

Environmental Management Plan (EMP)

For the construction and operational phase



PROPOSED KARIBIB 5MW SOLAR PV PLANT AND ITS ASSOCIATED TRANSMISSION LINE TO THE NAMPOWER KARIBIB DISTRIBUTION SUBSTATION

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GLOSSARY

ALIEN INVASIVE PLANTS	Plants that do not naturally occur in an area. These plants are also referred to as exotic plants.
CONSTRUCTION ACTIVITY	Any action taken by the contractor, his sub-contractors, suppliers or personnel during the operational phase and possible decommissioning phase of the project.
ENVIRONMENT	an interconnected system of natural and human-made elements such as land, water and air; all living organisms and matter arising from nature, cultural, historical, artistic, economic and social heritage and values.
ENVIRONMENTAL CONTROL OFFICER	An individual nominated through the Project Manager to be present on site to act on behalf of the Project Manager in matters concerning the implementation and day to day monitoring of the EMP.
ENVIRONMENTAL MANAGEMENT	A management process which seeks to ensure, as far as possible, that no avoidable impact is caused to the environment and that when this is unavoidable that the consequences are understood prior to the impact being caused and that the impact is then mitigated as far as possible.
GROUNDWATER	Water located beneath the earth's surface in soil pore spaces and in the fractures of rock formations
HAZARDOUS WASTE	Waste that poses substantial or potential threats to public health or the environment.
MITIGATION	The implementation of practical measures to reduce adverse impacts or enhance beneficial impacts.
NO-GO AREA	Areas where all construction activities and related matters are prohibited.
POLLUTION	Any change in the environment caused by substances, radioactive or other waves; or noise, odours, dust or heat, emitted from any activity, including the storage or treatment of waste or substances, construction and the provision of services, whether engaged in by any person or an organ of state, where that change has an adverse effect on human health or well-being or on the composition, resilience and productivity of natural or managed ecosystems, or on materials useful to people, or will have such an effect in the future.
REHABILITATION	Restoring the disturbed area to more or less the natural set up.
SITE	An area of ground where the solar pv plant is located.

1. INTRODUCTION and BACKGROUND

The aim of a construction and operational EMP is to ensure that all activities are done in an environmentally acceptable and safe manner. This Environmental Management Plan (EMP) serves as a managing tool for the construction and operation of the new 5MW Solar PV Plant in Karibib. The EMP is developed to outline measures to be implemented in order to minimise adverse environmental degradation associated with this development.

The EMP serves as a guiding tool for the proponent, contractors and workforce on their roles and responsibilities concerning environmental management on site, and also provides an environmental monitoring framework for all project phases of the development. This environmental management plan aims to take a pro-active route by addressing potential problems before they occur. The EMP acts as a stand-alone document, which can be used during the various phases of the development.

In this report, the Contractor refers to Metdecci Energy Investment (Pty) Ltd and its sub-contractors.

The purpose of the EMP is to:

- ✓ Train employees and contractors with regard to environmental obligations.
- ✓ Promote and encourage good environmental management practices.
- ✓ Outline responsibilities and roles of Metdecci Energy Investment (Pty) Ltd and its contractors in managing the environment.
- ✓ Describe all monitoring procedures required to identify environmental impacts.
- ✓ Minimise disturbance of the natural environment.
- ✓ Develop waste management practices.
- ✓ Prevent all forms of pollution.
- ✓ Protect the natural environment.
- ✓ Prevent soil and water erosion.
- ✓ Comply with all applicable laws, regulations and standards for environmental protection.

Phases covered by the EMP:
Construction Phase
Operational Phase

The construction phase of the new power line entails:

- Transportation of relevant material.
- Installation of solar panels and its associated transmission line.
- Demarcation and fencing of temporary lay down areas
- Clearing/trimming of vegetation (mostly invader species)

The operational phase will entail:

- Management and monitoring of the solar pv plant.

- Maintenance of transmission line.
- Monitoring of bird mortalities within the plant.
- Clearing/trimming of vegetation periodically.

The decommissioning phase will entail:

- Removal of all infrastructure not reused in the future use of land.
- Re-use of transmission line by other operators
- Rehabilitation of disturbed environment.

2. LEGISLATIVE FRAMEWORK

➤ National Legislative Requirements

The EIA process is undertaken in terms of Namibia's Environmental Management act no. 7 of 2007 and the Environmental Assessment Policy of 1996, which stipulates activities that may have significant impacts on the environment. Listed activities require the authorisation from the Ministry of Environment and Tourism (DEA). Section 32 of the Environmental Management Act requires that an application for an environmental clearance certificate be made for the listed activities. The following environmental legislations are relevant to this project:

➤ The Namibian Constitution

The Namibian Constitution has a section on principles of state policy. These principles cannot be enforced by the courts in the same way as other sections of the Constitution. But they are intended to guide the Government in making laws which can be enforced.

The Constitution clearly indicates that the state shall actively promote and maintain the welfare of the people by adopting policies aimed at management of ecosystems, essential ecological processes and biological diversity of Namibia for the benefit of all Namibians, both present and future.

➤ Environmental Management Act No.7 of 2007

This Act provides a list of projects requiring an Environmental assessment. It aims to promote the sustainable management of the environment and the use of natural resources and to provide for a process of assessment and control of activities which may have significant effects on the environment; and to provide for incidental matters.

The Act defines the term "*environment*" as an interconnected system of natural and human-made elements such as land, water and air; all living organisms and matter arising from nature, cultural, historical, artistic, economic and social heritage and values.

The Environmental Management Act has three main purposes:

- (a) to make sure that people consider the impact of activities on the environment carefully and in good time.
- (b) to make sure that all interested or affected people have a chance to participate in environmental assessments
- (c) to make sure that the findings of environmental assessments are considered before any decisions are made about activities which might affect the environment

Line Ministry: Ministry of Environment and Tourism

➤ ***Atmosphere Pollution Prevention Ordinance (1976)***

This Ordinance generally provides for the prevention of the pollution of the atmosphere. Part IV of this ordinance deals with dust control. The Ordinance is clear in requiring that any person carrying out an industrial process which is liable to cause a nuisance to persons residing in the vicinity or to cause dust pollution to the atmosphere, shall take the prescribed steps or, where no steps have been prescribed, to adopt the best practicable means for preventing such dust from becoming dispersed and causing a nuisance.

Line Ministry: Ministry of Environment and Tourism

➤ ***Water Resources Management Act of Namibia (2004)***

This act repealed the existing South African Water Act No.54 of 1956 which was used by Namibia. This Act ensures that Namibia's water resources are managed, developed, protected, conserved and used in ways which are consistent with fundamental principles depicted in section 3 of this Act. Part IX regulates the control and protection of groundwater resources. Part XI, titled Water Pollution Control, regulates discharge of effluent by permit.

