
**PROPOSED WATERCOURSE CROSSINGS
WITHIN THE AUTHORISED
SONNENBERG SOLAR PV FACILITY AND
ASSOCIATED INFRASTRUCTURE ON A
SITE NEAR KEIMOE, NORTHERN CAPE
PROVINCE**

**CONSTRUCTION & OPERATION
ENVIRONMENTAL MANAGEMENT
PROGRAMME (EMPR)**

Submitted as part of the Final Basic Assessment

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PROJECT DETAILS

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DEFINITIONS AND TERMINOLOGY

Alien species: A species that is not indigenous to the area or out of its natural distribution range.

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.

Assessment: The process of collecting, organising, analysing, interpreting and communicating information which is relevant.

Biological diversity: The variables among living organisms from all sources including, terrestrial, marine and other aquatic ecosystems and the ecological complexes they belong to.

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.

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 of time and can include both direct and indirect impacts.

Direct impacts: Impacts that are caused directly by the activity and generally occur at the same time and at the 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

Ecosystem: A dynamic system of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit.

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.

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 (EIA), 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 coordinates mitigation, rehabilitation and monitoring measures in order to guide the implementation of a proposal and its on-going maintenance after implementation.

Environmental assessment practitioner: An individual responsible for the planning, management and coordinating of environmental management plan or any other appropriate environmental instruments introduced by legislation.

Habitat: The place in which a species or ecological community occurs naturally.

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).

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

Indirect impacts: Indirect or induced changes that may occur as a result of the activity (e.g. the reduction of water in a stream that 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 as a result 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 general public.

Perennial and non-perennial: Perennial systems contain flowing or standing water for all or a large proportion of any given year, while non-perennial systems are episodic or ephemeral and thus contain 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.

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).

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).

Water course: as per the National Water Act means -

- (a) a river or spring;
- (b) a natural channel in which water flows regularly or intermittently;
- (c) a wetland, lake or dam into which, or from which, water flows; and
- (d) 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

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PROJECT DETAILS

CHAPTER 1

Networx S28 Energy (Pty) Ltd obtained environmental authorisation for the Sonnenberg Photovoltaic Plant (DEA reference: 12/12/20/2231) on a site located approximately 30 km west of Keimoes in the Northern Cape, in July 2012. Refer to figure 1. The authorisation included authorisation for the proposed PV facility and associated infrastructure, including the impacts on biodiversity and ecology, heritage sites and the social environment associated with these activities. This authorisation did however not include the activities associated with the crossing of watercourses by roads or encroachment on watercourses by infrastructure as it was expected that these could be avoided. However, though detailed planning, it has been determined that the facility will encroach onto drainage lines within the development site and some infrastructure will be located within these drainage lines (refer to Figure 2 and 3). The proposed activities are to include the upgrade of the existing gravel road (if required), construction of internal gravel access roads and construction of PV panel support structures, each with a footprint of approximately 0,07m², being ~1,5m deep.

This EMPr is applicable to all Networx S28 Energy employees and contractors working on the pre-construction, construction, and operation and maintenance phases of the Sonnenberg solar PV Facility, including the watercourse crossings. The document will be adhered to, updated as relevant throughout the project life cycle. As this activities fall within the approved Sonnenberg Solar PV facility site, this EMPr should be read in conjunction with the EMPr for the Sonnenberg Solar PV facility (approved by the DEA in July 2012).

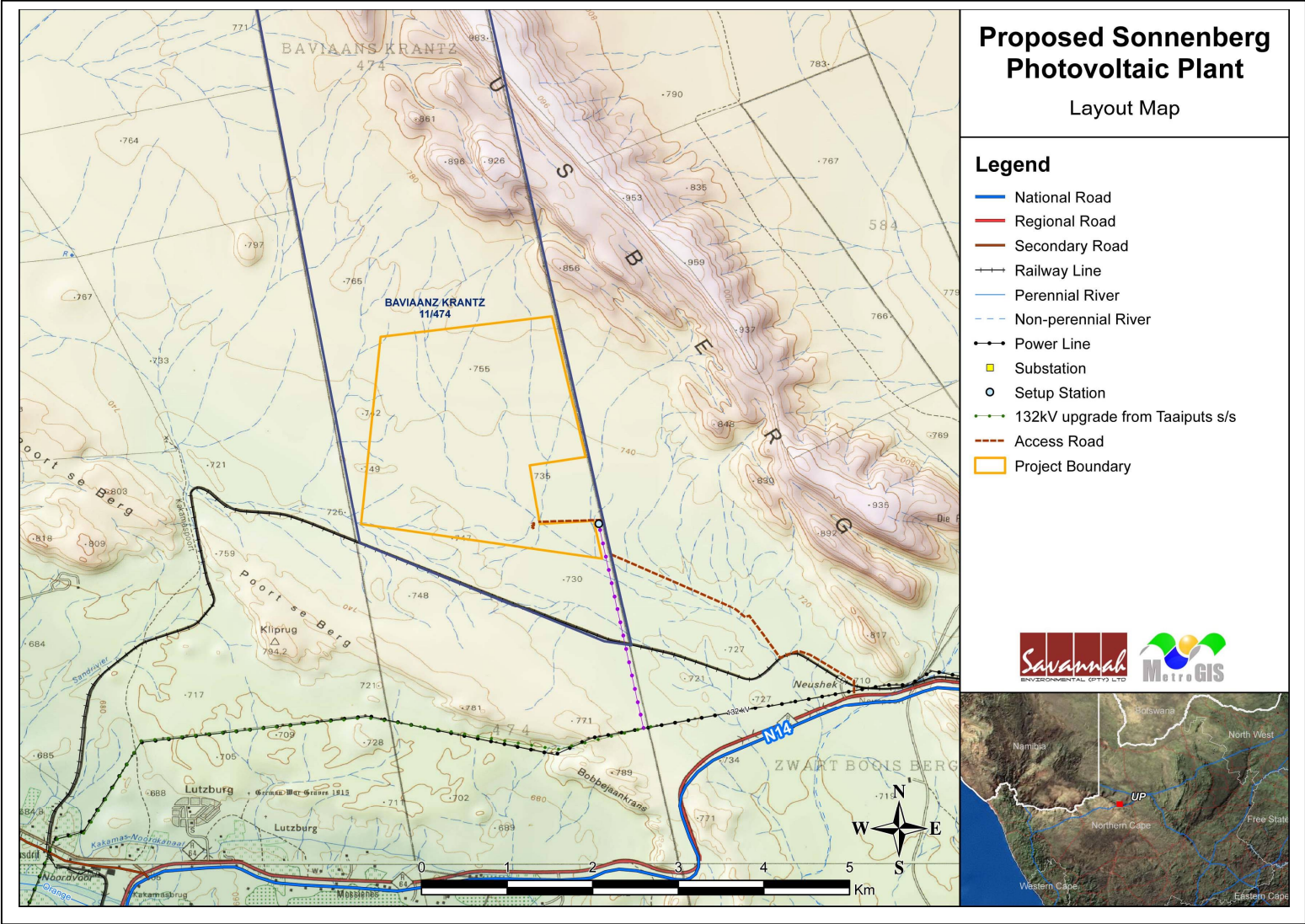


Figure 1: Locality map showing area proposed for the Sonnenberg Solar PV Facility

