PROPOSED UPINGTON SOLAR THERMAL PLANT TWO NORTHERN CAPE PROVINCE

DEA REFERENCE NUMBER: 14/12/16/3/3/2/656

DRAFT ENVIRONMENTAL MANAGEMENT PROGRAMME

Submitted as part of the Draft Environmental Impact Assessment Report for Public Review
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PROJECT DETAILS

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DEFINITIONS AND TERMINOLOGY

Alternatives: Alternatives are different means of meeting the general purpose and need of a proposed activity. Alternatives may include location or site alternatives, activity alternatives, process or technology alternatives, temporal alternatives or the 'do nothing' alternative.

Concentrating solar power: Solar generating facilities use the energy from the sun to generate electricity. Concentrating Solar Power facilities collect the incoming solar radiation and concentrate it (by focusing or combining it) onto a single point, thereby increasing the potential electricity generation.

Commercial Operation date: The date after which all testing and commissioning has been completed and is the initiation date to which the seller can start producing electricity for sale (i.e. when the project has been substantially completed).

Commence: The start of any physical activity, including site preparation and any other activity on site furtherance of a listed activity or specified activity, but does not include any activity required for the purposes of an investigation or feasibility study as long as such investigation or feasibility study does not constitute a listed activity or specified activity.

Commissioning: Commissioning commences once construction is completed. Commissioning covers all activities including testing after all components of the wind turbine are installed.

Construction: Construction means the building, erection or establishment of a facility, structure or infrastructure that is necessary for the undertaking of a listed or specified activity. Construction begins with any activity which requires Environmental Authorisation.

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

Decommissioning: To take out of active service permanently or dismantle partly or wholly, or closure of a facility to the extent that it cannot be readily re-commissioned. This usually occurs at the end of the life of a facility.

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

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

Drainage line: A drainage line is a lower category or order of watercourse that does not have a clearly defined bed or bank. It carries water only during or immediately after periods of heavy rainfall i.e. non-perennial and riparian vegetation may or may not be present.

Endangered species: Taxa in danger of extinction and whose survival is unlikely if the causal factors continue operating. Included here are taxa whose numbers of individuals have been reduced to a critical level or whose habitats have been so drastically reduced that they are deemed to be in immediate danger of extinction.

Emergency: An undesired/ unplanned event that results in a significant environmental impact and requires the notification of the relevant statutory body, such as a local authority.

Endemic: An "endemic" is a species that grows in a particular area (is endemic to that region) and has a restricted distribution. It is only found in a particular place. Whether something is endemic or not depends on the geographical boundaries of the area in question and the area can be defined at different scales.

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

i. The land, water and atmosphere of the earth;
ii. Micro-organisms, plant and animal life;
iii. Any part or combination of (i) and (ii) and the interrelationships among and between them; and
iv. The physical, chemical, aesthetic and cultural properties and conditions of the foregoing that influence human health and well-being.

Environmental impact: An action or series of actions that have an effect on the environment.

Environmental impact assessment: Environmental Impact Assessment, as defined in the NEMA EIA Regulations and in relation to an application to which scoping must be applied, means the process of collecting, organising, analysing, interpreting and communicating information that is relevant to the consideration of that application.

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

Environmental management programme: An operational plan that organises and co-ordinates mitigation, rehabilitation and monitoring measures in order to guide the implementation of a proposal and its ongoing maintenance after implementation.

Hazardous waste: Any waste that contains organic or inorganic elements or compounds that may, owing to the inherent physical, chemical or toxicological characteristics of that waste, have a detrimental impact on health and the environment (Van der Linde and Feris, 2010;pg 185).

Heliostats: Heliostats are mirrors that track the sun and reflect the sunlight onto a central receiving point (the power tower)

Heritage: That which is inherited and forms part of the National Estate (Historical places, objects, fossils as defined by the National Heritage Resources Act of 2000).

Indigenous: All biological organisms that occurred naturally within the study area prior to 1800

Indirect impacts: Indirect or induced changes that may occur because of the activity (e.g. the reduction of water in a stream that supply water to a reservoir that supply water to the activity). These types of impacts include all the potential impacts that do not manifest immediately when the activity is undertaken or which occur at a different place because of the activity.

Interested and affected party: Individuals or groups concerned with or affected by an activity and its consequences. These include the authorities, local communities, investors, work force, consumers, environmental interest groups, and the public.

Method statement: A written submission to the ECO and the site manager (or engineer) by the EPC Contractor in collaboration with his/her Environmental Representative.

Natural properties of an ecosystem (*sensu* convention on wetlands): Defined in Handbook 1 as the "…physical, biological or chemical components, such as soil, water, plants, animals and nutrients, and the interactions between them." (Ramsar Convention Secretariat 2004. Ramsar handbooks for the wise use of wetlands. 2nd Edition. Handbook 1. Ramsar Convention Secretariat, Gland, Switzerland.) (See http://www.ramsar.org/).

No-go areas: Areas of environmental sensitivity that should not be impacted on or utilised during the development of a project as identified in any environmental reports.

Perennial and non-perennial: Perennial systems contain flow or standing water for all or a large proportion of any given year, while non-perennial systems are episodic or ephemeral and thus contains flows for short periods, such as a few hours or days in the case of drainage lines.

Pollution: A change in the environment caused by substances (radio-active or other waves, noise, odours, dust or heat emitted from any activity, including the storage or treatment or waste or substances.

Power Tower: A CSP technology, a type of solar furnace using a 200m – 300m tower to receive focused sunlight. It uses an array of flat, movable mirrors (called heliostats) to focus the sun's rays upon a collector tower (the target).

Pre-construction: The period prior to the commencement of construction, this may include activities which do not require Environmental Authorisation (e.g. geotechnical surveys).

Ramsar convention on wetlands: "The Convention on Wetlands (Ramsar, Iran, 1971) is an intergovernmental treaty whose mission is "the conservation and wise use of all wetlands through local, regional, and national actions and international cooperation, as a contribution towards achieving sustainable development throughout the world." As of March 2004, 138 nations have joined the Convention as Contracting Parties, and more than 1300 wetlands around the world, covering almost 120 million hectares, have been designated for inclusion in the Ramsar List of Wetlands of International Importance." (Ramsar Convention Secretariat. 2004. Ramsar handbooks for the wise use of wetlands. 2nd Edition, Handbook 1. Ramsar Convention Secretariat, Gland, Switzerland.) (Refer http://www.ramsar.org/). South Africa is a Contracting Party to the Convention.

Rare species: Taxa with small world populations that are not at present Endangered or Vulnerable, but are at risk as some unexpected threat could easily cause a critical decline. These taxa are usually localised within restricted geographical areas or habitats or are thinly scattered over a more extensive range. This category was termed Critically

Rare by Hall and Veldhuis (1985) to distinguish it from the more generally used word "rare."

Red data species: Species listed in terms of the International Union for Conservation of Nature and Natural Resources (IUCN) Red List of Threatened Species, and/or in terms of the South African Red Data list. In terms of the South African Red Data list, species are classified as being extinct, endangered, vulnerable, rare, indeterminate, insufficiently known or not threatened (see other definitions within this glossary).

Riparian: the area of land adjacent to a stream or river that is influenced by stream-induced or related processes. Riparian areas which are saturated or flooded for prolonged periods would be considered wetlands and could be described as riparian wetlands. However, some riparian areas are not wetlands (e.g. an area where alluvium is periodically deposited by a stream during floods but which is well drained).

Significant impact: An impact that by its magnitude, duration, intensity, or probability of occurrence may have a notable effect on one or more aspects of the environment.

Waste: Any substance, whether or not that substance can be reduced re-used, recycled and recovered; that is surplus, unwanted, rejected, discarded, abandoned or disposed of which the generator has no further use for the purposes of production. Any product which must be treated and disposed of, that is identified as waste by the minister of Environmental affairs (by notice in the Gazette) and includes waste generated by the mining, medical or other sectors, but: A by-product is not considered waste, and portion of waste, once re-used, recycled and recovered, ceases to be waste (Van der Linde and Feris, 2010; pg 186).

Water course: as per the National Water Act means -

* a river or spring;
* a natural channel in which water flows regularly or intermittently;
* a wetland, lake or dam into which, or from which, water flows; and
* any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse, and a reference to a watercourse includes, where relevant, its bed and banks

Wetland: Land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which under normal circumstances supports or would support vegetation typically adapted to life in saturated soil (Water Act 36 of 1998); land where an excess of water is the dominant factor determining the nature of the soil development and the types of plants and animals living at the soil surface (Cowardin *et al*., 1979).

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INTRODUCTION CHAPTER 1

1.1. Summary of the Proposed Project

Abengoa Solar Power South Africa (Pty) Ltd (herein referred to as the "Developer") is proposing the construction and operation of a commercial solar thermal electricity generating facility (using power tower technology) and associated infrastructure near Upington, Northern Cape Province. The project is known as the Upington Solar Thermal Plant Two, and is one of three Abengoa Solar CSP facilities proposed to be established on Portion 3 of the farm McTaggarts Camp 453. The three Abengoa Solar facilities are as follows:

» Khi Solar One Solar Thermal Plant (a 50MW power tower technology), which is currently under construction (planned commercial operation date is end-2014).
» Proposed Upington Solar Thermal Plant Two (up to 125MW power tower technology), which is the subject of this EIA (DEA Ref Number 14/12/16/3/3/2/656).
» Proposed Upington Solar Thermal Plant Three (up to 125MW trough plant technology), which is currently under EIA (DEA Ref Number14/12/16/3/3/2/657).

Each project is located on a different area within Portion 3 of the Farm McTaggarts Camp 453, which lies approximately 20 km west of the town of Upington in the Northern Cape. It is the developer's intention to bid each CSP Facility under the Department of Energy's (DoE) Renewable Energy Independent Power Producer Procurement (REIPPP) Programme. The power generated from the CSP facilities will be sold to Eskom through a 20-year power purchase agreement (PPA) and will feed into the national electricity grid. Ultimately, the projects are intended to be a part of the renewable energy projects portfolio for South Africa. This EMPr Report applies to the Proposed Upington Solar Thermal Plant Two (DEA Reference Number: 14/12/16/3/3/2/656).

The Upington Solar Thermal Plant Two is proposed to utilise power tower technology with a generation capacity of up to 125MW[1]. A locality map showing the proposed location of the Upington Solar Thermal Plant Two on Portion 3 of the Farm McTaggarts Camp 453 (and in relation to the Khi Solar One facility under construction, and the proposed Upington Solar Thermal Two facility) is included as Figure 1. The site falls within Ward 8 of the Kai !Garib Local Municipality but is physically closer to the town of Keimos and Upington.

[1] Power Tower plants are modular in nature, and can easily be adapted to change the generation capacity of the plant. It is expected that the Department of Energy may soon make provision for CSP facilities up to a capacity of 125MW to be bid through their REIPPP Programme (current cap as of March 2014 is 100MW).

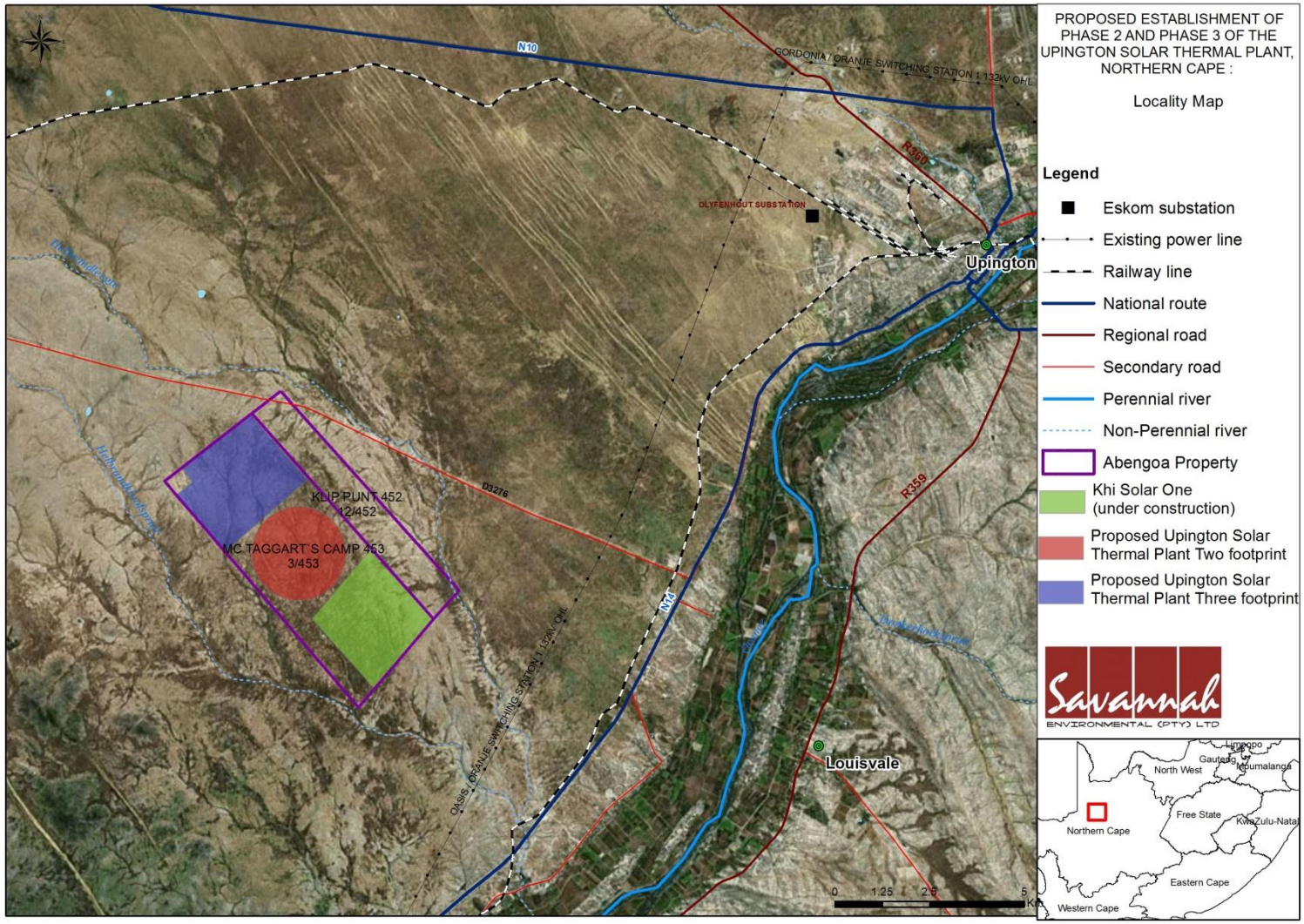


Figure 1: Locality map showing the proposed site for the construction of the Upington Solar Thermal Plant Two (in relation to the Khi Solar One Solar Thermal Plant and proposed Upington Solar Thermal Plant Three) on Portion 3 of the farm McTaggarts Camp 453

The Upington Solar Thermal Plant Two is proposed to utilise power tower technology with a generation capacity of up to 125MW, and energy storage of up to 6 hours (using molten salts technology). A power tower system comprises of a heat collection system and a conventional generating plant portion. The heat collection system consists of **heliostats** (movable, flat reflective mirrors roughly 140 m^2 which are oriented according to the sun's position in order to capture and reflect the solar radiation) and a **receiver** (consisting of metal tubes which transfer the heat from the solar radiation to water or molten salt with the purpose of generating steam). The receiver is mounted on a 200m to 300m high **power tower** that provides elevation and structurally supports the receiver. The collected energy in the power tower is used to generate steam through a conventional heat exchanger system that is in turn used for electricity generation in a conventional steam turbine and generator.

The Upington Solar Thermal Plant Two will have a development footprint of up to 700 ha, to be placed within a demarcated area of 600ha (which is located within a broader site of ~2200 ha) and will include the following associated infrastructure:

» Solar tower with central receivers and heliostat technology using superheated steam with dry cooling (700 hectares in extent).
» Power island which will include a steam turbine and generator; a dry cooled condenser; a generator transformer and substation; auxiliary fossil fuel and/or electric boilers and associated molten salt storage vessels and heat exchangers (approximately 200m x 500m in extent).
» Access roads (roads up to 6m wide).
» Plant substation (50m x 50m).
» 132 kV power line up to 4km in length to connect to Eskom's existing McTaggerts Substation, which is located on the same property as the proposed CSP Plant.
» Water abstraction point located at the Gariep River, filter station (20m x 30m) and water supply pipeline (up to 20km in length).
» Water storage reservoir and tanks (combined capacity up to 15 000m^3).
» Packaged water treatment plant (roughly 30m x 30 m).
» Up to 5 lined evaporation ponds (approximately 100m x 100m each).
» Workshop and office buildings (approximately 20m x 50m each).
» Mirror assembly facility (approximately 100m x 50m)

A layout map is included in Appendix A.

1.2 Findings of the Environmental Impact Assessment

The findings of the specialist studies undertaken within this EIA to assess both the benefits and potential negative impacts anticipated from the proposed project conclude that:

- There are **no environmental fatal flaws** that should prevent the proposed CSP Plant and associated infrastructure from proceeding on the identified site, provided that the recommended mitigation and management measures are implemented, and given due consideration during the process of finalising the facility layout.
- The proposed development on the site will create a localised reduction of indigenous trees and shrubs, geophytes and other species of conservation concern, but not to a degree that the current conservation status of such species will be negatively affected. Due to the areas of high ecological sensitivity being avoided by the design and layout of the CSP Plant, the **ecological impacts** of the CSP plant will be of a medium acceptable significance.
- The threat to **fauna and avifauna** communities would be from the loss of habitat, disturbance, collisions with the overhead power line and/or any interaction of fauna with the facility, and is not anticipated to have a significant negative impact on fauna in the area.
- Very sparse **heritage resources** were found during the field survey undertaken for the site. From an archaeological perspective the observed heritage resources may be regarded as being of generally low significance. The **fossil record** from Kalahari deposits is very poor with respect to finds of fossil bones of vertebrates.
- The cumulative significance of all the potential impacts on the **soils** is medium to low due to the limited scale of the development and the scarcity of development in the immediate surrounding area.
- The anticipated **visual** impact is not considered to be a fatal flaw from a visual perspective, considering the low incidence of visual receptors in the region and the contained area of potential visual exposure.
- The development will have both positive and negative **social** impacts. It will create employment and business opportunities for locals during both the construction and operational phases and represent an investment in clean, renewable energy infrastructure. The potential for cumulative impacts also exists due to the proximity of the other authorised and proposed CSP and solar projects adjacent to the site, however, these impacts are not considered to represent a fatal flaw, and in addition, there is no indication if (or when) other developments will take place.
- When considering these technical considerations, access Alternative 1 is nominated as the preferred access route alternative.
- The benefits of the project are expected to occur at a national, regional and local level. These benefits partially offset the localised environmental costs of the project.

The significance levels of the majority of identified negative impacts can generally be reduced by implementing the recommended mitigation measures. With reference to the information available at this planning approval stage in the project cycle, the **confidence** in the environmental assessment undertaken is regarded as **acceptable**.

An environmental sensitivity map is included in Appendix B.

1.3 Activities and Components associated with the Solar Energy Facility

Table 2.1 below described the dimensions of the main infrastructural components for one 125W power tower plant (the Upington Solar Thermal Plant Two).

Table 2.1: Dimensions of the main infrastructural components for a 125W power tower plant

Infrastructure	Footprint	Height
Power Tower	Approx. 50m in diameter (~10ha)	200m – 300m
Heliostat field	up to 700 ha	6m pedestal
Power island and steam turbine and generator	200m x 500m	40m
Molten salt storage tanks	4 tanks each 40m diameter	40 m
Auxiliary boilers	10m x 10m	5 m
Water storage reservoir and tanks (combined capacity up to 15 000m^3) and associated infrastructure	Tanks 15m to 20m diameter	Up to 30 m
Substation	50m x 50m	40 m
132 kV power line	32 m servitude, 4 km in length	25 - 35m towers
Workshop building (maintenance) and office buildings	20m x 50m each	20m
Packaged waste treatment plant	30m x 30m	10m
Lined evaporation ponds	5 ha - 5 ponds 100m x 100m each	1.8 m deep
Mirror assembly facility	100m x 50m	20m
Internal access roads	6m wide, 10km in length	n/a
Water abstraction point located at the Gariep River, filter station	20m x 30m	1 storey
Water supply pipeline	20km in length	± 1m depth (where practical)
Temporary laydown area and construction camp.	200m x 200m	10m
Concrete batching plant	112m x 80m	15m

Table 2.2: Activities associated with Planning, Construction, Operation, and Decommissioning of the Upington Solar Thermal Plant Two

Main Activity/Project Component	Components of Activity	Details
	Planning	
Conduct technical surveys	» Geotechnical survey by geotechnical engineering company. » Site survey and confirmation of the micro-siting footprint for the solar arrays and associated infrastructure by professional surveyor. » Survey of power line, internal access road and water supply pipeline servitudes by professional surveyor.	All surveys are to be undertaken prior to initiating construction.
	Construction	
Establishment of access roads	Establish internal access road (i.e. internal asphalt access roads of approximately 6 m wide which will lead directly to the power island for use during construction and operation phase).	» Access roads will be constructed in advance of any components being delivered to site, and will remain in place after completion for future access. » Existing access roads to the site will be utilised, and upgraded where required. » Special haul roads may need to be constructed to and within the site to accommodate abnormally loaded vehicle access and circulation. » The internal service road alignment will be informed by the final micro-siting/positioning of the solar array and the power island.
Undertake site preparation	» Site establishment of offices/ workshop with ablutions, storage areas, and contractors camp » Clearance of vegetation at the footprint of the solar field.	» These activities will require the stripping of topsoil, which will need to be appropriately stockpiled for use in rehabilitation. » A temporary construction area is needed for containers, toilets, and equipment. » Laydown areas are also required. » Requires the clearing of vegetation and levelling of the

Main Activity/Project Component	Components of Activity	Details
		development site. » Lay down areas for building materials and equipment associated with these buildings will also be required.
Construct foundations for the power tower, power island and workshops, offices, storage areas and associated infrastructure	Excavations for foundations (final dimensions to be defined by final design and EPC contractor).	» Foundations will be excavated as required. » Shoring and safety barriers will be erected. » Aggregate and cement to be transported from the closest centre to the development, with the establishment of a concrete batching plant close to the activities (i.e. this would most likely be a movable plant).
Transport of components and equipment to site	» Flatbed and other trucks will be used to transport all components to site. » The normal civil engineering construction equipment for the civil works (e.g. excavators, trucks, graders, compaction equipment, cement mixers, etc.). » The components required for the establishment of the substation (including transformers). » Components required for the establishment of the power line (including monopole towers and cabling). » Ready-mix cement trucks for power tower, power block and workshop/storage area foundations.	» The solar arrays will be brought to site by the supplier in sections to be assembled on-site in a designated assembly building. » Individual components *may* be defined as abnormal loads in terms of the Road Traffic Act (Act No 29 of 1989) by virtue of the dimensional limitations. » The dimensional requirements of the load during the construction phase (length/height) may require alterations to the existing road infrastructure (widening on corners, removal of traffic islands), accommodation of street furniture (electricity, street lighting, traffic signals, telephone lines etc.), and protection of road-related structures (bridges, culverts, portal culverts, retaining walls etc) as a result of abnormal loading. » The equipment will be transported to the site using appropriate National and Provincial routes, and the dedicated access/haul road to the site itself.
Construct power island and ancillary infrastructure	» Steam turbine and generator. » Generator transformer. » An auxiliary steam boiler and associated vessels (i.e. fossil fuel	» The substation will be constructed with a high-voltage (HV) yard footprint of up to 50m x 50 m. » The substation would be constructed in the following simplified sequence:

Main Activity/Project Component	Components of Activity	Details
	boiler/ generator), proposed to be fired by either diesel fuel or liquid petroleum gas (LPG). » Substation and associated components. » Security fencing around high-voltage (HV) yard.	* Step 1: Survey of the site * Step 2: Site clearing and levelling and construction of access road to substation site * Step 3: Construction of terraces and foundations * Step 4: Assembly, erection and installation of equipment (including transformers) * Step 5: Connection of conductors to equipment * Step 6: Rehabilitation of any disturbed areas and protection of erosion sensitive areas
Connection of the CSP plant and the steam turbine and generator to the substation	» CSP infrastructure. » Underground electrical cabling connecting the steam turbine and generator to the substation.	» The installation of these cables will require the excavation of trenches, approximately 1 m in depth within which these cables can then be laid. The underground cables would follow the internal access roads as far as reasonably possible.
Connect substation to the power grid	» One overhead 132 kV power line connecting the substation to the McTaggarts Substation.	» The route for the power line will be assessed, surveyed, and pegged prior to construction. » Servitude of approximately 32 m will be required for the power line.
Commissioning of the facility	Solar energy facility commissioning.	» Prior to the start-up of solar component, a series of checks and tests will be carried out, including both static and dynamic tests to make sure it is working within appropriate limits. » Grid interconnection and unit synchronisation.
Undertake site remediation	» Remove all construction equipment from the site. » Rehabilitation of temporarily disturbed areas where practical and reasonable.	» On full commissioning of the facility, any access points to the site which are not required during the operation phase will be closed and prepared for rehabilitation.
Operation		
Operation	Operation of power tower and heliostat	» Once operational, the solar energy facility will be monitored

Main Activity/Project Component	Components of Activity	Details
	field within the solar energy facility.	and maintained by a staff complement of approximately 80 full time employees. » All solar components will be operational, except during mechanical breakdown, extreme weather conditions or maintenance activities.
Maintenance	» Oil and grease – moving components of the solar arrays. » Diesel or LPG for the auxiliary boiler. » Transformer oil – substation. » Waste product disposal.	» The solar components will be subject to periodic maintenance and inspection. » Any waste products (e.g. used oil and grease etc.) will be disposed of in accordance with relevant waste management legislation (OHS Act). » The solar infrastructure is expected to have a lifespan of approximately 35 years, with proper maintenance and refurbishment this could be expanded.
Decommissioning		
Site preparation	» Confirming the integrity of the access to the site to accommodate required equipment. » Preparation of the site. » Mobilisation of construction equipment.	» Equipment associated with this facility would only be decommissioned once it has reached the end of its economic life. » It is most likely that decommissioning activities of the infrastructure of the facility would comprise the disassembly and replacement of the solar infrastructure with more appropriate technology/infrastructure available at that time.
Disassemble and replace existing solar components	General construction equipment will be required to replace components of the solar facility.	» Components would be reused, recycled, or disposed of in accordance with regulatory requirements. » The hours of operation for noisy construction activities are guided by the Environment Conservation Act (noise control regulations). » If the project requires construction work outside of the designated hours, regulatory authorities will be consulted and affected stakeholders informed.

PURPOSE & OBJECTIVES OF THE EMPR CHAPTER 2

An Environmental Management Programme (EMPr) is defined as "an environmental management tool used to ensure that undue or reasonably avoidable adverse impacts of the construction, operation and decommissioning of a project are prevented or mitigated, and that the positive benefits of the projects are enhanced"[2]. The objective of this EMPr is to provide consistent information and guidance for implementing the management and monitoring measures established in the permitting process and help achieve environmental policy goals. The purpose of an EMPr is to ensure continuous improvement of environmental performance, reducing negative impacts and enhancing positive effects during the construction and operation of the facility. An effective EMPr is concerned with both the immediate outcome as well as the long-term impacts of the project.

The EMPr provides specific environmental guidance for the construction and operation phases of a project, and is intended to manage and mitigate construction and operation activities so that unnecessary or preventable environmental impacts do not result. These impacts range from those incurred during start up (i.e. site clearing and site establishment), during the construction activities themselves (i.e. erosion, noise, dust, and visual impacts), during site remediation (i.e. soil stabilisation, re-vegetation), during operation and decommissioning (i.e. similar to construction phase activities).

The EMPr has been developed as a set of environmental specifications (i.e. principles of environmental management), which are appropriately contextualised to provide clear guidance in terms of the on-site implementation of these specifications (i.e. on-site contextualisation is provided through the inclusion of various monitoring and implementation tools and the development of Method Statements). During its lifecycle, projects journey through four distinctive phases, i.e. planning, construction, operational, and decommissioning phases. The EMPr is accordingly separated into measures dealing with the various project phases.

This EMPr has the following objectives:

» Outline mitigation measures and environmental specifications which are required to be implemented for the planning, construction and rehabilitation, operation, and decommissioning phases of the project in order to manage and minimise the extent of potential environmental impacts associated with the facility.

