Draft EMPr 14/12/16/3/3/2/2296

PROPOSED RENEWABLE ENERGY GENERATION PROJECT ON PORTION 2 OF THE FARM ROOIDRAAI 85 IQ, JB MARKS LOCAL MUNICIPALITY, DR KENNETH KAUNDA DISTRICT MUNICIPALITY, NORTH-WEST PROVINCE

Short Name: MOPANE SOLAR PV 5

June 2023

Commissioned by: Voltalia South Africa (Pty) Ltd

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REPORT DISTRIBUTION LIST

Name	Institution
Mr. Armandt Joubert	Voltalia South Africa (Pty) Ltd
	National Department of Forestry, Fisheries and the Environment (DFFE)
	Department of Water and Sanitation (DWS)
	Department of Agriculture, Land Reform and Rural Development (DALRRD)
	North-West Department of Economic Development, Environment, Conservation and Tourism (DEDECT)
Municipal Manager	Dr Kenneth Kaunda District Municipality
Municipal Manager	JB Marks Local Municipality
	South African Heritage Resources Agency (SAHRA)
	Eskom Land & Rights
	Registered Interested and Affected Parties (I&AP's)

DOCUMENT HISTORY

Report No	Date	Version	Status
14/12/16/3/3/2/2296	June 2023	1.0	Draft EIA Report

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1 DETAILS OF THE ENVIRONMENTAL ASSESSMENT PRACTITIONER (EAP)

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Curriculum Vitae of EAP is included in Annexure U.

2 GENERAL PROJECT INFORMATION

VOLTALIA SOUTH AFRICA (PTY) **LTD** is proposing the development of a renewable solar energy facility in a key strategic location in terms of the connection to the Eskom grid and in terms of the favourable solar irradiation on:

- Portion 2 of the Farm Rooidraai 85 IQ

located within the **JB Marks Local Municipality, Dr Kenneth Kaunda District Municipality, North-West Province.**

Surveyor-general 21-digit site codes:

T	0	I	Q	0	0	0	0	0	0	0	0	0	**0**	**8**	**5**	0	0	0	**0**	**2**
1	**2**			**3**				**4**								**5**				

The renewable energy generation facility will be a **Photovoltaic (PV) Power Plant** with a **maximum generation capacity up to 120 MW** at the point of connection (**Export Capacity**).

The name of the facility will be **MOPANE SOLAR PV 5.**

The **footprint (fenced area)** of the proposed development is approximately **182 ha in extent**, as detailed in the table below:

Table 1. List of properties forming part of the Project Site and Project footprint

Site location and Property details	
Farm	Rooidraai 85 IQ
Portion	Portion 2
LPI code	T0IQ00000000008500002
Overall Extent	800.6533 hectares
Landowner	Gerbet Trust
Diagram deed number	DB82/905
Title deed number	T71062/2002
Registration date	2002/06/14
Current land use	Grazing, cattle farming

Access to the Mopane Solar PV 5 will be from both the D859 (Preferred) and R501 (alternative).

In order to develop the facility, Voltalia South Africa (Pty) Ltd must undertake an Environmental Impact Assessment (EIA) process and acquire environmental authorisation from the *National Department of Forestry, Fisheries and the Environment (DFFE)*, in consultation with the *North-West Department of Economic Development, Environment, Conservation and Tourism (DEDECT)*, in terms of the EIA Regulations, 2014 published on 4 December 2014, as amended under section 24(5) and 44 of the National Environmental Management Act (NEMA, Act No. 107 of 1998).

Voltalia South Africa (Pty) Ltd is the applicant for the Mopane Solar PV 5 (the proposed project) which will be connected to the Eskom **Carmel Substation (MTS)** which is located approximately 15km south-east of the project site.

The independent Environmental Assessment Practitioners (EAP's) which have been appointed for the undertaking of the detailed environmental studies in compliance with the 2014 EIA Regulations as amended, are **AGES Limpopo (Pty) Ltd** (AGES)**.**

With the aim of identifying and assessing all potential environmental impacts related to the development as well as suggesting possible mitigation measures and alternatives, AGES has appointed specialist sub-consultants to compile detailed reports and to study the activities necessary for the assessment of the specific impacts related to their field of expertise.

AGES and the other specialist consultants are in a position of independency from Voltalia South Africa (Pty) Ltd and not subsidiaries or affiliated to the latter. AGES and the specialist consultants have no secondary interest connected with the development of this project or of other projects which may originate from the authorization of the project.

3 PROJECT OBJECTIVE

This Environmental Management Programme (EMPr) is an environmental management tool used to prevent or mitigate avoidable adverse impacts of the construction, operation and decommissioning of the proposed Mopane Solar PV 5. This EMPr can also be considered a tool useful for the enhancement of the positive benefits of the project and is compiled with the objective to supply the Department of Forestry, Fisheries and the Environment, (DFFE) with an updated EMPr to make a decision regarding the approval of the EMPr.

To comply with the Environmental Impact Assessment Regulations 2014, as amended in terms of Section 24(2) and 24D of the National Environmental Management Act, 1998 (Act No. 107 of 1998), the EIA report must contain an Environmental Management Programme.

4 PURPOSE AND OBJECTIVES OF THE EMPR

This Environmental Management Programme (EMPr) is compiled with reference to the requirements included in Appendix 4 of the EIA Regulations, 2014, as amended. The purpose of this EMPr is to ensure that all potentially identified impacts identified during the Environmental Impact Assessment (EIA) process are managed effectively during the phases of the project. The EMPr indicates the mitigation measures to be implemented on site to ensure compliance with the said regulations.

The decommissioning phase is similar to the construction phase, but all possible care must be considered for the recycling of the materials and for the re-establishment of the site as it was the *status quo – ex ante* the development.

All the phases have been carefully examined in relation to the PV plant and the connection infrastructure (preferred connection solution), to the Eskom grid.

The mitigation and management measures in the EIA process are systematically addressed in this EMPr which ensures the minimisation of adverse environmental impacts to an acceptable level.

In particular, the objectives of this EMPr are:

- to outline mitigation measures and environmental specifications required for the three phases of the project to manage and minimise the potential environmental impacts associated with the solar park.
- to ensure that the three phases have not adverse environmental impacts and that any potential environmental benefits are improved.
- to detect the responsible people/entities for the implementation of the measures, outlining functions and responsibilities.
- to state mechanisms and frequency for preventing long term or permanent environmental degradation.
- to facilitate responses to unforeseen events or changes in the project implementation not considered in the EIA process.

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

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 the Environmental Authorisation;
- 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.

The relevant sections of this EMP have been updated to separately reflect the environmental outcomes and environmental actions.

Must amendment of any of the EMPr objectives be required, an application for this must be submitted to the competent authority and approved before such changes are implemented. Changes to the EMPr actions may be affected without the need for an amendment process, subject to approval by the ECO and future amendment as part of the first environmental audit report.

To achieve the goal of good and correct environmental management, the role of the on-site contractor is very important. The contractor must be aware of the responsibilities of the relevant environmental legislation and specific contents of the EMPr. Contractors must ensure that employees have a basic understanding of the environmental features of the site and the surrounding environment and are familiar with the requirements of the EMPr having also attended an environmental awareness training course. A copy of the EMPr must be available to all on-site staff and officials that may request to read the document.

5 AUTHORITIES, LEGAL CONTEXT AND ADMINISTRATIVE REQUIREMENTS

The legislative and regulatory framework of reference for the solar power plant project includes statutory and non-statutory instruments by which National, Provincial and Local authorities exercise control throughout the development of the same project. The development and the environmental assessment process of a solar power plant project involve various authorities dealing with the different issues related to the project (economic, social, cultural, biophysical *etc*.).

5.1 REGULATORY AUTHORITIES

5.1.1 National Authorities

At national level, the main regulatory authorities and agencies are:

- *Department of Energy (DoE):* Department is competent and responsible for all policies related to energy, including renewable energy.
- *Department of Forestry, Fisheries and the Environment (DFFE):* The Department is competent and responsible for all environmental policies and is the controlling authority under the terms of NEMA and EIA Regulations. The DFFE is also the competent authority for the proposed project and is entrusted with granting the relevant environmental authorisation.
- *National Energy Regulator of South Africa (NERSA):* The Regulator is competent and responsible for regulating all aspects dealing with the electricity sector and issues the licence for independent power producers.
- *South African Heritage resources Agency (SAHRA):* The Agency is responsible for the protection and the survey, in association with provincial authorities of listed or proclaimed sites, such as urban conservation areas, nature reserves and proclaimed scenic routes under the terms of the National Heritages Resources Act (Act no. 25 of 1999).
- *South African National Roads Agency Limited (SANRAL):* the Agency is responsible for all National road routes.

5.1.2 Provincial Authorities

At provincial level, the main regulatory authority is the *North-West Department of Economic Development, Environment, Conservation and Tourism (DEDECT);* this Department is responsible for environmental policies and is the Provincial authority in terms of NEMA and the EIA Regulations and is also the commenting authority for the proposed project.

5.1.3 Local Authorities

At a local level, the local and municipal authorities are the principal regulatory authorities responsible for planning, land use and the environment. In the North-West Province, Municipalities and District Municipalities are involved in various aspects of planning and the environment related to solar energy facilities development. The Local Municipality is the *JB Marks Local Municipality* which is part of the *Dr Kenneth Kaunda District Municipality*.

Under the terms of the Municipal System Act (Act no. 32 of 2000), all municipalities are deemed to go through an Integrated Development Planning (IDP) process in order to devise a five-year strategic development plan for the area of reference. The identification of priority areas for conservation and their positioning within a planning framework of core, buffer, and transition areas is the subject of bioregional planning. Priority areas are individuated and defined with reference to visual and scenic resources and their identification and protection is granted through visual guidelines drafted for the area included in bioregional plans. Local authorities also provide specific by-laws and policies in order to protect visual and aesthetic resources with reference to urban edge lines, scenic drives, special areas, signage, communication masts *etc*.

Finally, there are also various non-statutory bodies and environmental groups, who are involved in the definition of various aspects of planning and the protection of the environment, which may influence in the development of the proposed project. The Lichtenburg Solar Park will comply with the international standards and regulations for photovoltaic power plants.

5.2 LEGISLATION, REGULATIONS AND GUIDELINES

A review of relevant legislation related to the proposed development is detailed in table 2.

Table 2: Review of relevant legislation

National Legislation	Sections applicable to the proposed project
Constitution of the Republic of South Africa (Act no. 108 of 1996)	• Bill of Rights (S2) • Rights to freedom of movement and residence (S22) • Environmental Rights (S24) • Property Rights (S25) • Access to information (S32) • Right to just administrative action (S33)
Fencing Act (Act no. 31 of 1963)	• Notice in respect of erection of a boundary fence (S7) • Clearing bush for boundary fencing (S17) • Access to land for purpose of boundary fencing (S18)
Conservation of Agricultural Resources Act (Act no. 43 of 1983)	• Prohibition of the spreading of weeds (S5) • Classification of categories of weeds & invader plants and restrictions in terms of where these species may occur (Regulation 15 of GN R0148) • Requirement and methods to implement control measures for alien and invasive plant species (Regulation 15E of GN R0148)
Environment Conservation Act (Act no. 73 of 1989)	• National Noise Control Regulations (GN R154 dated 10 January 1992)
National Water Act (Act no. 36 of 1998)	• Entrustment of the National Government to the protection of water resources (S3)

	• Entitlement to use water (S4) - Schedule 1 provides the purposes which entitle a person to use water (reasonable domestic use, domestic gardening, animal watering, firefighting and recreational use) • Duty of Care to prevent and remedy effects of water pollution (S19) • Procedures to be followed in the event of an emergency incident which may impact on water resources (S20) • Definition of water use (S21) • Requirements for registration of water use (S26 and S34) • Definition of offences in terms of the Act (S151)
National Forests Act (Act no. 84 of 1998)	• Protected trees
National Environmental Management Act (Act no. 107 of 1998)	• Definition of National environmental principles (S2): strategic environmental management goals and objectives of the government applicable within the entire Republic of South Africa to the actions of all organs of state, which may significantly affect the environment • NEMA EIA Regulations, 2010 and 2014, as amended. • Requirement for potential impact on the environment of listed activities to be considered, investigated, assessed, and reported on to the competent authority (S24 - Environmental Authorisations) • Duty of Care (S28): requirement that all reasonable measures be taken to prevent pollution or degradation from occurring, continuing and recurring, or, where this is not possible, to minimise and rectify pollution or degradation of the environment • Procedures to be followed in the event of an emergency incident which may impact on the environment (S30)
National Heritage Resources Act (Act no. 25 of 1999)	• SAHRA, in consultation with the Minister and the MEC must establish a system of grading places and objects which form part of the national estate (S7) • Provision for the protection of all archaeological objects, paleontological sites, material and meteorites entrusted to the provincial heritage resources authority (S35) • Provision for the conservation and care of cemeteries and graves by SAHRA, (S36) • List of activities which require notification from the developer to the responsible heritage resources authority, with details regarding location, nature, extent of the proposed development (S38) • Requirement for compilation of a Conservation Management Plan and permit from SAHRA for the presentation of archaeological sites for tourism (S44) promotion
National Environmental Management: Biodiversity Act (Act no. 10 of 2004)	• Provision for the MEC for Environmental Affairs/Minister to publish a list of threatened ecosystems in need of protection (S52) • Provision for the MEC for Environmental Affairs/Minister to identify any process or activity which may threaten a listed ecosystem (S53)

	Provision for the MEC for Environmental Affairs/Minister to publish a list of critical endangered species, endangered species, vulnerable species and protected species (S56(1) - see Government Gazette 29657) • Three government notices were published: GN R150 (Commencement of Threatened and Protected Species Regulations, 2007), GN R151 (Lists of critically endangered, vulnerable, and protected species) and GN R152 (Threatened Protected Species Regulations)
National Environmental Management: Air Quality Act (Act no. 39 of 2004)	• Provision for measures in respect of dust control (S32) • Provision for measures to control noise (S34)
National Environmental Management: Waste Management Act (Act no. 59 of 2008)	• Waste management measures • Regulations and schedules • Listed activities which require a waste licence
Occupational Health and Safety Act (Act No. 85 of 1993)	• Health and safety of all involved before and after construction must be protected.

Guideline Documents	**Sections applicable to the proposed project**
South African National Standard (SANS) 10328, Methods for environmental noise impact assessments in terms of NEMA no. 107 of 1998	• Impact of noise emanating from a proposed development may have on occupants of surrounding land by determining rating level • Noise limits are based on the acceptable rating levels of ambient noise contained in SANS 10103
Draft Guidelines for Granting of Exemption Permits for the Conveyance of Abnormal Loads and for other Events on Public Roads	• The Guidelines outline rules and conditions related to transport of abnormal loads and vehicles on public roads and detailed procedures to be followed for the grant of exemption permits

Policies and White Papers	**Sections applicable to the proposed project**
The White Paper on the Energy Policy of the Republic of South Africa (December 1998)	• The White Paper supports investment in renewable energy initiatives, such as the proposed solar power plant project
The White Paper on Renewable Energy (November 2003)	• The White Paper outlines the Government's vision, policy, principles, strategic goals and objectives for the promotion and the implementation of renewable energy in South Africa
Integrated Resource Plan (IRP1) Integrated Resources Plan 2010-2030 (IRP 2010) and updated IRP.	• The first Integrated Resource Plan (IRP1) was released late 2009. Subsequently the DoE decided to undertake a detailed process to determine South Africa's 20-year electricity plan, the Integrated Resources Plan 2010-2030 (IRP 2010).

	• The IRP1. IRP 2010 and IRP 2019 outline the Government's vision, policy and strategy in matter of the use of energy resources and the current status of energy policies in South Africa. • In the **IRP 2019**, published in October 2019, provision has been made to procure an additional **6 000 MW** of solar PV and 14 400 MW of wind between **2022** and **2030**.
Renewable Energy IPP Procurement Programme (REIPPPP)	• The IPP Procurement Programme, issued on 3rd August 2011 by the DoE, envisages the commissioning of **3 725 MW** of renewable projects (**1 450 MW with Solar photovoltaic technology**) **capable of beginning commercial operation before the end of 2020**.
Equator Principles (July 2006)	• The Equator Principles provide that future developments with total project capital costs of US$10 million or more shall be financed only if socially and environmentally sustainable.

5.3 LISTED ACTIVITIES IN TERMS OF NEMA

The application was submitted in terms of the EIA Regulations, 2014, as amended and listed activities involved in the proposed development are listed in table 3.

Table 3: Listed Activities in terms of sections 24 and 24D of NEMA approved for the proposed development

GN R.327 Item 11 (i) The development of facilities or infrastructure for the transmission and distribution of electricity - (i) outside urban areas or industrial complexes with a capacity of more than 33 but less than 275 kilovolts.	A 132 kV powerline will of 2,8 km will be constructed from the onsite substation to the collector substation which is also located on Portion 12 of the farm Blaauwbank 125 iQ.
GN R.327, Item 24 (ii) The development of - (ii) a road with a reserve wider than 13,5m, or where no reserve exists where the road is wider than 8m.	Access to Mopane Solar PV 5 will be from D859 and R501. During construction, the access road will be wider than 8 m to allow the transportation of abnormal goods (e.g., power transformers, turbines).
GN R.327, Item 28 Residential, mixed, retail, commercial, industrial or institutional developments where such land was used for agriculture or afforestation on or after 01 April 1998 and where such development: (ii) will occur outside an urban area, where the total land to be developed is bigger than 1 hectare; excluding where such land has already been developed for residential, mixed, retail, commercial, industrial or institutional purposes.	The construction of the Mopane Solar PV 5 facility will require clearance of indigenous, where the total area to be transformed (footprint of the plant) will be up to 182 ha.

GN R.325 Item 1 The development of facilities or infrastructure for the generation of electricity from a renewable resource where the electricity output is 20 MW or more, excluding where such development of facilities or infrastructure is for photovoltaic installations and occurs within a urban area.	The Mopane Solar PV 5 facility consisting of the construction, operation and maintenance of a Photovoltaic (PV) Power Plant with a maximum generation capacity up to 120 MW. The proposed substation will be located on Portion 12 of the farm Blaauwbank 125 iQ.
GN R.325 Item 15 The clearance of an area of 20 ha or more of indigenous vegetation	The construction of the Mopane Solar PV 5 facility will require clearance of indigenous, where the total area to be transformed (footprint of the plant) will be up to 182 ha. The required footprint should be cleared from the existing vegetation.
GN R.324 Item 12(h)iv **The clearance of an area of 300 square metres or more of indigenous vegetation except where such clearance of indigenous vegetation is required for maintenance purposes undertaken in accordance with a maintenance management plan.**	The construction of the Mopane Solar PV 5 facility will require clearance of indigenous, where the total area to be transformed (footprint of the plant) will be up to 182 ha in a critical biodiversity area in North-West province.

5.4 All recommendations and mitigation measures recorded in the EIA report.

In section 7 of this report, there is a summary table which constitutes the actual Environmental Management Program to be implemented, on site, during the construction, operation, and decommissioning phases. The first column of this table lists the recommendations and mitigation measures as recorded in the EIA report.

Despite all the management actions and mitigation measures to be implemented the applicant must adhere to the "duty of care" principle as included in section 28 of the National Environmental Management Act, 1998 (Act No. 107 of 1998) which states the following:

Every person who causes, has caused or may cause significant pollution or degradation of the environment must take reasonable measures to prevent such pollution or degradation from occurring, continuing or recurring, or, in so far as such harm to the environment is authorised by law or cannot reasonably be avoided or stopped, to minimise and rectify such pollution or degradation of the environment.

5.5 All mitigation measures as listed in the specialist reports

The mitigation measures included in the specialist's reports (obtained during the EIA process) are included in the EMPr in table format in Section 7 of this report.

5.6 Proposed site layout map

Figure 1. Proposed Draft Layout Plan of the Mopane Solar PV 5

5.7 Alien Invasive Management Plan

The construction phase of developments in the area will almost certainly carry the greatest risk of Invasive Alien Species being imported to the site, and the high levels of habitat disturbance also provide the greatest opportunities for such species to establish themselves, since most indigenous species are less tolerant of disturbance. Continued movement of personnel and vehicles on and off the development sites, as well as occasional delivery of materials will result in a risk of importation of alien species throughout the life of the project. The biggest risk is that invasive alien species such as the seeds of noxious plants may be carried onto the site along with materials that have been stockpiled elsewhere at already invaded sites.

According to the National Environmental Management: Biodiversity Act, 2004 (Act No.10 of 2004), (NEMBA) it is stated that landowners are under legal obligation to control invasive alien plants occurring on their properties. Landowners must then identify all invasive alien plants on their property and make use of the correct methods to control or remove these plants. The Alien and Invasive Species Regulations (GNR 599 of 2014) are stipulated as part of NEMBA.

The control methods of alien invasive plants are listed and included in the Alien Invasive Management Plan, as included in Annexure 1. A specific table is included in the Alien Invasive Management Plan, which lists the alien invader species found on the proposed development site and specific methods of control of these species (see Annexure 1). The aim of the Alien Invasive Management Plan is to reduce the invasion of alien species and ensure the continuous monitoring and removal of alien species.

5.8 Plant Rescue and Protection Plan

Plant species are also protected in the North-West Province according to the North-West Nature Conservation Bill, 2014. According to this Bill, no person may pick, import, export, transport, possess, cultivate or trade in a specimen of a specially protected or protected plant species. Appendices to the Act provide extensive lists of species that are protected, comprising a significant component of flora expected to occur on site. After a detailed survey was conducted during November 2022, the listed species *Boophane disticha* confirmed for the site. No eradication should be allowed without a permit.

5.9 Revegetation & Habitat Rehabilitation

Rehabilitation can be defined as the return of disturbed areas to a safe, stable, productive, and self-sustaining state that promotes biodiverse land use. Land rehabilitation techniques are used to speed up the time required to restore the impacted area back to its original, or better, state. To re-create and maintain a sustainable environment it is important to plan how the areas to be impacted by the construction of Mopane Solar PV 5 will be rehabilitated and revegetated. The purpose of rehabilitation planning is to promote the ecological integrity of the site and surrounding landscapes.

At site level, emphasis is placed on rehabilitation techniques such as land-form replication and planting species that will promote site stability and sustainability. Re-vegetation must use indigenous species that contribute most to the compatibility of the local ecology and increase biodiversity.

The final goal of the rehabilitation planning process is a practical, achievable, and adequately resourced rehabilitation programme. Rehabilitation of the disturbed areas must be done in such a way to ensure that the rehabilitation and revegetation on the site for the Mopane Solar PV 5 will be sustainable in the long term. The Re-vegetation and Habitat Rehabilitation Plan must be implemented during the construction and operation of the facility. Restoration must be undertaken as soon as possible after completion of construction activities to reduce the amount of habitat converted at any one time and to speed up the recovery to natural habitats.

The main actions to be implemented as part of the Re-vegetation and Habitat Rehabilitation Plan include the following.

- Identification and Protection of Environmentally Sensitive Areas
- Comprehensive Photographic Record
- Search and Rescue Activities
- Removal of Overburden
- Stormwater Management
- Compaction Rehabilitation Measures (ripping and / or scarifying)
- Erosion control and rehabilitation
- Erosion prevention
- Prevention of sedimentation
- Pollution prevention
- Littering prevention
- Building activity associated impacts
- Plant species management principles
- Fire Hazard
- Fauna
- Rehabilitation Areas and Site Specifications

A rehabilitation plan was compiled for Mopane Solar PV 5 and is included in Annexure 3.

5.10 Traffic Management

A traffic management plan must be in place, specifically for the site access roads to ensure that no hazards would result from the increase truck traffic and that traffic flow would not be adversely impacted. This plan must include measures to minimize impacts on local commuters *e.g*. limiting construction vehicles travelling on public roadways during the morning and late afternoon commute time and avoid using roads through densely populated built-up areas to not disturb existing retail and commercial operations.

The construction timeframe is estimated to be approximately **12-15 months.**

Traffic to and from the work site will be approximately 3 800 medium/heavy vehicle trips during the construction phase. The average number of medium and heavy trucks to and from the site will be 11.5 trucks per working day. The average daily trips of medium and heavy vehicles during the construction phase are indicated and discussed in the Traffic Impact Assessment Report as included in Annexure J of the EIA Report. Due to the anticipated number of vehicle trips to be generated by the proposed project during the construction and operational phases, it is expected that the vehicle traffic anticipated to be generated by the proposed project will have a negligible impact on the existing road network vehicle capacity and existing intersection performance.

Access to and from the proposed project site is discussed in the Traffic Impact Assessment Report as included in Annexure M of the EIA Report and safety factors at existing intersections at or near the development site.

5.11 STORMWATER MANAGEMENT

A storm water management plan must be implemented during the construction and operation phases of the project. The plan must ensure compliance with applicable regulations and prevent off-site migration of contaminated storm water of increase soil erosion. The plan must include the construction of appropriate design measures that allow surface and subsurface movement of water along drainage lines so as not to impede natural surface and subsurface flows. Drainage measures must promote the dissipation of storm water run-off. The purpose of the Storm Water Management Plan (SWMP) is the following:

- To provide guidance to align all phases of development and the eventual operation to the relevant legislation.
- To minimise risk of onsite and / or downstream damage due to hydrological impact. This includes exposure to runoff associated with normal rain, as well as during more extreme flood events.
- To minimise the risk to on site and / or downstream contamination through storm water due to waste on site.
- It needs to consider the impact of rain on the site, the impact of water entering the site from higher ground and the impact of water leaving the site.
- This is not a design report; guidance is given in it for compliance by the eventual design-, implementation- and operational teams.

Diligence in stormwater management is essential and a full-time task, even during dry periods, as the lack of it may lead to slow degrading of the site, rendering it susceptible to serious damage in the event of unexpected flooding, and subsequent potential damage to equipment on site due to gradual erosion after normal rainfall events. Given the low rainfall, flat topography and low flow speed of run-off, no formal storm water structures are required as the proposed gravel roads will be developed at ground level so as not to disturb the natural flow of storm water. This means that run-off will not be concentrated, and the existing drainage patterns will be left undisturbed.

Because of the proximity of the development footprint to the drainage lines and rivers running through the farm it was deemed necessary to conduct a surface water survey which relates to the potential stormwater, on site and a Storm Water Management Plan was compiled.

CONSTRUCTION PHASE STORMWATER MANAGEMENT

- It is recommended that access and service roads, as well as stormwater systems are constructed at the commencement of the construction phase to ensure that suitable stormwater management measures are in place at the least additional cost.
- These permanent routes must be used also for construction purposes. In order to preserve the natural state of the surface and vegetation as far as practically possible, off-road driving must be restricted to the absolute essential.
- Space for lay-down areas for construction material and for construction facilities is restricted on site. It is not possible to give clear directions in terms of positioning it. The following must however be considered:
    - Temporary or permanent soil stockpiles must be placed in such a way to minimize the impact on surface flow.
    - High resolution site survey data must be used to design stormwater ditches to direct surface flood water past any stockpiles.
- Site clearing must be limited to the essential.
- Construction waste, including possible broken and damaged panels must be collected and stored safely for disposal in accordance with the relevant waste regulations, protocols, and product specifications. Care must be taken not to leave any waste on site that can lead to future contamination of the site or the downstream area.
- Training with regards to stormwater management of construction personnel must be undertaken as part of their induction.

OPERATIONAL PHASE STORMWATER MANAGEMENT

- Training with regards to stormwater management of site personnel must be undertaken as part of their induction. Refreshment training must be undertaken periodically.
- Regular conditional inspections of all storm water infrastructure are required. Inspection data must be recorded and accumulated for tracking purposes. Regular reporting must be a scheduled management task.
- Any item that may be found to be out of order, for instance accumulation of settled sand in a trench, or erosion, must be addressed and corrected without delay to keep the storm water system in a good and fully functional condition. Record must be kept on all repairs.
- Specific attention must be given to inspection during and after any rain and/or flood event to kerb any damage that may occur.
- If any structures have to be erected in the 1:100-year flood line zones, Water Use Licencing is compulsory (in terms of section 21(c)) of the National Water Act. Any such licence will contain various conditions about monitoring, maintenance, repair and reporting that must be complied with. It is essential to make this a key responsibility of the relevant manager.

WAY FORWARD

A detailed stormwater management plan will be compiled at the final design stage. Prior to the detailed design stage and implementation, a physical survey needs to be conducted. Based on this:

- The flood line determination must be reviewed.
- The site drainage needs to be designed on this elevation basis, with the full consideration of:
    - Final infrastructural layout on site. The final infrastructural layout and drainage design mutually impact on each other and will therefore be an iterative process.
    - Final flood line alignment that may require either or both of limited infrastructural re-arrangement of ground work to mitigate any exceedance of infrastructural development in the 1:100-year flood zones.

5.12 EROSION MANAGEMENT PLAN

A major component of construction at solar PV sites is the clearing and grading of land, which exposes, disturbs, and moves the soil. This inevitably increases an area's susceptibility to erosion. Since in these situations it is not feasible to eliminate all erosion risk factors and, thus, all erosion, the goal of implementing erosion control measures is primarily to minimize erosion. Therefore, an erosion management plan for monitoring and rehabilitation erosion events associated with the facility is required and appropriate erosion mitigation must form part of the EMPr to prevent and reduce the risk of any potential erosion.

A separate Erosion Management Plan was not compiled, as erosion management is discussed here. Erosion, by the action of water and wind, is a natural process in which soil and rock material is loosened and removed.

There are two major classifications of erosion:
(1) Geological erosion, and
(2) Man-made erosion.

Geological erosion, which includes soil-forming as well as soil-removing, has contributed to the formation of soils and their distribution on the surface of the earth.

Man-made erosion, which can greatly accelerate the natural erosion process, includes the breakdown of soil aggregates and the increased removal of organic and mineral particles; it is caused by clearing, grading, or otherwise altering the land. Erosion of soils that occurs at construction sites is **man-made erosion**.

Human activities can cause compaction of the soil, or disturbance of the soil. This hardening of the soil prevents water from effectively infiltrating the soil. This then results in larger volumes of water which moves quickly across a site carrying sediment to streams and rivers away from the site. The main factor causing or helping erosion on is erosion by water. This is the loosening and removal of soil and rock particles from a piece of land by running water, mostly caused by rainstorms. There are a number of factors influencing or affecting erosion namely soil characteristics, climate, rainfall intensity and duration, vegetation or other surface cover and topography.

5.12.1 Problems Caused by Erosion

The most important effect of erosion is the permanent loss of valuable topsoil at a site. If it is not controlled from the onset of a project and through the duration of the project, it will cause a loss of topsoil and can degrade the area permanently. The sediment that is transported by the rainwater can end up in surface streams and drainage lines and other water bodies.

5.12.2 Actions to stop or minimize erosion on a site

The affected area must be stabilised as soon as possible during or after construction. Preserving of existing vegetation or re-vegetation of disturbed soil as soon as possible after construction is usually the most effective way of controlling erosion. Vegetation cover acts in the following ways to reduce erosion:

- Shielding the soil against the direct impact of rain drops falling on the ground.
- It improves the soil water storage porosity, and more water filters into the ground.
- It slows down runoff so that the sediment can settle on the land.
- It holds the soil in place through the plant root system.

Areas which cannot be re-vegetated must be shaped or changed to effectively slow down the speed of the water over the area or by preventing the water to flow over such an area by diverting it away from the site. Mechanical ways can also be used to minimise or control erosion on a site.

5.12.3 Preserving of Natural Vegetation

By preserving natural vegetation, especially grasses, on the site that does not interfere with the construction process, must be left undisturbed or maintained to minimize damage. It will minimise erosion potential and aesthetically is pleasing which beneficial. The more vegetation area that is preserved the less area exposed to erosion. This is important to the areas between the panels where reseeding of the area afterwards is difficult. This must be planned still before the construction activities on site starts. The trees and shrubs in the area between the panels will unfortunately have to be removed.

- Do not grade the area to a "clean" state before constructing the panel supports and panels. Only remove the rocks and vegetation that will be in the way of the panels. Grass cover can be slashed or sprayed with an herbicide to slow down the regrowth of the grasses during construction.
- Don't let vehicles drive around where the panels must be constructed apart from a few designated driveways. This will prevent compaction of soil and destruction of vegetation in those areas.

5.12.4 Advantages of preserving natural vegetation

- Can handle higher volumes of storm water runoff than newly seeded areas.
- Does not require time to establish and increases filtering capacity because the vegetation and root structure are usually denser in preserved natural vegetation than in newly seeded or base areas.
- Enhances aesthetics.
- Provides areas for infiltration, reducing volume and velocity of storm water runoff.
- Usually requires less maintenance (e.g., irrigation, fertilizer) than planting new vegetation.

It requires good planning to be able to preserve natural vegetation.

5.12.5 Planting of new vegetation

It is important to establish permanent vegetation to minimize soil exposure to water and wind erosion. Vegetation/plants that have fibrous root system with fast establishment of roots and ground cover are good options. The grass cover can be sown by hand or machine sowing after scarifying the soil. Keep the planted area moist if possible so that the seeds can germinate quickly. Do not move over these areas again until a grass cover has been established.

5.12.6 Mulching

Similar to seeding, mulching is a method of applying plant or non-plant materials on the surface of the land to cover bare soil surface. Materials used are grass, hay, woodchips, wood fibres, straw, or gravel that is placed on the soil surface. The main goal of mulching is to protect the surface of the soil from the impact of erosive forces like the falling raindrops. In construction sites, mulch can be placed to minimize wind and water erosion.

However, the type of mulching selection depends on the land (i.e., slope). Heavy and large sized mulch would be more appropriate for a steep slope. In steep or gentle slopes, matting can be done to hold the mulch in place and reduce its movement by wind or water.

When used together with seeding or planting, mulching can aid in plant growth by holding the seeds, fertilizers, and topsoil in place, by helping to retain moisture(conserve moisture), and by insulating against extreme temperatures. If the mulch is plant-based or organic, it also increases the soil fertility. Mulching can provide immediate, effective, and inexpensive erosion control.

Advantages of mulching

- Provides immediate protection to soils that are exposed and that are subject to heavy erosion
- Retains moisture, which may minimize the need for watering
- Requires no removal because of natural deterioration of mulching

Disadvantages of mulching

- It can delay germination of some seeds because cover reduces the soil surface temperature
- Mulch can be easily blown or washed away by runoff if not secured
- Mulch may absorb nutrients necessary for plant growth

5.12.7 Structural measures to control erosion

Berms

Berms can be constructed around a site on especially the upstream side to keep extra water out of the site. This will minimise the volume of water flowing over a site which limits the erosion on the site. Berms can also be constructed on road surfaces with a gradient to slow down the velocity of the water and to divert the water off the road into storm water drains on the site.

Storm water drains

The storm water drains can be packed with rocks on short intervals and art the end to slow down the velocity of the flowing water and to dissipate the energy of the water where it leaves the site.

Gabions

Gabions of wire packed with rocks and lined with geotextile can slow down the water especially where the slope is steep. The geotextiles can also aid in trapping the sediment. This can be used in storm water drains next to roads by installing flat gabions on the drain surface to prevent unnecessary scouring of the soil surface in the drains if it is not constructed of concrete.

5.12.8 Monitoring of erosion on site

Before construction commences, the site manager must appoint a person to be on site for the construction phase. He/she will have the responsibility to monitor the risk and actual erosion arising from activities on site. His/her responsibilities will include:

- Monitoring the movements of vehicles and construction equipment on site to ensure that there is minimal movement off the normal roads and agreed drive lanes between the solar PV panels.
- Monitor the preservation of the vegetation in open spaces to ensure the integrity of the vegetation and soil is kept intact.
- Ensure that only areas are cleared of vegetation according to the site plans
- Ensure that only the planned roads are graded on the site.
- Ensure that gravel roads are kept moist during dry times to prevent the wind from blowing dust away and thus causing erosion in this manner.
- 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 must be rectified as soon as possible.
- Monitor any erosion damage after rains events so that repairs to damaged areas can be done before the next rain event.
- Oversee the re-vegetation/mulching of cleared areas as soon possible to prevent unnecessary re-entry or movement in these areas.

5.13 Effective Monitoring System

An Effective Monitoring System must be in place to detect any leakage or spillage of all hazardous substances during transportation, handling, use and storage. This must include precautionary measures to limit the possibility of oil and other toxic liquids from entering the soil or storm water systems and will prove that environmental degradation and biological diversity have been mitigated and restored where it has been negatively impacted upon. Good record keeping is essential. All illegal invader plants and weeds must be eradicated as required in terms of Sections 119 to 126 of the National Environmental Management Act, 1998 (Act No. 107 of 1998).

Monitoring must take place at regular intervals to establish if the revegetation strategy was successful. The site must be monitored for at least two years to observe any possible invasion by alien species and, if they appear, they must be controlled as is appropriate. Also, to monitor and correct possible erosion, storm water and siltation problems. Soil sampling and analysis must be done every two years to monitor the development of the soil and need for supplementary fertilization.

Construction at solar PV sites will use equipment and vehicles that contain hazardous substances or has the potential to spill hazardous substances on site. There will also be chemicals and other hazardous substances which are used on site, which needs to be stored. This creates the potential for possible spillages and these substances can pollute soil and water systems and it needs to be handled with care. Strict control needs to be exercised regarding the handling and use of such substances.

5.13.1 Possible sources of hazardous substances

The following substances are potentially stored or used on site:

- Most construction vehicles and equipment used on site runs on diesel. The diesel is stored either in stationary tanks or in mobile fuel trailers or bowsers on site.
- The oils needed for lubrication of the equipment and vehicles.
- Hydraulic oils used in drills and equipment like cranes, TLB's and graders.
- Paints used on site.
- Petrol cans for supplying fuel to four-wheeler motorcycles used on site.
- Other chemicals and detergents used on site.

5.13.2 Measures to store hazardous substances on site

All hazardous substances on site must be handled in the following ways:

- All access to these substances must be controlled and must be locked away.
- All containers or storerooms where these substances are kept must have an impermeable floor and must be able to contain the substance in the room/store where it may be cleaned up.
- Where the floor is not impermeable, the substances will be stored in a drip tray capable of containing any spills from these containers.
- Material Safety Data Sheets (MSDS) for the specific substances must be available in a central file where the substances are stored.
- All substances will only be issued against a signature - records will be kept.
- Stationary diesel tanks will be kept in a concrete bunding able to contain at least 110% of the tank volume. A tap to drain storm water inside the bunding must run through an oil/water separator. All oils and fuel from the separator must be taken to an oil recycling company. Records of all oil/fuel removed must be kept.
- Fuel trailers must be parked either with sufficient drip trays underneath or it must be parked on an area where there is plastic sheeting underneath the soil to prevent ingress of the fuel/oil into the subsoil or groundwater. Polluted soil must be removed from time to time to a site registered to accept this material.

5.13.3 Handling of spills

Small spills on the ground

- Pick up the soil to a depth where it is clean from the substance and store it in a closed container from where it cannot leak and closed to rain.
- Have these soils removed by a registered contractor and keep records of volumes and details of each removal.

Large spills on the ground

- Keep spill kits available on site.
- Contain the spill by either using a spill absorbent sock from the spill kit or by making a soil berm around the spill.
- Scoop or pump out as much as possible of the pollutant into a closed container.
- Remove the polluted soil to a depth below the pollutant and place on a large sail to prevent any leaching of the pollutant to the soil and groundwater.
- Close the sails to prevent the ingress rainwater.
- Have the soil removed form site by a company registered to do that to a permitted waste site or let the company treat the soil on site until the pollutant levels are low enough to dispose of the soil on site again.
- If there is a possibility of pollution of groundwater or surface water, samples must be taken to be analysed to ensure that pollution can be treated if necessary.