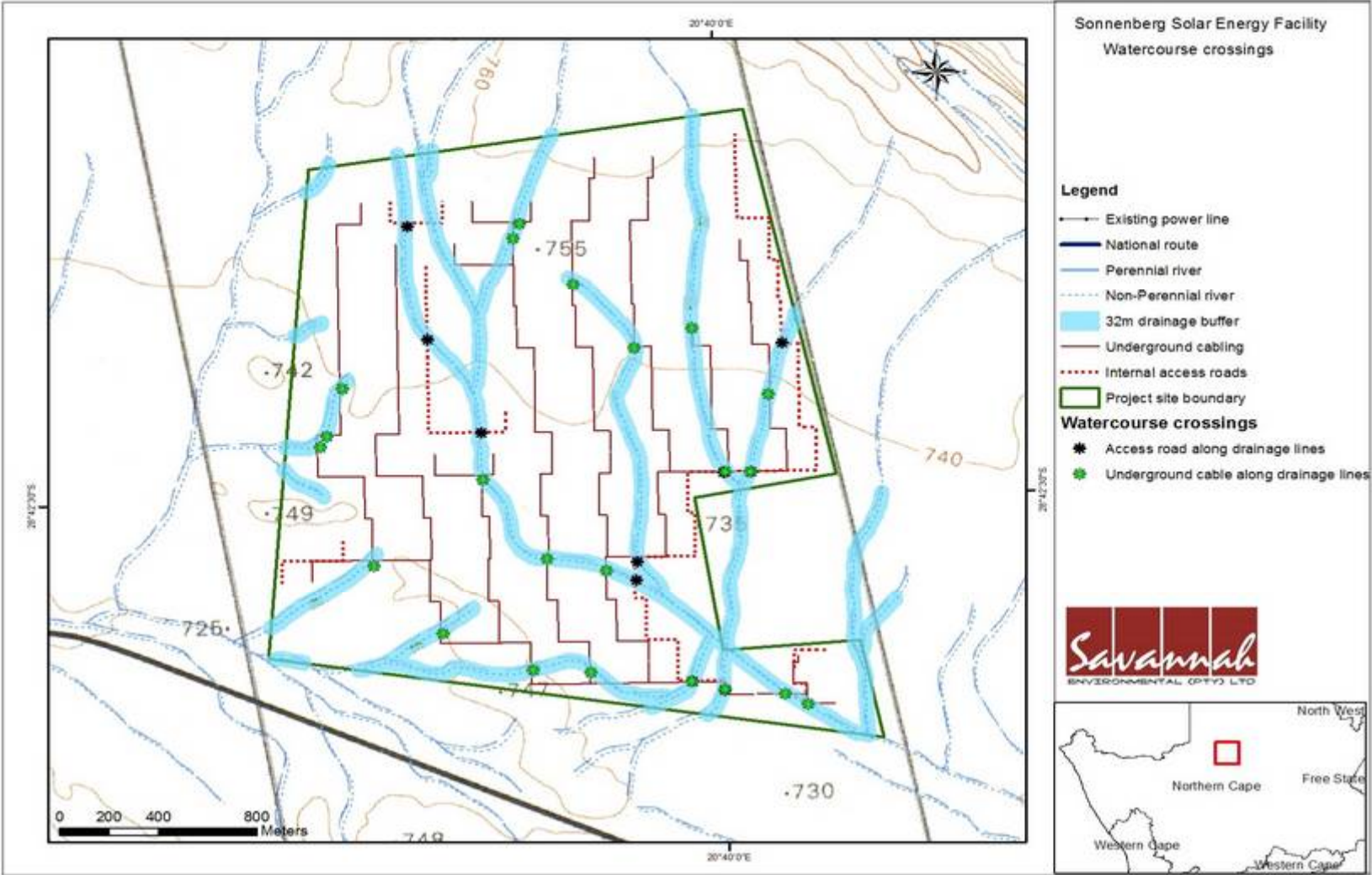


Figure 2: Locality map indicating the watercourse crossings due to internal access roads and underground cable trenches within the Sonnenberg Solar PV facility site

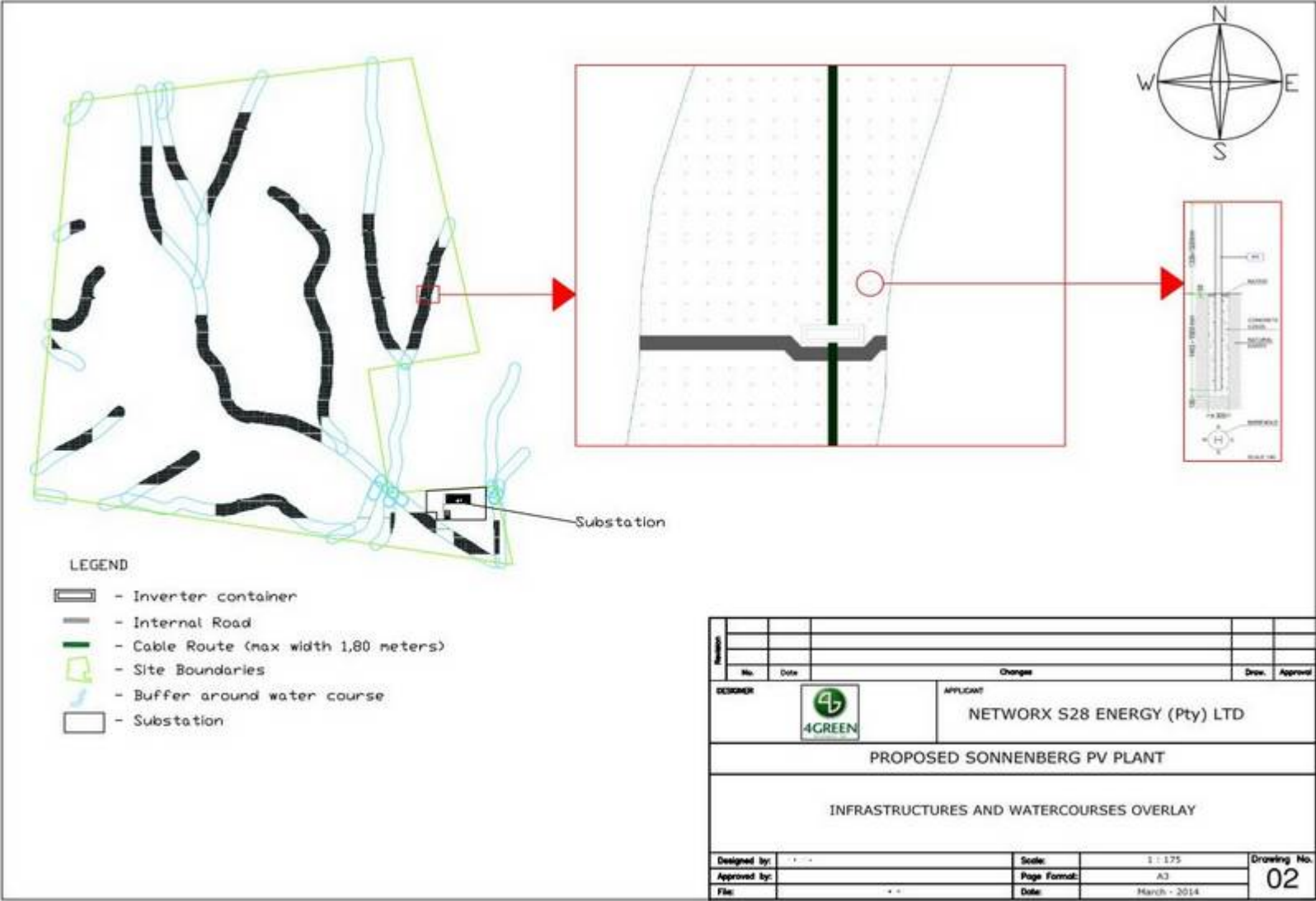


Figure 3: Map indicating watercourse crossings due to PV array foundations (pilings) and gravel access road sections

LEGISLATIVE REQUIREMENTS

CHAPTER 2

Table 2.1 provides an outline of the relevant environmental legislation and permitting requirements associated with the proposed project. This list of legislation is applicable at this time and should be updated on a continuous basis as the environmental legislation within South Africa changes.