Line Ministry: Ministry of Agriculture, Water Affairs and Forestry

➤ ***Water Act No.54 of 1956***

This Act provides for Constitutional demands including pollution prevention, ecological and resource conservation and sustainable utilisation. In terms of this Act, all water resources are the property of the State and the EIA process is used as a fundamental management tool.

A water resource includes a watercourse, surface water, estuary or aquifer, and, where relevant, its bed and banks. A watercourse means a river or spring; a natural channel in which water flows regularly or intermittently; a wetland lake or dam, into which or from which water flows; and any collection of water that the Minister may

declare to be a watercourse. Permits are required in terms of the Act for the undertaking of the following activities relevant to the proposed project:

- ✓ Discharge of waste or water containing waste into a water resource through a pipe, canal, sewer, sea outfall or other conduit in terms of Section 21 (f); and
- ✓ Disposal of waste in a manner that may detrimentally impact on a water resource in terms of Section 21 (g).

Line Ministry: Ministry of Agriculture, Water Affairs and Forestry

➤ ***The Draft Wetland Policy (1993)***

Requires that any wetlands and its associated hydrological functions form a part, to be managed in such a way that their biodiversity, vital ecological functions and life support systems are protected for the benefit of present and future generations.

Line Ministry: Ministry of Environment and Tourism

➤ ***Environmental Assessment Policy of Namibia (1995)***

Environmental Assessments (EA's) seek to ensure that the environmental consequences of development projects and policies are considered, understood and incorporated into the planning process, and that the term ENVIRONMENT (in the context of IEM and EA's) is broadly interpreted to include biophysical, social, economic, cultural, historical and political components.

All listed policies, programmes and projects, whether initiated by the government or the private sector, should be subjected to the established EA procedure as set out in Figure 2.

Line Ministry: Ministry of Environment and Tourism

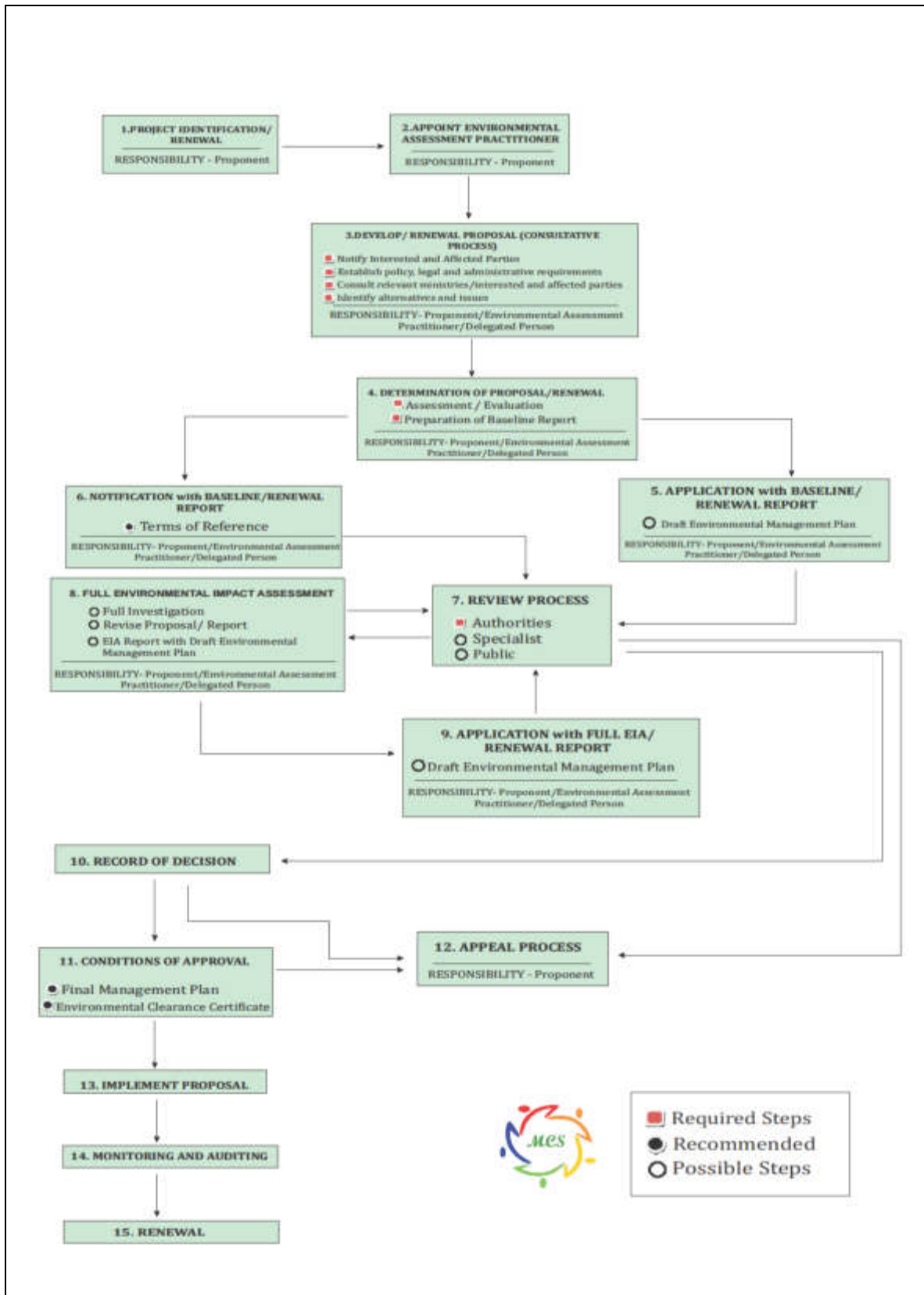


Figure 1: Environmental Assessment Procedure of Namibia (Adapted from the Environmental Assessment Policy of 1995).

➤ ***Draft Pollution Control and Waste Management Bill***

The proposed new 5MW Karibib Power Plant project, only applies to Parts 2 and 7 of the Bill.

Part 2 stipulates that no person shall discharge or cause to be discharged any pollutant to the air from a process except under and in accordance with the provisions of an air pollution licence issued under section 23. It further provides for procedures to be followed in licence application, fees to be paid and required terms of conditions for air pollution licences.

Part 7 states that any person who sells, stores, transports or uses any hazardous substances or products containing hazardous substances shall notify the competent authority, in accordance with sub-section (2), of the presence and quantity of those substances.

➤ ***Hazardous Substances Ordinance No. 14 of 1974***

The Ordinance applies to the manufacture, sale, use, disposal and dumping of hazardous substances, as well as their import and export and is administered by the Minister of Health and Social Welfare. Its primary purpose is to prevent hazardous substances from causing injury, ill-health or the death of human beings.