5.13.4 Transportation of hazardous substances

- It is the responsibility of the transportation company to train their drivers and crews to handle packaging and transportation of hazardous substances safely and environmentally responsible.
- All vehicles transporting hazardous substances to the PV solar site must carry spill kits as first line treatment of spillages of hazardous substances.
- Material Safety Data Sheets (MSDS) for the substances transported must be available in the vehicle used for transportation.

5.13.5 Training of staff

- All staff working on site and responsible for a specific area must be trained in the detection of incidents, and the reporting there-of.
- All staff on site must be trained in the using of the spill response kit.
- All staff must be trained in the using of MSDS's and first aid kits must it be necessary during any spill incident.
- The staff must undergo an environmental consciousness course.

5.13.6 General

All spill incidents must be reported to the environmental control officer who must then report it to the authorities as required by law. Each pollution incident must be entered into a register on site. All details about the spill, the emergency measures taken, and the clean-up done must also be part of the entry in the register. Preventative measures must be drawn up to prevent recurring of the incident. The incident register must be available for scrutiny by IAP's must it be requested.

5.14 Protection of Hydrological Features

Measures must be in place for the protection of hydrological features such as streams, rivers, pans, wetlands, dans and their catchments, and other environmental sensitive areas from construction impacts including the direct or indirect spillage of pollutants. In section 6.11 an Effective Monitoring System, is discussed, which must be in place to detect any leakage or spillage of all hazardous substances during their transportation, handling, use and storage. This includes the protection of hydrological features and other environmental sensitive areas from construction activities and its' impacts. Precautionary measures to limit the possibility of oil and other toxic liquids from entering the soil or storm water systems are discussed and if these measures are implemented it will also lead to the protection of hydrological and other environmentally sensitive features at the proposed development site.

5.15 Fire Management

In case of an unplanned fire, a management plan needs to be in order, which must include management protocols to ensure the surrounding natural environment will not be affected by an unplanned fire sourcing from the facility. The main objective of the fire management plan is to prevent fires on site, not to extinguish fires. A Fire Management Plan will have to be in place to prevent and/or contain fires from spreading that may start at the proposed development site. Fires caused by PV systems are regarded as rare, they do however still happen. Main causes for these fires include:

- Installation mistakes;
- Production failures;
- External influence; and
- Planning failure.

The correct management of these fires are crucial as they not only pose a major risk to the plant but also the surrounding environment and the firefighters (electrocution). There are several scenarios which could lead to a fire event with the BESS. One of these scenarios could lead to an event which is known as a "thermal runaway" which is a chain reaction leading to a decomposition reaction of the cell that spreads to adjacent cells which could consequently lead to an exothermic reaction with heat release, release of flammable and toxic gases which are generated within the cell enclosure before venting and an intense fire due to the fact that the cells are constructed primarily of plastic, it is crucial to note that re-ignition can occur long after the fire is fully extinguished and must be considered a risk long after. Recommendations to reduce potential for BESS fires and the effects it may have on the PV solar park include *inter alia*:

- Batteries installed must have passed the non-thermal runaway propagation tests UL9540A to minimize scaling of a fire and will be contained in one rack.
- BESS enclosures are 60 min fire resistant.
- BESS have an aerosol extinguishing system triggered by temperature.

The continued maintenance of proper fire breaks is very important, as it serves to prevent external fires from entering a farm property and obstruct internal fires from spreading to neighbouring areas.

5.15.1 HIGH LEVEL RISK ASSESSMENT FOR BESS TECHNOLOGY

Batteries store electrical energy in chemical form. The range of electrochemical technologies include:
a) batteries with solid electrolyte, as Lithium-ion battery;
b) batteries with liquid electrolyte, as Na–S battery, Lead–Acid (PbA) battery, nickel - cadmium (Ni–Cd) battery or other types of liquid metal battery.

The preferred technology for the Battery Energy Storage System ("BESS") is **Lithium-ion battery cells**, which will be pre-assembled at the supplier factory and installed in the containers prior to delivery to the site. Lithium-ion cells technology offers the highest energy density (compared to the other cell technologies), does not suffer from memory effect and is low maintenance. Typical lithium-ion cells used for BESS hold a solid rechargeable electrolyte (the energy accumulator), therefore they don't hold any liquid or gas. The main benefit of solid ceramic electrolytes is that there is no risk of leaks, which is a serious safety issue for batteries with liquid electrolytes.

A BESS does not emit any gas to the atmosphere during construction and/or normal operation. The containers of the batteries are equipped with a firefighting system conceived to effectively detect smoke and high temperatures and automatically activate the extinguishers to prevent fire. Furthermore, the external metallic surface of the cells is conceived to resist to fire.

The preferred technology is therefore Lithium-ion battery cells with solid rechargeable electrolyte.

Batteries with liquid electrolytes are not preferred for the risk of leakage and consequent potential impacts on environment.

RISK

The primary focus is on the **fire hazards** associated with Li-ion batteries and potential for a condition known as "thermal runaway". Thermal runaway results from **internal shorts** inside a battery cell which occur due to a variety of reasons and **can ultimately lead to the battery catching fire.**

The following measures will reduce the fire risk to an acceptable level:

- The Battery Management System must include an approved device to preclude, detect, and control thermal runaway.
- The BESS must incorporate appropriately certified inverters/inverter systems and must comply with other recognised safety standards which address risk assessment and controls.

- The BESS must be well away from critical buildings or equipment and located in a non-combustible enclosure. Sufficient clearance must be maintained around the installation to provide for fire service access.
- Clear signage must be visible to include warnings of a possible fire hazard.
- An approved, monitored, automatic smoke detection system must be installed at the BESS. A fire suppression system must be designed and installed at the BESS.
- Regular inspections must be undertaken to ensure the battery systems are not overheating.
- Portable fire extinguishers must be provided at the BESS.
- Installations must have emergency power disconnects to ensure manual, remote, and local disconnect is possible adjacent to the BESS.
- The BESS must have an online condition monitoring system. The system must be fitted with temperature monitoring which incorporates a high temperature alarm for the battery room and container. Temperatures must be monitored at a constantly attended location.

Additional general recommendations to prevent and manage potential contamination of water resources:

- Compilation and adherence to a procedure for the safe handling of battery cells;
- Lithium-ion batteries must have battery management systems (containment, automatic alarms and shut-off systems) to monitor and protect cells from overcharging or damaging conditions, such as temperature extremes;
- Compilation of an Emergency Response Plan for implementation in the event of a spill of electrolyte from the batteries;
- Provision of spill kits on-site for clean-up of spills and leaks;
- Immediate clean-up of spills and disposal of contaminated absorbents and materials or soil at a licensed hazardous waste disposal facility;
- Recording and reporting of all significant electrolyte spills so that appropriate clean-up measures can be implemented. A copy of these records must be made available to authorities on request throughout the project lifecycle;
- Frequent and appropriate disposal of any hazardous waste to prevent pollution of soil and groundwater;
- On-site battery maintenance must only be undertaken on impermeable surfaces with secondary containment measures. Any resulting hazardous substances must be disposed of appropriately; and
- Provision of suitable emergency and safety signage on-site, and demarcation of any areas which may pose a safety risk (including hazardous substances). Emergency numbers for the local police, fire department, Eskom and the Local Municipality must be placed in a prominent clearly visible area on the site.
- Dispose of waste batteries in accordance with national legislation. When collected waste batteries must undergo recycling to comply with national regulations. Batteries must not be disposed of into the environment.

Safe handling advice

- When handling the batteries (cells), use personal protective equipment (non-conductive gloves), specifically to avoid short-circuits between the battery poles.

Technical measures/precautions:

- Follow the instructions reported in the user's manual prepared by the manufacturer.
- Do not short (+) or (-) battery terminals with conductors, do not allow battery terminals to contact each other.
- Do not use unadapted charging systems.
- Do not reverse the polarity,
- Do not mix different types of batteries or mix new and old ones together e.g. in a power pack,
- Do not open the battery system or modules,
- Do not use the unit without its electronic management system,
- Do not submit to static electricity risks to avoid damages to the protecting electronic circuit,
- Do not submit to excessive mechanical stress,
- Do not expose the battery to water or humidity (avoid water condensation),
- Do not expose to heat, solder or throw into fire. Such unsuitable use can cause leakage or evacuate through a safety valve gaseous electrolyte fumes that may cause fire,
- Immediately disconnect the batteries and isolate in a safe place if, during operation, they emit an unusual smell, develop heat, change shape/geometry, or behave abnormally. Contact the manufacturer if any of these problems are observed.

Storage

- Keep in a dry, cool and well-ventilated place, check the recommended storage temperature usually reported in the user's manual prepared by the manufacturer, (e.g. 35°C),
- Keep away from heat sources (max 60°C) and sources of ignition. Protect from direct exposure to sunlight.
- Keep away from water and condensation.
- Store in closed container and packaging, in such a way to prevent short circuits and damages during storage/transportation. Packaging qualified for transport is generally suitable for storage.
- In case of risk of thermal runaway during storage or transport, it is necessary to use strong outer packaging as recommended by the UN Special Provision 376 in order to restrict the potential ejection of cells constituents and battery parts during fire.
- In case of mixed storage of goods and articles, organize separate storage area for lithium-ion batteries. *E.g*. by maintaining a distance of 2.5 meters between the Lithium-ion batteries storage area and other goods.
- Store in limited quantities and in isolated area under external surveillance, unless specifically designed storage building (detectors and/or sprinklers protection systems).
- Infra-Red cameras may be used to detect any excessive temperature raise in stored quantities, *e.g*. > 85°C

The potential hazard offered by damaged lithium batteries *in absence of fire* is mainly release of an electrolyte containing a corrosive salt. Measures must be taken to protect operators from inhaling volatile organic substances. Reaction of the electrolyte with water/humidity may generate hydrofluoric acid and irritate the eyes, nose, throat and skin.

Personal precautions

- Use personal protective equipment.
- Avoid contact with skin and eyes.
- Ventilate the area.
- Position yourself in the wind direction.

Environmental precautions

- Eliminate all possible sources of heat or ignition.
- Prevent further leakage or spillage if safe to do so (use absorbent cloth or other inert absorbent non-conductive mineral such as sand, sodium bicarbonate, alumina or vermiculite).
- Dry clothes can also be used as a absorbent material in absence of fire.
- Do not allow material to contaminate ground water system.

The information below refers to exposure to the substances contained in the battery.

Call for emergency services. Consider and decide about the adapted intervention plan (ACTIVE/PASSIVE Response, proximity or distance response).

In active response, (with Fire)

- Large flow of water can be used to **reduce the temperature of the batteries** and stop the fire reactions inside the batteries. Specific care must be taken for large and compact batteries, where cooling may require more time.
- Foam and specialized products can be used to reduce access of oxygen to the fire and stop flames, but are generally less efficient than cooling down the batteries. Be aware of the risk of re-ignition until the batteries have been cooled down below 100°C.

In passive response, control extension of fire to neighbours materials and buildings:

- Use abundant flow of water to cool down cells or batteries adjacent to the ones that have caught fire (maintain low temperature) whatever the type of batteries at the origin of the fire.
- The first responders need to be informed that in case of fire there is a risk of ejection of projectiles from the battery.

Suitable extinguishing media:

- Water (see below)
- Specialized products, liquid foam, carbon dioxide (CO2), sand, vermiculite.

Warning/risk for the use of water:

- If water is used on active batteries, caution must be taken to avoid the electrical hazard that may be present (in case of high voltage battery, > 36 Volts).

- The decision to use large amount of water is depending on the local circumstances (water retentions systems, environment risks, etc.).
- In case of fire including large Lithium metal or Lithium metal polymer batteries, the use of water may increase the energy /heat release.
- In such case, stop the use of water and allow the energetic fire of the battery during 15 minutes.
- Protect or cool with water the surrounding to avoid propagation of the fire.

Treatment of Wastewater:

- Confine the effluent or the contaminated material and collect it further as hazardous waste (water) for appropriate treatment.
- Pick up and transfer to properly labelled containers.
- Dispose of in accordance with local waste management legislation and emissions regulations.

5.16 Open Space Management Plan

This was not a requirement listed in the EA but is deemed important to manage areas at the development site, which are not going to be utilized but must be managed. An Open Space is any open piece of land that is undeveloped (has no buildings or other built structures) and is accessible to the public. Open space can include a green space, which is land that is partly or completely covered with grass, trees, shrubs, or other vegetation. At a PV plant, the space is defined as green space as it is usually covered by vegetation, but it **is not accessible by the public**.

In the development of a solar PV plant a large proportion of the site will remain in a natural to near-natural condition. Also, a large proportion of the areas disturbed during the construction phase will be re-vegetated with locally occurring species. There must not be a long-term negative impact on the local environment.

5.16.1 Risks and Management on site

The open spaces present certain risks to the site and must be operated and maintained for the safe and effective operation of the facility.

5.16.2 Fire risk on site

The vegetation on the site and specifically on the open areas needs to be managed to have a low fire risk.

- Tall woody plants and any other plants that may pose a risk will have to be cut on a regular basis and removed to minimise the fire risk.
- The grass cover will also have to be kept short to minimise the fire risk.
- NO fires will be allowed within the site, unless at designated areas.
- Fire breaks must be maintained and a road network in the facility must act as fire breaks.

5.16.3 Erosion risk on site

An open area where vegetation is removed during construction is prone to erosion by wind or by water and erosion has to be prevented and minimised as far as possible.

- Demarcate clearance areas and minimise surface disturbance. Do not remove vegetation on areas where panels will not be constructed, and which will be used as open spaces.
- Rehabilitate cleared sites as soon as possible.
- Minimise erosion risks. Do not drive through areas designated as open spaces except on roads constructed for driving.
- Monitor the site regularly for erosion especially after rain events.
- Follow the measures in the erosion management plan.
- Implement dust suppression measures.

5.16.4 Alien vegetation

Open areas can get infested by alien invasive plants as the plants can spread easily in an area in different ways. Open areas as well as the areas between the panels need to be regularly monitored for alien invasive vegetation and this vegetation must be controlled at a young stage according to the alien invasive management plan.

5.16.5 Littering

There is the risk that an open space can get polluted by littering which could come from workers inside the site, or which can be windblown from outside the site. Control littering through good housekeeping and by minimising waste on site.

5.16.6 Summary

Soil is a very valuable resource that needs to be conserved. Construction site managers need to plan well and make sure that measures are in place for managing the impacts of the construction process on aspects like erosion. Conserving the soil on a construction site is far less expensive than mitigation of the damage afterwards. It is also far more efficient to maintain exiting vegetation cover to limit erosion than planting of new vegetation on the site afterwards.

All pollution incidents, especially regarding leakages or spillages of hazardous substances, are important and must be reported and investigated to prevent recurrence of such incidents. It is the duty of each worker and staff member to take the responsibility to monitor their work surroundings for spill incidents and to report it must it happen. This will ensure continual improvement in the environmental performance of the construction and operations teams on the site.

Open spaces must be kept clean and well managed so that if forms part of the visual appeal of the site. It must be managed in such a way as to preserve biological integrity of the site as well as to limit fire risk on the site.

6 AUDITING OF THE EA AND EMPR

Compliance with the conditions of the EA and EMPr for the construction and post-construction monitoring phases must be monitored monthly. Compliance reports must be submitted to the competent authority monthly.

The results of the audit must be recorded in an environmental audit report and any noncompliance 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 326 of the 2014 EIA Regulations, as amended, 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) must comply with these requirements.

Table 4: 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 a 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.

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

Table 5: Roles and responsibilities regarding the implementation of this EMPr

Responsible Parties	**Role and responsibilities**
Environmental Authority – Department of Forestry, Fisheries and the Environment.	Role: The Department of Forestry, Fisheries and the Environment (DFFE) is the competent authority responsible for compliance with the relevant environmental legislation, namely the National Environmental Management Act and other Specific Environmental Management Acts (SEMA's) Responsibilities: • Ensure overall compliance with the Environmental Authorisation (EA) & EMPr. • 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 EMPr and EA.
Holder of the Authorisation – Voltalia South Africa (Pty) Ltd.	Role: The holder of the Authorisation is ultimately responsible and legally liable for ensuring compliance with all statutory requirements relating to the Solar facility. Responsibilities: • 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 EMPr. • Ensuring all other permits, permissions and licences from all other statutory departments are in place.
Environmental Control Officer (ECO) – To be appointed	Role: The ECO fulfils an advisory role to monitor, guide and report compliance with the EMPr. Responsibilities: • 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. • 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	Role: To assist the ECO with the day to day implementation and monitoring of the environmental management actions that are taking place on site. Responsibilities: • 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	Role: 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. Responsibilities: • 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. • 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.
Landowner – Gerbet Trust	Role: The landowner is responsible for compliance with legislation applicable to the management of the remainder of the property. Responsibilities: *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.

ENVIRONMENTAL MANAGEMENT PROGRAMME

7 ENVIRONMENTAL MANAGEMENT PROGRAMME - PV POWER PLANT AND CONNECTION INFRASTRUCTURE

PLANNING & DESIGN PHASE						
PLANNING & DESIGN PHASE						
Impact Management Outcome: Minimise impact to the environment by adhering to planning and design principles and relevant legislation						
Impact Management actions (mitigation measures)	Implementation			Monitoring		
	Responsible person	Method of implementation	Timeframe: implementation	Responsible person	Frequency	Evidence: compliance
• Environmental Management Program (EMPr) must be compiled for clearance of indigenous vegetation and approved by DFFE.	Environmental Consultant	Compile EMPr	During EIA phase	ECO	When EA is issued	Approval of EMPr
• A full Environmental Impact Assessment must be conducted, and Environmental Authorisation obtained from DFFE.	Environmental Consultant	Conduct EIA process, obtain EA	During EIA phase	ECO	When EA is issued	Environmental Authorisation

CLEARANCE PHASE						
AIR QUALITY/NOISE - CLEARANCE PHASE						
Impact Management Outcome: Minimise impact to the environment and people through the control/mitigation of air quality impacts						
Impact Management actions (mitigation measures)	Implementation			Monitoring		
	Responsible person	Method of implementation	Timeframe: implementation	Responsible person	Frequency	Evidence: compliance
Earthworks and vegetation clearance - dust						
• Construction areas must be dampened to prevent excessive dust formation when applicable during clearance and site preparation. • The use of a product like Eco-bond is recommended as opposed to water. It must be an inert product with no pollution risk.	Contractor	Water spray. Dust abatement program	During dry windy conditions	Site manager ECO	Daily	Visual & check records

CLEARANCE PHASE						
AIR QUALITY/NOISE - CLEARANCE PHASE						
Impact Management Outcome: Minimise impact to the environment and people through the control/mitigation of air quality impacts						
Impact Management actions (mitigation measures)	Implementation			Monitoring		
	Responsible person	Method of implementation	Timeframe: implementation	Responsible person	Frequency	Evidence: compliance
• Clearing of the construction sites must be done in phases as the construction progresses. • Cleared topsoil must be stockpiled in such a way that transportation by wind or rain is limited. Restrict height of stockpiles, cover it and/or sandbag it.	Contractor	Clearance schedule	During construction	Site manager ECO	Weekly	Visual & check records
Movement of vehicles and construction equipment-fumes/smoke						
• Vehicles and construction equipment must be well serviced so that it does not produce excessive smoke. • The construction machinery must be maintained properly.	Contractor	Regular services	According to Maintenance schedule	Site Manager ECO	Weekly	Service records
Movement of vehicles and construction equipment-Dust						
• Main roads must be gravelled or sprayed with water especially during the dry months for dust suppression. • The use of a product like Ecobond is recommended as opposed to water. However, it must be inert with no pollution risk. • Internal roads must be maintained on a regular basis during construction.	Contractor	Spray with water truck	When need in construction	Project manager ECO	Daily	Visual check
• A speed limit must be enforced on dirt roads (30km/h). • All vehicles must adhere to all road signage within the site. • Vehicles are only allowed in designated areas.	Contractor	Road signs	During construction	Project manager Contractor	Weekly	Visual check
Burning of cleared vegetation and solid waste or fires for cooking and heating – smoke						
• Cleared vegetation waste will not be burned on site but removed to an authorised waste disposal site in the JB Marks Local Municipality on a regular basis. • No open fires are allowed at construction sites. Plant material can be used as mulch or for compost. Thicker branches can be used for firewood by the workers and community.	Contractor	Instruction to workers Visual checks Supply waste containers & remove waste	During construction	Project manager ECO	Daily for fires Monthly for disposal	Visual check & disposal records

CLEARANCE PHASE						
AIR QUALITY/NOISE - CLEARANCE PHASE						
Impact Management Outcome: Minimise impact to the environment and people through the control/mitigation of air quality impacts						
Impact Management actions (mitigation measures)	Implementation			Monitoring		
	Responsible person	Method of implementation	Timeframe: implementation	Responsible person	Frequency	Evidence: compliance
• Solid waste will not be allowed to be burnt on site. Solid waste must be kept in scavenger and weatherproof bins from where it must be removed to the Local Municipal landfill site weekly. • Fires for cooking must be restricted to designated areas and must never be left unsupervised. • Fire belts must be made around the development. • Fire extinguishers must be placed strategically for easy access. • Smoking only allowed at designated areas per on-site signage. Workers must dispose of cigarette butts in designated containers. • Firebreaks must be maintained to decrease risk of accidental fires.		weekly				
• A waste management and recycling plan must be compiled for the construction phase of the development. The aim of the plan must ensure that the construction materials/debris generated on site be reduced, reused and recycled. The plan must be compiled in consultation with contractors and engineers.	Contractor	Implement plan	Daily during Construction	Project manager ECO	Weekly	Visual Records of disposal.
Movement and operation of vehicles and machinery						
• Contractors must comply with all noise regulations. • It must be ensured that the construction personnel comply with speed restriction of 30 km per hour within the site boundaries to reduce the generation of noise. • Construction vehicles must be serviced regularly to ensure that they do not make excessive noise. The construction machinery must be fitted with noise mufflers and be maintained properly.	Contractor / On-site safety officer	Vehicle maintenance	Continuous in construction according to schedule	Project manager Contractor / on-site safety office	Weekly	Records of compliance and incident register in Safety file

CLEARANCE PHASE						
AIR QUALITY/NOISE - CLEARANCE PHASE						
Impact Management Outcome: Minimise impact to the environment and people through the control/mitigation of air quality impacts						
Impact Management actions (mitigation measures)	Implementation			Monitoring		
	Responsible person	Method of implementation	Timeframe: implementation	Responsible person	Frequency	Evidence: compliance
• Construction of the PV plant and connection must be limited to take place between sunrise and sunset from Monday to Saturday. • Construction activities must only be allowed to take place on Sundays and after hours in case of serious time constraints. Surrounding property owners must be informed immediately if construction is going to take place after hours and/or on Sundays. • A verbal agreement, with adjacent landowners, must be in place before actions are taken outside normal daylight hours and on Sundays and Public Holidays. • Construction activities that is required to be conducted after hours must be done with minimal noise and disturbance.						
• All employees working in a noisy environment must be given the necessary ear protection gear.	Contractor	Physical handout of ear plugs	Daily	Project manager ECO	Weekly	Check use of ear protection by workers

CONSTRUCTION PHASE						
GROUND- AND SURFACE WATER POLLUTION - CONSTRUCTION PHASE						
Impact Management outcome: Minimise impact to the environment and people through the minimisation and control of groundwater and surface water pollution						
Impact Management actions (mitigation measures)	Implementation			Monitoring		
	Responsible person	Method of implementation	Timeframe: implementation	Responsible person	Frequency	Evidence: compliance
Sanitation seepage and spillage from temporary chemical toilets.						
• Chemical sanitation facilities must be used on site and regularly (weekly) serviced by registered companies to ensure that no spills or leaks from toilets to groundwater or surface water take place. • Temporary sanitation system must be regularly inspected to ensure that no spills or leaks from sanitation system to groundwater take place.	Contractor	Appoint service contractor for weekly service of toilets Inspect toilets weekly	Weekly	Project manager ECO	Weekly	Records
• Chemical sanitation facilities must not be positioned closer than 100m from surface water resources. The ratio of one toilet for every 15 workers on site must be maintained.	Contractor	Positioning of toilets	Once off at beginning of each phase	Project manager ECO	Monthly	Visual inspection
Spillage of fuel and lubricants from construction vehicles and machinery						
• Construction vehicles must be serviced regularly to prevent or minimize the risk of spills or leakages of fuel and oil. • If servicing of vehicles is done on site, it must be done at designated areas. • All construction vehicles must be inspected for oil and fuel leaks regularly and frquently. • Vehicles must be parked with spill pans underneath vehicles. • The storage of fuel, oils and lubricants must only take place where spillages can be controlled, in bunded areas.	Contractor	Service records, instructions/training to drivers and visual checks. Maintenance at service centre or on site (emergency) as required.	Daily	Project manager ECO	Monthly	Visual check Records check
• When a spill incident occurs all possible measures must be taken to ensure that spilled fuel or oil do not reach any drainage line. Water falling on areas polluted with oil/diesel or other hazardous substances must be contained.	Contractor	Handle the spill correctly	When spill takes place	Project manager ECO	Monthly	Check spill records

CONSTRUCTION PHASE						
GROUND- AND SURFACE WATER POLLUTION - CONSTRUCTION PHASE						
Impact Management outcome: Minimise impact to the environment and people through the minimisation and control of groundwater and surface water pollution						
Impact Management actions (mitigation measures)	Implementation			Monitoring		
	Responsible person	Method of implementation	Timeframe: implementation	Responsible person	Frequency	Evidence: compliance
• Any excess or waste material or chemicals must be removed from the site and discarded in an environmental friendly way. • Spill incidents must be reported to DFFE and North-West Department of Economic Development, Environment, Conservation and Tourism (DEDECT) in terms of Section 30(5) of NEMA.						
Solid and domestic waste removal						
• Domestic waste must be kept in adequate wind-, water- and animal proof waste bins or storage cages and must be disposed of weekly at a registered municipal landfill site. • Waste must be sorted and recycled as far as possible.	Contractor	Continuous	Weekly removal	Project manager/ECO	Daily checking Weekly removal	Disposal records
• Ensure strict compliance that no foreign matter is deposited in trenches. Foreign matter must be removed immediately.	Contractor	Visual inspection before closure	Continuous	Project manager ECO	Weekly	Spot checks
Spillage as a result of BESS and potential contamination of water resources.						
• Compilation and adherence to a procedure for the safe handling of battery cells. • Lithium-ion batteries must have battery management systems (containment, automatic alarms and shut-off systems) to monitor and protect cells from overcharging or damaging conditions, such as temperature extremes. • Compilation of an Emergency Response Plan for implementation in the event of a spill or leakage. • Provision of spill kits on-site for clean-up of spills and leaks.	Contractor	Visual inspection before closure	Continuous	Project manager ECO	Weekly	Spot checks

CONSTRUCTION PHASE						
GROUND- AND SURFACE WATER POLLUTION - CONSTRUCTION PHASE						
Impact Management outcome: Minimise impact to the environment and people through the minimisation and control of groundwater and surface water pollution						
Impact Management actions (mitigation measures)	Implementation			Monitoring		
	Responsible person	Method of implementation	Timeframe: implementation	Responsible person	Frequency	Evidence: compliance
• Immediate clean-up of spills and disposal of contaminated absorbents and materials or soil at a licensed hazardous waste disposal facility. • Recording and reporting of significant fuel, oil, hydraulic fluid or electrolyte spills or leaks for appropriate clean-up measures to be implemented. Copy of records must be made available to authorities on request through project lifecycle. • Frequent and appropriate disposal of general and hazardous waste to prevent pollution of soil and groundwater. • Installation of leak detection monitoring systems where possible. • On-site battery maintenance must only be undertaken on impermeable surfaces with secondary containment measures. Any resulting hazardous substances must be disposed of appropriately. • Provision of suitable emergency and safety signage on-site, and demarcation of areas which may pose a safety risk (including hazardous substances). Emergency numbers for local police, fire department, Eskom and Local Municipality must be placed in a prominent clearly visible area on the site. • DFFE and North-West Department of Economic Development, Environment, Conservation and Tourism (DEDECT) must be notified immediately of any incident, which constitutes an unexpected, sudden, and uncontrolled release of a hazardous substance, including major emission, fire or explosion, that causes, has caused or may cause significant harm to the environment, human life or property.						

CONSTRUCTION PHASE						
GROUND- AND SURFACE WATER POLLUTION - CONSTRUCTION PHASE						
Impact Management outcome: Minimise impact to the environment and people through the minimisation and control of groundwater and surface water pollution						
Impact Management actions (mitigation measures)	Implementation			Monitoring		
	Responsible person	Method of implementation	Timeframe: implementation	Responsible person	Frequency	Evidence: compliance
Spillage/use of fuel in temporary fuel tanks as well as construction activities (*e.g.*, mixing of concrete, cement, paints etc.)						
• Diesel storage must be **less** than 80 000 litres at construction camps (higher volume will require EA). • A bund wall must be constructed around the fuel tank structures and the run-off diverted to a conservancy tank. • The constructed bund must be able to hole 110% of the maximum allowable volume of the fuel tank. • Fuel tank must be covered with a roof to minimise rainwater ingress. • Drip pans must be used during re-fuelling and servicing of construction vehicles. Drip pans can also be placed underneath stationary construction vehicles and equipment. • Spilled fuel must be disposed of at the nearest approved fuel recycling collection point. Alternatively , an approved contractor can collect fuel waste and old oil to be taken to a licensed hazardous waste landfill site.	Contractor	Supply and erect surface tanks <30 000 litres	When required	Project manager	Weekly	Inspection log sheet Spot checks/photos
• Provision must be made for refuelling at the storage area by protecting the soil with an impermeable groundcover. Where dispensing equipment is used, a drip tray must be used to ensure small spills are contained.	Contractor	Supply drip trays and sheeting	Prior to any refuelling	Project manager ECO	Weekly	Photos
• Where refuelling away from the dedicated refuelling station is required, a mobile refuelling unit must be used. Appropriate ground protection such as drip trays must be used.	Contractor	Supply drip trays and sheeting	Prior to any refuelling	Project manager ECO	Weekly	Photos
• Mixing of cement, concrete, paints etc. must be done at designated areas in concrete aprons or on protected plastic linings to contain possible spillages into surface / groundwater resources.	Contractor	Supply protective material	When needed in construction	Project manager ECO	Weekly	Spot checks/photos

CONSTRUCTION PHASE						
GROUND- AND SURFACE WATER POLLUTION - CONSTRUCTION PHASE						
Impact Management outcome: Minimise impact to the environment and people through the minimisation and control of groundwater and surface water pollution						
Impact Management actions (mitigation measures)	Implementation			Monitoring		
	Responsible person	Method of implementation	Timeframe: implementation	Responsible person	Frequency	Evidence: compliance
• Accidental spillages must be contained and cleaned up promptly. • Spill kits must be on-hand to deal with spills immediately.	Contractor	Have spill kits available	When spills take place	Project manager ECO	Monthly	Spill records
• Spillages or leakages must be treated according to an applicable procedure as determined by a plan of action for the specific type of disturbance.	Contractor	Spills procedure available on site and communicate to workers		Project manager ECO	Monthly	Spill records
• The temporary vehicle maintenance yard and storage area must be fenced off.	Contractor	Fence off yard	Beginning of construction	Project manager	Weekly	Once off check
• Hazardous waste e.g. bitumen, oils, oily rags, paint tins and other used parts like filters must be contained and disposed of at approved waste landfill site licensed for such waste.	Contractor	Appoint contractor for disposal of parts	Start of construction. Disposal as needed	Project manager ECO	Monthly	Disposal records / Invoices and or receipts
Leakage of oil from the power transformers of the on-site HV substation						
• The on-site HV substation and switching station must be built according to the Eskom standards and guidelines.	Contractor	Build according to standards and guidelines	Construction phase	Project Manager	Weekly	Construction site meetings and records
• According to Eskom *Oil Clean-Up And Rehabilitation Standards*, containment of spillages must involve action that will prevent or stop a spill from spreading. It's vital to prevent oil spills from entering stormwater systems. Containment of oil pollution can be done using one or more of the following: ○ soil barriers; ○ sand bags; ○ bund walls; and ○ absorbent materials.	Contractor	Clean up according to standards and guidelines	When needed	Project manager ECO	Monthly	Checking of spillage records

CONSTRUCTION PHASE						
GROUND- AND SURFACE WATER POLLUTION - CONSTRUCTION PHASE						
Impact Management outcome: Minimise impact to the environment and people through the minimisation and control of groundwater and surface water pollution						
Impact Management actions (mitigation measures)	Implementation			Monitoring		
	Responsible person	Method of implementation	Timeframe: implementation	Responsible person	Frequency	Evidence: compliance
• Polluted soils must be removed to a waste site where it is authorized.						
Storage and disposal of waste and littering on site						
• Solid waste generated by the construction teams will not be burned on site or the surrounding areas. Solid waste must be kept in animal and weatherproof bins at the construction site. • Solid waste must be removed and taken to the Local Municipality landfill site regularly, together with building rubble as the development progresses. • Regular clean-up programs must be put into effect throughout the premises to limit the impact of littering caused by construction activities.	Contractor	Supply waste containers Dispose of waste at the correct site Clean up site regularly	Continuously during construction Daily cleaning	Project manager ECO	Monthly	Check disposal records
• A comprehensive waste and recycling management plan must be compiled for the construction phase. The aim of the plan must be to ensure that the construction materials/debris generated on site be reduced, reused and recycled. • This plan must be compiled in consultation with the contractors and engineers and must be implented as indicated.	Contractor	Get waste plan from Project Manager	Start of construction	Project manager ECO	Once off	Waste and recycling management plan records
Storage of chemicals						
• Chemicals must be stored on an impervious surface protected from rainfall and storm water run-off. • Safety data sheets (MSDS) must be visible where chemicals are stored.	Contractor	Correct storage of the chemicals	Continuously during construction	Project manager ECO	Once off	Spot checking

CONSTRUCTION PHASE						
GROUND- AND SURFACE WATER POLLUTION - CONSTRUCTION PHASE						
Impact Management outcome: Minimise impact to the environment and people through the minimisation and control of groundwater and surface water pollution						
Impact Management actions (mitigation measures)	Implementation			Monitoring		
	Responsible person	Method of implementation	Timeframe: implementation	Responsible person	Frequency	Evidence: compliance
Storm water across cleared areas						
• Clearance of vegetation must be restricted to 181ha development footprint, and a 132 kV powerline of 2,8 km will be constructed from the onsite substation to the collector substation which is also located on Portion 12 of the farm Blaauwbank 125 IQ. • Construction activities must be restricted to the 181ha footprint.	Contractor	Construction according to plans	During construction phase	Project manager ECO	Weekly	Check construction against plan
• Cleared areas must be rehabilitated by reintroducing a grass layer as soon as possible to limit the occurrence of water/wind erosion.	Contractor	Vegetate area with grass layer	During construction	Project manager ECO	Monthly	Checking Photo records
• Slopes produced by removing of soil must be kept to a minimum to reduce the chances of erosion damage to the area.	Contractor	Construction according to plans	Construction phase	Project manager ECO	Monthly	Checking Photo records
• Trenches for pipes or cables must follow the shortest and most efficient possible route to connect plant components (PV strings, MV stations, HV substation, *etc*.). • Where possible, construction of trenches must be dug next to roads where it will have the smallest impact. Any trenches dug for services to various buildings must be filled up and compacted well and slightly higher than the areas around it. • Construct sufficient outflow drains from roads to prevent soil erosion.	Contractor	Construction according to plans	During construction phase	Project manager ECO	Monthly	Checking Photo records
• Monitor and repair any signs of erosion after heavy downpours.	Contractor	Visual checks	After rainstorms	Project manager ECO	Monthly	Visual checks

CONSTRUCTION PHASE

GROUND- AND SURFACE WATER POLLUTION - CONSTRUCTION PHASE

Impact Management outcome: Minimise impact to the environment and people through the minimisation and control of groundwater and surface water pollution

Impact Management actions (mitigation measures)	Implementation			Monitoring		
	Responsible person	Method of implementation	Timeframe: implementation	Responsible person	Frequency	Evidence: compliance
The use of herbicides to control exotic invasive vegetation species						
• Alien Invasive Management plan (cluded in EMPr) is applicable.	Project Manager	Compile rehabilitation plan	Prior to construction	Project manager/ECO	Once off	Eradication and rehabilitation plan
• Use of eco-friendly products to control pests vermin and invasive plants must be promoted and an ecologist be consulted before use.	Contractor	Check type of products to use	Prior to use in construction phase	Project manager ECO	During site meetings	Records of products used.