[2] Provincial Government Northern Cape, Department of Environmental Affairs and Development Planning: *Guideline for Environmental Management Plans*. 2005

» Ensure that all the phases of the project do not result in undue or reasonably avoidable adverse environmental impacts, and ensure that any potential environmental benefits are enhanced.
» Identify entities responsible for the implementation of the measures and outline functions and responsibilities.
» Propose mechanisms and frequency for monitoring compliance, and preventing long-term or permanent environmental degradation.
» Facilitate appropriate and proactive responses to unforeseen events or changes in project implementation that was not considered in the EIA process.

The management and mitigation measures identified within the Environmental Impact Assessment (EIA) process are systematically addressed in this EMPr, and ensure the minimisation of adverse environmental impacts to an acceptable level.

The developer must ensure that the implementation of the project complies with the requirements of all environmental authorisations, permits, and obligations emanating from all relevant environmental legislation. This obligation is partly met through the development and the implementation of this EMPr through its integration into the contract documentation. Since this EMPr is part of the EIA process it is important that this guideline document be read in conjunction with the Scoping Report and EIA Report. This will contextualise the EMPr and enable a thorough understanding of its role and purpose in the integrated environmental management process. This EMPr has been compiled in accordance with Section 33 of the EIA Regulations on June 2010, and will be further developed in terms of specific requirements as the project develops.

In order to achieve effective environmental management, it is important that Contractors are aware of the responsibilities in terms of the relevant environmental legislation and the contents of this EMPr. The Contractor is responsible for informing employees and sub-contractors of their environmental obligations in terms of the environmental specifications, and for ensuring that employees are adequately experienced and properly trained in order to execute the works in a manner that will minimise environmental impacts. The Contractor's obligations in this regard include the following:

» Ensuring that employees have a basic understanding of the key environmental features of the construction site and the surrounding environment.
» Ensuring that a copy of the EMPr is readily available on-site, and that all site staff are aware of the location and have access to the document. Employees will be familiar with the requirements of the EMPr and the environmental specifications as they apply to the construction of the facility.
» Ensuring that, prior to commencing any site works, all employees and sub-contractors have attended an Environmental Awareness Training course. The course

must provide the site staff with an appreciation of the project's environmental requirements, and how they are to be implemented.

» Providing basic training in the identification of archaeological sites/objects, and protected flora and fauna that may be encountered on the site.

» Ensuring awareness of any other environmental matters, which are deemed to be necessary by the Environmental Control Officer (ECO).

KEY LEGISLATION APPLICABLE TO THE DEVELOPMENT CHAPTER 3

The following legislation and guidelines have informed the scope and content of this Draft EMPr:

- National Environmental Management Act (Act No 107 of 1998)
- EIA Regulations, published under Chapter 5 of the NEMA (GN R543, GN R544 and GN R546 in Government Gazette 33306 of 18 June 2010)
- Guidelines published in terms of the NEMA EIA Regulations, in particular:
  - Companion to the National Environmental Management Act (NEMA) Environmental Impact Assessment (EIA) Regulations of 2010 (Draft Guideline; DEA, 2010).
  - Public Participation in the EIA Process (DEA, 2010).
- International guidelines – the Equator Principles

Acts, standards or guidelines which have informed the project process and the scope of issues assessed within this EMPr are summarised in Table 3.1 below.

Table 3.1: Relevant legislative permitting requirements applicable to the Upington Solar Thermal Plant Two

Legislation	Applicable Requirements	Relevant Authority	Compliance requirements
	National Legislation		
National Environmental Management Act (Act No 107 of 1998)	» EIA Regulations have been promulgated in terms of Chapter 5. Activities which may not commence without an environmental authorisation are identified within these Regulations. » In terms of S24(1) of NEMA, the potential impact on the environment associated with these listed activities must be considered, investigated, assessed and reported on to the competent authority (the decision-maker) charged by NEMA with granting of the relevant environmental authorisation. » In terms of GNR 387 of 21 April 2006, a scoping and EIA process is required to be undertaken for the proposed project	» National Department of Environmental Affairs – lead authority » NC DENC - commenting authority	The listed activities triggered by the proposed solar energy facility have been identified and assessed in the EIA process being undertaken (i.e. Scoping and EIA). This EIA Report will be submitted to the competent and commenting authority in support of the application for authorisation.
National Environmental Management Act (Act No 107 of 1998)	» In terms of the Duty of Care provision in S28(1) the project proponent must ensure that reasonable measures are taken throughout the life cycle of this project to ensure that any pollution or degradation of the environment associated with this project is avoided, stopped or minimised. » In terms of NEMA, it has become the legal duty of a project proponent to consider a project holistically, and to consider the cumulative effect of a variety of impacts.	» Department of Environmental Affairs (as regulator of NEMA)	While no permitting or licensing requirements arise directly by virtue of the proposed project, this section has found application during the EIA Phase through the consideration of potential impacts (cumulative, direct, and indirect). It will continue to apply throughout the life cycle of the project.
Environment Conservation Act (Act No 73 of 1989)	» National Noise Control Regulations (GN R154 dated 10 January 1992)	» National Department of Environmental Affairs » NC DENC	There is no requirement for a noise permit in terms of the legislation. Noise impacts may result from specific activities carried

		» Local Authorities » District & Local Municipality	out during the construction phase of the project and could present an intrusion impact to the local community.
National Water Act (Act No 36 of 1998)	» Water uses must be licensed unless such water use falls into one of the categories listed in S22 of the Act or falls under the general authorisation.	» Department of Water Affairs	» The abstraction of water and storage of water are regarded as a water uses (as defined in terms of S21 of the NWA). » A water use license (WUL) is required to be obtained if wetlands or drainage lines are impacted on, or if infrastructure lies within 500m of wetland features or the regulated area of a watercourse (being the riparian zone or the 1:100yr floodline whichever is greatest). » A water use license (WUL) is required to be obtained for the handling and storage of wastewater associated with the project. » A water use license application will be applied for in line with the DWA requirements, once the project has obtained preferred bidder status.
National Water Act (Act No 36 of 1998)	» In terms of S19, the project proponent must ensure that reasonable measures are taken throughout the life cycle of this project to prevent and remedy the effects of pollution to water resources from occurring, continuing, or recurring.	» Department of Water Affairs (as regulator of NWA)	This section will apply throughout the life cycle of the project.
Minerals and Petroleum Resources Development Act (Act No 28 of 2002)	» A mining permit or mining right may be required where a mineral in question is to be mined (e.g. materials from a borrow pit) in accordance with the provisions of the Act. » Requirements for Environmental Management	» Department of Minerals and Energy	As no borrow pits are expected to be required for the construction of the facility, no mining permit or right is required to be obtained.

	Programmes and Environmental Management Plans are set out in S39 of the Act.		
National Environmental Management: Air Quality Act (Act No 39 of 2004)	» S21 – Listed activities requiring an Air Emissions License. » Minimum emission standards are set for Listed Activities. » Measures in respect of dust control (S32) and National Dust Control Regulations of November 2013. » Measures to control noise (S34) - no regulations promulgated yet. » The Act provides that an air quality officer may require any person to submit an atmospheric impact report if there is reasonable suspicion that the person has failed to comply with the Act.	» National Department of Environmental Affairs » District Municipality	» While no permitting or licensing requirements arise from this legislation, this act will find application during the operational phase of the project. » The Act provides that an air quality officer may require any person to submit an atmospheric impact report if there is reasonable suspicion that the person has failed to comply with the Act.
National Heritage Resources Act (Act No 25 of 1999)	» Stipulates assessment criteria and categories of heritage resources according to their significance (S7). » Provides for the protection of all archaeological and palaeontological sites, and meteorites (S35). » Provides for the conservation and care of cemeteries and graves by SAHRA where this is not the responsibility of any other authority (S36). » Lists activities which require developers any person who intends to undertake to notify the responsible heritage resources authority and furnish it with details regarding the location, nature, and extent of the proposed development (S38). » Requires the compilation of a Conservation Management Plan as well as a permit from	South African Heritage Resources Agency and the Provincial Heritage Resources Agency	An HIA and PIA has been undertaken as part of the EIA Process to identify heritage sites (refer to Appendix K and L). Should a heritage resource be impacted upon, a permit may be required from SAHRA.

	SAHRA for the presentation of archaeological sites as part of tourism attraction (S44).		
National Environmental Management: Biodiversity Act (Act No 10 of 2004)	» Provides for the MEC/Minister to identify any process or activity in such a listed ecosystem as a threatening process (S53) » A list of threatened and protected species has been published in terms of S 56(1) - Government Gazette 29657. » Three government notices have been published, i.e. GN R 150 (Commencement of Threatened and Protected Species Regulations, 2007), GN R 151 (Lists of critically endangered, vulnerable and protected species) and GN R 152 (Threatened or Protected Species Regulations). » Provides for listing threatened or protected ecosystems, in one of four categories: critically endangered (CR), endangered (EN), vulnerable (VU) or protected. The first national list of threatened terrestrial ecosystems has been gazetted, together with supporting information on the listing process including the purpose and rationale for listing ecosystems, the criteria used to identify listed ecosystems, the implications of listing ecosystems, and summary statistics and national maps of listed ecosystems (National Environmental Management: Biodiversity Act: National list of ecosystems that are threatened and in need of protection, (G 34809, GN 1002), 9 December 2011). » This Act also regulates alien and invader species.	Department of Environmental Affairs	Under this Act, a permit would be required for any activity which is of a nature that may negatively impact on the survival of a listed protected species. An ecological study has been undertaken as part of the EIA Phase. As such the potential occurrence of critically endangered, endangered, vulnerable, and protected species and the potential for them to be affected has been considered. This report is contained in Appendix F.

Conservation of Agricultural Resources Act (Act No 43 of 1983)	» Prohibition of the spreading of weeds (S5) » Classification of categories of weeds & invader plants (Regulation 15 of GN R1048) & restrictions in terms of where these species may occur. » Requirement & methods to implement control measures for alien and invasive plant species (Regulation 15E of GN R1048).	» Department of Agriculture	While no permitting or licensing requirements arise from this legislation, this Act will find application during the EIA phase and will continue to apply throughout the life cycle of the project. In this regard, soil erosion prevention and soil conservation strategies must be developed and implemented. In addition, a weed control and management plan must be implemented.
National Forests Act (Act No. 84 of 1998)	According to this Act, the Minister may declare a tree, group of trees, woodland or a species of trees as protected. The prohibitions provide that 'no person may cut, damage, disturb, destroy or remove any protected tree, or collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree, except under a licence granted by the Minister'.	National Department of Forestry	A licence is required for any removal of protected trees.
National Veld and Forest Fire Act (Act 101 of 1998)	In terms of S12 the applicant must ensure that the firebreak is wide and long enough to have a reasonable chance of preventing the fire from spreading, not causing erosion, and is reasonably free of inflammable material. In terms of S17, the applicant must have such equipment, protective clothing, and trained personnel for extinguishing fires.	Department of Agriculture, Forestry and Fisheries (DAFF)	While no permitting or licensing requirements arise from this legislation, this Act will find application during the construction and operational phase of the project.
Aviation Act (Act No 74 of 1962) 13th amendment of the Civil Aviation Regulations (CARS) 1997	» Any structure exceeding 45 m above ground level or structures where the top of the structure exceeds 150 m above the mean ground level, the mean ground level considered the lowest point in a 3km radius	» Civil Aviation Authority (CAA)	This act will find application during the operational phase of the project. Appropriate marking is required to meet the specifications as detailed in the CAR Part 139.01.33.

	around such structure. » Structures lower than 45 m, which are considered as a danger to aviation shall be marked as such when specified.		
Hazardous Substances Act (Act No 15 of 1973)	» This Act regulates the control of substances that may cause injury, or ill health, or death by reason of their toxic, corrosive, irritant, strongly sensitising or inflammable nature or the generation of pressure thereby in certain instances and for the control of certain electronic products. To provide for the rating of such substances or products in relation to the degree of danger; to provide for the prohibition and control of the importation, manufacture, sale, use, operation, modification, disposal or dumping of such substances and products. » Group I and II: Any substance or mixture of a substance that might by reason of its toxic, corrosive etc, nature or because it generates pressure through decomposition, heat or other means, cause extreme risk of injury etc., can be declared to be Group I or Group II hazardous substance; » Group IV: any electronic product; » Group V: any radioactive material. The use, conveyance, or storage of any hazardous substance (such as distillate fuel) is prohibited without an appropriate license being in force.	» Department of Health	It is necessary to identify and list all the Group I, II, III and IV hazardous substances that may be on the site and in what operational context they are used, stored or handled. If applicable, a license is required to be obtained from the Department of Health.
National Road Traffic Act (Act No 93 of 1996)	» The Technical Recommendations for Highways (TRH 11): "Draft Guidelines for Granting of Exemption Permits for the Conveyance of Abnormal Loads and for other Events on Public Roads" outline the rules and conditions which	Provincial Department of Transport (provincial roads) » South African National Roads Agency Limited (national roads)	» An abnormal load/vehicle permit may be required to transport the various components to site for construction. These include route clearances and permits will be required for vehicles

	apply to the transport of abnormal loads and vehicles on public roads and the detailed procedures to be followed in applying for exemption permits are described and discussed. » Legal axle load limits and the restrictions imposed on abnormally heavy loads are discussed in relation to the damaging effect on road pavements, bridges, and culverts. » The general conditions, limitations, and escort requirements for abnormally dimensioned loads and vehicles are also discussed and reference is made to speed restrictions, power/mass ratio, mass distribution, and general operating conditions for abnormal loads and vehicles. Provision is also made for the granting of permits for all other exemptions from the requirements of the National Road Traffic Act and the relevant Regulations.		carrying abnormally heavy or abnormally dimensioned loads. » Transport vehicles exceeding the dimensional limitations (length) of 22m. » Depending on the trailer configuration and height when loaded, some of the power station components may not meet specified dimensional limitations (height and width).
Development Facilitation Act (Act No 67 of 1995)	» Provides for the overall framework and administrative structures for planning throughout the Republic » Sections 2- 4 provide general principles for land development and conflict resolution.	» Local Municipality, District Municipality	The applicant must submit a land development application in the prescribed manner and form as provided for in the Act. A land development applicant who wishes to establish a land development area must comply with procedures set out in the DFA.
Subdivision of Agricultural Land Act (Act No 70 of 1970)	» Details land subdivision requirements and procedures. Applies for subdivision of all agricultural land in the province	» Local Municipality, District Municipality	» Subdivision will have to be in place prior to any subdivision approval in terms of Section 24 and 17 of LUPO. » Subdivision is required to be undertaken following the issuing of an environmental authorisation for the proposed project.

National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008)	» The Minister may by notice in the *Gazette* publish a list of waste management activities that have, or are likely to have, a detrimental effect on the environment. » The Minister may amend the list by— *(a)* adding other waste management activities to the list; *(b)* removing waste management activities from the list; or *(c)* making other changes to the particulars on the list. » A Basic Assessment or Environmental Impact Assessment is required to be undertaken for identified listed activities. » Any person who stores waste must at least take steps, unless otherwise provided by this Act, to ensure that *(a)* the containers in which any waste is stored, are intact and not corroded or in any other way rendered unlit for the safe storage of waste; *(b)* adequate measures are taken to prevent accidental spillage or leaking; *(c)* the waste cannot be blown away; *(d)* nuisances such as odour, visual impacts and breeding of vectors do not arise; and *(e)* pollution of the environment and harm to health are prevented	National Department of Water and Environmental Affairs (hazardous waste and effluent) Provincial Department of Environmental Affairs (general waste)	» As no waste disposal site is to be associated with the proposed project, no permit is required in this regard. » Waste handling, storage and disposal during construction and operation is required to be undertaken in accordance with the requirements of this Act, as detailed in the EMPr.
Promotion of Access to Information Act (Act No 2 of 2000)	» All requests for access to information held by state or private body are provided for in the Act under S11.	» National Department of Environmental Affairs (DEA)	No permitting or licensing requirements
Promotion of Administrative Justice Act (Act No 3 of 2000)	» In terms of S3 the government is required to act lawfully and take procedurally fair, reasonable and rational decisions	» National Department of Environmental Affairs (DEA)	No permitting or licensing requirements

	» Interested and affected parties have right to be heard		
Astronomy Geographic Advantage Act (Act No. 21 of 2007)	» In terms of section 7(1) and 7(2) of this Act, the Minister declared core astronomy advantage areas on 20 August 2010 under Regulation No. 723 of Government Notice No. 33462. In this regard, all land within a 3 kilometres radius of the centre of the Southern African large Telescope dome falls under the Sutherland Core Astronomy Advantage Area. The declaration also applies to the core astronomy advantage area containing the MeerKAT radio telescope and the core of the planned Square Kilometre Array (SKA) radio telescope.	» Department of Science and Technology	Approval from SKA required.
Provincial Legislation			
Northern Cape Nature Conservation Act, Act No. 9 of 2009	This Act provides for the sustainable utilisation of wild animals, aquatic biota and plants; provides for the implementation of the Convention on International Trade in Endangered Species of Wild Fauna and Flora; provides for offences and penalties for contravention of the Act; provides for the appointment of nature conservators to implement the provisions of the Act; and provides for the issuing of permits and other authorisations. Amongst other regulations, the following may apply to the current project: » Boundary fences may not be altered in such a way as to prevent wild animals from freely moving onto or off of a property; » Aquatic habitats may not be destroyed or damaged; » The owner of land upon which an invasive	Northern Cape Department of Environment and Nature Conservation	A collection/destruction permit must be obtained from Northern Cape Nature Conservation for the removal of any protected plant species found on site. .

	species is found (plant or animal) must take the necessary steps to eradicate or destroy such species. » The Act provides lists of protected species for the Province.		

STRUCTURE OF THe EMPr CHAPTER 4

The first four chapters provide background to the EMPr and the proposed project, while the chapters which follow consider the following:

» Roles of responsibilities for implementation of the EMPr
» Pre-construction (planning and design) activities;
» Construction activities;
» Operation activities; and
» Decommissioning activities.

These chapters set out the procedures necessary for Upington Solar Thermal Two to achieve environmental compliance. For each of the phases of implementation for the solar energy facility project, an over-arching environmental **goal** is stated. In order to meet this goal, a number of **objectives** are listed. The management programme has been structured in table format in order to show the links between the goals for each phase and their associated objectives, activities/risk sources, mitigation actions, monitoring requirements and performance indicators. A specific environmental management programme table has been established for each environmental objective. The information provided within the EMPr table for each objective is illustrated below:

OBJECTIVE-: Description of the objective, which is necessary in order to meet the overall goals; these take into account the findings of the EIA specialist studies

Project Component/s	List of project components affecting the objective.
Potential Impact	Brief description of potential environmental impact if objective is not met.
Activity/Risk Source	Description of activities which could impact on achieving objective.
Mitigation: Target/Objective	Description of the target; include quantitative measures and/or dates of completion.

Mitigation: Action/Control	**Responsibility**	**Timeframe**
List specific action(s) required to meet the mitigation target/objective described above	Who is responsible for the measures?	Time periods for implementation of measures.

Performance Indicator	Description of key indicator(s) that track progress/indicate the effectiveness of the management programme.
Monitoring	Mechanisms for monitoring compliance; the key monitoring actions required to check whether the objectives are being achieved, taking into consideration responsibility, frequency, methods and reporting.

The objectives and EMPr tables are required to be reviewed and possibly modified whenever changes, such as the following, occur:

» Planned activities change (i.e. in terms of the components and/or layout of the facility).
» Modification to or addition to environmental objectives and targets.
» Relevant legal or other requirements are amended or introduced.
» Significant progress has been made on achieving an objective or target such that it should be re-examined to determine if it is still relevant, should be modified, etc.

4.1 Project Team

This draft EMPr was compiled by:

	Name	**Company**
EMPr Compilers:	Ravisha Ajodhapersadh – EAP Karen Jodas – EAP	Savannah Environmental
Specialists:	Marianne Strobach -Ecologist	Savannah Environmental
	Johann Lanz - Agricultural And Soils Impact Assessment	Johann Lanz Consulting
	Bernard Oberholzer and Quinton Lawson - Visual Impact Assessment	Bernard Oberholzer, Landscape Architect (BOLA), and Quinton Lawson, MLB Architects (MLB)
	John Pether - Paleontological study	Geological and Paleontological Consultant
	Dr B M Colloty - Surface Water Resources Assessment Study	Scherman Colloty & Associates
	David Morris – Impacts on Heritage Resources	McGregor Museum
	Morne De Jager-Environmental Noise Impact Assessment	Enviro Acoustic Research cc
	Tony Barbour - Social Impacts Assessment (SIA)	Tony Barbour Environmental Consulting & Research

The Savannah Environmental team have extensive knowledge and experience in EIA and environmental management, having been involved in EIA processes over the past ten (10) years. They have managed and drafted Environmental Management Programmes for power generation projects throughout South Africa, including numerous wind and solar energy facilities.

ROLES AND RESPONSIBILITIES FOR IMPLEMENTATION OF THE EMPR CHAPTER 5

5.1 Roles and Responsibilities for the Construction Phase of the Solar Thermal Plant

As the Proponent, **Abengoa Solar Power South Africa (Pty) Ltd** (herein **referred to as the "developer"**) must ensure that the implementation of the **Upington Solar Thermal Plant Two** (herein **referred to as the "solar energy facility**") complies with the requirements of any and all environmental authorisations and permits, and obligations emanating from all relevant environmental legislation. This obligation is partly met through the development of the EMPr, and the implementation of the EMPr through its integration into the contract documentation. Abengoa Solar Power South Africa (Pty) Ltd will retain various key roles and responsibilities during the construction of the solar energy facility. These are outlined below.

Specific responsibilities of the Owner's Representatives; Environmental Control Officer and EPC Contractor for the construction phase of this project are as detailed below.

The **Project Manager** will:

» Ensure all specifications and legal constraints specifically with regards to the environment are highlighted to the Contractor(s) so that they are aware of these.
» Ensure that its Contractors are made aware of all stipulations within the EMPr.
» Ensure that the EMPr is correctly implemented throughout the project cycle by means of site inspections and meetings. This will be documented as part of the site meeting minutes.
» Be fully conversant with the Environmental Impact Assessment for the project, the EMPr, the conditions of the Environmental Authorisation, and all relevant environmental legislation.

The **Site Manager** (On-site Representative) will:

» Be fully knowledgeable with the contents of the Environmental Impact Assessment.
» Be fully knowledgeable with the contents and conditions of the Environmental Authorisation.
» Be fully knowledgeable with the contents of the EMPr.
» Be fully knowledgeable with the contents of all relevant environmental legislation, and ensure compliance with these.
» Be fully knowledgeable with the contents of all relevant licences and permits.
» Have overall responsibility of the EMPr and its implementation.
» Conduct audits to ensure compliance to the EMPr.
» Ensure there is communication with the Project Manager, the Environmental Control Officer/s and relevant discipline Engineers on matters concerning the environment.

» Ensure that no actions are taken which will harm or may indirectly cause harm to the environment, and take steps to prevent pollution on the site.
» Confine activities to the demarcated construction site.

An independent **Environmental Control Officer (ECO)** must be appointed by the project proponent prior to the commencement of any listed activities. The ECO will be responsible for monitoring, reviewing and verifying compliance by the Contractor with the environmental specifications of the EMPr and the conditions of the Environmental Authorisation. The ECO will:

» Be fully knowledgeable of the contents with the Environmental Impact Assessment.
» Be fully knowledgeable of the contents with the conditions of the Environmental Authorisation (once issued).
» Be fully knowledgeable of the contents with the EMPr.
» Be fully knowledgeable of the contents with all relevant environmental legislation, and ensure compliance with them.
» Be fully knowledgeable of all the licences and permits issued to the site.
» Ensure that the contents of this document are communicated to the Contractor site staff and that the Site Manager and Contractor are constantly made aware of the contents through discussion.
» Ensure that the compliance of the EMPr is monitored through regular and comprehensive inspection of the site and surrounding areas.
» Ensure that the Site Manager has input into the review and acceptance of construction methods and method statements.
» Ensure that activities on site comply with all relevant environmental legislation.
» Ensure that a removal is ordered of any person(s) and/or equipment responsible for any contravention of the specifications of the EMPr.
» Ensure that any non-compliance or remedial measures that need to be applied are reported.
» Keep record of all activities on site, problems identified, transgressions noted and a task schedule of tasks undertaken by the ECO.
» Independently report to DEA in terms of compliance with the specifications of the EMPr and conditions of the Environmental Authorisation (once issued).
» Keep record of all reports submitted to DEA.

The ECO shall remain employed until all rehabilitation measures, as required for implementation due to construction damage, are completed and the site handed over for operation.

Contractors and Service Providers: All contractors (including sub-contractors and staff) and service providers are ultimately responsible for:

» Ensuring adherence to the environmental management specifications.

- Ensuring that Method Statements are submitted to the Site Manager for approval before any work is undertaken. Any lack of adherence to this will be considered as non-compliance to the specifications of the EMPr.
- Ensuring that any instructions issued by the Site Manager on the advice of the ECO are adhered to.
- Ensuring that a report is tabled at each site meeting, which will document all incidents that have occurred during the period before the site meeting.
- Ensuring that a register is kept in the site office, which lists all transgressions issued by the ECO.
- Ensuring that a register of all public complaints is maintained.
- Ensuring that all employees, including those of sub-contractors receive training before the commencement of construction in order that they can constructively contribute towards the successful implementation of the EMPr (i.e. ensure their staff are appropriately trained as to the environmental obligations).

Contractor's Environmental Representative: The Contractor's Environmental Representative (CER), employed by the Contractor, is responsible for managing the day-to-day on-site implementation of this EMPr, and for the compilation of regular (usually weekly) Monitoring Reports. In addition, the CER must act as liaison and advisor on all environmental and related issues and ensure that any complaints received from the public are duly recorded and forwarded to the Site Manager and Contractor.

The Contractor's Environmental Representative should:

- Be well versed in environmental matters.
- Understand the relevant environmental legislation and processes.
- Understand the hierarchy of Environmental Compliance Reporting, and the implications of Non-Compliance.
- Know the background of the project and understand the implementation programme.
- Be able to resolve conflicts and make recommendations on site in terms of the requirements of this Specification.
- Keep accurate and detailed records of all EMPr-related activities on site.

5.2. Roles and Responsibilities for the Operation Phase of the Solar Thermal Plant

Formal responsibilities are necessary to ensure that key procedures are executed. Specific responsibilities of solar energy facility's Operations Manager, and Environmental Manager for the operation phase of this project are detailed below.

The **Power Station Manager** will:

» Ensure that adequate resources (human, financial, technology) are made available and appropriately managed for the successful implementation of the operational EMPr.
» Conduct annual basis reviews of the EMPr to evaluate its effectiveness.
» Take appropriate action as a result of findings and recommendations in management reviews and audits.
» Provide forums to communicate matters regarding environmental management.

The **Environmental Manager** will:

» Develop and Implement an Environmental Management System (EMS) for the solar energy facility and associated infrastructure.
» Manage and report on the facility's environmental performance.
» Maintain a register of all known environmental impacts and manage the monitoring thereof.
» Conduct internal environmental audits and co-ordinate external environmental audits.
» Liaise with statutory bodies such as the National and Provincial Department of Environmental Affairs (DEA) on environmental performance and other issues.
» Conduct environmental training and awareness for the employees who operate and maintain the solar thermal plant.
» Compile environmental policies and procedures.
» Liaise with interested and affected parties on environmental issues of common concern.
» Track and control the lodging of any complaints regarding environmental matters.

MANAGEMENT PROGRAMME: PRE-CONSTRUCTION (PLANNING & DESIGN)
CHAPTER 6

6.1. Goal for Planning and Design

Overall Goal for Planning and Design: Undertake the planning and design phase of the solar energy facility in a way that:

» Ensures that the design of the facility responds to the identified environmental constraints and opportunities.
» Ensures that pre-construction activities are undertaken in accordance with all relevant legislative requirements.
» Ensures that adequate regard has been taken of any landowner concerns and that these are appropriately addressed through design and planning (where appropriate).
» Ensures that the best environmental options are selected for the project, including the power line alignment and substation site.
» Enables the solar energy facility construction activities to be undertaken without significant disruption to other land uses in the area.

In order to meet this goal, the following objectives have been identified, together with necessary actions and monitoring requirements.