Line Ministry: Ministry of Health and Social Services

➤ ***Public Health Act 36 of 1919 and Subsequent Amendments***

The Act, with emphasis to Section 119 prohibits the presence of nuisance on any land occupied. The term nuisance for the purpose of this EIA is specifically relevant specified, where relevant in Section 122 as follows:

- ✓ any dwelling or premises which is or are of such construction as to be injurious or dangerous to health or which is or are liable to favour the spread of any infectious disease;
- ✓ any area of land kept or permitted to remain in such a state as to be offensive, or liable to cause any infectious, communicable or preventable disease or injury or danger to health; or
- ✓ any other condition whatever which is offensive, injurious or dangerous to health.

Potential impacts associated with the New Otavi Landfill project are expected to include dust, air quality impacts, noise nuisance and smoke emissions.

Line Ministry: Ministry of Health and Social Services

➤ ***International Conventions and Regulations***

Article 144 of the Namibian Constitution states that “the general rules of public international law and international agreements binding upon Namibia form part of the law of Namibia.” This means that all the international agreements that Namibia signed become part of the law of our country. These laws and/or agreements are:

- ✓ Convention on Biological Diversity, 1992;
- ✓ United Nations Framework Convention on Climate Change, 1992;
- ✓ Kyoto Protocol on the Framework Convention on Climate Change, 1998;
- ✓ Stockholm Convention of Persistent Organic Pollutants, 2001.

3. DESCRIPTION OF THE RECEIVING ENVIRONMENT

3.1 Locality and Land use

MetDecci Energy Investment (Pty) Ltd hereafter often referred to as the proponent has developed a 5MW solar photovoltaic(PV) plant in Karibib townlands, which is connected to the existing NAMPOWER substation (900m away) in Karibib. The Solar Plant is having a developmental footprint of 6Ha. (See locality map: fig 2). The Solar Plant Area is surrounded by small holdings farms, cemetery and undeveloped townlands.

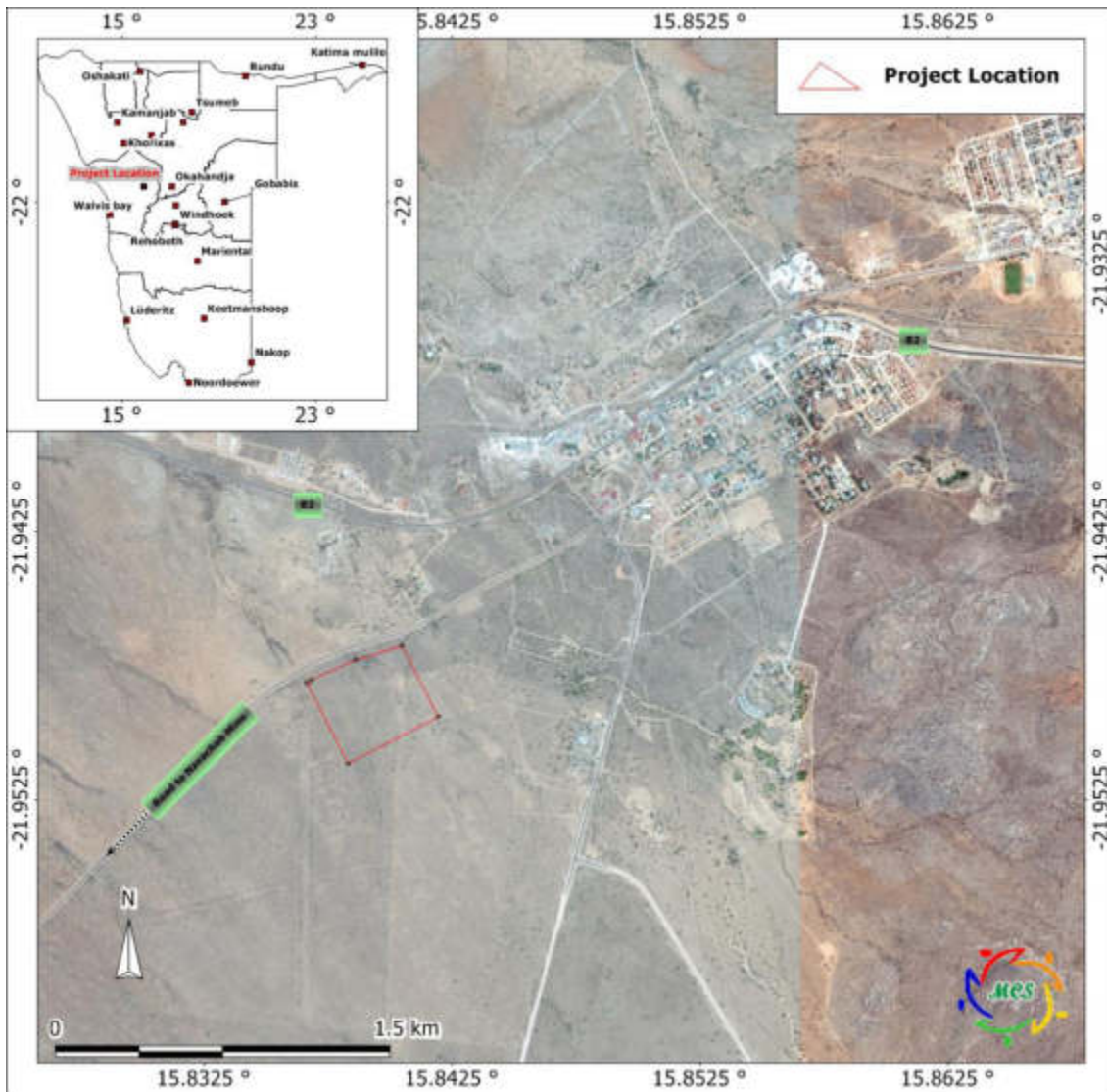


Figure 2. Locality map

3.2 Climate

Classification of climate:	Semi-arid area
Average rainfall:	Rainfall in the area is averaged to be between 200-250 mm per year.
Variation in rainfall:	Variation in rainfall is averaged to be 50-60 % per year.
Average evaporation:	Evaporation in the area is averaged to be between 2100-2240 mm per year.
Precipitation:	The highest summer rains are experienced in February.
Water Deficit:	Water deficit in the area is averaged to be between 2100-2300 mm per year.
Temperatures:	Temperatures in the area are averaged to be between 20- 22 °C per year.
Wind direction:	Wind directions in the area are predominantly easterly and southerly winds.