Table 2.1: Relevant legislative permitting requirements applicable to the Sonnenberg Energy Facility Project

Title of the Legislation /Policy/Guideline	Application to the project	Relevant Authority	Date
National Environmental Management Act (Act No 107 of 1998)	<p>EIA Regulations have been promulgated in terms of Chapter 5. Activities which may not commence without an environmental authorisation are identified within these Regulations.</p> <p>In terms of Section 24(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.</p> <p>In terms of GNR 544 of June 2010, a Basic Assessment process is required to be undertaken for the proposed project</p>	<u>Northern Cape Department of Environment and Nature Conservation – leading Authority</u>	1998
National Environmental Management Act (Act No 107 of 1998)	<p>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.</p> <p>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.</p>	Department of Environmental Affairs (as regulator of NEMA).	1998
National Environmental Management: Waste Act (Act No 59 of 2008)	The purpose of this Act is to reform the law regulating waste management in order to protect health and the environment by providing for the licensing and control of waste management activities. To set standards for waste management on the project.	Provincial Environmental Authorities – general waste National DEA – hazardous waste	2008
National Water Act (Act No 36 of 1998)	In terms of Section 19, the project proponent must ensure that reasonable measures are taken throughout the life cycle of this	Department of Water Affairs (as regulator of NWA)	1998

Title of the Legislation /Policy/Guideline	Application to the project	Relevant Authority	Date
	<p>project to prevent and remedy the effects of pollution to water resources from occurring, continuing or recurring.</p> <p>In terms of Section 21, a water use license is required for certain identified activities. The impacting on watercourses as is proposed for this project is listed as such an activity and therefore a Water use License will be required to be obtained</p>		
<p>National Heritage Resources Act (Act No 25 of 1999)</p>	<p>Section 38 states that Heritage Impact Assessments (HIAs) are required for certain kinds of development including</p> <ul style="list-style-type: none"> » the construction of a road, power line, pipeline, canal or other similar linear development or barrier exceeding 300 m in length; » any development or other activity which will change the character of a site exceeding 5 000 m² in extent. <p>The relevant Heritage Resources Authority must be notified of developments such as linear developments (such as roads and power lines), bridges exceeding 50 m, or any development or other activity which will change the character of a site exceeding 5 000 m²; or the re-zoning of a site exceeding 10 000 m² in extent. This notification must be provided in the early stages of initiating that development, and details regarding the location, nature and extent of the proposed development must be provided.</p> <p>Standalone HIAs are not required where an EIA is carried out as long as the EIA contains an adequate HIA component that fulfils the provisions of Section 38. In such cases only those components not addressed by the EIA should be covered by the heritage component.</p>	<p>South African Heritage Resources Agency (SAHRA)</p>	<p>1999</p>

Title of the Legislation /Policy/Guideline	Application to the project	Relevant Authority	Date
	<p>An HIA was undertaken for the site as part of the EIA completed for the solar energy facility</p>		
<p>National Environmental Management: Biodiversity Act (Act No 10 of 2004)</p>	<p>In terms of Section 57, the Minister of Environmental Affairs has published a list of critically endangered, endangered, vulnerable and protected species in GNR 151 in Government Gazette 29657 of 23 February 2007 and the regulations associated therewith in GNR 152 in GG29657 of 23 February 2007, which came into effect on 1 June 2007.</p> <p>In terms of GNR 152 of 23 February 2007: Regulations relating to listed threatened and protected species, the relevant specialists must be employed during the EIA phase of the project to incorporate the legal provisions as well as the regulations associated with listed threatened and protected species (GNR 152) into specialist reports in order to identify permitting requirements at an early stage of the EIA phase.</p> <p>the developer has a responsibility for:</p> <ul style="list-style-type: none"> » The conservation of endangered ecosystems and restriction of activities according to the categorisation of the area (not just by listed activity as specified in the EIA regulations). » Promote the application of appropriate environmental management tools in order to ensure integrated environmental management of activities thereby ensuring that all development within the area are in line with ecological sustainable development and protection of biodiversity. » Limit further loss of biodiversity and conserve endangered ecosystems. 	<p>National Department of Environmental Affairs</p>	<p>2004</p>
<p>Conservation of Agricultural Resources Act</p>	<p>Regulation 15 of GNR1048 provides for the declaration of weeds and invader plants, and these are set out in Table 3 of GNR1048.</p>	<p>Department of Agriculture</p>	<p>1983</p>

Title of the Legislation /Policy/Guideline	Application to the project	Relevant Authority	Date
(Act No 43 of 1983)	<p>Declared Weeds and Invaders in South Africa are categorised according to one of the following categories:</p> <ul style="list-style-type: none"> » <u>Category 1 plants</u>: are prohibited and must be controlled. » <u>Category 2 plants</u>: (commercially used plants) may be grown in demarcated areas providing that there is a permit and that steps are taken to prevent their spread. » <u>Category 3 plants</u>: (ornamentally used plants) may no longer be planted; existing plants may remain, as long as all reasonable steps are taken to prevent the spreading thereof, except within the floodline of watercourses and wetlands. <p>These regulations provide that Category 1, 2 and 3 plants must not occur on land and that such plants must be controlled by the methods set out in Regulation 15E.</p>		
National Veld and Forest Fire Act (Act 101 of 1998)	<p>In terms of Section <u>12</u> the applicant would be obliged to burn firebreaks to ensure that should a veld fire occur on the property, that it does not spread to adjoining land.</p> <p>In terms of section 13 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.</p> <p>In terms of section 17, the applicant must have such equipment, protective clothing and trained personnel for extinguishing fires.</p>	Department of Agriculture, Forestry and Fisheries	1998
<u>National Forests Act (Act 84 of 1998)</u>	<u>In terms of S15 (1) no person may cut, disturb, damage or destroy any protected tree or possess, collect, remove, transport, export, purchase, sell donate or in any other manner acquire or dispose of any protected tree or any forest product derived from a protected tree, except under a license granted by the Minister to an (applicant and subject to such period and conditions as may</u>	<u>Department of Agriculture, Forestry and Fisheries</u>	1998

Title of the Legislation /Policy/Guideline	Application to the project	Relevant Authority	Date
	<p><u>be stipulated".</u></p> <p><u>GN 1042 provides a list of protected tree species</u></p>		
<i>Provincial legislation</i>			
<p><u>Northern Cape Nature Conservation Act,(Act 9 of 2009)</u></p>	<p><u>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:</u></p> <ul style="list-style-type: none"> » <u>Boundary fences may not be altered in such a way as to prevent wild animals from freely moving onto or off of a property;</u> » <u>Aquatic habitats may not be destroyed or damaged;</u> » <u>The owner of land upon which an invasive species is found (plant or animal) must take the necessary steps to eradicate or destroy such species.</u> <p><u>The Act provides lists of protected species for the Province..</u></p>	<p><u>Northern Cape DENC</u></p>	<p>2009</p>

PURPOSE & OBJECTIVES OF THE EMPR

CHAPTER 3

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”¹. The objective of this Environmental Management Programme 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 help ensure compliance with recommendations and conditions specified through an EIA process, as well as 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 (site clearing and site establishment) through those incurred during the construction activities themselves (erosion, noise, dust) to those incurred during site rehabilitation (soil stabilisation, revegetation) and operation. The EMPr also defines monitoring requirements in order to ensure that the specified objectives are met.

The EMPr has been developed as a set of environmental specifications (i.e. principles of environmental management for the proposed watercourse crossings within the Sonnenberg Solar PV Facility), 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.

The EMPr has the following objectives:

- » To outline mitigation measures and environmental specifications which are required to be implemented for the planning, construction, rehabilitation and operation phases of the project in order to minimise the extent of environmental impacts, and to manage environmental impacts associated with the watercourse crossings.

¹ Provincial Government Western Cape, Department of Environmental Affairs and Development Planning: *Guideline for Environmental Management Plans*, 2005

- » To ensure that the construction and operation phases do not result in undue or reasonably avoidable adverse environmental impacts, and ensure that any potential environmental benefits are enhanced.
- » To identify entities who will be responsible for the implementation of the measures and outline functions and responsibilities.
- » To propose mechanisms for monitoring compliance, and preventing long-term or permanent environmental degradation.
- » To facilitate appropriate and proactive responses to unforeseen events or changes in project implementation that were not considered in the EIA process.

The mitigation measures identified within the Environmental Impact Assessment process are systematically addressed in the EMPr, ensuring the minimisation of adverse environmental impacts to an acceptable level.

Networx S28 Energy (Pty) Ltd must ensure that the implementation of the project complies with the requirements of any and all environmental authorisations and any other permits (once issued), and obligations emanating from other 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 for activities associated with both construction and operation. Since this EMPr is part of the EIA process undertaken for the proposed watercourse crossings, it is important that this guideline document be read in conjunction with the Final Basic Assessment Report (April 2014). This will contextualise the EMPr and enable a thorough understanding of its role and purpose in the integrated environmental process. This EMPr for construction and operation activities has been compiled in accordance with the EIA Regulations of June 2010 and will be further developed in terms of specific requirements listed in any authorisations issued for the proposed project. This EMPr should be considered a dynamic document, requiring regular review and updating as new information becomes available in order for it to remain relevant to the requirements of the site and the environment.