6.2. Objectives

OBJECTIVE 1 : Ensure the design of the facility responds to the identified environmental constraints and opportunities

From the specialist investigations undertaken for the proposed solar energy facility development site, no *'no go'* areas were identified. In order to minimise impacts associated with the construction and operation of the solar energy facility and associated infrastructure, the following surveys are required to be undertaken during the final design phase of the facility:

» Geotechnical survey.
» An ecological walk through survey for the CSP plant and associated infrastructure (such as pipeline, power line and access roads) must be undertaken prior to construction.

Project Component/s	» Power Tower » Heliostats » Power island » Access roads » Substation » Power line » Pipeline
Potential Impact	Design fails to respond optimally to the environmental consideration.
Activities/Risk Sources	» Positioning of solar components and access roads. » Positioning of substation. » Alignment of power line and pipeline.
Mitigation: Target/Objective	Ensure that the design of the facility responds to the identified environmental constraints and opportunities.

Mitigation: Action/Control	Responsibility	Timeframe
Undertake pre-construction geotechnical surveys.	Specialist	Design phase
Obtain all relevant permits (e.g. water use licence, permit to remove protected plants and trees, etc.) prior to construction in an area.	Developer	Design phase
Develop a procedure which details what to do in the event of any major heritage feature being encountered during any phase of development or operation (for the construction and operational phase). A procedure regarding fossil finds must be developed and included in the EMPr.	Developer Specialist	Pre-construction
Access roads to be carefully planned to minimise the impacted area and prevent unnecessary over compaction of soil.	Developer	Design phase
Road alignments must be planned in such a way that the minimum of cut and fill operations are required.	Developer	Design phase
As far as possible, existing roads must be used.	Developer	Design phase
Submit a final layout of the facility and associated infrastructure to DEA prior to the commencement of construction.	Developer	Pre-construction
Develop a storm water management plan for the construction and operational phase.	Developer	Pre-construction
Develop a site specific waste management plan for the construction phase.	Contractor	Planning
Due to the number of channels and drainage lines within the area, a 1:100 year floodline delineation must be conducted, if possible using Lidar data.	Developer	Planning & design phase
An emergency response and management plan must be drafted and available to deal with chemical spillages. This plan must include as a minimum: » Specifications of harmful substances that could be	Developer	Planning & design phase

Mitigation: Action/Control	Responsibility	Timeframe
released from accidental breakages » How such harmful substances can best be salvaged and removed as soon as an accidental breakage has occurred » How and where broken components and potential harmful substances can be disposed of – it must also be indicated if any material can be recycled, and where materials must then be taken for recycling		
Evaporation ponds to be designed in accordance with GN 704 - 706 specifications.	Developer	Planning & design phase
The possibility of spillages should be catered for in the design of the infrastructure development where, pollution control dams or evaporation ponds could contain water prior to the discharge.	Developer	Planning & design phase
Install large markers on the power line, which will increase the visibility of the power line. The two most common bird marking devices include Bird Flight Diverters and Bird Flappers, both of which are effective.	Developer	Planning & design phase

Performance Indicator	» Design meets objectives and does not degrade the environment. » Design responds to the mitigation measures and recommendations in the EIA report.
Monitoring	Ensure that the design implemented meets the objectives and mitigation measures in the EIA report through review of the design by the Project Manager, Developer and the Contractor prior to the commencement of construction.

OBJECTIVE 2 : Ensure effective communication mechanisms

On-going communication with affected and surrounding landowners and stakeholders is important to maintain during the construction and operational phases of the solar energy facility. Any issues and concerns raised should be addressed as far as possible in as short a timeframe as possible.

Project component/s	» Solar energy facility » Pipeline » Power line » Access roads
Potential Impact	Impacts on affected and surrounding landowners and land uses
Activity/risk source	» Activities associated with solar energy facility construction » Activities associated with solar energy facility operation

Mitigation: Target/Objective	» Effective communication with affected and surrounding landowners » Addressing of any issues and concerns raised as far as possible in as short a timeframe as possible

Mitigation: Action/control	Responsibility	Timeframe
Compile and implement a grievance mechanism procedure for the public to be implemented during both the construction and operational phases of the facility (refer to the draft generic grievance mechanism included within Appendix E). This procedure should include details of the contact person who will be receiving issues raised by interested and affected parties, and the process that will be followed to address issues.	Developer	Pre-construction (construction procedure) Pre-operation (operation procedure)

Performance Indicator	» Effective communication procedures in place.
Monitoring	» An incident reporting system should be used to record non-conformances to the EMPr.

MANAGEMENT PROGRAMME: CONSTRUCTION CHAPTER 7

7.1. Overall Goal for Construction

Overall Goal for Construction: Undertake the construction phase of the solar energy facility in a way that:

» Ensures that construction activities are properly managed in respect of environmental aspects and impacts.
» Enables construction activities to be undertaken without significant disruption to other land uses in the area, in particular concerning noise impacts, dust, farming practices, traffic and road use, and effects on local residents.
» Minimises the impact on the indigenous natural vegetation, protected tree species, and habitats of ecological value (i.e. drainage lines).
» Minimises impacts on avifauna and other fauna using the site.
» Minimises the impact on the heritage and historical value of the site.

7.2. Objectives

In order to meet this goal, the following objectives have been identified, together with necessary actions and monitoring requirements.

OBJECTIVE 3 : Securing the site and site establishment

Project Component/s	» Power Tower » Heliostats » Power island » Access roads » Substation » Power line » Pipeline
Potential Impact	» Hazards to adjacent landowners and public. » Security of materials. » Substantially increased damage to sensitive vegetation.
Activities/Risk Sources	» Open excavations (foundations and cable trenches). » Movement of construction vehicles in the area and on-site.
Mitigation: Target/Objective	» To secure the site against unauthorised entry. » To protect members of the public/landowners/residents.

Mitigation: Action/Control	Responsibility	Timeframe
Secure site, working areas and excavations in an appropriate manner.	Contractor	Construction
The Contractor must take all reasonable measures to ensure the safety of the public in the surrounding area. Where the public could be exposed to danger by any of the works or site activities, the Contractor must, as appropriate, provide suitable flagmen, barriers and/or warning signs in suitable languages, all to the approval of the Site Manager.	Contractor	Construction
All unattended open excavations shall be adequately demarcated and/or fenced (fencing shall consist of a minimum of three strands of wire wrapped with two coloured shade cloth netting).	Contractor	Construction
Adequate protective measures must be implemented to prevent unauthorised access to the working area and the internal access/haul routes.	Contractor	Construction
Fence and secure Contractor's equipment camp.	Contractor	Construction
Access control should be implemented and maintained for the duration of the construction period.	Contractor	Construction
Provide adequate sanitation facilities and ablutions for construction workers (1 toilet per every 15 workers) at appropriate locations on site.	Contractor	Construction
Ablution or sanitation facilities should not be located within 100 m from a 1:100 year flood line including water courses, drainage lines or within a horizontal distance of less than 100 m, whichever is applicable.	Contractor	During site establishment, construction, and operation
Supply adequate waste collection bins at site where construction is being undertaken.	Contractor	Construction

Performance Indicator	» Site is secure and there is no unauthorised entry. » No members of the public/ landowners injured.
Monitoring	» An incident reporting system will be used to record non-conformances. » ECO to monitor all construction areas on a continuous basis until all construction is completed; immediate report backs to site manager.

OBJECTIVE 4 : Minimise loss of indigenous biodiversity, including plants of conservation concern

Project Component/s	» Power Tower » Heliostats » Power island » Access roads » Substation

	» Power line » Pipeline » Topsoil stockpiles
Potential Impact	» Substantially increased loss of species of conservation concern and other natural vegetation at construction phase, » waste of on-site plant resources, » lack of locally sourced material for rehabilitation of disturbed areas » Increased cost of rehabilitation
Activities/Risk Sources	» Construction related loss and damage to remaining natural and semi-natural vegetation
Mitigation: Target/Objective	» Rescue, maintenance and subsequent replanting of at least all bulbous protected plant species within the specific land portion

Mitigation: Action/Control	**Responsibility**	**Timeframe**
Prior to commencement of construction, including earthworks (grading, road construction, etc.) within areas of natural vegetation a plant search and rescue program must be developed and implemented, preceded by an investigation of all footprint areas by a suitably qualified botanist. This survey must be conducted during the optimal growing season (February to April) within the entire development area.	Developer	Prior to construction
» Search and Rescue (S&R) of protected plants that can be transplanted should be undertaken. Plants that should be considered for rescue and included in subsequent rehabilitation programs are all tubers, bulbs, and indigenous succulents » Rescued species should be transplanted immediately or bagged (or succulents left to first air-dry before planting) and kept in the horticulturist's or a designated well-maintained on-site nursery, and should be returned to site or land portion once all construction is completed and rehabilitation of disturbed areas is required.	Developer	Prior to construction
» All trenches within the development area must be checked on a daily basis for the presence of trapped animals. Any animals found must be removed in a safe manner, unharmed, and placed in an area where the animal will be safe. » If the ECO or contractor is unable to assist in the movement of a fauna species, ensure a member of the conservation authorities assists with the translocation.	Contractor	Duration of construction
All mammal, large reptiles and avifauna species found injured during construction must be taken to a suitably qualified veterinarian or rehabilitation centre to either be put down in a humane manner or cared for until it can be released again	Contractor	Duration of construction
Reduce risk of vehicle movement injuring animals, especially at night or in low light conditions by vehicles maintaining low	Contractor's Environmental	Duration of construction

Mitigation: Action/Control	Responsibility	Timeframe
speeds.	Representative	and operation
Monitor intermittent pans after larger rainfall events to see if any amphibians (tadpoles) or tadpole shrimps will hatch. If this happens in pans that will be transformed by the development, such species must be relocated as best possible to similar suitable habitats either within the study area or beyond.	Contractor's Environmental Representative	Duration of construction
The ostrich pair observed in the area must be monitored prior to construction to ensure that they are not nesting on site. If so, the nesting area must be suitably protected and excluded from the construction process until all eggs have hatched and the animals can be relocated.	Contractor's Environmental Representative	Duration of construction
All social weavers nests that may be affected by the development must be moved by a qualified contractor or with the assistance of the relevant qualified persons; other bird nests in trees/higher shrubs need to be monitored and only removed if not used for breeding.	Contractor's Environmental Representative and specialist	Pre-construction

Performance Indicator	» Rescue of species of conservation concern » No damage or injury to fauna » Re-establishment of rescued plant species
Monitoring	» CER to monitor Search and Rescue, continue search and rescue operations during the construction process where it becomes necessary after the initial S&R » It may be possible that geophytic species may emerge during construction that were not accounted for in the original S&R plan – once observed the ECO should consult the botanists on the identification and possible S&R for those plant species

OBJECTIVE 5 : Good management of the construction equipment camps and all other temporary structures

No staff will be accommodated on site. All construction staff will reside within existing accommodation in nearby towns. Construction equipment and machinery will be stored on the site for the duration of the construction period, and temporary staff facilities (such as ablutions) will be made available.

Project Component/s	» Construction equipment camp » Facilities for storing, mixing and general handling of materials » Storage areas
Potential Impact	» Damage to indigenous natural vegetation » Damage to and/or loss of topsoil

	» Initiation of accelerated erosion » Compacting of soil » Pollution of the surrounding environment due to excessive dust, inadequate and/or inappropriate facilities provided or procedures implemented
Activities/Risk Sources	» Vegetation clearing and levelling of temporary construction or storage area/s » Transport to and from the temporary construction or storage area/s » Types of materials or equipment and the manner in which they are stored or handled » Dust emissions
Mitigation: Target/Objective	» To minimise impacts on the biophysical and social environment » To prevent any residual or cumulative impacts arising from temporary construction or storage areas

Mitigation: Action/Control	Responsibility	Timeframe
The location of the construction equipment camp to take cognisance of any ecologically sensitive areas identified in the EIA and must located outside these areas.	Contractor	Pre-construction
Cooking on open fires must be prohibited, if staff need cooking/kitchen facilities on site, such should be provided by the contractor	Contractor	Construction
Adequate ablution facilities must be provided for construction staff	Contractor	Construction
Create specific turning points and parking areas for vehicles and heavy machinery as needed	Contractor	Construction
Fuels, lubricants and other chemicals to be stored in appropriately bunded areas	Contractor	Construction

Performance Indicator	» No visible erosion scars or any pollution once construction in an area is completed » All damaged areas successfully rehabilitated
Monitoring	» Regular monitoring and audits of the construction camps and temporary structures on site by the CER and ECO » An incident reporting system should be used to record non-conformances to the EMPr, followed by the necessary action from the developer to ensure full compliance

OBJECTIVE 6 : Appropriate handling and storage of chemicals, hazardous substances and waste (waste management plan)

The construction phase will involve the storage and handling of a variety of chemicals including adhesives, abrasives, oils and lubricants, paints and solvents. The main wastes expected to be generated by the construction of the facility will include general solid waste, hazardous waste and liquid waste.

Project Component/s	» Construction camp » Storage areas » Use of, storage and handling of chemicals, hazardous substances and waste.
Potential Impact	» Release of contaminated water from contact with spilled chemicals. » Generation of contaminated wastes from used chemical containers. » Inefficient use of resources resulting in excessive waste generation. » Litter or contamination of the site or water through poor waste management practices. » Pollution of water and soil resources.
Activity/Risk Source	» Vehicles associated with site preparation and earthworks. » Power line construction activities. » Substation construction activities. » Packaging and other construction wastes. » Hydrocarbon use and storage. » Spoil material from excavation, earthworks and site preparation.
Mitigation: Target/Objective	» To ensure that the storage and handling of chemicals and hydrocarbons on-site does not cause pollution to the environment or harm to persons. » To ensure that the storage and maintenance of machinery on-site does not cause pollution of the environment or harm to persons. » To comply with waste management guidelines. » To minimise production of waste. » To ensure appropriate waste storage and disposal. » To avoid environmental harm from waste disposal.

Mitigation: Action/Control	Responsibility	Timeframe
Implement a site specific waste management plan during the construction phase	Contractor	Duration of contract
Spill kits must be made available on-site for the clean-up of spills and leaks of contaminants.	Contractor	Duration of contract
Corrective action must be undertaken immediately if a complaint is received, or potential/actual leak or spill of polluting substance identified. This includes stopping the contaminant from further escaping, cleaning up the affected environment as much as practically possible and	Contractor	Duration of contract

Mitigation: Action/Control	Responsibility	Timeframe
implementing preventive measures.		
Implement an effective monitoring system to detect any leakage or spillage of all hazardous substances during their 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.	Contractor	Duration of contract
Leakage of fuels must be avoided at all times and if spillage occurs, it must be remediated immediately.	Contractor	Duration of contract
In the event of a major spill or leak of contaminants, the relevant administering authority must be immediately notified as per the notification of emergencies/incidents.	Contractor	Duration of contract
Spilled cement, fly ash and concrete must be cleaned up as soon as possible and disposed of at a suitably licensed waste disposal site.	Contractor	Duration of contract
Any contaminated/polluted soil removed from the site must be disposed of at a licensed hazardous waste disposal facility.	Contractor	Duration of contract
All stored fuels to be maintained within a sealed bund and on a sealed concrete surface. The bund must be at least 110% of the volume of the total containers.	Contractor	Duration of contract
Adjacent fuelling areas situated around fuel tanks must be provided with an impervious paving or concrete slab upon which vehicles must park during refuelling.	Contractor	Duration of contract
Areas around fuel tanks must be appropriately bunded or contained in an appropriate manner as per the requirements of SABS 089:1999 Part 1.	Contractor	Duration of contract
Fuel storage areas must be inspected regularly to ensure bund stability, integrity, and function.	Contractor, and ECO	Duration of contract
Oily water from bunds at the substations must be removed from site by licensed contractors.	Contractors	Duration of contract
The storage of flammable and combustible liquids such as oils will be in designated areas which are appropriately bunded, and stored in compliance with MSDS files.	Contractor	Duration of contract
Any storage and disposal permits/approvals which may be required must be obtained, and the conditions attached to such permits and approvals will be compiled with.	Contractor	Duration of contract
Transport of all hazardous substances must be in accordance with the relevant legislation and regulations.	Contractor	Duration of contract
Construction sub-contractors must provide specific detailed waste management plans to deal with all waste streams.	Contractor	Duration of contract
Specific areas must be designated on-site for the temporary management of various waste streams, i.e.	Contractor	Duration of contract

Mitigation: Action/Control	Responsibility	Timeframe
general refuse, construction waste (wood and metal scrap) and contaminated waste as required. Location of such areas must seek to minimise the potential for impact on the surrounding environment, including prevention of contaminated runoff, seepage and vermin control.		
Where practically possible, construction and general wastes on-site must be reused or recycled. Bins and skips must be available on-site for collection, separation, and storage of waste streams (such as wood, metals, general refuse etc.).	Contractor	Duration of contract
Disposal of waste must be in accordance with relevant legislative requirements, including the use of licensed contractors and disposal at appropriately licensed waste disposal sites.	Contractor	Duration of contract
Hydrocarbon waste must be contained and stored in sealed containers within an appropriately bunded area.	Contractor	Duration of contract
Waste and surplus dangerous goods must be kept to a minimum and must be transported by approved waste transporters to sites designated for their disposal.	Contractor	Duration of contract
Documentation (waste manifest) must be maintained detailing the quantity, nature, and fate of any regulated waste. Waste disposal records must be available for review at any time.	Contractor and ECO	Duration of contract
An incident/complaints register must be established and maintained on-site.	Contractor and ECO	Duration of contract
The sediment control and water quality structures used on-site must be monitored and maintained in a fully operational state at all times.	Contractor	Duration of contract
An integrated waste management approach that is based on waste minimisation must be used and must incorporate reduction, recycling, re-use and disposal where appropriate.	Contractor	Duration of contract
Upon the completion of construction, the area must be cleared of potentially polluting materials.	Contractor	Completion of construction
Dispose of all solid waste collected at an appropriately registered waste disposal site. Waste disposal shall be in accordance with all relevant legislation and under no circumstances may waste be burnt on site.	Contractor	Duration of contract
Where a registered waste site is not available close to the construction site, provide a method statement with regard to waste management.		

Performance Indicator	» Limited chemical spills outside of designated storage areas. » No water or soil contamination by spills.

	» No complaints received regarding waste on site or indiscriminate dumping. » Internal site audits ensuring that waste segregation, recycling and reuse is occurring appropriately. » Provision of all appropriate waste manifests for all waste streams.
Monitoring	» Observation and supervision of chemical storage and handling practices and vehicle maintenance throughout construction phase. » A complaints register must be maintained, in which any complaints from the community will be logged. » Observation and supervision of waste management practices throughout construction phase. » Waste collection will be monitored on a regular basis. » Waste documentation completed. » A complaints register will be maintained, in which any complaints from the community will be logged. » Complaints will be investigated and, if appropriate, acted upon » An incident reporting system will be used to record non-conformances to the EMPr.

OBJECTIVE 7 : Ensure disciplined conduct of on-site contractors and workers

In order to minimise impacts on the surrounding environment, Contractors must be required to adopt a certain Code of Conduct and commit to restricting construction activities to areas within the development footprint. Contractors and their sub-contractors must be familiar with the conditions of the Environmental Authorisation (once issued), the EIA Report, and this EMPr, as well as the requirements of all relevant environmental legislation.

Project Component/s	» Construction staff » Contractors » Sub-contractors
Potential Impact	» Pollution/contamination of the environment. » Disturbance to the environment.
Activity/Risk Source	Contractors are not aware of the requirements of the EMPr, leading to unnecessary impacts on the surrounding environment.
Mitigation: Target/Objective	To ensure appropriate management of actions by on-site personnel in order to minimise impacts to the surrounding environment.

Mitigation: Action/Control	Responsibility	Timeframe
The terms of this EMPr and the Environmental Authorisation (once issued) must be included in all	Developer and Contractor	Tender process

Mitigation: Action/Control	Responsibility	Timeframe
tender documentation and Contractors contracts.		
Implement Health and Safety Plan	Developer	Duration of construction
An Environmental Officer representing the Contractor must be on site prior to the commencement of any construction activities including early works.	Developer	Duration of construction
» Contractors must use chemical toilets/ablution facilities situated at designated areas of the site; no ablution activities must be permitted outside the designated area. » These facilities must be regularly serviced by appropriate contractors. » A minimum of one toilet shall be provided per 15 persons at each working area such as the Contractor's camp.	Contactor	Duration of contract
Cooking/meals must take place in a designated area. No firewood or kindling may be gathered from the site or surrounds.	Contractor	Duration of contract
All litter must be deposited in a clearly marked, closed, animal-proof disposal bin in the construction area. Particular attention needs to be paid to food waste.	Contractor	Duration of contract
Contractors appointed by the developer must ensure that all workers are informed at the outset of the construction phase of the conditions contained on the Code of Conduct and trespassing on adjacent farms.	Contractor	Construction
On completion of the construction phase all construction workers must leave the site.	Contractor	Construction

Performance Indicator	» Compliance with specified conditions of Environmental Authorisation, EIA report and EMPr. » No complaints regarding contractor behaviour or habits. » Fire fighting equipment and training provided before the construction phase commences. » Code of Conduct drafted before commencement of construction phase » Briefing session with construction workers held at outset of construction phase.
Monitoring	» Observation and supervision of Contractor practices throughout construction phase. » A complaints register will be maintained, in which any complaints from the community will be logged. » Complaints will be investigated and, if appropriate, acted upon. » An incident reporting system will be used to record non-conformances to

	the EMPr.

OBJECTIVE 8 : Good Housekeeping

Project Component/s	Handling of waste and materials, and cleanliness of construction site.
Potential Impact	» Health and Safety impacts » Contamination of the environment
Activity/Risk Source	» Construction activities and use of chemicals
Mitigation: Target/Objective	Ensuring all work areas are kept clean and all waste and rubble are stored in the appropriate disposal bin/area.

Mitigation: Action/Control	Responsibility	Timeframe
All employees on site are obligated to contribute towards keeping the site orderly and neat.	Contractor	Construction phase
No littering of any kind will be permitted.	Contractor	Construction phase
All facilities and working areas must be maintained in a neat and tidy condition.	Contractor	Construction phase
All waste material, rubbish, spoil etc. must be stored at designated collection points that comply with the EMPr and in a manner approved by the ECO.	Contractor	Construction phase

OBJECTIVE 9 : Minimisation of disturbance to and loss of topsoil

Topsoil conservation is an integral part of rehabilitation efforts and helps to maintain the productive capability and ecological functionality of rangelands. Removal of topsoil is required for:

» Areas will be severely compacted
» Areas will be buried with excavated material
» Areas will be permanently covered with altered surfaces

Topsoil must at all times be treated as a valuable natural resource, and may thus not be discarded or degraded. In many sections of the development area, topsoils are very shallow or rocky, which would make topsoil removal difficult. Grading in such areas should be kept as low as possible.

Project Component/s	» Power Tower » Heliostats » Power island » Access roads » Substation » Power line » Pipeline » Temporary construction camps » Topsoil stockpiles
Potential Impact	» Loss of topsoil and natural resources and biological activity within the topsoil » Loss of natural regeneration potential of soils » Loss of agricultural potential of soils and associated rangelands
Activity/Risk Source	» Site preparation and earthworks » Excavation of foundations and trenches » Construction of site access road » Power line and pipeline construction activities » Blasting
Mitigation: Target/Objective	» To retain full biological activity and functionality of topsoil » To retain desirable natural vegetation, where possible » To minimise footprints of disturbance of vegetation/habitats » Remove and store all topsoil on areas that are to be excavated; and use this topsoil in subsequent rehabilitation of disturbed areas » Minimise spoil material

Mitigation: Action/Control	Responsibility	Timeframe
Areas to be cleared must be clearly marked on-site to eliminate the potential for unnecessary disturbance.	Contactor	Pre-construction
Construction activities must be restricted to demarcated construction areas so that impact on topsoil is minimised.	Contactor	Construction
Salvaging topsoil: » Topsoil to be salvaged and stored separately from subsoil and lower-lying parent rock or other spoil material. » Topsoil stripping removes up to 30 cm or less of the upper soils. o Prior to salvaging topsoil the depth, quality and characteristics of topsoil should be known for every management area. This will give an indication of total volumes of topsoil that need to be stored to enable the proper planning and placement of topsoil storage. » Topsoils should be removed (and stored) under dry conditions to avoid excessive compaction whenever topsoil will have to be stored for longer than one year.	Contactor	Construction
Storing topsoil: » Topsoil is typically stored in berms. Place berms along	Contactor	Construction

Mitigation: Action/Control	Responsibility	Timeframe
contours or perpendicular to the prevailing wind direction. » If volumes of topsoil and subsoil are very high, a stockpile with landscaped and compacted subsoil at the base and topsoil over the top can be created, but this stockpile may not exceed a height of 4m, and needs to be managed permanently to prevent erosion and maintain a permanent vegetation cover » Topsoil handling should be reduced to stripping, piling (once), and re-application. Between the piling and reapplication, stored topsoils should not undergo any further handling except control of erosion and (alien) invasive vegetation. » Where topsoil can be reapplied within six months to one year after excavation, it will be useful to store the topsoil as close as possible to the area of excavation and re-application, e.g. next to pipeline trenches » In such case, use one side of the linear development for machinery and access only » Place topsoil on the other/far side of this development, followed by the subsoil (also on geotextile) » For long-term storage of topsoil in specified stockpiles, this must be indicated in the design phase already and accompanied by a detailed topsoil stockpile management plan » In cases where topsoil has to be stored longer than 6 months or during the rainy season, soils should be kept as dry as possible and protected from erosion and degradation by: * Covering topsoil berms * Monitoring establishment of all invasive vegetation and removing such if it appears * Keeping slopes of topsoil at a maximal 2:1 ratio * Where topsoil needs to be stored in excess of one year, it is recommended to either cover the topsoil or allow an indigenous grass cover to grow on it – if this does not happen spontaneously, seeding should be considered		
Reapplying topsoils: » Spoil materials and subsoil must be back-filled or landscaped first, then covered with topsoil. » It is recommended that where feasible, spoil materials be used to fill in and close old mine pits in the development area that currently pose a great safety risk to man and animals » Generally, topsoils should be re-applied to a depth equal to slightly greater than the topsoil horizon of a pre-selected undisturbed reference site	Contactor	Construction

Mitigation: Action/Control	Responsibility	Timeframe
» The minimum depth of topsoil needed for revegetation to be successful is approximately 20 cm » Reapplied topsoils should be landscaped in a way that creates a variable microtopography of small ridges and valleys that run parallel to existing contours of the landscape. The valleys become catch-basins for seeds and act as run-on zones for rainfall, increasing moisture levels where the seeds are likely to be more concentrated. This greatly improves the success rate of revegetation efforts. » To stabilise reapplied topsoils and minimise raindrop impact and erosion: * Use organic material from cleared and shredded woody vegetation where possible * Alternatively, suitable geotextiles or organic erosion mats can be used as necessary » Monitoring will be necessary to detect any sign of erosion early enough to allow timeous mitigation		
Re-applied topsoils need to be re-vegetated as soon as possible	Contactor	Before and during construction

Performance Indicator	» Minimal disturbance outside of designated work areas. » Topsoil appropriately stored, managed, and rehabilitated.
Monitoring	» Monitoring of appropriate methods of vegetation clearing and soil management activities by CER and ECO throughout construction phase. » An incident reporting system will be used to record non-conformances to the EMPr. » Regular monitoring of topsoil after construction by developer until such topsoil can be regarded as fully rehabilitated, stable and no longer prone to accelerated erosion » A photographic record must be established before, during and after rehabilitation of topsoil stockpiles, these must be continually monitored and also evaluated at least once a year with the Landscape Function Analysis Method or similar until decommissioning

OBJECTIVE 10 : Good soil management

Project component/s	» Power Tower » Heliostats » Power island » Access roads » Substation » Power line » Pipeline
Potential Impact	» Soil Loss » Soil erosion » Sedimentation
Activities/risk sources	All constructional activities that disturb the soil below surface, such as levelling, excavations etc.
Mitigation: Target/Objective	Ensure effective topsoil covering on all disturbed areas.