3

WATER SUPPLY MANAGEMENT - CONSTRUCTION PHASE

Impact Management outcome: Implement responsible water usage

Impact Management actions (mitigation measures)	Implementation			Monitoring		
	Responsible person	Method of implementation	Timeframe: implementation	Responsible person	Frequency	Evidence: compliance
Construction activities and dust abatement along internal roads and at construction sites						
• Water must be used sparingly and it must be ensured that no water is wasted. • Roads must be treated with dust abatement chemicals to reduce the use of water. The use of a product like Eco-bond is recommended as opposed to water. However, it must be an inert product with no pollution risk. • Washing of construction vehicles must be limited and done with high pressure sprayers to reduce water consumption. • Water tanks must be inspected to ensure no leaks occur. • Construction workers must be educated on the importance and ways to use water sparingly.	Contractor	Keep water use records Training of workers in water saving	Continuous	Project manager ECO	Monthly	Visual checks

WATER SUPPLY MANAGEMENT - CONSTRUCTION PHASE						
Impact Management outcome: Implement responsible water usage						
Impact Management actions (mitigation measures)	Implementation			Monitoring		
	Responsible person	Method of implementation	Timeframe: implementation	Responsible person	Frequency	Evidence: compliance
Water use by exotic invasive plant species						
• Current exotic weed species must be eradicated, increasing water seepage towards the surface and groundwater resources.	Contractor	Program of eradication of weeds	Continuous during construction	Project manager ECO	Monthly	Spot checks

SOIL POLLUTION AND DEGRADATION (Geology, Soils & Wetlands) - CONSTRUCTION PHASE						
Impact Management outcome: Minimise impact to the environment and people through the minimisation and control of soil pollution and degradation						
Impact Management actions (mitigation measures)	Implementation			Monitoring		
	Responsible person	Method of implementation	Timeframe: implementation	Responsible person	Frequency	Evidence: compliance
Operation of construction vehicles and machinery & Fuel storage (leakages)						
• Construction vehicles must be well serviced and maintained regularly according to manufaturers' specifications to prevent oil and fuel leaks. • All construction vehicles must be inspected for oil and fuel leaks regularly and frequently. • Temporary vehicle maintenance yard and storage area must be fenced off.	Contractor	Maintenance of vehicles	According to schedule	Project manager ECO	Monthly	Records
• Used parts like filters must be contained and disposed of at a site licensed for dumping of these waste products.	Contractor	Disposal at correct site	As maintenance is done	Project manager ECO	Monthly at site meetings	Records
• Machinery must be serviced and re-fuelled at existing facilities as far as is possible.	Contractor	Instructions to drivers	Continuously	Project manager ECO	Monthly	Records

SOIL POLLUTION AND DEGRADATION (Geology, Soils & Wetlands) - CONSTRUCTION PHASE						
Impact Management outcome: Minimise impact to the environment and people through the minimisation and control of soil pollution and degradation						
Impact Management actions (mitigation measures)	Implementation			Monitoring		
	Responsible person	Method of implementation	Timeframe: implementation	Responsible person	Frequency	Evidence: compliance
• Prevent spillage of fuel or oil onto the soil, and put in place measures to ensure that any accidental spillages can be contained and cleaned up promptly. • Any spills must be treated and removed by a qualified agent/company.	Contractor	Clean-up	When applicable	Project manager ECO	Monthly	Records
• Diesel storage must be **less** than 30 000 litres at construction camps. • A bund wall must be constructed around the fuel tank structures and the run-off diverted to a conservancy tank. • The spilled fuel must be disposed of at the nearest approved fuel recycling collection point. Alternatively drip pans can be placed underneath temporary fuel tanks. • Drip pans must be used when refuelling and servicing construction vehicles or equipment. • Drip pans must be placed underneath stationary vehicles. • Used or spilled oil must be taken to the nearest oil refiner or recycling plant for recycling.	Contractor	Supply and erect surface tanks <30 000 litre	When required	Project manager ECO	Weekly	Inspection log sheet Spot checks/photos Disposal records
• Spill kits must be at-hand to deal with spills immediately.	Contractor	Keep spill kits on site	When required	Project manager / ECO	Weekly	Inspection log sheet. Spot checks/photos
Leakage of oil from the power transformers of the on-site HV substation						
• The on-site HV substation and switching station must be built according to the Eskom standards and guidelines.	Contractor	Build according to plans	Construction phase	Project manager	Weekly	Inspection Reporting at Site meetings.
• According to the *Eskom Oil Clean-Up And Rehabilitation Standards*, the containment of spillage must involve an action that will either prevent or stop a spill from spreading. It is vital to prevent any oil spill from entering the stormwater system.	Contractor	Treat spillage as prescribed in standards	When applicable in construction phase	Project manager ECO	When applicable	Incident logs and reports. Photo records

SOIL POLLUTION AND DEGRADATION (Geology, Soils & Wetlands) - CONSTRUCTION PHASE						
Impact Management outcome: Minimise impact to the environment and people through the minimisation and control of soil pollution and degradation						
Impact Management actions (mitigation measures)	Implementation			Monitoring		
	Responsible person	Method of implementation	Timeframe: implementation	Responsible person	Frequency	Evidence: compliance

• Containment of the oil near the source will minimize pollution and will enable easy clean-up and/or remediation. This shall be done using one or more of the following:
  ○ soil barriers;
  ○ sand bags;
  ○ bund walls; and
  ○ absorbent materials.
• Polluted soils must be removed to a waste site which is authorised to accept it.						

Spillage from temporary chemical toilets						
• Chemical sanitation facilities must be used on site and regularly serviced by registered companies to ensure that no spills or leaks from toilets to groundwater or surface water take place. The ratio of one toilet for every 15 workers on site must be maintained. • The temporary sanitation system in the construction site must be regularly inspected to ensure that no spills or leaks from sanitation system to groundwater take place. • For the private wastewater treatment works, the applicant must obtain approval in terms of the National Water Act, 1998 (Act No. 36 of 1998) (NWA) for the water and sewer uses of the proposed development. • Plan and execute groundwater management plan around the selected site to protect the already vulnerable aquifer. (Must be submitted with WULA for approval)	Contractor	Appoint service contractor	Weekly	Project manager	Monthly	Spot checks
Increase in storm water run-off - soil erosion						
• Cleared areas must be re-vegetated allowing a grass layer to re-establish as soon as possible to limit erosion.	Contractor	Construction according to	Construction phase.	Project manager	Weekly	Check construction

SOIL POLLUTION AND DEGRADATION (Geology, Soils & Wetlands) - CONSTRUCTION PHASE						
Impact Management outcome: Minimise impact to the environment and people through the minimisation and control of soil pollution and degradation						
Impact Management actions (mitigation measures)	Implementation			Monitoring		
	Responsible person	Method of implementation	Timeframe: implementation	Responsible person	Frequency	Evidence: compliance
• Minimize land disturbance. • Ensure that exposed bare soil is minimized by staging earthworks in phases and leaving as much ground cover intact as possible during construction. • Develop and implement stringent erosion and dust control practices. • The clearing of the site must be done in phases as the construction progresses. An efficient erosion control and slope-stabilizing program must be designed and implemented along the steep slopes of the site to reduce the risk of erosion. • Conservation of topsoil must be prioritized on site. • Slopes produced by removing of soil must be kept to a minimum to reduce chances of erosion damage to the area.		plans. Follow revegetation plans	Continuous rehabilitation	ECO		against plan
• Monitor and repair any signs of erosion after heavy downpours. • Repair erosion damage as soon as possible to allow for sufficient rehabilitation growth.	Contractor	Visual checks Repair erosion	After rainstorms	Project manager/ECO	Monthly	Visual checks
• Institute a storm water management plan. • Have both temporary (during construction) and permanent erosion control plans.	Contractor	Institute stormwater plans	Prior to Construction	Project manager ECO	Monthly	Visual Checks
• Sufficient drainage must be provided along access roads to prevent erosion and pollution of watercourses or wetlands. • Natural storm water runoff not contaminated during the development and clean water can be discharged directly to watercourses and water bodies, subject to the Project Manager's approval and support by ECO.	Contractor	Construct roads with drainage according to plans	During construction phase	Project manager ECO	Monthly	Visual checks
• Training with regards to stormwater management of construction personnel must be undertaken as part of their induction.	Contractor	Training and induction program	Prior to working on site	Project manager ECO	Weekly	Check records

SOIL POLLUTION AND DEGRADATION (Geology, Soils & Wetlands) - CONSTRUCTION PHASE						
Impact Management outcome: Minimise impact to the environment and people through the minimisation and control of soil pollution and degradation						
Impact Management actions (mitigation measures)	Implementation			Monitoring		
	Responsible person	Method of implementation	Timeframe: implementation	Responsible person	Frequency	Evidence: compliance
Solid waste accumulation on/in soil. Storage and disposal of building rubble, waste and littering on site						
• Solid waste must be kept in adequate animal-proof waste bins (scavenger and weatherproof) at the construction camp and at the construction sites. Building rubble and waste must be removed on a regular basis to the Local Municipality's landfill site. • A suitably positioned and clearly demarcated waste collection site must be identified and provided. • The waste collection site must be maintained in a clean and orderly manner. • Waste must be sorted into separate bins and clearly marked for each waste type for recycling and safe disposal. • Staff must be trained in sorting of waste. • A comprehensive waste management plan must be compiled for the construction phase to ensure that construction waste on site be reduced, reused and recycled. • Regular clean-up programs must be put into effect throughout the premises to limit the impact of littering caused by construction activities.	Contractor	Continuous implementation of waste management plan	Weekly removal	Project manager ECO	Monthly	Records of waste disposal to be kept.
Handling/use/storage of dangerous substances (spillages)-Storage of chemicals/fuels on site						
• Chemicals to be stored on an impervious surface protected from rainfall and storm water run-off. (If necessary in a bunding)	Contractor	Supply safe, protected storage for chemicals and drip trays and sheeting	When required	Project manager ECO	Monthly	Inspection log sheet

SOIL POLLUTION AND DEGRADATION (Geology, Soils & Wetlands) - CONSTRUCTION PHASE						
Impact Management outcome: Minimise impact to the environment and people through the minimisation and control of soil pollution and degradation						
Impact Management actions (mitigation measures)	Implementation			Monitoring		
	Responsible person	Method of implementation	Timeframe: implementation	Responsible person	Frequency	Evidence: compliance
Excavation for cabling and pipes laying						
• Trenches for pipes or cables will be constructed following the shortest and the most efficient possible route in order to connect all plant components (PV strings, MV substations, HV substation, *etc*.), where possible the construction of this trenches will be dug next to the roads where it will have the smallest impact. • Any trenches dug for the supply of services to buildings of the PV plant must be filled up and compacted well and slightly higher than the areas around it. This would allow for settling of the soil without trenches or erosion gullies forming again. • Repair all erosion damage as soon as possible no later than six months before the termination of the Maintenance Period to allow for sufficient rehabilitation growth. • Sufficient drainage must be provided along access roads to prevent erosion and pollution.	Contractor	Follow construction plans	Construction phase	Project manager ECO	Weekly	Visual checks Photo records
Assembly and installation of towers						
• Prior to installation, assembled towers and tower sections must be stored on elevated surface (suggest wooden blocks) to minimise damage to the underlying vegetation. • In sensitive areas, tower assembly must take place off-site or away from sensitive positions. • The crane used for tower assembly must be operated in a manner which minimises impact to the environment. • The number of crane trips to each site must be minimised. • Wheeled cranes must be utilised in preference to tracked cranes.	Contractor	Follow construction plans	Construction phase	Project manager ECO	Weekly	Visual checks Photo records

SOIL POLLUTION AND DEGRADATION (Geology, Soils & Wetlands) - CONSTRUCTION PHASE						
Impact Management outcome: Minimise impact to the environment and people through the minimisation and control of soil pollution and degradation						
Impact Management actions (mitigation measures)	Implementation			Monitoring		
	Responsible person	Method of implementation	Timeframe: implementation	Responsible person	Frequency	Evidence: compliance
• Access to tower positions to be done in accordance with access requirements. • Vegetation clearance to be undertaken in accordance with general vegetation clearance requirements specified in Section: Vegetation clearing. • No levelling at tower sites must be permitted unless approved by Site Manager. • Topsoil must be removed separately from subsoil material and stored for later use during rehabilitation of such tower sites. • Topsoil must be stored in heaps not higher than 2m to prevent destruction of the seed bank within the topsoil. • Excavated slopes must be no greater that 1:3, but where unavoidable, slopes must be stabilised. • Fly rock from blasting must be minimised and pieces greater than 150 mm falling beyond the site, must be collected and removed. • Only existing disturbed areas must be utilised as spoil areas. • Surface water runoff is appropriately channeled through or around spoil areas. • During backfilling operations, care must be taken not to dump topsoil at the bottom of a foundation and then put spoil on top. • The surface of the spoil must be rehabilitated in accordance with the requirements specified in this EMPr. • Retained topsoil must be spread evenly over rehabilitation areas and compacted to effect re-vegetation of areas and prevent erosion as soon as construction activities are complete. Spreading of topsoil must not be done, beginning of the dry season.						

SOIL POLLUTION AND DEGRADATION (Geology, Soils & Wetlands) - CONSTRUCTION PHASE						
Impact Management outcome: Minimise impact to the environment and people through the minimisation and control of soil pollution and degradation						
Impact Management actions (mitigation measures)	Implementation			Monitoring		
	Responsible person	Method of implementation	Timeframe: implementation	Responsible person	Frequency	Evidence: compliance
Stringing						
• Where possible, previously disturbed areas must be used for the siting of winch and tensioner stations. In all other instances, the siting of the winch and tensioner must avoid access restricted areas and other sensitive areas. • Winch and tensioner station must be equipped with drip trays to contain any fuel, hydraulic fuel or oil spills and leaks. • In case the development of overhead grid connection infrastructure, a one metre "trace-line" may be cut through vegetation for stringing purposes only and no vehicle access must be cleared along "trace-lines". Vegetation clearing must be undertaken by hand, using chainsaws and handheld implements, with vegetation being cut off at ground level. No tracked or wheeled mechanised equipment must be used. • Alternative methods of stringing which limit impact to the environment must always be considered e.g. by hand or using a helicopter (in case the terrain is difficult and not accessable). • Where stringing operation crosses a public or private road protection measures must be installed to facilitate access. • If access has to be closed for a period during development, the persons affected must be given reasonable notice, in writing. • No services (electrical distribution lines, telephone lines, roads, railways lines, pipelines fences etc.) must be damaged because of stringing operations. Where disruption to services is unavoidable, persons affected must be given reasonable notice, in writing. • Necessary scaffolding protection measures must be installed to prevent damage to the structures supporting certain high value agricultural areas such as vineyards, orchards, nurseries.	Contractor	Visual Checks	Prior to construction/ During construction	ECO/ PM	Daily	Visual checks and photographic evidence where applicable

SOIL POLLUTION AND DEGRADATION (Geology, Soils & Wetlands) - CONSTRUCTION PHASE						
Impact Management outcome: Minimise impact to the environment and people through the minimisation and control of soil pollution and degradation						
Impact Management actions (mitigation measures)	Implementation			Monitoring		
	Responsible person	Method of implementation	Timeframe: implementation	Responsible person	Frequency	Evidence: compliance
Handling of soils						
• Soil must be handled when dry during removal and placement to reduce the risk of compaction. • During construction, sensitive soils with high risk of compaction (e.g. clayey soils) must be avoided by construction vehicles and equipment, wherever possible, to reduce potential impacts. • Topsoil must not be compacted in any way, nor must any object be placed or stockpiled upon it. • Stockpile topsoil for a minimum time period *i.e*. strip just before the activity commences and replace as soon as completed. • Stockpile topsoil separately from subsoil. • Stockpile in an area protected from storm water runoff and wind. • Topsoil stockpiles must not exceed 2.0 m in height and must be protected by a mulch cover where possible. • Maintain topsoil stockpiles in a weed free condition. • Direct storm water past stockpiles by designing stormwater ditches.	Contractor	Handle according to Procedure	Construction phase	Project manager ECO	Monthly	Visual Checks
Geo-technical characteristics of soils at sites						
• The recommendations with regard to the geo-technical characteristics of the underlying soils must be adhered to.	Contractor	Handle soils according to Geotech report	Construction phase	Project Manager	Monthly	Check development according to layout plans

ECOLOGY - CONSTRUCTION PHASE						
Impact Management outcome: Minimise and control impact to the ecological aspects during construction.						
Impact Management actions (mitigation measures)	Implementation			Monitoring		
	Responsible person	Method of implementation	Timeframe: implementation	Responsible person	Frequency	Evidence: compliance
Earthworks and vegetation clearance-loss of protected plants/other vegetation						
• The herbaceous layer must not be cleared prior to the construction of the plant but slashed. Once erected, the herbaceous layer could be kept short through slashing, which will also allow grazing in the area by small livestock and game species. • Clearance of vegetation and construction activities must be restricted to the proposed 181ha footprint, new section of access road **and** the connection infrastructure site - from the on site substation to the Theseus substation. • No-go areas must apply must the walk over reveal red data species. • For the Eskom connection and development of new overhead powerlines a one metre "trace-line" must be cut through the vegetation for stringing purposes only and no vehicle access must be cleared along the "trace-line". Alternative methods of stringing which limit impact to the environment must always be considered. • Care must be taken that unnecessary clearance of natural vegetation does not take place. Restrict it to the footprint area. • During construction, sensitive habitats (prestine grassland) must be avoided by construction vehicles and equipment, wherever possible, in order to reduce potential impacts. • Trenches pose a risk to ground-living animals and must be cordoned off and backfilled as soon as possible during construction to prevent animals from falling into trenches.	Contractor	Demarcate/ fence development and no-go areas	Before construction phase	Project manager ECO	Weekly	Visual inspection

ECOLOGY - CONSTRUCTION PHASE						
Impact Management outcome: Minimise and control impact to the ecological aspects during construction.						
Impact Management actions (mitigation measures)	Implementation			Monitoring		
	Responsible person	Method of implementation	Timeframe: implementation	Responsible person	Frequency	Evidence: compliance
• Clearly demarcate the entire development footprint prior to initial site clearance and prevent construction personnel from leaving the demarcated area. • During construction, sensitive habitats must be avoided by construction vehicles and equipment, wherever possible, to reduce potential impacts. Only necessary damage must be caused and, for example, unnecessary driving around in the veld or bulldozing natural habitat must not take place.						
• Cleared areas must be re-vegetated allowing a grass layer to re-establish as soon as possible to limit erosion. • Unnecessary driving around in the veld or bulldozing natural habitat must not take place. • The herbaceous layer must be revived after clearance of vegetation and actively managed through slashing during its lifetime of the project to help prevent fires in the panel area.	Contractor	Rehabilitation with grass layer	After each clearing phase and construction	Project manager ECO	Weekly	Visual inspection
• Clearance of vegetation must be done in phases and concurrent rehabilitation of impacted areas surrounding the site could also be implemented to ensure areas are kept as natural as possible. • At the end of construction all equipment and infrastructure used for construction purposes must be removed.	Contractor	Schedule clearance and rehabilitation roster	Prior to each clearing phase	Project manager ECO	Weekly/daily	Visual inspection
• A monitoring plan is recommended for the construction phase to ensure minimal impacts on ecology. • Bird nests found in this phase must be reported to the ECO.	Project Manager	Compile monitoring plan	During construction phase	Project manager ECO	Weekly/daily	Visual inspection
• No protected plants must be removed without authorisation from North-West Nature Conservation. • Project must comply with the North-West Nature Conservation Laws.	Project Manager	Apply for permits.	Prior to construction	Project Manager ECO	Weekly/Daily	Visual inspection.

ECOLOGY - CONSTRUCTION PHASE						
Impact Management outcome: Minimise and control impact to the ecological aspects during construction.						
Impact Management actions (mitigation measures)	Implementation			Monitoring		
	Responsible person	Method of implementation	Timeframe: implementation	Responsible person	Frequency	Evidence: compliance
• The ECO must advise the construction team in relevant matters to ensure minimum destruction and damage to the environment. • ECO must enforce measures that he/she deem necessary. Regular environmental training must be provided to workers to ensure protection of habitat, fauna and flora.	ECO	ECO site visits and training sessions	Prior to and ongoing during construction phase	Project manager & ECO	Monthly	Visual inspection & monitoring reports
Vegetation clearance and the use of herbicides to control re-growth-Inappropriate use of herbicides and pesticides						
• Herbicides used to control invasive plants must be chosen in consultation with an ecologist.	Contractor	Liaison with Ecologist	Construction phase	Project manager & ECO	Weekly	Herbicide application Records
• Exotic and invasive plants must be eradicated as construction progresses. • Rehabilitate disturbed areas as quickly as possible to reduce the area where invasive species would be at a strong advantage and most easily able to establish. • Institute a monitoring programme to detect alien invasive species early, before they become established and, in the case of weeds, before the release of seeds • Institute strict control over materials brought onto site, which must be inspected for potential invasive invertebrate species and steps taken to eradicate these before transport to the site. • Institute an eradication/control programme for early intervention if invasive species are detected, so that their spread to surrounding natural ecosystems can be prevented. • The ECO must regularly inspect the site, including storage facilities and compounds and eradicate any invasive or exotic plants and animals.	Contractor	Eradication and rehabilitation plan must be implemented	During construction phase	Project Manager ECO	Weekly/Daily	Photo records Site inspection records

ECOLOGY - CONSTRUCTION PHASE						
Impact Management outcome: Minimise and control impact to the ecological aspects during construction.						
Impact Management actions (mitigation measures)	Implementation			Monitoring		
	Responsible person	Method of implementation	Timeframe: implementation	Responsible person	Frequency	Evidence: compliance
Impact on avifauna population						
• All construction and maintenance activities must be carried out according to generally accepted environmental best practice and the temporal and spatial footprint of the development must be kept to a minimum. • The boundaries of the development footprint areas are to be clearly demarcated and it must be ensured that all activities remain within the demarcated footprint area. • The appointment of a competent Environmental Control Officer (ECO) is imperative. • It is strongly suggested that construction be carried out after the breeding season. • Construction workers must not be accommodated on site and when on site contactors and working staff must stay within development footprint and movement outside these demarcated areas must be restricted. • Provide adequate briefing for site personnel. • The impact of collision of birds must be mitigated by placing the on-site high voltage substation close to the existing and planned Eskom's high-voltage power lines. • Speed limit of 30 km/h on site to avoid collissions with night birds and twilight active birds. • Poisons for control of problem animals must be avoided since the wrong use thereof can have disastrous consequences for the raptors in the area. The use of poisons for the control of rats, mice or other vermin can only be used after approval from an ecologist.	Contractor	Construction of infrastructure according to approved plans. Poisons must be according to specialists' instructions	When applicable Only when there is no other way of getting rid of the problem animals	Project manager ECO	Monthly	Check plans Check poisons used

ECOLOGY - CONSTRUCTION PHASE						
Impact Management outcome: Minimise and control impact to the ecological aspects during construction.						
Impact Management actions (mitigation measures)	Implementation			Monitoring		
	Responsible person	Method of implementation	Timeframe: implementation	Responsible person	Frequency	Evidence: compliance
• The breeding sites of raptors and other wild birds species must be taken into consideration during the construction phase. • If present at connection infrastructure site, breeding sites must be kept intact and disturbance to breeding birds must be avoided. Care must be taken where nestlings or fledglings are present. • Nesting sites on site must be documented.						
• For Eskom connection infrastructure power lines must be marked with suitable anti-collision marking devices on the earth wires as well as bird guards and diverters as per the Eskom guidelines	Contractor	Fit devices as per plans	When power lines are constructed	Project manager	When power lines are constructed	Check according to plans.
• Use of owl boxes and bat hotels as biological pest control measures is recommended as an alternative to poisons and would serve to prevent owls and other birds from perching on solar panels. • Apply perch managing techniques such as conspicuous objects and support roosting sites along the power line that would allow large raptors and bustards to safely roost. • All probable and high risk perching surfaces must be fitted with bird guards and perch guards as deterrents. • Where possible the installation of artificial bird space perches or platforms at a safe distance from energised is advised. • Only power lines structures that are considered safe for birds must be erected to avoid the electrocution of birds (particularly large raptors) perching or attempting to perch. • The route internal power lines will follow must be the shortest distance possible or follow existing power lines.	Contractor	Construct in logical positions and protect from human activities	When applicable	Project manager ECO	Monthly	Inspection log sheet

ECOLOGY - CONSTRUCTION PHASE						
Impact Management outcome: Minimise and control impact to the ecological aspects during construction.						
Impact Management actions (mitigation measures)	Implementation			Monitoring		
	Responsible person	Method of implementation	Timeframe: implementation	Responsible person	Frequency	Evidence: compliance
• Overhead transmission cables must be marked with bird diverters to make lines as visible as possible to collision-susceptible species. • Recommended bird diverters such as brightly coloured 'aviation' balls or flapping devices must be installed and luminescent light emission reflector devices or night deterrents for nocturnal birds or night-flying diurnal species.						
Control of animals on site. Killing, poisoning, or hunting of animals						
• No animals will be allowed to be killed, captured or hunted or fed on site by construction workers. No poison must be used to control any animals without the input of an ecologist/zoologist. • Limit pesticide use to non-persistent, immobile pesticides and apply in accordance with label and application permit directions and stipulations. The wrong use thereof can have disastrous consequences for the raptors occurring in the area. • The use of poisons for the control of rats, mice or other vermin must only be used after approval from an ecologist. • Instruct employees, contractors, and site visitors to avoid harassment and disturbance of wildlife. • No pets must be allowed on the site. • If a dangerous animal or venomous snake is encountered, the safety officer must be consulted to ensure safety and well-being of employees. Procedure to follow during an encounter must be addressed during induction for people entering the site.	Contractor Health and Safety Officer	Fine for transgressors Apply according to label Training of work force	When applicable	Project manager ECO	Weekly	Incident logs Check pesticides log Training records
• Where trenches pose a risk to animal safety, they must be adequately cordoned off to prevent animals falling in and being trapped and/or injured. This could be prevented by the constant excavating and backfilling of trenches during construction.	Contractor	Close trenches	When work in trench is done	Project manager ECO	Weekly	Visual checks

ECOLOGY - CONSTRUCTION PHASE						
Impact Management outcome: Minimise and control impact to the ecological aspects during construction.						
Impact Management actions (mitigation measures)	Implementation			Monitoring		
	Responsible person	Method of implementation	Timeframe: implementation	Responsible person	Frequency	Evidence: compliance
• A register must be kept of all relevant details of herbicide and pesticide usage.	Contractor	Draw up register	When applicable	Project manager/ECO	Monthly	Inspection log sheet
Occurrence of veld fires on site						
• Cleared vegetation will not be burned on site and must be stockpiled and taken to closest available landfill site. • Educate construction workers regarding risks and correct disposal of cigarettes. • Designated smoking area in project area must be provided, where the fire hazard and risk is insignificant and must have a fireproof sand filled container for extinguishing cigarettes. Smoking is prohibited across the site and work areas. • Fires will only be allowed in designated places. No open fires are allowed but small fires for cooking must be restricted to designated areas, care must be taken to ensure prevention of veld fires from occurring. Cooking facilities within a designated area needs to be provided. • A fire hydrant system must be designed and installed.	Contractor	Training & keep site clean of cleared vegetation Check incidence of open fires and cooking within designated areas	Weekly Daily	Project manager ECO Health & Safety Officer	Monthly Daily	Training records & visual inspection records.
• Portable firefighting equipment must be provided at strategic locations on site, in line with the building Code of SA and relevant provincial building codes. All emergency equipment including portable fire extinguishers, hose reels and hydrants must be maintained and inspected by a qualified person according to relevant legislation and national standards.	Contractor	Training on using firefighting equipment	At start of construction	Health & Safety Officer	As per the standards	Monitoring records
• Each employee, subcontractor or any other visitor must be made aware of the provisions of the fire management plan and is made familiar of the location and proper use of firefighting equipment as well as the location of assembly points.	Health & Safety Officer	Fires safety awareness and training	Ongoing	Health & Safety Officer	Ongoing	Training and induction records

ECOLOGY - CONSTRUCTION PHASE						
Impact Management outcome: Minimise and control impact to the ecological aspects during construction.						
Impact Management actions (mitigation measures)	Implementation			Monitoring		
	Responsible person	Method of implementation	Timeframe: implementation	Responsible person	Frequency	Evidence: compliance
• Fire Management training for all staff about the correct steps to take in case of an accidental fire, including the report of a fire as well as the use of the available equipment. • Contact numbers for the Fire Protection Agency (FPA), if in place and emergency services must be communicated in training programmes and displayed at a central location on site.	Health & Safety Officer	Fires safety awareness and training.	Monthly	Health & Safety Officer	Monthly	Training records
• Fire occurrence emergency protocol training. • The local FPA must be informed of construction activities.	Project manager ECO	Fire emergency drill tests	From April until October, every two months	Project manager ECO	From April until Oct, every 2 months	Records of training
• Make and maintain proper firebreaks wide enough to prevent fires from crossing and monitoring of fire breaks at development footprint. Firebreaks must comply with National Veld and Forest Fire Act, 1998 (Chapter 4).	Contractor	Make fire breaks according to standards	Once-off Maintain as necessary	Project manager ECO	Monthly	Visual inspection
• The establishment and proliferation of Alien Invasive Plants (AIP) at the firebreaks must be monitored.	Contractor	Assess fire break and establishment of alien vegetation	Quarterly, especially during dry season	ECO	Quarterly, especially during the dry season	Records of Monitoring
• Fire risk must be reduced by removing dry vegetation and combustible materials from hazardous material storage areas, cooking areas, smoking areas or equipment that may create a spark. Grass must be slashed under and around the PV plant.	Contractor	Removal of dry vegetation or combustible material	Daily	ECO	Daily	Records of Monitoring
• Local firefighting/fire protection agencies must be contacted in order to establish a relationship and shall have access to the solar park and the access road must allow any relevant fire fighting vehicle/truck to travel without hinder.	Contractor	Provide access to the solar park	Ongoing when needed	ECO	Ongoing	Entry records
• Adjacent landowners must be informed in the case of any fire.	Contractor ECO	Inform the landowners	In case of fire	Site Manager	In case of fire	Incident records
• A Fire Prevention and Fire Emergency Method must be in order and limited to the following: ○ Fire Fighting training for designated site staff;	Contractor Health and Safety officer	Compile, make available and training of the Fire	Ongoing	Health and Safety officer	Ongoing	Training records.

ECOLOGY - CONSTRUCTION PHASE						
Impact Management outcome: Minimise and control impact to the ecological aspects during construction.						
Impact Management actions (mitigation measures)	Implementation			Monitoring		
	Responsible person	Method of implementation	Timeframe: implementation	Responsible person	Frequency	Evidence: compliance
○ Sources of fire risk and hazards, especially the BESS; ○ How to comply with equirements of local fire departments; ○ How to minimise the risk of accidental fires; ○ How to control accidental fires; and ○ Appropriate distance to stand away from PV system to avoid electrocution.		Prevention and Fire Emergency Method				
• The solar park must be part of or form a Fire Protection Association (FPA). (https://www.fpasa.co.za/)	Contractor	Apply for membership of FPA	Ongoing	ECO	Ongoing	
• Routine checking of all the connections and panels.	Contractor Electrician	Physically test and check equipment.	Ongoing	Electrician	Ongoing Annual check	Monitoring records
• Mobile electrostatic equipment must be used to ensure the system is grounded correctly.	Contractor Technician	Ground equipment as per standards		Technician	Monthly	Monitoring records Presence of electrostatic reading
• Check for animals and nests in the PV system and in/around the BESS.				ECO	Bi-Weekly	Monitoring records
• Lightning rods must be installed as per national guidelines.	Contractor	Install rods as per guidelines	Ongoing	Contractor	Ongoing	
Increase in traffic on the site						
• Speed of construction vehicles on internal roads must be kept as low as possible (30 km/h) to reduce incidence of road kill. • Use existing roads to minimise new disturbance in the area. • Construction activities must remain within defined construction areas and the road servitudes.	Contractor	Speed checks Fines to transgressors	Construction phase	Project manager ECO	Monthly	Visual inspection

ECOLOGY - CONSTRUCTION PHASE						
Impact Management outcome: Minimise and control impact to the ecological aspects during construction.						
Impact Management actions (mitigation measures)	Implementation			Monitoring		
	Responsible person	Method of implementation	Timeframe: implementation	Responsible person	Frequency	Evidence: compliance
Construction of roads with a kerb & Fragmentation of available habitat & restriction of movement of small mammals, reptiles and amphibians						
• Internal roads must be constructed without a kerb or an angle of approximately 45º. This will allow for the free movement of small faunal species throughout the development area.	Contractor	Construction of roads according to plans	Construction phase	Project manager	Monthly	Visual check against plans
• Ensure protection of important resources by establishing protective buffers to exclude unintentional disturbance. • Use existing facilities (e.g., access roads, degraded areas) to the extent possible to minimize the amount of new disturbance. • Sensitive habitats must be avoided by construction vehicles and equipment, where possible, to reduce potential impacts.	Contractor	Construction according to plans to stay out of sensitive areas. Demarcate sensitive areas.	Beginning and during Construction phase	Project manager ECO	Monthly	Visual check against plans
Materials brought onto site-Spreading of invasive animal species						
• Institute strict control over materials brought onto site, which must be inspected for potential invasive invertebrate species and steps taken to eradicate these before transport to the site.	Contractor ECO	Check materials during off loading	In construction phase	ECO	During offloading.	Visual Check of materials
• Institute an eradication/control programme for early intervention if invasive species are detected, so that their spread to surrounding natural ecosystems can be prevented.	Contractor	Implement Eradication programme	Beginning of construction phase	Project Manager ECO	Beginning of construction Monthly	Visual checks
• Monitor alien invasive species monthly during the rainy season. • ECO must regularly inspect the site, including storage facilities and eradicate any invasive or exotic plants and animals. • The ECO must be in attendance with every delivery at the construction site. The ECO must also sign the delivery register to indicate attendance and inspection of delivered goods.	Contractor	Walk over monitoring	Monthly – during rainy season	Project manager ECO	Monthly	Visual inspection
Littering (*e.g.* cans & plastics) along access road & at construction sites						
• Solid waste must be kept in adequate animal and weatherproof waste bins at the construction camp and construction sites.	Contractor	Removal of waste to licensed disposal site	During construction phase	Project Manager ECO	Daily Weekly	Disposal records

ECOLOGY - CONSTRUCTION PHASE						
Impact Management outcome: Minimise and control impact to the ecological aspects during construction.						
Impact Management actions (mitigation measures)	Implementation			Monitoring		
	Responsible person	Method of implementation	Timeframe: implementation	Responsible person	Frequency	Evidence: compliance
• Building rubble and various wastes must be removed on a regular basis to the Local Municipality's landfill site. • A recycling program must be designed in order to minimise production of solid waste (e.g. organic waste made into compost, the rest will be sorted and taken to various recycling stations in the Local Municipality, if available). • Regular clean-up programs must be put into effect along access road and throughout the premises to limit impact of littering.		Regular site clean-up programs				

VISUAL DISTURBANCE - CONSTRUCTION PHASE						
Impact Management outcome: Prevent unnecessary negative visual impact by ensuring that visual impacts are mitigated.						
Impact Management actions (mitigation measures)	Implementation			Monitoring		
	Responsible person	Method of implementation	Timeframe: implementation	Responsible person	Frequency	Evidence: compliance
Construction activities and temporary structures-visual impact.						
• Earth works must be executed as such that only footprint and small 'construction buffer zone' are exposed. In other areas, natural occurring vegetation, and indigenous vegetation must be retained.	Contractor	Walk over monitoring	Monthly	Project manager ECO	Monthly	Visual inspection
• Materials and colours used in construction of structures and infrastructure must give preference to natural and eco-friendly choices, to minimize visual impact on aesthetic character of area.	Contractor	Walk over monitoring	Monthly	Project manager ECO	Monthly	Visual inspection
• No waste will be allowed to be burned on site.	Contractor	Instruction to personnel	Daily	Project manager ECO	Monthly	Visual inspection
• Minimum amount of existing vegetation and topsoil must be removed. Specifically, large trees must be saved were possible.	Contractor	Instruction to personnel	Daily	Project manager ECO	Monthly	Visual inspection

VISUAL DISTURBANCE - CONSTRUCTION PHASE						
Impact Management outcome: Prevent unnecessary negative visual impact by ensuring that visual impacts are mitigated.						
Impact Management actions (mitigation measures)	Implementation			Monitoring		
	Responsible person	Method of implementation	Timeframe: implementation	Responsible person	Frequency	Evidence: compliance
• Stockpiled topsoil must be used during rehabilitation phase of disturbed areas and re-vegetation of the earth berm. The presence of degraded areas and disused construction roads, which are not rehabilitated, will increase the overall visual impact. • Construction camp, waste and storage areas and placement of ablution facilities, must be screened or positioned in areas less visible from human settlements and main roads. • Construction activities must be limited to 08:00 and 17:00 • Construction activities must be restricted to specifically demarcated areas. • Building or waste material discarded must be undertaken at an authorised location, which must not be within any sensitive areas. • Pole mounted CCTV facilities must be located 'in rhythm' with other project components. • All cut and fill slopes and areas affected by construction work must be top soiled and re-vegetated as soon as possible. • Soil exposure must be for the minimum time possible once cleared of vegetation to avoid prolonged exposure to wind and water erosion and to minimise dust generation. • The establishment of the proposed berm must occur immediately when construction activities star. • Progressive rehabilitation of all construction areas must be carried out immediately after they have been established. • Paint structures with colours that reflect and compliment colours of surrounding landscape. To reduce potential glare, external surfaces of structures must be articulated or textured to create interplay of light and shade. Avoid pure whites and blacks.						

VISUAL DISTURBANCE - CONSTRUCTION PHASE						
Impact Management outcome: Prevent unnecessary negative visual impact by ensuring that visual impacts are mitigated.						
Impact Management actions (mitigation measures)	Implementation			Monitoring		
	Responsible person	Method of implementation	Timeframe: implementation	Responsible person	Frequency	Evidence: compliance
• Ensure the perimeter fence, is 'see through' and that its colour blends with the environment. • "Housekeeping" procedures must be developed to ensure the project site and lands adjacent to the project site are kept clean of debris, garbage, graffiti, fugitive trash, or waste generated onsite. • Plant clumps of indigenous evergreen trees. A tree screen will only become effective after 5 – 10 years of growth, when the impact of PV arrays can be reduced over time. • During construction, temporary fences surrounding storage yards and laydown areas must be covered with cloth (khaki coloured). • Install light fixtures that provide precisely directed illumination to reduce light "spillage" beyond immediate surrounds of the site. • Avoid high pole top security lighting along the periphery of the site and use only lights that are activated on illegal entry to site. • Minimise the number of light fixtures including security lighting to the minimum.						

HERITAGE RESOURCES - CONSTRUCTION PHASE						
Impact Management outcome: Prevent/minimise negative impacts on heritage resources						
Impact Management actions (mitigation measures)	Implementation			Monitoring		
	Responsible person	Method of implementation	Timeframe: implementation	Responsible person	Frequency	Evidence: compliance
Earthworks and excavations						
• Before construction commences an archaeologist must be appointed to do a final walk over survey to confirm that there are no archaeological finds and or areas of archaeological significance on site.	Contractor	Halt construction Call Archaeologist	When required	Project manager ECO	When required	Incident log sheet

HERITAGE RESOURCES - CONSTRUCTION PHASE						
Impact Management outcome: Prevent/minimise negative impacts on heritage resources						
Impact Management actions (mitigation measures)	Implementation			Monitoring		
	Responsible person	Method of implementation	Timeframe: implementation	Responsible person	Frequency	Evidence: compliance
• Implement chance find procedures in case possible heritage finds are uncovered. • Halt construction and notify the archaeologist or SAHRA whenever anything of potential heritage value is discovered. • The area must be cordoned off and no access must be allowed to the site until the archaeologist has indicated that it is in order to do so.						