To achieve effective environmental management, it is important that Contractors are aware of their 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:

- » 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 must 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 appropriate Environmental Awareness Training course. The course must provide the site staff with an appreciation of the project's environmental requirements, the EMPr specifications, and how they are to be implemented.
- » Basic training in the identification of archaeological sites/objects, and protected or Red List flora and fauna that may be encountered on the site.
- » Awareness of any other environmental matters which are deemed to be necessary.

STRUCTURE OF THIS EMPr

CHAPTER 4

The first two chapters provide background to the EMPr and the proposed project, and the relevant legislative context for the project. The chapters which follow consider the:

- » Planning and design activities
- » Construction activities
- » Operation activities
- » Decommissioning activities

These chapters set out the procedures necessary for watercourse crossings within the Sonnenberg Solar PV Facility to achieve environmental compliance. For each of the phases of the solar PV facility project, an over-arching environmental **goal** is stated. In order to meet this goal, a number of **objectives** are listed. The management plan 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 plan 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 environmental impact assessment 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 plan.
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 of the facility).
- » Modification to or addition to environmental objectives and targets.
- » Additional or unforeseen environmental impacts are identified.
- » Relevant legal or other requirements are changed 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:

EMPr Compilers	
Jo-Anne Thomas	Savannah Environmental
Geraldine Mogashane	Savannah Environmental

The Savannah Environmental team has extensive knowledge and experience in environmental impact assessment and environmental management, having being involved in EIA processes over the past ten (10) years. They have managed and drafted environmental management plans for other solar energy facility projects throughout South Africa. In addition, they have been involved in compliance monitoring of major construction projects in South Africa.

MANAGEMENT PLAN FOR PLANNING & DESIGN

CHAPTER 5

Overall Goal: undertake the planning and design phase in a way that:

- » Ensures that the design of the watercourse crossings responds to the identified environmental constraints and opportunities.
- » Ensures that adequate regard has been taken of any landowner and community concerns and that these are appropriately addressed through design and planning (where appropriate).
- » Enables the construction activities to be undertaken without significant disruption to other land uses and activities in the area.

In order to meet this goal, the following objectives have been identified, together with necessary actions and monitoring requirements. As previously stated, this EMPr should be read together with the EMPr prepared for the Sonnenberg PV facility. Specifications not specific to the watercourse crossings are not repeated within this document

5.1. Objectives

OBJECTIVE: To ensure that the design of the watercourse crossings responds to the identified environmental constraints and opportunities

Project component/s	» Watercourse crossings
Potential Impact	» Design fails to respond optimally to the environmental consideration
Activities/risk sources	» Construction of watercourse crossings
Mitigation: Target/Objective	<ul style="list-style-type: none"> » To ensure that the design of the watercourse crossings responds to the identified environmental constraints and opportunities » <u>To ensure selection of best environmental option for design of infrastructure</u> » <u>To undertake preconstruction activities in accordance with all relevant legislative requirements</u>

Mitigation: Action/control	Responsibility	Timeframe
In order to minimise impacts associated with the construction and operation of the facility, a stormwater management plan must be developed during the final design phase. This must detail how stormwater runoff	Networx Energy	S28 Design phase

Mitigation: Action/control	Responsibility	Timeframe
can be managed to reduce velocities and volumes of water that could lead to erosion and potential sedimentation of drainage systems.		
Culvert structures within the watercourse should be kept to a minimum and not retain any middle channel flows.	Networx Energy	S28 Design phase
The culvert crossings should not trap any run-off, thereby creating inundated areas, but allow for free flowing systems	Networx Energy	S28 Design phase
Include stormwater management systems along the roads that would reduce flow velocities. Stormwater and any runoff generated by the hard surfaces should be discharged into retention swales or areas with rock rip-rap. These energy dissipation structures should be placed in manner that flows are managed prior to being discharged back into the natural systems, thus not only preventing erosion, but would support the maintenance of natural base flows within these systems, i.e. hydrological regime (water quantity and quality) is maintained.	Networx Energy	S28 Design phase
All stormwater control features should have soft engineered areas that attenuate flows allowing for water to percolate in the local aquifers	Networx Energy	S28 Design phase
Water use license to be obtained for watercourse crossings.	Networx Energy	S28 Design phase
<u>A permit must be obtained for the removal or cutting of any protected trees found on site prior to the commencement of construction</u>	<u>Networx Energy</u>	<u>S28 Pre-Construction</u>

Performance Indicator	» Design meets objectives and does not degrade the environment and respond to the mitigation measures and recommendations in the Basic Assessment report.
Monitoring	» Ensure that the design implemented meets the objectives and mitigation measures in the Basic Assessment report through review of the design by the Project Manager, SHE representative and Environmental Control Officer (ECO) prior to the commencement of construction.

OBJECTIVE: To ensure effective communication mechanisms

On-going communication with affected and surrounding landowners 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	» Watercourse crossings
Potential Impact	» Impacts on affected and surrounding landowners and land uses
Activity/risk source	» Activities associated with construction of watercourse crossings
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 (as outlined in Appendix A) to be implemented during both the construction and operational phases of the facility. 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. This procedure should be in line with the South African Labour Law.	Networx Energy S28	Pre-construction (construction procedure)
Liaison with landowners is to be undertaken prior to the commencement of construction in order to provide sufficient time for them to plan agricultural activities.	Networx Energy/ Contractor S28	Pre-construction

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

OBJECTIVE: Search and Rescue of All Translocatable Indigenous Plants

Prior to any earthworks within areas of natural vegetation, a plant Search and Rescue program should be developed and implemented. Principles for the Search and Rescue program are included in **Appendix B**. The section below provides a guideline for the Search & Rescue Plan on site and will need to be supplemented with the relevant methodology depending on the final placement of infrastructure

<u>Project Component/s</u>	» <u>Any infrastructure or activity that will result in disturbance to natural areas.</u>
<u>Potential Impact</u>	» <u>Substantially increased loss of natural vegetation at construction phase and waste of on-site plant resources, and lack of locally sourced material for rehabilitation of disturbed areas.</u> » <u>Increased cost of having to buy in material for rehabilitation.</u>
<u>Activities/Risk Sources</u>	» <u>Construction related loss and damage to remaining natural vegetation via heavy machinery, etc.</u>
<u>Mitigation: Target/Objective</u>	» <u>Rescue, maintenance and subsequent replanting of at least 40% of the natural vegetation in all development footprints within any areas of natural vegetation on site</u>

<u>Mitigation: Action/Control</u>	<u>Responsibility</u>	<u>Timeframe</u>
<u>Search and Rescue (S&R) of certain translocatable, selected plants occurring in long term and permanent, hard surface development footprints should take place. All such development footprints must be surveyed and pegged out as soon as possible, and then suitably qualified specialist with Search and Rescue experience should be appointed to undertake the S&R. All rescued species should be translocated to a suitable habitat or removed to a nursery.</u>	<u>Networx S28 Energy</u>	<u>Prior to construction</u>
<u>Compile a site rehabilitation plan for implementation.</u>	<u>Networx S28 Energy</u>	<u>Prior to construction</u>

<u>Performance Indicator</u>	» <u>Zero disturbance outside of designated work areas.</u> » <u>Minimised clearing of existing/natural vegetation.</u> » <u>Limited impacts on areas of identified and demarcated sensitive habitats/vegetation.</u>
<u>Monitoring</u>	» <u>Observation of vegetation clearing activities by ECO throughout construction phase.</u> » <u>Monitoring of vegetation clearing activities in terms of permit conditions.</u> » <u>Supervision of all clearing and earthworks.</u> » <u>An incident reporting system will be used to record non-conformances to the EMPr.</u>

MANAGEMENT PLAN FOR CONSTRUCTION

CHAPTER 6

Overall Goal: Undertake the construction phase 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 and activities in the area, in particular concerning farming practices.
- » Minimises the impact on any remaining indigenous natural vegetation and habitats of ecological value.
- » Minimises the impact on heritage sites should they be uncovered.