Mitigation: Action/control	Responsibility	Timeframe
Strip and stockpile topsoil from all areas where soil will be disturbed.	Contractor	Construction
If an activity will mechanically disturb below surface in any way, then the upper 40 cm of topsoil should first be stripped from the entire disturbed surface and stockpiled for re-spreading during rehabilitation.	Contractor	Construction
Topsoil stockpiles must be conserved against losses through erosion by establishing vegetation cover on them or through the use of other appropriate means.	Contractor	Construction
Dispose of all subsurface spoils from excavations where they will not impact on agricultural land (for example on road surfaces) or where they can be effectively covered with topsoil.	Contractor	Construction
The stockpiled topsoil must be evenly spread over the entire disturbed surface.	Contractor	Construction
Utilise appropriate Erosion Control measures, where required. Maintain measures throughout the construction phase.	Contractor	Construction
Areas that have been compacted should be ripped to break up the compacted soil.	Contractor	Construction
After completion of construction activities, re-spread topsoil over the surface. Ensure effective topsoil covering to conserve soil fertility on all disturbed areas.	Contractor	Construction

Mitigation: Action/control	Responsibility	Timeframe
Rehabilitate disturbed areas and stabilise soils after construction.	Contractor	Post-Construction

Performance Indicator	» No disturbed areas are left without an effective covering of topsoil, and potential for re-vegetation. » Areas where erosion has developed are appropriately managed and maintained.
Monitoring	» An incident reporting system will be used to record non-conformances to the EMPr » ECO to monitor all construction areas on a continuous basis until all construction is completed; immediate report backs to site manager in terms of non-conformances recorded. » Establish an effective record keeping system for each area where soil is disturbed/ poor soil management occurs during the construction phase . These records should be included in ECO reports, and should include all the records below. * Record the GPS coordinates of each area. * Record the date of topsoil stripping. * Record the GPS coordinates of where the topsoil is stockpiled. * Record the date of cessation of constructional (or operational) activities at the particular site. * Photograph the area on cessation of constructional activities. * Record date and depth of re-spreading of topsoil. * Photograph the area on completion of rehabilitation and on an annual basis thereafter to show vegetation establishment and evaluate progress of restoration over time.

OBJECTIVE 11 : Effective management of concrete batching plants

Project component/s	» Concrete batching plant and cement usage during construction
Potential Impact	» Dust emissions » Release of contaminated water » Generation of contaminated wastes from used chemical containers » Inefficient use of resources resulting in excessive waste generation
Activity/risk source	» Operation of the batching plant » Packaging and other construction wastes » Hydrocarbon use and storage » Spoil material from excavation, earthworks and site preparation
Mitigation:	» To ensure that the operation of the batching plant does not cause

Target/Objective	pollution to the environment or harm to persons

Mitigation: Action/control	**Responsibility**	**Timeframe**
Where possible, concrete batching plants to be sited such that impacts on the environment or the amenity of the local community from noise, odour or polluting emissions are minimised	Contractor	Construction phase
Access and exit routes for heavy transport vehicles should be planned to minimise noise and dust impacts on the environment	Contractor	Construction phase
The concrete batching plant site should demonstrate good maintenance practices, including regular sweeping to prevent dust build-up	Contractor	Construction phase
The prevailing wind direction should be considered to ensure that bunkers and conveyors are sited in a sheltered position to minimise the effects of the wind.	Contractor	Construction phase
Aggregate material should be delivered in a damp condition, and water sprays or a dust suppression agent should be correctly applied to reduce dust emissions and reduce water usage	Contractor	Construction phase
Conveyors must be designed and constructed to prevent fugitive dust emissions. This may include covering the conveyor with a roof, installing side protection barriers and equipping the conveyor with spill trays, which direct material to a collection point. Belt cleaning devices at the conveyor head may also assist to reduce spillage.	Contractor	Construction phase
The site should be designed and constructed such that clean stormwater, including roof runoff, is diverted away from contaminated areas and directed to the stormwater discharge system.	Contractor	Construction phase
Any liquids stored on site, including admixtures, fuels and lubricants, should be stored in accordance with applicable legislation	Contractor	Construction phase
Contaminated stormwater and process wastewater should be captured and recycled where possible. A wastewater collection and recycling system should be designed to collect contaminated water.	Contractor	Construction phase
Process wastewater and contaminated stormwater collected from the entire site should be diverted to a settling pond, or series of ponds, such that the water can be reused in the concrete batching process. The settling pond or series of ponds should be lined with an impervious liner capable of containing all contaminants found within the water they are designed to collect	Contractor	Construction phase
Areas where spills of oils and chemicals may occur should	Contractor	Construction

Mitigation: Action/control	Responsibility	Timeframe
be equipped with easily accessible spill control kits to assist in prompt and effective spill control		phase
Ensure that all practicable steps are taken to minimise the adverse effect that noise emissions. This responsibility includes not only the noise emitted from the plant and equipment but also associated noise sources, such as radios, loudspeakers and alarms	Contractor	Construction phase
Where possible, waste concrete should be used for construction purposes at the batching plant or project site.	Contractor	Construction phase
The batching plant to be monitored by the ECO to ensure that the plant is operating according to its environmental objectives and within legislative requirements.	ECO	Construction phase

Performance Indicator	» No complaints regarding dust or contamination » No water or soil contamination by chemical spills » No complaints received regarding waste on site or indiscriminate dumping
Monitoring	» Observation and supervision of chemical storage and handling practices and vehicle maintenance throughout construction phase » A complaints register will be maintained, in which any complaints from the community will be logged. Complaints will be investigated and, if appropriate, acted upon » A complaints register will be maintained, in which any complaints from the community will be logged. Complaints will be investigated and, if appropriate, acted upon » An incident reporting system will be used to record non-conformances to the EMPr » Developer or appointed ECO must monitor indicators listed above to ensure that they have been met for the construction phase

OBJECTIVE 12 : Limit damage to drainage lines

Project Component/s	» CSP Plant » Access roads » Water Pipeline » Abstraction Point at the Gariep River
Potential Impact	Damage to watercourses by any means that will result in hydrological changes (includes erosion, siltation, dust, direct removal of soil of vegetation, dumping of material within wetlands).
Activity/Risk	Construction and operation of the facility.

Source	
Mitigation: Target/Objective	» No unnecessary damage to watercourse areas within project area. » The focus should be on the functioning of the watercourse as a natural system.

Mitigation: Action/Control	Responsibility	Timeframe
For any new construction, cross watercourses perpendicularly to minimise disturbance footprints.	Contractor	Construction
Rehabilitate any disturbed areas as soon as possible after construction is completed in an area.	Contractor	Construction
Control storm water and runoff water.	Contractor	Construction, and operational phase
Any stormwater within the site must be handled in a suitable manner, i.e. clean and dirty water streams around the plant must be separated and install stilling basins to capture large volumes of run-off, trapping sediments and reduce flow velocities (i.e. water used when washing the mirrors).	Contractor	Planning, design, construction and operation phase
The placement of pump inlets and the supporting infrastructure must be done so as to prevent the potential for scour / erosion and downstream sedimentation of the Gariep River. The current placement is within an area of dense reed growth (*Phragmites australis*), and would not be considered a severe impact. Care should however be taken that if any clearing is done, that this area is monitored for plant re-growth, firstly to prevent alien plant infestations and to ensure no erosion or scour takes place.	Contractor	Planning, design, construction and operation phase

Performance Indicator	Limited impact on water quality, water quantity, wetland vegetation, natural status of watercourses outside of footprint of infrastructure.
Monitoring	» Habitat loss in watercourses should be monitored before and after construction. » The environmental manager should be responsible for driving this process.

OBJECTIVE 13 : Minimise river system erosion and downstream sedimentation

Project Component/s	Placement of access roads, pipelines, and dams off-site.
Potential Impact	» There is a risk of elevated sediment input into the Gariep River during the establishment of the water abstraction facilities on the banks and floodplains of the Gariep River Gariep River. » Backwash water discharged from the sand filters could result in sediment laden water reaching the Gariep River. » Poor planning and design of new abstraction infrastructure and new flood protection measures on the floodplain, resulting in bank erosion or slumping to occur during river flooding events.
Activities/Risk Sources	Design, placement, and operation of water abstraction infrastructure.
Mitigation: Target/Objective	Minimise the potential impact by the supporting infrastructure on the riparian systems.

Mitigation: Action/Control	Responsibility	Timeframe
Construction appropriate hard-engineered bank erosion protection structures to be installed at the abstraction point.	Contractor	Construction and operation phase
Careful rehabilitation should be undertaken using natural riparian vegetation to stabilise the riverbanks and all disturbed areas in the riparian zone.	Contractor	Post-Construction

Performance Indicator	» Limited impact on the Gariep River » Compliance with water use licence conditions
Monitoring	CER and ECO to monitor construction near water courses

OBJECTIVE 14 : Manage and reduce the impact of invasive vegetation

Within the project area invasive species – indigenous and alien - occur, which all have a potential of reproducing to such an extent that the ecosystem within and beyond the project area could be impaired. Additional alien species grow along major transport routes to the area and thus could be potentially spread. Indigenous invasive species that need to be controlled include: *Acacia mellifera* subsp. *mellifera,* and *Rhigozum trichotomum.* Alien invasives that must be controlled and eradicated to prevent degradation include *Nicotianan glauca, Prosopis glandulosa, Salsola kali.* Weeds and potentially invasive species on and

around the site that need to be monitored and managed include: *Melia azedarach, Tribulus terrestris, Alternanthera pungens.* An Alien Invasive Management Plan in attached to Appendix C.

Project Component/s	» Power Tower » Heliostats » Power island » Access roads » Substation » Power line » Pipeline » Temporary construction camps » Topsoil stockpiles
Potential Impact	» Impacts on natural vegetation » Impacts on soil » Impact on faunal habitats » Degradation and loss of agricultural potential
Activity/Risk Source	» Transport of construction materials to site » Movement of construction machinery and personnel » Site preparation and earthworks causing disturbance to indigenous vegetation » Construction of site access road » Stockpiling of topsoil, subsoil and spoil material » Routine maintenance work – especially vehicle movement
Mitigation: Target/Objective	» To significantly reduce the presence of weeds and eradicate alien invasive species » To avoid the introduction of additional alien invasive plants to the project control area » To avoid further distribution and thickening of existing alien plants on the project area » To complement existing alien plant eradication programs in gradually causing a significant reduction of alien plant species throughout the project control area

Mitigation: Action/Control	Responsibility	Timeframe
The Alien Invasive Management Plan in attached to Appendix C. This plan must be impmented and can be updated as and when required.	Contractor	Construction
Eradicate and control invasive plants that occur within the development's footprint area	Contractor CER	Construction

Performance Indicator	» Visible reduction of number and cover of alien invasive plants within the project area. » Improvement of vegetation cover from current dominance of invasive

	shrubs to dominance of perennial grasses and dwarf shrubs » No establishment of additional alien invasive species.
Monitoring	Ongoing monitoring of area by the CER and ECO during construction.

OBJECTIVE 15 : Protect of heritage sites or finds

Project component/s	» Power Tower » Heliostats » Power island » Access roads » Substation » Power line » Pipeline » Linear infrastructure
Potential Impact	Destruction, damage, excavation, alteration, removal or collection of heritage objects from their current context on the site.
Activity/risk source	Activities which could impact on achieving this objective include deviation from the planned lay-out of infrastructure without taking heritage impacts into consideration.
Mitigation: Target/Objective	Mitigation measures are not considered necessary. However, should any heritage resources be found, it needs to be dealt with.

Mitigation: Action/control	Responsibility	Timeframe
Develop and implement a procedure in the event that heritage resources (including fossils) are found during construction which details what to do in the event of any major heritage feature being encountered during any phase of development or operation.	Contractor	Construction
Grave and burial areas must be identified and cordoned off prior to the commencement of development so that negative impact and vandalism is avoided.	Contractor	Pre-Construction
Construction managers/foremen should be informed before construction starts on the possible types of heritage sites and cultural material they may encounter and the procedures to follow when they find sites.	Contractor	Pre-Construction
The CER is to be trained to assist in identifying fossils, as required by the recommendations from SAHRA.	CER Specialist	Construction
In the event of any archaeological deposits or features (such as a grave or an ostrich eggshell cache) being encountered, relevant personnel should halt work and notify SAHRA immediately (Tel: 021 462 4502. Fax: 021	Contractor in consultation with Specialist	Construction

462 4509; 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000) to allow for investigation and possible mitigation.		

Performance Indicator	» Inclusion of further heritage impact consideration in any future extension of infrastructural elements. » Immediate reporting to relevant heritage authorities of any heritage feature discovered during any phase of development or operation of the facility.
Monitoring	⌖ Officials from relevant heritage authorities (National and Provincial) to be permitted to inspect the operation at any time in relation to the heritage component of the management plan.

OBJECTIVE 16 : Avoid and or minimise the potential risk of increased veld fires during the construction phase

Project component/s	Construction of the solar energy facility.
Potential Impact	Fires can pose a personal safety risk to local farmers and communities, and their homes, crops, livestock and farm infrastructure, such as gates and fences.
Activity/risk source	The presence of construction workers and their activities on the site can increase the risk of grass fires.
Mitigation: Target/Objective	To avoid and or minimise the potential risk of grass fires on local communities and their livelihoods.

Mitigation: Action/control	Responsibility	Timeframe
Ensure that open fires on the site for are not allowed.	Contractor	Construction
Designate areas for cooking or heating food.	Contractor	Construction
Provide adequate firefighting equipment onsite in a designated area.	Contractor	Construction
Provide fire-fighting training to selected construction staff.	Contractor	Construction
Should any proven losses to farm equipment, land or infrastructure occur as a result of fires started on site or as a result of construction activities, compensate farmers / affected parties. A legal process will have to be undertaken in this regard.	Contractor	Construction

Performance Indicator	» Fire-fighting equipment and training provided before the construction phase commences. » Resolving social issues that may arise timeously
Monitoring	» The proponent and must monitor indicators listed above

OBJECTIVE 17 : Traffic management and transportation of equipment and materials to site

The construction phase of the project will be the most significant in terms of generating traffic impacts; resulting from the transport of equipment (including solar components) and materials and construction crews to the site and the return of the vehicles after delivery of materials. Potential impacts associated with transportation and access relate to works within the site boundary and external works outside the site boundary. Existing national roads (i.e. the N14) and access roads will be used to access the sites in conjunction with the proposed access road during construction and operational phases.

Project Component/s	» Construction vehicles » Abnormal loads/ trucks
Potential Impact	» Traffic congestion, particularly on narrow roads or on road passes where overtaking is not permitted. » Risk of accidents. » Deterioration of road pavement conditions (both surfaced and gravel road) due to abnormal loads.
Activity/Risk Source	» Traffic congestion increase. » Site preparation and earthworks. » Foundations or plant equipment installation. » Transportation of ready-mix cement from off-site batching plant to the site. » Mobile construction equipment movement on-site. » Power line and substation construction activities.
Mitigation: Target/Objective	» To minimise impact of traffic associated with the construction of the facility on local traffic. » To minimise potential for negative interaction between pedestrians or sensitive users and traffic associated with the facility construction. » To ensure all vehicles are roadworthy and all materials/equipment are carried appropriately and within any imposed permit/licence conditions.

Mitigation: Action/Control	Responsibility	Timeframe
Permits for abnormal loads must be applied for from the relevant authority, if required.	Contractor	Pre-construction
A designated access to the proposed site must be created to ensure safe entry and exit.	Contractor	Pre-construction
Appropriate road management strategies must be implemented on external and internal roads with all employees and contractors required to abide by standard road and safety procedures.	Contractor	Pre-construction
Appropriate dust suppression techniques must be used to minimise dust emissions on un-surfaced roads when and if required.	Contractor	Duration of contract

Mitigation: Action/Control	Responsibility	Timeframe
Times for arrival and departure of heavy vehicles must be co-ordinated to minimise congestion as is possible.	Contractor	Duration of contract
Any traffic delays as a result of construction traffic must be co-ordinated with the appropriate authorities.	Contractor	Duration of contract
The movement of all vehicles within the site must be on designated roadways.	Contractor	Duration of contract
Signage must be established at appropriate points warning of turning traffic and the construction site (all signage to be in accordance with prescribed standards and must be maintained for the duration of construction).	Contractor	Duration of contract
Appropriate maintenance of all vehicles of the contractor must be ensured.	Contractor	Duration of contract
All vehicles of the contractor travelling on public roads must adhere to the specified speed limits and all drivers must be in possession of an appropriate valid driver's license.	Contractor	Duration of contract
Keep hard road surfaces as narrow as possible.	Contractor	Duration of contract
Prevent damage to roads by construction vehicles.	Contractor	Duration of contract
Fine grained aggregates transported to and from site must be covered with tarpaulins.	Contractor	Duration of contract
Overloading of any transport vehicles is prohibited.	Contractor	Duration of contract
Compile and implement a traffic management plan for the site access road to ensure that no hazards would result from the increased truck traffic and that traffic flow would not be adversely impacted. This plan must include measures to minimise impacts on local commuters.	Contractor	Construction

Performance Indicator	» No traffic incidents involving the project construction personnel or appointed contractors. » Appropriate signage in place. » No complaints resulting from traffic congestion, delays or driver negligence associated with construction of the solar energy facility.
Monitoring	» Visual monitoring of dust produced by traffic movement. » Visual monitoring of traffic control measures to ensure they are effective » A complaints register will be maintained, in which any complaints from the community will be logged. » Complaints will be investigated and, if appropriate, acted upon. » An incident reporting system will be used to record non-conformances to the EMPr.

OBJECTIVE 18 : Control of blasting operations

Project Component/s	Any infrastructure onsite or in the vicinity and rock formation
Potential Impact	Affect structural stability of surrounding infrastructure Disturbance of the geology and rock formation/stability of the area
Activity/Risk Source	Blasting
Mitigation: Target/Objective	Blasting must be conducted in line with the requirements of the Explosives Act, Occupational Health and Safety Act and Explosive Regulations of South Africa.

Mitigation: Action/Control	Responsibility	Timeframe
Timing, duration and type of blasting procedures must be planned with awareness of other land uses and structures in the vicinity.	Contractor	Construction phase
Neighboring landowners and communities must be informed prior to any blasting event	Contractor	Construction phase
When blasting will be carried out within 500m of any infrastructure, then these must be inspected and their condition must be photographically recorded prior to blasting. Infrastructure include: • Railways • National roads • Power lines • Telecommunication lines • Water mains • Gas mains • Sewer mains • Electric cables • Any building • Public main road Requirements and provisions of relevant authorities must be complied with.	Contractor	Construction phase
Mitigation measures must be implemented during blasting to limit flyrock.	Contractor	Construction phase
Flyrock must be collected and removed which falls beyond the working area together with the rock spill.	Contractor	Construction phase
Waste generated by blasting operations (packaging boxes for explosives) must be managed according to MSDS files.	Contractor	Construction phase

OBJECTIVE 19 : Control noise due to construction activities

Project component/s	» Power Tower » Heliostats » Power island » Access roads » Substation » Power line » Pipeline
Potential Impact	» Increased noise levels at potentially noise-sensitive receptors. » Changing ambient sound levels could change the acceptable land use capability. » Any construction activities taking place at night.
Activities/risk sources	Construction Activities including: » Site clearing » Site establishment » Excavations » Grading / levelling of surfaces » Concrete works » Blasting (if required)
Mitigation: Target/Objective	» Ensure that the change in ambient sound/Rating levels as experienced by receptors is less than 5 dBA. » Prevent the generation of nuisance noises. »

Mitigation: Action/control	Responsibility	Timeframe
Inform surrounding landowners within 2000 metres of the site if any night-time construction activities are to take place.	Contractor	Prior to night-time construction activities
If a valid and reasonable complaint is registered relating to the construction of the facility, additional noise measurements should be undertaken as recommended by an acoustic consultant.	Suitably qualified person/ Acoustical Consultant appointed by Developer	As and when required

Performance Indicator	» Ensure that the change in ambient sound levels or Rating level as experienced by receptors is less than 5 dBA at night. » Ensure that maximum noise levels at potentially sensitive receptors are less than 65 dBA. » No noise complaints are registered.
Monitoring	» ECO to monitor if any noise complaints are lodged with the Contra » ctor.

OBJECTIVE 20 : Mitigation of visual impacts associated with construction

Project Component/s	Construction site
Potential Impact	Visual impact of general construction activities, and the potential scarring of the landscape due to vegetation clearing and resulting erosion.
Activity/Risk Source	The viewing of the above mentioned by observers on or near the site.
Mitigation: Target/Objective	Minimal visual intrusion by construction activities and intact vegetation cover outside of immediate works areas.

Mitigation: Action/control	Responsibility	Timeframe
Ensure that vegetation is not unnecessarily cleared or removed during the construction period.	Contractor	Construction
Plan the placement of lay-down areas and temporary construction equipment camps in order to minimise vegetation clearing (i.e. in already disturbed areas) wherever possible.	Contractor	Construction
Restrict the activities and movement of construction workers and vehicles to the immediate construction site and existing access roads.	Contractor	Construction
Ensure that rubble, litter, and disused construction materials are appropriately stored (if not removed daily) and then disposed regularly at licensed waste facilities.	Contractor	Construction
Reduce and control construction dust through the use of approved dust suppression techniques as and when required (i.e. whenever dust becomes apparent).	Contractor	Construction
Rehabilitate all disturbed areas, construction areas, servitudes etc. immediately after the completion of construction works.	Contractor	Post-Construction

Performance Indicator	» Limited visual scarring of the landscape due to construction.
Monitoring	» Monitoring of vegetation clearing during construction (by contractor as part of construction contract). » Monitoring of rehabilitated areas quarterly for at least a year following the end of construction (by contractor as part of construction contract).

OBJECTIVE 21 : Minimise social nuisances such as noise and dust and damage to roads caused by construction vehicles during the construction phase.

Project component/s	» Construction activities » Construction vehicles utilising public roads
Potential Impact	Heavy vehicles can generate noise and dust impacts. Movement of heavy vehicles can also damage roads.
Activity/risk source	The movement of heavy vehicles and their activities on the site can result in noise and dust impacts and damage roads.
Mitigation: Target/Objective	To avoid and or minimise the potential noise and dust impacts associated with heavy vehicles, and also minimise damage to roads.

Mitigation: Action/control	Responsibility	Timeframe
Implement dust suppression measures for heavy vehicles such as wetting roads.	Contractor	Construction
Ensure that vehicles used to transport sand and building materials are fitted with tarpaulins or covers.	Contractor	Construction
Ensure that all vehicles are road-worthy, drivers are qualified and are made aware of the potential noise, dust and safety issues.	Contractor	Construction
Ensure that drivers adhere to low speed limits.	Contractor	Construction
Ensure that any proven damage to public roads due to the construction of the solar energy facility and associated infrastructure is repaired before completion of construction phase.	Contractor	Construction

Performance Indicator	• Dust suppression measures implemented. • No complaints from the community or landowners.
Monitoring	• A complaints register to be kept on site and filled in. • ECO to monitor and report on the complaints register log

OBJECTIVE 22 : Stimulate and enhance positive socio-economic impacts during the construction phase

Project component/s	CSP Plant All linear infrastructure
Potential Impact	High local economic benefits
Activities/risk sources	Construction procurement practices

Mitigation: Target/Objective	» Employ local community members as far as possible » Stimulate the local economy

Mitigation: Action/control	Responsibility	Timeframe
Increase the local procurement practices and employment of people from local communities as far as feasible to maximise the benefits to the local economies.	Developer and contractors	Construction
Engage with local authorities and business organisations to investigate the possibility of procurement of construction materials, goods, and products from local suppliers where feasible.	Developer and contractors	Construction
Inform the local community meetings to advise the local labour on the project that is planned to be established and the jobs that can potentially be applied for.	Developer and contractors	Construction
Sub-contract to local construction companies where possible	Developer and contractors	Construction
Use local suppliers where feasible.	Developer and contractors	Construction
As much local labour as possible, should be considered for employment to increase the positive impact on the local economy	Developer and contractors	Construction
Facilitate knowledge and skills transfer between workers	Developer and contractors	Construction
Implement apprenticeship programmes to build onto existing or develop new skills of construction workers, especially those coming from the local communities	Developer and contractors	Construction

Performance Indicator	» Developer has engaged with local authorities and business organisations. » Percentage of the expenditure spent on the project spent in the local communities versus the entire nation. » Percentage of labour force employed from local community. » Number of contracts signed between contractor and the local construction companies to supply goods and services directly used in the construction and support of site activities
Monitoring	» The contractors to provide the information on local labour to the ECO to include in ECO reports. »

OBJECTIVE 23 : Reduce social impacts related to crime, social conflicts, property damages and loss of assets

Project component/s	» Construction staff » Power Tower » Heliostats » Power island » Access roads » Substation » Power line » Pipeline
Potential Impact	» Increase in crime and social conflict incidents due to the influx of construction workers and job seekers into the area; » property damages; » theft and losses of assets on the nearby farms including poaching.
Activities/risk sources	Construction Activities including: » Site clearing » Site establishment » Excavations » Grading / levelling of surfaces » Concrete works
Mitigation: Target/Objective	» No illegal / criminal activities due to the construction work-force » No damage to property/ assets

Mitigation: Action/control	Responsibility	Timeframe
Ensure that job seekers are not allowed to loiter around the gates or set up informal settlements in the vicinity of the site.	Contractor	Construction
Reimburse any resident who can adequately prove that any loss, damage or theft was the result of employees associated with the construction of the project.	Contractor / Liable Party	Construction
Construction workers must have a form of identification such as ID tags/ ID cards.	Contractor	Construction
Access to the construction site must be controlled.	Contractor	Construction
Any proven damage to privately owned land or assets as a result of the construction of the CSP Plant must follow a process to rectify / compensate any such person for any such losses.	Contractor / Liable Party	Construction

Performance Indicator	» Number of the workers employed in construction that come from local communities. » Access control system to the construction site. » Number of complaints regarding property damages and asset losses

		received from the affected and the percentage thereof that has been resolved.
Monitoring	»	Developer to monitor the above.

7.3. Detailing Method Statements

OBJECTIVE 24 : : To ensure all construction are undertaken with the appropriate level of environmental awareness to minimise environmental risk, in line with the specifications of the EMPr.

The environmental specifications are required to be underpinned by a series of Method Statements, within which the Contractors and Service Providers are required to outline how any identified environmental risks will practically be mitigated and managed for the duration of the contract, and how specifications within this EMPr will be met. That is, the Contractor will be required to describe how specified requirements will be achieved through the submission of written Method Statements to the Site Manager.

A Method Statement is defined as "a written submission by the Contractor in response to the environmental specification or a request by the Site Manager, setting out the plant, materials, labour and method the Contractor proposes using to conduct an activity, in such detail that the Site Manager is able to assess whether the Contractor's proposal is in accordance with the Specifications and/or will produce results in accordance with the Specifications". The Method Statement must cover applicable details with regard to:

» Details of the responsible person/s
» Construction procedures
» Materials and equipment to be used
» Getting the equipment to and from site
» How the equipment/material will be moved while on-site
» How and where material will be stored
» The containment (or action to be taken if containment is not possible) of leaks or spills of any liquid or material that may occur
» Timing and location of activities
» Compliance/non-compliance with the Specifications, and
» Any other information deemed necessary by the Site Manager.

Method Statements must be compiled for all activities which affect any aspect of the environment and should be applied consistently to all activities. Specific areas to be addressed in the method statement: pre, during and post construction include:

- Site establishment (which explains all activities from induction training to offloading, construction sequence for site establishment and the different amenities and to be established etc. Including a site camp plan indicating all of these).
- Preparation of the site (i.e. clearing vegetation, compacting soils and removing existing infrastructure and waste).
- Soil management/stockpiling and erosion control.
- Excavations and backfilling procedure.
- Stipulate norms and standards for water supply and usage (i.e.: comply strictly to licence and legislation requirements and restrictions)
- Stipulate the storm water management procedures recommended in the storm water management method statement.
- Ablution facilities (placement, maintenance, management and servicing)
- Solid Waste Management:
  - Description of the waste storage facilities (on site and accumulative).
  - Placement of waste stored (on site and accumulative).
  - Management and collection of waste process.
  - Recycle, re-use and removal process and procedure.
- Liquid waste management:
  - The design, establish, maintain and operate suitable pollution control facilities necessary to prevent discharge of water containing polluting matter or visible suspended materials into rivers, streams or existing drainage systems.
  - Should grey water (i.e. water from basins, showers, baths, kitchen sinks etc.) need to be disposed of, link into an existing facilities where possible. Where no facilities are available, grey water runoff must be controlled to ensure there is no seepage into wetlands or natural watercourses.
- Dust and noise pollution
  - Describe necessary measures to ensure that noise from construction activities is maintained within lawfully acceptable levels.
  - Procedure to control dust at all times on the site, access roads, borrow pits and spoil sites (dust control shall be sufficient so as not to have significant impacts in terms of the biophysical and social environments). These impacts include visual pollution, decreased safety due to reduced visibility, negative effects on human health and the ecology due to dust particle accumulation.
- Hazardous substance storage (Ensure compliance with all national, regional and local legislation with regard to the storage of oils, fuels, lubricants, solvents, wood treatments, bitumen, cement, pesticides and any other harmful and hazardous substances and materials. South African National Standards apply).
  - Lists of all potentially hazardous substances to be used.
  - Appropriate handling, storage and disposal procedures.
  - Prevention protocol of accidental contamination of soil at storage and handling areas.