3.3 Geology and Hydrogeology

The area of Karibib is situated within the northern part of the Central Zone of the late Proterozoic Damara orogenic belt. The Damara Belt in central Namibia forms part of a system of Pan-African collisional belts in southern Africa that record the amalgamation of the Gondwana supercontinent in the latest Proterozoic and early Phanerozoic (Miller, 2008). The geological scenario in this area encompasses classical geosynclines metasedimentary and intrusive rocks belonging to the Damaran and Karoo Sequences, thus spanning more than 400 Ma of earth history. On the platform edges of the trough chiefly calcareous sediments were deposited. Both rock suites were subsequently folded and metamorphosed and granitic intrusion took place. Bands of marble and quartzite in these otherwise phyllitic metamorphic rocks are of hydrogeological significance. Several anorogenic complexes of Cretaceous age are present in the area. Karibib Carbonate Complex forms a prominent landmark. Also, numerous pinnacles of Damara granite and rounded quartzite hill rises above most of the flat landscape in the area (Miller, 2008; Schneider, 2004).

The geology of Karibib itself, consists mainly of marble, schist, quartzite, calc-silicate and graphitic schist of the Damara Sequence (Swakop Group) in the northern half of the town, whereas undifferentiated Damara granites are situated more in the

southern half of the town. As you drive out of town northward to Otjiwarongo, rocks of syn - to post-tectonic granite, granodiorite, monzonite and diorite are observed.

The groundwater potential of fractured aquifers in the Swakop Group of the Damara Sequence is generally low. However, the carbonates (marbles and limestones) are of moderate potential and at properly selected targets like fracture zones and karstified contact zones, even high yields can be found. This depends on the amount of rainfall and associated weathering and recharge. The most significant aquifer presently utilised is the marble aquifer north and north-east of Otjiwarongo. The water supply scheme relies on a fractured and slightly karstified marble band of the Karibib Formation, which allows medium to high pumping rates and supplies Group B water. The water supply scheme of Karibib is situated between Omaruru and Otjiwarongo in an area underlain by meta-sediments and granites of the Damara Sequence that have a low groundwater potential (Christelis and Struckmeier, 2001). Alluvial sediments of the Omaruru ephemeral River provide another good aquifer and a source of water for nearby urban centres and settlements including Karibib (Schneider, 2014).

Groundwater flow from the site can be expected in a south-westerly direction. Local flow patterns may vary due to groundwater abstraction in the area. According to the Department of Water Affairs (DWA) database, 7 boreholes are located within a 2km radius of the project location. The water table at the site is expected to be between 10mbs and 30mbs. Water quality in the area is generally good and classified as good quality water, according to Namibian drinking water quality standards.

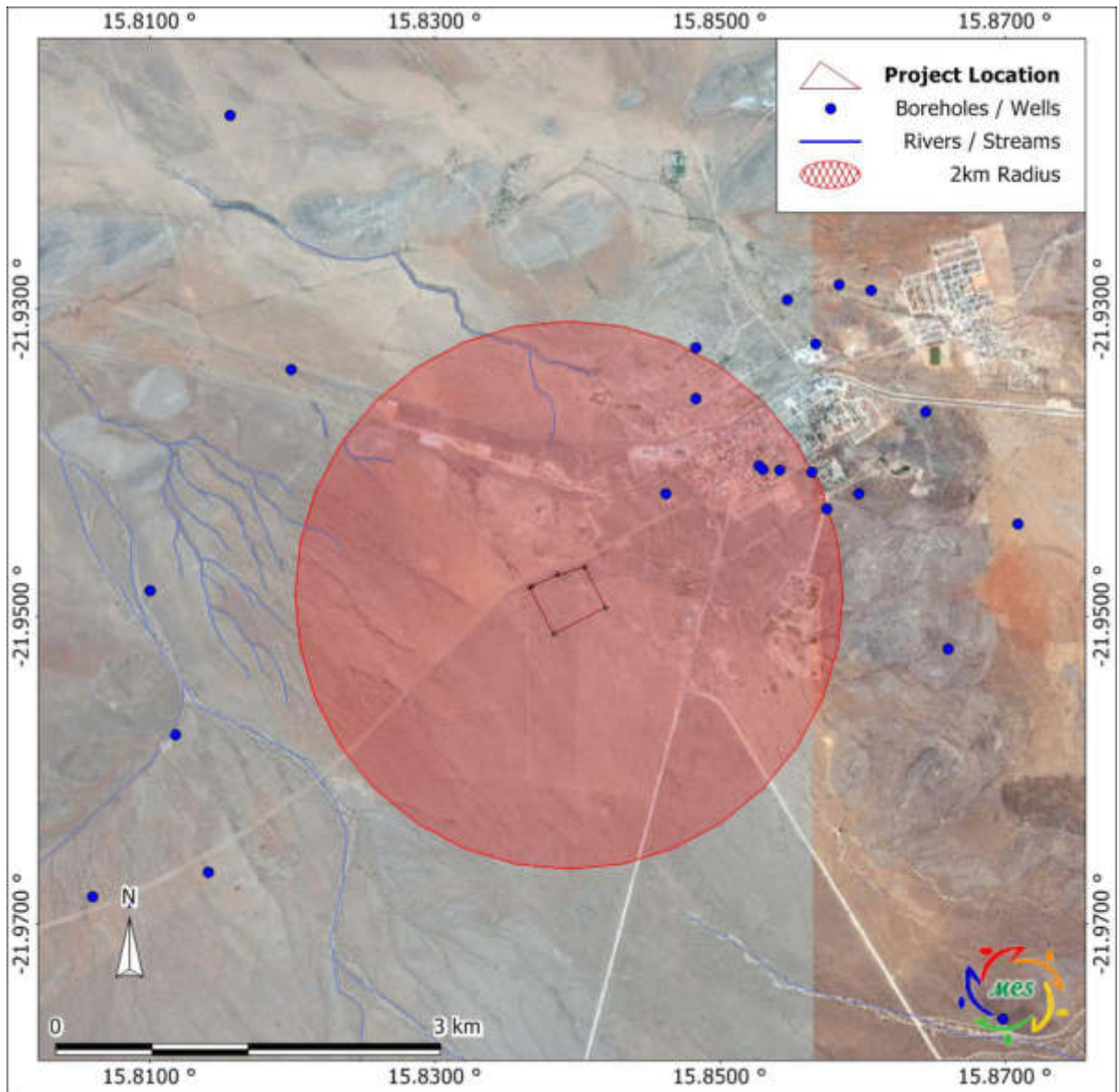


Figure 3: Groundwater in the study area

4. ENVIRONMENTAL MANAGEMENT PLAN

4.1 Responsibilities for environmental management

METDECCI ENERGY INVESTMENT (PTY) LTD will be responsible for environmental control on site during the operational phase. It is very important a pre-work briefing meeting be held at all times to reach an agreement on specific roles of various parties and penalties for non-compliance.