SAFETY, SECURITY, SOCIO-ECONOMICS, AND FIRE HAZARDS - CONSTRUCTION PHASE						
Impact Management outcome: Ensuring a safe/secure construction environment, enhanced socio-economic development and prevention of fires.						
Impact Management actions (mitigation measures)	Implementation			Monitoring		
	Responsible person	Method of implementation	Timeframe: implementation	Responsible person	Frequency	Evidence: compliance
Construction activities - safety of employees						
• The Contractor shall conform to all the stipulations of Occupational Health and Safety act, 1993 and any Regulation applicable at start of construction. The Act requires designation of Health and Safety representative when more than 20 employees are employed.	Contractor	Apply Act	Continuous	Project manager	Monthly	Check number of employees on site Safety File records
• A person trained and accredited to administer first aid must be present on site and a first aid kit must be available at the office.	Contractor	Appoint trained safety officer. Supply first aid kit	Daily	Project manager	Monthly	Visual inspection Safety file records
• All personnel must be informed of emergency procedures and contact numbers must be displayed prominently.	Contractor	Training talks Display emergency numbers.	Weekly	Project manager	Monthly	Training records

SAFETY, SECURITY, SOCIO-ECONOMICS, AND FIRE HAZARDS - CONSTRUCTION PHASE						
Impact Management outcome: Ensuring a safe/secure construction environment, enhanced socio-economic development and prevention of fires.						
Impact Management actions (mitigation measures)	Implementation			Monitoring		
	Responsible person	Method of implementation	Timeframe: implementation	Responsible person	Frequency	Evidence: compliance
• Personal Protective Equipment (PPE) and safety gear must be provided to all site personnel (hard hats, safety boots, masks *etc.*).	Contractor	Supply PPE	When required	Project manager	Monthly	Check: workers must use PPE
Fires caused by the negligence of construction workers						
• The development must comply with the requirements of the National Veld and Forest Fire Act, 1998 (Chapter 2: Fire Protection Associations and Chapter 4: Duty to Prepare and maintain firebreaks). • An emergency plan must be in place so that any fire can be combatted in the most efficient manner. An emergency response plan that is aligned with the local Fire Department must be in place.	Contractor	Ensure compliance with Act. Training on Emergency plan	At onset of construction phase Monthly	Project manager	Monthly	Training records
• No solid waste or vegetation will be allowed to be burned on the premises or surrounding areas. No fires will be allowed outside designated areas (construction camp).	Contractor	Instruction to employees	Weekly	Project manager ECO	Monthly	Incident log sheet
• All employees must be properly trained in the use of firefighting equipment and the emergency procedures in case of a fire.	Contractor	Training cessions	Monthly	Project manager	Monthly	Training records
• Firefighting equipment must be available and must be checked regularly to ensure it is in working order and easily accessible.	Contractor	Supply & check firefighting equipment	Weekly	Project manager Contractor	Monthly	Inspection log sheet
Construction activities - socio-economic impact- Long and short-term Employment of workers						
• Adherence to the Local and District Municipality's guidelines, principles and policies is imperative.	Contractor	Ensure adherence to policies. Implement standards	Daily during construction phase	Project Manager	Monthly	Follow up during site meetings
• During the construction and operational phases, jobs must be created for unemployed local people and skills must be transferred	Contractor	Appoint local people	Construction phase	Project manager	Monthly	Staff records

SAFETY, SECURITY, SOCIO-ECONOMICS, AND FIRE HAZARDS - CONSTRUCTION PHASE						
Impact Management outcome: Ensuring a safe/secure construction environment, enhanced socio-economic development and prevention of fires.						
Impact Management actions (mitigation measures)	Implementation			Monitoring		
	Responsible person	Method of implementation	Timeframe: implementation	Responsible person	Frequency	Evidence: compliance
to them. Where viable, the work must be executed in a labour intensive manner to create as many jobs possible.						
• Contribute 1.5% of turnover to community development in the vicinity of the project.	Developer	Community projects and development	Construction and operation	Developer	Annual	Record and proof of contributions
Security Issues- Unauthorized entrance to construction areas and construction workers staying overnight at construction site						
• All personnel must be informed of emergency procedures and emergency contact numbers must be displayed prominently. • Proper access control (I.D. cards) must be enforced at entrance gate to ensure that no unauthorised persons enter the site. Security personnel must be appointed to enforce strict access control.	Contractor	Training sessions on security issues- induction	Start of construction	Project manager	Monthly	Training records
• No staff will be allowed to overnight on the site. Transportation must be arranged for construction workers to ensure that workers have daily transportation available to and from the site. • For Eskom connection infrastructure, access to servitude and tower positions must be negotiated with relevant landowner (if not the same as the authorised access point) and must fall within the assessed and authorised area. • The access roads to tower positions must be signposted after access has been negotiated and before the commencement of the activities. • All private roads used for access to the servitude must be maintained and upon completion of the works, be left in at least the original condition. • Any access route deviation from that in the written agreement must be closed and re-vegetated immediately, at contractor's expense.	Contractor	Arrange transport for the workers	Start of construction phase	Project manager	Monthly	Transport records

SAFETY, SECURITY, SOCIO-ECONOMICS, AND FIRE HAZARDS - CONSTRUCTION PHASE						
Impact Management outcome: Ensuring a safe/secure construction environment, enhanced socio-economic development and prevention of fires.						
Impact Management actions (mitigation measures)	Implementation			Monitoring		
	Responsible person	Method of implementation	Timeframe: implementation	Responsible person	Frequency	Evidence: compliance
• Maximum use of existing servitudes and roads must be made to minimize further disturbance with the development of new roads. • Access roads in flattish areas must follow fence lines and tree belts to avoid fragmentation of vegetated areas. • Access roads must only be developed on pre-planned and approved roads.						
• A boundary fence can be constructed around the site, which will act as a security barrier. A temporary fence must be erected around the construction camp and storage area.	Contractor	Construct fences	Start of construction phase	Project manager	Monthly	Visual checks
• Security lights and infra-red video surveillance will be installed at the construction camp and storage area in such a manner that it does not become a nuisance to the surrounding properties. • Security lights must shine directly down and directed towards the site away from the surrounding properties. • Video-surveillance system using infrared/microwave video cameras, which don't need a switch-on lighting system, recommended. • Adherence to the Visual Impact Assessment mitigation measures.	Contractor	Install security lighting and video surveillance system	Start of construction phase	Project manager ECO	Monthly	Visual checks

TRAFFIC IMPACT MANAGEMENT - CONSTRUCTION PHASE						
Impact Management outcome: Prevent/minimise negative impacts on heritage resources						
Impact Management actions (mitigation measures)	Implementation			Monitoring		
	Responsible person	Method of implementation	Timeframe: implementation	Responsible person	Frequency	Evidence: compliance
Construction vehicles and increase in traffic						
• All road safety regulations must be adhered to – on and off-site. • Vehicles must be roadworthy. • Speed limits to be ahered at all times. • Dust suppression to done to avoid visibility problems. • The use of a product like Ecobond is recommended as opposed to water. It must be an inert product with no pollution risk. • Provide a dedicated loading and off-loading area on site as part of the Proposed Development and ensure that contractors make use of the dedicated area.	Contractor	Visual checks	When required	Site Manager	When required	Incident log sheet
Road Safety						
• It is required to repair roadway at intersection of Roads D859 and D331 as it's in very poor condition. A pavement design engineer needs to be appointed in order to assess the intersection from a pavement design point of view and to implement improvements in collaboration with Gautrans. • Provide reflective road studs as part of the intersection to improve visibility of the intersection geometry when it is dark. • Provide relevant road traffic signs and road markings. • Provide 60 metres dedicated right-turn lane on the northern approach of Road D331. • Provide 60 metres dedicated left-turn lane on the eastern approach of Road D859. • During construction phase, ensure that contractors load and off-load pedestrians on site and not at the access intersection.	Roads Authority	Construction of mentioned changes and aspects	Prior to construction of the solar park.	Site Manager	Prior to and during construction of solar park.	Incident log sheet

OPERATIONAL PHASE						
AIR QUALITY – OPERATIONAL PHASE						
Impact Management outcome: Prevent/minimise negative impacts on safety of employees						
Impact Management actions (mitigation measures)	Implementation			Monitoring		
	Responsible person	Method of implementation	Timeframe: implementation	Responsible person	Frequency	Evidence: compliance
Movement of vehicles and construction equipment-fumes/smoke						
• Vehicles and construction equipment must be well serviced so that it does not produce excessive smoke. • The construction machinery must be maintained properly.	Site Manager	Regular services	According to Maintenance schedule	Project manager ECO	According to service plan	Service records
Movement of vehicles and construction equipment-Dust						
• Main roads must be sprayed with water during dry months or a product like Eco-bond (inert product with no pollution risk) which is recommended as opposed to using potable water. an. • Internal roads must be maintained during operational phase.	Site Manager	Spray with water truck	During lifetime of project	Site Manager	Daily	Visual check
• Speed limit must be enforced on roads (preferably 20 - 30km/h).	Site Manager	Road signs	Project lifetime	Site Manager	Weekly	Visual check
NOISE - OPERATIONAL PHASE						
Impact Management outcome: Prevent/minimise negative impacts on safety of employees						
Movement and operation of vehicles						
• On site personell must comply with all noise regulations. • On site personnel mustcomply with speed restriction of 30 km/h within the site boundaries to reduce the generation of noise. • All vehicles must be serviced regularly to limit excessive noise.	Site Manager	Regular services	According to Maintenance schedule	Site Manager	According to service plan	Service records

VISUAL IMPACT - OPERATIONAL PHASE						
Impact Management outcome: Prevent/minimise negative impacts on safety of employees						
Impact Management actions (mitigation measures)	Implementation			Monitoring		
	Responsible person	Method of implementation	Timeframe: implementation	Responsible person	Frequency	Evidence: compliance
Visual impact.						
• All lights must shine directly down, directed towards PV plant. • Adherence to the Visual Impact Assessment mitigation measures. • Soft lighting and only where needed is permitted. • Use lighting that relies on infrared sensors to swithch on the lights.	Site Manager	Visual Check during the night	Life of the project	Site Manager	Daily	Management reports
• No waste will be burned on site.	Site Manager	Visual check	Daily	Site Manager	Daily	Management reports

ECOLOGY - OPERATIONAL PHASE						
Impact Management outcome: Minimise and control impact to the natural ecology						
Impact Management actions (mitigation measures)	Implementation			Monitoring		
	Responsible person	Method of implementation	Timeframe: implementation	Responsible person	Frequency	Evidence: compliance
Spreading and propagation of Alien Invasive Species						
• The site manager must be assisted by an ecologist to be able to identify AIS, on site. • If detected early, the entire population must be eradicated. • Implement Control Methods as indicated in Table 1 of the AIS Management Plan.	Site Manager	Walk through site. Early detection of AIS. Mechanical, Chemical or Biological Control	Continues during operational phase, but important during the rainy season	Site Manager	Bi-annually (After the first rainfall and near the end of the rainfall season)	Visual inspection – Site walk-through

ECOLOGY - OPERATIONAL PHASE						
Impact Management outcome: Minimise and control impact to the natural ecology						
Impact Management actions (mitigation measures)	Implementation			Monitoring		
	Responsible person	Method of implementation	Timeframe: implementation	Responsible person	Frequency	Evidence: compliance
Revegetation and Habitat Rehabilitation						
• Identify and Protect Environmentally Sensitive Areas.	Site Manager / Ecologist / ECO	Consult Re-vegetation and Rehabilitation Plan - liaise with Ecologist	Throughout the project lifetime	Site Manager	Annually	Monitoring Report
• Keep Photographic Record.	Site Manager / Ecologist / ECO	Take Photographs smart phone/camera	Throughout the project lifetime	Site Manager	Annually at the same time, each year	Report – Photographic Record
• Search and Rescue Activities by keeping transplantable plant species in a temporary nursery (no exotic plant species will be allowed to be planted).	Site Manager / Ecologist / ECO	Create and maintain temporary nursery of indigenous plants	During Rehabilitation, after construction	Site Manager	Annually same time, each year	Monitoring Report
• Cleared Indigenous plant to be used in erosion prone areas and mulching in rehabilitated areas.	Site Manager / Ecologist / ECO	Brush Packing and mulching in erosion areas	During Rehabilitation, after construction	Site Manager	Annually at the same time, each year	Monitoring Report
• Revegetate or stabilize disturbed areas for erosion control and rehabilitation.	Site Manager / Ecologist / ECO	Re-seeding, replanting and brush packing	During Rehabilitation, after construction	Site Manager	Annually at the same time, each year	Monitoring Report
• Littering prevention by providing rubbish bins for staff at designated areas, particularly where food is consumed.	Site Manager / Ecologist / ECO	Provide bins for waste with signage.	Throughout the project lifetime	Site Manager	Monthly	Monitoring Report
• Plants kept in temporary nursery to be re-planted for re-vegetation.	Site Manager / Ecologist / ECO	Planting and seeding on sited	Immediately after topsoil reinstatement	Site Manager	Monthly until 80% vegetation cover is established	Monitoring Report

ECOLOGY - OPERATIONAL PHASE						
Impact Management outcome: Minimise and control impact to the natural ecology						
Impact Management actions (mitigation measures)	Implementation			Monitoring		
	Responsible person	Method of implementation	Timeframe: implementation	Responsible person	Frequency	Evidence: compliance
• To limit fire hazard on site the grass cover along boundary must be kept short (30cm).	Site Manager	Grass cutting when vegetation cover is higher than 30cm	Throughout the project lifetime	Site Manager	Bi-annually, after rainy and before winter season	Monitoring Report
• Monitoring system to be designed based on EMPr, according to development company requirements for general maintenance and monitoring.	Site Manager / Ecologist / ECO	Design effective and appropriate monitoring system.	Throughout the project lifetime	Site Manager	According to different aspects to be monitored	Monitoring Report
Impact on avifauna population						
• Lighting of the solar farm (for example security lights) must be kept to a minimum. Lights must be directed downwards (using low-UV type lights) to prevent night birds such as owls from becoming confused during flight and colliding with solar panels and infrastructure.	Site Manager	Install effective	Throughout the project lifetime	Site Manager	Daily	Monitoring Report
• Regular cleaning and maintenance activities must prevent defecation on the panels from becoming a problem. Eco-friendly bird deterring devices could also prevent large birds from perching on the panel structures. • All incidents of collision with panels must be recorded as meticulously as possible using good scientific protocols. • If birds are nesting on infrastructure of the facility and cannot be tolerated, birds must be prevented from accessing nesting sites by using mesh or other manner of excluding them. • If there are persistent problems with avifauna, then an avifaunal specialist must be consulted for advice on further mitigation. • Panels must be tilted towards the vertical when not in use.	Site Manager	Construct in logical positions and protect from human activities	When applicable	Site Manager	Monthly	Inspection log sheet

ECOLOGY - OPERATIONAL PHASE						
Impact Management outcome: Minimise and control impact to the natural ecology						
Impact Management actions (mitigation measures)	Implementation			Monitoring		
	Responsible person	Method of implementation	Timeframe: implementation	Responsible person	Frequency	Evidence: compliance
• Overhead transmission cables should be marked with enough bird diverters and as close as possible to each other to make the lines visible to collision-susceptible species. • An area conducive to raptors being present will aid in the containment of snakes occurring in the area. • ECO's must be trained in collecting information w.r.t bird collision cases and avian research institutions must be commissioned to carry out ongoing monitoring. • Regular monitoring of power lines must be undertaken to detect bird carcasses, to enable the identification of any areas of high impact to be marked with bird diverters.						
Sanitation seepage and spillage from private wastewater treatment works						
• A private wastewater treatment works will be designed and installed on site for the development. • Treated effluent will be available as irrigation water. • Water quality according to General Limits specified by DWS. • The applicant must obtain approval in terms of the NWA for the water and sewer uses of the proposed development. • Groundwater management plan must be implemented to protect aquifer.	Site Manager / Ecologist / ECO	Install effective and appropriate WWT system.	Throughout the project lifetime	Site Manager	Bi-Annually	Monitoring Report
Storm Water Management						
• Regular conditional inspections of all storm water infrastructure are required. Inspection data must be recorded and accumulated for tracking purposes. Regular reporting must be a scheduled management task.	Site manager	Compile inspection plan	Scheduled inspections as well as during and after rainfall events	Site manager	Monthly and ad hoc	Inspection report
• Storm Water Infrastructure must be clear from debris, waste etc.	Site Manager	Visual inspection of stormwater	During and after rain and flood	Site Manager	During and after rain and flood	Monitoring Report

ECOLOGY - OPERATIONAL PHASE						
Impact Management outcome: Minimise and control impact to the natural ecology						
Impact Management actions (mitigation measures)	Implementation			Monitoring		
	Responsible person	Method of implementation	Timeframe: implementation	Responsible person	Frequency	Evidence: compliance
		infrastructure as well as correction of problems	events		events	
• Waste to be safely stored and disposed of off-site.	Site Manager	Storing facilities and waste removal schedule	Monthly	Site Manager	Monthly	Monitoring Report
• Site personnel to be trained as part of induction – maintenance of stormwater systems.	Site Manager	Training program as part of induction	At induction	Site Manager	Monthly	Monitoring Report
Fire Management Minimise Fire Risk on developed site						
• Tall woody plants to be cut and removed. • Grass cover to be kept short. • No fires allowed on site (signage to be put up). • Firebreaks to be maintained.	Site Manager	Slashing and cutting of tall trees and grass (avoid the use of herbicides)	Annually	Site Manager	Annually	Monitoring and Photographic Report
• Appointed personnel on site must attend a fire-fighting training program and be able to use fire-fighting equipment, on site.	Site Manager and Health & Safety Officer	Personnel to attend relevant courses	Lifetime of the project	Site Manager and Health & Safety Officer	Annual refresher courses	Health and Safety records
Fire Management - Minimise Fire Risk as a result of BESS						
• Liaise with local fire department.	Site Manager and Safety Officer	Arrange meeting with local fire department	Start of Operational Phase	Site Manager	Annually	Monitoring Report
• Standard Operating Procedures (SOPs) and Standard Operating Guidelines (SOGs) must be in place for use of staff on site.	Developing Company	SOPs and SOGs to be compiled	Start of Operational Phase	Site Manager	Annually	Updated SOPs and SOGs
• Adequate temperature control by ensuring that ventilation and air conditioning systems are in working order.	Site Manager	Check all components	Lifetime of the project	Site Manager	Daily	Separate record keeping for BESS

ECOLOGY - OPERATIONAL PHASE						
Impact Management outcome: Minimise and control impact to the natural ecology						
Impact Management actions (mitigation measures)	Implementation			Monitoring		
	Responsible person	Method of implementation	Timeframe: implementation	Responsible person	Frequency	Evidence: compliance
• Gas and smoke detection system must be in working order.	Site Manager	Check all components	Lifetime of the project	Site Manager	Daily	Separate record keeping for BESS
• Water for fire fighting must always be available.	Site Manager	Check water levels in water tanks	Lifetime of the project	Site Manager	Daily	Separate record keeping for BESS
• Aerosol extinguishjng system must be in working order.	Site Manager	Check extinguishing system	Lifetime of the project	Site Manager	Daily	Separate record keeping for BESS
• Equipment must be maintained. • Intenal resistance of cells must be measured.	Site Manager	Inspections and, testing	Lifetime of the project	Site Manager	Daily	Separate record keeping - BESS
• Testing of equipment.	Site Manager	infrared scans	Annually	Site Manager	Annually	Separate record keeping - BESS
• Module-level shutdown devices to be maintained.	Site Manager	Inspections and, testing	Lifetime of the project	Site Manager	Daily	Separate record keeping - BESS
• Maintenance of PV Modules and connections.	Site Manager / Electrician	Visual inspections	Lifetime of the project	Site Manager	Daily	Monitoring Record
• BESS must continuoysly be grounded properly.	Site Manager	Mobile electrostatic equipment	Lifetime of the project	Site Manager	Annually	Separate record keeping - BESS
• Water used for extinguishing a fire or thermal runaway at BESS must be contained and disposed of or treated at a Hazardous waste facility.	Site Manager	Work according to SOP and legislation	When applicable	Site Manager	Daily	Separate record keeping - BESS
Groundwater Management - Minimise Groundwater Pollution as a result of BESS						
• Compilation and adherence to a procedure for the safe handling of battery cells. • Lithium-ion batteries must have battery management systems (containment, automatic alarms and shut-off systems) to monitor and protect cells from overcharging or damaging conditions, such as temperature extremes.						

ECOLOGY - OPERATIONAL PHASE						
Impact Management outcome: Minimise and control impact to the natural ecology						
Impact Management actions (mitigation measures)	Implementation			Monitoring		
	Responsible person	Method of implementation	Timeframe: implementation	Responsible person	Frequency	Evidence: compliance
• Compilation of an Emergency Response Plan for implementation in the event of a spill or leakage. • Provision of spill kits on-site for clean-up of spills and leaks. • Immediate clean-up of spills and disposal of contaminated absorbents and materials or soil at a licensed hazardous waste disposal facility. • Recording and reporting of all significant fuel, oil, hydraulic fluid or electrolyte spills or leaks so that clean-up measures can be implemented. A copy of records must be made available to authorities on request through project lifecycle. • Frequent and appropriate disposal of both general and hazardous waste to prevent pollution of soil and groundwater. • Installation of leak detection monitoring systems. • On-site battery maintenance must be done on impermeable surfaces with secondary containment measures. • Hazardous substances must be disposed of appropriately. • Provision of suitable emergency and safety signage on-site, and demarcation of any areas which may pose a safety risk (incl. hazardous substances). Emergency numbers for the local police, fire department, Eskom and the Local Municipality must be placed in a prominent clearly visible area on the site. • Both the DFFE and the North-West DEDECT must be notified immediately of any incident, where the incident constitutes an unexpected, sudden, and uncontrolled release of a hazardous substance, including from a major emission, fire or explosion, that causes, has caused or may cause significant harm to the environment, human life or property.						

ECOLOGY - OPERATIONAL PHASE						
Impact Management outcome: Minimise and control impact to the natural ecology						
Impact Management actions (mitigation measures)	Implementation			Monitoring		
	Responsible person	Method of implementation	Timeframe: implementation	Responsible person	Frequency	Evidence: compliance
• Water used for extinguishing a fire or thermal runaway at BESS must be contained and disposed of or treated at a Hazardous waste facility.						
Waste Management – Reduce, Re-Use and Recycle						
• A management system for waste must be implemented with the aim to reduce, re-use and recycle. • Household waste must stored in closed containers. • A service provided must be appointed to collect household waste to be taken to a licensed landfill site. • An approved contractor must be appointed to collect fuel waste and old oil to be taken to a licensed hazardous waste landfill site. • Spent Batteries must be dispoed of/recycled according to National legislation.	Site Manager and Health & Safety Officer	Applying sound household / domestic and health practices	Lifetime of the project	Site Manager and Health & Safety Officer	Monthly	Health and Safety records

TRAFFIC IMPACT MANAGEMENT - OPERATIONAL PHASE						
Impact Management outcome: Prevent/minimise negative impacts on safety of employees						
Impact Management actions (mitigation measures)	Implementation			Monitoring		
	Responsible person	Method of implementation	Timeframe: implementation	Responsible person	Frequency	Evidence: compliance
Road Safety						
• Road safety training to be part of general employee training. • Speed limit (30km/h) on-site indicated on signage.	Contractor	Visual checks	When required	Site Manager	When required	Incident log sheet

SAFETY, SECURITY, AND FIRE HAZARDS - OPERATIONAL PHASE						
Impact Management outcome: Ensuring a safe/secure construction environment, enhanced socio-economic development and prevention of fires.						
Impact Management actions (mitigation measures)	Implementation			Monitoring		
	Responsible person	Method of implementation	Timeframe: implementation	Responsible person	Frequency	Evidence: compliance
Fires caused by the BESS						
• Fire extinguishers and fire-fighting equipment must be available especially to be able to combat fires at the BESS. • Emergency plan must be in place so that fire can be combatted in the most efficient manner. An emergency response plan aligned with local Fire Department must be in place.	Contractor	Ensure compliance with Act. Training on Emergency plan	At onset of construction phase Monthly	Project manager	Monthly	Training records
• No solid waste or vegetation will be allowed to be burned on the premises or surrounding areas.	Contractor	Instruction to employees	Weekly	Project manager ECO	Monthly	Incident log sheet
• All employees must be properly trained in the use of firefighting equipment and the emergency procedures in case of a fire.	Contractor	Training cessions	Monthly	Project manager	Monthly	Training records
• Firefighting equipment must be available and must be checked regularly to ensure it is in proper working order and accessible.	Contractor	Supply & check firefighting equipment	Weekly	Project manager Contractor	Monthly	Inspection log sheet
• Personal Protective Equipment (PPE) and safety gear must be provided to site personnel: hard hats, safety boots, masks etc.	Contractor	Supply PPE	When required	Project manager	Monthly	Check if workers are using PPE
Security Issues- Unauthorized entrance to facility areas						
• The Contractor shall conform to all the stipulations of the Occupational Health and Safety act (Act 85 of 1993) and any Regulation applicable at the time of starting of decommissioning. • Proper access control (I.D. cards) must be enforced at the entrance gate to ensure that no unauthorised persons enter the site. Security personnel must be appointed to enforce strict access control.	Contractor	Apply Act	Continuous	Project manager	Monthly	Check number of employees on site Safety File records

DECOMMISSIONING PHASE						
AIR QUALITY – DECOMMISSIONING PHASE						
Impact Management Outcome: Minimise impact to the environment and people through the control/mitigation of air quality impacts						
Impact Management actions (mitigation measures)	Implementation			Monitoring		
	Responsible person	Method of implementation	Timeframe: implementation	Responsible person	Frequency	Evidence: compliance
Earthworks and vegetation clearance - dust						
Movement of vehicles and construction equipment-fumes/smoke						
• Vehicles and construction equipment must be well serviced so that it does not produce excessive smoke. • The construction machinery must be maintained properly.	Contractor	Regular services	According to Maintenance schedule	Project manager ECO	Weekly	Service records
Movement of vehicles and construction equipment-Dust						
• Main roads must be gravelled or sprayed with water especially during the dry months. • The use of a product like Eco-bond is recommended as opposed to water. However, it must be an inert product with no pollution risk. • Internal roads must be maintained on a regular basis during construction.	Contractor	Spray with water truck	When need in construction	Project manager ECO	Daily	Visual check
• A speed limit must be enforced on dirt roads (preferably 30km/h).	Contractor	Road signs	During construction	Project manager Contractor	Weekly	Visual check
Burning of cleared vegetation and solid waste or fires for cooking and heating – smoke						
• Solid waste will not be allowed to be burnt on site. Solid waste must be kept in animal proof bins from where they will be removed to the Local Municipality's landfill site on a regular basis e.g. weekly. • No open fires are allowed at construction sites. • Fires for cooking must be restricted to designated areas, extra care must be taken to ensure to prevent veld fires from occurring. Fire belts must be made around the development according to regulations of the Veld and Forest Fire Act. • Cigarette butts must be disposed of in designated containers only. • Firebreaks must be maintained to decrease risk of accidental fires.	Contractor	Instruction to workers Visual checks Supply waste containers & remove waste weekly	During construction	Project manager ECO	Daily for fires Monthly for disposal	Visual check & disposal records

DECOMMISSIONING PHASE						
AIR QUALITY – DECOMMISSIONING PHASE						
Impact Management Outcome: Minimise impact to the environment and people through the control/mitigation of air quality impacts						
Impact Management actions (mitigation measures)	Implementation			Monitoring		
	Responsible person	Method of implementation	Timeframe: implementation	Responsible person	Frequency	Evidence: compliance
• Waste management and recycling plan must be compiled for decommissioning phase of development. Aim of the plan must be to ensure that the construction materials/debris generated on site be reduced, reused and recycled. This plan must be compiled in consultation with the contractors and engineers.	Contractor	Implement plan	Daily during Construction	Project manager ECO	Weekly	Visual Records of disposal.

NOISE - DECOMMISSIONING PHASE						
Impact Management outcome: Minimise impact to animals and people through the control/mitigation of noise impacts						
Impact Management actions (mitigation measures)	Implementation			Monitoring		
	Responsible person	Method of implementation	Timeframe: implementation	Responsible person	Frequency	Evidence: compliance
Movement and operation of vehicles and machinery						
• Contractors must comply with all noise regulations. • Construction personnel must comply with speed restriction of 30 km/h within site boundaries to reduce generation of noise. • Construction vehicles to be serviced on a regular basis to ensure they do not make excessive noise. Construction machinery must be fitted with noise mufflers and be maintained properly. • Decommission activities must only take place between sunrise and sunset from Monday to Saturday. No decommissioning activities to be allowed on Sunday, unless an agreement has been reached with surrounding property owners.	Contractor	Vehicle maintenance	Continuous in construction according to schedule	Project manager Contractor	Weekly	Records and noise levels measurements
• All employees working in a noisy environment must be given the necessary ear protection gear.	Contractor	Physical handout of ear plugs	Daily	Project manager ECO	Weekly	Check use of ear protection by workers

GROUND- AND SURFACE WATER POLLUTION - DECOMMISSIONING PHASE						
Impact Management outcome: Minimise impact to the environment and people through the minimisation and control of groundwater and surface water pollution						
Impact Management actions (mitigation measures)	Implementation			Monitoring		
	Responsible person	Method of implementation	Timeframe: implementation	Responsible person	Frequency	Evidence: compliance
Sanitation seepage and spillage from temporary chemical toilets.						
• Chemical sanitation facilities must be used on site and regularly (at least weekly) serviced by registered companies to ensure that no spills or leaks from toilets to groundwater or surface water take place. • The temporary sanitation system must be regularly inspected to ensure that no spills or leaks from sanitation system to groundwater take place.	Contractor	Appoint service contractor for weekly service of toilets and inspection.	Weekly	Project manager ECO	Weekly	Records
• Chemical sanitation facilities must not be positioned closer than 100m from surface water resources. The ratio of one toilet for every 15 workers on site must be maintained.	Contractor	Positioning of toilets	Once off at beginning of each phase of construction	Project manager ECO	Monthly	Visual inspection
Spillage of fuel and lubricants from construction vehicles and machinery						
• Construction vehicles must be serviced on a regular basis to prevent/minimize risk of spills/leakages of fuel and oil. • All construction vehicles must be inspected for oil and fuel leaks regularly. • Vehicles must be parked with spill pans underneath. • The storage of fuel, oils and lubricants must only take place where spillages can be controlled. • Maintenance must also be done at the temporary maintenance workshop on the site.	Contractor	Service records, instructions / training to drivers and visual checks	Daily	Project manager ECO	Monthly	Visual check Records check
• When a spill incident occurs all possible measures must be taken to ensure that spilled fuel or oil do not reach any drainage line. • Spill incidents must be reported to DFFE in terms of Section 30(5) of NEMA.	Contractor	Handle the spill correctly	When spill takes place	Project manager ECO	Monthly	Check spill records

GROUND- AND SURFACE WATER POLLUTION - DECOMMISSIONING PHASE						
Impact Management outcome: Minimise impact to the environment and people through the minimisation and control of groundwater and surface water pollution						
Impact Management actions (mitigation measures)	Implementation			Monitoring		
	Responsible person	Method of implementation	Timeframe: implementation	Responsible person	Frequency	Evidence: compliance
Spillage/use of fuel in temporary fuel tanks as well as construction activities (e.g., mixing of concrete, cement, paints etc.)						
• Diesel storage must be **less** than 80 000 litres at construction decommissioning camps. • A bund wall must be constructed around the fuel tank structures and the run-off diverted to a conservancy tank. • Drip pans must be used during re-fuelling and servicing of construction vehicles. Drip pans can also be placed underneath stationary construction vehicles and equipment. • Spilled fuel must be disposed of at the nearest approved fuel recycling collection point. Alternatively drip pans can be placed underneath temporary fuel tanks.	Contractor	Supply and erect surface tanks <30 000 litres Supply drip pans	When required	Project manager	Weekly	Inspection log sheet Spot checks/photos
• Provision must be made for refuelling at the storage area by protecting the soil with an impermeable groundcover. Where dispensing equipment is used, a drip tray must be used to ensure small spills are contained.	Contractor	Supply drip trays and sheeting	Prior to any refuelling	Project manager ECO	Weekly	Photos
• Where refuelling away from the dedicated refuelling station is required, a mobile refuelling unit must be used. Appropriate ground protection such as drip trays must be used.	Contractor	Supply drip trays and sheeting	Prior to any refuelling	Project manager ECO	Weekly	Photos
• Accidental spillages must be contained and cleaned up promptly. • Spill kits must be on-hand to deal with spills immediately.	Contractor	Have spill kits available	When spills take place	Project manager ECO	Monthly	Spill records
• Spillages or leakages must be treated according to an applicable procedure as determined by a plan of action for the specific type of disturbance.	Contractor	Spills procedure available on site and communicate to workforce		Project manager ECO	Monthly	Spill records

GROUND- AND SURFACE WATER POLLUTION - DECOMMISSIONING PHASE						
Impact Management outcome: Minimise impact to the environment and people through the minimisation and control of groundwater and surface water pollution						
Impact Management actions (mitigation measures)	Implementation			Monitoring		
	Responsible person	Method of implementation	Timeframe: implementation	Responsible person	Frequency	Evidence: compliance
• The temporary vehicle maintenance yard and storage area must be fenced off.	Contractor	Fence off yard	Beginning of construction	Project manager	Weekly	Once off check
• Used parts like filters must be contained and disposed of at a site licensed for dumping of these waste products.	Contractor	Appoint contractor for disposal of parts	Beginning of construction Disposal when needed	Project manager ECO	Monthly	Disposal records
Leakage of oil from the power transformers of the on-site HV substation						
• The on-site HV substation and switching station must be decommissioned according to the Eskom standards and guidelines.	Contractor	Decommission according to standards and guidelines	Construction phase	Project Manager	Weekly	Construction site meetings and records
• According to the Eskom Oil Clean-Up And Rehabilitation Standards, containment of spillages must involve an action that will either prevent or stop a spill from spreading. It's vital to prevent any oil spill from entering development site's stormwater systems. Containment of oil pollution can be done using one or more of the following: o soil barriers; o sand bags; o bund walls; and o absorbent materials. • Polluted soils must be removed to authorized waste site.	Contractor	Clean up according to standards and guidelines	When needed	Project manager ECO	Monthly	Checking of spillage records
Storage and disposal of waste, littering and disassembled components on site						
• Solid waste generated by decommissioning teams will not be burned on site or surrounding areas. Solid waste must be kept in animal proof bins at construction sites and be removed to Local Municipality's landfill site regularly.	Contractor	Supply waste containers Dispose of waste at correct site Clean up site	Continuously during construction Daily cleaning	Project manager ECO	Monthly	Check disposal records

GROUND- AND SURFACE WATER POLLUTION - DECOMMISSIONING PHASE						
Impact Management outcome: Minimise impact to the environment and people through the minimisation and control of groundwater and surface water pollution						
Impact Management actions (mitigation measures)	Implementation			Monitoring		
	Responsible person	Method of implementation	Timeframe: implementation	Responsible person	Frequency	Evidence: compliance
• Building rubble must be removed to Local Municipality landfill site as progress is made. • All components will be disassembled. Silicon of PV modules will be recycled, as well as mounting structures (aluminium/zinced steel frames and piles), cables (copper and/or aluminium) and the connection structures. • Non-recyclable components of inverter, transformers and electrical devices will be disposed of appropriately, in compliance with applicable laws and. • Regular clean-up programs must be put into effect throughout the premises to limit the impact of littering caused by decommissioning activities.		regularly Supply material to recyclers				
• A comprehensive waste and recycling management plan must be compiled for the decommissioning phase. The aim of the plan must be to ensure that the decomissioned materials/debris generated on site be reduced, reused and recycled. This plan must be compiled in consultation with the contractors and engineers.	Contractor	Get waste plan from Project Manager	Start of construction	Project manager ECO	Once off	Waste and recycling management plan records
• Ensure strict compliance that no foreign matter is deposited in trenches. Any foreign matter must be removed immediately.	Contractor	Visual inspection before closure	Continuous	Project manager ECO	Weekly	Spot checks
Storm water across cleared areas						
• Cleared areas must be rehabilitated by reintroducing a grass layer and indigenous plant species as soon as possible to limit the occurrence of erosion.	Contractor	Vegetate area with grass layer	As soon as possible during construction	Project manager ECO	Monthly	Checking Photo records
• Monitor and repair any signs of erosion after heavy downpours.	Contractor	Visual checks	After rainstorms	Project manager ECO	Monthly	Visual checks

WATER SUPPLY MANAGEMENT - DECOMMISSIONING PHASE						
Impact Management outcome: Implement responsible water usage						
Impact Management actions (mitigation measures)	Implementation			Monitoring		
	Responsible person	Method of implementation	Timeframe: implementation	Responsible person	Frequency	Evidence: compliance
Decommissioning activities and dust abatement along internal roads and at decommissioning sites						
• Water must be used sparingly and it must be ensured that no water is wasted. • Roads must be treated with dust abatement chemicals to reduce the use of water. • Washing of construction vehicles must be limited to once or twice a month and must be done with high pressure sprayers to reduce water consumption. • Water tanks must be regularly inspected to ensure no leaks occur. • Decommissioning workers must be educated on the importance and ways to use water sparingly.	Contractor	Keep water use records. Train workers in water saving	Continuous	Project manager ECO	Monthly	Visual checks

SOIL POLLUTION AND DEGRADATION (Geology, Soils & Wetlands) - DECOMMISSIONING PHASE						
Impact Management outcome: Minimise impact to the environment and people through the minimisation and control of soil pollution and degradation						
Impact Management actions (mitigation measures)	Implementation			Monitoring		
	Responsible person	Method of implementation	Timeframe: implementation	Responsible person	Frequency	Evidence: compliance
Operation of construction vehicles and machinery &Fuel storage (leakages)						
• Construction vehicles must be well serviced and maintained regularly to prevent oil and fuel leaks. Vehicle maintenance will not be done on site except in emergency. • All construction vehicles must be inspected for oil and fuel leaks regularly and frequently. • The temporary vehicle maintenance yard and storage area must be fenced off.	Contractor	Maintenance of vehicles	According to schedule	Project manager ECO	Monthly	Records

SOIL POLLUTION AND DEGRADATION (Geology, Soils & Wetlands) - DECOMMISSIONING PHASE						
Impact Management outcome: Minimise impact to the environment and people through the minimisation and control of soil pollution and degradation						
Impact Management actions (mitigation measures)	Implementation			Monitoring		
	Responsible person	Method of implementation	Timeframe: implementation	Responsible person	Frequency	Evidence: compliance
• Used parts like filters must be contained and disposed of at a site licensed for dumping of these waste products.	Contractor	Disposal at correct site	When maintenance is done	Project manager ECO	Monthly at site meetings	Records
• Machinery must be serviced and re-fuelled at existing facilities as far as is possible.	Contractor	Instructions to drivers	Continuously	Project manager ECO	Monthly	Records
• Prevent spillage of fuel or oil onto the soil, and put in place measures to ensure that any accidental spillages can be contained and cleaned up promptly. • Any spills must be treated and removed by a qualified agent/company.	Contractor	Clean-up	When applicable	Project manager ECO	Monthly	Records
• Diesel storage must be **less** than 80 000 litres at decommissioning camps. • A bund wall must be constructed around the fuel tank structures and the run-off diverted to a conservancy tank. • The spilled fuel must be disposed of at the nearest approved fuel recycling collection point. Alternatively drip pans can be placed underneath temporary fuel tanks. • Drip pans must be used when refuelling and servicing construction vehicles or equipment. Drip pans can also be placed underneath stationary construction vehicles and equipment. Used or spilled oil must be taken to the nearest oil refiner or recycling plant for recycling.	Contractor	Supply and erect surface tanks <30 000 litre Procedures for handling of spills Supply drip pans	When required	Project manager ECO	Weekly	Inspection log sheet Spot checks/photos Disposal records
• Spill kits must be on-hand to deal with spills immediately.	Contractor	Keep spill kits on site	When required	Project manager ECO	Weekly	Inspection log sheet Spot checks/photos

SOIL POLLUTION AND DEGRADATION (Geology, Soils & Wetlands) - DECOMMISSIONING PHASE						
Impact Management outcome: Minimise impact to the environment and people through the minimisation and control of soil pollution and degradation						
Impact Management actions (mitigation measures)	Implementation			Monitoring		
	Responsible person	Method of implementation	Timeframe: implementation	Responsible person	Frequency	Evidence: compliance
Leakage of oil from the power transformers of the on-site HV substation						
• The on-site HV substation and switching station must be built according to the Eskom standards and guidelines.	Contractor	Build according to plans	Construction phase	Project manager	Weekly	Inspection Reporting at Site meetings.
• According to the Eskom Oil Clean-Up And Rehabilitation Standards, the containment of spillage must involve an action that will either prevent or stop a spill from spreading. It is vital to prevent any oil spill from entering the stormwater system. • Containment of the oil near the source will minimize pollution and will enable easy clean-up and/or remediation. This shall be done using one or more of the following: o soil barriers; o sand bags; o bund walls; and o absorbent materials. • Polluted soils must be removed to a waste site where it is authorised.	Contractor	Treat spillage as prescribed in standards	When applicable in construction phase	Project manager ECO	When applicable	Incident logs and reports. Photo records
Groundwater Management - Minimise Groundwater Pollution as a result of BESS						
• Compilation and adherence to a procedure for the safe handling of battery cells. • Lithium-ion batteries must have battery management systems (containment, automatic alarms and shut-off systems) to monitor and protect cells from overcharging or damaging conditions, such as temperature extremes. • Compilation of an Emergency Response Plan for implementation in the event of a spill or leakage. • Provision of spill kits on-site for clean-up of spills and leaks.						

