All infrastructure that will no longer be required for the upgraded facility must be removed as described in Scenario 1 above. The remainder of the infrastructure should remain in place or upgraded depending on the requirements of the new facility. As described for Scenario 1 above, the function PV panels that are still capable of producing sufficient output, could be donated to

local schools and clinics. Any upgrades to the facility at this stage must comply with relevant legislation and guidelines of the time.

9. MONITORING AND AUDITING

Environmental monitoring and audits are fundamental in ensuring the implementation of the management actions contained within this EMPr, environmental sustainable development and maintenance of the Humansrus Solar 3 Solar PV Facility. .

To promote transparency and cooperative governance, the results of relevant audits should be submitted to:

- The operators of the facility;
- The local authority (Siyathemba Municipality);
- The provincial environmental authority: Department of Environmental Affairs & Nature Conservation (DENC);
- The national environmental authority: Department of Environmental Affairs (DEA); and
- Eskom.

The results of the audit must be recorded in an environmental audit report and any non-compliance must be formally recorded, along with the response-action required or undertaken. Each non-compliance incident report must be issued to the relevant person(s), so that the appropriate corrective and preventative action is taken within an agreed upon timeframe.

Appendix 7 of Regulation 982 of the 2014 EIA Regulations contains the required contents of an Environmental Audit Report. The table below shows the legislated requirements of an audit reports, and all relevant environmental audits undertaken as part of this development (during construction and operation) should comply with these requirements.

Table 17: Contents of an audit report

(1) An Environmental audit report prepared in terms of these Regulations must contain:
(a) Details of – (i) The independent person who prepared the environmental audit report; and (ii) The expertise of independent person that compiled the environmental audit report.
(b)Details of – (i) The independent person who prepared the environmental audit report; and (ii) The expertise of independent person that compiled the environmental audit report.
(c) A declaration that the independent auditor is independent in a form as may be specified by the competent authority.
(d) An indication of the scope of, and the purpose for which, the environmental audit report was prepared.
(e) A description of the methodology adopted in preparing the environmental audit report.
(f) An indication of the ability of the EMPr, and where applicable the closure plan to – (i) Sufficiently provide for the avoidance, management and mitigation of environmental impacts associated with the undertaking of the activity on an on-going basis; (ii) Sufficiently provide for the avoidance, management and mitigation of environmental impacts associated with the closure of the facility; and (iii) Ensure compliance with the provisions of environmental authorisation, EMPr, and where applicable, the closure plan.
(g) A description of any assumptions made, and any uncertainties or gaps in knowledge.
(h) A description of an consultation process that was undertaken during the course of carrying out the environmental audit report.
(i) A summary and copies of any comments that were received during any consultation process

(j) Any other information requested by the competent authority.

9.1 ECO Construction Monitoring

The ECO is responsible for environmental monitoring during construction as per the requirements of this EMPr. The monthly environmental monitoring reports compiled by the ECO, as well as the photographic record of works, must be submitted to the operators of the facility, the local authority, the provincial environmental authority, the national environmental authority and Eskom.

9.2 Recording and Reporting to the DEA.

It is likely that the following recording and reporting requirements will be required should the proposal obtain a positive authorisation:

- The holder of the authorisation must keep all records relating to monitoring and auditing on site and make it available for inspection to any relevant and competent authority in respect of this development.
- All documentation eg. Audit/monitoring/compliance reports and notifications required to be submitted to the department in terms of the EA, must be submitted to the Director: Compliance monitoring.

9.3 Environmental Audit Report

It is likely that a positive authorisation for the proposal will require the submission of Audit Reports.

This environmental audit report must:

- Be compiled an independent environmental auditor;
- Indicate the date of the audit, the name of the auditor and the outcome of the audit;
- Evaluate compliance with the requirements of the approved EMPr and the Environmental Authorisation;
- Include measures to be implemented to attend to any non-compliances or degradation noted;
- Include copies of approvals granted by other authorities relevant to the development for the reporting period;
- Highlight any outstanding environmental issues that must be addressed, along with recommendations for ensuring these issues are appropriately addressed;
- Include a copy of the EA and the approved EMPr;
- Include all documentation such as waste disposal certificates, hazardous waste landfill site licences etc, pertaining to this authorisation; and
- Include evidence of adherence to the conditions of this authorisation and the EMPr where relevant such as training records and attendance registers.

Further to these requirements, this audit report must also comply with the requirements of an audit as highlighted in Annexure 7 of R982 and included in Table 17 above.

9.4 Plant Rescue monitoring requirements

A plant rescue and protection plan is attached in **Appendix D** of this EMPR. The following reporting and monitoring requirements are recommended as part of the plant rescue and protection plan:

- Preconstruction walk-through report detailing the location and distribution of all listed and protected species. This should include a walk-through of all infrastructure including all new access roads, PV array areas, underground cables, power line routes, buildings and substations. The report should include recommendations of route adjustments where

necessary, as well as provide a full accounting of how many individuals of each listed species will be impacted by the development.

- Monitoring during construction by the ECO to ensure that listed species and sensitive habitats are avoided. All incidents should be recorded along with the remedial measures implemented.
- Post construction monitoring of plants translocated during search and rescue to evaluate the success of the intervention. Monitoring for a year post-transplant should be sufficient to gauge success.

9.5 Habitat Restoration Monitoring requirements

A Revegetation & Rehabilitation plan is attached in **Appendix E** of the EMPr.

As rehabilitation success, particularly in arid areas is unpredictable, monitoring and follow-up actions are important to achieve the desired cover and soil protection.