4.2 Training and induction

METDECCI ENERGY INVESTMENT (PTY) LTD is bound to be responsible for ensuring that environmental awareness education of all employees and contractors is done satisfactorily. METDECCI ENERGY INVESTMENT (PTY) LTD should ensure that employees and contractors are made aware of the environmental requirements of the project.

The EMP should form part of the Terms of Reference for all contractors, sub-contractors and suppliers. All contractors, sub-contractors and suppliers will have to sign an agreement to assure that they understood the EMP and that they will comply. All senior staff should familiarise themselves with the full contents of the EMP and its implications. Senior staffs (Foreman/Supervisor) are expected to train and assist the rest of the employees on the contents of the EMP.

It is imperative to ensure that all personnel have the appropriate level of environmental awareness to ensure continued environmental due diligence and ongoing minimisation of environmental harm.

To achieve efficient environmental management, it is important that workers, contractors and sub-contractors are aware of their responsibilities in terms of the relevant environmental legislation and the contents of this EMP.

METDECCI ENERGY INVESTMENT (PTY) LTD should ensure environmental awareness is enforced in order to:

- Promote environmental awareness amongst all employees on site,
- To inform workers of all environmental procedures, policies and programmes applicable,
- To provide generic training on the implementation of environmental management specifications; and

The environmental awareness training programme will include:

- The induction of all construction and operation workers;
- Proof of receiving and understanding the induction must be signed by all persons receiving the induction.

4.3 Environmental incident reporting

All environmental incidents occurring at the proposed site will be recorded. The incident report will have to include time, date, location, and nature of the incident, extent of the incident, actions taken, and personnel involved.

All complaints received from the neighbouring community should be directed to the Technical Manager / Environmental Health Officer of METDECCI ENERGY INVESTMENT (PTY) LTD and channelled to the appointed ECO officer. METDECCI ENERGY INVESTMENT (PTY) LTD Management should be able to respond to the complainant within a week (even if pending further investigation). It is important that the issues raised are considered and that the complainant feels that their concerns have been addressed to and wherever possible actions taken to address these. All complaints should be entered in the environmental register and all responses and actions taken to address these should be recorded.

The following documents must be kept on site in order to record compliance with the EMP:

- Environmental authorisations
- Record of complaints.
- Monitoring results.
- Written corrective action instructions.
- Non-conformance reports.
- Notification of emergencies and incidents.

4.4 Environmental monitoring

Periodic environmental monitoring must be taken on a regular basis. Monitoring should be done in order to ensure compliance with all aspects of the EMP. Findings should be liaised with to all responsible officers as chain command.

4.5 EMP administration

Copies of this EMP shall be kept at the site office and should be distributed to all senior staff members, including those of the contractors.

4.6 EMP amendments

The EMP amendments can only be made with the approval of the ECO officer and ultimately the DEA. Amendments to the EMP should be liaised to all employees and contractors.

4.6 Non compliance of the EMP

Problems may occur in carrying out mitigation measures or monitoring procedures that could result in non-compliance of the EMP. The responsible personnel should encourage staff to comply with the EMP, and address acts of non-compliance and penalties.

METDECCI ENERGY INVESTMENT (PTY) LTD is responsible for reporting non-conformance with the EMP, to the ECO officer. The management of METDECCI ENERGY INVESTMENT (PTY) LTD, in consultation with the ECO officer must, thereafter, undertake the following activities:

- ✓ Investigate and identify the cause of non-conformance.
- ✓ Report matters of non-conformance to METDECCI ENERGY INVESTMENT (PTY) LTD Project Engineer and MET (depending on the severity of the incident).
- ✓ Implement suitable corrective action as well as prevent recurrence of the incident.
- ✓ Assign responsibility for corrective and preventative action.
- ✓ Any corrective action taken to eliminate the causes of non-conformance shall be appropriate to the magnitude of the problems and commensurate with the environmental impact encountered.

4.7 Environmental Register

An environmental register should be kept on site in which incidents related to actual impacts are recorded. This will include information related to incidents as spillages, dust generation and complaints from adjacent neighbours. It should also contain information relating to actions taken. Any party on site may complete the register, however, it is envisaged that the Technical Manager, the contractor and the ECO officer will be the main contributors, and who will also be the main parties involved in suggesting mitigation measures.

4.8 Environmental Control Officer

The Environmental Control Officer for the site will be an independent environmental consultant appointed by METDECCI ENERGY INVESTMENT (PTY) LTD to monitor and review the on-site environmental management and implementation of this EMP.

Duties of the ECO officer:

- ✓ The identification of potential environmental impacts, prior to the onset of decommissioning. A site visit may also be required prior to site development. This would be carried out in consultation with the Technical Manager.
- ✓ Providing of an environmental register at the site to be filled in by any person reporting an environmental incident, issue or concern and inspected by the ECO officer on a regular basis to check for issues raised and actions taken.
- ✓ Ensuring that the EMP conditions are adhered to at all times and taking action.
- ✓ Ensuring that environmental impacts are kept to a minimum.

- ✓ Reviewing and approving method statements in consultation with the Technical Manager.
- ✓ Reporting to METDECCI ENERGY INVESTMENT (PTY) LTD and the Technical Manager on a regular basis and advising of any major environmental impacts. Attending the site meetings (when necessary)
- ✓ Inspecting the site and surrounding areas regularly, and monitoring an ongoing environmental awareness program in conjunction with the Technical Manager.
- ✓ Requesting the removal of people and/or equipment not complying with the specifications of EMP.
- ✓ Keeping both a written and photographic record of progress on site from an environmental perspective, and an ad hoc record of all environmental incidents
- ✓ Undertaking continual review of the EMP and submitting a report to the relevant stakeholders.
- ✓ The ECO officer will submit all written instructions and verbal requests to METDECCI ENERGY INVESTMENT (PTY) LTD via the Technical Manager and Project Engineer.

4.9 Contractors and Service Providers

All contractors (including subcontractors and staff) and service providers are ultimately responsible for:

- Organizing that all his employees and those of his subcontractors receive training before the commencement of construction in order that they are aware of the terms of reference of the EMP.
- Complying with the environmental management specifications.
- Submitting Methods Statements for specific activities controlled by the EMP for approval by the ECO before any work is undertaken.
- Adhering to any instructions issued by the Project Manager on the advice of the ECO.
- Submitting a report at each site meeting which will document all incidents that have occurred during the period before the site meeting.
- Displaying the list of EMP transgressions issued by the ECO officer on site.
- Maintaining a public complaints register on site.