    - All storage areas, (i.e.: for harmful substances appropriately bunded with a suitable collection point for accidental spills must be implemented and drip trays underneath dispensing mechanisms including leaking engines/machinery).
- Fire prevention and management measures on site.
- Fauna and flora protection process on and off site (i.e. removal to reintroduction or replanting, if necessary).
    - Rehabilitation and re-vegetation process.
- Incident and accident reporting protocol.
- General administration
- Designate access road and the protocol on while roads are in use.
- Requirements on gate control protocols.

The Contractor may not commence the activity covered by the Method Statement until it has been approved by the Site Manager, except in the case of emergency activities and then only with the consent of the Site Manager. Approval of the Method Statement will not absolve the Contractor from their obligations or responsibilities in terms of their contract.

Failure to submit a method statement may result in suspension of the activity concerned until such time as a method statement has been submitted and approved. The ECO should monitor the construction activities to ensure that these are undertaken in accordance with the approved Method Statement.

7.4. Awareness and Competence: Construction Phase of the Solar Energy Facility

OBJECTIVE 25 : To ensure all construction personnel have the appropriate level of environmental awareness and competence to ensure continued environmental due diligence and on-going minimisation of environmental harm

To achieve effective environmental management, it is important that Contractor is aware of the responsibilities in terms of the relevant environmental legislation and the contents of this EMPr. The Contractor is responsible for informing employees and sub-contractors of their environmental obligations in terms of the environmental specifications, and for ensuring that employees are adequately experienced and properly trained in order to execute the works in a manner that will minimise environmental impacts. The Contractors obligations in this regard include the following:

- Employees must have a basic understanding of the key environmental features of the construction site and the surrounding environment.
- Ensuring that a copy of the EMPr is readily available on-site, and that all site staff are aware of the location and have access to the document.

» Employees will be familiar with the requirements of the EMPr and the environmental specifications as they apply to the construction of the facility.
» Ensuring that, prior to commencing any site works, all employees and sub-contractors have attended an Environmental Awareness Training session.
» The training session should be sufficient to provide the site staff with an appreciation of the project's environmental requirements, and how they are to be implemented
» Awareness of any other environmental matters, which are deemed to be necessary by the ECO.
» Ensuring that employee information posters, outlining the environmental "do's" and "don'ts" are erected at prominent locations throughout the site.
» Records must be kept of those that have completed the relevant session.
» Refresher sessions must be held to ensure the contractor staff are aware of their environmental obligations as practically possible.

Therefore, prior to the commencement of construction activities on site and before any person commences with work on site thereafter, adequate environmental awareness and responsibility are to be appropriately presented to all staff present onsite, clearly describing their obligations towards environmental controls and methodologies in terms of this EMPr. This training and awareness will be achieved in the following ways:

7.4.1. Induction Training

Environmental induction training must be presented to all persons who are to work on the site – be it for short or long durations; Contractor's or Engineer's staff; administrative or site staff; sub-contractors or visitors to site.

This induction training should include discussing the developer's environmental policy and values, the function of the EMPr and Contract Specifications and the importance and reasons for compliance to these. The induction training must highlight overall do's and don'ts on site and clarify the repercussions of not complying with these. The non-conformance reporting system must be explained during the induction as well. Opportunity for questions and clarifications must form part of this training. A record of attendance of this training must be maintained by the Safety manager/ officer on site.

7.4.2. Toolbox Talks

Toolbox talks should be held on a scheduled and regular basis (at least twice a month) where foremen, environmental and safety representatives of different components of the Works and sub-consultants hold talks relating to environmental practices and safety awareness on site. These talks should also include discussions on possible common incidents occurring on site and the prevention of reoccurrence thereof. Records of attendance and the awareness talk subject must be kept on file.

7.5. Monitoring Programme: Construction Phase of the Solar Energy Facility

OBJECTIVE 26 : To monitor the performance of the control strategies employed against environmental objectives and standards.

A monitoring programme must be in place not only to ensure conformance with the EMPr, but also to monitor any environmental issues and impacts which have not been accounted for in the EMPr that are, or could result in significant environmental impacts for which corrective action is required. The period and frequency of monitoring will be stipulated by the Environmental Authorisation (once issued). Where this is not clearly dictated, Abengoa Solar Power South Africa through the Site Manager will determine and stipulate the period and frequency of monitoring required in consultation with relevant stakeholders and authorities. The Project Manager will ensure that the monitoring is conducted and reported.

The aim of the monitoring and auditing process would be to routinely monitor the implementation of the specified environmental specifications, in order to:

» Monitor and audit compliance with the prescriptive and procedural terms of the environmental specifications.
» Ensure adequate and appropriate interventions to address non-compliance.
» Ensure adequate and appropriate interventions to address environmental degradation.
» Provide a mechanism for the lodging and resolution of public complaints.
» Ensure appropriate and adequate record keeping related to environmental compliance.
» Determine the effectiveness of the environmental specifications and recommend the requisite changes and updates based on audit outcomes, in order to enhance the efficacy of environmental management on site.
» Aid communication and feedback to authorities and stakeholders.

The ECO must have the appropriate experience and qualifications to undertake the necessary tasks. The ECO will ensure compliance with the EMPr, will conduct monitoring activities, and will report any non-compliance or where corrective action is necessary to the Site Manager and/or any other monitoring body stipulated by the regulating authorities. The following reports will be applicable:

7.5.1. Non-Conformance Reports

All supervisory staff including Foremen, Resident Engineers, and the ECO must be provided the means to be able to submit non-conformance reports to the Site Manager. Non-conformance reports will describe, in detail, the cause, nature and effects of any

environmental non-conformance by the Contractor. Records of penalties imposed may be required by the relevant authority.

The non-conformance report will be updated on completion of the corrective measures indicated on the finding sheet. The report must indicate that the remediation measures have been implemented timeously and that the non-conformance can be closed-out to the satisfaction of the Site Manager and ECO.

7.5.2. Monitoring Reports

A monitoring report will be compiled by the ECO on a monthly basis and must be submitted to DEA for their records. This report should include details of the activities undertaken in the reporting period, any non-conformances or incidents recorded, corrective action required, and details of those non-conformances or incidents which have been closed out.

7.5.3. Final Audit Report

A final environmental audit report must be submitted to DEA upon completion of the construction and rehabilitation activities. This report must indicate the date of the audit, the name of the auditor and the outcome of the audit in terms of compliance with the environmental authorisation conditions and the requirements of the EMPr.

MANAGEMENT PROGRAMME: REHABILITATION CHAPTER 8

8.1. Overall Goal for the Rehabilitation of Disturbed Areas

Overall Goal for the Rehabilitation of Disturbed Areas: Undertake the rehabilitation measures in a way that:

» Ensures rehabilitation of disturbed areas following the execution of the works, such that residual environmental impacts are remediated or curtailed

8.2. Objectives

In order to meet this goal, the following objective, actions and monitoring requirements are relevant:

OBJECTIVE 27 : To ensure appropriate rehabilitation of disturbed areas following the execution of the works, such that residual environmental impacts are remediated or curtailed

Areas requiring rehabilitation will include all areas disturbed during the construction phase and that are not required for regular operation and maintenance operations. Rehabilitation should be undertaken in an area as soon as possible after the completion of construction activities within that area.

The main areas requiring rehabilitation will be the disturbed areas around the footprint of the solar array and the power islands, any cable routings where these fall outside the above-mentioned areas, and disturbed areas around the substation and maintenance building, disturbed areas associated with the power line tower foundations, water supply pipeline and associated water storage/treatment reservoirs, and access roads.

Project Component/s	» Components of the solar energy facility (including temporary access roads and construction areas). » Power islands and associated service roads. » Water supply pipeline and water storage/treatment reservoirs. » Power line servitude.
Potential Impact	Environmental integrity of site undermined resulting in reduced visual aesthetics, erosion, compromised land capability and the requirement for on-going management intervention..
Activity/Risk Source	» Temporary construction areas. » Temporary access roads/tracks.

	» Other disturbed areas/footprints.
Mitigation: Target/Objective	» To ensure and encourage site rehabilitation of disturbed areas. » To ensure that the site is appropriately rehabilitated following the execution of the works, such that residual environmental impacts (including erosion) are remediated or curtailed.

Mitigation: Action/Control	Responsibility	Timeframe
All temporary facilities, equipment, and waste materials must be removed from site.	Contractor	Following execution of the works
All temporary fencing and two coloured shade cloth netting must be removed once the construction phase has been completed.	Contractor	Following completion of construction activities in an area
Necessary drainage works and anti-erosion measures must be installed, where required, to minimise loss of topsoil and control erosion.	Contractor	Following completion of construction activities in an area
A rehabilitation plan should be drawn up that specifies the rehabilitation process..	Contractor, Developer	Pre-construction
Rehabilitate and re-vegetate all disturbed areas at the construction equipment camp when construction is complete within an area.	Contractor	Following completion of construction activities in an area
Disturbed areas must be rehabilitated/re-vegetated with appropriate natural vegetation and/or local seed mix. .	Contractor, ECO	Following completion of construction activities in an area
Re-vegetated areas may have to be protected from wind erosion and maintained until an acceptable plant cover has been achieved.	Developer	Post-rehabilitation
Erosion control measures should be used in sensitive areas such as steep slopes, hills and drainage lines where necessary.	Developer	Post-rehabilitation
On-going alien plant monitoring and removal must be undertaken on all areas of natural vegetation on an annual basis.	Developer	Post-rehabilitation

Performance Indicator	» All portions of site, including construction equipment camp and working areas, cleared of equipment and temporary facilities. » Topsoil replaced on all areas and stabilised where practicable or

	required after construction and temporally utilised areas. » Disturbed areas rehabilitated and acceptable plant cover achieved on rehabilitated sites. » Completed site free of erosion and alien invasive plants.
Monitoring	» On-going inspection of rehabilitated areas in order to determine effectiveness of rehabilitation measures implemented during the operational lifespan of the facility. » On-going alien plant monitoring and removal should be undertaken on an annual basis.

MANAGEMENT PROGRAMME: OPERATION CHAPTER 9

9.1. Overall Goal for Operation

Overall Goal for Operation: To ensure that the operation of the solar energy facility does not have unforeseen impacts on the environment and to ensure that all impacts are monitored and the necessary corrective action taken in all cases. In order to address this goal, it is necessary to operate the solar energy facility in a way that:

» Ensures that operation activities are properly managed in respect of environmental aspects and impacts.
» Enables the operation activities to be undertaken without significant disruption to other land uses in the area, in particular with regard to noise impacts, farming practices, traffic and road use, and effects on local residents.

9.2. Objectives

In order to meet this goal, the following objectives have been identified, together with necessary actions and monitoring requirements.

OBJECTIVE 28 : Good environmental management of the remaining biodiversity on the site

Indirect impacts on vegetation during operation could result from maintenance activities and the movement of people and vehicles on site.

Project Component/s	» Power Tower » Heliostats » Power island » Access roads » Substation » Power line » Pipeline » Storage tanks and evaporation ponds » Topsoil stockpiles
Potential Impact	» Substantially increased loss of species of conservation concern and other natural vegetation at construction phase, waste of on-site plant resources, lack of locally sourced material for rehabilitation of disturbed areas; » Increased cost of rehabilitation
Activities/Risk Sources	» Construction related loss and damage to remaining natural and semi-natural vegetation

Mitigation: Target/Objective	» Rescue, maintenance and subsequent replanting of at least all bulbous protected plant species within the specific land portion

Mitigation: Action/Control	Responsibility	Timeframe
An open space management plan must be drafted relating to ecosystem integrity to ensure the safeguarding of the lands productivity and the functionality of the ecosystem on and beyond the development site.	Developer	Operations
Implement a biodiversity monitoring programme for all components of the project.	Developer	Operations
Implement an appropriate alien and invasive management programme for all components of the project	Developer	Operation
Implement an erosion management plan	Developer	Operation
Implement a storm water management plan to: » Ensure that stormwater management structures do not negatively affect the above or pose any contamination risk of lower-lying larger ephemeral drainage lines, rivers and the Gariep (Orange) River. » Aim to channel runoff back into larger natural drainage lines to maintain seasonal moisture replenishment of these drainage lines beyond the development area to prevent the die-off of keystone species in drainage lines outside the development area.	Developer	Operation
Implement a Zero Liquid Effluent Discharge (ZLED) policy for the CSP Plant	Developer	Operation
Obtain water use licence for the operation of the power plant prior to commencement of operation	Developer	Prior to the Operation al Phase
Implement a fire management plan	Developer	Operation
Monitor for any seepage at evaporation ponds	Developer	Operation
Develop and implement a procedure for handling and clean-up of the chemical spillages including the following: » Should any chemical spillages occur, these must be cleaned up as soon as possible » Use appropriate techniques such as non-combustible absorbent materials for clean-up of chemical spillages. » Store collected / contaminated material in a suitable, labelled container. » If heated material is spilled, allow it to cool to ambient before proceeding with disposal methods. » Keep area around hot, spilled material well ventilated. » Reporting: Report spills to appropriate local authorities. This product is classified as dangerous good. » Discharge or spills that produce a visible sheen on surface water or in waterways/sewers that lead to surface water must be reported to appropriate authorities.	Developer	Operation

Mitigation: Action/Control	Responsibility	Timeframe
Develop a monitoring and leak detection procedure for monitoring of the chemicals.	Developer	Operation
Independent environmental audits to be conducted during the operational phase at a monitoring frequency to be determine by the DEA.	Independent environmental auditor	Operation Recommend bi-annual audits for first two years and then annually thereafter

Performance Indicator	» Rescue of species of conservation concern » No damage or injury to fauna » Limited pollution due to the operation of the CSP Plant
Monitoring	» The Environmental Manager will keep records of the impacts and mitigation measures implemented during the operational phase. » Independent environmental auditing during the operational phase.

OBJECTIVE 29 : Maintenance of rehabilitated areas

In order to ensure the long-term environmental integrity of the site following construction, maintenance of the areas rehabilitated post-construction must be undertaken until these areas have successfully re-established.

Project Component/s	» Power Tower » Heliostats » Power island » Access roads » Substation » Power line » Pipeline » Power island and associated service roads. » Water storage/treatment reservoirs.
Potential Impact	» Environmental integrity of site undermined resulting in reduced visual aesthetics, erosion, compromised land capability and the requirement for on-going management intervention.
Activity/Risk Source	» Constructions areas. » Access roads. » Other disturbed areas.
Mitigation: Target/Objective	To ensure and encourage site rehabilitation of disturbed areas.

Mitigation: Action/Control	Responsibility	Timeframe
A botanist familiar with the vegetation of the area should monitor the rehabilitation success and alien plant removal on an annual basis.	Specialist	Annual monitoring until successful re-establishment of vegetation in an area
Fire breaks should be established, where appropriate and applicable.	Developer	Duration of contract

Performance Indicator	Successful rehabilitation of disturbed areas.
Monitoring	On-going alien plant monitoring and removal should be undertaken on an annual basis.

OBJECTIVE 30 : Protection of avifauna and priority bird species

During the operation of the facility, the threat of collision of avifauna with the power line exists. The threat of electrocution while perching on the power line and associated infrastructure serves as a threat to certain sensitive species.

Project Component/s	Power line.
Potential Impact	Collision and electrocution events with the overhead power line.
Activities/Risk Sources	Overhead power line.
Mitigation: Target/Objective	To maintain a low number of collision and electrocution events.

Mitigation: Action/Control	Responsibility	Timeframe
Monitor power line for any electrocution and collision events must be sent to a qualified ornithologist for the recommendation of further mitigation measures.	Environmental manager	Operation

Performance Indicator	Limited collision or electrocution events.
Monitoring	» Observation of electrocution or collision events with the power line » Monitor power line servitude for.

OBJECTIVE 31 : Minimisation of visual impacts of the CSP Plant

The placement of the solar energy facility and its associated infrastructure will have a visual impact on the natural scenic resources and rural character of this region. The primary visual impact, namely the appearance and dimensions of the solar energy facility is not possible to mitigate to any significant extent within this landscape. The functional design of the structures and the dimensions of the facility cannot be changed in order to reduce visual impacts. Other impacts include impacts associated with lighting of the substation and the operational, security and safety lighting fixtures of the proposed solar energy facility will have some impact surrounding observers.

Project Component/s	» Power tower » Heliostats » Associated infrastructure. » Water supply pipeline and water storage/treatment reservoirs. » Power line. » Operational, security and safety lighting fixtures.
Potential Impact	» Enhanced visual intrusion. » Impact on ambient lighting conditions.
Activity/Risk Source	» Substation, operational, and security associated lighting. » Access roads. » Power line, and water storage/treatment reservoirs. » Other associated infrastructure.
Mitigation: Target/Objective	» To minimise potential for visual impact. » Minimise contrast with surrounding environment and visibility of the associated infrastructure. » The containment of light emitted from the facility in order to eliminate the risk of additional night-time visual impacts.

Mitigation: Action/Control	Responsibility	Timeframe
Ensure that proper planning is undertaken regarding the placement of lighting structures.	Contractor	Construction, operation, and maintenance
Maintain the general appearance of the facility in an aesthetically pleasing way.	Developer	Operation and maintenance
Undertake regular maintenance of light fixtures.	Developer	Operation and maintenance
Control access to the solar energy facility site, power line, water supply pipeline and associated infrastructure.	Developer	Operation and maintenance
Avoid the unnecessary removal of vegetation within the distribution power line servitude during maintenance, and limit access to the servitudes (during both construction	Developer	Operation and maintenance

and operational phases) along existing access roads.		

Performance Indicator	» Minimised visual intrusion on surrounding areas. » Appropriate visibility of infrastructure to aircraft. » The effective containment of light.
Monitoring	» The monitoring of the condition and functioning of the light fixtures during the operational phase of the project.

OBJECTIVE 32 : Appropriate handling and management of hazardous substances and waste

The operation of the solar energy facility will involve the generation of waste products and waste water. The main wastes expected to be generated by the operation activities includes general solid waste, hazardous waste and liquid waste.

Project Component/s	» Use of fuel for start up » Use of chemicals » Operation and maintenance staff » Workshop
Potential Impact	» Inefficient use of resources resulting in excessive waste generation » Litter or contamination of the site or water through poor waste management practices.
Activity/Risk Source	» Transformers and switchgear – substation. » Water storage tank. » Fuel and oil storage. » Maintenance building.
Mitigation: Target/Objective	» To comply with waste management guidelines. » To minimise production of waste. » To ensure appropriate waste disposal. » To avoid environmental harm from waste disposal.

Mitigation: Action/Control	Responsibility	Timeframe
Maintain evaporation ponds and associated liners on an ongoing basis to minimise risk of failures.	Developer	Operation and maintenance
Monitor evaporation ponds for detection of any leakages	Developer	Operation and maintenance
Hazardous substances (such as used/new transformers and chemicals) must be stored in sealed containers within a clearly demarcated designated area.	Developer	Operation and maintenance
Storage areas for hazardous substances must be appropriately sealed and bunded.	Developer	Operation and maintenance

Mitigation: Action/Control	Responsibility	Timeframe
All structures and/or components replaced during maintenance activities must be appropriately disposed of at an appropriately licensed waste disposal site or sold to a recycling merchant for recycling.	Developer	Operation and maintenance
Care must be taken to ensure that spillage of oils and other hazardous substances are limited during maintenance. Handling of these materials should take place within an appropriately sealed and bunded area. Should any accidental spillage take place, it will be cleaned up according to specified standards regarding bioremediation.	Developer	Operation and maintenance
Waste handling, collection, and disposal operations must be managed and controlled by a waste management contractor.	Developer	Operation and maintenance
Used oils and chemicals: Appropriate disposal must be arranged with a licensed facility in consultation with the administering authority.	Developer	Operation and maintenance
Waste must be stored and handled according to the relevant legislation and regulations.	Developer	Operation and maintenance
General waste must be recycled where possible or disposed of at an appropriately licensed landfill.	Developer	Operation and maintenance
Hazardous waste (including hydrocarbons) and general waste must be stored and disposed of separately.	Developer	Operation and maintenance
Disposal of waste must be in accordance with relevant legislative requirements, including the use of licensed contractors.	Developer	Operation and maintenance

Performance Indicator	» No complaints received regarding waste on site or indiscriminate dumping. » Internal site audits identifying that waste segregation recycling and reuse is occurring appropriately. » Provision of all appropriate waste manifests. » No contamination of soil or water.
Monitoring	» Waste collection must be monitored on a regular basis. » Waste documentation must be completed and available for inspection on request. » An incidents/complaints register must be maintained, in which any complaints from the community must be logged. » Complaints must be investigated and, if appropriate, acted upon. » Regular reports on exact quantities of all waste streams exiting the site must be compiled by the waste management contractor. » All appropriate waste disposal certificates accompany the monthly reports.

MANAGEMENT PROGRAMME: DECOMMISSIONING CHAPTER 10

The solar infrastructure which will be utilised for the proposed solar energy facility is expected to have a lifespan of 30 years and eventual extensions (i.e. with maintenance and refurbishment) potentially increasing this to 40 years. Equipment associated with this facility would only be decommissioned once it has reached the end of its economic life. It is most likely that decommissioning activities of the infrastructure of the facility would comprise the disassembly and replacement of the solar infrastructure with more appropriate technology/infrastructure available at that time. *The mitigations contained under the construction section should be applied during decommissioning and this is not repeated in this section.*

Should the activity ever cease or become redundant, the applicant shall undertake the required actions as prescribed by legislation at the time and comply with all relevant legal requirements administered by any relevant and competent authority at that time.

10.1. Site Preparation

Site preparation activities will include confirming the integrity of the access to the site to accommodate required equipment, preparation of the site (e.g. lay down areas, construction platform) and the mobilisation of construction equipment.

10.2 Disassemble and Remove Infrastructure

Disassembled components will be reused, recycled, or disposed of in accordance with regulatory requirements.

OBJECTIVE 33 : To minimise the environmental and social impacts associated with the decommissioning phase

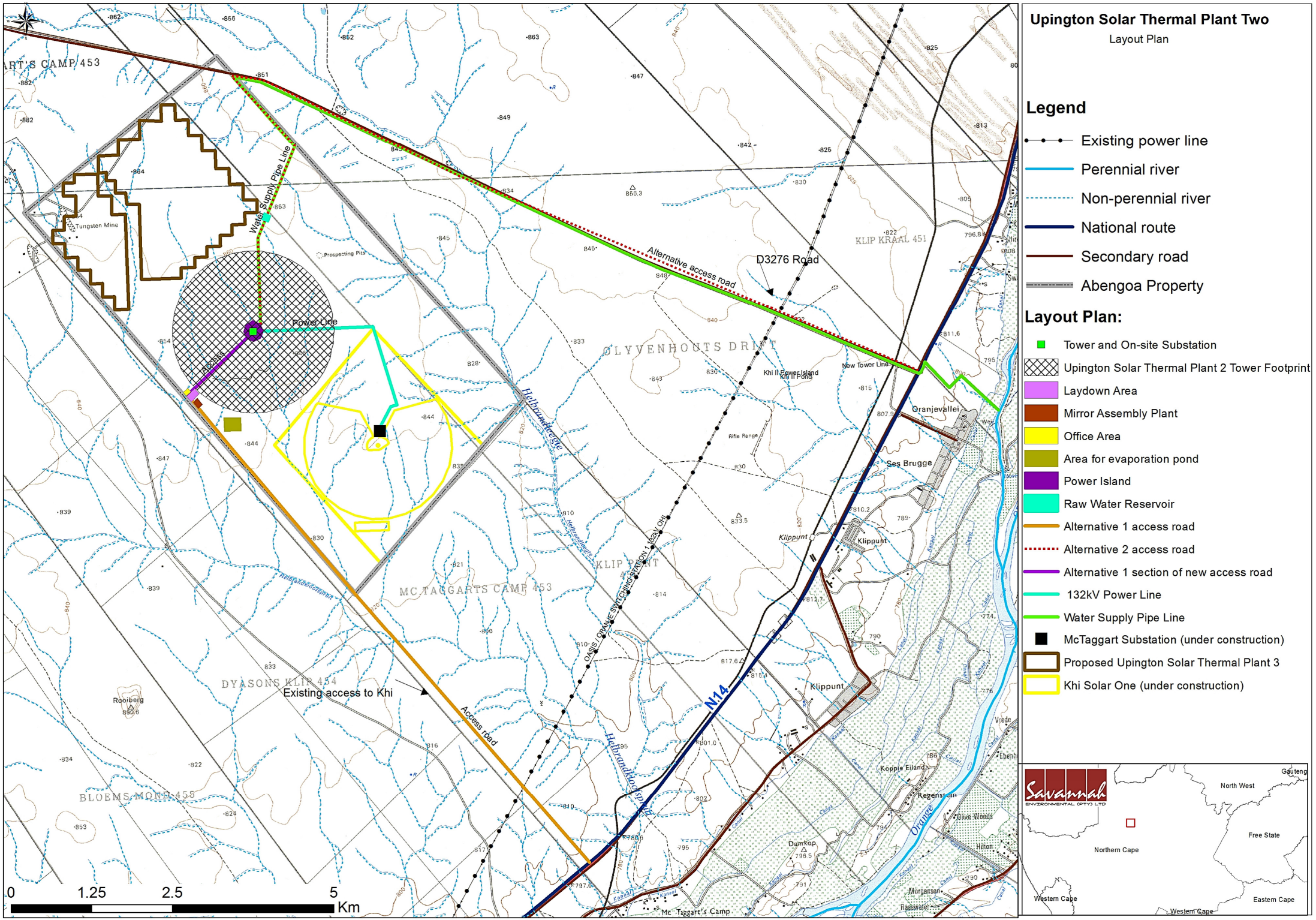
Project Component/s	Decommissioning phase of the solar energy facility.
Potential Impact	» Decommissioning will result in job losses and create temporary employment opportunities. » Environmental degradation
Activity/Risk Source	Decommissioning of the solar energy facility.
Mitigation: Target/Objective	To avoid and or minimise the potential social impacts associated with decommissioning phase of the solar energy facility.