- Re-vegetated areas should be monitored every 4 months for the first 12 months following construction.
- Re-vegetated areas showing inadequate surface coverage (less than 20% within 12 months after re-vegetation) should be prepared and re-vegetated;
- Any areas showing erosion, should be re-contoured and seeded with indigenous grasses or other locally occurring species which grow quickly.

9.6 Alien Vegetation Monitoring During the Construction Phase

An alien vegetation management plan is attached in **Appendix F**.

The following monitoring actions should be implemented during the construction phase of the development.

Table 18: Alien vegetation monitoring requirements during the construction phase

Monitoring Action	Indictor	Timeframe
Document alien species present at the site	List of alien species	Preconstruction
Document alien plant distribution	Alien plant distribution map within priority areas	3 Monthly
Document & record alien control measures implemented	Record of clearing activities	3 Monthly
Review & evaluation of control success rate	Decline in documented alien abundance over time	Biannually

9.7 Alien Vegetation Monitoring During the Operational Phase

An alien vegetation management plan is attached in **Appendix F**.

The following monitoring and evaluation actions should take place during the operational phase of the development.

Table 19: Alien vegetation monitoring requirements during the operational phase

Monitoring Action	Indictor	Timeframe
Document alien species distribution and abundance over time at the site	Alien plant distribution map	Biannually

Document alien plant control measures implemented & success rate achieved	Records of control measures and their success rate. A decline in alien distribution and cover over time at the site	Biannually
Document rehabilitation measures implemented and success achieved in problem areas	Decline in vulnerable bare areas over time	Biannually

10. METHOD STATEMENTS

Method statements are written submissions by the Contractor to the Engineer and ECO in response to the requirements of this EMPr or in response to a request by the Engineer or ECO. The Contractor shall be required to prepare method statements for several specific construction activities and/or environmental management aspects.

The Contractor shall not commence the activity for which a method statement is required until the Engineer and ECO have approved the relevant method statement.

Method statements must be submitted at least five (5) working days prior to the proposed date of commencement of the activity. Failure to submit a method statement may result in suspension of the activity concerned until such time as a method statement has been submitted and approved.

An approved method statement shall not absolve the Contractor from any of his obligations or responsibilities in terms of the contract. However, **any damage caused to the environment through activities undertaken without an approved method statement shall be rehabilitated at the contractor’s cost.**

Additional method statements can be requested at the ECO’s discretion at any time during the construction phase.

The method statements should include relevant details, such as:

- Construction procedures and location on the construction site;
- Start date and duration of the specific construction procedure;
- Materials, equipment and labour to be used;
- How materials, equipment and labour would be moved to and from the development site, as well as on site during construction;
- Storage, removal and subsequent handling of all materials, excess materials and waste materials;
- Emergency procedures in case of any potential accident / incident which could occur during the procedure;
- Compliance / non-compliance with an EMPr specification and motivation for proposed non-compliance.

10.1 Method Statements Required

Based on the specifications in this EMPr, the following method statements are likely to be required as a minimum (more method statements may be requested at any time as required under the direction of the ECO):

- Vegetation clearing & topsoil stripping, and associated stockpiling;
- Hazardous substances declaration of use, handling and storage – e.g. for fuels, chemicals, oils and any other harmful / toxic / hazardous materials;
- Cement and concrete batching;
- Traffic, transport & delivery accommodation e.g. need for traffic diversion/turning circles etc.;

- Solid waste management / control procedures;
- Stormwater and wastewater management / control systems;
- Erosion remediation and stabilisation;
- Fire control and emergency procedures;
- Job site security plan;
- Blasting activities (if necessary);
- Ramming and jack hammering;
- Re-vegetation, rehabilitation and re-seeding.

11. HEALTH AND SAFETY

The Occupational Health and Safety Act (No. 85 of 1993) aims to provide for / ensure the health and safety of persons at work or in connection with the activities of persons at work and to establish an advisory council for occupational health and safety.

The main Contractor must ensure compliance with the Occupational Health and Safety Act, as well as that all subcontractors comply with the Occupational Health and Safety Act.

The following is of key importance (Section 8 of the aforesaid Act):

General duties of employers to their employees

(1) Every employer shall provide and maintain, as far as is reasonably practicable, a working environment that is safe and without risk to the health of his employees.

(2) Without derogating from the generality of an employer's duties under subsection (1), the matters to which those duties refer include in particular-

(a) the provision and maintenance of systems of work, plant and machinery that, as far as is reasonably practicable, are safe and without risks to health;

(b) taking such steps as may be reasonably practicable to eliminate or mitigate any hazard or potential hazard to the safety or health of employees, before resorting to personal protective equipment;

(c) making arrangements for ensuring, as far as is reasonably practicable, the safety and absence of risks to health in connection with the production, processing, use, handling, storage or transport of articles or substances;

(d) establishing, as far as is reasonably practicable, what hazards to the health or safety of persons are attached to any work which is performed, any article or substance which is produced, processed, used, handled, stored or transported and any plant or machinery which is used in his business, and he shall, as far as is reasonably practicable, further establish what precautionary measures should be taken with respect to such work, article, substance, plant or machinery in order to protect the health and safety of persons, and he shall provide the necessary means to apply such precautionary measures;

(e) providing such information, instructions, training and supervision as may be necessary to ensure, as far as is reasonably practicable, the health and safety at work of his employees;

(f) as far as is reasonably practicable, not permitting any employee to do any work or to produce, process, use, handle, store or transport any article or substance or to operate any plant or machinery, unless the precautionary measures contemplated in paragraphs (b) and (d), or any other precautionary measures which may be prescribed, have been taken;