4.10 Site Management

Areas outside this designated working zone shall be considered “no go” areas. The offloading zones must be clearly demarcated when offloading goods to enhance safety around the site.

4.10.1.1 Access routes and work sites

Road transport trucks will access the site via the Navachab mine road. No new tracks/roads shall be established and only existing roads may be used. Work sites shall be clearly demarcated and road signs erected where needed. The general public should not have unauthorised/uncontrolled access to the site during decommissioning and operational phase.

The camp entrance will be manned during the operation hours, but will be lockable to prevent unauthorised entry. Suitable signs must also be erected on the approach roads and on-site, to direct drivers and to control speed.

Road access to the working zones of the project must be maintained at all times in a manner suitable to accommodate vehicles normally expected to use the facility. Roads must be regularly graded and wetted to control dust, where necessary.

4.10.1.2 Fire and safety management

Should there be a need for electrical wiring at the facility in future, it must be approved by a qualified electrician/electrical engineer who will issue a Certificate of Compliance.

This site does not in any way accommodate hazardous waste (e.g. hydrocarbons, paint, pesticides, mercury, batteries, radioactive waste e.t.c.) disposal. Hydrocarbons are volatile under certain conditions and their vapours in specific concentrations are flammable. If precautions are not taken to prevent their ignition, fire and subsequent safety risks may arise.

No fire, whether for cooking or any other purpose, is to be made at site during any of the three phases (construction, operational and decommissioning). The Contractor shall take all reasonable measures and active steps to avoid increasing the risk of fire through activities on site and prevent the accidental occurrence or spread of fire; and shall ensure that there is sufficient fire-fighting equipment on site at all times. This equipment shall include fire extinguishers. The Contractor should be prepared for such events.

The METDECCI ENERGY INVESTMENT (PTY) LTD management together with contractors shall take all reasonable measures to avoid increasing the risk of fire and shall ensure that there is sufficient fire-fighting equipment on site at all times.

4.10.1.3 Staff management

The Contractor must ensure that their employees have suitable personal protective equipment and properly trained in fire fighting and first aid. Training records must be kept for future references.

4.10.1.4 Waste management

Construction rubble shall be disposed of in pre-agreed demarcated dumps that have been approved by the neighbouring local authority. To reduce littering impacts, refuse bins must be placed at strategic locations to ensure that litter does not accumulate within the construction site. All windblown litter must be collected by hand around the site on a daily/weekly basis depending on the severity.

Regular housekeeping is encouraged regularly. Skip containers on site must be maintained at all times, and they must be animal proof and arrangements must be made regular collection with the nearest local authority or private waste removal contractors.

All hazardous materials must either be stored in a bunded or lined areas and then disposed of at an approved hazardous waste site. It remains the contractor's responsibility to install mobile toilets on site. The ablution facilities must 100m away from working zones and 60m away from any surface or groundwater resource. Spills must be cleaned up immediately and disposed at an appropriate landfill or bio-remediated.

4.10.1.5 Cement and concrete batching

Concrete mixing directly on the ground shall not be allowed and shall take place on an impermeable surface. All run-off from batching areas shall be strictly controlled, and cement contaminated water shall be collected, stored and disposed of at a licensed suitable waste disposal facility.

4.10.1.6 Hydrocarbons management

If any spillage occurs, contaminated soil shall be collected in a holding tray or drum and which will then disposed at a **hazardous waste disposal site**. Any spillage of more than 200 litres must be reported to the Ministry of Mines and Energy as per the Petroleum Products Act.

The Contractor shall take all reasonable measures to prevent surface or groundwater pollution from the release of oils and fuels.

4.10.1.7 Information board

The Contractor will be responsible for erecting information boards on site. The number and locations of these boards shall be agreed upon by the ECO officer.

The contents of the information board shall be provided by the Technical Manager and will essentially be to advise the public of the construction activity and the prohibition on entering certain areas. The information board shall also provide the contact number of the ECO, to ensure that the public can access

relevant information and lodge any complaints during construction and operational phase of the power line.

4.10.1.8 Flood management

The power line will be designed in a way that it can withstand flood. Storm water management of the site should be a key aspect of flood management on site. The site must be managed in order to prevent pollution of drains, downstream watercourse or groundwater due to suspended solids, silt or pollutants.

4.10.1.9 Progressive Rehabilitation

All final levels and slopes must be in conformance with the design and the end-use plan, with slopes no steeper than 1:3. Rehabilitation must commence as soon as possible on areas where no further construction is to take place. Once the final level is achieved the area must be capped and covered with the final cover indigenous vegetation.

4.10.2 Management of environmental aspects during all phases of the project

Groundwater

Maintenance/Decommissioning phase	
Description	Groundwater contamination can be caused by leakages and spills of fuel from machinery and heavy-duty vehicles during the decommissioning phase. Care must be taken to avoid contamination of soil and groundwater.
Proposed Mitigation Measures	Prevent spillages of any chemical or fuel. Use drip trays when doing maintenance on machinery. Maintenance should be done on dedicated areas with linings or concrete floor. No maintenance of machinery may be done at the site. All Storage tanks containing hazardous materials must be placed in bunded containment areas with sealed surfaces. The bund wall must be high enough to contain a minimum of 110% of the total volume of the stored hazardous materials. All hazardous materials must be stored 50m away from surface water bodies. Contaminated waste water must be managed to ensure or prevention of groundwater pollution. Cement contaminated water must not enter the water system as this disturbs the natural acidity of the soil and affects plant growth. Workers will not be allowed to use any open water body or natural water source for the purpose of bathing, washing of clothing or for any construction related activities. The site must be managed in order to prevent pollution of drains, downstream watercourses, due to suspended solids, silt or pollutants.
Proposed Monitoring	Regular visual inspection.
Responsible Party	METDECCI ENERGY INVESTMENT (PTY) LTD/Contractors

Operational phase	
Description	Spillages from machinery might occur during maintenance.
Proposed Mitigation Measures	The risk can be lowered further through proper training of staff. All spills must be cleaned up immediately. The presence of an emergency response plan and suitable equipment is advised, so as to react to any spillage or leakages properly and efficiently.
Proposed Monitoring	Sampling the nearest boreholes in the area for pollution when any significant water quality changes have been reported.
Responsible Party	METDECCI ENERGY INVESTMENT (PTY) LTD