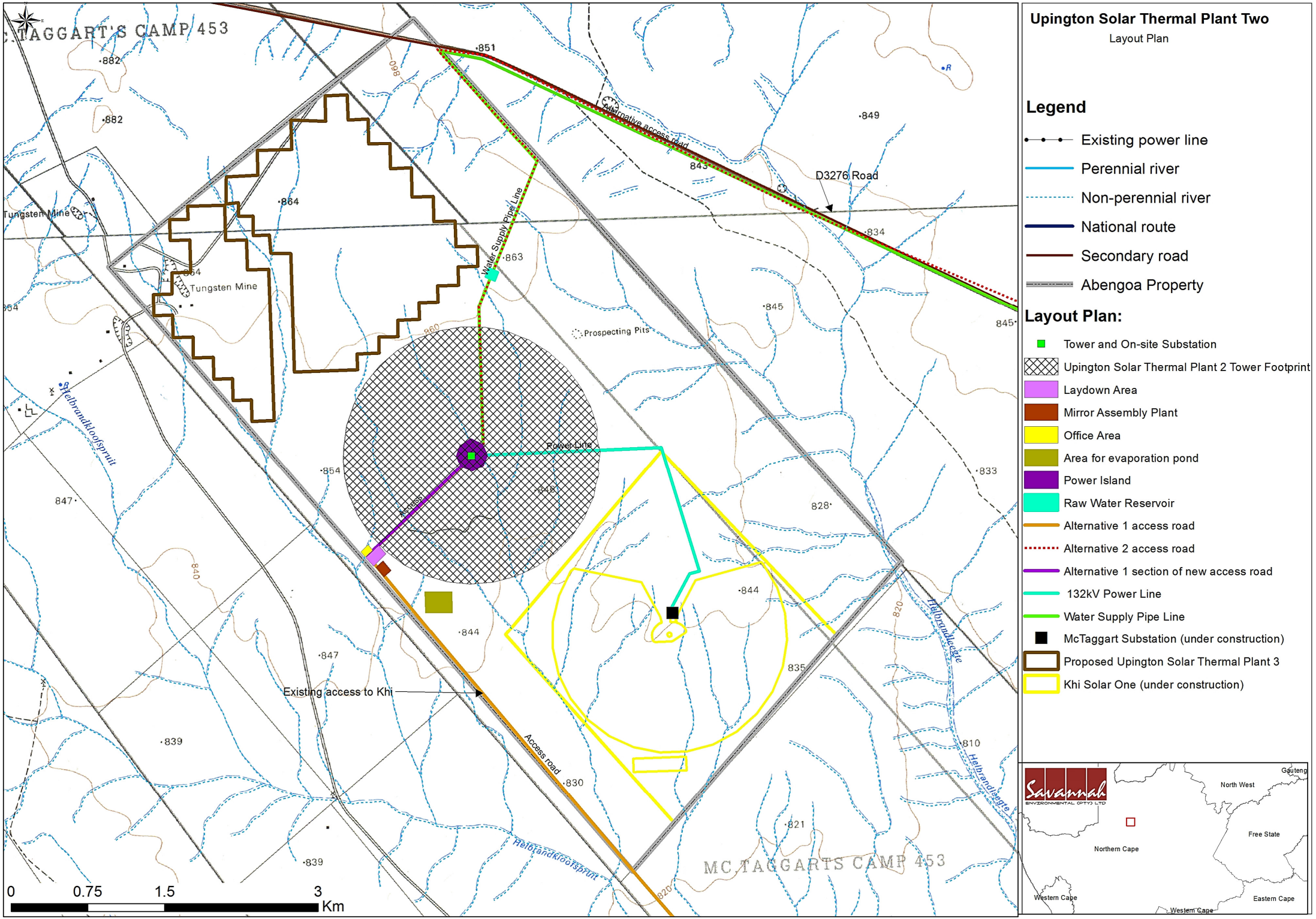
Mitigation: Action/control	Responsibility	Timeframe
Retrenchments should comply with South African labour legislation of the day	Developer	Decommissioning.
Rehabilitation to be undertaken in terms of specifications outlined in the Rehabilitation Section of this EMP (Chapter 8) as well as in terms of any specific requirements applicable at the time.	Developer	Decommissioning.
Once the facility has exhausted its life span, the main facility and all associated infrastructure not required for the post rehabilitation use of the site should be removed and all disturbed areas appropriately rehabilitated. An ecologist should be consulted to give input into rehabilitation specifications.	Developer	Decommissioning.
All rehabilitated areas should be monitored for at least a year following decommissioning, and remedial actions implemented as and when required.	Developer	Decommissioning.
Rehabilitation of the site should start immediately after decommissioning is completed.	Developer	Decommissioning
All excavations must be rehabilitated with soil and topsoil, which should not contain invasive plant species	Developer	Decommissioning
Re-vegetation specifications to be developed.	Developer	Decommissioning
All building materials must be removed from the site. All compacted surfaces must be ripped and re-vegetated as per the re-vegetation specifications.	Developer	Decommissioning
Rehabilitation to be conducted in a progressive manner (i.e. once decommissioning in an area has been completed the area will be rehabilitated). The rehabilitation of the area with indigenous vegetation must coincide with the rainfall events and all alien invasive vegetation shall be removed.	Developer/ appointed Contractor	Decommissioning
Rehabilitation measures for the site are to include the following: » Re-contouring Subsoil stockpiles should be used to re-contour construction affected areas. The Contractor shall restore the profile, soil condition and landform to as close as possible state to the pre-construction state. » Scarification and ripping All areas where rehabilitation interventions are required shall be cross-ripped before topsoil placement. Topsoil and fertile soil shall be uniformly scarified to allow for vegetation growth Fertilising The Contractor shall be required to perform soil	Developer/ appointed Contractor	Decommissioning

Mitigation: Action/control	Responsibility	Timeframe
analysis tests on the top 75mm of prepared surface prior to re-vegetation/seeding to determine the required fertiliser levels for permanent cover. » Seed acquisition The Contractor shall purchase seed from a South African National Seed Organisation (SANSOR) accredited dealer.		
Schedule works for placing of topsoil once all infrastructure has been successfully decommissioned. Seeding can then take place after the first rains of the season and should be concluded by one month before the end of the growing season.	Developer/ appointed Contractor	Decommissioning
The seed mix for use in rehabilitation must be an approved mix of indigenous grass species common to the area.	Project Developer/ appointed Contractor	Decommissioning
Maintain rehabilitated areas free of weeds and invader plants until the end of the Defects Notification Period applicable to rehabilitation. Control of weeds and invader plants must be done in accordance with the specifications stipulated in the CARA.	Developer/ appointed Contractor	Decommissioning
Implement appropriate measures to erosion in areas impacted upon by their activities. All erosion repairs must be implemented at the first signs thereof and no erosion shall be allowed to develop on a large scale.	Developer/ appointed Contractor	Decommissioning
All recyclable rubble and solid waste (e.g. scrap metal, cables, bottles, cans, and plastic residues) shall be collected and disposed of through a registered recycling company. Waste manifests will be kept by the Contractor and shown to the ECO on request.	Developer/ appointed Contractor	Decommissioning
All non-recyclable rubble and solid waste shall be collected and disposed of at an approved waste disposal site. Waste manifests will be shown to the ECO on request.	Developer/ appointed Contractor	Decommissioning
Prepare a Rehabilitation Close-Out Report	Developer/ appointed Contractor	Post-Decommissioning

Performance Indicator	» South African Labour legislation at the relevant time » Successful re-vegetation and rehabilitation of the site
Monitoring	» Rehabilitation undertaken in accordance with the EMPr » Monitoring of Rehabilitation by ECO b& Rehabilitation Close-Out Report

APPENDIX A:
SITE LAYOUT MAP


Upington Solar Thermal Plant Two
Layout Plan
Legend
Existing power line
Perennial river
Non-perennial river
National route
Secondary road
Abengoa Property
Layout Plan:
Tower and On-site Substation
Upington Solar Thermal Plant 2 Tower Footprint
Laydown Area
Mirror Assembly Plant
Office Area
Area for evaporation pond
Power Island
Raw Water Reservoir
Alternative 1 access road
Alternative 2 access road
Alternative 1 section of new access road
132kV Power Line
Water Supply Pipe Line
McTaggart Substation (under construction)
Proposed Upington Solar Thermal Plant 3
Khi Solar One (under construction)
Water Supply Pipe Line
Alternative access road
D3276 Road
Power Line
Existing access to Khi
Access road
N14
Tungsten Mine
Prospecting Pits
Khi II Power Island
Khi II Pond
New Tower Line
Rifle Range
Oranjevallei
Ses Brugge
Klippunt
Koppie Eiland
Regenstein
Olive Woods
Hilton
Damkop
Morgenson
Raasvalei
Mc Taggart's Camp
Rooiberg
KLIP KRAAL 451
OLYVENHOUTS DRIFT
MC TAGGARTS CAMP 453
DYASONS KLIP 454
BLOEMS MONS 458
Orange
0
1.25
2.5
5
Km
Savannah
ENVIRONMENTAL (PTY) LTD
Gauteng
North West
Free State
Northern Cape
Western Cape
Eastern Cape



Upington Solar Thermal Plant Two

Layout Plan

Legend

- Existing power line
- Perennial river
- Non-perennial river
- National route
- Secondary road
- Abengoa Property

Layout Plan:

- Tower and On-site Substation
- Upington Solar Thermal Plant 2 Tower Footprint
- Laydown Area
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- Area for evaporation pond
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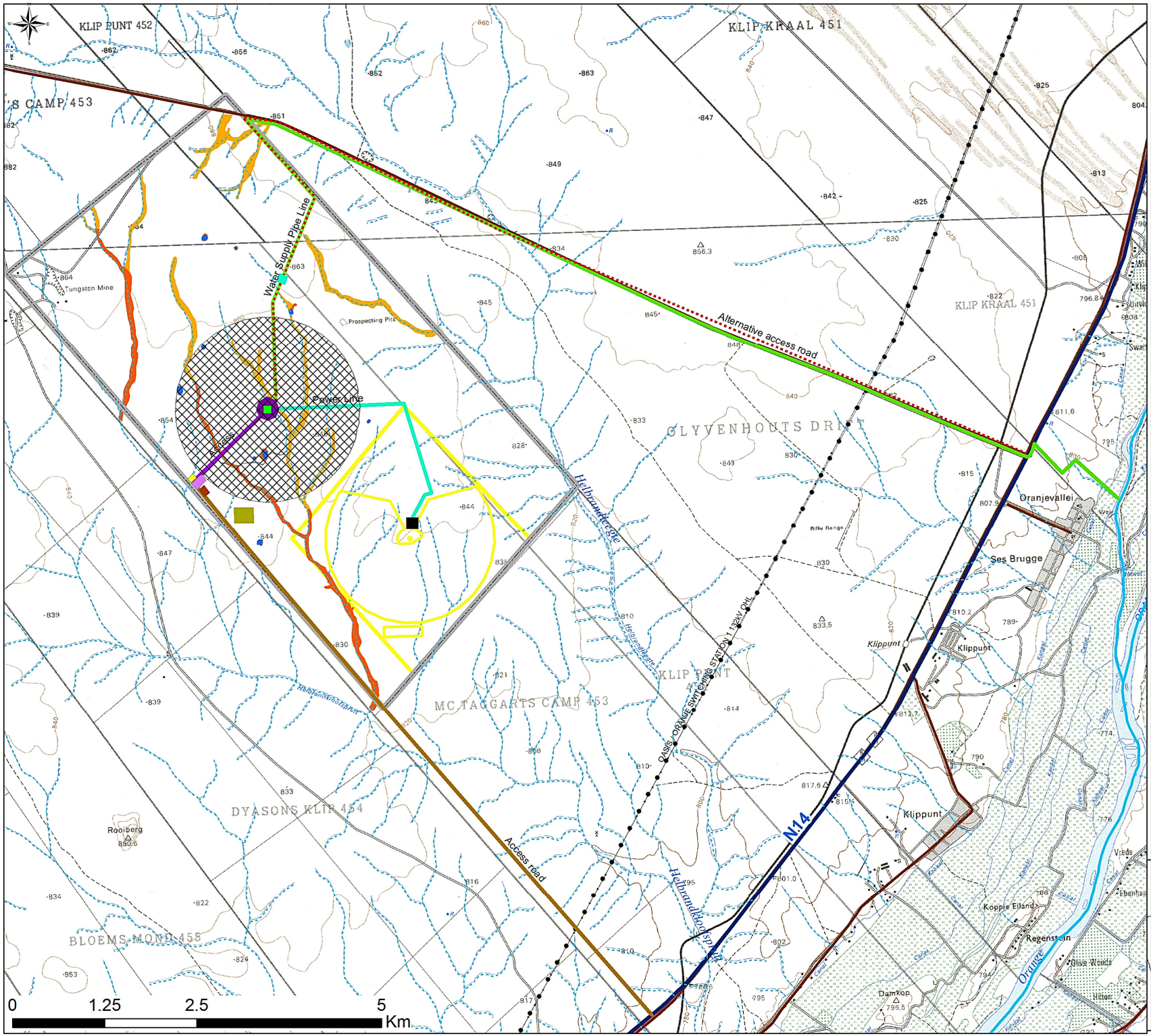
- 132kV Power Line
- Water Supply Pipe Line
- McTaggart Substation (under construction)
- Proposed Upington Solar Thermal Plant 3
- Khi Solar One (under construction)

APPENDIX B:
ENVIRONMENTAL SENSITIVITY MAP



Upington Solar Thermal Plant Two

Environmental sensitivity

Legend

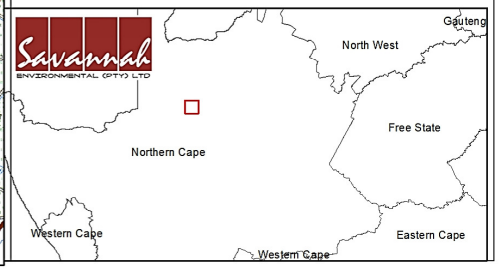
- Existing power line
- Perennial river
- Non-perennial river
- National route
- Secondary road
- Abengoa Property

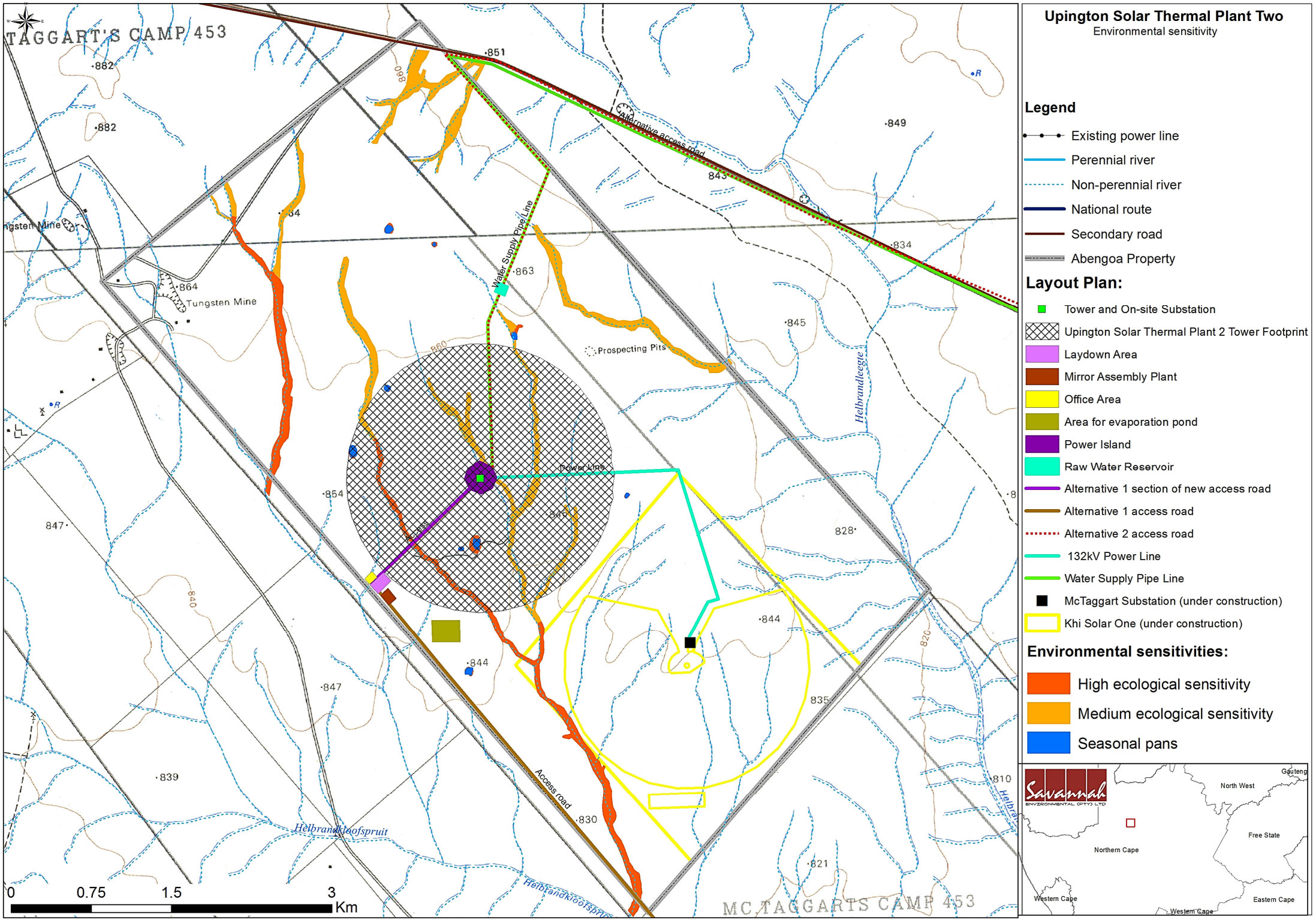
Layout Plan:

- Tower and On-site Substation
- Upington Solar Thermal Plant 2 Tower Footprint
- Laydown Area
- Mirror Assembly Plant
- Office Area
- Area for evaporation pond
- Power Island
- Raw Water Reservoir
- Alternative 1 section of new access road
- Alternative 1 access road
- Alternative 2 access road
- 132kV Power Line
- Water Supply Pipe Line
- McTaggart Substation (under construction)
- Khi Solar One (under construction)

Environmental sensitivities:

- High ecological sensitivity
- Medium ecological sensitivity
- Seasonal pans





Upington Solar Thermal Plant Two

Environmental sensitivity

Legend

- Existing power line
- Perennial river
- Non-perennial river
- National route
- Secondary road
- Abengoa Property

Layout Plan:

- Tower and On-site Substation
- Upington Solar Thermal Plant 2 Tower Footprint
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- Alternative 1 section of new access road
- Alternative 1 access road
- Alternative 2 access road
- 132kV Power Line
- Water Supply Pipe Line
- McTaggart Substation (under construction)
- Khi Solar One (under construction)

Environmental sensitivities:

- High ecological sensitivity
- Medium ecological sensitivity
- Seasonal pans

APPENDIX C:
ALIEN INVASIVE MANAGEMENT PLAN

ALIEN INVASIVE PLANT MANAGEMENT PLAN

OVERALL OBJECTIVE

Manage alien and invasive plant species during the construction and operation of the solar energy facility, through the implementation of an alien invasive species management and control programme.

PROBLEM OUTLINE

Alien plants replace indigenous vegetation leading to severe loss of biodiversity and change in landscape function. Potential consequences include loss of biodiversity, loss of grazing resources, increased fire risk, increased erosion, loss of wetland function, impacts on drainage lines, increased water use etc.

In addition, the Conservation of Agricultural Resources Act (Act 43 of 1983), as amended in 2001, requires that land users clear *Declared Weeds* from their properties and prevent the spread of *Declared Invader Plants* on their properties. A list of declared weeds and invader plants is attached.

Table 3 of CARA (the Conservation of Agricultural Resources Act) lists all declared weeds and invader plants. Alien plants are divided into 3 categories based on their risk as an invader.

- Category 1 - These plants must be removed and controlled by all land users. They may no longer be planted or propagated and all trade in these species is prohibited.
- Category 2 – These plants pose a threat to the environment but nevertheless have commercial value. These species are only allowed to occur in demarcated areas and a land user must obtain a water use license as these plants consume large quantities of water.
- Category 3 – These plants have the potential of becoming invasive but are considered to have ornamental value. Existing plants do not have to be removed but no new plantings may occur and the plants may not be sold.

The following guide is a useful starting point for the identification of alien species:

Bromilow, C. 2010. *Problem Plants and Alien Weeds of South Africa*. Briza, Pretoria.

SPECIFIC MANAGEMENT OBJECTIVES:

- Ensure alien plants do not become dominant in parts or the whole landscape
- Initiate and implement a monitoring and eradication programme for alien and invasive species

- Control alien and invasive species dispersal & encroachment
- Promote the natural reestablishment and planting of indigenous species

VULNERABLE ECOSYSTEMS AND HABITATS

Certain habitats and environments are more vulnerable to alien plant invasion and are likely to bear the brunt of alien plant invasion problems at the site. In addition, construction activities and changes in water distribution at the site following construction are also likely to increase and alter the vulnerability of the site to alien plant invasion.

Areas at the site which are likely to require specific attention include the following

- Wetlands, drainage lines and other mesic areas
- Cleared and disturbed areas such as road verges, crane pads and construction footprints etc.
- Construction camps and lay-down areas which are cleared or are active for an extended period

Wetlands, drainage lines and other mesic areas

There are a relatively large number of drainage lines at the site as well as a number of natural and artificial wetlands. Disturbance within these areas often results in alien plant invasion on account of the greater water and nutrient availability in this habitat. Although there are no turbines within such areas, numerous road crossings will be required. The disturbance footprint within such areas should be minimized and these areas should be checked for alien species more often than the surrounding landscape.

Cleared and disturbed areas

Cleared and disturbed areas are clearly vulnerable to invasion on account of the lack of existing plant cover to resist invasion as well as the disturbance which created during construction which promotes the germination and establishment of alien plant species.

Construction camps and laydown areas

Construction camps and lay down areas are either cleared of vegetation or prolonged activities in these areas result in negative impact on indigenous vegetation. In addition, repeated vehicle and human activity in these areas usually results in the import of alien plant seed on clothes, dirty vehicles or with construction machinery and materials.

GENERAL CLEARING & GUIDING PRINCIPLES

- Alien control programs are long-term management projects and should include a clearing plan which includes follow up actions for rehabilitation of the cleared area. Alien problems at the site should be identified during preconstruction surveys of the development footprint. This may occur simultaneously to other required searches and

surveys. The clearing plan should then form part of the preconstruction reporting requirements for the site.
- The plan should include a map showing the alien density & indicating dominant alien species in each area.
- Lighter infested areas should be cleared first to prevent the build-up of seed banks.
- Dense mature stands of woody species where present should be left for last, as they probably will not increase in density or pose a greater threat than they are at the moment.
- Collective management and planning with neighbours may be required as seeds of aliens are easily dispersed across boundaries by wind or water courses.
- All clearing actions should be monitored and documented to keep track of which areas are due for follow-up clearing.

CLEARING METHODS

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

USE OF HERBICIDES FOR ALIEN CONTROL

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

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

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

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

ALIEN PLANT MANAGEMENT PLAN

CONSTRUCTION PHASE ACTIVITIES

The following management actions are aimed at reducing soil disturbance during the construction phase of the development, as well as reducing the likelihood that alien species will be brought onto site or otherwise encouraged.

Action	Frequency
The ECO is to provide permission prior to any vegetation being cleared for development.	Daily
Clearing of vegetation must be undertaken as the work front progresses – mass clearing is not allowed unless the entire cleared area is to be rehabilitated immediately.	Weekly
Should re-vegetation not possible immediately, the cleared areas must be protected with packed brush, or appropriately battered with fascine work. Alternatively, jute (Soil Saver) may be pegged over the soil to stabilise it.	Weekly
Cleared areas that have become invaded can be sprayed with appropriate herbicides provided that these are such that break down on contact with the soil. Residual herbicides should not be used.	Weekly
Although organic matter is frequently used to encourage regrowth of vegetation on cleared areas, no foreign material for this purpose should be brought onto site. Brush from cleared areas should be used as much as possible. Arid soils are usually very low in organic matter and the use of manure or other soil amendments is likely to encourage invasion.	Weekly
Clearing of vegetation should not be allowed within 50m of any wetland or pan, 80m of any wooded area, within 1:100 year floodlines, in conservation servitude areas or on slopes steeper than 1:3, unless permission is granted by the ECO for specifically allowed construction activities in these areas.	Weekly
Care must be taken to avoid the introduction of alien plant species to the site and surrounding areas. (Particular attention must be paid to imported material such as building sand or dirty earth-moving equipment.) Stockpiles should be checked regularly and any weeds emerging from material stockpiles should be removed.	Weekly
Alien vegetation regrowth must be controlled throughout the entire site during the construction period.	Monthly
The alien plant removal and control method guidelines should adhere to best-practice for the species involved. Such information can be obtained from the DWAF Working for Water website.	Monthly

Clearing activities must be contained within the affected zones and may not spill over into demarcated No Go areas.	Daily
Pesticides may not be used. Herbicides may be used to control listed alien weeds and invaders only.	Monthly
Drainage lines and other sensitive areas should remain demarcated with appropriate fencing or hazard tape while construction activities within the area are underway. These areas are no-go areas (this must be explained to all workers) that must be excluded from all development activities.	Daily

MONITORING – CONSTRUCTION PHASE

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

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

OPERATIONAL PHASE ACTIVITIES

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

Action	Frequency
Surveys for alien species should be conducted regularly. Every 3 months for the first two years after construction and biannually thereafter. All aliens identified should be cleared.	Every 3 months for 2 years and biannually thereafter
Re-vegetation with indigenous, locally occurring species should take place in areas where natural vegetation is slow to recover or where repeated invasion has taken place.	Biannually, but re-vegetation should take place at the start of the rainy season.
Areas of natural vegetation that need to be maintained or managed to reduce plant height or biomass, should be controlled using methods that leave the soil protected, such as using a weed-eater to	When necessary

mow above the soil level.	
No alien species should be cultivated on-site. If vegetation is required for esthetic purposes, then non-invasive, water-wise locally-occurring species should be used.	When necessary

MONITORING – OPERATIONAL PHASE

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

Monitoring Action	**Indictor**	**Timeframe**
Document alien species distribution and abundance over time at the site	Alien plant distribution map	Biannually
Document alien plant control measures implemented & success rate achieved	Records of control measures and their success rate. A decline in alien distribution and cover over time at the site	Quarterly
Document rehabilitation measures implemented and success achieved in problem areas	Decline in vulnerable bare areas over time	Biannually

DECOMMISSIONING PHASE ACTIVITIES

The following management actions are aimed at preventing the invasion, by alien plant species, of the re-vegetated areas created during the decommissioning phase. Re-vegetation of the disturbed site is aimed at approximating as near as possible the natural vegetative conditions prevailing prior to operation.

Action	**Frequency**
All damaged areas shall be rehabilitated if the infrastructure is removed and the facility is decommissioned.	Once off
All natural areas must be rehabilitated with species indigenous to the area. Re-seed with locally-sourced seed of indigenous grass species that were recorded on site pre-construction.	Once off, with annual follow up re-vegetation where required.
Maintain alien plant monitoring and removal programme for 3 years after rehabilitation.	Biannually

MONITORING – DECOMMISSIONING PHASE

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

Monitoring Action	Indictor	Timeframe
Monitor newly disturbed areas where infrastructure has been removed to detect and quantify any aliens that may become established for 3 years after decommissioning and rehabilitation.	Alien plant surveys and distribution map	Biannually until such time as the natural vegetation has recovered sufficiently to resist invasion.
Monitor re-vegetated areas to detect and quantify any aliens that may become established for 3 years after decommissioning and rehabilitation.	Alien plant surveys and distribution map	Biannually for 3 years
Document alien plant control measures implemented & success rate achieved	Records of control measures and their success rate. A decline in alien distribution and cover over time at the site	Annually for 3 years

REFERENCES:

AGIS (2006) Weeds and Invasive Plants Atlas (www.agis.agric.za/wip)

APPENDIX D:
PLANT RESCUE AND PROTECTION AND REHABILITATION PLAN

METHODS FOR PLANT RESCUE AND RE-VEGETATION MANAGEMENT PLAN

List of Abbreviations

CARA:	Conservation of Agricultural Resources Act 43 of 1983
DEA:	Department of Environmental Affairs
EA:	Environmental Authorisation
ECO:	Environmental Control Officer
EMP:	Environmental Management Plan
NEMA:	National Environmental Management Act 107 of 1998
LFA:	Landscape Functional Analysis (Tongway and Hindley 2004)
IAP:	Invasive Alien Plant

List of Definitions:

Accelerated soil erosion: Soil erosion induced by human activities.

Acceptable cover: An acceptable cover shall mean that not less than 75% (in an area with rainfall above 400 mm per annum), or 40% (in regions receiving less than 400 mm rain per annum), of the area planted or hydroseeded shall be covered with grass and that there shall be no bare patches of more than 500 mm in maximum dimension.

Alien: originating from another country or continent and originally different environment, commonly used to describe plants that are not indigenous to South Africa and have become problematic (spreading rapidly, threatening existing biodiversity).

Allelopathic components: one or more biochemical compound produced by a plant and released through leaf litter or roots that suppresses the growth, survival, and reproduction of other surrounding vegetation.

Bare soil: Un-vegetated soil surface, unaltered by humans.

Compacted soil surface: A soil surface that has been hardened by an outside source, causing the soil to be more compacted than the surrounding area.

Container plants: Container plants include all vegetation which are bought or supplied in acceptable containers from nurseries or vegetation lifted out of their natural position and placed in containers.

Desirable end state: the future condition or target on which the rehabilitation is designed and that will serve later as a basis for rehabilitation success evaluation. This can be based on a reference site or modelled according to available information on historic vegetation.

Ecological rehabilitation: The process of assisting the recovery of a degraded or damaged ecosystem in a trajectory that renders the ecosystem fully functional, stable, and able to develop further, but not necessarily returning to the original historic state.