(g) taking all necessary measures to ensure that tire requirements of this Act are complied with by every person in his employment or on premises under his control where plant or machinery is used;

- (h) enforcing such measures as may be necessary in the interest of health and safety;*
- (i) ensuring that work is performed and that plant or machinery is used under the general supervision of a person trained to understand the hazards associated with it and who have the authority to ensure that precautionary measures taken by the employer are implemented; and*
- (j) causing all employees to be informed regarding the scope of their authority as contemplated in section 37 (1) (b).*

12. CONTRACTORS CODE OF CONDUCT

The Contractor's Code of Conduct is a document to be drawn up by the solar facility Developer and provided to all contractors or subcontractors that undertake any service on site. This code of conduct should include generic conduct rules for construction and operation activities on the Humansrus Solar 3 Solar PV site and must be signed by all contractors. **This code of conduct does not exonerate contractors from complying with this EMPr and must not be viewed as a stand-alone document.**

The following general template is suggested for this Code of Conduct document and must be adapted and updated to include the provisions of this EMPr, recommendations of participating specialists, conditions of approval of the Environmental Authorisation, conditions imposed by the Local Authority (as part of the rezoning and consent use), as well as the all service agreements.

12.1 Objectives

To ensure compliance with the Conditions of the Environmental Authorisation, the Environmental Management Programme (EMPr), recommendations of participating specialists, conditions imposed by the Local Authority as part of the rezoning and subdivision, as well as the service agreements.

- To ensure the least possible damage to:
 - Existing infrastructure on and adjacent to the site;
 - Indigenous flora and fauna (biophysical environment); and
 - Water quality of surface and groundwater on and surrounding the site. Particularly the water quality entering and exiting the on-site washes/minor drainage lines;
- Construction and development are undertaken with due consideration to all environmental factors;
- Where such damage occurs, provision is made for re-instatement and rehabilitation;

12.2 Acceptance of Requirements

In order to achieve these objectives, the Developer and Contractor bind themselves jointly and severally to fulfil and comply with all the obligations contained herein, as well as prescriptions and obligations contained in other documents controlling the development of the RE Capital 3 solar facility.

12.3 Contractor's Pre-Construction Obligations

Contractors may not commence any construction on the Humansrus Solar 3 PV Facility until:

- The Contractor and the ECO have carried out a joint site inspection (this is to be done as part of the pre-construction compliance workshop as detailed in the EMPr);
- A qualified ecologist has undertaken an inspection of the final development footprint and determined the number, species and extent of protected / listed plant species within this area (this has already been done);
- A permit for the removal or relocation-and-transplant of these protected / listed plant species has been obtained from the Kimberly office of the Northern Cape Department of Environmental Affairs & Nature Conservation (DEANC);

- Search and rescue of sensitive plants, within the development footprint has been carried out in compliance with the Plant Rescue and Protection Plan in **Appendix D** and signed off by the ECO (where this is necessary);
- The construction and no-go areas are suitably demarcated to the satisfaction of the ECO;
- Where necessary, approval of Building / Construction Plans has been obtained from the local authority (Siyathemba Municipality); and
- All contract staff has attended the required environmental induction training and on-going environmental education sessions, as necessary.

12.4 Contractor’s Obligations During Construction

- The Contractor is required to comply with the necessary Health and Safety requirements as required by the Occupational Health and Safety Act of 1993;
- The Contractor must comply with the construction requirements as detailed in the EMPr, including the following plans detailed therein:
 - Transport & Traffic Management Plan,
 - Stormwater, Erosion and Washwater Management Plan,
 - Vegetation Clearing & Plant Rescue Plan,
 - Re-vegetation & Rehabilitation Plan,
 - Alien Management Plan
 - Open Space Management Plan;
- The contractor must comply with all the requirements detailed in the Environmental Authorisation, once issued;
- All conditions, processes and fees as prescribed by the Local Authority must be complied with; and
- The Contractor shall only be permitted to erect a single signboard which must comply with legislative requirements.

13. SITE DEVELOPMENT PLAN

The Site Development Plan (SDP) is attached in **Appendix A** of this EMPr. Approval of this EMPr infers approval of the SDP. The holder of the EA and the contractor must ensure that all works are undertaken in approximation to the SDP. Should there be any dispute on any aspect of the works in relation to the SDP, the ECO must make ruling, which should be referred to the CA if necessary.

The table below shows the key components as defined in the SDP and the EMPr applicability of each of these component’s.

Table 20: EMP Sections applicable to SDP Components

SDP Component	EMPr Applicability
Construction Road	Sections 5, 6,7, 8 & 9
Perimeter Road	Sections 5, 6,7, 8 & 9
Internal Roads	Sections 5, 6,7, 8 & 9
Access Road	Sections 5, 6,7, 8 & 9
Perimeter Fencing	Sections 6
PV Panels	Sections 5, 6,7, 8 & 9
Inverter Stations	Sections 5, 6,7, 8 & 9
AC Cabling	Sections 5 & 6,
Sub-Station	Sections 5, 6,7, 8 & 9
Monitoring Building	Sections 5 & 6

Laydown Area	Section 6
Evacuation Line	Sections 5, 6,7, 8 & 9

14. IMPLEMENTATION

The following table is provided to assist the developer, design team, engineer and contractor with the effective implementation of this EMPr. The table below serves as a quick reference guide to the EMPr, but must be read in conjunction with the entire document.