As previously stated, this EMPr should be read together with the EMPr prepared for the Sonneberg PV facility. Specifications not specific to the watercourse crossings are not repeated within this document

6.1. Institutional Arrangements: Roles and Responsibilities for Construction

As the Proponent, Networx S28 Energy must ensure that the implementation of the project complies with the requirements of any and all environmental authorisations and permits, and obligations emanating from other 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. Networx S28 Energy will retain various key roles and responsibilities during construction. These are outlined within the EMPr compiled for the Sonneberg PV facility (dated July 2012) and are also applicable for the watercourse crossings

OBJECTIVE: To establish clear reporting, communication and responsibilities in relation to environmental incident

Formal responsibilities are necessary to ensure that key procedures are executed. Specific responsibilities of the Project Manager; Site Manager; Safety, Health and Environmental Representative; Environmental Control Officer and Contractor for the construction phase of this project are as detailed below.

The **Project Manager** will:

- » Ensure of 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 Networx S28 Energy and its Contractor(s) are made aware of all stipulations within the EMPr.

- » Ensure that the EMPr is correctly implemented throughout the project by means of site inspections and meetings. This will be documented as part of the site meeting minutes.
- » Be fully conversant with the Environmental Basic Assessment for the project, the EMPr, the conditions of the Environmental Authorisation (once issued), and all relevant environmental legislation.

The **Site Manager** (Networx S28 Energy's On-site Representative) will:

- » Be fully knowledgeable with the contents of the Environmental Basic Assessment.
- » Be fully knowledgeable with the contents and conditions of the Environmental Authorisation (once issued).
- » 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 for the project.
- » 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 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 in accordance with the IFC standards.
- » Confine activities to the demarcated construction site.

The **Safety, Health and Environmental Representative** (SHE officer) will:

- » Develop and compile environmental policies and procedures.
- » Direct and liaise with the Environmental Control Officer (ECO) regarding monitoring and reporting on the environmental performance of the construction phase.
- » Conduct internal environmental audits and co-ordinate external environmental audits.
- » Liaise with statutory bodies on environmental performance and other issues as required.

An independent **Environmental Control Officer (ECO)** must be appointed by the project proponent prior to the commencement of any authorised 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. *This ECO can be the same person as that employed for the broader solar energy facility construction.* The ECO will:

- » Be fully knowledgeable with the contents with the Environmental Basic Assessment.

- » Be fully knowledgeable with the contents with the conditions of the Environmental Authorisation (once issued).
- » Be fully knowledgeable with the contents with the EMPr.
- » Be fully knowledgeable with the contents with all relevant environmental legislation, and ensure compliance with them.
- » Be fully knowledgeable of all the licences and permits issued for the project.
- » 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 if the EMPr conditions or specifications are not followed then appropriate measures are undertaken to address this.
- » Monitoring and verification must be implemented to ensure that environmental impacts are kept to a minimum, as far as possible.
- » 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 the compilation of progress reports for submission to the Project Manager, with input from the Site Manager, takes place on a regular basis, including a final post-construction audit.
- » Ensure that there is communication with the Site Manager regarding the monitoring of the site.
- » 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).

As a general mitigation strategy, the Environmental Control Officer (ECO) should be present full-time on site for:

- » facilitate environmental induction with construction staff, and
- » the site preparation and initial clearing activities to ensure the correct demarcation of no-go areas,
- » Excavation,
- » monitoring of linear infrastructure construction activities (power line and access road),

Thereafter, monthly or bi-weekly site compliance inspections would probably be sufficient, reducing as construction proceeds, provided compliance is maintained. However, in the absence of the ECO there should be a designated environmental officer present to deal with any environmental issues that may arise such as fuel or oil spills.

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 (and ECO) 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 and the.
- » 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.

6.2. Objectives

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

OBJECTIVE: Erosion control, water quality management

The natural soil on the site needs to be preserved as far as possible in order to minimise impacts on the environment. Soil degradation including erosion (by wind and water) and subsequent deposition elsewhere is of a concern in areas underlain by fine grained soil which can be mobilised when disturbed, even on relatively low slope gradients (accelerated erosion). Uncontrolled run-off relating to construction activity will also lead to accelerated erosion. Degradation of the natural soil profile due to excavation, stockpiling, compaction, pollution and other construction activities will affect soil forming processes and associated ecosystems.

A set of strictly adhered to mitigation measures are required to be implemented in order to effectively limit the impact on the environment. The disturbance areas where human impact is likely are the focus of the mitigation measures laid out below.

Project component/s	» Watercourse crossings
Potential Impact	<ul style="list-style-type: none"> » Erosion and soil loss » Soil mixing, wetting, stockpiling, compaction » Soil pollution » Accelerated soil erosion » Negative impacts on wetlands » Sedimentation of watercourses/wetland areas » Loss of indigenous vegetation cover
Activities/risk sources	<ul style="list-style-type: none"> » Rainfall and wind erosion of disturbed areas » Excavation, stockpiling and compaction of soil » Concentrated discharge of water from construction activity » Stormwater run-off from sealed surfaces » Mobile construction equipment movement on site » River/stream/drainage line road crossings
Mitigation: Target/Objective	<ul style="list-style-type: none"> » To minimise erosion of soil from site during construction » To minimise deposition of soil into drainage lines » To minimise damage to vegetation by erosion or deposition

	<ul style="list-style-type: none"> » No reduction in the surface area of wetlands (drainage lines and other wetland areas) as a result of the establishment of infrastructure » Minimal loss of vegetation cover due to construction related activities » No increase in runoff into drainage lines as a result of road construction
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Mitigation: Action/control	Responsibility	Timeframe
Identify and demarcate construction areas for general construction work and restrict construction activity to these areas. Prevent unnecessary destructive activity within construction areas (prevent over-excavations and double handling)	Contractor	Construction
Stockpile topsoil for re-use in rehabilitation phase. Maintain stockpile shape and protect from erosion. All stockpiles must be positioned at least 50 m away from drainage lines and wetlands. Limit the height of stockpiles as far as possible in order to reduce compaction.	Contractor	Duration of construction
Disturbance of vegetation and topsoil must be kept to a practical minimum.	Contractor	Duration of contract
No unauthorised off road driving will be allowed, to prevent sensitive vegetation being destroyed, unless authorised by the ECO.	Contractor	Duration of contract
Rehabilitate disturbance areas as soon as construction in an area is completed.	Contractor	Construction
As far as possible, access to the construction site should be restricted to a single access point.	Contractor	Duration of contract
Internal access roads should be kept to a minimum.	Contractor / ECO	During site establishment
Stormwater and any runoff generated by the hard surfaces should be discharged into retention swales or areas with rock rip-rap. These energy dissipation structures should be placed in manner that flows are managed prior to being discharged back into the natural systems, thus not only preventing erosion, but would support the maintenance of natural base flows within these systems, i.e. hydrological regime (water quantity and quality) is maintained	Contractor	Construction
Implement a stormwater management and erosion control plan, as well as a rehabilitation plan.	Networx Energy Contractor	S28 Construction
Culverts (or other appropriate measures) must be designed to allow free flow. Regular maintenance must be carried out.	Networx Energy Contractor	S28 Construction
All vehicles on site must be appropriate to access the site. No off road driving is permitted unless authorised by the ECO.	Networx Energy Contractor	S28 Construction

Performance Indicator	<ul style="list-style-type: none"> » Acceptable level of activity within disturbance areas, as determined by ECO » Acceptable level of soil erosion around site, as determined by ECO
Monitoring	<ul style="list-style-type: none"> » Fortnightly inspections of sediment control devices by ECO » Immediate reporting of ineffective sediment control systems » An incident reporting system must record non-conformances to the EMPr. » Public complaints register must be developed and maintained on site.

OBJECTIVE: Minimisation of development footprint

In order to minimise impacts on flora, fauna and ecological processes, the development footprint should be limited.