Ecological restoration: The process of assisting the recovery of an ecosystem that has been degraded damaged or destroyed, in a trajectory that ultimately returns the ecosystem to its natural successional stage.

Ecosystem: The combination of biota within a given area, together with a suitable environment that sustains the biota and the interactions between biota. It can have a spatial unit of any size, but shows some degree homogeneity as far as structure, function and species composition is concerned. Small-scale ecosystems typically link up to larger scale ecosystems and all contribute to the ecosystem function and services at the landscape-scale.

Establishment of grass: All procedures necessary to produce an acceptable cover of grass on an area.

Establishment Period: The Establishment Period is defined as the period beginning from the actual planting or placing of vegetation until three months thereafter, unless otherwise specified or unless grass cover is unacceptable or unless plants have not taken.

Extinction debt: is a concept that describes the future extinction of species due to events in the past. Extinction debt occurs because of time delays between impacts on a species, such as destruction of habitat or reduction of population size, and the species' ultimate disappearance.

Geophytic: resprouting during the growing season from an underground storage organ such as bulbs, corms, tubers or rhizomes, and dying back completely during unfavourable seasons.

Hydroseeding: To apply seed in a slurry with water (plus other materials to enhance growth) by means of a spraying device.

Indigenous: refers to a plant or animal that occurs naturally in the place in which it is currently found.

Invasive plant: a kind of plant which has under section 2 (3) of CARA been declared an invader plant, and includes the seed of such plant and any vegetative part of such plant which reproduces itself asexually.

Landscape: Consists of a mosaic of two or more ecosystems that exchange organisms, energy, water, and nutrients.

Nursery conditions: These are the necessary conditions to maintain healthy growth of rescued and/or container plants. This includes protection of such plants against wind, frost, direct sunlight, pests, rodents, diseases, and drought. It also includes the provision of suitable water, fertilizer and any other measures required to maintain the container plants.

Period of Maintaining: The Period of Maintaining is defined as the period following directly after the Establishment Period until the end of the Period of Maintenance for the whole Contract as defined in the General Conditions of Contract, unless otherwise specified.

Revegetation: The process of establishing a vegetative cover on exposed soils, regardless of species composition or structure, as long as the species are

non-invasive and their presence will not impede the gradual process of ecological rehabilitation or –restoration.

Soil Erosion: is a natural process whereby the ground level is lowered by wind or water action and may occur as a result of inter alia chemical processes and or physical transport on the land surface**.**

Scarifying: To roughen the surface of soil as a preparation for seeding or topsoil addition.

Trimming: To neatly round off the levels of existing or previously shaped earthworks to blend in with the levels of other earthworks, constructed works, or natural landforms.

Transformation: The conversion of an ecosystem to a different ecosystem or land use type.

Topsoil: uppermost layer of soil, in natural vegetation maximally 30 cm, in cultivated landscapes the total depth of cultivation, containing the layer with humus, seeds and nutrients. Topsoils that are applied to landscapes to be rehabilitated must be free of refuse, large roots and branches, stones, alien weeds and/or any other agents that would adversely affect the topsoils suitability for re-vegetation.

Weed: a plant that grows where it is not wanted, and can therefore be an indigenous or alien species. An unwanted plant growing in a garden is just called a weed, but the 198 listed IAPs are called "declared weeds and invaders".

1. Purpose

The Plant Rescue and Revegetation Management Plan addresses the need to mitigate all impacts leading to disturbed vegetation, loss of species and/or agricultural potential, disturbed soil surfaces, and generally bare soils prone to erosion and further degradation on the proposed development site.

The objective of the plan is therefore to provide:

» Protocols for the removal, temporary storage and replanting of plant species of conservation concern
» Protocols for the rehabilitation of vegetative cover across the project area
» Tools for planning the rehabilitation work and responding to unforeseen events
» Guidelines on implementation and post-implementation tasks
» Criteria for evaluating rehabilitation success
» A summary of items to be included in the rehabilitation budget to ensure that there is sufficient allocation of resources on the project budget so that the scale of EMPR-related activities is consistent with the significance of project impacts

2. Scope

This document is a plant rescue, rehabilitation, and revegetation plan that provides a guideline to be applied by all contractors on the development site. This plan, as part of the project EMPr, is a legally binding document that must be implemented to fullfil the requirements of relevant legislation. However, the management plan is an evolving guideline that needs to be updated or adapted as progress is made with the rehabilitation and revegetation of the project area, and successes and failures of procedures identified.

The objective of rescuing plants, rehabilitation and revegetation on the project area is:

» Preventing the loss of species either directly or through future extinction and minimising impacts of development on population dynamics of species of conservation concern.
» Preserving the natural configuration of habitats as part of ecosystems, thus ensuring a diverse but stable hydrology, substrate and general environment for species to be able to become established and persist.
» Preserving or re-creating the structural integrity of natural plant communities.
» Actively aid the improvement of indigenous biodiversity according to a desirable end state according to a previously recorded reference state. This reference state, if healthy, will be dynamic and able to recover after occasional disturbances without returning to a degraded state.
» Improving the ecosystem function of natural landscapes and their associated vegetation.

3. Legislation and Standards

Relevant legislation:

» Conservation of Agricultural Resources Act 43 of 1983
» Environmental Conservation Act 73 of 1989
» National Forestry Act 84 of 1998
» National Environmental Management Act 107 of 1998
» Northern Cape Nature Conservation Act (Act No. 9 of 2009)

4. Effect of clearing alien vegetation

Invasive and Alien Plants (IAPs) gradually displace and suppress indigenous and/or herbaceous vegetation as their stands become bigger and denser. In addition, they use more water, hence desiccate the soil more, and may alter chemical properties of the soil – partially through secondary compounds released from their litter, partially from compounds released from roots. These altered soils suppress the germination and establishment of herbaceous species, leading to bare soil underneath dense IAP canopies.

After clearing dense stands of invasive shrubs, soil surfaces are thus generally bare with topsoil exposed to erosion and often already somewhat capped and eroded.

5. Effect of removing individuals of species of conservation concern

Species of conservation concern are declining either due to overexploitation or because their range of occupancy is limited and further infringed on by development. Most plant populations require a certain minimum number of individuals within a population or metapopulation to allow for sufficient genetic transfer between individuals. This prevents genetic erosion and hence weakening of the ability of individuals to persist in their environments. Similarly, where the distance between metapopulations is significantly increased due to fragmentation and the resultant loss of some populations, populations may suffer genetic decline due to restricted movement of pollen. Pollinators or other species that depend on a particular plant species for a specific microhabitat or food source may be equally affected because of the reduction of available resources. Therefore the aim of plant rescue actions are always to maintain as many individuals of a plant population in as close proximity to the original habitat as possible to minimise loss of individuals and fragmentation of populations to prevent the creation of future extinction debts of the development.

6. General: Plant rescue and protection

Successful plant rescue can only be achieved if:

» Species can be removed from their original habitat with minimal damage to the plant, especially the roots.
» All plants removed are safely stored and treated according to their specific requirements prior to being transplanted again.
» They are relocated into a suitable habitat and protected from further damage and all disturbances to aid their re-establishment.
» Timing of planting activities is planned with the onset of the growing season.
» Steps are taken where necessary to aid the initial establishment of vegetation, including occasional watering.

6.1. Time of planting

» All planting shall be carried out as far as is practicable during the period most likely to produce beneficial results (i.e. during the peak growing season), but as soon as possible after completion of a section of earthworks.
» Drainage line rehabilitation preparation must be done during autumn, and planting of appropriate species in these areas should commence during early spring after the first rains.

7. General: IAP removal

Removal of invasive plants should at all time follow the specifications and guidelines of the Working for Water Programme (refer also to invasive plant management plan).

Information can be obtained from the relevant website:
http://www.dwaf.gov.za/wfw

Detailed information on clearing methods is available on the above websites "Alien Invasive Plants" menu (clearing methods, operational standards and species-specific treatment methods).

8. General: Rehabilitation and re-vegetation

Successful rehabilitation can only be achieved with:
» A long-term commitment
» Practical, adaptive management
» Viable goals of desired outcomes

Prior to vegetation rehabilitation, all stakeholders involved should be consulted to determine:

» What the rehabilitation is ultimately aiming for– rehabilitation of cropping/grazing lands or rehabilitation of indigenous vegetation, after soil erosion and storm water management is in place and IAPs have been cleared?

» A clear definition of incompatible and compatible vegetation on and in the immediate surroundings of the development must be defined and maintained as such. No tree or shrubs shall be allowed to grow to a height in excess of the horizontal distance of that tree or shrub from the nearest newly developed structure or to grow in such a manner as to endanger the development or its operation
» Who will take long-term ownership and hence responsibility for the rehabilitation and its subsequent monitoring and management? Continued monitoring of vegetation establishment and composition, as well as erosion detection will have to be coupled with continued follow-up maintenance of rehabilitation and erosion control from commencement of activity up to the decommissioning phase.

The ultimate objective for rehabilitation should focus on the stabilisation of soil erosion, retaining agricultural potential of transformed areas and /or the establishment of a dense and protective plant cover and the maintenance of habitats to enable vegetation to persist and flourish on rehabilitated areas indefinitely, ultimately relying only on environmental resources.

8.1. Map and create management areas

The entire project area must be mapped and divided into management areas indicating:

» Current land cover
  - Roads and residential
  - Areas with IAPs, subdivided further in sparse or dense infestations where applicable
  - Transformed areas
  - Untransformed indigenous vegetation

For every one of the management areas, the project proponent, in consultation with the land users, will have to decide what intervention will be necessary, desirable, and feasible to enable the development of the project and long-term sustainable maintenance of infrastructure. Thus for every management area there must be an operational outline on:

» what will happen there
» what needs to be mitigated – including storm water- and erosion management
» which management units need priority intervention/mitigation
» how will this mitigation / intervention be done (method statements) including schedule of work
» realistic and desirable end states including list of species that should be established to initiate rehabilitation after initial revegetation
» approximate timeframes
» monitoring protocol to evaluate success or failures of interventions

    - establish permanently marked transects and monitor with fixed-point photography
- » who will be responsible for doing what
- » how will different actions be integrated to achieve and maintain or improve the desirable end state of the environment of that management unit

Special attention will have to be given to drainage zones, as these not only have very active morphodynamics, but are also distributers of seeds – both indigenous and of IAPs. Thus clearing a downstream invasion of aliens to enable maintenance of the development will be futile if the upstream IAPs are not cleared or at least aggressively controlled.

8.2. Setting realistic rehabilitation goals

Rehabilitation efforts typically aim at improving ecosystem function that consists of a series of processes, which can in the end be evaluated against a desired outcome or reference state of the vegetation and environment.

Attainable goals of rehabilitation on the project area should be possible and viable for at least the following:

- » Stabilisation of soils
- » Stabilisation of riparian areas
- » Storm water reduction through management and wetland integrity
- » Clearing of IAPs
    - The degree to which IAPs can be cleared from the project area needs to be determined according to desirability, available project funding, personnel and project requirements
- » Restoring and/or rehabilitating vegetative cover on non-transformed areas to obtain an acceptable vegetation cover that can be maintained or persists on its own indefinitely

8.3. Remove or ameliorate the cause of degradation

This will include:

- » Physical rehabilitation of topsoil where it has been removed.
- » Topsoil on areas that have not been cultivated are considered as the upper 20 - 30 cm only. These contain the most important nutrients, micro flora and –fauna essential for nutrient cycling processes. Topsoils are also an important source of seeds.
- » Subsoils and overburden substrata lack the above elements and will first have to be used for physical rehabilitation of landscapes as and where necessary, and then overlain with topsoils
- » Stabilisation of topsoils and prevention of erosion – refer to the Erosion management pan

» Removal of all invasive vegetation – refer to the Invasive Management Plan
  - Where it is desirable to use brush or logs of the cleared vegetation for soil stabilisation, such material must be free of regenerative material – e.g. seeds or root suckers

8.4. Initial revegetation

Immediately after clearing of vegetation, the soil surface must be inspected for signs of erosion and stabilised as soon as possible. After completion of construction, such erosion stabilisation should preferably be with a cover of vegetation. A dense initial grass or other perennial cover will be desirable. The appropriate seed mix should be determined in consultation with an ecologist familiar with the area. The aim of the first vegetation cover is to form a protective, relatively dense indigenous layer to slow runoff, increase moisture infiltration into the soil, and gradually change the soil nutrient status in order for it to be more favourable for other desirable indigenous vegetation to become established.

8.5. Plant Search and Rescue

Prior to construction, once all the areas where topsoil will be removed or areas will be transformed have been demarcated, the contractor will be responsible to remove all bulbous species from the topsoil, as well as succulents and small indigenous shrubs that can be transplanted. These are to be kept in a raised, protected position in a designated area until they can be replanted again as part of the rehabilitation process. Further details are listed in the operation standards.

8.6. Natural seed banks and improvement of plant structural and compositional diversity

It is expected that soil seed banks of indigenous vegetation will be present to initiate initial vegetation cover, but may not be sufficient to establish an acceptable cover of desirable species. After deciding which indigenous species should be re-introduced, seed should be ideally collected from site or an environmentally-matched site nearby.

Seed collection may be done throughout the year as seed ripens, but can also be restricted to summer, when a large amount of the perennial seed should have ripened. Seeds should be stored in paper or canvas bags dusted with insecticide, and sown at the onset of the rainy season.

Alternatively, slower-growing perennials may be raised from seed or cuttings in a nursery and then transplanted once established. It will be beneficial to investigate if community members would be able to create and maintain such a nursery, or if there are nurseries in the area, that raise indigenous flora from the area.

The final vegetation cover should resemble the original (non-encroached) vegetation composition and structure as far as practicable possible or permissible within each management unit.

For drainage areas:

» First restore drainage line morphology following the guidelines of the Erosion management plan – without that ecological recovery cannot be initiated
» Determine if natural seed sources may be present further upstream
» If such upstream seed sources are still present, rehabilitation of riparian vegetation after soil erosion management will most likely occur naturally, PROVIDED that follow-up monitoring of the establishment of vegetation is carried out, and all invasive species eradicated as they emerge. This can only be achieved with a long-term commitment (> 5 years minimum)
» Should no upstream seed resources be available, suitable species (as determined in consultation with an ecologist) should be sown or planted.

8.7. Monitoring and follow-up action

Throughout the lifecycle of the development, regular monitoring and adaptive management must be in place to detect any new degradation of ecosystems affected by the development, and remedy these as soon as detected.

During the construction phase, the contractor will be responsible for initiating and maintaining a suitable monitoring system. Once the development is operational, the project proponent will have to identify a suitable entity that will be able to take over and maintain the monitoring cycle and initiate adaptive management as soon as it is required. Monitoring personnel must be adequately trained.

The following are the minimum criteria that should be monitored:
» Composition and density of replanted vegetation, distinguishing between species introduced for initial revegetation only and species that are part of the pre-determined desirable end state
» Associated nature and stability of surface soils
  - It is recommended that permanent transects are marked and surveyed annually according to the LFA technique (Tongway and Hindley 2004), adapted to integrate both surface soil characteristics and the vegetation to be monitored
» Re-emergence of IAPs
  - If noted, remedial action must be taken immediately according to Working for Water specifications
» Nature and dynamics of riparian zones
  - Stability of riparian vegetation
  - Any form of bank erosion, slumping or undercutting
  - Stability of channel form and width of streams – if this increases, it shows that vegetation on plains and/or riparian areas and upper drainage lines are

not yet in a stable enough state to be fully functional in reducing excess runoff and the ecosystem overall is losing valuable resources

8.8. Timeframes and duration

» Rehabilitation will occur during construction, as areas for the re-application of topsoil and revegetation become available or where revegetation can be initiated after clearing of invasives or to stabilise erosion.
» The initial revegetation period post construction is estimated to be over a period of 6 (minimum) to 12 months (maximum), or a time period specified by the Horticultural Landscape Contractor, particularly if planting of trees and shrubs occurs.
» The rehabilitation phase (including post seeding maintenance) should be at least 12 months (depending on time of seeding and rainfall) to ensure establishment of an acceptable plant cover is achieved (excluding invasive plant species or weeds).
» If the plants have not established and the acceptable plant cover is not achieved within the specified maintenance period, maintenance of these areas shall continue until at acceptable plant cover is achieved (excluding alien plant species or weeds).
» Additional seeding or planting may be necessary to achieve acceptable plant cover. Hydroseeding may have to be considered as an option in this case.
» Any plants that die, during the maintenance period, shall be replaced by the Horticultural Landscape Contractor (at the Horticultural Landscape Contractor's cost if it was due to insufficient maintenance).
» Succession of natural plant species should be encouraged
» Monitoring of rehabilitation success and follow-up adaptive management, together with clearing of emerging invasives shall be carried on until the decommissioning phase has been completed.

9. Conclusion

The Plant Rescue and Revegetation Management Plan is a document to assist the contractor and the developer with guidelines on how to plan and implement the required work, and understand the concepts behind successful rehabilitation. The exact details of the rehabilitation plan will depend on the determined extent of rehabilitation that will have to be undertaken, available funding, and desirable end state of the vegetation after rehabilitation.

10. References and further reading

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A. APPENDIX: RECOMMENDED OPERATIONAL STANDARDS

OBJECTIVE: Revegetate and Rehabilitate disturbed areas

The Contractor must take all reasonable measures to ensure that plant species of conservation concern are rescued and survive indefinitely. Landscaped topsoils as well as areas cleared of IAPs must be adequately rehabilitated and /or revegetated to ensure that the ecosystems affected by the development regain and/or retain their functionality indefinitely.

Throughout the lifecycle of the development, regular monitoring and adaptive management must be in place to detect any new degradation of ecosystems affected by the development and remedy these as soon as detected.

Mitigation measures relating to the vegetative cover as part of a healthy ecosystem must be implemented in order to effectively limit and gradually reverse the impact on the environment. The focus of the mitigation measures laid out below relate to project-related disturbances. Where such disturbances are exacerbated by farming-related disturbances or vice versa, mitigation measures must be carried out in consultation with the land-user responsible.

Project component/s	Project components affecting the objective: » Turbines » Access roads and cabling between and to turbine units » Power line » Sealed surfaces (e.g. roofs, concrete surfaces, compacted road surfaces, paved roads / areas) » Substation » All other infrastructure
Potential Impact	» Loss of suitable substrate for a stable vegetation cover » De-stabilisation and/or alteration of substrate and hence degradation of vegetation cover, significant change in species composition or loss of agricultural potential » Loss of suitable habitat for flora and fauna » Leaky ecosystem due to loss of nutrients and moisture from the system, leading to a less resilient vegetation cover and loss of ecosystem function and -services » Degradation and/or loss of riparian areas and wetlands on and beyond the project boundaries » A loss of indigenous vegetation cover and possibly endangered species » Disturbance of fauna species
Activities/risk sources	» Rainfall and wind erosion of disturbed areas » Excavation, stockpiling and compaction of soil » Existing IAPs as well as clearing thereof » Concentrated discharge of water from construction activity or new

	infrastructure » Storm water run-off from sealed, altered or bare surfaces » Mobile construction equipment movement on site » Cabling and access roads construction activities » Power line construction activities » River/stream/drainage line road crossings » Roadside drainage ditches » Project related infrastructure » Premature abandonment of follow-up monitoring and adaptive management of rehabilitation
Mitigation: Target/ Objective	» To minimise loss of plant species of conservation concern » To minimise unfavourable runoff conditions and loss of resources from the ecosystems » To minimise erosion of soil from site during and after construction » To minimise and mitigate unfavourable alteration to drainage lines, especially incision » To minimise damage to indigenous vegetation during and after construction » No accelerated overland flow related surface erosion as a result of project infrastructure » No reduction in the surface area or general nature and functionality of wetlands (drainage lines and other wetland areas) as a result of the establishment of infrastructure on the project areas and beyond its boundaries » A clear reduction of IAPs on the project area and replacement thereof by indigenous vegetation according to a pre-determined desirable end state

Mitigation: Action/control	**Responsibility**	**Timeframe**
Planning		
Classify the entire project area into management units according to current land cover and state of the environment and map accordingly	Developer / Contractor	Prior to construction
For each management unit » establish what interventions will be necessary relating to IAPs, soil erosion management, topsoil handling, landscape rehabilitation and revegetation » where rehabilitation and revegetation will be necessary, decide on the desired end state of vegetation for that management unit and create a list of species to be established on specific sites » outline the management of construction activities, including topsoils, excavated materials and felled biomass in a manner that will optimise the rehabilitation goals as fast and as effective as possible for that management unit	Developer / Contractor in collaboration with ECO and land-users	Prior to construction
Plant Rescue and indigenous plant materials		
All harvested plant materials shall be labelled with » Genus as minimum, species if known	Contractor	Prior to construction

Mitigation: Action/control	Responsibility	Timeframe
» Habitat from which materials were collected		
Indigenous plant materials for re-vegetation: » All plant material shall be obtained from the search-and-rescue operation on the site prior to clearing or from local nurseries or reputable seed providers » Indigenous materials shall only be removed from their habitat with the necessary permits whenever applicable » Each plant removed shall be handled, packed and stored in a manner suitable for that species » Removed plants shall be protected from windburn or other damage during transportation » No plants or plants with exposed roots shall be subjected to excessive exposure to drying winds and sun, or subjected to water logging » All plants shall be kept free from plant diseases and pests and protected from rodents or other damaging agents » All indigenous plants that have been removed prior to clearing shall be returned to conditions resembling their original habitat as close as practically possible	Contractor in collaboration with ECO	Before, during and after construction
Seed stocks for rehabilitation » Seed can be used for cultivation of desirable species for revegetation » Seed shall be utilised for direct sowing or hydroseeding » Seed collected from the site must be dried and stored in a suitable facility under cool (7-10°C), dry, insect free conditions until required for cultivation or seeding. Only viable, ripe seed shall be used » Seed harvested shall be insect- and pathogen free » Seed harvested shall not contain materials of any invasive species » Prior to clearing, seed should be collected from the site on a regular basis as species start to seed to maximise the amount of fully developed seed secured » From sites that will be cleared, 100% of all seeds available may be collected » From sites adjacent to the development, 25% of seeds can be collected for rehabilitation	Contractor and ECO	Before, during and after construction
Site-specific nursery » On-site nursery facilities shall be erected for the holding of rescued plant material and the propagation of appropriate species for re-vegetation » Where nursery facilities can only cater for rescued plants, a suitable (local) nursery shall be identified that will be willing to receive seeds collected and propagate the necessary species for later revegetation » Soil or other propagation media, were used, shall be weed- and pathogen free » Argentine ants shall be controlled at all times	Contractor, ECO to control	Prior to construction

Mitigation: Action/control	Responsibility	Timeframe
» The area where plants are stored shall be kept free of weeds » Plants stored in the designated area shall be protected from rodents, excessive sun and wind, and inspected regularly until being planted for pathogens and pests, and then treated accordingly » The nursery shall be adequately secured to prevent loss or theft of species		
Protected flora » Ensure that no indigenous protected flora is removed from its original habitat in the project area without legal documents from the relevant authorities	Contractor	Before, during and after construction
Topsoil		
Avoid » Management units that will not be developed or selected elements – trees, rocky outcrops on site shall be maintained in situ and demarcated clearly to prevent any disturbance during construction » These units will be considered as NO-GO areas during construction	Contractor and ECO	Before, during and immediately after construction
Invasives » Remove all invasive shrubs as per the Working for Water specifications	Contractor, ECO to control	Before, during and after construction
Mulch » all trees felled shall be debranched and the logs used in controlling erosion from re-landscaped topsoils and/or adding surface roughness and organic matter to topsoils to be rehabilitated » all cut branches from trees, as well as all shrubs cleared from the construction site shall be shredded to mulch, either by a chipper or by hand to sticks no longer than 10 cm » preparation of mulch shall be done at source » mulched material shall be free of seed-bearing invasive plant material » the mulch shall be suitably stored – bagged if necessary - and will be used in rehabilitation and soil erosion management on the site » should additional mulch be used for rehabilitation, this should be obtained from invasive shrubs of areas not cleared » mulch shall be stored for as short a period as possible	Contractor, ECO to control	Before, during and immediately after construction
Storage of topsoil and subsoil: » topsoils constitute the upper 20 – 30 cm of soil only, lower layers of soil are regarded as subsoil » stockpiling of topsoils and subsoils shall only be done on previously transformed areas, and be kept at least 50 m from any remaining natural vegetation	Contractor, ECO to control	During and immediately after construction

Mitigation: Action/control	Responsibility	Timeframe
» care shall be taken during stockpiling to prevent the mixing of topsoil with subsoil and/or any other material » topsoils shall be stored in heaps no higher than 100 cm, and shall be re-applied as soon as possible » care shall be exercised during stockpiling of topsoils to prevent compaction thereof » topsoils shall be adequately protected from erosion by preventing concentration of surface water and scouring of slopes » erosion of topsoils has to be contained and repaired as soon as it occurs, before large scale erosion and loss of topsoil develops » any logs obtained during clearing operations can be used in continuous rows to curtail erosion where necessary. Geojute (geotextile) shall be used additionally if the logs are not sufficient to remedy any erosion – for details refer to the erosion management plan » where topsoils need to be stored longer than 6 months, such stockpiles shall be revegetated, even if this has to include re-seeding to achieve an acceptable cover of vegetation		
Boulders and rocks » where removed during clearing, should be stored separately and used in the rehabilitation program » boulders and rocks must be partially buried within the topsoil layer wherever practical to provide greater soil-holding stability and reduce water erosion » placement of rocks and boulders shall mimic the natural occurrence of rocks and boulders in the area	Contractor, ECO to control	During and after construction
Rehabilitation of surface		
Prior to the application of topsoil » subsoil shall be shaped and trimmed to blend in with the surrounding landscape or used for erosion mitigation measures » ground surface or shaped subsoil shall be ripped or scarified with a mechanical ripper or by hand to a depth of 15 – 20 cm, » compacted soil shall be ripped to a depth greater than 25 cm and the trimmed by hand to prevent re-compacting the soil » any rubbish, concrete remnants, steel remnants or other objects introduced to the site during the construction process shall be cleared before ripping, or shaping and trimming of any landscapes to be rehabilitated takes place » shaping will be to roughly round off cuts and fills and any other earthworks to stable forms, sympathetic to the natural surrounding landscapes	Contractor, ECO to control	During and after construction

Mitigation: Action/control	Responsibility	Timeframe
Application of topsoil » topsoils shall be spread evenly over the ripped or trimmed surface, if possible not deeper than the topsoil originally removed » the final prepared surface shall not be smooth but furrowed to follow the natural contours of the land » the final prepared surface shall be free of any pollution or any kind of contamination » care shall be taken to prevent the compaction of topsoil » where applicable, the final prepared surface will also contain scattered rocks and/or logs to mimic the natural condition of the original habitat or area and to aid in soil stabilisation and erosion control	Contractor, ECO to control	During and after construction
Soil stabilisation » mulch from brush shall be applied by hand to achieve a layer of uniform thickness » mulch shall be rotovated into the upper 10 cm layer of soil o this operation shall not be attempted if the wind strength is such as to remove the mulch before it can be incorporated into the topsoil » in very rocky areas a layer of mulch shall be applied prior to adding the topsoil » measures shall be taken to protect all areas susceptible to erosion by installing temporary and permanent drainage work as soon as possible o where natural water flow-paths can be identified, subsurface drains or suitable surface drains and chutes need to be installed » additional measures shall be taken to prevent surface water from being concentrated in streams and from scouring slopes, banks or other areas o if mulch is limited, available mulch, together with harvested seeds, should be concentrated in these hollows to promote rapid re-vegetation in them » runnels or erosion channels developing shall be back-filled and restored to a proper condition o such measures shall be effected immediately before erosion develops at a large scale » where erosion cannot be remedied with available mulch, logs or rocks, geojute shall be used to curtail erosion	Contractor, ECO to control	During and after construction
Borrow-pits » shall be shaped to have undulating, low-gradient slopes and surfaces that are rough and irregular, suitable for trapping sediments and facilitation of plant growth » upon completion of rehabilitation these reshaped and	Contractor, ECO to control	After construction