Table 21: EMPr Actions and Outcomes

Item	Associated Impacts	Management Action	Timing	Responsible Party	Monitoring
Design & Pre-Construction Phase					
Familiarisation with the contents of the EMPr & EA.	<ul style="list-style-type: none"> o Creation of employment during construction (positive) o Employment opportunities and skills development opportunities during the operation (positive) 	Attendance of a pre-construction environmental compliance workshop	Prior to commencement of site clearing & earthworks.	ECO, Engineers, Contractor & Project Management.	ECO to include details of this in the first environmental control Report.
	<ul style="list-style-type: none"> o Disturbance of fauna during construction o Disturbance of fauna during operation o Disturbance and displacement of avifaunal species o Disturbance of fauna during construction o Disturbance of fauna during operation o Disturbance and displacement of avifaunal species 	Environmental induction of all staff.	Prior to commencement of earthworks.	ECO and all contract staff.	Contractor to keep records of all staff attending inductions.
Demarcation of Development Areas and No-Go Areas.	<ul style="list-style-type: none"> o Disturbance of fauna during construction o Disturbance of fauna during operation o Disturbance and displacement of avifaunal species o Disturbance of fauna during construction o Disturbance of fauna during operation o Disturbance and displacement of avifaunal species 	All areas outside of the construction / development area to be clearly demarcated. Pan areas, and all sensitive drainage lines & vegetation outside development area are considered no-go.	Prior to commencement of site clearing & earthworks.	Contractor with input from the Engineer, ECO and participating specialists where necessary. Contractor responsible for maintaining demarcation throughout the construction phase.	ECO to maintain photographic record of demarcation.
Obtain Permit for removal /	<ul style="list-style-type: none"> o Removal of vegetation and listed or protected plant 	Permit application to be informed be list of protected	Prior to plant rescue and vegetation	ECO, ESA, Ecological Specialist & Contractor	ECO & Ecological specialist to provide

Item	Associated Impacts	Management Action	Timing	Responsible Party	Monitoring
translocation of protected plant species.	<ul style="list-style-type: none"> ○ species during construction ○ Alien plant invasion during operation ○ Habitat loss for avifaunal species ○ Physical removal of the narrow strips of woody riparian zones at crossings ○ Loss of topsoil 	plant species found by the ecological specialist within the final facility development footprint. Permit requirements & list to inform updated plant rescue plan.	clearing.		photographic record of protected plant species (to be used in on-going Environmental Education) and of plant rescue & translocation operation.
Panel and Powerline Pylon siting / walk down	<ul style="list-style-type: none"> ○ Land disturbance, changing run-off characteristics and increasing erosion risks ○ Placement of spoil material during construction ○ Removal of vegetation and listed or protected plant species during construction ○ Disturbance of fauna during construction ○ Soil erosion during construction ○ Alien plant invasion during operation ○ Disturbance of fauna during operation ○ Soil erosion during operation ○ Cumulative impact on broad-scale ecological processes & habitat fragmentation ○ Habitat loss for avifaunal species ○ Disturbance and displacement of avifaunal species ○ Disorientation from solar panels ○ Mortality due to 	As defined in the EMPr	Prior to finalisation of detailed design.	Developer with input from ECO, Engineer and relevant participating specialists	ECO to include details in monthly reports.

Item	Associated Impacts	Management Action	Timing	Responsible Party	Monitoring
	<ul style="list-style-type: none"> ○ electrocution and collisions ○ Physical removal of the narrow strips of woody riparian zones at crossings ○ Increasing the surface run-off velocities, while reducing the potential for any run-off to infiltrate the soils at crossings ○ Increase in sedimentation and erosion within the development footprint ○ Physical disturbance by the supporting infrastructure (roads & transmission lines) on the riparian environment ○ Visual intrusion from the possible multiple power lines linking up to different proposed PV projects in the vicinity ○ Dust impacts during construction 				
Environmental Induction Training	<ul style="list-style-type: none"> ○ Creation of employment during construction (positive) ○ Employment opportunities and skills development opportunities during the operation (positive) 	As defined in the EMPr	Prior to commencement of site clearing & earthworks.	ECO & Contractor	Contractor to provide details to ECO. ECO to provide details in monthly reports.
Construction Phase					
Minimise impact of construction vehicles	<ul style="list-style-type: none"> ○ Land disturbance, changing run-off characteristics and increasing erosion risks ○ Soil erosion during construction ○ Alien plant invasion during 	Implementation of recommendations of Transport & Traffic Plan defined in EMPr.	Throughout construction phase	Contractor	Engineer

Item	Associated Impacts	Management Action	Timing	Responsible Party	Monitoring
	<ul style="list-style-type: none"> ○ operation ○ Disturbance of fauna during operation ○ Soil erosion during operation ○ Disturbance and displacement of avifaunal species ○ Mortality due to electrocution and collisions ○ Dust impacts during construction ○ Increased heavy traffic on the R357 ○ Temporary increase in traffic disruptions and movement patterns during the construction phase ○ Temporary increase in safety and security concerns associated with the influx of people during the construction phase ○ Point of access off the R357 and nuisance impacts in terms of temporary increase in dust and the wear and tear on the R357 ○ Cumulative increase in traffic disruptions and increase in noise and dust with other solar energy facility developments 				
Prevent concrete contamination	<ul style="list-style-type: none"> ○ Increasing the surface run-off velocities, while reducing the potential for any run-off to infiltrate the soils at crossings ○ Increase in sedimentation 	Use of delivered ready-mix concrete. Control at batching sites	Throughout construction phase	Contractor	Engineer, ESA and ECO.