SOIL POLLUTION AND DEGRADATION (Geology, Soils & Wetlands) - DECOMMISSIONING PHASE						
Impact Management outcome: Minimise impact to the environment and people through the minimisation and control of soil pollution and degradation						
Impact Management actions (mitigation measures)	Implementation			Monitoring		
	Responsible person	Method of implementation	Timeframe: implementation	Responsible person	Frequency	Evidence: compliance
• Immediate clean-up of spills and disposal of contaminated absorbents and materials or soil at a licensed hazardous waste disposal facility. • Recording and reporting of all significant fuel, oil, hydraulic fluid or electrolyte spills or leaks so that appropriate clean-up measures can be implemented. A copy of records must be made available to authorities on request. • Frequent and appropriate disposal of both general and hazardous waste to prevent soil and groundwater pollution. • Installation of leak detection monitoring systems. • On-site battery maintenance must only be undertaken on impermeable surfaces with secondary containment measures. • Any resulting hazardous substances must be disposed of appropriately. • Provision of emergency and safety signage on-site, and demarcation of areas which may pose a safety risk (incl. hazardous substances). Emergency numbers for local police, fire department, Eskom and Local Municipality must be in a prominent clearly visible area on site. • Both the DFFE and the North-West Department of Economic Development, Environment, Conservation and Tourism (DEDECT); must be notified immediately of any incident, where the incident constitutes an unexpected, sudden, and uncontrolled release of a hazardous substance, including from a major emission, fire or explosion, that causes, has caused or may cause significant harm to the environment, human life or property.						

SOIL POLLUTION AND DEGRADATION (Geology, Soils & Wetlands) - DECOMMISSIONING PHASE						
Impact Management outcome: Minimise impact to the environment and people through the minimisation and control of soil pollution and degradation						
Impact Management actions (mitigation measures)	Implementation			Monitoring		
	Responsible person	Method of implementation	Timeframe: implementation	Responsible person	Frequency	Evidence: compliance
Spillage from temporary chemical toilets						
• Chemical sanitation facilities must be used on site and regularly serviced by registered companies to ensure no spills or leaks from toilets to groundwater or surface water take place. Ratio of one toilet for every 15 workers on site must be maintained. • Temporary sanitation system on construction site must be regularly inspected to ensure no spills or leaks from sanitation system to groundwater take place.	Contractor	Appoint service contractor	Weekly	Project manager	Monthly	Spot checks
Increase in storm water run-of - soil erosion						
• Cleared areas must be re-vegetated allowing a grass layer to re-establish as soon as possible to limit erosion. • Minimize the amount of land disturbance. • Develop and implement stringent erosion and dust control practices. • Slopes produced by removing of soil must be kept to a minimum to reduce the chances of erosion damage to the area.	Contractor	Construction according to plans Follow revegetation plans	During construction phase Continuous rehabilitation	Project manager ECO	Weekly	Check construction against plan
• Monitor and repair any signs of erosion after heavy downpours.	Contractor	Repair erosion	After rainstorms	Project manager ECO	Monthly	Visual checks
Solid waste accumulation on/in soil. Storage and disposal of building rubble, waste and littering on site						
• Solid waste must be kept in adequate animal and weatherproof waste bins at decommissioning camp. Building rubble and waste must be removed regularly to Local Municipality's landfill site. • Comprehensive waste management plan must be compiled for decommissioning phase to ensure that materials/debris generated on site be reduced, reused and recycled. • Regular clean-up programs must be in effect on the premises to limit impact of littering caused by construction activities.	Contractor	Continuous implementation of actions according to waste management plan	Weekly removal	Project manager ECO	Monthly	Records of waste disposal to be kept.

ECOLOGY - DECOMMISSIONING PHASE						
Impact Management outcome: Minimise and control impact to the ecological aspects during decommissioning.						
Impact Management actions (mitigation measures)	Implementation			Monitoring		
	Responsible person	Method of implementation	Timeframe: implementation	Responsible person	Frequency	Evidence: compliance
Control of animals on site. Killing, poisoning, or hunting of animals						
• No animals will be allowed to be killed, captured or hunted or fed on site by construction workers. No poison must be used to control any animals without the input of an ecologist/zoologist. • Limit pesticide use to no-persistent, immobile pesticides and apply according to label and application directions and stipulations for terrestrial and aquatic applications since the wrong use thereof can have disastrous consequences for the raptors occurring in the area. • Instruct employees, contractors, and site visitors to avoid harassment and disturbance of wildlife.	Contractor	Fine for transgressors Apply according to label Training of work force	When applicable	Project manager ECO	Weekly	Incident logs Check pesticides log Training records
• A register must be kept of all relevant details of herbicide and pesticide usage.	Contractor	Draw up register	When applicable	Project manager/ECO	Monthly	Inspection log sheet
Occurrence of veld fires on site						
• Educate construction workers regarding risks and correct disposal of cigarettes. • Fires must only be allowed in designated places within the decommissioning camp and extra care must be taken to prevent veld fires from occurring.	Contractor	Training & keep site clean of cleared vegetation Site instruction	Weekly	Project manager ECO	Monthly	Training records & visual inspection
• Maintain proper firebreaks around entire development footprint. Firebreaks must comply with the National Veld and Forest Fire Act, 1998 (Chapter 4: Duty to Prepare and maintain firebreaks).	Contractor	Make fire breaks	Once-off Maintain as necessary	Project manager ECO	Monthly	Visual inspection

ECOLOGY - DECOMMISSIONING PHASE						
Impact Management outcome: Minimise and control impact to the ecological aspects during decommissioning.						
Impact Management actions (mitigation measures)	Implementation			Monitoring		
	Responsible person	Method of implementation	Timeframe: implementation	Responsible person	Frequency	Evidence: compliance
Increase in traffic on the site						
• The speed of construction vehicles on internal roads must be kept as low as possible (30 km/h) to reduce incidence of road kill. • Decommissioning activities must remain within defined construction areas and the road servitudes.	Contractor	Speed checks Fines to transgressors	Decommissioning phase	Project manager ECO	Monthly	Visual inspection
Littering (e.g. cans & plastics) along access road & at construction sites						
• Solid waste must be kept in adequate animal proof waste bins at the construction camp and construction sites. • Building rubble and various wastes must be removed to a Local Municipality landfill site. A recycling program must be designed to minimise production of solid waste (e.g. organic waste into compost, the rest will be sorted and taken to various recycling stations in the Local Municipality). • Regular clean-up programs must be put into effect along the access road and throughout the premises to limit the impact of littering caused by decommissioning activities.	Contractor	Removal of waste to licensed disposal site Regular site clean-up programs	During decommissioning phase	Project Manager ECO	Daily Weekly	Disposal records
Rehabilitation of site						
• Open areas, where infrastructure was removed must be re-vegetated allowing a grass layer to re-establish soonest. • Area must be safe for workers and staff and after rehablitation, it must provide a safe environment for both animals and people. • Revegetate / re-seed or stabilize disturbed areas for erosion control and rehabilitation. • Follow-up actions to check if re-vegetation was successful.	ECO	According to Rehabilitation plan included in EMPr	Decommissioning phase	ECO	Once off after decommissioning is concluded	Monitoring report

VISUAL DISTURBANCE - DECOMMISSIONING PHASE						
Impact Management outcome: Prevent unnecessary negative visual impact by ensuring that visual impacts are mitigated.						
Impact Management actions (mitigation measures)	Implementation			Monitoring		
	Responsible person	Method of implementation	Timeframe: implementation	Responsible person	Frequency	Evidence: compliance
Construction activities and temporary structures-visual impact.						
• Security lights at the temporary maintenance yard and storage area must shine directly down and directed towards the site. • Adherence to the Visual Impact Assessment mitigation measures.	Contractor	Walk over monitoring	Monthly	Project manager ECO	Monthly	Visual inspection
• No waste will be allowed to be burned on site.	Contractor	Instruction to personnel	Daily	Project manager/ECO	Monthly	Visual inspection

HERITAGE RESOURCES - DECOMMISSIONING PHASE						
Impact Management outcome: Prevent/minimise negative impacts on heritage resources						
Impact Management actions (mitigation measures)	Implementation			Monitoring		
	Responsible person	Method of implementation	Timeframe: implementation	Responsible person	Frequency	Evidence: compliance
Earthworks and buildings & structures removing						
• Halt decommissioning and notify the archaeologist or SAHRA whenever anything of potential heritage value is discovered.	Contractor	Halt construction Call Archaeologist	When required	Project manager ECO	When required	Incident log sheet

SAFETY, SECURITY, SOCIO-ECONOMICS, AND FIRE HAZARDS - DECOMMISSIONING PHASE						
Impact Management outcome: Ensuring a safe/secure construction environment, enhanced socio-economic development and prevention of fires.						
Impact Management actions (mitigation measures)	Implementation			Monitoring		
	Responsible person	Method of implementation	Timeframe: implementation	Responsible person	Frequency	Evidence: compliance
Decommissioning activities - safety of employees						
• The Contractor shall conform to all the stipulations of the Occupational, Health and Safety Act, and any Regulation applicable at the time of starting of decommissioning. • The Act requires designation of a Health and Safety representative if more than 20 employees are employed.	Contractor	Apply Act	Continuous	Project manager	Monthly	Check number of employees on site Safety File records
• A person trained and accredited to administer first aid must be present on site and a first aid kit must be available at the site office.	Contractor	Appoint trained safety representative. Supply first aid kit	Daily	Project manager	Monthly	Visual inspection Safety file records
• All personnel must be informed of emergency procedures and contact numbers must be displayed prominently.	Contractor	Training talks Display emergency numbers.	Weekly	Project manager	Monthly	Training records
• Personal Protective Equipment (PPE) and safety gear must be provided to all site personnel.	Contractor	Supply PPE	When required	Project manager	Monthly	Check if workers are using PPE
Fires caused by the negligence of decommissioning workers						
• Development must comply with the requirements of the National Veld and Forest Fire Act, 1998 (Chapter 2 and Chapter 4). • An emergency plan must be in place so that any fire can be combatted in the most efficient manner. An emergency response plan aligned with the local Fire Department must be in place.	Contractor	Ensure compliance with Act. Training on Emergency plan	At onset of construction phase Monthly	Project manager	Monthly	Training records
• **No** solid waste or vegetation will be burned on the premises or surrounding areas. No fires will be allowed outside designated areas (construction camp).	Contractor	Instruction to employees	Weekly	Project manager ECO	Monthly	Incident log sheet

SAFETY, SECURITY, SOCIO-ECONOMICS, AND FIRE HAZARDS - DECOMMISSIONING PHASE						
Impact Management outcome: Ensuring a safe/secure construction environment, enhanced socio-economic development and prevention of fires.						
Impact Management actions (mitigation measures)	Implementation			Monitoring		
	Responsible person	Method of implementation	Timeframe: implementation	Responsible person	Frequency	Evidence: compliance
• All employees must be properly trained in use of firefighting equipment and the emergency procedures in case of a fire.	Contractor	Training cessions	Monthly	Project manager	Monthly	Training records
• Firefighting equipment must be available and must be checked regularly to ensure it is in proper working order and accessible.	Contractor	Supply & check firefighting equipment	Weekly	Project manager Contractor	Monthly	Inspection log sheet
Decommissioning activities - socio-economic impact- Employment of workers						
• Adherence to the Local and District Municipality's guidelines, principles and policies is imperative.	Contractor	Ensure adherence to policies. Implement work procedures and standards	Daily during construction phase	Project Manager	Monthly	Follow up during site meetings
• During the decommissioning phase, if and where possible, jobs must be created for local people and skills must be transferred to them. Where viable, the work must be executed in a labour intensive manner to create as many jobs possible.	Contractor	Appoint local people	Construction phase	Project manager	Monthly	Staff records
Security Issues- Unauthorized entrance to construction areas and construction workers staying overnight at construction site						
• All personnel must be informed of emergency procedures and emergency contact numbers must be displayed prominently. • No staff / personnel will be allowed to overnight on the site. • Proper access control must be enforced at entrance gate to ensure no unauthorised persons enter site. Security personnel will be appointed to enforce access control.	Contractor	Training sessions on security issues-induction	Start of construction	Project manager	Monthly	Training records
• No staff / personnel will be allowed to overnight on the site. Transportation must be pre-arranged for the decommissioning workers to ensure that the workers from the surrounding local communities have daily transportation available to and from the site.	Contractor	Arrange transport for the workers	Start of construction phase	Project manager	Monthly	Transport records

SAFETY, SECURITY, SOCIO-ECONOMICS, AND FIRE HAZARDS - DECOMMISSIONING PHASE						
Impact Management outcome: Ensuring a safe/secure construction environment, enhanced socio-economic development and prevention of fires.						
Impact Management actions (mitigation measures)	Implementation			Monitoring		
	Responsible person	Method of implementation	Timeframe: implementation	Responsible person	Frequency	Evidence: compliance
• A temporary fence must be erected around the decommissioning camp and storage area.	Contractor	Construct fences	Start of construction phase	Project manager	Monthly	Visual checks
• The security lights at the temporary maintenance yard and storage area must shine directly down and directed towards the site away from the surrounding properties. • Adherence to the Visual Impact Assessment mitigation measures.	Contractor	Install security lighting and video surveillance system	Start of construction phase	Project manager ECO	Monthly	Visual checks

AN ALIEN INVASIVE MANAGEMENT PLAN FOR THE PROPOSED DEVELOPMENT OF THE MOPANE SOLAR PARK PHASE 5 ON PORTION 2 OF THE FARM ROOIDRAAI 85 IQ, LOCATED WITHIN THE JB MARKS LOCAL MUNICIPALITY, DR KENNETH KAUNDA DISTRICT MUNICIPALITY, NORTH WEST PROVINCE

November 2022

Prepared for: VOLTALIA SOUTH AFRICA (PTY) LTD

Compiled by Dr BJ Henning

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AN ALIEN INVASIVE MANAGEMENT PLAN FOR THE PROPOSED DEVELOPMENT OF THE MOPANE SOLAR PARK PHASE 5 ON PORTION 2 OF THE FARM ROOIDRAAI 85 IQ, LOCATED WITHIN THE JB MARKS LOCAL MUNICIPALITY, DR KENNETH KAUNDA DISTRICT MUNICIPALITY, NORTH WEST PROVINCE

November 2022

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Compiled by:

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Reviewed by:

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	Registered Interested and Affected Parties

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1 GENERAL INFORMATION AND BACKGROUND

AGES Limpopo (Pty) Ltd was appointed by VOLTALIA SOUTH AFRICA (PTY) LTD to compile an alien invasive management plan for the proposed development of a solar plant and associated infrastructure named as follows:

- Mopane Solar Park Phase 5.

The project site includes the establishment of a renewable energy generation facilities (Photovoltaic Power Plants) with associated infrastructure and structures, and power lines on Portion 2 of the farm Rooidraai 85 IQ, located within the JB Marks Local Municipality, Dr Kenneth Kaunda District Municipality, North West Province. The project site is located ±7 km northwest of Welverdiend along the border between Gauteng and the North West Province. The Eskom Carmel Main Transmission Substation (MTS) is located 16.4 km South-East of project sites.

The assignment is interpreted as follows: Compile a management plan to control Alien Invasive Species (AIS) occurring on the proposed development site. The study will be done according to guidelines stipulated by the, then called, Department of Environmental Affairs and Tourism (DEAT) and forms part of the Environmental Management Programme (EMPR) for implementation.

1.1 Information Sources

The following information sources were obtained:

1. AIS distribution data according to databases to ascertain which species occur in the study area.
2. All relevant maps through Geographical Information Systems (GIS) mapping, and information (previous studies and environmental databases) on AIS of proposed site.
3. Requirements regarding the management plan as requested by DEFF.
4. Information on micro-habitat level was obtained through obtaining a first-hand perspective from the ecological study compiled by Henning (2022).

1.2 Regulations governing this report.

1.2.1 National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA)

This report was prepared in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) Gazette No. 38282 Government Notice R. 982 of 4 December 2014 (as amended). Appendix 6 – Specialist reports includes a list of requirements to be included in a specialist report:

1. A specialist report or a report prepared in terms of these regulations must contain:
    a. Details of
        i. The specialist who prepared the report; and
        ii. Expertise of that specialist to compile a specialist report, including a CV.

b. A declaration that the specialist is independent in a form as may be specified by the competent authority.
c. An indication of the scope of, and purpose for which, the report was prepared.
d. The date and season of the site investigation and the relevance of the season to the outcome of the assessment.
e. A description of the methodology adopted in preparing the report or carrying out the specialized process.
f. The specific identified sensitivity of the site related to the activity and its associated structures and infrastructure.
g. An identification of any areas to be avoided, including buffers.
h. A map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers.
i. A description of any assumptions made and any uncertainties or gaps in knowledge.
j. A description of the findings and potential implications of such findings on the impact of the activity, including identified alternatives, on the environment.
k. any mitigation measures for inclusion in the EMPr.
l. any conditions for inclusion in the environmental authorisation.
m. any monitoring requirements for inclusion in the EMPr or environmental authorisation
n. a reasoned opinion –
    i. As to whether the activity or portions thereof should be authorised and
    ii. If the opinion is that the activity or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr and where applicable, the closure plan.
o. A description of any consultation process that was undertaken while preparing the specialist report.
p. A summary and copies of any comments received during any consultation process and where applicable all responses thereto; and
q. Any other information requested by the competent authority.

This Act also embraces all three fields of environmental concern namely: resource conservation and exploitation; pollution control and waste management; and land-use planning and development. The environmental management principles include the duty of care for wetlands / rivers and special attention is given to management and planning procedures.

1.2.2 Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004)

The Alien and Invasive Species Regulations (GNR 599 of 2014) are stipulated as part of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004). In South Africa there is a total of 383 invasive plant species that must be controlled, and these species are listed in the NEMBA Alien and Invasive Species list of 2016.

Below is a brief explanation of four categories of Invasive Alien Plants (IAPs) as per the regulation.

1. Category 1a: Invasive species requiring compulsory control. Remove and destroy. Any specimens of Category 1a listed species need, by law, to be eradicated from the environment. No permits will be issued.
2. Category 1b: Invasive species requiring compulsory control as part of an invasive species control programme. Remove and destroy. These plants are deemed to have such a high invasive potential that infestations can qualify to be placed under a government sponsored invasive species management programme. No permits will be issued.
3. Category 2: Invasive species regulated by area. A demarcation permit is required to import, possess, grow, breed, move, sell, buy or accept as a gift any plants listed as Category 2 plants. No permits will be issued for Category 2 plants to exist in riparian zones.
4. Category 3: Invasive species regulated by activity. An individual plant permit is required to undertake any of the following restricted activities (import, possess, grow, breed, move, sell, buy or accept as a gift) involving a Category 3 species. No permits will be issued for Category 3 plants to exist in riparian zones.

1.2.3 Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983)

In terms of amendments to the regulations under this Act, landowners are legally responsible for the control of invasive alien plants on their properties. The schedules provide a list of declared weeds and invaders, which have been divided into three categories, as follows:

- Category 1 plants are prohibited and must be controlled.
- Category 2 plants (commercially used plants) may be grown in demarcated areas providing that there is a permit and that steps are taken to prevent their spread.
- Category 3 plants (ornamentally used plants) may no longer be planted; existing plants may remain, if all reasonable steps are taken to prevent the spreading there of, except within the floodline of watercourses and wetlands.

Alien species, regulated in terms of the Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983) as weeds and invaders are exempted from NEMBA. This implies that the provisions of the CARA regarding listed weed and invader plants supersede those of NEMBA.

1.2.4 Fertilizer, Farm Feeds, Agricultural Remedies and Stock Remedies Act, 1947 (Act No. 36 of 1947)

According to Government Notice No. 13424 dated 26 July 1992, it is an offence to "acquire, dispose, sell or use an agricultural or stock remedy for a purpose or in a manner other than that specified on the label on a container thereof or on such a container".

Contractors using herbicides need to have a valid Pest Control Operators License (limited weeds controller) according to the Fertilizer, Farm Feeds, Agricultural Remedies and Stock Remedies Act, 1947 (Act No. 36 of 1947). This is regulated by the Department of Agriculture.

1.3 Terms of reference

1.3.1 Objectives

- Determine the AIS occurring in the study area.
- Describe the management principles and specific methodology on the control of specific IAS occurring in the study area.

1.3.2 Limitations and assumptions

- To obtain a comprehensive understanding of the dynamics of AIS, surveys and monitoring should ideally be replicated over several seasons and over several years. However, due to project time constraints such long-term studies are not feasible.
- The large study area did not allow for a finer level of assessment that can be obtained in smaller areas. Therefore, data collection in this study relied on data from representative sections, as well as general observations, generic data and a desktop analysis.

2 INTRODUCTION

Alien Invasive Species (plants, animals and micro-organisms) are species that occur outside of their natural habitat or country of origin and due to their ability to outperform and outgrow indigenous species; they establish themselves in these non-native habitats. Alien Invasive Species (AIS) have also been called weeds, pests, encroachers, aliens, invasives, exotics or non-indigenous. They are native to an area or region, but have been introduced elsewhere, either by accident or on purpose. Alien Invasive Species can be animals (*e.g.*, rats), plants (*e.g.*, lantana) and micro-organisms (*e.g.*, cholera). AIS can be found in households as decorative plants, pets or pests or on land as terrestrials and in water as aquatics. The most aggressive invaders can spread far from parent plants and cover large areas.

South Africa has a long history of problem plants. Alien plants were first introduced in South Africa more than a thousand years ago. These were plants mainly from central and northern Africa and were associated with human activities. Plants from other continents were introduced by colonists from 1652 onwards. Invasive alien plants (IAPs) pose a direct threat not only to South Africa's biological diversity, but also to water security, the ecological functioning of natural systems and the productive use of land. Invasive alien plants have negative impacts on the environment by decreasing both surface water runoff and groundwater recharge, causing direct habitat destruction, intensify flooding, and increasing the risk and intensity of wildfires (Görgens and Van Wilgen, 2004). With invasive plants having high evaporation rates, they often use more water than surrounding indigenous plants, which has a direct impact on stream flow and groundwater reserves. In South Africa, an estimate of 1.44 billion m^3 of water is lost to invasive plants annually. This amount of water loss is enough to provide 3.38 million households with four inhabitants with water for a year or to irrigate 120 000 hectares of cropland (WWF, 2016). It is estimated that these plants cover about 10% of the country and the problem is growing at an exponential rate. Figure 1 indicates the distribution and percentage cover of AIS in South Africa.

Vehicles often transport many seeds, and some may be invader species, which may become established along the roads inside the study area, especially where the area is disturbed. The construction phase of developments in the area will almost certainly carry the greatest risk of Invasive Alien Species being imported to the site, and high levels of habitat disturbance also provide the greatest opportunities for such species to establish themselves, since most indigenous species are less tolerant of disturbance. Continued movement of personnel and vehicles on and off the development sites, as well as occasional delivery of materials required for maintenance, will result in a risk of importation of alien species throughout the life of the project. The biggest risk is that invasive alien species such as the seeds of noxious plants may be carried onto the site along with materials that have been stockpiled elsewhere at already invaded sites.

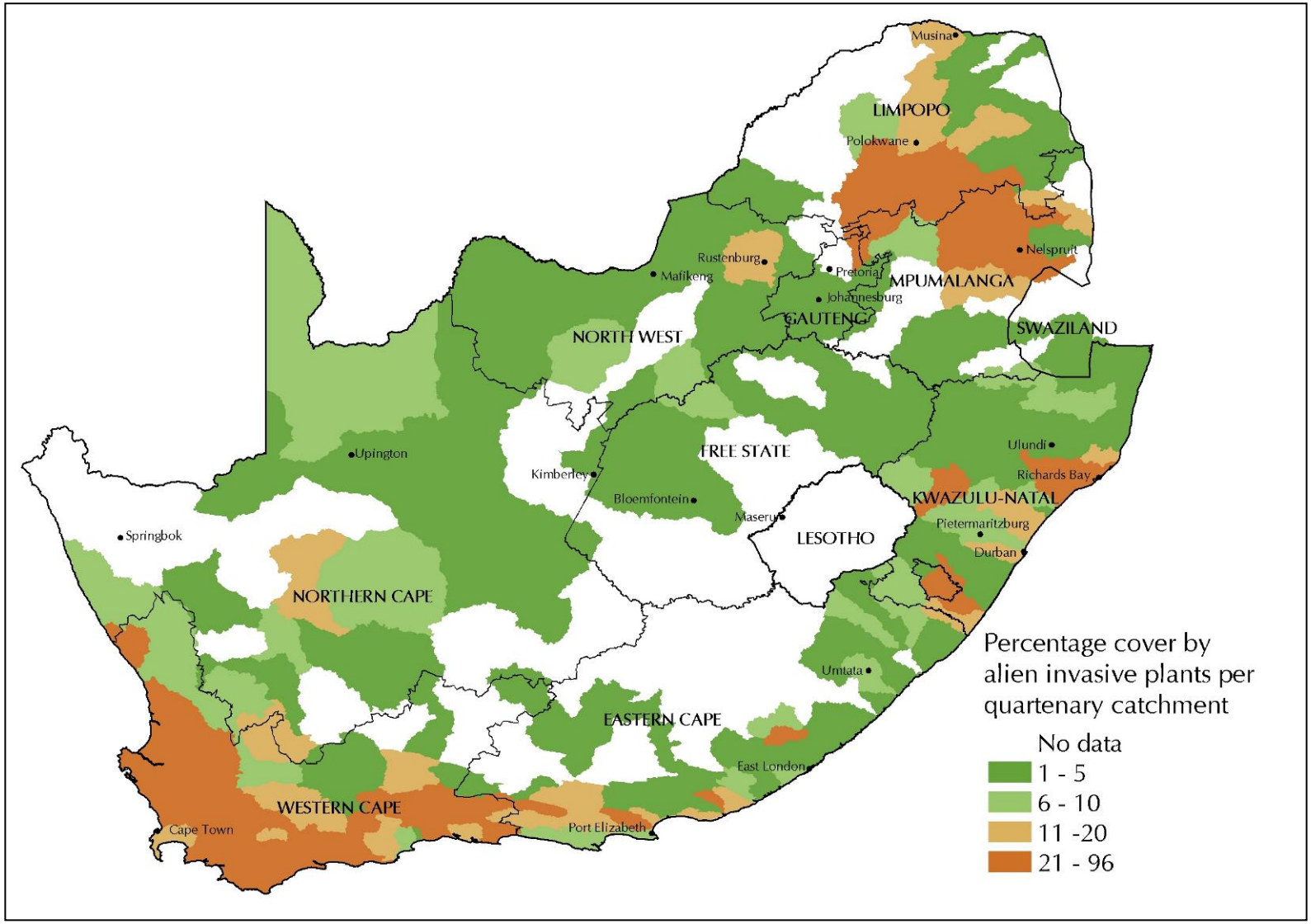


Figure 1. Distribution and percentage cover of AIS in South Africa

3 STUDY AREA

3.1 Location and description of activity

In view of the growing electricity demand and to use renewable energy resources, VOLTALIA SOUTH AFRICA (PTY) LTD is assessing the feasibility of energy generation facilities, consisting of the construction, operation and maintenance of Photovoltaic (PV) Power Plants with a maximum generation capacity up to 100 MW, at the point of connection.

The project site is on Portion 2 of the farm Rooidraai 85 IQ, located within the JB Marks Local Municipality, Dr Kenneth Kaunda District Municipality, North West Province.

The project site is located ±7 km north west of Welverdiend along the border between Gauteng and the North West Province (Figure 2). The Eskom Carmel Main Transmission Substation (MTS) is located 16.4 km South-East of project sites.

The development is located 5.5km north of R501 with access from both the D859 (Preferred) and R501 (alternative).

The developed area (footprint) required for the proposed project will be up to 366 hectares. The final size and location of the project footprint will be assessed following the outcomes of the Public Participation Process and of the recommendations and conclusions of the Specialist Studies to be conducted during the Environmental Impact Assessment (EIA) process.

The proposed development (the Photovoltaic (PV) Power Plants and connection infrastructure) consists of the installation of the following equipment:

- Photovoltaic modules (mono-crystalline, poly-crystalline, or bi-facial modules)
- Mounting systems for the PV arrays (single-axis horizontal trackers or fixed structures) and related foundations
- Internal cabling and string boxes
- DC/AC inverters
- Medium voltage stations, hosting LV/MV power transformers
- Medium voltage receiving station(s)
- Workshops & warehouses

- One on-site high-voltage substation and one high-voltage busbar with metering and protection devices
- One on-site high-voltage substation with high-voltage power transformers, stepping up the voltage to 400kV/132kV and one high-voltage busbar with metering and protection devices
- One on-site switching station, with one high-voltage busbar with metering and protection devices
- Battery Energy Storage Systems (BESS), with a Maximum Export Capacity up to 100 MW and a 5-hour storage capacity up to 1250 MWh, with a footprint up to 10 ha, next to the on-site high-voltage substation, within the PV plant footprint / fenced areas
- Electrical system and UPS (Uninterruptible Power Supply) devices
- Lighting system
- Grounding system
- Internal roads
- Fencing of the site and alarm and video-surveillance system
- Water access point, water supply pipelines, water treatment facilities
- Small scale patented wastewater treatment system

During the construction phase, the site may be provided with additional activities which will be removed at the end of construction.

- Water access point, water supply pipelines, water treatment facilities
- Prefabricated buildings
- Workshops & warehouses

The aerial map of the site (including the footprints) is indicated in Figure 3, while the topographical map of the proposed development is presented in Figure 4.

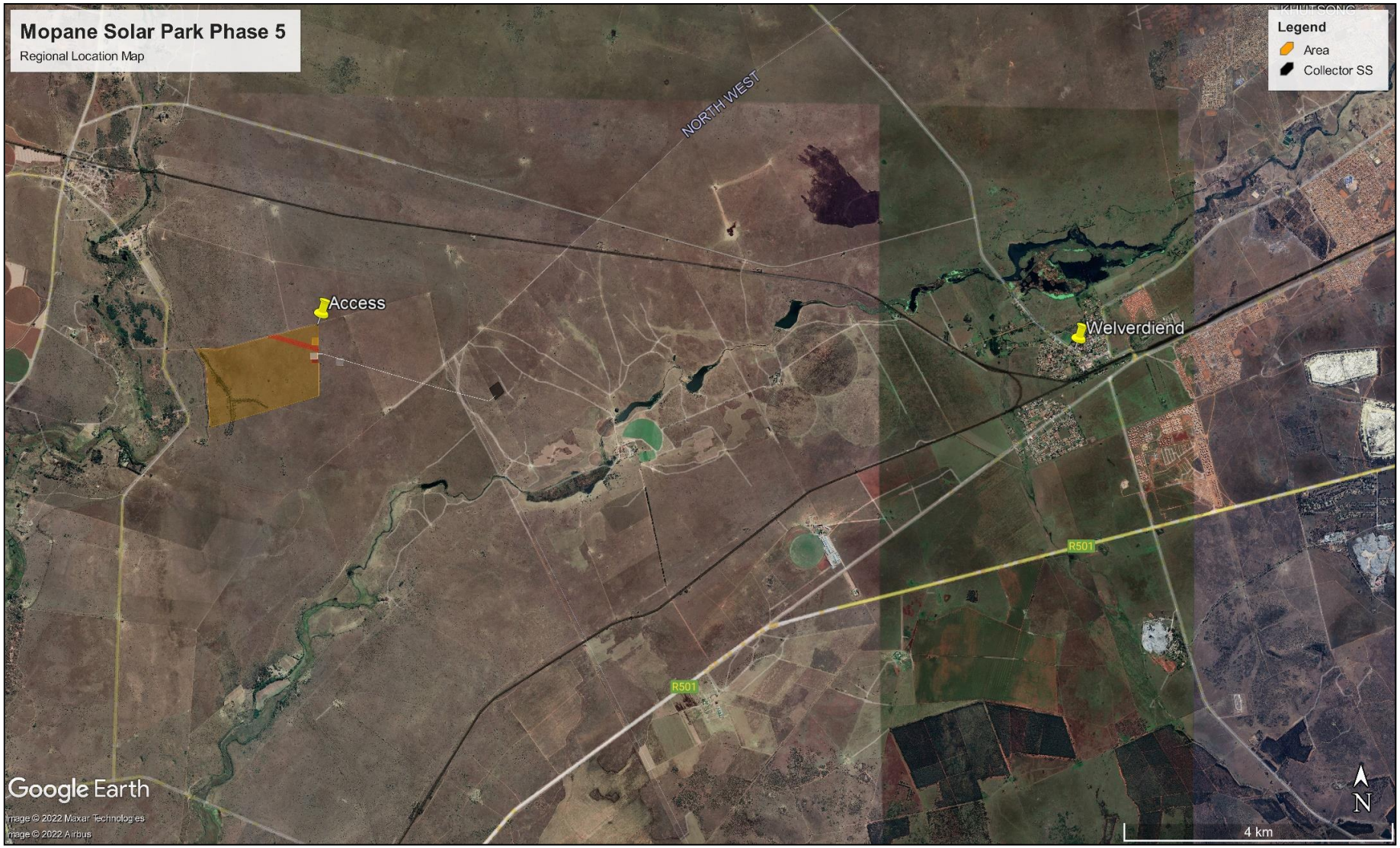


Figure 2. Regional location Map of the project area

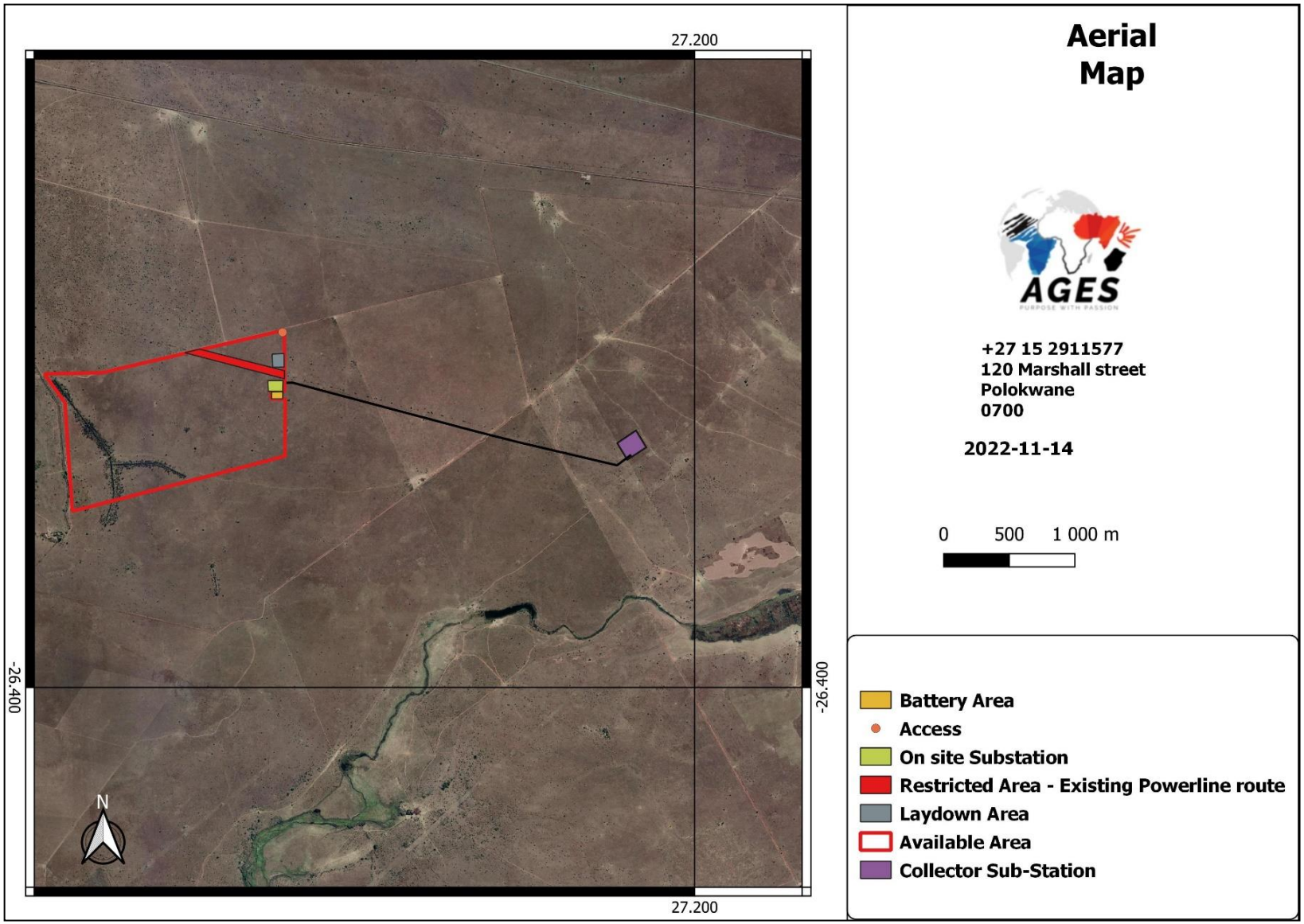


Figure 3. Aerial Map indicating the proposed location of the Solar Plant and associated infrastructure

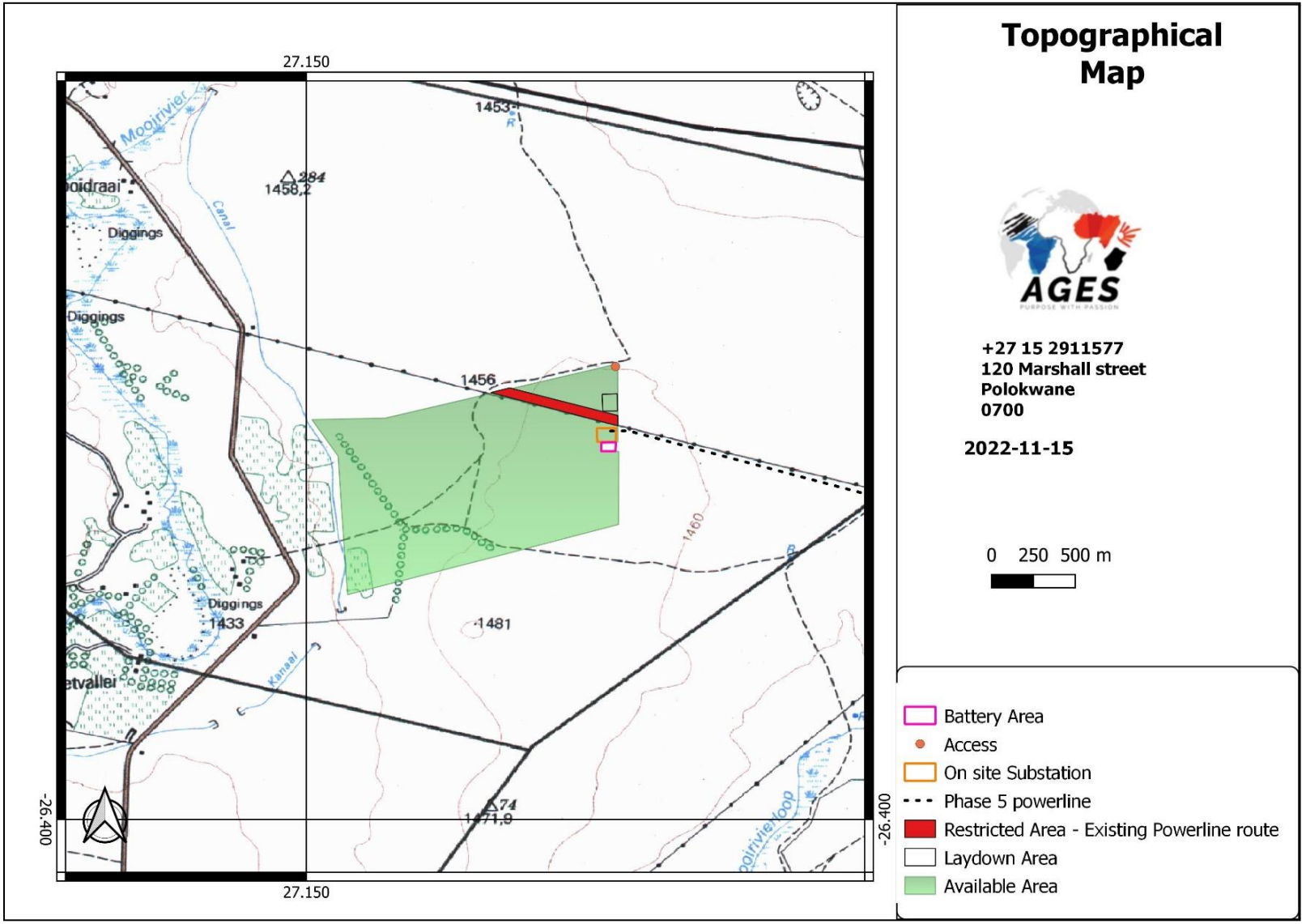


Figure 4. Topographical Map of the project area

4 LEGAL OBLIGATIONS OF LANDOWNERS WITH REGARDS TO LISTED ALIEN INVASIVE SPECIES CONTROL

As per the definition clauses, an "Invasive species" means any species whose establishment and spread outside of its natural distribution range:

(a)Threaten ecosystems, habitats or other species or have demonstrated potential to threaten ecosystems, habitats or other species; and

(b) May result in economic or environmental harm or harm to human health.