Project component/s	<ul style="list-style-type: none"> » Watercourse crossings
Potential Impact	<ul style="list-style-type: none"> » Impacts on natural vegetation and habitats » Impacts on soil » Loss of topsoil
Activity/risk source	<ul style="list-style-type: none"> » Site preparation and earthworks » Construction of site watercourse crossings » Stockpiling of topsoil, subsoil and spoil material
Mitigation: Target/Objective	<ul style="list-style-type: none"> » To minimise footprints of disturbance of vegetation/habitats on-site » Remove and store all topsoil on areas that are to be excavated; and use this topsoil in subsequent rehabilitation of disturbed areas. » Spoil material to be minimised.

Mitigation: Action/control	Responsibility	Timeframe
Construction activities must be restricted to demarcated areas so that impact on flora and fauna is restricted.	Contractor	Site establishment & duration of contract
<u>Ensure that no vegetation or species of conservation concern are removed or disturbed without the necessary permits as per National Forests Act</u>	Contractor	Site establishment
Rehabilitate any disturbed areas immediately after construction in that area is complete in order to stabilise landscapes.	Contractor	Construction

Performance	<ul style="list-style-type: none"> » Zero disturbance outside of designated work areas
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Indicator	<ul style="list-style-type: none"> » Minimise loss of topsoil » Minimise clearing of existing natural vegetation
Monitoring	<ul style="list-style-type: none"> » Observation of vegetation clearing and soil management activities by ECO throughout construction phase. » Supervision of all clearing and earthworks. » An incident reporting system must be used to record non-conformances to the EMPr. » Public complaints register must be developed and maintained on site.

OBJECTIVE: Limit Damage to drainage lines

The proposed activity is deemed to have a limited potential impact (negative) on the aquatic environment. The proposed area has a number of dry stream beds and drainage lines. According to the National Water Act, these are considered as water resources. The activities associated with watercourse crossings must be contained within the construction camp approved for the greater Sonnenberg Solar PV Facility.

Project component/s	» Watercourse crossings
Potential Impact	» Damage to drainage lines.
Activity/risk source	» Construction of watercourse crossings
Mitigation: Target/Objective	<ul style="list-style-type: none"> » Limited damage to drainage lines or watercourses within project area » Infrastructure must be established at a correct distance from watercourses

Mitigation: Action/control	Responsibility	Timeframe
Rehabilitate any disturbed areas as soon as possible once construction is completed in an area.	Contractor	Construction
Minimise disturbance footprints within watercourse crossing areas.	Contractor	Construction
The culvert crossings should not trap any run-off, thereby creating inundated areas, but allow for free flowing systems	Construction	Construction
Obtain a permit as required in terms of the National Water Act from DWA to impact on any water resource.	Networkx Energy	S28 Pre-construction

Performance Indicator	» Limited impacts on water quality, water quantity, vegetation, natural status of watercourses
Monitoring	<ul style="list-style-type: none"> » Habitat loss in watercourses should be monitored before and after construction. » The presence and development of erosion features downstream of any construction through watercourses must be monitored and

	<p>appropriately managed.</p> <ul style="list-style-type: none"> » An incident reporting system must be used to record non-conformances to the EMPr. » Public complaints register must be developed and maintained on site.
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OBJECTIVE: Protection of indigenous vegetation and control of alien invasive plants

The study area consists of natural vegetation. There is one Vulnerable Plant species, *Aloe dichotoma*, and two Declining plant species, *Acacia erioloba* and *Hoodia gordonii*, that occur on site. All three could potentially be affected by the proposed development, depending on the location of the watercourse crossings. There are very few concentrations of alien plants on site. There is a possibility for some alien invasion along margins of disturbed areas. This could lead to general invasion of surrounding vegetation, especially along watercourses

Project component/s	» Watercourse crossings
Potential Impact	<ul style="list-style-type: none"> » Loss of vegetation of conservation concern » Spread of alien species
Activity/risk source	<ul style="list-style-type: none"> » Site preparation and earthworks » Construction-related traffic » Dumping or damage by construction equipment outside of demarcated construction areas
Mitigation: Target/Objective	<ul style="list-style-type: none"> » To retain natural vegetation as far as possible » To minimise footprints of disturbance of vegetation/habitats on-site » Limit alien plants within project control area » Limit loss of species of conservation concern

Mitigation: Action/control	Responsibility	Timeframe
<u>Ensure compliance with all national, regional and local legislation with regard to removal, disturbance and translocation of indigenous species and species of ecological concern</u>	contractor	construction
Unnecessary impacts on surrounding natural vegetation must be avoided, e.g. driving around in the veld. The construction impacts must be contained to the footprint of the infrastructure.	Contractor	Construction
Avoid creating conditions in which alien plants may become established: <ul style="list-style-type: none"> » Keep disturbance of indigenous vegetation to a minimum » Rehabilitate disturbed areas as quickly as possible 	Contractor	Construction

Mitigation: Action/control	Responsibility	Timeframe
once construction is complete in an area » Do not import soil from areas with alien plants		
Establish an ongoing monitoring programme to detect and quantify any alien species that may become established and identify the problem species (as per Conservation of Agricultural Resources Act, Act 43 of 1983) and the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004).	Networx Energy Contractor	S28 Construction
Immediately control any alien plants that become established using registered control methods.	Contractor	Construction
A site rehabilitation programme should be compiled and implemented.	Contractor in consultation with Specialist	Duration of contract
<u>Obtain relevant permits for removal of any flora or species of conservation concern as per National Forests Acts)</u>	<u>Networx Energy</u>	<u>S28</u> <u>Construction</u>

Performance Indicator	<ul style="list-style-type: none"> » Zero disturbance outside of designated work areas. » Minimised clearing of existing/natural vegetation. » Loss of natural vegetation only within designated footprint of infrastructure. » No significant fragmentation of untransformed areas of natural vegetation. » No alien infestation within project control area.
Monitoring	<ul style="list-style-type: none"> » Observation of vegetation clearing activities by ECO throughout construction phase. » Monitoring of alien plant establishment within the project control area on an on-going basis. » Annual audit of project area and immediate surroundings by qualified botanist. If no species are detected, then this can be stated. If any alien invasive species are detected then the distribution of these should be mapped (GPS co-ordinates of plants or concentrations of plants), number of individuals (whole site or per unit area), age and/or size classes of plants and aerial cover of plants. The results should be interpreted in terms of the risk posed to sensitive habitats within and surrounding the project area. The environmental manager should be responsible for driving this process. Reporting frequency depends on legal compliance framework. » An incident reporting system must be used to record non-conformances to the EMPr. » Public complaints register must be developed and maintained on site.

OBJECTIVE: Appropriate handling and storage of chemicals, hazardous substances and waste

Project component/s	» Watercourse crossings
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
Activity/risk source	» Vehicles associated with site preparation and earthworks » 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 legislation

Mitigation: Action/control	Responsibility	Timeframe
The storage of flammable and combustible liquids such as oils must be in designated areas which are appropriately bunded, and stored in compliance with MSDS files, as defined by the SHE	Contractor	Duration of contract
Any spills must receive the necessary clean-up action. Bioremediation kits are to be kept on-site and used to remediate any spills that may occur. Appropriate arrangements to be made for appropriate collection and disposal of all cleaning materials, absorbents and contaminated soils (in accordance with a waste management plan).	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 must be complied with.	Contractor	Duration of contract
Routine servicing and maintenance of vehicles is not to take place on-site (except for emergency situations or large cranes which cannot be moved off-site). If repairs of vehicles must take place on site, an appropriate drip tray must be used to contain any fuel or oils.	Contractor	Duration of contract
Transport of all hazardous substances must be in accordance with the relevant legislation and	Contractor	Duration of contract

Mitigation: Action/control	Responsibility	Timeframe
regulations.		
Waste disposal records must be available for review at any time.	Contractor	Duration of contract
Construction 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. general refuse, construction waste (wood and metal scrap) and contaminated waste. 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.	Contractor	Duration of contract
Where 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.	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 hazardous waste.	Contractor	Duration of contract
An incident/complaints register must be established and maintained on-site.	Contractor	Duration of contract
Hazardous and non-hazardous waste must be separated at source. Separate waste collection bins must be provided for this purpose. These bins must be clearly marked and appropriately covered.	Contractors	Duration of Contract
All solid waste collected must be disposed of at a registered waste disposal site. A certificate of disposal must be obtained and kept on file. The disposal of waste must be in accordance with all relevant legislation. Under no circumstances may solid waste be burnt or buried on site.	Contractors	Duration of Contract
Supply waste collection bins at construction equipment and construction crew camps.	Contractors	Duration of Contract
Construction equipment must be refuelled within	Contractor	Duration of