Item	Associated Impacts	Management Action	Timing	Responsible Party	Monitoring
	and erosion within the development footprint				
Prevention of erosion of cable trenches	<ul style="list-style-type: none"> ○ Land disturbance, changing run-off characteristics and increasing erosion risks ○ Loss of topsoil ○ Placement of spoil material during construction ○ Removal of vegetation and listed or protected plant species during construction ○ Disturbance of fauna during construction ○ Soil erosion during construction ○ Alien plant invasion during operation ○ Disturbance of fauna during operation ○ Soil erosion during operation ○ Disturbance and displacement of avifaunal species ○ Physical removal of the narrow strips of woody riparian zones at crossings ○ Increasing the surface run-off velocities, while reducing the potential for any run-off to infiltrate the soils at crossings ○ Increase in sedimentation and erosion within the development footprint ○ Physical disturbance by the supporting infrastructure (roads & transmission lines) on the riparian 	Implementation of recommendations of Erosion Management Plan defined in EMPr.	During detailed design and throughout the construction phase.	Contractor	Engineer, ESA and ECO.

Item	Associated Impacts	Management Action	Timing	Responsible Party	Monitoring
	<p>environment</p> <ul style="list-style-type: none"> Dust impacts during construction 				
Protection of Archaeological Resources	<ul style="list-style-type: none"> Unearthing of significant finds during construction 	<p>Avoidance of drainage line and pans within and outside development area and quartz patches as far as possible. Report archaeological occurrences found during earthworks to NCHRA & SAHRA.</p>	<p>Demarcation of sites prior to commencement of earthworks. Other mitigations throughout the construction phase.</p>	Contractor	ESA, ECO & archaeologist.
Protection of hydrological resources (surface & underground).	<ul style="list-style-type: none"> Disturbance of fauna during construction Disturbance of fauna during operation Physical removal of the narrow strips of woody riparian zones at crossings Increasing the surface run-off velocities, while reducing the potential for any run-off to infiltrate the soils at crossings Increase in sedimentation and erosion within the development footprint Physical disturbance by the supporting infrastructure (roads & transmission lines) on the riparian environment 	<p>As per the requirements of the EMPr.</p>	<p>Throughout the construction phase.</p>	Contractor	ECO
Protection of all topsoil resources on site.	<ul style="list-style-type: none"> Disturbance of fauna during construction Disturbance of fauna during operation Physical removal of the narrow strips of woody riparian zones at crossings 	<p>As per the requirements of the EMPr i.e. brush/straw packing & re-seeding</p>	<p>Throughout the construction phase.</p>	Contractor	ECO

Item	Associated Impacts	Management Action	Timing	Responsible Party	Monitoring
	<ul style="list-style-type: none"> ○ Increasing the surface run-off velocities, while reducing the potential for any run-off to infiltrate the soils at crossings ○ Increase in sedimentation and erosion within the development footprint ○ Physical disturbance by the supporting infrastructure (roads & transmission lines) on the riparian environment 				
Construction of Cable Trenches	<ul style="list-style-type: none"> ○ Land disturbance, changing run-off characteristics and increasing erosion risks ○ Loss of topsoil ○ Placement of spoil material during construction ○ Removal of vegetation and listed or protected plant species during construction ○ Disturbance of fauna during construction ○ Soil erosion during construction ○ Alien plant invasion during operation ○ Disturbance of fauna during operation ○ Soil erosion during operation ○ Disturbance and displacement of avifaunal species ○ Physical removal of the narrow strips of woody riparian zones at crossings ○ Increasing the surface run- 	As per the requirements of this EMPr.	Throughout the construction phase	Contractor	ECO

Item	Associated Impacts	Management Action	Timing	Responsible Party	Monitoring
	<p>off velocities, while reducing the potential for any run-off to infiltrate the soils at crossings</p> <ul style="list-style-type: none"> ○ Increase in sedimentation and erosion within the development footprint ○ Physical disturbance by the supporting infrastructure (roads & transmission lines) on the riparian environment ○ Dust impacts during construction 				
<p>Limiting damage caused by the installation of overhead lines.</p>	<ul style="list-style-type: none"> ○ Removal of vegetation and listed or protected plant species during construction ○ Disturbance of fauna during construction ○ Disturbance of fauna during operation ○ Soil erosion during operation ○ Cumulative impact on broad-scale ecological processes & habitat fragmentation ○ Habitat loss for avifaunal species ○ Disturbance and displacement of avifaunal species ○ Disorientation from solar panels ○ Mortality due to electrocution and collisions ○ Physical removal of the narrow strips of woody riparian zones at crossings ○ Increasing the surface run- 	<p>As per the requirements of this EMPr.</p>	<p>Design phase and throughout the construction phase.</p>	<p>Design Team & Contractors</p>	<p>ECO & ER</p>

Item	Associated Impacts	Management Action	Timing	Responsible Party	Monitoring
	<p>off velocities, while reducing the potential for any run-off to infiltrate the soils at crossings</p> <ul style="list-style-type: none"> ○ Increase in sedimentation and erosion within the development footprint ○ Physical disturbance by the supporting infrastructure (roads & transmission lines) on the riparian environment ○ Change in land use character ○ Visual intrusion from the possible multiple power lines linking up to different proposed PV projects in the vicinity ○ Dust impacts during construction ○ Unearthing of significant finds during construction 				
Limiting Noise Impact	<ul style="list-style-type: none"> ○ Temporary increase in traffic disruptions and movement patterns during the construction phase ○ Temporary increase in safety and security concerns associated with the influx of people during the construction phase ○ Point of access off the R357 and nuisance impacts in terms of temporary increase in dust and the wear and tear on the R357 ○ Cumulative increase in traffic disruptions and 	As per the requirement of the EMPr.	Design, throughout the construction and operation phase	Contractor, ER	ECO & ER