Mitigation: Action/control	Responsibility	Timeframe
revegetated areas shall blend into the natural terrain		
Revegetation		
Recreate a non-invasive, acceptable vegetation cover that will facilitate the establishment of desirable and/or indigenous species » revegetation of the final prepared area is expected to occur spontaneously to some degree where topsoils could be re-applied within 6 months » revegetation will be done according to an approved planting/landscaping plan according to the management units initially delineated and their respective desirable end states and permissible vegetation	Contractor, ECO to control	Successively during construction, as construction of individual components is completed, then followed up until desired end state is reached
Re-seeding » revegetation can be increased where necessary by hand- seeding indigenous species o previously collected and stored seeds shall be sown evenly over the designated areas, and be covered by means of rakes or other hand tools » re-seeding shall occur at the recommended time to take advantage of the growing season » in the absence of sufficient follow-up rains after seeds started germinating, watering of the new vegetation cover until it is established shall become necessary to avoid loss of this vegetative cover and the associated seedbank » where, after initial re-seeding, the no acceptable vegetation cover has established within 12 months, hydroseeding should be considered as an option for follow-up revegetation work » sowing rates of seeds used during hydro-seeding should be obtained from the relevant supplier and in accordance with the existing environment	Contractor, ECO to control	Successively during construction, as construction of individual components is completed, then followed up until desired end state is reached
Planting of species » species to be planted include all rescued species » the size of planting holes shall be sufficiently large to ensure that the entire root system is well covered with topsoil » soil around the roots of container plants shall not be disturbed » bulbous plants shall be planted in groups or as features in selected areas » before placement of larger plant specimens into prepared holes, the holes shall be watered if not sufficiently moist	Contractor, ECO to control	Successively during construction, as construction of individual components is completed, then followed up until desired

Mitigation: Action/control	Responsibility	Timeframe
» during transplanting care shall be taken to limit or prevent damage to roots » plants should be watered immediately after transplanting to help bind soil particles to the roots (or soil-ball around rooted plants) and so facilitate the new growth and functioning of roots		end state is reached
Traffic on revegetated areas » designated tracks shall be created for pedestrian of vehicle traffic where necessary » Disturbance of vegetation and topsoil must be kept to a practical minimum, no unauthorised off road driving will be allowed » All livestock shall be excluded from revegetated areas	Contractor	Before, during and after construction
Establishment » The establishment and new growth of revegetated and replanted species shall be closely monitored » Where necessary, reseeding or replanting will have to be done if no acceptable plant cover has been created	Contractor	Successively during construction, as construction of individual components is completed, then followed up until desired end state is reached
Monitoring and follow-up treatments		
Monitor success of rehabilitation and revegetation and take remedial actions as needed according to the respective plan » Erosion shall be monitored at all times and measures taken as soon as detected » Where necessary, reseeding or replanting will have to be done if no acceptable plant cover has been created	ECO during construction, suitable designated person/institution after that	During and after construction, during operational and decommis-sioning phase
Weeding » It can be anticipated that invasive species and weeds will germinate on rehabilitated soils o These need to be hand-pulled before they are fully established and/or reaching a mature stage where they can regenerate o Where invasive shrubs re-grow, they will have to be eradicated according to the Working for Water specifications		

Performance Indicator	» No activity in identified no-go areas

	» Acceptable level of activity within disturbance areas, as determined by ECO » Natural configuration of habitats as part of ecosystems or cultivated land is retained or recreated, thus ensuring a diverse but stable hydrology, substrate and general environment for species to be able to become established and persist » The structural integrity and diversity of natural plant communities is recreated or maintained » Indigenous biodiversity continually improves according to the pre-determined desirable end state o This end state, if healthy, will be dynamic and able to recover by itself after occasional natural disturbances without returning to a degraded state » Ecosystem function of natural landscapes and their associated vegetation is improved or maintained
Monitoring	» Fortnightly inspections of the site by ECO during construction » An incident reporting system must record non-conformances to the EMPr. » Quarterly inspections and monitoring of the site by the ECO or personnel designated to the rehabilitation process until 80% of the desired plant species have become established o These inspections should be according to the monitoring protocol set out in the rehabilitation plan » Thereafter annual inspections according to the minimal monitoring protocol

B. APPENDIX: CHECKLIST OF ACTIONS FOR REHABILITATION PLANNING

Conceptual Planning	» Identify rehabilitation site locations and its boundaries » Identify ownership of rehabilitation program » Describe improvements that are anticipated following rehabilitation » Identify the kind of ecosystem to be rehabilitated at each site » Identify rehabilitation goals and desirable end state » Identify physical site conditions in need of repair » Identify stressors in need of regulation or re-initiation to maintain the integrity of the ecosystem, such as aliens, erosion, fire-regime » Identify the list and kinds of interventions of abiotic and biotic interventions that are and will be needed » Identify landscape restrictions and whether or not its integrity is dependent on a functioning ecosystem outside the project area » Determine project funding and sources » Identify labour sources and equipment needs » Identify biotic resource needs and sources, e.g. suitable topsoil, seeds » Identify any permit requirements or other legal issues » Determine project duration » Outline adaptable strategies for long-term protection and management
Preliminary Tasks	» Appoint a rehabilitation practitioner who is in charge of all the technical aspects of rehabilitation » Appoint a restoration team and train where necessary to ensure effective implementation » Prepare a budget to accommodate the completion of preliminary tasks » Document existing site conditions, also describing biota » Conduct pre-project monitoring as needed, including soil chemistry, that may affect the success of the rehabilitation program » Establish a reference site or past reference that represents the desired end state of the site » Gather information on key species to be re-introduced » Conduct investigations as needed to assess the effectiveness of restoration methods and strategies used in similar habitats up to date » Decide if rehabilitation goals are realistic or need modification » Prepare a list of objectives that need to be reached to achieve restoration goals » Ensure liaison with affected stakeholders, especially as far as rehabilitation goals are concerned » Investigate available accedes and infrastructure needed to facilitate implementation of rehabilitation
Implementation phase	» Describe the interventions that will be implemented to attain each set objective » Acknowledge potential for passive restoration where viable » Prepare performance standards and monitoring protocols to measure the attainment of each objective » Schedule tasks needed to fulfil each objective

	» Obtain equipment, supplies and biotic resources as needed » Prepare an appropriate budget
Implementation tasks	» Mark boundaries and work areas » Install permanent monitoring fixtures » Implement restoration tasks
Post-implementation tasks	» Protect the rehabilitation site against initial disturbance, including herbivores » Perform post-implementation maintenance, especially continued monitoring and eradication of emerging IAPs » Monitor site at least once per year, using the LFA technique, and identify needs for adaptive management
Evaluation	» Assess monitoring data to determine whether performance standards are met and rehabilitation objectives reached and maintained » Conduct an ecological evaluation of the newly completed rehabilitation

C. APPENDIX: TRANSPLANTING GUIDELINES FOR PLANTS WITH UNDERGROUND STORAGE ORGANS

Many of the plants in harsh environments have underground storage organs from which they resprout every year after sufficient rains, flower and then die back soon after fruiting and remain dormant, out of sight until the next growing season. All species of the families Amaryllidaceae, Iridaceae, Orchidaceae are protected provincially, nationally and/or internationally, as are many species of other monocot species.

Root system:	underground storage organs are variable in size, but usually between 15 and 40 cm deep in the soil
Transplanting:	success of transplanting is usually very high IF handled correctly
Rescue 101:	Plants should be lifted and transplanted after flowering and fruiting, preferably as the leaves start to die back. For lifting, loosen the soil or wedge apart rocks working from a circle of about 20 cm away from the base of the plant, working inwards but not closer than about 5 cm of the plant with a sharp narrow object such as a koevoet. Once the soil is loosened, gently feel by hand where the bulb, corm, or other storage organ is, and wedge out by hand, taking care not to damage it. Remove loose soil, gently cleanse off most of remaining soil, or rinse off the storage organ. Group these according to species and label clearly, keep records of labels to include name if that is known, or a brief description or photo, also the average depth of the organs when they were removed, and the habitat they were removed from. Spread these plants so that the storage organ can dry completely, and then loosely pack into newspaper or paper bag and then store in a shaded, dry position for maximally 3 months. Transplant into soil that is as similar as possible to the original habitat, TAKING CARE that the growing point of the organ points to the top, else the plant will die. Make sure the storage organs are positioned according to the records kept about original depth of the storage organ.
Aftercare:	Firm down soil around the base of the plant once it is in a new position. Allow plant to resprout naturally after sufficient rains, do not water. As these plants may not be visible for a while, clearly demarcate the area where these have been planted to avoid disturbing and potentially destroying them later on.

APPENDIX E:
GRIEVANCE MECHANISM

GRIEVANCE MECHANISM / PROCESS

AIM

The aim of the grievance mechanism is to ensure that grievances / concerns raised by local landowners and or communities are addressed in a manner that is:

- Fair and equitable;
- Open and transparent;
- Accountable and efficient.

It should be noted that the grievance mechanism does not replace the right of an individual, community, group or organization to take legal action should they so wish. However, the aim should be to address grievances in a manner that does not require a potentially costly and time consuming legal process.

Proposed generic grievance process

- Local landowners, communities and authorities will be informed in writing by the proponent (the renewable energy company) of the grievance mechanism and the process by which grievances can be brought to the attention of the proponent.
- A company representative will be appointed as the contact person for grievances to be addressed to. The name and contact details of the contact person will be provided to local landowners, communities and authorities.
- Project related grievances relating to the construction, operational and or decommissioning phase must be addressed in writing to the contact person. The contact person should assist local landowners and or communities who may lack resources to submit/prepare written grievances.
- The grievance will be registered with the contact person who, within 2 working days of receipt of the grievance, will contact the Complainant to discuss the grievance and agree on suitable date and venue for a meeting. Unless otherwise agreed, the meeting will be held within 2 weeks of receipt of the grievance.
- The contact person will draft a letter to be sent to the Complainant acknowledging receipt of the grievance, the name and contact details of Complainant, the nature of the grievance, the date that the grievance was raised, and the date and venue for the meeting.
- Prior to the meeting being held the contact person will contact the Complainant to discuss and agree on who should attend the meeting. The people who will be required to attend the meeting will depend on the nature of the grievance. While the Complainant and or proponent are entitled to invite their legal representatives to attend the meeting/s, it should be made clear that to all the parties involved in the process that the

grievance mechanism process is not a legal process. It is therefore recommended that the involvement of legal representatives be limited.

- The meeting will be chaired by the company representative appointed to address grievances. The proponent will provide a person to take minutes of and record the meeting/s. The costs associated with hiring venues will be covered by the proponent. The proponent will also cover travel costs incurred by the Complainant, specifically in the case of local, resource poor communities.
- Draft copies of the minutes will be made available to the Complainant and the proponent within 4 working days of the meeting being held. Unless otherwise agreed, comments on the Draft Minutes must be forwarded to the company representative appointed to manage the grievance mechanism within 4 working days of receipt of the draft minutes.
- In the event of the grievance being resolved to the satisfaction of all the parties concerned, the outcome will recorded and signed off by the relevant parties. The record should provide details of the date of the meeting/s, the names of the people that attended the meeting/s, the outcome of the meeting/s, and where relevant, the measures identified to address the grievance, the party responsible for implementing the required measures, and the agreed upon timeframes for the measures to be implemented.
- In the event of a dispute between the Complainant and the proponent regarding the grievance, the option of appointing an independent mediator to assist with resolving the issue should be discussed. The record of the meeting/s will note that a dispute has arisen and that the grievance has not been resolved to the satisfaction of all the parties concerned;
- In the event that the parties agree to appoint a mediator, the proponent will be required to identify three (3) mediators and forward the names and CVs to the Complainant within 2 weeks of the dispute being declared. The Complainant, in consultation with the proponent, will identify the preferred mediator and agree on a date for the next meeting. The cost of the mediator will be borne by the proponent. The proponent will provide a person to take minutes of and record the meeting/s.
- In the event of the grievance, with the assistance of the mediator, being resolved to the satisfaction of all the parties concerned, the outcome will recorded and signed off by the relevant parties, including the mediator. The record should provide details on the date of the meeting/s, the names of the people that attended the meeting/s, the outcome of the meeting/s, and where relevant, the measures identified to address the grievance, the party responsible for implementing the required measures, and the agreed upon timeframes for the measures to be implemented.
- In the event of the dispute not being resolved, the mediator will prepare a draft report that summaries the nature of the grievance and the dispute. The report should include a recommendation by the mediator on the proposed way forward with regard to the addressing the grievance.

- The draft report will be made available to the Complainant and the proponent for comment before being finalised and signed by all parties. Unless otherwise agreed, comments on the draft report must be forwarded to the company representative appointed to manage the grievance mechanism within 4 working days.

The way forward will be informed by the recommendations of the mediator and the nature of the grievance. As indicated above, the grievance mechanism does not replace the right of an individual, community, group or organization to take legal action should they so wish. In the event of the grievance not being resolved to the satisfaction of Complainant and or the proponent, either party may be of the opinion that legal action may be the most appropriate option.

APPENDIX F:
EROSION MANAGEMENT PLAN

PRINCIPLES FOR EROSION MANAGEMENT

1. Purpose

An Erosion Management Plan addresses the management and mitigation of significant impacts relating to soil erosion. The objective of the plan is to provide:

» A general framework for erosion management, which enables the contractor to identify areas where erosion can be accelerated from their action.
» An outline of general methods to monitor, manage and rehabilitate erosion in ensuring that all erosion caused by this development is addresses.

2. Legislation and Standards

Soil conservation pertaining to erosion has been a topic within legislation form the 1930's till today in South Africa. Internationally, standards have been set by the International Finance Corporation and the World Bank to address soil erosion in construction and decommissioning of areas. Therefore this document will ensure that the developer meets the South African legislative requirements and the IFC standards with regards to monitoring, managing and rehabilitating soil erosion on the solar energy facility site.

Relevant legislation:

» Conservation of Agricultural Resources Act No 43 of 1983
» Environmental Conservation Act No 73 of 1989
» National Forestry Act No 84 of 1998
» National Environmental Management Act No 107 of 1998
» The Department of Water Affairs and Forestry, February 2005. Environmental Best Practice Specifications: Construction Integrated Environmental Management Sub-Series No. IEMS 1.6. Third Edition. Pretoria.

3. Areas with a high soil erodability potential

The following areas are generally associated with high soil erodibility potential:

» Any areas without vegetation cover
» Excavated areas
» Steep areas
» Areas where the soil has been degraded already
» Dispersive, duplexed soil areas
» Areas with fine grained soil material with a low porosity
» Areas which undergo overland flow of water.
» Areas close to water
» Irrigated areas

» Compacted areas
» Rivers
» Drainage lines
» And any areas where developments cause water flow to accelerate on a soil surface.
» Coarsely gravelly covered surfaces

4. Precautionary management activities to avoid erosion

In the assessment process the contractor must assess all:
» Infrastructure and equipment placements and function to ensure that the infrastructure or equipment is not causing accelerating soil erosion on the site.
» Construction activities to ensure that no erosion indicators are forming as a result of the construction activities.

5. Monitoring

5.1. General Erosion

The developer must assess the site for erosion indicators in the monitoring process, which include:

» Bare soil
» Desiccation cracks
» Terracettes
» Sheet erosion
» Rill erosion (small erosion features with the same properties and characteristics as gullies)
» Hammocking (Soil build-up)
» Pedestalling (Exposing plant roots)
» Erosion pavements
» Gullies
» Evidence of Dispersive soils

In the assessment process, the contractor must assess all:

» Infrastructure and equipment placements and function to ensure that the infrastructure or equipment is not causing accelerated soil erosion on the site.
» Construction activities to ensure that no erosion indicators are forming as a result of the construction activities.

If any activities or placement of equipment cause pooling on the site, degrade the vegetation, result in removal of the surface or subsurface soil horizons, create compacted surfaces with steep gradients, or minimise runoff areas, the erosion potential on the site will increase.

If any erosion features are begin forming or are present as a result of the activities mentioned above the developer :

» Assess the situation.
» Take photographs of the soil degradation.
» Determine the cause of the soil erosion.
» Inform and show the relevant contractors the soil degradation.
» Inform the contractor that rehabilitation must take place and that the contractor is to implement a rehabilitation method statement and management plan.
» Monitor that the contractor is taking action to stop the erosion and assist them where needed.
» Report and monitor the progress of the rehabilitation weekly and recorded all the findings in a site diary.
» All actions with regards to the incidents must be reported on a monthly compliance report which will be submitted to the department.

The contractor/ developer (in consultation with the ECO) must:

» Select a system to treat the erosion
» Design the treatment system
» Implement the system
» Monitor the area to see if the system functions like it should, if the system fails, the method must be adapt or adjust to ensure the accelerated erosion is controlled.
» Monitoring must continue until the area has been stabilised

5.2. Stormwater Management

The developer must assess the site for erosion indicators such as:

» Bare soil
» Exposed plant roots, pedestalling
» Sheet erosion
» Rill erosion
» Hammocking
» Erosion pavements
» Terracettes
» Gullies

In the assessment process the developer must assess all:

» Disturbed watercourse areas by the development: roads, bridges, river crossings, cabling, permanent laydown areas, crane pads and any other remaining hard surfaces.

» Construction activity limited to specified areas. Stockpiles of aggregate and material will be positioned at least 50 m away from drainage lines and wetlands.

If any erosion features are present as a result of the activities mentioned above the developer must:

» Assess the situation
» Take photographs of the soil degradation.
» Determine the cause of the erosion.
» Inform and show the relevant contractors the soil degradation.
» Inform the contractor that rehabilitation must take place and that the contractor is to implement a rehabilitation method statement and management plan.
» Monitor that the contractor is taking action to stop the erosion and assist them where needed.
» Monitor the rehabilitation weekly and record the findings in a site diary.
» All actions with regards to the incidents must be reported on in the monthly compliance monitoring report.

The contractor/ developer must (in consultation with the ECO):

» Select a system to treat the erosion
» Design the treatment system
» Implement the system
» Monitor the area to ensure that the erosion has been addressed adequately.
» Monitor the erosion until the area has been stabilised.

6. Rehabilitation

The following erosion control measures and rehabilitation specifications must be implemented to ensure that good environmental practice is conducted and environmental compliance is achieved.

6.1. General Erosion Management

In this section the equipment needed to remediate erosion, the precautionary measures which must be taken to avoid erosion and mitigation requirements for already degraded areas.

6.1.1. Equipment

The civil works contractor may use the following instruments to combat erosion when necessary:
» Reno mattresses
» Slope attenuation

» Hessian material
» Shade catch nets
» Gabion baskets
» Mulching Run-off control (increase the amounts of runoff areas to disperse the water)
» Silt fences
» Storm water channels and catch pits
» Shade / catch nets
» Soil bindings
» Geofabrics
» Hydroseeding and/or re-vegetating
» Mulching over cleared areas
» Stone packing
» Tilling (roughing the surface)

6.1.2. Methods to prevent accelerated erosion

The following practises should be considered and adhered to:

» Ensure steep slopes are stabilised.
» Ensure that steep slopes are not stripped of vegetation and left to dry out and become water repellent (which will case increased runoff and a decreased infiltration rate) increasing the erosion potential.
» Ensure that all water on site (rain water or water wastage from the construction process) does not result in any surface flow (increase velocity and capacity of water) as a result of the poor drainage systems.
» Ensure that pooling of water on site is avoided, as the site and the general area consists of dispersive soils, pooling will cause an increase of infiltration on one area, causing the subsurface to begin eroding.
» Ensure that heavy machinery does not compact those areas which are not intended to be compacted (i.e. areas intended to be managed), as this will result in compacted hydrophobic, water repellent soils which increase the erosion potential of the area. where compaction does occur, the areas should be ripped.
» Ensure that compacted areas have adequate drainage systems to avoid pooling and surface flow.
» Prevent the concentration or flow of surface water or stormwater down cut or fill slopes, or along pipeline routes or roads, and ensure measures to prevent erosion are in place prior to construction.
» Ensure that stormwater and any runoff generated by hard surfaces should be discharged into retention swales or areas with rock rip-rap. These areas should be grassed with indigenous vegetation. These energy dissipation structures should be placed in a manner that surface flows are managed prior to being discharged back into a natural watercourse to support the maintenance of natural base flows within the ecological systems and prevent erosion, i.e. hydrological regime (water quantity and quality) is maintained.

» Ensure siltation and sedimentation through the use of the erosion equipment mentioned structures.
» Ensure that all stormwater control features have soft engineered areas that attenuate flows, allowing for water to percolate into the local ground watertable in low quantities (to reduce runoff but prevent subsurface erosion).
» Minimise and restrict site clearing to areas required for construction purposes only and restrict disturbance to adjacent undisturbed natural vegetation.
» Ensure that vegetation clearing is conducted in parallel with the construction progress across the site to minimise erosion and/or run-off.
» Ensure that large tracts of bare soil which would cause dust pollution in high winds, or have high erosion susceptibility and increase sedimentation in the lower portions of the catchment are controlled through temporary surface covering.
» Ensure no diversion of water flows in catchment occurs.
» Ensure that dust control measures are implemented, but prevent over-wetting/ saturating the area (to cause pooling) and run-off (that may cause erosion and sedimentation).
» Watercourse (stream) crossings should not trap any run-off, thereby creating inundated areas, but allow for free flowing watercourses.

6.1.3. Mitigation for previously degraded areas

Previously degraded areas could pose a threat to construction activities in the area and must therefore be stabilised, then remediated and rehabilitated through:

» Protecting, stabilise and isolate the degraded areas to ensure no further damage is caused by erosion due to construction activities.
» Increase the drainage in the area but avoid pooling.
» Prevent increasing sedimentation in areas that have been chocked by soils from degraded areas.
» Once construction has been completed, a method statement must be drafted for the rehabilitation of the previously degraded areas, using equipment mentioned above and implemented.
» Stabilisation of steep slopes must be undertaken.
» Ensure that bare soil is covered and hydro seeded to reduce topsoil loss.

6.2. Methodologies

The following erosion control measures and rehabilitation specifications may be required to be implemented to ensure that good environmental practice is conducted and environmental compliance is achieved.

» Topsoil covered with a geotextile or hessian material and a grass seed mixture (see Rehabilitation Specifications).
» Logging or stepping following the contours of the slope, to reduce surface runoff.

» Earth or rock-pack cut-off berms.
» Packed branches to roughen the surface and promote infiltration.
» Benches (sand bags).
» Stabilisation of near vertical slopes (1:1 – 1:2), if created during construction, will be required to utilise hard structures that have a natural look. The following methods may be considered:
  - Gabions (preferred method with geotextile material).
  - Retaining walls.
  - Stone pitching.
» The slopes of all stream diversions must be protected. The following methods may be considered:
  - Reno mattresses (preferred method), ensure that the reno mattresses are buried deep into the subsurface, to avoid undercutting from the water.
  - Coarse rock (undersize rip-rap)
  - Sandbags.
  - Stone packing with geotextile
» Where feasible use rubber dams as stream diversions when establishing water course crossings. Although (and considering that these are non-perennial watercourses) the recommendation is to construct watercourse crossings during dry periods (or no flow periods), where possible.
» Any concentration of natural water flow caused by road works or hardstands areas will be treated as follows:
  - if water flow is sub-critical, nothing is required
  - if water flow is supercritical, the outlets will be provided with protection (either gabions or stone pitching – depending on the flows) to release water subcritical back into the watercourse at a low velocity.

6.3. Engineering Specifications

A detailed Stormwater Management Plan describing and illustrating the proposed stormwater control measures must be prepared by the Civil Engineers and this includes erosion control.

Requirements for project design:

» Erosion control measures to be implemented before and during the construction period, including the final stormwater control measures (post construction).
» The location, area/extent (m^2/ha) and specifications of all temporary and permanent water management structures or stabilisation methods.
» A resident Engineer to be responsible for ensuring implementation of the erosion control measures on site during the construction period.
» The Developer holds ultimate responsibility for remedial action in the event that the approved stormwater plan is not correctly or appropriately implemented and damage to the environment is caused.

» Concrete lined drains placed adjacent to road to transfer the water to the existing water courses.
» Frequent gravel drains hydroseeded placed on permanent roadway edges.
» At the point where stormwater is discharged, energy dissipaters to be constructed to reduce the flow rate of run-off.
» All cut and fill banks will be seeded with an approved seed mix (as per the rehabilitation specifications) to ensure bank stabilisation and the elimination of potential erosion. Reno mattresses may be used to ensure that the area remains stable.

6.4. Rehabilitation Specifications

» Employ a Horticultural Landscape Contractor to fulfil the rehabilitation of disturbed areas post-construction.
» A detailed Rehabilitation Plan describing and illustrating the proposed rehabilitation activities on site must be prepared i.e. areas of top soiling, seeding and replanting of vegetation; species mix; requirements for fertilisation; seed sowing rates; watering etc. (i.e. bill of quantities).
» The following document should be consulted for further support with respect to information regarding rehabilitation, namely: The Department of Water Affairs and Forestry, February 2005. Environmental Best Practice Specifications: Construction Integrated Environmental Management Sub-Series No. IEMS 1.6. Third Edition. Pretoria.
» These specifications may be modified by the Horticultural Landscape Contractor on consideration of site conditions.

6.5. Post- and during construction rehabilitation activities

» Correct and appropriate stockpile management of topsoil will be required during the construction phase.
» Rehabilitation of disturbed areas will be implemented as these areas become available for rehabilitation.
» Disturbed areas will include, for example: construction camp site, areas where underground cabling has been layed/buried, roadsides of new access roads.

7. Rehabilitation steps to mitigate the eroded areas

» Stockpiled topsoil must be spread over disturbed areas (150 – 200mm thick) just prior to planting/seeding.
» Rip and scarify along the contours of the newly spread topsoil prior to watering and seeding.
» Organic fertilizers or compost shall be used if site conditions require it and can be applied as part of hydro-seeding applications.

» Seed should be sown into weed-free topsoil that has been stockpiled (i.e. original topsoil from the site).
» Indigenous plants shall be used to rehabilitate disturbed areas.
» Applying the seed through hydromulching (hydro-seeding) is advantageous (or organic mulching after seeding).
» Watering is essential and rehabilitation should ideally occur during the wet season.
» The topsoil in the area is vulnerable to erosion therefore the hydro-seeded surfaces must be covered with a shade cloth material or natural fibre (hessian material) to reduce the loss of soil while the plants establish.

7.1. 'Watering' to avoid erosion

» Movement of livestock in newly rehabilitated areas must be restricted, where possible, while taking into consideration drinking areas/paths.
» Watering the rehabilitated areas should be undertaken in the wet/rainy season essential but if this is not possible, an initial watering period (supplemental irrigation) will be required to ensure plant establishment (germination and established growth).
» Generous watering during the first two weeks, or until the seeds have germinated, is required (unless adequate rainfall occurs) i.e. seed beds will need to be kept moist for germination to occur.
» For grass to establish (once germination has occurred), rainfall or irrigation is needed at regular intervals, ideally every few days and possibly every day if weather conditions require it.
» During dry periods, with no rainfall, 100 litres per m² (or 100mm of rain) over a month or more, may be necessary to establish plants capable of surviving dry weather (or otherwise specified by the Horticultural Landscape Contractor).

7.2. Seeding

The developer should make use of an appropriate mix of grass species for rehabilitation 9to be determined in consultation with a suitably qualified ecologist) and they must be mixed for sowing either in summer or in winter. Grass species application (Rutherford, 2006) is at the rate secified as kg/ha.

7.3. Steep slopes

» Areas that have a steep gradient and require seeding for rehabilitation purposes should be adequately protected against potential run-off erosion e.g. with coir geotextile netting or other appropriate methodology.
» Provision for wind should also be made on these slopes to ensure the fine grained soil is not removed.

7.4. Maintenance and duration

» Rehabilitation will occur during construction, as areas for plant rehabilitation become available.
» The rehabilitation period post construction is estimated to be over a period of 6 (minimum) to 12 months (maximum), or a time period specified by the Horticultural Landscape Contractor, particularly if planting of trees and shrubs occurs.
» The rehabilitation phase (including post seeding maintenance) should be at least 6 months (depending on time of seeding and rainfall) to ensure establishment of plants with a minimum 80% cover achieved (excluding alien plant species).
» If the plants have not established and the 80% is not achieved within the specified maintenance period, maintenance of these areas shall continue until at least 80% cover is achieved (excluding alien plant species).
» Additional seeding may be necessary to achieve 80% cover.
» Any plants that die during the maintenance period must be replaced.
» Succession of natural plant species should be encouraged.

8. Conclusion

The Erosion Management Plan is a document to assist the Developer with guidelines on how to manage erosion. The implementation of management measures is not only good practice to ensure minimisation of degradation, but also necessary to ensure comply with legislative requirements. This document forms part of the EMPr, and is required to be considered and adhered to during the design, construction, operation and decommissioning phases of the project.

9. References

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