Mitigation: Action/control	Responsibility	Timeframe
designated refuelling locations, or where remote refuelling is required, appropriate drip trays must be utilised.		contract
All stored fuels to be maintained within a bund and on a sealed surface.	Contractor	Duration of contract
Fuel storage areas must be inspected regularly to ensure bund stability, integrity and function.	Contractor	Duration of contract
Construction machinery must be stored in an appropriately sealed area.	Contractor	Duration of contract
Oily water from bunds at the substation must be removed from site by licensed contractors.	Contractor	Duration of contract
Spilled cement or concrete must be cleaned up as soon as possible and disposed of at a suitably licensed waste disposal site.	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 implementing preventive measures.	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
Any contaminated/polluted soil removed from the site must be disposed of at a licensed hazardous waste disposal facility.	Contractor	Duration of contract
Upon the completion of construction, the area will be cleared of potentially polluting materials.	Contractor	Completion of construction

Performance Indicator	<ul style="list-style-type: none"> » No chemical spills outside of designated storage areas » No water or soil contamination by chemical 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 » Designated areas for fires identified on site at the outset of the construction phase » Fire fighting equipment and training provided before the construction phase commences
Monitoring	<ul style="list-style-type: none"> » Observation and supervision of waste management practices, chemical storage and handling practices and vehicle maintenance throughout construction phase

- » A complaints register must be maintained, in which any complaints from the public will be logged. Complaints must be investigated and, if appropriate, acted upon
- » An incident reporting system must be used to record non-conformances to the EMPr
- » Public complaints register must be developed and maintained on site.

6.3. Detailing Method Statements

OBJECTIVE: Ensure all construction activities are undertaken with the appropriate level of environmental awareness to minimise environmental risk

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:

- » 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.

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.

6.4. Awareness and Competence

OBJECTIVE: 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 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 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.
- » Employees must undergo training for the operation and maintenance activities associated with a solar energy facility and have a basic knowledge of the potential environmental impacts that could occur and how they can be minimised and mitigated.
- » Ensuring that, prior to commencing any site works, all employees and sub-contractors have attended an Environmental Awareness Training course.
- » The course 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.
- » Ensuring that employee information posters, outlining the environmental "do's" and "don'ts" (as per the environmental awareness training course) are erected at prominent locations throughout the site.
- » Ensure that construction workers have received basic training in environmental management, including the storage and handling of hazardous substances, minimisation of disturbance to sensitive areas, management of waste, and prevention of water pollution.
- » Records must be kept of those that have completed the relevant training.
- » Training should be done either in a written or verbal format but must be in an appropriate format for the receiving audience.
- » 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 EMP. This training and awareness will be achieved in the following ways:

6.4.1. Environmental Awareness Training

Environmental Awareness Training must take the form of an on-site talk and demonstration by the ECO before the commencement of site establishment and construction on site. The education/awareness programme should be aimed at all levels of management and construction workers within the contractor team. A record of attendance of this training must be maintained by the ECO on site.

6.4.2. 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 EMP 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 SHE Officer on site.

6.4.3. 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.

6.5. Monitoring Programme

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

A monitoring programme should 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 most likely be stipulated by the Environmental Authorisation. Where this is not clearly dictated, Networx S28 Energy 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.

6.5.1. 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 within 48 (forty eight) hours.

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.

6.5.2. 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.

MANAGEMENT PLAN FOR REHABILITATION OF DISTURBED AREAS

CHAPTER 7

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

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

OBJECTIVE: To ensure rehabilitation of disturbed areas

Areas requiring rehabilitation will include all areas disturbed during the construction phase and that are not required for regular maintenance operations.

Project component/s	» Watercourse crossings
Potential Impact	» Environmental integrity of site undermined resulting in erosion, compromised land capability and the requirement for on-going management intervention
Activity/risk source	» 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 and appropriately disposed of.	Contractor	Following execution of the works
Necessary drainage works and anti-erosion measures must be installed, where required, to minimise loss of topsoil and control erosion.	Contractor	Following execution of the works
Disturbed areas must be rehabilitated/re-vegetated with appropriate natural vegetation and/or local seed mix.	Contractor in consultation with rehabilitation specialist	Following completion of construction activities in an

Mitigation: Action/control	Responsibility	Timeframe
		area
Re-vegetated areas may have to be protected from wind erosion and maintained until an acceptable plant cover has been achieved.	Networkx S28 Energy in consultation with rehabilitation specialist	Post-rehabilitation
On-going alien plant monitoring and removal should be undertaken on all areas of natural vegetation on an annual basis.	Networkx S28 Energy in consultation with rehabilitation specialist	Post-rehabilitation

Performance Indicator	<ul style="list-style-type: none"> » All areas of the site cleared of equipment and temporary facilities » Topsoil replaced on all areas and stabilised » Disturbed areas rehabilitated and acceptable plant cover achieved on rehabilitated sites » Closed site free of erosion and alien invasive plants
Monitoring	<ul style="list-style-type: none"> » On-going inspection of rehabilitated areas in order to determine effectiveness of rehabilitation measures implemented » On-going alien plant monitoring and removal should be undertaken on an annual basis » An incident reporting system must be used to record non-conformances to the EMPr.

MANAGEMENT PLAN FOR OPERATION

CHAPTER 8

Overall Goal: To ensure that the operation of the watercourse crossings within the Sonnenberg Solar PV facility do 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 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 farming practices and effects on local residents.

An environmental manager must be appointed during operation whose duty it will be to ensure the implementation of the operational EMPr.

8.2. Objectives

In order to meet this goal, the following objectives have been identified, together with necessary actions and monitoring requirements. As previously stated, this EMPr should be read together with the EMPr prepared for the Sonnenberg PV facility. Specifications not specific to the watercourse crossings are not repeated within this document

OBJECTIVE: Minimise soil degradation and erosion

Project component/s	» Watercourse crossings
Potential Impact	» Soil degradation and erosion. » Increased deposition of soil into drainage systems. » Increased run-off over the site.
Activity/Risk Source	» Poor rehabilitation and/or revegetation of cleared areas. » Rainfall - water erosion of disturbed areas. » Wind erosion of disturbed areas. » Concentrated discharge of water from construction activity.
Mitigation: Target/Objective	» Ensure rehabilitation of disturbed areas is maintained. » Minimise soil degradation (i.e. wetting). » Minimise soil erosion and deposition of soil into drainage lines. » Ensure continued stability of embankments/excavations.

Mitigation: Action/Control	Responsibility	Timeframe
Implement stormwater management and erosion control plan, as well as a rehabilitation plan.	Networx S28 Energy	Operation
The culvert crossings should also not trap any run-off, thereby creating inundated areas, but allow for free flowing systems	Networx S28 Energy	Operation

Performance Indicator	» Minimal levels of soil erosion around site. » Minimal levels of increased siltation in drainage lines.
Monitoring	» Inspections of site on a bi-annual basis.