Item	Associated Impacts	Management Action	Timing	Responsible Party	Monitoring
	increase in noise and dust with other solar energy facility developments				
Reduction of dust generation as a result of construction activities.	<ul style="list-style-type: none"> ○ Loss of agricultural land ○ Land disturbance, changing run-off characteristics and increasing erosion risks ○ Loss of topsoil ○ Placement of spoil material during construction ○ Removal of vegetation and listed or protected plant species during construction ○ Soil erosion during construction ○ Soil erosion during operation ○ Dust impacts during construction ○ Point of access off the R357 and nuisance impacts in terms of temporary increase in dust and the wear and tear on the R357 ○ Cumulative increase in traffic disruptions and increase in noise and dust with other solar energy facility developments 	As per the requirements of the EMPr. Do not strip topsoil from entire development footprint	Throughout the construction phase	Contractor	ECO & ER.
Providing for effective ecological corridors	<ul style="list-style-type: none"> ○ Removal of vegetation and listed or protected plant species during construction ○ Disturbance of fauna during construction ○ Alien plant invasion during operation ○ Disturbance of fauna 	Implementing the fencing requirements as defined by the ecological specialist and this EMPr.	Design and construction phases.	ER & Contractor	ECO & ER.

Item	Associated Impacts	Management Action	Timing	Responsible Party	Monitoring
	<ul style="list-style-type: none"> ○ during operation ○ Cumulative impact on broad-scale ecological processes & habitat fragmentation ○ Habitat loss for avifaunal species ○ Disturbance and displacement of avifaunal species ○ Physical removal of the narrow strips of woody riparian zones at crossings ○ Physical disturbance by the supporting infrastructure (roads & transmission lines) on the riparian environment ○ Change in land use character ○ Visual intrusion from the possible multiple power lines linking up to different proposed PV projects in the vicinity 				
<p>Limit environmental damage from blasting, drilling, jackhammering and trenching activities including that on existing boreholes.</p>	<ul style="list-style-type: none"> ○ Land disturbance, changing run-off characteristics and increasing erosion risks ○ Loss of topsoil ○ Placement of spoil material during construction ○ Removal of vegetation and listed or protected plant species during construction ○ Disturbance of fauna during construction ○ Soil erosion during 	<p>Implementing the requirements for blasting detailed in this EMPr.</p>	<p>Throughout the construction phase.</p>	<p>Contractor</p>	<p>ECO & ER.</p>

Item	Associated Impacts	Management Action	Timing	Responsible Party	Monitoring
	<ul style="list-style-type: none"> construction ○ Alien plant invasion during operation ○ Disturbance of fauna during operation ○ Soil erosion during operation ○ Habitat loss for avifaunal species ○ Disturbance and displacement of avifaunal species ○ Disorientation from solar panels ○ Mortality due to electrocution and collisions ○ Physical removal of the narrow strips of woody riparian zones at crossings ○ Increasing the surface run-off velocities, while reducing the potential for any run-off to infiltrate the soils at crossings ○ Increase in sedimentation and erosion within the development footprint ○ Physical disturbance by the supporting infrastructure (roads & transmission lines) on the riparian environment ○ Dust impacts during construction ○ Unearthing of significant 				

Item	Associated Impacts	Management Action	Timing	Responsible Party	Monitoring
	<p>finds during construction</p> <ul style="list-style-type: none"> ○ Creation of employment during construction (positive) ○ Economic multiplier effects from the use of local goods and services (positive) ○ Added pressure on economic and social infrastructure and increase in social conflicts during construction as a result of in-migration of people ○ Temporary increase in traffic disruptions and movement patterns during the construction phase ○ Temporary increase in safety and security concerns associated with the influx of people during the construction phase ○ Point of access off the R357 and nuisance impacts in terms of temporary increase in dust and the wear and tear on the R357 ○ Employment opportunities and skills development opportunities during the operation (positive) ○ Benefits to the local area from SED/ ED programmes and community trust from REIPPPP social responsibilities 				

Item	Associated Impacts	Management Action	Timing	Responsible Party	Monitoring
	<ul style="list-style-type: none"> ○ Visual impacts and sense of place impacts associated with the operation ○ Impacts associated with loss of farmland available for livestock grazing due to occupation of land by the solar energy facility ○ Cumulative increase in employment opportunities, skills development, SED and business opportunities with the establishment of more than one solar energy facility ○ Change to the local economy with an in-migration of labourers and jobseekers to the area. ○ Cumulative increase in traffic disruptions and increase in noise and dust with other solar energy facility developments ○ Visual impacts and change in the sense of place impacts associated with the establishment of more than one solar energy facility in the area ○ Decommissioning - Social impacts associated with retrenchment including loss of jobs and source of income 				
Preventing of Erosion	<ul style="list-style-type: none"> ○ Physical removal of the narrow strips of woody 	Implementation of Stormwater	Design phase and	Design Team, Engineer	ECO & ER.