The obligations contained in the Act do not however apply to all invasive species. A distinction is drawn between "invasive species" and "listed invasive species", which means – *Any invasive species listed in terms of section 70 (1)"*

As far as listed invasive species are concerned, the situation is slightly different from that of alien species as the Act places some additional obligations on parties other than permit holders. A person wishing to conduct a restricted activity in relation to a listed invasive species will also require a permit and is subject to the same duty of care as is the case with alien species. However, in addition to those requirements, section 75 (4) mandates the Minister to coordinate and implement programmes for the prevention, control or eradication of listed invasive species. S 75 (4) reads as follows:

"75. Control and eradication of listed invasive species

(4) The Minister must ensure the coordination and implementation of programmes for the prevention, control or eradication of invasive species."

These programmes, referred to in the regulations as "Invasive Species Management Programmes" must be prepared by the governing bodies of all parastatal protected areas and all other organs of state. These programmes may also impact and be carried out on private land, but it is the Department who is responsible for its implementation, not the landowner.

However, in the context of certain "listed invasive species", specifically those categorised as 1a invasive species in terms of the regulations, the Act does place a limited obligation on the owner of land where listed invasive species occur.

In this regard, section 73 (2) of the Act reads as follows:

"73. Duty of care relating to listed invasive species.

(2) A person who is the owner of land on which a listed invasive species occurs must-

(a) Notify any relevant competent authority, in writing, of the listed invasive species occurring on the land.

(b) Take steps to control and eradicate the listed invasive species and to prevent it from spreading; and

(c) Take all the required steps to prevent or minimise harm to biodiversity.

(3) A competent authority may, in writing, direct any person who has failed to comply with subsection (1) or (2), or who has contravened section 71 (1), to take such steps-

(a) As may be necessary to remedy any harm to biodiversity caused by-

(i) The actions of that person; or

(ii) The occurrence of the listed invasive species on land of which that person is the owner; and

(b) As may be specified in the directive"

This provision certainly does place an obligation on a landowner to report the presence of any relevant listed invasive species (As per the regulations, category 1a species) to the competent authority and to rid the property of listed invasive species as well as prevent it from spreading.

4.1 Alien and Invasive Species Regulations

Categorisation of listed invasive species is significant as the regulations ascribe differing obligations for each category. The categories and obligations are as follows:
Category 1a invasive species: Category 1 species are those that require compulsory eradication. It is these, and only these, to which section 73 (2) of the Act applies. This means that the property owner must notify the relevant authority of the presence of these species, actively combat and eradicate them as well as prevent their spread. As with category 1b, a property owner must permit an authorised official from the department to enter the property to monitor, assist with and implement the eradication of category 1a invasive species. A permit is also required for any restricted activities vis-à-vis this category of species. Where an Invasive Species Management Programme exists, the specimens must be eradicated in accordance with that plan.

Category 1b invasive species: Category 1b species must be controlled. In the context of the Act, 'controlled' means eradicated, or where not possible, the spread and propagation of this species must be prevented. This category applies to persons who are in control of a listed invasive species. This section of the regulations does not expressly refer to section 73 (2) of the Act so presumably it does not apply to all landowners where the species occurs.

By a 'person in control', the regulations could possibly refer to permit holders or people who are conducting restricted activities. To facilitate this control, a landowner must permit authorised personnel from the Department to enter the property to monitor, assist with or implement the control of the listed category 1b species. There does not however, seem to be any specific obligation on the landowner to eradicate the category 1b invasive species on his own accord, if he is not considered a 'person in control' of this category of listed species. Where an Invasive Species Management Programme exists, the control must be carried out according to the programme. Permits are required for restricted activities.

Category 2 invasive species: A category 2 species requires a permit to carry out any restricted activities. As with category 3 species, should any species listed under category 2 occur on a landowner's property, he or she is obliged to control its spread in accordance with any relevant Invasive Species Management Programme (if applicable). Over and above the provisions of any Invasive Species Management Programme, a landowner must ensure that no specimens of the species spread outside of his or her land.

Category 3 invasive species: These listed invasive species are referred to as 'exemptions' because species listed in this category may be exempted from permit requirements in relation to any restricted activities. A landowner is not obligated to eradicate the species nor control its spread except in accordance with any relevant Invasive Species Management Programme (if applicable). However, should any species listed under this category occur in a riparian area (on the banks of a river); it is deemed to be a category 1b listed invasive species.

The categories can be summarised as follows.

	Compulsory eradication by landowner	Compulsory control by landowner (prevent specie from spreading)	Permit required for restricted activities	Compliance with Invasive Species Management Plan
Category 1a	X	X	X	X
Category 1b			X	X
Category 2		X	X	X (if applicable)
Category 3				X (if applicable)

5 CONTROL OF ALIEN INVASIVE SPECIES

5.1 Background

According to the Biodiversity Act, 2004 (Act No.10 of 2004), it is stated that landowners are under legal obligation to control invasive alien plants occurring on their properties. Landowners must then identify all invasive alien plants on their property and make use of the correct methods to control or remove these plants. The control methods of alien invasive plants can be broadly classified into three categories: mechanical, chemical, or biological. Mechanical control methods involve the physical destruction or total removal of plants (e.g., felling, strip-barking; ringbarking, hand-pulling and mowing); chemical control of invasive alien plants include the foliar spraying of herbicides to kill targeted plants and biological control, or biocontrol methods involves the release of natural enemies that will reduce plant health and reduce population vigour to a level comparable to that of the natural vegetation. It is often necessary to use a combination of at least two of these methods to control or remove invasive alien plants (State of the World Plants, 2017). With repeated follow-up, mechanical and chemical control methods tend to be short-term activities suitable for smaller plant invasions that can result in the complete removal of the target species. After the implementation of your methods, it is important to evaluate the effectiveness of your methods and to monitor the cleared areas on a regular basis to identify emergent seedlings and to remove those immediately.

Goals for addressing the Alien Invasive Species (AIS) problem on site should include:

- Prevention: Keeping an AIS from being introduced onto the site ecosystem. Ideally, this means preventing alien plants from entering the development site.
- Early detection: Locating AIS before they get established and spread. This requires an effective, site-based inventory and monitoring program.
- Eradication: Killing the entire population of AIS. Typically, this can only be accomplished when the organisms are detected early.
- Control: Long-term management of the AIS population size and distribution when eradication is unfeasible, by implementing the following strategies:
    - Institute strict control over materials brought onto site, which should be inspected for potential invasive invertebrate species or plant material (seeds etc.) and steps taken to eradicate these before transport to the site. Routinely fumigate or spray all materials with appropriate low-residual insecticides prior to transport to or in a quarantine area on site. The contractor is responsible for the control of weeds and invader plants at the construction site during the construction phase.

- Control involves killing the plants present, killing emerging seedlings and establishing and managing an alternative plant cover to limit re-growth and re-invasion. Weeds and invader plants will be controlled in the manner prescribed for that category by the Conservation of Agricultural Resources Act or in terms of Working for Water guidelines.
- Rehabilitate disturbed areas as quickly as possible to reduce the area where invasive species would be at a strong advantage and most easily able to establish.
- Institute a monitoring programme to detect Alien Invasive Species early, before they become established and, in the case of weeds, before the release of seeds.
- Institute an eradication/control programme for early intervention if invasive species are detected, so that their spread to surrounding natural ecosystems can be prevented.

Any control programme for alien vegetation must include the following 3 phases:

- Initial control: drastic reduction of existing population.
- Follow-up control: control of seedlings, root suckers and coppice growth.
- Maintenance control: sustain low alien plant numbers with annual control.

Scientists and field workers use a range of methods to control invasive alien plants. These include:

- Mechanical methods - felling, removing, or burning invading alien plants.
  - Start at the highest point and work downwards (downhill/downstream).
  - Start from the edge of the infestation and work towards the centre.
  - Take care to prevent the spread of cuttings.
  - Once plants are removed, banks and slopes should be stabilised by erosion protection measures (geotextiles/other suitable materials).
  - When stacking materials, take note of fire protection measures and remember to always stack the material in rows.
- Chemical methods - using environmentally safe herbicides. The following general principles apply when using this method:
  - Chemical control of alien plants is not recommended in aquatic systems due to the risk of pollution but may be used on the floodplain / riparian zone in conjunction with cutting or slashing of plants.
  - Pesticides should always be used in a lawful manner, consistent with the product's label.

  - Chemicals should only be applied by qualified personnel.
  - Only approved chemicals should be applied.
  - Follow the manufacturer's instructions carefully.
  - Appropriate protective clothing must be worn.
  - Chemicals to be applied immediately after cutting.
  - Only designated spray bottles to be used for applying chemicals.
  - Decanting of chemicals and cleaning of equipment should be undertaken at a designated location using drip trays and ground sheets to prevent spillage and contamination of the soil.
  - See next section on herbicides to use for treatment of specific plants.
- Biological control - using species-specific insects and diseases from the alien plant's country of origin. To date 76 bio-control agents have been released in South Africa against 40 weed species. The following general principles apply when using this method:
  - This method is environmentally responsible as it does not cause pollution and affects only the target plant.
  - It is cost effective.
  - It does not disturb the soil or create large empty areas where other invaders could establish, as it does not kill all target plants at once.
  - It allows natural vegetation to recover gradually in the shelter of dying weeds.
- Integrated control - combinations of the above three approaches. Often an integrated approach is required to prevent enormous impacts.

Detailed descriptions of the control methods are included in Appendix A of this management plan.

6 ALIEN INVASIVE SPECIES MANAGEMENT

6.1 DISPOSAL METHODS

Disposal of cut IAP material needs to be carefully considered. Options may include burning on site (with serious risks that need to be managed); chipping and composting (not appropriate if plant material contains seeds); use of woody biomass for charcoal manufacturing; use of cut material to generate electricity (if feasible); transporting of material to a garden refuse or disposal landfill site. Selected disposal method must meet all legal requirements and must not create risk for residents and infrastructure. Burning of some IAPs stimulates seed release or rapid seed germination.

6.2 PRIORITY CONTROL AREAS

Under normal circumstances, proposed development sites are divided into different priority areas according to the density of alien invasive and weed species. The listed alien invasive species and other exotic weeds occur patchy throughout the site and therefore all areas identified was considered as low priority control areas on the proposed development site. No map was therefore needed to indicate priority control areas.

6.3 SPECIES SPECIFIC CONTROL STRATEGY

Based on the integrated approach of initial clearing, follow-up and maintenance the following methods are best suited:

- Clearing Phase: Mechanical clearing initially after which necessary chemical control methods (cut-stump treatments etc.) for woody species are applied. Weeds are removed by hand or directly sprayed if already in flower or seed.
- Follow-up and maintenance phases: Monitoring of cleared plants followed by chemical control methods applied if any regrowth appeared.

Table 1 indicate specific control methods for the different IAS that occurs on the proposed development site as identified by Henning (2021)

Table 1. Invasive Alien Species with a distribution centred within the study area and documented during the ecological surveys (Henning, 2014) in arid regions of the country and their control.

Species	Control Method
Xanthium strumarium 	**Mechanical Control: Seedlings can be controlled by cultivation, but older plants often produce shoots from axillary buds if the root has not been severed. Adoption of zero or reduced tillage systems can potentially reduce Xanthium populations, because burs seldom germinate on the soil surface.** **Chemical Control:** X. strumarium is controlled by many soil-applied and foliar herbicides.
Datura stramonium 	**Mechanical control**: Isolated thornapple plants should be hand-pulled before they set seed, whereas larger areas of infestation are readily controlled by tillage when weeds are in the seedling stage. Cultivation becomes less effective as plants mature, because stems become woody and roots may not be completely severed. Seedlings emerge over a long period of time so repeated cultivations may be necessary to reduce the level of infestation **Chemical Control:** Chemical: Herbicide treatment can be done by using 20ml Access and 30ml 2,4 D Eser / 10l water on active growing plants. Care must be taken not to affect other broadleaf herbs and trees.

Species	Control Method
Eucalyptus camaldulensis 	**Mechanical control** by ringbarking or cutting down trees above ground. **Chemical Control:** Methods of chemical control including chemical control by basal stem treatment (ringbark) or stump treatment. Basal Stem: Use Kaput 100 Gel (applied with paintbrush) or Garlon® 4 200ml/10L diesel and painted onto the stem up to a height of 25cm above the soil surface. Cut Stump: Immediately use Kaput 100 Gel or Chopper® 300ml/10L water. **Control at Zwavelpoort Spruit:** • Young and medium sized trees could be cut down and if roots not removed the cutstumps should be treated with herbicides stated above. • Larger Trees can be ring-barked, and for the sake of safety the dead trees should preferably be felled before they fall over. When cut down remaining stumps must be treated with herbicide to prevent rapid regrowth. There are registered herbicides for foliar, soil, frill, and aerial applications. The older trees do not qualify as so-called “Champion Trees”as discussed earlier in the document due to being less than 120 years old.
Verbena bonariensis 	Controlling the weed before it seeds will reduce future problems. Control is best applied to the least infested areas before dense infestations are tackled. Consistent follow-up work is required for sustainable management. Complete clearance of the mature plant before seeding and the use of uncontaminated planting material and farm implements can help to prevent its spread. Small infestations can be cleared by hand pulling and digging. Larger infestations can be treated with herbicide. When using any herbicide always read the label first and follow all instructions and safety requirements. If in doubt consult an expert.

Species	Control Method
Argemone ochroleuca 	Chemical control: Plants of *A. ochroleuca* should be destroyed or removed before they produce seeds. Seedlings are readily controlled by light tillage. Long cultivated fallow or vigorous perennial pastures will control large infestations (Parsons and Cuthbertson, 1992). Herbicides which control A. ochroleuca include 2,4-D, 2,4-DB, dicamba, diuron, fluroxypyr, hexazinone, isoproturon, karbutilate, MCPA, metribuzin, oxadiazon, picloram and terbutryn. Biological control: A biological control programme of A. ochroleuca has been initiated in Australia. This native of Mexico is naturalized in most warm countries of the world in sub-humid as well as semiarid regions. This project sought natural enemies in Mexico and identified several predatory insects including an extremely damaging species of root-breeding and leaf-feeding weevil (CSIRO, 1999; Julien, 2002).

7 RECOMMENDED MONITORING PLAN FOR AIS

The implementation of an AIS monitoring programme is strongly recommended and will be a direct indicator of habitat transformation. This is the only quantifiable means to evaluate the impact of current and possible future management practices on the vegetation of the study area. This includes evaluating the success of clearance of AIS. The nature of secondary succession in disturbed areas should be evaluated to determine whether a favourable succession pathway is occurring towards indigenous vegetation cover.

Monitoring and maintenance of alien invasive, indigenous trees and grass cover should be done until a self-sustaining plant community is established. Re-establishment of plant cover on cleared areas should take place as soon as clearance activities have ceased for specific priority areas.

Monitoring of alien invasive plants and weeds should be conducted bi-annually around the focus area as follows:

Phase 1 (Pre-Construction): As an initial stocktaking exercise, a reconnaissance-type survey should be undertaken to determine:

- The number, distribution and broad categorization of habitat of AIS.
- Whether any obvious signs of dense stands do occur and prioritize control of the specific AIS populations.

Phase 2 (Construction and Operational Phases): Monitoring should be undertaken bi-annually during the construction phase and annually during the operational phase of the solar plant. The monitoring should be conducted by a botanist or an Environmental Control Officer or suitably trained on site personnel with suitable knowledge of the plants, especially during the construction phase where vegetation is cleared. The following will be determined:

- The continued presence of AIS in all recorded localities.
- The population density and age of all located populations.
- Further control of the AIS populations on site.
- Success of planting indigenous trees and the rehabilitation of the cleared areas/ riverbanks.
- The next monitoring exercise should be conducted early 2023.
- The monitoring plan could be implemented on the Mopane Solar Park Phase 5 by the Environmental Control Officer.

8 REFERENCES

BROMILOW, C. 2001. Problem Plants of South Africa: A Guide to the Identification and Control of more than 300 Invasive Plants and other Weeds. Briza Publications.

A TERRESTRIAL BIODIVERSITY IMPACT ASSESSMENT (INCLUDING PLANT AND ANIMAL SPECIES ASSESSMENT) FOR THE PROPOSED DEVELOPMENT OF THE MOPANE SOLAR PARK PHASE 5 ON PORTION 2 OF THE FARM ROOIDRAAI 85 IQ, LOCATED WITHIN THE JB MARKS LOCAL MUNICIPALITY, DR KENNETH KAUNDA DISTRICT MUNICIPALITY, NORTH WEST PROVINCE

The Nature Conservation Corporation 2008. Invasive Alien Vegetation Management Manual.

VAN WILGEN, B. Invasive alien species – an important aspect of global change

www.agis.agric.za

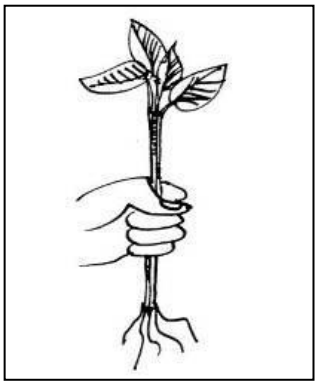
APPENDIX A. CONTROL METHODS

The different control methods are discussed in the following section of this management plan as stipulated by the Nature Conservation Corporation (2008):

1. **Mechanical Methods**

a. Hand pulling

- Hand pulling is most effective where plants are small (30cm), immature or shallow rooted.
- Use the following method:
    - Use a pair of gloves and grip the plant firmly around the stem just above the root (see figure below)



    - Pull hard and remove the plant, roots & all.
    - Kicking around the root area of the plant may assist in loosening root system, making it easier to pull out.
    - Shake the excess sandy material from the plant, this makes the plant easier to stockpile and lighter to transport.
    - Stack removed material into piles or spread out evenly if it is not going to be a fire hazard, or
    - Stack the seedlings on brush piles or rows along contour lines, to facilitate easy follow-up.

b. Chopping/ cutting/ slashing

- This method is most effective for plants in the immature stage, or for plants that have relatively woody stems/ trunks.
- This is an effective method for non-re-sprouters or in the case of re-sprouters (coppicing), if done in conjunction with chemical treatment of cut stumps

- Use implements such as pangas (slashers), handsaws, bowsaws, chainsaws, brush cutters and axes. Remember to wear protective clothing.
- Use the following method:
    - Cut/slash the stem of the plant as near as possible to ground level.
    - Paint re-sprouting plants (i.e., black wattle, lantana and port jackson) with an appropriate herbicide immediately after they have been cut.
    - Stockpile removed material into piles of 2m high, 3m wide windrows/stacks.

c. Grubbing/ hoeing/ digging out/ tree poppers.

- Grubbing, hoeing, or digging involves the use of a hoe, stick, tree popper or spade.
- The entire plant and root must be removed.
- Use the following method:
    - Dig around the plant making sure the sand is loosened around the root system.
    - Dig down, under the roots, applying pressure, and wrench the entire plant out.
    - Kicking the plant may help to dislodge it, however, care should be taken if the plant is seeding, as dry seeds may be dislodged.
    - Stockpile removed material into piles of 2m high, 3m wide windrows/stacks.

d. Basal bark

- Application of suitable herbicide in diesel can be carried out to the bottom 250mm of the stem. Applications should be by means of a low pressure, coarse droplet spray from a narrow angle solid cone nozzle or by using a paintbrush. If multi stemmed, then each stem needs to be treated.

e. Ring barking

- Remove bark and cambium around the trunk of the tree for a continuous band around the tree at least 25cm wide, starting as low as possible.

- Where clean de-barking is not possible due to crevices in the stem or where exposed roots are present, a combination of bark removal and basal stem treatments should be carried out.
- For better control of aggressively coppicing species pull off the bark below the cut to ground level (bark stripping), to avoid the use of herbicide.

Note: that since this method means that the tree is left standing, it is only recommended for single trees, not for stands. Slashers or axes should be used for debarking.

f. Frill

- Using an axe or bush knife, make a series of overlapping cuts around the trunk of the tree, through the bark into the softwood (approximately 500mm from ground level). The thickness of the blade should force the bark open slightly, ensuring access to the cambium layer.
- Ensure to affect the cuts around the entire stem.
- Immediately apply the registered herbicide to the cuts by spraying into the frill '. The frill needs to be deep enough to retain the herbicide.

g. Bark stripping

- Where bark stripping is used, then all the bark shall be stripped from the trunk between the ground level and 1 meter above ground level.
- Application of suitable herbicide can also be used with this method.
- Applications should be by means of a low pressure, coarse droplet spray from a narrow angle solid cone nozzle or by using a paintbrush.

2. Chemical control

a. Injection

- Drill or punch downward slanting holes into the tree around the entire circumference of the stem
- Inject the chemical directly into the plant.

b. Foliar spray

- This method is not recommended but may be used under certain circumstances. Best results are obtained if the solution is sprayed on a large leaf area on an actively growing plant.

- Use a solid cone nozzle that ensures an even coverage on all leaves and stems to the point of run off.
- Do not spray just before rain (a rainfall-free period of 6 hours is recommended) or before dew falls.
- Avoid spraying in windy weather as the spray may spread to non-target plants.
- Spraying dormant or drought stressed plants is not effective as they do not absorb enough of the herbicide.

c. Cut stump application.

- This is a highly effective and appropriate control method for larger woody vegetation that has already been cut off close to the ground.
- The appropriate herbicide should be applied to the stump using a paintbrush within 30 min of being cut.
- Stems should be cut as low as practical as stipulated on the label and herbicides are applied in diesel or water, as recommended.
- Applications in diesel should be to the whole stump and exposed roots and in water to the cut area as recommended on the label.

d. Stacking

- Stacking the cut material in heaps, or in windrows along mountain contours to reduce erosion, facilitates easy access for follow up.
- It also assists in containing the resulting fuel load and risk of an uncontrolled fire.
- Keep stacks well apart to prevent fires from crossing easily, not less that fire meters apart, this is naturally dependant on the size of the stack & the resulting fire intensity when they burn.
- Stockpile removed material into piles of 2m high, 3m wide windrows/stacks.
- Stack light branches separately from heavy timber (75mm and more). Preferably remove heavy branches to reduce long burning fuel loads that can result in soil damage from intensely hot fire.
- Do not make stacks under trees and power lines, within 30 meters of a fire belt or near watercourses, houses and other infrastructure.

e. Safety

- Always wear the appropriate safety clothing when working with herbicides.
- Mix all herbicides on a drip groundsheet when working in the veld. Keep away from watercourses.
- Do not rinse herbicide equipment in veld. ALWAYS READ THE HERBICIDE LABEL and observe instructions for safe use of herbicide.

3. Biological Control

a. What is biological control?

Biological control is an attempt to introduce the plant ‘s natural enemies to its new habitat, with the assumption that these natural enemies will remove the plants’ competitive advantage until its vigour is reduced to a level comparable to that of the natural vegetation. Natural enemies that are used for biological control are called bio control agents. In the control of invasive plants, the bio control agents used most frequently are insects, mites, and pathogens (disease-causing organisms such as fungi). Bio control agents target specific plant organs, such as the vegetative parts of the plant (its leaves, stems or roots) or the reproductive parts (flowers, fruits, or seeds).

The choice of bio control agents depends on the aim of the control project. If the aim is to get rid of the invasive plant species, scientists select the types of bio control agents causing the most damage that are available. In such projects, scientists may use agents that affect the vegetative parts of the plant as well as agents that reduce seed production. However, if the target plant is useful in certain situations but becomes a pest when uncontrolled, conflict of interests arises regarding biological control. This conflict is usually resolved by avoiding bio control agents that could cause damage to the useful part of the plant, and instead using only seed-reducing agents. These reduce the reproductive potential of the plants, curb seed dispersal and reduce follow-up work needed after clearing, while still allowing the continued utilisation of the plant.

b. How effective is biological control?

Probably without exception, bio control agents do not completely exterminate populations of their host plants. At best, they can be expected to reduce the weed density to an acceptable level or to reduce the vigour and/or reproductive potential of individual plants.

The fact that a few host plants always survive, despite the attack by a bio control agent, ensures that the agent does not die out because of a lack of food. The small population of bio control agents that persists will disperse onto any regrowth or newly emerged seedlings of the weed. For this reason, bio control can be regarded as a sustainable control method. Biological control works relatively slowly. On average, at least five years should be allowed for a bio control agent to establish itself successfully before causing significant damage to its host plant.

Unfortunately, not all growth of invasive plant species can be curbed by biological control. It could be that effective bio control agents do exist but cannot be released in South Africa because they are not sufficiently host specific. Alternatively, the invasive plant might be a man-made hybrid between two or more species and is no longer an acceptable host to the natural enemies of either of the parent plants. It could also happen that the natural enemies of some plants are not adapted to all climatic regions in which the plant is a problem in South Africa, or that the habitat already contains predators or parasitoids that attack the bio control agents. In such cases, biological control will have to be replaced or supplemented by chemical or other control measures.

c. Advantages of biological control

Bio control is:

- Environmentally friendly because it causes no pollution and affects only the target (invasive) plant.
- Self-perpetuating or self-sustaining and therefore permanent
- Cost-effective
- Does not disturb the soil or create large empty areas where other invaders could establish, because it does not kill all the target plants at once. Instead, it allows the natural vegetation of the area to recover gradually in the shelter of the dying weeds.

A PROTECTED PLANT RESCUE AND PROTECTION PLAN FOR THE PROPOSED DEVELOPMENT OF THE MOPANE SOLAR PARK PHASE 5 ON PORTION 2 OF THE FARM ROOIDRAAI 85 IQ, LOCATED WITHIN THE JB MARKS LOCAL MUNICIPALITY, DR KENNETH KAUNDA DISTRICT MUNICIPALITY, NORTH WEST PROVINCE

November 2022

Prepared for: VOLTALIA SOUTH AFRICA (PTY) LTD

Compiled by Dr BJ Henning

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	Registered Interested and Affected Parties

DOCUMENT HISTORY

Report no	Date	Version	Status
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1 GENERAL INFORMATION AND BACKGROUND

AGES Limpopo (Pty) Ltd was appointed by VOLTALIA SOUTH AFRICA (PTY) LTD to compile a plant rescue and protection for the proposed development of a solar plant named as follows:

- Mopane Solar Park Phase 5.

The project site includes the establishment of a renewable energy generation facilities (Photovoltaic Power Plants) with associated infrastructure and structures, and power lines on Portion 2 of the farm Rooidraai 85 IQ, located within the JB Marks Local Municipality, Dr Kenneth Kaunda District Municipality, North West Province. The project site is located ±7 km northwest of Welverdiend along the border between Gauteng and the North West Province. The Eskom Carmel Main Transmission Substation (MTS) is located 16.4 km South-East of project sites.

The assignment is interpreted as follows: Compile a management plan to be implemented as guidelines by the Environmental Control Officer (ECO) for the rescue and protection of rare and endemic plant species occurring on the proposed development site. The study will be done according to guidelines stipulated by the, then called, Department of Environmental Affairs and Tourism (DEAT) and legislation pertaining to the protection of plants in the North West Province and forms part of the Environmental Management Programme (EMPR) for implementation.

1.1 Information Sources

The following information sources were obtained:

1. National and provincial legislation was evaluated to provide lists of any plant or animal species that have protected status. The most important legislation is the following:
    a. National Environmental Management: Biodiversity Act (Act No 10 of 2004)
    b. National Forest Act.
    c. Transvaal Nature Conservation Ordinance.
    d. CITES: Convention on the Trade in Endangered Species of Wild Fauna and Flora.
2. All relevant maps through Geographical Information Systems (GIS) mapping, and information (previous studies and environmental databases) on the rare and protected plants of the site concerned.

3. Requirements regarding the management plan as requested by DEAT.
4. Information on the micro-habitat level was obtained through obtaining a first-hand perspective from the ecological study compiled by Henning (2014) was also utilized for this study.

1.2 Regulations governing this report.

1.2.1 National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) - Regulation No. R982

This report was prepared in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) Gazette No. 38282 Government Notice R. 982 of 4 December 2014 (as amended). Appendix 6 – Specialist reports includes a list of requirements to be included in a specialist report:

1. A specialist report or a report prepared in terms of these regulations must contain:
    a. Details of
        i. The specialist who prepared the report; and
        ii. The expertise of that specialist to compile a specialist report, including a curriculum vitae.
    b. A declaration that the specialist is independent in a form as may be specified by the competent authority.
    c. Indication of scope of, and purpose for which, the report was prepared.
    d. The date and season of the site investigation and the relevance of the season to the outcome of the assessment.
    e. A description of the methodology adopted in preparing the report or carrying out the specialized process.
    f. The specific identified sensitivity of the site related to the activity and its associated structures and infrastructure.
    g. An identification of any areas to be avoided, including buffers.
    h. A map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers.
    i. A description of any assumptions made and any uncertainties or gaps in knowledge.
    j. A description of the findings and potential implications of such findings on the impact of the activity, including identified alternatives, on the environment.

k. any mitigation measures for inclusion in the EMPr.
l. any conditions for inclusion in the environmental authorisation.
m. any monitoring requirements for inclusion in the EMPr or environmental authorisation
n. a reasoned opinion –
    i. As to whether the activity or portions thereof should be authorised and
    ii. If the opinion is that the activity or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr and where applicable, the closure plan.
o. A description of any consultation process that was undertaken while preparing the specialist report.
p. A summary and copies of any comments received during any consultation process and where applicable all responses thereto; and
q. Any other information requested by the competent authority.

This Act also embraces all three fields of environmental concern namely: resource conservation and exploitation; pollution control and waste management; and land-use planning and development. The environmental management principles include the duty of care for wetlands / rivers and special attention is given to management and planning procedures.

1.2.2 National Environmental Management Biodiversity Act (Act 10 0f 2004) (NEMBA)

The following aspects of the NEMBA (2004) are important to consider in the compilation of an ecological report. It:

- Lists ecosystems that are threatened or in need of national protection.
- Links to Integrated Environmental Management processes.
- Must be considered in EMPs and IDPs.
- The Minister may make regulations to reduce the threats to listed ecosystems.

1.2.3 The National Forest Act (Act 84 of 1998) (NFA)

In terms of section 15(1) of the National Forests Act, 1998, no person may cut, disturb, damage or destroy any protected tree; or possess, collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree or any product derived from a protected tree, except under a licence or exemption granted by the Minister of Agriculture, Forestry and Fisheries.

1.2.4 Transvaal Nature Conservation Ordinance

This Act deals with the following:

- To provide for the sustainable utilisation and protection of biodiversity within the North West Province.
- To provide for professional hunting.
- To provide for the preservation of caves and cave formations.
- To provide for the establishment of zoos and similar institutions.
- To provide for the appointment of nature conservators.
- To provide for the issuing of permits and other authorisations.
- To provide for offences and penalties for contravention of the Act.
- To implement the provisions of the Ordinance and to provide for matters connected therewith.

1.3 Terms of reference

1.3.1 Objectives

1. List the plant species of conservation concern in the study area.

2. Describe the management principles and specific methodology on the plant rescue and protection on the proposed development site. It includes plant rescue methods (relocation, seed collection or taking vegetative cuttings), but primarily focuses on plant relocation procedures (root preparation and excavation, lifting and backfill requirements), and the installation of marker stakes, tree guards, weed mats and mulch around relocated plants.

1.3.2 Limitations and assumptions

- To obtain a comprehensive understanding of the dynamics of protected plant rescue and protection plan, surveys and monitoring should ideally be replicated over several seasons and over several years. However, due to project time constraints such long-term studies are not feasible.

- The large study area did not allow for the finer level of assessment that can be obtained in smaller study areas. Therefore, data collection in this study relied heavily on data from representative sections, as well as general observations, generic data and a desktop analysis.

2 INTRODUCTION

Plants are the backbone of life on Earth. Today, however, plant communities around the world are under threat. Scientists estimate that at least 100,000 plants are threatened with extinction--that's more than one-third the total known species of plants on the planet.

The main threats to plants today are habitat destruction, invasive species, and overcollection. The loss of a plant species can have devastating effects on ecosystems, as other species lose their sources of food and shelter. Additionally, plants play a crucial role in stabilising soils and help prevent erosion.

While the situation is critical, efforts are underway around the globe to halt the loss of plant diversity. International treaties such as the Convention on Biological Diversity are setting goals and targets for conservation worldwide. More specifically, the Global Strategy for Plant Conservation (GSPC) has laid out 16 outcome-oriented targets to be achieved by 2010. The GSPC recognizes the important role that education can play in conservation programmes. Target 14 of the GSPC calls for the "importance of plant diversity and the need for its conservation incorporated into communication, educational and public-awareness programmes."

There are two main ways to conserve biodiversity. These are termed *ex situ* (i.e., out of the natural habitat) and *in situ* (within the natural habitat). Populations of plant species are much easier than animals to maintain artificially. They need less care and their requirements for habitat conditions can be provided more readily. It is also much easier to breed and propagate plant species in captivity. This management plan focusses specifically on the rescue and protection of plant species on the site for the proposed development of a solar plant.

3 STUDY AREA

3.1 Location and description of activity

In view of the growing electricity demand and to use renewable energy resources, VOLTALIA SOUTH AFRICA (PTY) LTD is assessing the feasibility of energy generation facilities, consisting of the construction, operation and maintenance of Photovoltaic (PV) Power Plants with a maximum generation capacity up to 100 MW, at the point of connection.

The project site is on Portion 2 of the farm Rooidraai 85 IQ, located within the JB Marks Local Municipality, Dr Kenneth Kaunda District Municipality, North West Province.

The project site is located ±7 km north west of Welverdiend along the border between Gauteng and the North West Province (Figure 1). The Eskom Carmel Main Transmission Substation (MTS) is located 16.4 km South-East of project sites.

The development is located 5.5km north of R501 with access from both the D859 (Preferred) and R501 (alternative).

The developed area (footprint) required for the proposed project will be up to 366 hectares. The final size and location of the project footprint will be assessed following the outcomes of the Public Participation Process and of the recommendations and conclusions of the Specialist Studies to be conducted during the Environmental Impact Assessment (EIA) process.

The proposed development (the Photovoltaic (PV) Power Plants and connection infrastructure) consists of the installation of the following equipment:

- Photovoltaic modules (mono-crystalline, poly-crystalline, or bi-facial modules)
- Mounting systems for the PV arrays (single-axis horizontal trackers or fixed structures) and related foundations
- Internal cabling and string boxes
- DC/AC inverters
- Medium voltage stations, hosting LV/MV power transformers
- Medium voltage receiving station(s)
- Workshops & warehouses

- One on-site high-voltage substation and one high-voltage busbar with metering and protection devices
- One on-site high-voltage substation with high-voltage power transformers, stepping up the voltage to 400kV/132kV and one high-voltage busbar with metering and protection devices
- One on-site switching station, with one high-voltage busbar with metering and protection devices
- Battery Energy Storage Systems (BESS), with a Maximum Export Capacity up to 100 MW and a 5-hour storage capacity up to 1250 MWh, with a footprint up to 10 ha, next to the on-site high-voltage substation, within the PV plant footprint / fenced areas
- Electrical system and UPS (Uninterruptible Power Supply) devices
- Lighting system
- Grounding system
- Internal roads
- Fencing of the site and alarm and video-surveillance system
- Water access point, water supply pipelines, water treatment facilities
- Small scale patented wastewater treatment system

During the construction phase, the site may be provided with additional activities which will be removed at the end of construction.

- Water access point, water supply pipelines, water treatment facilities
- Prefabricated buildings
- Workshops & warehouses

The aerial map of the site (including the footprints) is indicated in Figure 2, while the topographical map of the proposed development is presented in Figure 3.