OBJECTIVE: Protection of vegetation

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

Project component/s	» Watercourse crossings
Potential Impact	» Disturbance to or loss of vegetation and/or habitat » Environmental integrity of site undermined resulting in reduced visual aesthetics, erosion, compromised land capability and the requirement for on-going management intervention
Activity/risk source	» Movement of employee vehicles within and around site » Disturbed areas
Mitigation: Target/Objective	» To maintain minimised footprints of disturbance of vegetation/habitats on-site » To ensure and encourage plant regrowth in areas of post-construction rehabilitation

Mitigation: Action/control	Responsibility	Timeframe
Vehicle movements must be restricted to designated roadways	Networx S28 Energy and contractors	Operation
An on-going alien monitoring and eradication programme must be implemented, where necessary.	Networx S28 Energy and contractors	Operation
An independent environmental manager must be appointed during operation whose duty it will be to minimise impacts on surrounding sensitive habitats	Networx S28 Energy and contractors	Operation
A botanist familiar with the vegetation of the area should monitor the rehabilitation success and alien plant removal on an annual basis, for the first 5 years of the operational phase, or until deemed	Networx S28 Energy / Specialist	Annual monitoring until successful re-

unnecessary by the botanist,	establishment of vegetation in an area
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Performance Indicator	<ul style="list-style-type: none"> » No further disturbance to vegetation » Continued improvement of rehabilitation efforts » No colonisation of the site by alien vegetation
Monitoring	<ul style="list-style-type: none"> » Observation of vegetation on-site by Site Manager and environmental manager » Regular inspections to monitor plant regrowth/performance of rehabilitation efforts and weed infestation compared to natural/undisturbed areas » On-going alien plant monitoring and removal should be undertaken on an annual basis , for the first 5 years of the operational phase, or until deemed unnecessary by a suitably qualified botanist

MANAGEMENT PLAN FOR DECOMMISSIONING

CHAPTER 9

The infrastructure associated with the watercourse crossings would only be decommissioned in the event that the Sonnenberg PV Facility was decommissioned and the roads were no longer required by the landowner. The infrastructure which will be utilised for the Sonnenberg Solar PV Facility is expected to have a lifespan of 20 to 30 years (with maintenance). The decommissioning activities of the solar panels and all associated infrastructure would need to comply with the legislation relevant at the time.

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 at any relevant and competent authority at that time.

FINALISATION OF THE ENVIRONMENTAL MANAGEMENT PROGRAMME

CHAPTER 10

The EMPr is a dynamic document, which must be updated when required. It is considered critical that this draft EMPr be updated to include site-specific information and specifications following the final walk-through survey by specialists of the watercourse crossings, and development site. This will ensure that the construction and operation activities are planned and implemented taking sensitive environmental features into account.

**APPENDIX A:
GRIEVANCE MECHANISM FOR PUBLIC COMPLAINTS
AND ISSUES**

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.

1 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 be 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 be 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 summarises 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 B:
**Plant Search and Rescue Plan Re-vegetation Plan and
Rehabilitation Plan**

METHODS FOR PLANT RESCUE AND HABITAT REHABILITATION

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.

Environmental Management Plan: an environmental management tool used to ensure that undue or reasonably avoidable adverse impacts of the construction and operation, and decommissioning of a project are prevented; and that the positive benefits of the projects are enhanced.

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 plan overlaps to some degree with the Storm Water and Erosion Management Plan, and for successful rehabilitation, it is imperative that this plan is at all times used in conjunction with other EMPs mentioned.

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 EMP-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 EMP, is a legally binding document that must be implemented to fulfill 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 distributors 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 plan
- » 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 ECO and 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 ECO and 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, the developer, and the ECO with guidelines on how to plan and implement the required work, and understand the concepts behind successful rehabilitation. This plan will have to be implemented in conjunction with erosion-, storm water- and IAP management plans. 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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- Tongway, D.J. and Hindley, N.L. (2004) *Landscape Function Analysis: Procedures for Monitoring and Assessing Landscapes*, CSIRO Sustainable Ecosystems, CANBERRA, AUSTRALIA.
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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	<p>Project components affecting the objective:</p> <ul style="list-style-type: none"> » 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	<ul style="list-style-type: none"> » 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	<ul style="list-style-type: none"> » 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

	<p>infrastructure</p> <ul style="list-style-type: none"> » 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	<ul style="list-style-type: none"> » 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
<p>For each management unit</p> <ul style="list-style-type: none"> » 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		
<p>All harvested plant materials shall be labelled with</p> <ul style="list-style-type: none"> » Genus as minimum, species if known » Habitat from which materials were collected 	ECO	Prior to construction

Mitigation: Action/control	Responsibility	Timeframe
<p>Indigenous plant materials for re-vegetation:</p> <ul style="list-style-type: none"> » 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
<p>Seed stocks for rehabilitation</p> <ul style="list-style-type: none"> » 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
<p>Site-specific nursery</p> <ul style="list-style-type: none"> » 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 » The area where plants are stored shall be kept free of 	Contractor, ECO to control	Prior to construction

Mitigation: Action/control	Responsibility	Timeframe
weeds <ul style="list-style-type: none"> » 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 <ul style="list-style-type: none"> » Ensure that no indigenous protected flora is removed from its original habitat in the project area without legal documents from the relevant authorities 	ECO	Before, during and after construction
Topsoil		
Avoid <ul style="list-style-type: none"> » 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 <ul style="list-style-type: none"> » Remove all invasive shrubs as per the Working for Water specifications 	Contractor, ECO to control	Before, during and after construction
Mulch <ul style="list-style-type: none"> » 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: <ul style="list-style-type: none"> » 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 » care shall be taken during stockpiling to prevent the 	Contractor, ECO to control	During and immediately after construction

Mitigation: Action/control	Responsibility	Timeframe
<p>mixing of topsoil with subsoil and/or any other material</p> <ul style="list-style-type: none"> » 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 		
<p>Boulders and rocks</p> <ul style="list-style-type: none"> » 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		
<p>Prior to the application of topsoil</p> <ul style="list-style-type: none"> » 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
<p>Application of topsoil</p> <ul style="list-style-type: none"> » 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
<p>Soil stabilisation</p> <ul style="list-style-type: none"> » 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 <ul style="list-style-type: none"> ○ 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 <ul style="list-style-type: none"> ○ 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 <ul style="list-style-type: none"> ○ 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 <ul style="list-style-type: none"> ○ 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
<p>Borrow-pits</p> <ul style="list-style-type: none"> » 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 revegetated areas shall blend into the natural terrain 	Contractor, ECO to control	After construction

Mitigation: Action/control	Responsibility	Timeframe
Revegetation		
<p>Recreate a non-invasive, acceptable vegetation cover that will facilitate the establishment of desirable and/or indigenous species</p> <ul style="list-style-type: none"> » 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
<p>Re-seeding</p> <ul style="list-style-type: none"> » revegetation can be increased where necessary by hand- seeding indigenous species <ul style="list-style-type: none"> ○ 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
<p>Planting of species</p> <ul style="list-style-type: none"> » 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 » during transplanting care shall be taken to limit or 	Contractor, ECO to control	Successively during construction , as construction of individual components is completed, then followed up until desired end state is

Mitigation: Action/control	Responsibility	Timeframe
<p>prevent damage to roots</p> <ul style="list-style-type: none"> » 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 		reached
<p>Traffic on revegetated areas</p> <ul style="list-style-type: none"> » designated tracks shall be created for pedestrian or 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
<p>Establishment</p> <ul style="list-style-type: none"> » 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		
<p>Monitor success of rehabilitation and revegetation and take remedial actions as needed according to the respective plan</p> <ul style="list-style-type: none"> » 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 decommissioning phase
<p>Weeding</p> <ul style="list-style-type: none"> » It can be anticipated that invasive species and weeds will germinate on rehabilitated soils <ul style="list-style-type: none"> ○ These need to be hand-pulled before they are fully established and/or reaching a mature stage where they can regenerate ○ Where invasive shrubs re-grow, they will have to be eradicated according to the Working for Water specifications 		
Performance Indicator	<ul style="list-style-type: none"> » No activity in identified no-go areas » Acceptable level of activity within disturbance areas, as 	

	<p>determined by ECO</p> <ul style="list-style-type: none">» 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<ul style="list-style-type: none">○ 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	<ul style="list-style-type: none">» Fortnightly inspections of the site by ECO during construction» An incident reporting system must record non-conformances to the EMP.» 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<ul style="list-style-type: none">○ 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

<p>Conceptual Planning</p>	<ul style="list-style-type: none"> » 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
<p>Preliminary Tasks</p>	<ul style="list-style-type: none"> » 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
<p>Implementation phase</p>	<ul style="list-style-type: none"> » 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

	<ul style="list-style-type: none">» Obtain equipment, supplies and biotic resources as needed» Prepare an appropriate budget
Implementation tasks	<ul style="list-style-type: none">» Mark boundaries and work areas» Install permanent monitoring fixtures» Implement restoration tasks
Post-implementation tasks	<ul style="list-style-type: none">» 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	<ul style="list-style-type: none">» 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.