Surface Water and Stormwater

Maintenance/Decommissioning phase	
Description	Leakage from machinery during the decommissioning phase. Oil Spills from heavy equipment and machinery may form a film on water surfaces causing physical damage to organisms. Oxygen transfer could be impaired.
Proposed Mitigation Measures	Machinery should not be serviced on site to avoid spills. All spills should be cleaned up as soon as possible. Hydrocarbon/chemical contaminated soil; clothing or equipments should not be washed within 25m of any surface water. The site must be managed in order to prevent pollution of drains, downstream watercourses, due to suspended solids, silt or pollutants. Earth, stone and rubble is to be properly disposed of so as not to obstruct natural water path ways (rivers, drainage line, stormwater channels) over the site.
Proposed Monitoring	Regular visual inspection. Surface water quality monitoring in cases of evident pollution.
Responsible Party	METDECCI ENERGY INVESTMENT (PTY) LTD/Contractors

Operational phase	
Description	Spillages might occur during the maintenance of the solar plant and its associated infrastructure. Contaminated soil might pose a risk to surface water bodies in the area in case of huge spill.
Proposed Mitigation Measures	All spills should be cleaned up as soon as possible. The presence of an emergency response plan and suitable equipment is advised, so as to react to any spillage or leakages properly and efficiently.
Proposed Monitoring	Regular visual inspection. Surface water monitoring sampling for hydrocarbon pollution.
Responsible Party	METDECCI ENERGY INVESTMENT (PTY) LTD

Air quality (including dust)

Maintenance/Decommissioning phase	
Description	Dust may be produced during the maintenance phase; and might be worsened when strong winds occur. These are expected to be site specific and could potentially pose a nuisance to the neighbouring properties. The possible decommissioning of the power line will have minimal impact on the surrounding air quality.
Proposed Mitigation Measures	Excavation, handling and transport of materials must be avoided under high wind conditions. During high winds, dust suppression measures may be required (e.g. dampening with water). Retention of vegetation where possible will reduce dust travel. speed limits of 20km/h must be enforced on dirt roads. To reduce odour impacts, regular servicing of vehicles in order to limit gaseous emissions (off-site), and regular servicing of on-site toilets to avoid potential odours. LP Gas cookers may be used , to ensure safety and avoid fires. No open fires
Proposed Monitoring	Regular visual inspection.
Responsible Party	METDECCI ENERGY INVESTMENT (PTY) LTD/Contractors

Operational phase	
Description	Dust and odour will normally be released during maintenance of vehicles.
Proposed Mitigation Measures	Vehicles idling time shall be minimised by putting up educative signs. To reduce odour impacts, regular servicing of vehicles in order to limit gaseous emissions (off-site).
Proposed Monitoring	A complaints register regarding dust/emissions/odour should be kept and acted on if it becomes a regular complaint.
Responsible Body	METDECCI ENERGY INVESTMENT (PTY) LTD

Health and Safety

Maintenance/Decommissioning phase	
Description	During the maintenance or decommissioning phase, earthmoving equipment will be used on site. This increases the possibility of injuries. The presence of equipment lying around on site may encourage criminal activities (theft). Veld fires could also be an issue on site.
Proposed Mitigation Measures	Equipment and machinery operators should be equipped with ear protection equipment. Operations should be strictly between 07H00 to 19H00. First aid and safety awareness training for contractors. Ensure the general safety and security at all times by providing day and night security guards and adequate lighting within and around the premises. The staff must be properly trained on safety and health issues of the project. Workers should be fully equipped with personal protective equipment gear. No cooking in the open may be allowed to avoid veld fires.
Proposed Monitoring	Safety procedures evaluation. Health and safety incident monitoring.
Responsible Party	METDECCI ENERGY INVESTMENT (PTY) LTD/Contractors

Operational phase	
Description	The operations of the Solar PV Plant can cause health and safety risks to workers on site and the neighbouring communities. Occupational exposures are normally related to inhalation of harmful vapours and physical contact with pollutants or electrocution.
Proposed Mitigation Measures	Ensure the general safety and security at all times by providing day and night security guards and adequate lighting within and around the premises. Operators must be properly trained on safety and health issues of the project, including HIV/AIDS. Well stocked first aid box which is readily available and accessible should be provided on site. Signs such as 'NO SMOKING' must be prominently displayed in parts where flammable materials are stored on the site. Workers should be fully equipped with personal protective equipment gear. It is not recommended that humans live under power lines due to the effects of electro magnetic fields (EMF).
Proposed Monitoring	Regular inspection and incident monitoring report evaluation.
Responsible Body	METDECCI ENERGY INVESTMENT (PTY) LTD

Noise Pollution

Maintenance/Decommissioning phase	
Description	Noise pollution due to heavy-duty equipment and machinery on site. Noise emanating from excavating and site clearing activities.
Proposed Mitigation Measures	Sensitize construction vehicle drivers and machinery operators to switch off engines of vehicles or machinery not being used. Ensure engines of machinery are fitted with mufflers. Equipment and machinery operators should be equipped with ear protection equipment. Operations should be strictly between 07H00 to 19H00. Noise from labourers must be controlled.
Proposed Monitoring	Strict operational times. Regular inspection.
Responsible Party	METDECCI ENERGY INVESTMENT (PTY) LTD/Contractors

Operational phase	
Description	Noise pollution generated from vehicles accessing the plant and those using the navachab mine road.
Proposed Mitigation Measures	Sensitize maintenance vehicle drivers and machinery operators to switch off engines of vehicles or machinery not being used. Ensure engines of machinery are fitted with mufflers. Equipment and machinery operators should be equipped with ear protection equipment. Operations should be strictly between 07H00 to 19H00. Noise from labourers must be controlled. Loud music from vehicles loading should be restricted.
Proposed Monitoring	Strict delivery and collection times. Observation of on-site noise levels by the Site Manager or Supervisor.
Responsible Body	METDECCI ENERGY INVESTMENT (PTY) LTD

Waste Generation

Maintenance/Decommissioning phase	
Description	This can be in a form of contaminated soil, building rubble , hazardous waste and domestic waste disposed.
Proposed Mitigation Measures	Ensure that no excavated soil, refuse or building rubble generated on site are placed, dumped or deposited on adjacent/surrounding properties or land. All waste must be taken away from site and disposed of at an approved waste disposal site. Construction rubble shall be disposed of in pre-agreed, demarcated spoil dumps that have been approved by the relevant local authority. Regular housekeeping and waste skips maintenance must be enforced during the maintenance phase. The skips must be animal-proof , and arrangements for them to be picked up regularly should be in place. All hazardous waste materials must either be stored in a bunded or lined area, and then disposed at an appropriate hazardous waste disposal site. The contractor must install mobile toilets on site, which should at least be within 100m from working zones, but not 60m closer to any surface water body or boreholes. Contaminated soil can be bio-remediated or excavated and disposed of at an approved hazardous landfill.
Proposed Monitoring	Regular inspection and housekeeping procedure monitoring. Observation of site appearance by the manager.
Responsible Party	METDECCI ENERGY INVESTMENT (PTY) LTD/Contractors