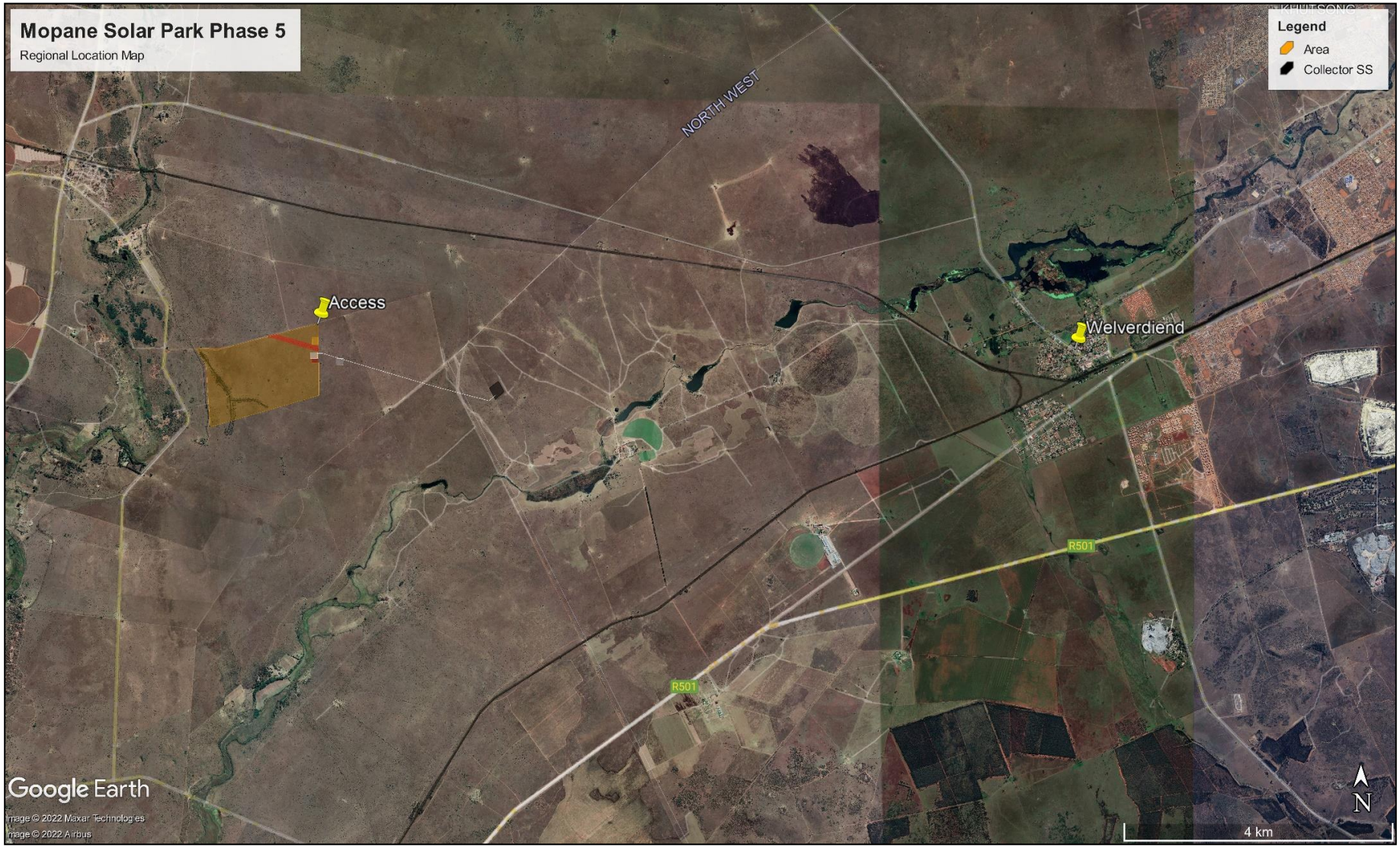

Figure 1. Regional location Map of the project area

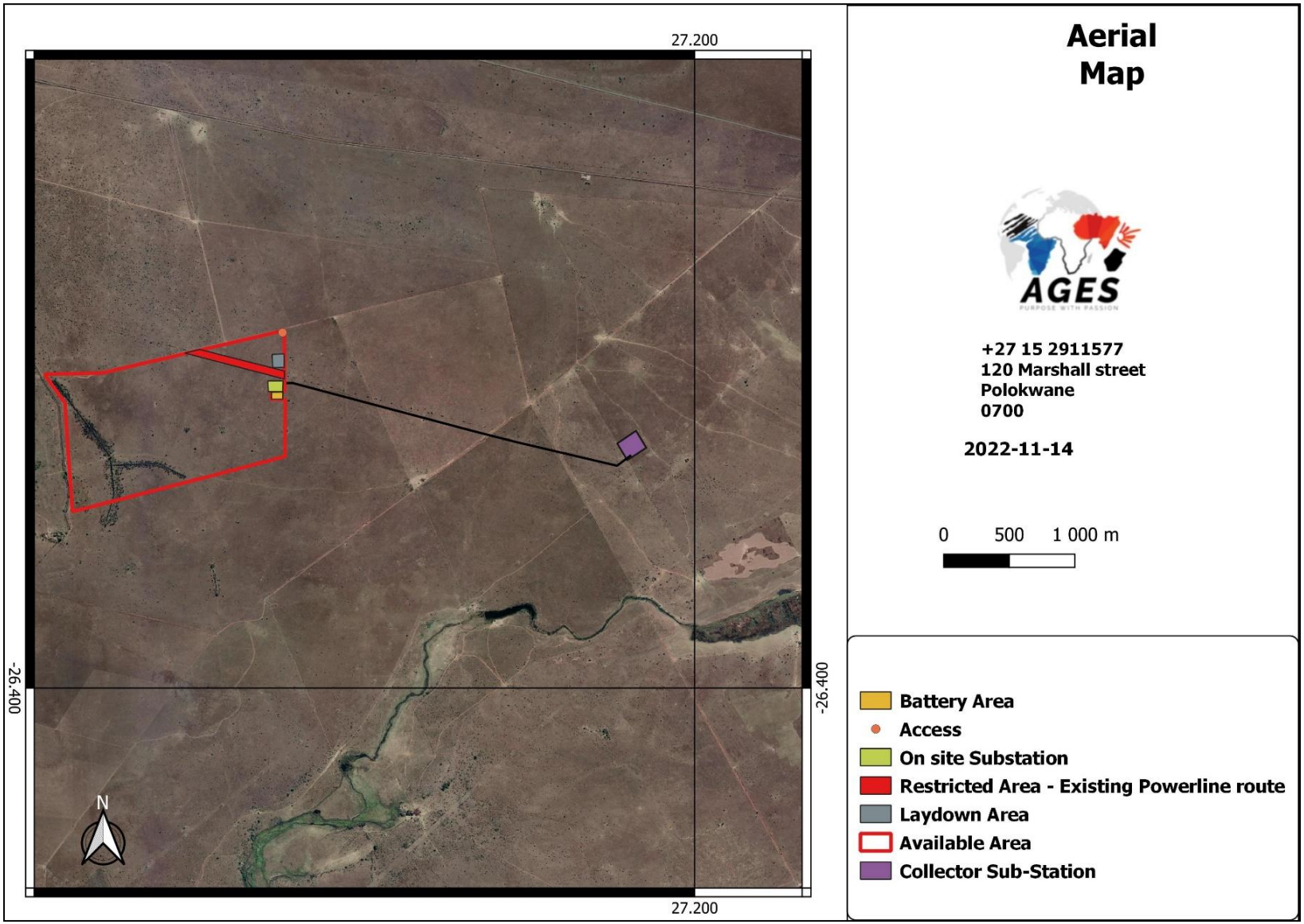

Figure 2. Aerial Map indicating the proposed location of the Solar Plant and associated infrastructure

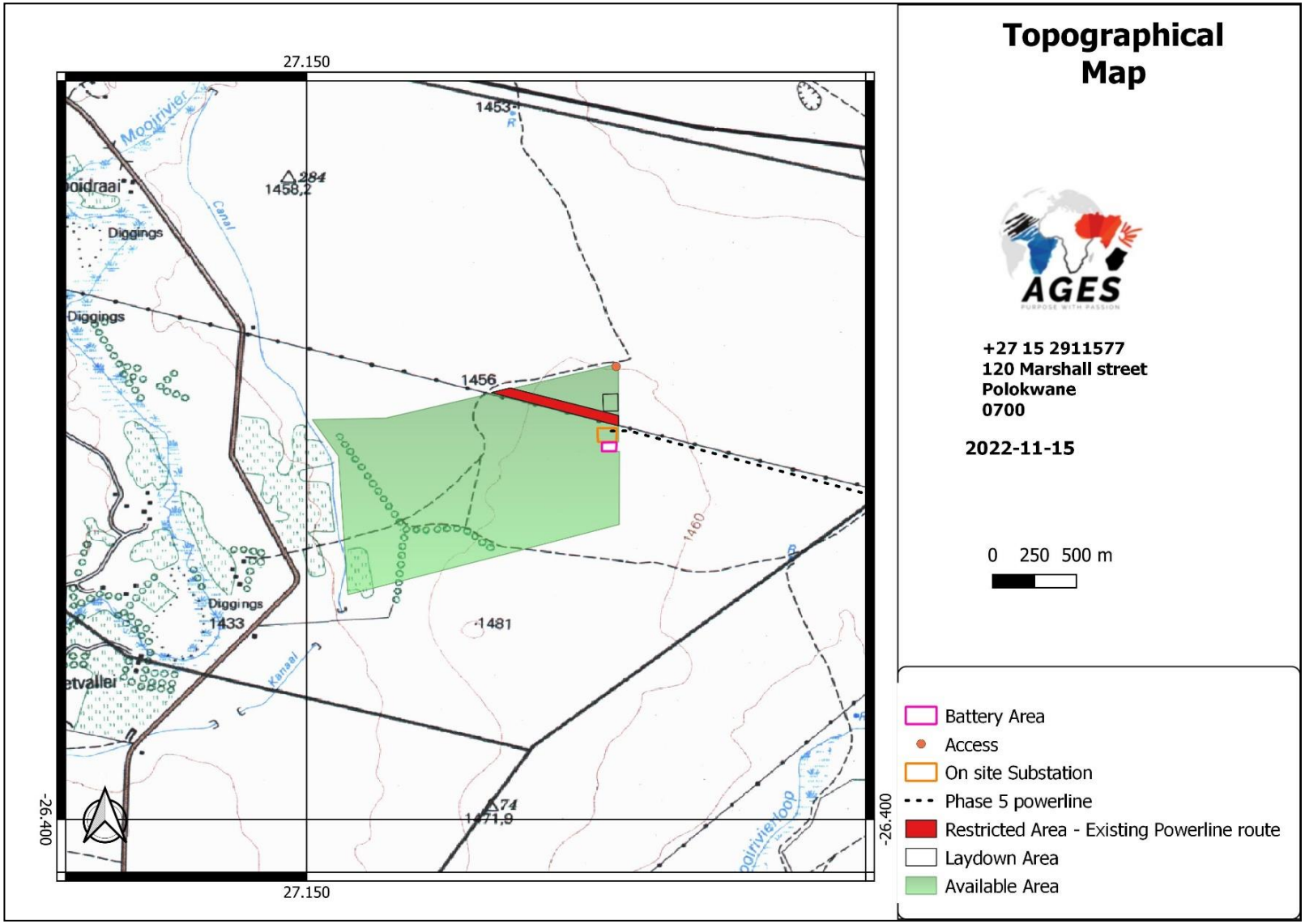

Figure 3. Topographical Map of the project area

4 PROTECTED AND THREATENED PLANT SPECIES OF THE STUDY AREA

The following lists and recommendation regarding threatened and protected plant species on the proposed development site has been adapted from the ecological report for the EIA conducted by Henning (2022). A plant species list documented on the proposed development site is included in Appendix A.

4.1 Plant species of concern

Species of conservation concern are species that have a high conservation importance in terms of preserving South Africa's high floristic diversity and include not only threatened species, but also those classified in the categories Extinct in the Wild (EW), Regionally Extinct (RE), Near Threatened (NT), Critically Rare, Rare, Declining and Data Deficient – Insufficient Information (DDD). It should also be noted that not all species listed as protected are threatened or vice versa. A list of SCC plant species previously recorded in the study area in which the proposed development is planned was obtained from the Plants of Southern Africa (POSA) database of SANBI. Figure 4 indicates the classification system used by Sanbi for SCC:

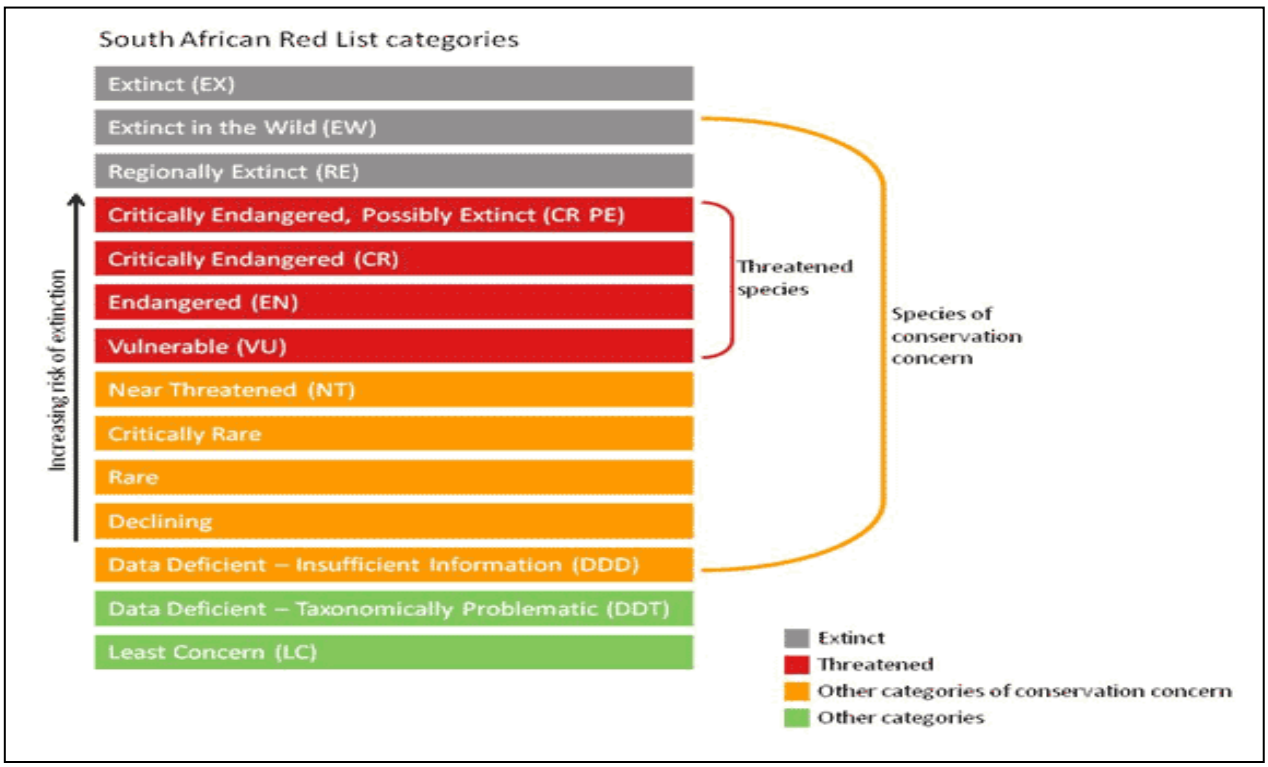

Figure 4. South African red list categories indicating the categories to be used for Species of Conservation Concern

Habitat degradation is one of the main reasons for plant species becoming extinct in a particular area. Threatened species are also seen as indicators of the overall health of an ecosystem (Hilton-Taylor, 1996).

A list of red data plant species previously recorded in the grid square in which the proposed development is planned was obtained from SANBI as indicated in Table 1.

Table 1. Red data and endemic species occurring in the project area of the QDS

Species	Threat status	Confirmed presence on site
Myrothamnus flabellifolius	DATA DEFICIENT	NO
Acalypha caperonioides	DATA DEFICIENT	NO
Habenaria mossii	ENDANGERED	NO
Boophane distycha	Declining	YES

Only the red data species Boophane distycha listed above was observed during the surveys. The species can be relocated from its current conditions if needed through a rescue and relocation programme should the development activities impact on populations.

Ecological monitoring should however still be implemented during the construction phase and specific sensitive habitats (riparian) needs to be avoided to ensure that any potential red data species potentially missed during the field surveys are preserved and not potentially impacted on.

The EIA screening tool highlight the following red listed flora.

4.1.1 Sensitive species 1261

A relatively widespread (EOO 13 374 km²), but very rare species that has lost a large proportion of its habitat to agriculture, urban expansion and mining. It is known from fewer than 10 locations and continue to decline due to ongoing habitat loss and degradation. Habitat includes sandy loam soils in thornveld and Themeda-grassland

Probability of occurrence on site: LOW due to the absence of suitable habitat on the proposed development footprint.

Probability of impact during vegetation clearance: LOW, no suitable habitat observed on site and population of the species was documented.

4.1.2 Sensitive species 1147

Surveys of remaining habitat within Gauteng Province revealed that there are only about 230 mature individuals. These occur as six scattered subpopulations, the largest of which only has 70-80 mature individuals, but there are generally fewer than 40 mature individuals per subpopulation. There is a continuing decline due to the rapid urban expansion.

Occurs in Open grassland on dolomite or in black, sandy soil. Threats include invasive alien species (direct effects), habitat loss and habitat degradation.

Probability of occurrence on site: Moderate due to the presence of suitable habitat on the proposed development footprint.

Probability of impact during vegetation clearance: LOW, no population of the species was documented, although monitoring should be implemented during the construction phase of the development.

4.2 Protected Plants (North West Nature Conservation Ordinance)

Plant species are also protected in the North West Province according to the North West Nature Conservation Ordinance. According to this ordinance, no person may pick, import, export, transport, possess, cultivate, or trade in a specimen of a specially protected or protected plant species. The Appendices to the ordinance provide an extensive list of species that are protected, comprising a significant component of the flora expected to occur on site. Communication with Provincial authorities indicates that a permit is required for all these species if they are expected to be affected by the proposed project.

After a detailed survey was conducted during November 2022, the listed species *Boophane disticha* confirmed for the site. No eradication should be allowed without a permit.

Where construction/operation may impact on plants designated as specially protected under the North West Nature Conservation Ordinance, an application must be submitted to the Provincial authorities to clear or translocate these plants as part of the plant rescue operation.

Photograph 1.*Boophone disticha* in the project area

5 PLANT CLEARANCE GUIDELINES AS PART OF THE RESCUE AND PROTECTION PLAN FOR THE SITE

Plant material that is to be “rescued” must be potted up into bags utilising local soil obtained from the topsoil obtained from the construction site or larger area. Adequate root systems per plant material type must be carefully excavated and retained for plant material to remain viable. Search and Rescue activities would include the removal of grass clumps, smaller transplantable shrubs and trees and endangered species such as geophytes and succulents should be placed into bags using local soil.

Should the ECO require that plants be cleared for the proposed construction of the solar facility, the following rescue and conservation strategy for the relevant plant species should apply:

- General principles:
    - Vegetation removal must be limited to the PV plant construction site.
    - Vegetation to be removed as it becomes necessary rather than removal of all vegetation throughout the site in one step.
    - Materials should not be delivered to the site prematurely which could result in additional areas being cleared or affected.
    - No vegetation to be used for firewood.
    - Gathering of firewood, fruit, muthi plants, or any other natural material onsite or in areas adjacent to the site is prohibited unless with prior approval of the ECO.
    - Only vegetation within the footprint area must be removed.
    - Vegetation removal must be phased to reduce impact of construction.
    - Construction site office and laydown areas must be clearly demarcated, and no encroachment must occur beyond demarcated areas.
    - All-natural areas impacted during construction must be rehabilitated with locally indigenous plant species.
    - A buffer zone should be established in areas where construction will not take place to ensure that construction activities do not extend into these areas. These areas include drainage channels and rocky outcrops in the study area.
    - Construction areas must be well demarcated, and these areas strictly adhered to.

  - The use of pesticides and herbicides in the study area must be discouraged as these impacts on important pollinator species of indigenous vegetation.
  - Soils must be kept free of petrochemical solutions that may be kept on site during construction. Spillage can result in a loss of soil functionality thus limiting the re-establishment of flora.

- Harvesting of seeds from specimens to be used in the *ex-situ* nursery and future rehabilitation. The ecologist shall determine when seed is mature and ready for collecting, and shall collect, extract, clean and label the seed. Seed shall be labelled to indicate the plant species name, date of collection, weight of seed and place of collection. The seed shall be stored in air-tight containers at a constant temperature, away from direct light. Seed shall be provided to the principal of the ex-situ nursery.

- Intact removal of protected plant species under permit. Permits should be obtained from the North West Environmental authorities where red data or protected flora is to be disturbed or relocated. Plant material that is to be “rescued” must be potted up into bags utilising local soil obtained from the previously stored topsoil heap. Adequate root systems per plant material type must be carefully excavated and retained for plant material to remain viable. Search and Rescue activities would include the removal of grass clumps, smaller transplantable shrubs and trees and endangered species such as geophytes and succulents should be placed into bags using local soil.

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APPENDIX A. PLANT SPECIES LISTS FOR SITE

Woody species
Eucalyptus camaldulensis
Grewia flava
Vachellia karroo
Ziziphus mucronata
Diospyros lycioides
Searsia lancea
Searsia pyroides
Grass species
Aristida congesta
Aristida junciformes
Brachiaria nigropedata
Brachiaria serata
Cymbopogon pospischilli
Cynodon dactylon
Dichanthium annulatum
Digitaria eriantha
Diplachne fusca
Eragrostis bicolor
Eragrostis biflora
Eragrostis curvula
Eragrostis gummiflua
Eragrostis lehmanniana
Eragrostis plana
Heteropogon contortus
Hyparrhenia hirta
Hyparrhenia tamba
Melinis repens
Panicum natalense
Eragrostis racemosa
Setaria sphacelata
Sporobolus africanus
Themeda triandra
Trachypogon spicatus
Trichoneura grandiglumis
Triraphis andropogonoides
Urochloa mosambicensis
Urochloa panicoides
Dwarf shrubs, Forbs, geophytes & succulents
Acalypha angusta
Altenanthera pungens
Amaranthus spinosa

Anthospermum rigidum
Argemone ochroleuca
Asparagus laricinus
Asparagus suaveolens
Athrixia elata
Barleria macrostegia
Berkheya onopordifolia
Berkheya purpurea
Berkheya rigida
Berkheya speciosa
Bidens bipinnata
Bidens pilosa
Boophane disticha
Chamaecrista mimosoides
Chamaesyce inaequilatera
Clematis brachiata
Conyza albida
Conyza bonariensis
Crabbea angustifolia
Cyperus obtusiflorus
Cyperus sexangularis
Datura stramonium
Dianthus mooiensis
Dicoma anomala
Felicia muricata
Helichrysum caespititium
Helichrysum miconiifolium
Helichrysum nudifolium
Hermbstaedtia linearis
Hypoxis rigidula
Indigofera comosa
Indigofera daleioides
Ipomoea ommaneyi
Kyling alba
Kyphocarpa angustifolia
Nidorella anomala
Opuntia ficus indica
Oxalis spp.
Pentzia incana
Persicaria serrulata
Pygmaeothamnus zeyheri
Senecio coronatus
Senecio inornatus
Solanum incanum

Stoebe vulgaris
Tagetes minuta
Tylosema esculentum
Tylosema fassoglense
Typha capensis
Vernonia oligocephala
Wahlenbergia caledonica
Xanthium strumarium
Zinnia peruviana
Ziziphus zeyheriana.

APPENDIX B. PLANT RELOCATION PROCEDURES

1. **Timing**
    - If practicable plants shall be moved in autumn or winter when their growth rate is slowest, and the soil is moist.
2. **Weed Control**
    - Refer to the Alien Invasive Management Plan compiled for the weed control requirements.
    - The areas where plants are to be relocated shall be eradicated of weeds before replanting commences. Any existing vegetative growth shall be slashed to a height of 1m.
3. **Root Preparation**
    - The ECO shall undertake root pruning in advance of relocating and must cut the roots at the margins of the root ball which will allow the plant to 'adjust' whilst *in situ*. For large plants (trees and shrubs) root cutting must occur progressively starting at least 4-8 weeks prior to the plant being dug from the ground. A section of the margin of the root ball shall be cut each week during the period leading up to the plant being relocated.
4. **Preparation of Planting Holes**
    - Planting holes shall be prepared before the plant to be relocated is dug up. As far as practicable, topsoil and subsoil shall be kept separate when preparing planting holes. The ECO shall remove from site any unsuitable material brought to the surface during excavation.
    - The hole shall be at least twice the diameter of the root ball and no deeper than the height of the proposed root ball. If the depth of the hole exceeds the root ball height, compacted soil shall be added to the hole to prevent settling after transplanting. Sides of the hole shall be sloped and roughened to create an irregular surface that will facilitate root penetration.
5. **Root Excavation Technique**
    - Before any excavation is carried out, the ECO shall thoroughly water the plants to be relocated and shall mark the proposed root ball size on the ground. In general, the root ball diameter for larger plants (trees and shrubs) should be 10 mm for every 1 mm of trunk diameter, measured at 300 mm above the ground.
    - For tussock grasses and other strap leaf plants the root ball shall generally be twice the diameter of the base of the tussock.

- Spade Dug
    - Plants shall be dug from the ground using a spade. Beyond the edge of the root ball, a sharp spade shall be driven into the ground, cutting all the way around the plant. Soil taken with the plants shall extend a minimum of 100mm beyond the root ball to minimise disturbance and/or root damage. Any exposed roots shall be pruned flush with the face of the root ball using sharp secateurs or loppers, ensuring the root ball is not loosened.
    - If necessary, the root ball shall be wrapped in natural fibre (e.g., hessian) to prevent soil being lost during relocation. Once the ball is securely wrapped and tied, the plant shall be undercut. (Small plants may not need to be wrapped, especially if the soil is moist and holds together).
    - A spade shall be used to excavate roots in situations where the use of other machinery would cause undue damage to the remaining vegetation.
    - This method is most suitable for relocating individual small plants or clumps of bulbous, grass or sedge species.
- Mini Excavator/Backhoe/Skid Steer Loader Excavated
    - Plants shall be dug from the ground using a mini excavator, backhoe or skid steer loader. Soil taken with the plants shall extend a minimum of 150 mm beyond the root ball to minimise disturbance and/or root damage. Any exposed roots shall be pruned flush with the face of the root ball using sharp secateurs or loppers, ensuring the root ball is not loosened.
    - If necessary, the root ball shall be wrapped in natural fibre (*e.g.*, hessian) to prevent soil being lost during relocation. Once the ball is securely wrapped and tied, the plant shall be undercut. (Small plants may not need to be wrapped especially if the soil is moist and holds together).
    - This root excavation method shall only be used for sites that are sparsely vegetated and where the machinery will not cause undue damage to the remaining vegetation.

6. Lifting Technique

- Plants shall be lifted from their existing location and immediately placed in the pre-prepared planting holes.

- For small plants, the root ball shall be lifted from the hole by hand or by using a sling attached to a small machine.
- Lifting of plants shall be carried out or supervised by a qualified and/or suitably experienced horticulturist and crane/machine operator.
- Appropriate lifting equipment shall be used.
- Suitable slings shall be attached around a balance point of the plant to provide a support system around the root ball. When a sling is attached to the plant, padding and protection is required to reduce possible damage. Plants shall not be lifted by the trunk alone. A qualified crane/machine operator shall determine the support system to be used.

7. Backfill

- Once the plant has been placed in the hole it shall be backfilled with site topsoil and lightly consolidated. The plant shall be set at a height such that the surface of root ball is at the same level as the surrounding soil surface.
- Only topsoil free from perennial weeds, stones, debris, clods of subsoil or other deleterious material may be used as backfill for planting. Topsoil stockpiled from the removal site also may be used as backfill.
- Where in the opinion of the Superintendent excavated material is unsuitable for backfill, imported soil shall be used. Imported soil shall be matched as closely as practicable to the existing site soil. Organic matter shall not be added to the backfill material.

8. Soil Additives

- Water Retention Agents
    - Water retention agents (*i.e*., AquaBoost AG, Alcosorb Water Crystals) shall be applied in accordance with the manufacturer's instructions and recommended rates. The watering regime during the maintenance period shall be closely monitored to ensure over watering does not occur.

9. Initial Watering

- Immediately following planting, each plant shall be watered with a volume of clean potable water.

10. Initial Fertiliser

- Aquasol, Thrive or Maxicrop shall be applied at the manufacturer's recommended rates once per month, for 6 months.

A REHABILITATION AND REVEGETATION PLAN FOR THE PROPOSED DEVELOPMENT OF THE MOPANE SOLAR PARK PHASE 5 ON PORTION 2 OF THE FARM ROOIDRAAI 85 IQ, LOCATED WITHIN THE JB MARKS LOCAL MUNICIPALITY, DR KENNETH KAUNDA DISTRICT MUNICIPALITY, NORTH WEST PROVINCE

November 2022

Prepared for: VOLTALIA SOUTH AFRICA (PTY) LTD

Compiled by Dr BJ Henning

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A REHABILITATION AND REVEGETATION PLAN FOR THE PROPOSED DEVELOPMENT OF THE MOPANE SOLAR PARK PHASE 5 ON PORTION 2 OF THE FARM ROOIDRAAI 85 IQ, LOCATED WITHIN THE JB MARKS LOCAL MUNICIPALITY, DR KENNETH KAUNDA DISTRICT MUNICIPALITY, NORTH WEST PROVINCE

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Reviewed by:

Ms. E Grobler

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	Registered Interested and Affected Parties

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L22 091 E	November 2022	1.0	Draft

Table of Contents

1 GENERAL INFORMATION AND BACKGROUND

AGES Limpopo (Pty) Ltd was appointed by VOLTALIA SOUTH AFRICA (PTY) LTD to compile a rehabilitation and re-vegetation plan for the proposed development of a solar plant named as follows:

- Mopane Solar Park Phase 5.

The project site includes the establishment of a renewable energy generation facilities (Photovoltaic Power Plants) with associated infrastructure and structures, and power lines on Portion 2 of the farm Rooidraai 85 IQ, located within the JB Marks Local Municipality, Dr Kenneth Kaunda District Municipality, North West Province. The project site is located ±7 km northwest of Welverdiend along the border between Gauteng and North West Provinces. Eskom Carmel Main Transmission Substation (MTS) is located 16.4 km South-East of project site.

The assignment is interpreted as follows: Compile a management plan to be implemented by the Environmental Control Officer (ECO) for the rehabilitation and revegetation of the proposed development site. The study will be done according to guidelines stipulated by the Department of Environment, Forestry and Fisheries (DEFF) and forms part of the Environmental Management Programme (EMPR) for implementation.

1.1 Information Sources

The following information sources were obtained:

1. All relevant maps through Geographical Information Systems (GIS) mapping, and information (previous studies and environmental databases) on the rehabilitation and revegetation of the site concerned.
2. Requirements regarding the management plan as requested by DEAT.
3. Information on the micro-habitat level was obtained through obtaining a first-hand perspective from the ecological study compiled by Henning (2022) was also utilized for this study.

1.2 Regulations governing this report.

1.2.1 National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) - Regulation No. R982

This report was prepared in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) Gazette No. 38282 Government Notice R. 982 of 4 December 2014 (as amended). Appendix 6 – Specialist reports includes a list of requirements to be included in a specialist report:

1. A specialist report or a report prepared in terms of these regulations must

contain:

a. Details of
    i. The specialist who prepared the report; and
    ii. The expertise of that specialist to compile a specialist report, including a curriculum vitae.
b. A declaration that the specialist is independent in a form as may be specified by the competent authority.
c. An indication of the scope of, and purpose for which, the report was prepared.
d. The date and season of the site investigation and the relevance of the season to the outcome of the assessment.
e. A description of the methodology adopted in preparing the report or carrying out the specialized process.
f. The specific identified sensitivity of the site related to the activity and its associated structures and infrastructure.
g. An identification of any areas to be avoided, including buffers.
h. A map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers.
i. Description of any assumptions made and any uncertainties or gaps in knowledge.
j. A description of findings and potential implications of findings on impact of the activity, including identified alternatives, on the environment.
k. any mitigation measures for inclusion in the EMPr.
l. any conditions for inclusion in the environmental authorisation.
m. any monitoring requirements for inclusion in the EMPr or environmental authorisation
n. a reasoned opinion –
    i. As to whether the activity or portions thereof should be authorised and
    ii. If the opinion is that the activity or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr and where applicable, the closure plan.
o. A description of any consultation process that was undertaken while preparing the specialist report.
p. A summary and copies of any comments received during any

consultation process and where applicable all responses thereto; and

q. Any other information requested by the competent authority.

This Act also embraces all three fields of environmental concern namely: resource conservation and exploitation; pollution control and waste management; and land-use planning and development. The environmental management principles include the duty of care for wetlands / rivers and special attention is given to management and planning procedures.

1.3 Terms of reference

1.3.1 Objectives

- The main aim of the plan is to provide guidelines to be implemented after the construction phase of the development to ensure that previous impacts are rectified by rehabilitating or restoring the affected environment. This will include attempts at habitat re-creation, to restore the original land uses and biodiversity values.
- Provide management and rehabilitation guidelines to ensure that the biodiversity will form part of a sustainable environment after rehabilitation.
- Make recommendations in terms of revegetation ecological management and rehabilitation procedures for the general environment of the site and surrounding areas.

1.3.2 Limitations and assumptions

- To obtain a comprehensive understanding of the dynamics of rehabilitation and revegetation plan, monitoring should ideally be replicated over several seasons and over a few years. However, due to project time constraints such long-term studies are not feasible.
- The large study area did not allow for the finer level of assessment that can be obtained in smaller study areas. Therefore, data collection in this study relied heavily on data from representative sections, as well as general observations, generic data and a desktop analysis.

2 INTRODUCTION

Rehabilitation can be defined as the return of disturbed areas to a safe, stable, productive and

self-sustaining condition that promotes biodiverse land use. Land rehabilitation techniques can be used to speed up the time required to restore the impacted area back to its original, or better, state. To re-create and maintain a sustainable environment it is important to plan how the areas to be impacted by the construction of the Mopane Solar Park Phase 5 will be rehabilitated and revegetated.

A central purpose in rehabilitation planning should be to promote the ecological integrity of each site and surrounding landscapes. The application of ecological restoration principles requires that plans are developed consistent with regional or landscape level ecological objectives. At the local scale, this involves an examination of surrounding landscapes, in combination with determining predicted successional trends of vegetation communities appropriate to enhance local and regional ecosystems.

At the site level, emphasis is placed on rehabilitation techniques such as land-form replication and planting species that will promote site stability and sustainability. Re-vegetation should use indigenous species that contribute most to the compatibility of the local ecology and increase biodiversity.

The final goal of the rehabilitation planning process is a practical, achievable and adequately resourced rehabilitation programme. Rehabilitation of the disturbed areas should be done in such a way to ensure that the rehabilitation and revegetation on the site for the Mopane Solar Park Phase 5 will be sustainable in the long term.

3 STUDY AREA

3.1 Location and description of activity

In view of the growing electricity demand and to use renewable energy resources, VOLTALIA SOUTH AFRICA (PTY) LTD is assessing the feasibility of energy generation facilities, consisting of the construction, operation and maintenance of Photovoltaic (PV) Power Plants with a maximum generation capacity up to 100 MW, at the point of connection.

The project site is on Portion 2 of the farm Rooidraai 85 IQ, located within the JB Marks Local Municipality, Dr Kenneth Kaunda District Municipality, North West Province.

The project site is located ±7 km north west of Welverdiend along the border between Gauteng and the North West Province (Figure 1). The Eskom Carmel Main Transmission Substation (MTS) is located 16.4 km South-East of project sites.

The development is located 5.5km north of R501 with access from both the D859 (Preferred) and R501 (alternative).

The developed area (footprint) required for the proposed project will be up to 366 hectares. The final size and location of the project footprint will be assessed following the outcomes of the Public Participation Process and of the recommendations and conclusions of the Specialist Studies to be conducted during the Environmental Impact Assessment (EIA) process.

The proposed development (the Photovoltaic (PV) Power Plants and connection infrastructure) consists of the installation of the following equipment:

- Photovoltaic modules (mono-crystalline, poly-crystalline, or bi-facial modules)
- Mounting systems for the PV arrays (single-axis horizontal trackers or fixed structures) and related foundations
- Internal cabling and string boxes
- DC/AC inverters
- Medium voltage stations, hosting LV/MV power transformers
- Medium voltage receiving station(s)
- Workshops & warehouses

- One on-site high-voltage substation and one high-voltage busbar with metering and protection devices
- One on-site high-voltage substation with high-voltage power transformers, stepping up the voltage to 400kV/132kV and one high-voltage busbar with metering and protection devices
- One on-site switching station, with one high-voltage busbar with metering and protection devices
- Battery Energy Storage Systems (BESS), with a Maximum Export Capacity up to 100 MW and a 5-hour storage capacity up to 1250 MWh, with a footprint up to 10 ha, next to the on-site high-voltage substation, within the PV plant footprint / fenced areas
- Electrical system and UPS (Uninterruptible Power Supply) devices
- Lighting system
- Grounding system
- Internal roads
- Fencing of the site and alarm and video-surveillance system
- Water access point, water supply pipelines, water treatment facilities
- Small scale patented wastewater treatment system

During the construction phase, the site may be provided with additional activities which will be removed at the end of construction.

- Water access point, water supply pipelines, water treatment facilities
- Prefabricated buildings
- Workshops & warehouses

The aerial map of the site (including the footprints) is indicated in Figure 2, while the topographical map of the proposed development is presented in Figure 3.