Item	Associated Impacts	Management Action	Timing	Responsible Party	Monitoring
and siltation of the wash / drainage lines.	<ul style="list-style-type: none"> o riparian zones at crossings o Increasing the surface run-off velocities, while reducing the potential for any run-off to infiltrate the soils at crossings o Increase in sedimentation and erosion within the development footprint o Physical disturbance by the supporting infrastructure (roads & transmission lines) on the riparian environment 	Management and Erosion Control Measures detailed in this EMP, as well as those made by the ecological specialists.	throughout the construction phase	and Contractors	
Protection of protected plant species and on-going re-vegetation & rehabilitation.	<ul style="list-style-type: none"> o Land disturbance, changing run-off characteristics and increasing erosion risks o Loss of topsoil o Placement of spoil material during construction o Removal of vegetation and listed or protected plant species during construction o Soil erosion during construction o Alien plant invasion during operation o Soil erosion during operation o Cumulative impact on broad-scale ecological processes & habitat fragmentation o Habitat loss for avifaunal species <p>Physical removal of the narrow strips of woody riparian zones at crossings</p> <ul style="list-style-type: none"> o Physical disturbance by the 	Implementation of Plant Rescue, Re-vegetation & Rehabilitation Plan, as well as recommendation of ecological specialist.	Design phase and throughout the construction phase.	Design Team, Engineer and Contractors	ECO & ER.

Item	Associated Impacts	Management Action	Timing	Responsible Party	Monitoring
	supporting infrastructure (roads & transmission lines) on the riparian environment <ul style="list-style-type: none"> ○ Dust impacts during construction ○ Unearthing of significant finds during construction 				
Prevention of theft and other crime.	<ul style="list-style-type: none"> ○ Added pressure on economic and social infrastructure and increase in social conflicts during construction as a result of in-migration of people. ○ Temporary increase in safety and security concerns associated with the influx of people during the construction phase ○ Change to the local economy with an in-migration of labourers and jobseekers to the area. 	Development of a job site security plan.	Before commencement of construction.	Contractor	ER
On-going Environmental Education	<ul style="list-style-type: none"> ○ Creation of employment during construction (positive) ○ Employment opportunities and skills development opportunities during the operation (positive) ○ Development of clean, renewable energy infrastructure (positive) ○ Benefits to the local area from SED/ ED programmes and community trust from REIPPPP social responsibilities ○ Cumulative increase in 	As defined in the EMPr.	During construction.	ECO & Contractor	Contractor to provide details to ECO. ECO to provide details in monthly reports.

Item	Associated Impacts	Management Action	Timing	Responsible Party	Monitoring
	employment opportunities, skills development, SED and business opportunities with the establishment of more than one solar energy facility				
Prevent pollution resulting from oil and fuel storage and handling.	<ul style="list-style-type: none"> o Increasing the surface run-off velocities, while reducing the potential for any run-off to infiltrate the soils at crossings o Increase in sedimentation and erosion within the development footprint o Physical disturbance by the supporting infrastructure (roads & transmission lines) on the riparian environment 	Implement correct fuel and oil handling procedures. Implement emergency spill response plan.	Duration of the project lifespan.	ECO & Contractor	ECO, ER & Contractor
Operational Phase					
Prevent pollution resulting from oil and fuel storage and handling.	<ul style="list-style-type: none"> o Increasing the surface run-off velocities, while reducing the potential for any run-off to infiltrate the soils at crossings o Increase in sedimentation and erosion within the development footprint o Physical disturbance by the supporting infrastructure (roads & transmission lines) on the riparian environment 	Implement correct fuel and oil handling procedures. Implement emergency spill response plan.	Duration of the project lifespan	Facility operator	Facility manager and Environmental Authority.
Manage vegetation growth	<ul style="list-style-type: none"> o Loss of agricultural land o Land disturbance, changing run-off characteristics and increasing erosion risks 	Trimming of vegetation under panels to avoid overshadowing and fire risk.	Throughout operation	Operation & Maintenance staff.	Operation staff to report to Operator.

Item	Associated Impacts	Management Action	Timing	Responsible Party	Monitoring
	<ul style="list-style-type: none"> ○ Loss of topsoil ○ Placement of spoil material during construction ○ Removal of vegetation and listed or protected plant species during construction ○ Soil erosion during construction ○ Alien plant invasion during operation ○ Soil erosion during operation ○ Cumulative impact on broad-scale ecological processes & habitat fragmentation ○ Habitat loss for avifaunal species ○ Disturbance and displacement of avifaunal species ○ Physical removal of the narrow strips of woody riparian zones at crossings ○ Change in land use character ○ Dust impacts during construction ○ Point of access off the R357 and nuisance impacts in terms of temporary increase in dust and the wear and tear on the R357 				
Prevent & manage erosion / obstruction of washes / drainage lines	<ul style="list-style-type: none"> ○ Physical removal of the narrow strips of woody riparian zones at crossings ○ Increasing the surface run-off velocities, while reducing the potential for 	Regular monitoring of wash to remove obstructions and repair erosion.	Throughout operation	Operation & Maintenance staff.	Operation staff to report to Operator.

Item	Associated Impacts	Management Action	Timing	Responsible Party	Monitoring
	<p>any run-off to infiltrate the soils at crossings</p> <ul style="list-style-type: none"> ○ Increase in sedimentation and erosion within the development footprint ○ Physical disturbance by the supporting infrastructure (roads & transmission lines) on the riparian environment 				
Control of alien plants	<ul style="list-style-type: none"> ○ Loss of agricultural land ○ Land disturbance, changing run-off characteristics and increasing erosion risks ○ Loss of topsoil ○ Removal of vegetation and listed or protected plant species during construction ○ Soil erosion during construction ○ Alien plant invasion during operation ○ Soil erosion during operation ○ Cumulative impact on broad-scale ecological processes & habitat fragmentation ○ Habitat loss for avifaunal species ○ Physical removal of the narrow strips of woody riparian zones at crossings ○ Increasing the surface run-off velocities, while reducing the potential for any run-off to infiltrate the soils at crossings ○ Increase in sedimentation 	Regular monitoring and removal of alien invasive plant species.	Throughout operation	Operation & Maintenance staff.	Operation staff to report to Operator.