Operational phase	
Description	Waste in the form of contaminated soil, rubble and domestic waste. Littering along access roads may also be produced during the operational phase.
Proposed Mitigation Measures	Waste minimization policy should be formulated by METDECCI ENERGY INVESTMENT (PTY) LTD. Burning of waste material is not allowed. Regular maintenance and housekeeping of the access roads. No hazardous waste may be disposed off at the Site. Contaminated soil can be bio-remediated or excavated and disposed of at an approved hazardous landfill.
Proposed Monitoring	Regular visual inspection.
Responsible Body	METDECCI ENERGY INVESTMENT (PTY) LTD (Site Manager)

Traffic

Maintenance/Decommissioning phase	
Description	Maintenance site related activities are expected to have a minimal impact on the movement of traffic along B1 road and the Navachab mine road . Diversion of traffic or closure of roads is not expected.
Proposed Mitigation Measures	It is recommended that if the need arises for traffic diversion or road closure, the METDECCI ENERGY INVESTMENT (PTY) LTD should liaise with the relevant authorities. Speed limit and site warning signs must be erected to minimise accidents. Construction vehicles must be tagged with reflective signs or tapes to maximise visibility of the vehicles and avoid accidents.
Proposed Monitoring	Observations of the traffic flow on the mine road and B2 road.
Responsible Party	METDECCI ENERGY INVESTMENT (PTY) LTD/Contractors

Operational phase	
Description	Traffic around the solar PV plant and the Navachab mine road
Proposed Mitigation Measures	Maintenance vehicles should be limited to normal working hours (07h00 to 19h00).
Proposed Monitoring	Strict working times monitoring. Observation of traffic by the Site Manager or Supervisor.
Responsible Body	METDECCI ENERGY INVESTMENT (PTY) LTD

Ecological impacts

Maintenance/Decommissioning phase	
Description	The location of the power line is free of any conservation worthy terrestrial vegetation (except for <i>Parkinson africana</i>). Impacts on fauna and flora are expected to be low, as the area is previously disturbed, which visible signs of disturbance. Parkinson Africana specie should be avoided, conserved as much as possible.
Proposed Mitigation Measures	The site has been previously disturbed and cleared to be used as a grazing area. Prevent surface water contamination and disturbance of areas outside the designated working zone. Construction sand must not be obtained from any river tributary on site. If a nest of large birds is found in the maintenance phase, a bird specialist must be contacted to remove them.
Proposed Monitoring	Regular site inspection by the Site Manager or Supervisor.
Responsible Party	METDECCI ENERGY INVESTMENT (PTY) LTD/Contractors

Operational phase	
Description	Disturbance or impacts on fauna and flora. Very little impacts are expected as the area is already disturbed and earmarked for the servitude.
Proposed Mitigation Measures	Prevent surface water contamination and disturbance of areas outside the designated working zone.
Proposed Monitoring	Regular site inspection by the Site Manager or Supervisor.
Responsible Body	METDECCI ENERGY INVESTMENT (PTY) LTD

Spillages, leakages from trucks and vehicles

Operational phase	
Description	Fuel leakages and spillages may take place from vehicles frequenting the site during maintenance.
Proposed Mitigation Measures	This impact can be reduced by using drip trays, servicing of vehicles regularly and through proper training of the operators.
Proposed Monitoring	Regular inspection of vehicle conditions frequenting the site by the Technical Manager or Supervisor.
Responsible Body	METDECCI ENERGY INVESTMENT (PTY) LTD

Avifaunal impacts

Maintenance/Decommissioning phase	
Description	Impacts on birds breeding, foraging and roosting in or in close proximity of the site the modification of habitat.
Proposed Mitigation Measures	The site has been previously disturbed and cleared to be used as grazing land. No new areas will be cleared, and all works must be restricted to the rail servitude. Those areas surrounding the construction site that are not part of the demarcated development area should be considered as “no-go” areas for employees, machinery or even visitors. Construction workers must also be trained in awareness of priority species (i.e. Black Stork, Secretary bird, Martial Eagle, Booted Eagle, African Fish-Eagle, Peregrine Falcon, Lanner Falcon, Kori Bustard, Ludwig’s Bustard and Red Lark) in the event that a ground-based nest is discovered.
Proposed Monitoring	Regular site inspection by the Site Manager or Supervisor.
Responsible Party	METDECCI ENERGY INVESTMENT (PTY) LTD/Contractors

Operational phase	
Description	Bird collisions with powerlines and possible bird electrocutions.
Proposed Mitigation Measures	The transmission lines will be buried underground, thus reducing the risks of bird electrocution.
Proposed Monitoring	Regular site inspection by the Site Manager or Supervisor.
Responsible Body	METDECCI ENERGY INVESTMENT (PTY) LTD

Nuisance Pollution

Maintenance/Decommissioning phase	
Description	Aesthetics and inconvenience caused to person trying to access/exit the site.
Proposed Mitigation Measures	The Technical Manager or Supervisor should maintain tidiness on site at all times. Take cognition when parking vehicles and placing equipment.
Proposed Monitoring	Regular visual site inspection.
Responsible Party	METDECCI ENERGY INVESTMENT (PTY) LTD/Contractors

Fire and explosion hazard

Operational phase	
Description	Most hydrocarbon products are volatile under certain conditions and their vapours in specific concentrations and conditions are flammable. Dry cleared vegetation is flammable.
Proposed Mitigation Measures	There should be sufficient water available for fire fighting purposes. Ensure that all fire-fighting devices are in good working order and they are serviced. All personnel have to be trained about responsible fire protection measures and good housekeeping such as the removal of flammable materials on site. Vegetation under the solar must maintained and trimmed to a maximum height of 0.7m.
Proposed Monitoring	Regular inspections should be carried out to inspect and test fire fighting equipment. Perform mock fire exercises to monitor the employees' preparedness for real fire events.
Responsible Body	METDECCI ENERGY INVESTMENT (PTY) LTD

5. CONCLUSIONS

If the above-mentioned management recommendations are properly implemented, it is anticipated that most of the adverse impacts on the environment can be mitigated. An appointed environmental officer/consultant will need to monitor or audit the site throughout the operations and possible decommissioning phase to ensure that the EMP is fully implemented and complied with. The EMP caters for all project phases, but will need to be reviewed during all phases of project, especially when revisions are made to the project development plans.

The Environmental Management Plan should be used as an on-site tool during all phases of the proposed project. Parties responsible for contravention of the EMP should be held responsible for any rehabilitation that may need to be undertaken.

Clearance certificates issued on EIA/EMPs are only valid for 3 years and will need to be reviewed and submitted to the Department of Environmental Affairs again for approval. It is the responsibility of the proponent to initiate the renewal process.

Matrix Consulting Services

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