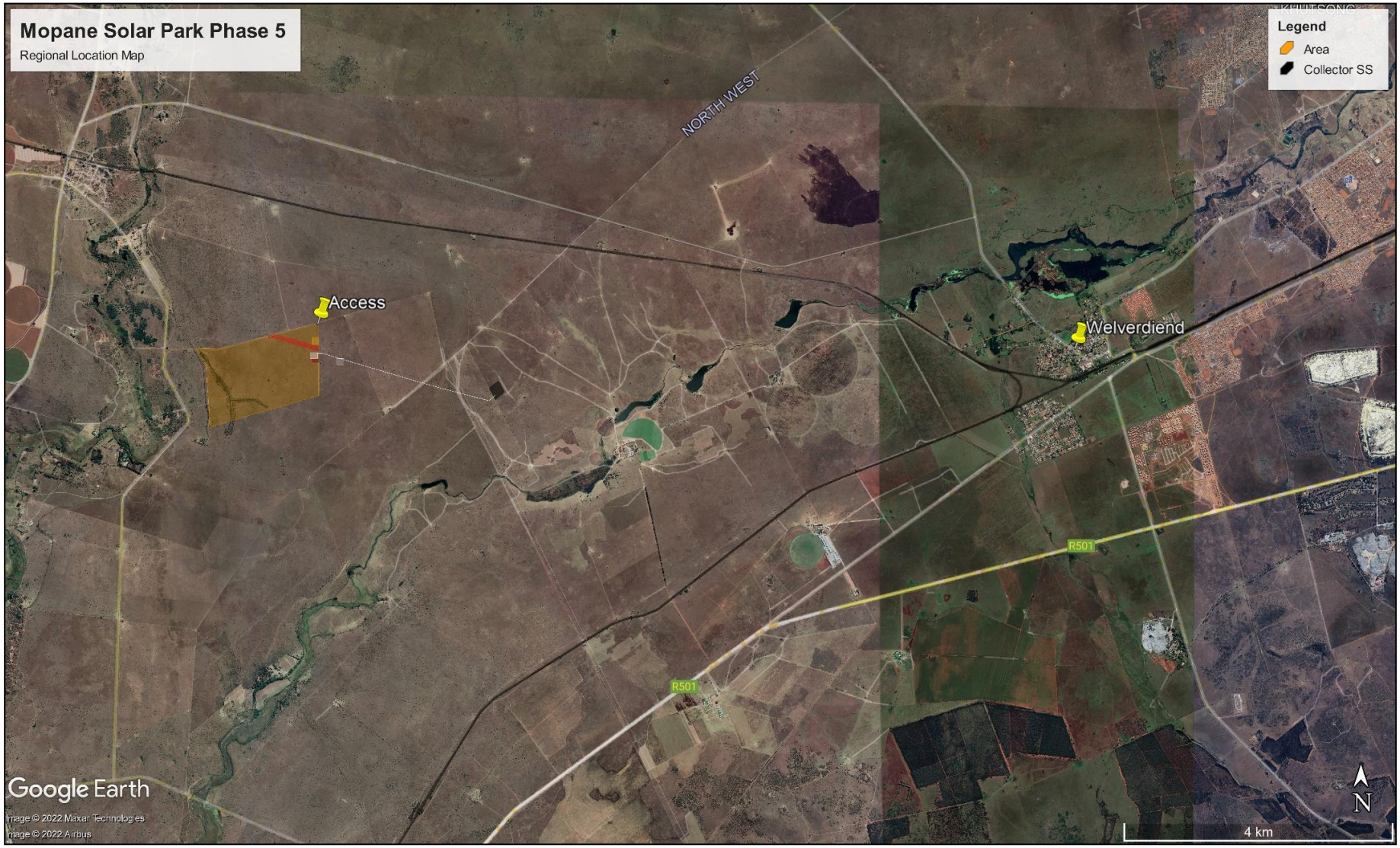

Figure 1. Regional location Map of the project area

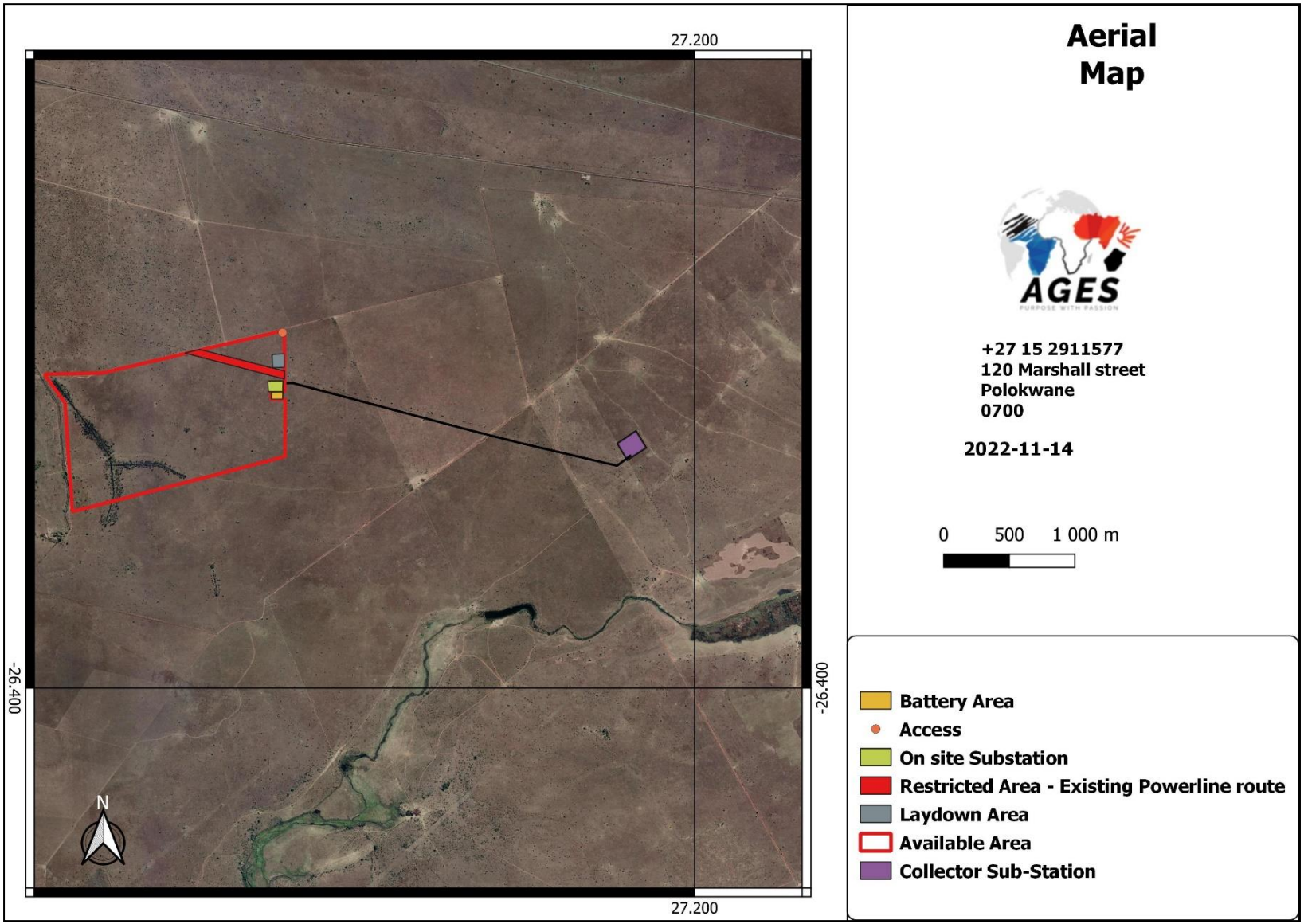

Figure 2. Aerial Map indicating the proposed location of the Solar Plant and associated infrastructure

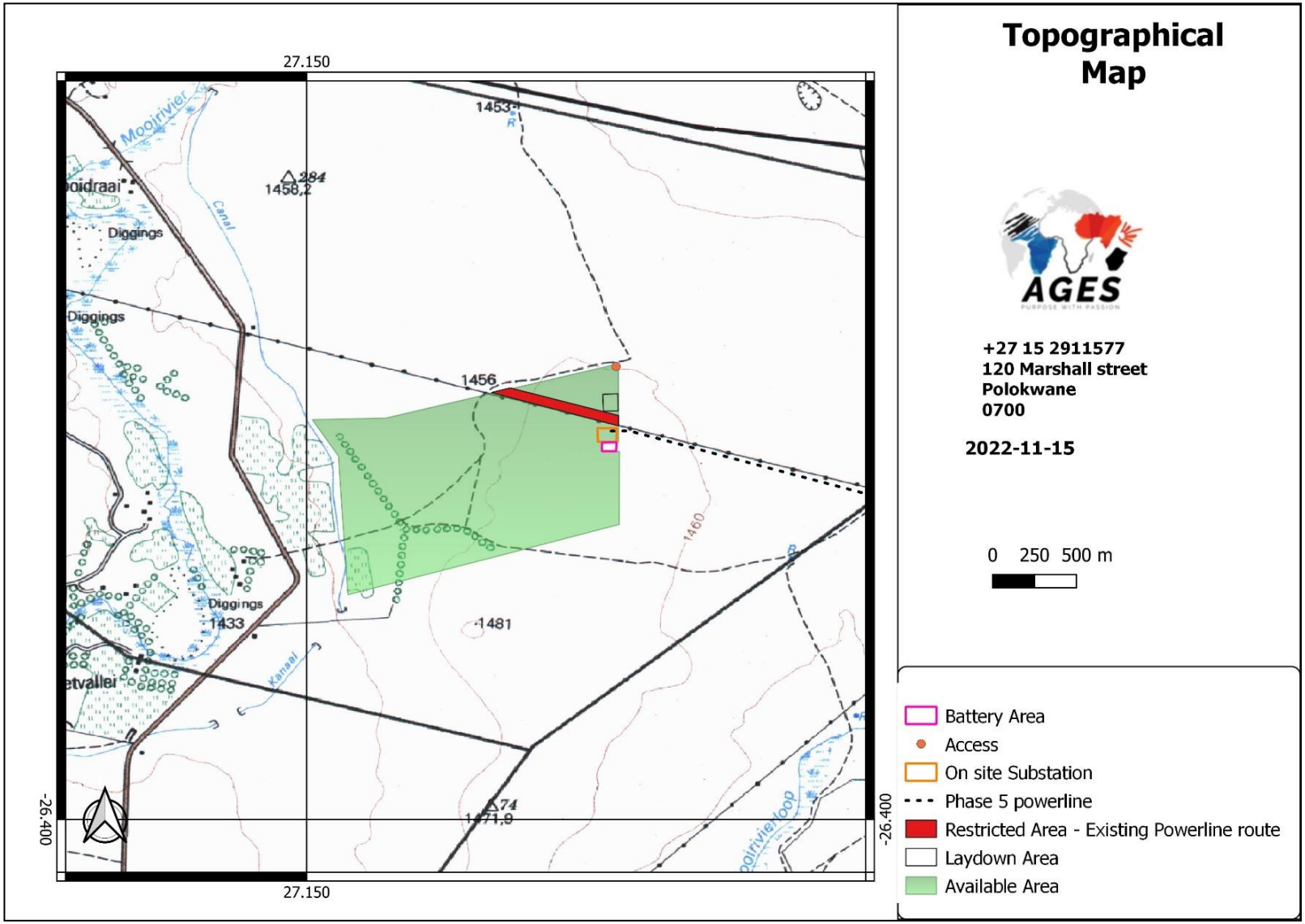

Figure 3. Topographical Map of the project area

4 REHABILITATION MEASURE PRINCIPLES TO BE IMPLEMENTED FOR THE MOPANE SOLAR PARK PHASE 5

The Environmental Rehabilitation process at the construction site should form an integral part of site development, operation and post-construction activities. A Rehabilitation Specialist and/or Environmental Control Officer (ECO) should therefore be appointed and be available on-site as part of the rehabilitation management / construction team. The ECO should form an integral part of the management team, attending regular site meetings, receiving Project Meeting Minutes and being kept fully updated regarding the closure plan and site rehabilitation process. **The ECO must be appointed according to conditions of the Environmental Authorization.**

Rehabilitation measures that may be affected on site include systems such as soil terracing, berm creation, grass blocks, fascine work, gabion basket work, reno mattresses, retaining block mechanisms, sandbags, boulder and rock placement, stone pitching, and grading. Decisions pertaining to plant material choices and specific vegetation utilisation for specific areas from an integral part of the process, as the hard landscape components work in conjunction with the soft landscape components. For example, the utilisation of plants with substantial roots for bank stabilisation purposes.

4.1 Identification and Protection of Environmentally Sensitive Areas

The on-site Environmental Control Officer and/or Rehabilitation Specialist should be fully aware of the scale and extent of the rehabilitation operations. No further vegetation clearing, levelling, excavation, topsoil removal or plant material removal is to be permitted without prior consent from the ECO and Rehabilitation Specialist based on the rehabilitation plan for the site unless instructed by them. Care must be taken during rehabilitation to avoid the natural drainage areas adjacent to the construction site. No vegetation clearance, topsoil collection or movement of machinery and vehicles should be allowed here as to keep the ecological integrity of the drainage areas and banks intact.

4.2 Comprehensive Photographic Record

For practical and attainable rehabilitation goals to be defined, it is recommended that a comprehensive photographic record of the entire property be created. Video footage may be useful in compiling such a record. A photographic record of the entire property should be kept as it could become a very valuable tool for future Rehabilitation.

The photographic record should include photographs of the site before development, during the construction phase and during rehabilitation activities.

Photographs must be taken of the site before construction commences and must be kept as a data base. Points from where photographs are taken must be recorded and coordinates be detailed for future reference. Photographs should be taken on the same dates, each year at the same time of day. (E.g., 1 February, 1 July and 1 December at 8:00 in the morning). This would serve as the basis for rehabilitation requirements during the actual rehabilitation process, informing decisions on drainage, soil shaping, levels, plant choices and rehabilitation in general. It can also serve as a verification report to authorities and land administrators regarding the legislative processes, sustainable approach and progressive improvement.

4.3 Search and Rescue Activities

Search and Rescue activities must be initiated as part of the rehabilitation process. Where rehabilitation actions will commence, viable, transplantable plant species can be identified by the ECO Rehabilitation Specialist, removed and stored in a potential 'on-site', self-sustaining nursery, to be re-used in rehabilitation activities in future.

Plant material that is to be "rescued" must be potted up into bags utilising local soil obtained from the previously stored topsoil heap. Adequate root systems per plant material type must be carefully excavated and retained for plant material to remain viable. Search and Rescue activities would include the removal of grass clumps, smaller transplantable shrubs and trees and endangered species such as geophytes and succulents should be placed into bags using local soil.

Animals like small mammals, reptiles and birds encountered during rehabilitation must be captured or moved by a specialist and released in a safe area. No animals may be poached at the property or adjacent areas. Many animals are protected by law and poaching, or other interference could result in a fine or jail term.

4.4 Cleared Indigenous Plant Material

Where construction or rehabilitation activities are to commence in a specific area, certain indigenous plant material from the construction footprint area could be collected and bagged to be used in re-vegetation or as mulch during rehabilitation. To protect drainage areas and small streams as well as erosion prone areas, encroachers such as sickle bush could be cut and used to "brush pack" these problem areas to protect it. This will also restrict movement of animals and humans over sensitive erosion probe areas until pioneer vegetation has established.

4.5 Removal of Overburden

Removal of Overburden (or spoil material) means the total removal of soil and rock material from the site up to natural surrounding ground level. Overburden may be used to backfill excavated areas. Where overburden remains after backfilling excavated areas to natural ground level, this needs to be transported off-site by the contractor to a location approved by the Engineers.

In addition to the removal of excess rock and soil from the site, all other construction-related materials (bricks, concrete, steel rods, machinery etc.) also must be taken off-site after cessation of construction activities.

4.6 Stormwater Management: The Sustainable Drainage System

Stormwater management objectives should include the following:

- Minimise the Threat of Flooding: This remains a key objective of any stormwater management system. However, the challenge when contemplating design of stormwater management systems is to consider the following:
  - To mimic pre-development responses to storms
  - To reduce the volume of runoff by promoting infiltration
  - To reduce the peak flows and increase the time-to-peak through detaining the runoff and releasing it at a gradual rate.
  - Where necessary, to construct means to contain flood waters and safely convey them out of the urban area.
- Protection of Receiving Water Bodies, which include the following:
  - Rivers / streams.
  - Groundwater.
  - Wetlands.

A “receiving water body” is not necessarily the system into which stormwater is discharged directly but can also be a natural system located further downstream in the catchment. Every endeavour should be made to achieve the following:

- Maintain natural flow regimes and seasonality.
- Prevent deterioration in water quality.
- Prevent erosion or sedimentation of natural wetlands or rivers.
- Preserve natural river channels, wetlands and vegetation, and preclude any interventions that may alter physical and ecological characteristics.

The need to design appropriate stormwater management systems at the dam overflow should be an opportunity to preserve or, if possible, improve natural freshwater ecosystems that have suffered degradation because of past activities, and in some cases, create additional freshwater habitats that will contribute to the availability of appropriate, high quality river and wetland habitat that mimics the natural condition.

- Promote Multi-Functional Use of Stormwater Management Systems: Resources such as land and water are becoming increasingly scarce and multiple use of these must be strived for. Stormwater systems provide a wide range of opportunities for multi-functionality.
- Development of Sustainable Environments: Developers should think beyond their short-term involvement with the project and consider the sustainability of the stormwater management system that is to be implemented. All relevant factors that will impact on future operation and maintenance should be considered. Maintenance requirements should be minimised as far as possible to maximise the available local authority funding, personnel and equipment. Responsibilities for maintenance must be resolved with the relevant local authority department at an early stage of the design. The possibility of developing public/private partnerships should be explored with local authorities (e.g., division of funding of capital versus maintenance costs between public and private sectors). Environmental policies such as promoting the use of locally indigenous vegetation in planting programmes will also reduce the long-term maintenance requirements of the development.

4.7 Compaction Rehabilitation Measures (ripping and / or scarifying)

Soil compaction, especially where construction vehicles operate, is often an effect of high traffic areas on development sites. It can become a major problem and can be recognized by:

- Excess surface moisture and slow drying soils due to deeper compaction preventing the percolation of water through the soil profile.
- Water runoff due to surface compaction preventing penetration and absorption (ponding of water), especially on banks and sloping surfaces.
- Large clear or sparsely covered areas devoid of a good vegetative cover due to hardened topsoil layers.

Ripping and/or scarifying mean the loosening of compacted soils by hand or appropriate machinery. Removal of overburden by excavator will loosen some of the upper compacted soils to some degree. Soils are to be loosened to a depth not less than 500mm. Slope angles should not exceed 18º incline angles (unless where specifically required in which case slope stabilization methods must be implemented). Re-shaped land must resemble the pre-construction landscape as closely as possible. Ripping/Scarifying should preferably be done before the rainy season. Do not rip and/or scarify areas under wet conditions, as the soil will not loosen. Compacted soil can also be decompacted by “Rotary Decompactors” to effectively aerate soils for vegetation establishment.

4.8 Erosion control and rehabilitation

Erosion control will need to be undertaken to ensure the successful landscape and rehabilitation of the site. Specific soil management practices need to be implemented to prevent erosion and sedimentation as stipulated below:

4.8.1 Erosion prevention

During the construction phase, clearing of the site will leave soil exposed and can cause erosion. The following list provides a guide to preventing erosion on construction sites:

- Programming: Install erosion control measures before construction commences. Schedule construction activities to minimize land disturbance.
- Land clearing: minimize the extent and duration of land clearing.
- Stormwater and run-off systems: install temporary drains and minimize concentrated water flows. Control stormwater velocity where necessary with temporary energy dissipater structures. Divert run-off around trench excavations or disturbed areas.
- Rehabilitation: revegetate or stabilize all disturbed areas as soon as possible. Indigenous trees can be planted in the buffer zone of the proposed development to enhance the aesthetic value of the site and stabilize soil conditions.
- Services: coordinate the provision of site services to minimize disturbance.
- Stockpiles: locate stockpiles away from concentrated flows and divert run-off around them.

4.8.2 Prevention of sedimentation

Erosion is likely to occur on site, with sediment export being an inevitable risk. Measures must be employed to capture sediment and reduce the amount of sediment that leaves the site. The generation of dust, litter and debris need to be minimized. A regular site maintenance schedule needs to be introduced. Sediment control devices need to be installed to capture mobilized sediment. The following sediment control devices are suggested:

- Grass filter strips: it encourages sediment to settle as water passes over a vegetated area.
- Sediment filters: use materials such as fine mesh or geo-fabric to filter run-off prior to discharge.
- Sediment traps: temporary sedimentation basins.
- Drop inlet filters: e.g., hay bales and silt fences, which prevent sediment entry into the drainage system.

4.9 Pollution prevention

Stored material that has been poorly located or left unprotected can be a source of pollutants. The following measures need to be taken to prevent pollution to the soils and water resources in the larger area:

- Stockpile location: locate stockpiles and material storage 30m or more away from drainage lines and identified riparian zone habitat.
- Stockpile construction: minimize the number and size of stockpiles. Construct stockpiles with a height to width ratio of less than 2:1. Surround unstabilised stockpiles and batters with silt fences or drainage systems that will collect and treat uncontaminated water.
- Stockpile maintenance: cover any stored material to protect it from rainfall.
- All stockpile areas should be rehabilitated after construction phase has concluded.

4.10 Littering prevention

Uncontrolled littering can be a source of pollution. The following measures need to be taken to mitigate against littering:

- Litter storage and housekeeping: maintain a high standard of housekeeping. Store all litter carefully so it cannot be washed or blown into stormwater drainage systems.
- Rubbish bins: provide bins for construction workers and staff at appropriate locations, particularly where food is consumed and at drop off and pick up points.
- Daily site clean-up: clean-up site of all litter daily.
- Rubbish disposal: dispose of scrap materials (*e.g.*, off-cuts and scrap machinery components) in a responsible manner.

4.11 Building activity associated impacts.

Dust concrete, solvents, steel fillings, fuel and other wastes are all produced during building construction and can cause impacts to the riparian zones. Take the following mitigation measures:

- Materials storage: store building materials under cover or contained areas.
- Site cleaning: clean the repair or construction site daily. Do not use water for cleaning the site.
- Leakage containment and treatment: ensure that oil, fuel or solvent leakages cannot enter the stormwater system.
- Temporary filters: fit temporary inlet pit filters near wash-down areas to prevent pollutant entry into the drainage system.

4.12 Plant species management principles

4.12.1 Re-vegetation

Revegetation is the process of vegetation establishment and care, as part of the process of reclamation, rehabilitation, or restoration. The biggest challenge of rehabilitation is to establish a sustainable ecosystem that is self-productive and able to survive without continued anthropogenic interventions (irrigation, fertilization, or re-seeding). After the construction on a landscape has ceased, processes of self-restoration are often slow (decades), and the final community of plants may not be the most desirable. Re-vegetation may be achieved by three main techniques, namely planting of trees and shrubs, direct seeding, or by self-regeneration.

Topsoil must be used wisely to achieve successful re-vegetation. Analysing the chemical properties of the soil can be helpful in directing possible soil amendments and guiding species selection. A well-prepared site will provide the most suitable conditions for plant germination, survival and long-term re-vegetation success.

Plant species that have been rescued or removed and relocated to the temporary nursery could be used in replanting rehabilitation areas. Additional plant material (indigenous trees) as required should be sourced from local indigenous nurseries and specifications regarding plant sizes, heights and the installation process of these plants should be developed by the On-Site ECO and Rehabilitation Specialist. Standard horticultural best practice would apply, with specific reference to the fact that the plant material would have to be in good condition, free from pests and diseases (any such plant would have to be removed from the site), well-formed and well rooted, potting materials are weed free and with sufficient root cover. Groundcovers and sedges are often supplied in trays, and the same standards would apply.

- A grass seed specification for reseeding the rehabilitated areas is included in Section 5. Re-grassing should be undertaken (as far as possible) during the summer months, as germination and establishment is best at this time of year. Spring rains are also conducive to good germination results, and as such rehabilitation programmes should take these factors into consideration.
- There are two methods for seeding, hand broadcasting and hydroseeding. The methods utilised will be site specific and the On-Site ECO and Rehabilitation Specialist will determine them.
- In certain areas grass runners may be required, and grass sods where instant cover is necessary.

Re-vegetation (grassing) should occur immediately after topsoil reinstatement. Seeding on site can be done by hand. The contractor must follow up, monthly until such time as 80% success of vegetation cover has been achieved.

4.12.2 Plant species management

The following general management measures and guidelines should be implemented during the development:

- Vegetation removal should be kept to a minimum during any future construction activities and only vegetation on the footprint areas should be removed. The unnecessary impact on the surrounding vegetation types and agricultural land should be avoided as far as possible.
- Vegetation to be removed as it becomes necessary rather than removal of all vegetation throughout the site in one step.
- No vegetation to be used for firewood.
- All-natural areas impacted during construction must be rehabilitated with locally indigenous plant species.
- Construction areas must be well demarcated.
- The few taller than 3m indigenous trees along the proposed site provide resting/perching sites for larger birds like vultures, birds of prey, arboreal reptiles and mammals that might occur/pass through the area and must be preserved. The larger trees should be protected as far as possible and be incorporated as part of the landscaping in the area.
- Limit pesticide use to non-persistent, immobile pesticides. Apply in accordance with label and application permit directions.
- When possible, construction activities and excavation activities should be scheduled for the low rainfall season (winter).
- The developer should advise the construction team in all relevant matters to ensure minimum destruction and damage to the environment. The developer should enforce any measures that he/she deem necessary. Regular environmental training must be provided to construction workers.

4.12.3 Control of alien invasive plant species (AIS)

The Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983) holds landowners legally responsible for the control of invasive alien plants on their properties.

Control involves killing the plants present, killing the seedlings which emerge, and establishing and managing an alternative plant cover to limit re-growth and re-invasion. Weeds and invader plants will be controlled in the manner prescribed for that category by the Conservation of Agricultural Resources Act or in terms of Working for Water guidelines. Goals for addressing the problem of Invasive Alien Species (IAS) on the construction site should include:

- Prevention: Keeping an IAS from being introduced onto the ecosystem. Ideally, this usually means keeping alien plants from entering the site.
- Early detection: Locating IAS before they have a chance to establish and spread. This usually requires effective, site-based inventory and monitoring programmes.
- Eradication: Killing the entire population of IAS. Typically, this can only be accomplished when the organisms are detected early.
- Control: The process of long-term management of the IAS' population size and distribution when eradication is no longer feasible.

Weed control begins with preventing their spread. Ensure that rehabilitation works do not contribute to the distribution of weeds by:

- Limit soil disturbance to minimise the exposure of bare ground.
- Use mulches and establish plant growth as quickly as possible to protect bare ground.
- Avoiding the importation or movement of soils or plant matter that could contain weed seeds, for example using straw mulch.
- Avoid re-using weed infested topsoil if possible.
- Ensure all materials and equipment are clean and weed free. This means that equipment must be washed when it is moved from one site to another, and between different parts of a site if weeds grow in one part of the site. This is important for trenching operations, to ensure weeds are not spread along the length of a trench.
- Use fertilisers conservatively to avoid creating the conditions for weed establishment by over-fertilising.

Scientists and field workers use a range of methods to control invasive alien plants. These include (Appendix A):

- Mechanical methods - felling, removing, or burning invading alien plants.
- Chemical methods - using environmentally safe herbicides.
- Biological control - using species-specific insects and diseases from the alien plant's country of origin. To date 76 bio-control agents have been released in South Africa against 40 weed species.
- Integrated control - combinations of the above three approaches. Often an integrated approach is required to prevent enormous impacts.

The following basic principles apply to the control of AIS on the proposed development site during the rehabilitation process:

- The Contractor is responsible for the control of weeds and invader plants within the construction site for the duration of the construction phase. Alien invasive tree species and weeds should be eradicated.
- Institute an eradication/control programme for early intervention if invasive species are detected, so that their spread to surrounding natural ecosystems can be prevented.
- Rehabilitate disturbed areas as quickly as possible to reduce the area where invasive species would be at a strong advantage and most easily able to establish.
- Institute a monitoring programme to detect alien invasive species early before they become established. In the case of weeds, before seeds are released.
- During site visits several exotic weeds have established on site. These invasive plants should be monitored and eradicated as soon as they appear on the property.

4.13 Fire Hazard

Wildfires can be started by people and acts of nature and are often associated with slash and burn activities, which in times of drought, can pose great hazards and negligence often plays a major role. Factors affecting the impact of vegetation fire hazards are:

- Vegetation dryness (moisture content and amount of living vegetation).
- Changes in weather variables that influence spread and intensity of fires.
- Availability of combustibles; and
- Long term drought in the dry season.

The following management guidelines should be implemented on the site:

- The grass cover along the boundary fences of the adjacent properties should be kept short (30 cm) to minimise the fire hazards.
- Adequate precautions must be taken to ensure fires are not started on-site.
- Do not permit any fires or open flames anywhere on the site, except at designated areas.
- Cleared vegetation must not be burned on the site.

4.14 Fauna

- Rehabilitation should be done to ensure that fauna which occurred around the solar farm return to the area after rehabilitation.
- If pesticides or herbicides are used, products should be chosen responsibly. Storage, administering and disposal must be done according to prescribed methods. Pollution of drainage channels must be prevented.
- Restoration/rehabilitation actions will need the implementation of a faunal monitoring program. It will serve as a barometer for management to recognise positive changes and trends in biodiversity of the development area during and after closure.
- The objectives of such a programme may include:
    - Assessment of future improvement/deterioration of the faunal biodiversity of the area (thus a measure of success of environmental management).
    - Increase accuracy of present status determination (actual species present vs. expected species) of area with every survey.
    - Determination of both temporal and spatial trends in faunal biodiversity on the area.
    - Assist in future management of area by providing recommendations and guidelines regarding future activities and rehabilitation.
- Biodiversity management actions during closure should include controlling and monitoring of numbers of alien invasive fauna numbers by eradication, habitat modification, resource limitation and public education.
- Young nutrient rich growth may entice herbivores to rehabilitated areas. The increased grazing pressure may decrease the rate of rehabilitation. Herbivore-proof fencing or brush packing may be required around the rehabilitation zones in the early stages to protect seedlings from grazers if grazing pressure is found to significantly affect growth.
- Revegetation programs will include consideration of the possibility of

reconstructing fauna habitats. Old salvage logs from cleared areas will be replaced after construction where possible, to provide habitat for fauna.

- Key fauna species will be identified and targeted for re-colonisation where appropriate. Edible seed-bearing plants, perennial grasses and sedges may be seeded or planted to encourage re-colonisation by fauna.

5 REHABILITATION AREAS AND SITE SPECIFICATIONS

5.1 General

From the previous specialist assessments for the solar park, some general guidelines for the rehabilitation sites are recommended. Management of stormwater runoff from the development is critical to maintaining the integrity of the rehabilitated system. An increase in hardened surfaces from the surrounding areas, will not only increase the potential volume of water entering the riparian zone but also decrease the time taken for this accumulated flow to reach the system. The increase velocity and volume of water has a far greater capacity to erode and damage the riparian zone and channel banks of the site.

The design and construction of the solar plant should aim to meet the following criteria to ensure the on-going ecological integrity of the ecosystem in the vicinity of the infrastructure construction.

5.2 Site specific measures

- Ensure that all current activities consider the development site boundaries. No vehicles are to enter or drive through any areas not demarcated for the development unnecessarily.
- Demarcate all development boundaries with pegs and danger tape.
- Edge effects of pre-construction and construction activities, including erosion, sedimentation, and alien/weed control, need to be strictly managed.
- Stormwater on site should be addressed in a detailed stormwater management plan compiled by a hydrological engineer.

5.3 Surface Rehabilitation

- All disturbed surface areas will be re-shaped to resemble the surrounding natural topography. Surfaces will be ripped / scarified, and re-vegetated with indigenous grass species. The grass species to be used is stipulated in this document as part of the plant species plan.
- As far, as is practical, implement concurrent rehabilitation processes to limit degradation of soil biota.
- Terrestrial invasive removal programs must be maintained throughout the proposed development as well as in the aftercare and maintenance phases.
- The ripped areas should be revegetated with grass species according to the seeding specification.

5.4 Spoil Areas

Soil material at the spoil areas will be used in the re-shaping of disturbed areas. All other excess material such as building material will be moved off site to natural ground level. Where required, topsoil will be reinstated prior to re-vegetation of these areas with natural grass species as specified.

5.5 Construction site management

The following guidelines should be implemented as part of the rehabilitation process, during construction:

- The construction footprint width must be kept to a minimum.
- A sequential construction strategy will be followed, i.e.
    - Construction will be immediately followed by rehabilitation.
    - Soils must be replaced in same sequence as excavated.
- Soil surfaces will not be left open for lengthy periods to prevent erosion.
- Storm water management measures will be implemented.
- Appropriate erosion and sediment control measures should be implemented.
- Vegetation and soil should be retained if possible and should be removed immediately ahead of construction/earthworks in a specific area.
- Remove only the vegetation where essential for the continuation of construction. Do not allow any disturbance to the adjoining natural vegetation cover or soils.
- Any alien invasive plants that have grown up on disturbed areas are to be removed before reinstating topsoil.
- Compacted areas (including temporary access tracks) are to be ripped/scarified (along contour) to a depth of 150 mm prior to the replacement of topsoil.
- Ensure that no unnatural depressions remain that could act as channels for preferential water flow.
- Monitor site for signs of erosion and take remedial action where problems occur.
- Planting/grassing is required where cleared areas require stabilization and/or erosion protection or if topsoil replacement was inadequate for natural regrowth.
- Planting shall, as far as possible, utilize indigenous species common to the area (e.g., *Cynodon dactylon*) by means of sodding, planting of runners or seeding.
- The Contractor must ensure that all structures, equipment, materials, and facilities used or created on site for or during construction activities are removed once the project has been completed. The surface will be ripped / scarified; topsoil reinstated and re-vegetated with grass species as specified.

5.6 PLANT SPECIES PLAN

5.6.1 Search and Rescue Activities

Search and Rescue activities could be initiated as part of the rehabilitation process. Where rehabilitation actions will commence, viable, transplantable plant species must be identified by an ECO/Rehabilitation Specialist, removed, and stored in an 'on-site', self-sustaining nursery, to be re-used in rehabilitation activities in future.

Plant material that is to be "rescued" must be potted into bags utilising local soil obtained from the previously stored topsoil heap. Adequate root systems per plant material type must be carefully excavated and retained for plant material to remain viable. Search and Rescue activities would include the removal of grass clumps, smaller transplantable shrubs and trees and endangered species such as geophytes and succulents should be placed into bags using local soil.

5.6.2 Cleared Indigenous Plant Material

Where construction or rehabilitation activities are to commence in a specific area, certain indigenous plant material from the construction footprint area could be collected and bagged to be used in re-vegetation or as mulch during rehabilitation. To protect erosion prone areas, encroachers such as sickle bush could be cut and used to "brush pack" these problem areas to protect it. This will also restrict movement of animals and humans over sensitive erosion probe areas until pioneer vegetation has established.

5.6.3 Re-vegetation

Revegetation is the process of vegetation establishment and care, as part of the process of reclamation, rehabilitation or restoration. The biggest challenge of rehabilitation is to establish a sustainable ecosystem that is self-productive and able to survive without continued anthropogenic interventions (irrigation, fertilization or re-seeding). After the construction on a landscape has ceased, processes of self-restoration are often slow (decades), and the final community of plants may not be the most desirable. Re-vegetation may be achieved by three main techniques, namely planting of trees and shrubs, direct seeding, or by self-regeneration. Topsoil must be used wisely to achieve successful re-vegetation. Analysing the chemical properties of the soil can be helpful in directing possible soil amendments and guiding species selection. A well-prepared site will provide the most suitable conditions for plant germination, survival and will promote long-term re-vegetation success.

Plant species that have been rescued or removed and relocated to the temporary nursery could be used in replanting rehabilitation areas. Additional plant material (indigenous trees) as required should be sourced from local indigenous nurseries and specifications regarding plant sizes, heights and the installation process of these plants should be developed by the On-Site ECO and Rehabilitation Specialist. Standard horticultural best practice would apply, with specific reference to the fact that the plant material would have to be in good condition, free from pests and diseases (any such plant would have to be removed from the site), well-formed and well rooted, potting materials are weed free and with sufficient root cover. Groundcovers and sedges are often supplied in trays, and the same standards would apply.

- A grass seed specification for reseeding the rehabilitated areas is included below. Re-grassing should be undertaken (as far as possible) during the summer months, as germination and establishment is best at this time of year. Spring rains are also conducive to good germination results, and as such rehabilitation programmes should take these factors into consideration.
- There are two methods for seeding, hand broadcasting and hydroseeding. The methods utilised will be site specific and the On-Site ECO and Rehabilitation Specialist will determine them.
- In certain areas grass runners may be required, and grass sods where instant cover is necessary.
- A typical grass seed mixture (hand sowing) that could be implemented for rehabilitation activities will include: (specification 4-5kg/ha).

    - *Eragrostis tef* (Tef).
    - *Eragrostis curvula* (Weeping Love Grass).
    - *Digitaria eriantha* (Smutsvinger).
    - *Cynodon* spp. (Bermuda kweek).
    - *Panicum maximum* (Witbuffel).
    - *Chloris gayana* (Rhodes grass)
    - *Paspalum notatum* (Bahia Grass).

Re-vegetation (grassing) should occur immediately after topsoil reinstatement. Seeding on the site can in most cases be done by hand. The contractor is to guarantee a success rate of 80% for all re-seeded areas and follow up will be conducted monthly until such time as 80% success of vegetation cover has been achieved.

5.6.4 Control of alien invasive plant species (AIS)

The following basic principles apply to the control of AIS on the development site during the rehabilitation process:

- The Contractor is responsible for the control of weeds and invader plants within the construction site for the duration of the construction phase. Alien invasive tree species and weeds should be eradicated.
- Institute an eradication/control programme for early intervention if invasive species are detected, so that their spread to surrounding natural ecosystems can be prevented.
- Rehabilitate disturbed areas as quickly as possible to reduce the area where invasive species would be at a strong advantage and most easily able to establish.
- Institute a monitoring programme to detect alien invasive species early, before they become established and, in the case of weeds, before the release of seeds.

6 MAINTENANCE AND MONITORING

Several methods exist to monitor rehabilitated areas to scientifically prove that a self-sustainable ecosystem has developed or show a positive trend towards successful rehabilitation. This will prove that environmental degradation and biological diversity have been mitigated and restored where it has been negatively impacted upon. The important aspect to keep in mind is that it is not only a visual inspection, but measurable information gathering *e.g*., water samples, soil samples, vegetation diversity, biomass, basal cover, species composition etc. The monitoring data must be of such a standard that meaningful conclusions can be made, and a trend indicated. Good record keeping is essential. All illegal invader plants and weeds shall be eradicated as required in terms of Sections 119 to 126 of The National Environmental Management Act, 1998 (Act No. 107 of 1998).

Monitoring should take place on regular time intervals to establish if the revegetation strategy was successful. The site must be monitored for at least two years (bi-annually) to observe any possible invasion by alien species and, if they appear, they must be controlled as is appropriate. Also, to monitor and correct possible erosion, storm water and siltation problems. Soil sampling and analysis should be done every two years to monitor the development of the soil and need for supplementary fertilization.

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APPENDIX A. PLANT SPECIES LISTS FOR SITE

Woody species
Eucalyptus camaldulensis
Grewia flava
Vachellia karroo
Ziziphus mucronata
Diospyros lycioides
Searsia lancea
Searsia pyroides
Grass species
Aristida congesta
Aristida junciformes
Brachiaria nigropedata
Brachiaria serata
Cymbopogon pospischilli
Cynodon dactylon
Dichanthium annulatum
Digitaria eriantha
Diplachne fusca
Eragrostis bicolor
Eragrostis biflora
Eragrostis curvula
Eragrostis gummiflua
Eragrostis lehmanniana
Eragrostis plana
Heteropogon contortus
Hyparrhenia hirta
Hyparrhenia tamba
Melinis repens
Panicum natalense
Eragrostis racemosa
Setaria sphacelata
Sporobolus africanus
Themeda triandra
Trachypogon spicatus
Trichoneura grandiglumis
Triraphis andropogonoides
Urochloa mosambicensis
Urochloa panicoides
Dwarf shrubs, Forbs, geophytes & succulents
Acalypha angusta
Altenanthera pungens
Amaranthus spinosa

Anthospermum rigidum
Argemone ochroleuca
Asparagus laricinus
Asparagus suaveolens
Athrixia elata
Barleria macrostegia
Berkheya onopordifolia
Berkheya purpurea
Berkheya rigida
Berkheya speciosa
Bidens bipinnata
Bidens pilosa
Boophane disticha
Chamaecrista mimosoides
Chamaesyce inaequilatera
Clematis brachiata
Conyza albida
Conyza bonariensis
Crabbea angustifolia
Cyperus obtusiflorus
Cyperus sexangularis
Datura stramonium
Dianthus mooiensis
Dicoma anomala
Felicia muricata
Helichrysum caespititium
Helichrysum miconiifolium
Helichrysum nudifolium
Hermbstaedtia linearis
Hypoxis rigidula
Indigofera comosa
Indigofera daleioides
Ipomoea ommaneyi
Kyling alba
Kyphocarpa angustifolia
Nidorella anomala
Opuntia ficus indica
Oxalis spp.
Pentzia incana
Persicaria serrulata
Pygmaeothamnus zeyheri
Senecio coronatus
Senecio inornatus
Solanum incanum

Stoebe vulgaris
Tagetes minuta
Tylosema esculentum
Tylosema fassoglense
Typha capensis
Vernonia oligocephala
Wahlenbergia caledonica
Xanthium strumarium
Zinnia peruviana
Ziziphus zeyheriana.