Item	Associated Impacts	Management Action	Timing	Responsible Party	Monitoring
	and erosion within the development footprint ○ Change in land use character ○ Dust impacts during construction ○ Creation of employment during construction (positive) ○ Employment opportunities and skills development opportunities during the operation (positive)				
On-going Environmental Education	○ Creation of employment during construction (positive) ○ Employment opportunities and skills development opportunities during the operation (positive) ○ Development of clean, renewable energy infrastructure (positive) ○ Benefits to the local area from SED/ ED programmes and community trust from REIPPPP social responsibilities ○ Cumulative increase in employment opportunities, skills development, SED and business opportunities with the establishment of more than one solar energy facility	As defined in the EMPr	During maintenance and operation.	Operation & Maintenance staff.	Operation staff to report to Operator.
Closure & Decommissioning Phase					
Items, management, responsibilities and monitoring as per construction phase, as above.					
Decommissioning of Solar facility.	○ Land disturbance, changing run-off	Closure of facility in compliance with legislation and	After lifespan of project.	Facility operator & Siyathemba local	Local, provincial and national Authorities

Item	Associated Impacts	Management Action	Timing	Responsible Party	Monitoring
	<p>characteristics and increasing erosion risks</p> <ul style="list-style-type: none"> ○ Loss of topsoil ○ Placement of spoil material during construction ○ Disturbance of fauna during construction ○ Soil erosion during construction ○ Alien plant invasion during operation ○ Disturbance of fauna during operation ○ Soil erosion during operation ○ Cumulative impact on broad-scale ecological processes & habitat fragmentation ○ Disturbance and displacement of avifaunal species ○ Disorientation from solar panels ○ Mortality due to electrocution and collisions ○ Change in land use character ○ Dust impacts during construction ○ Unearthing of significant finds during construction ○ Creation of employment during construction (positive) ○ Decommissioning - Social impacts associated with retrenchment including loss of jobs and source of income 	<p>this EMPr.</p>		<p>municipality.</p>	

Item	Associated Impacts	Management Action	Timing	Responsible Party	Monitoring
On-going Environmental Education	<ul style="list-style-type: none"> ○ Creation of employment during construction (positive) ○ Employment opportunities and skills development opportunities during the operation (positive) ○ Development of clean, renewable energy infrastructure (positive) ○ Benefits to the local area from SED/ ED programmes and community trust from REIPPPP social responsibilities ○ Cumulative increase in employment opportunities, skills development, SED and business opportunities with the establishment of more than one solar energy facility 	As defined in the EMPr	During decommissioning.	ECO & Contractor	Contractor report to ECO. ECO to provide details in monthly reports.

15. NON-COMPLIANCE

Any person is liable on conviction of an offence in terms of regulation 49(a) of the National Environmental Laws Second Amendment Act (Act 30 of 2013) to imprisonment for a period not exceeding ten (10) years or to a fine not exceeding R10 million or an amount prescribed in terms of the Adjustment of Fines Act, 1991 (Act No. 101 of 1991).

It is the responsibility of the ECO to report matters of non-compliance to the Employer's Representative (e.g. Project Engineer), who in turn is tasked with reporting such matters to the Holder of the Authorisation. It is the responsibility of the Holder of the Authorisation (the Applicant), and not the ECO, to report such matters of non-compliance to the relevant Authority.

15.1 Procedures

The Project Proponent shall comply with the environmental specifications and requirements of this EMP, any EA issued and Section 28 of NEMA, on an on-going basis and any failure on his part to do so will entitle the authorities to **impose a penalty**.

In the event of non-compliance the following recommended process shall be followed:

- The relevant authority shall issue a **Notice of Non-compliance** to the Project Proponent, stating the nature and magnitude of the contravention.
- The Project Proponent shall **act to correct the transgression** within the period specified in by the authority.
- The Project Proponent shall provide the relevant authority with a **written statement** describing the actions to be taken to discontinue the non-conformance, the actions taken to mitigate its effects and the expected results of the actions.
- In the case of the Project Proponent failing to remedy the situation within the predetermined time frame, the relevant authority may recommend halting the activity.
- In the case of non-compliance giving rise to physical environmental damage or destruction, the relevant authority shall be entitled to undertake or to cause to be undertaken such **remedial works** as may be required to make good such damage at the cost of the Project Proponent.
- In the event of a dispute, difference of opinion, etc. between any parties in regard to or arising out of interpretation of the conditions of the EMMP, disagreement regarding the implementation or method of implementation of conditions of the EMMP, etc. any party shall be entitled to require that the issue be referred to **specialists and / or the competent authority** for determination.

The relevant authority shall at all times have the right to **stop work** and/or certain activities on site in the case of non-compliance or failure to implement remediation measures.

15.2 Offences and Penalties

Any avoidable non-compliance with the conditions of the EMP shall be considered sufficient ground for the imposition of a penalty by the Engineer

Possible offences, which should result in the issuing of a contractual penalty, include, but are not limited to:

- Unauthorised entrance into no-go areas;
- Catching and killing of wild animals, and removal or damage to conservation-worthy plant species;
- Open fires outside of the contractor camp site and insufficient fire control;
- Unauthorised damage to natural vegetation;
- Unauthorised camp establishment (including stockpiling, storage, etc.);
- Hydrocarbons / hazardous material: negligent spills / leaks and insufficient storage;
- Ablution facilities: non-use, insufficient facilities, insufficient maintenance;

- Insufficient solid waste management (including clean-up of litter, unauthorised dumping etc.;
- Erosion due to negligence / non-performance;
- Excessive cement / concrete spillage / contamination;
- Non-induction of staff.

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