

VEGETATION ENVIRONMENTAL MANAGEMENT PLAN (REPORT

REFERENCE: 2017/BES/MPR/03

**Species search and rescue
Invasive plant management
Retaining agricultural potential
Rehabilitation and revegetation**

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1. Design Phase

1.1. Optimal design and pre-commencement activities

OBJECTIVE 1	Ensure the selection of the best environmental option for the development area as well as the associated infrastructure and access roads.
OBJECTIVE 2	Ensure all possible impacts are fully accounted for that the methods are in place for the mitigation prior to commencement of activities.
<p>Opportunities to mitigate the associated negative impacts largely arise during the planning and design stages. The correct choice of footprint locality and layout design is crucial, therefore biodiversity and ecosystem function should be given full consideration during the design phases, as determined by the Environmental Impact Assessment. Once the layout has been designed, a detailed investigation of the footprint area during the optimal growth season must be conducted before the layout is finalised and activity commences.</p>	
Project Components	<ul style="list-style-type: none"> • Solar field • Water supply pipeline • Water storage tanks • Water treatment facility • Wastewater treatment facility • Substations; • Access roads (temporary & permanent roads) and fencing around the development area; • Temporary laydown area (workshops, mobile offices, mobile ablution facilities, material storage area, vehicle parking area, water tanks fencing, etc.); • Permanent office/workshop building; • Permanent living quarters for operational phase workers; • Surface run-off control system (trenches, canals, run-off dissipating structures, evaporation ponds, etc.).
Potential Impact	<ul style="list-style-type: none"> • Habitat destruction; • Loss of indigenous flora and conservation worthy species; • Potential disturbance to drainage lines; • Establishment and persistence of alien invasive plants; • Erosion.
Activities / Risk Sources	<ul style="list-style-type: none"> • Positioning of solar components and internal access routes; • Positioning of workshop, substation and other associated infrastructure; • Alignment of access roads to development; • Positioning of temporary sites.

Mitigation: Target / Objective	<ul style="list-style-type: none"> • Ensure the selection of the optimum environmental option for positioning alignment of proposed infrastructure; • Ensure that environmental sensitivities are taken into consideration and avoided as far as possible (mitigating potential impacts). 	
Mitigation: Action / Control	Responsibility	Timeframe
<p>Undertake pre-construction walk-through footprint investigations for protected flora. This walk-through is aimed to inform the developer, responsible conservation authority (that will issue the relevant permits and authorisations), contractors, EO and ECO about the following:</p> <ul style="list-style-type: none"> • Potential micro-siting requirements; • Protected species that will be affected by the development (indicating the protection status of each species observed); • Locality of the protected plant species within the footprint area (individually mapped or approximate areas of occurrence); • Identification of the affected species by providing a representative photo record that enables ECOs and contractors to identify these species; • The estimated number of specimens per species that will be affected; • Identification of species which can be successfully relocated; • Estimation of the number of specimens per species that will be destroyed; • Location and nature of any invasive species that will have to be cleared by the contractor; • Location and nature of any significant environmental concerns (for instance gully erosion) that need to be addressed to prevent degradation of the development footprint; • Should more than 1000 specimens of any critically endangered, endangered or protected species be affected, a risk assessment report for that species must be prepared according to Section 15 of the NEMA:BA Draft Threatened or Protected Species Regulations, Gazette General Notice 388 of 2013, and amendments (2014). 	<p>Developer, carried out by Specialist</p>	<p>Design review phase</p>
<p>The above pre-construction footprint investigations will be used together with the results from the vegetation report to draft the following:</p> <ul style="list-style-type: none"> • A comprehensive search and rescue program for vegetation. • A comprehensive alien invasive species eradication and management plan. 	<p>Developer carried out by Specialist</p>	<p>Design review phase</p>
<p>Obtain permits for protected plant removal and relocation prior to commencement of any activity related to this development. As a minimum, permits will be required to remove all or some of the following species, found within the development footprint:</p> <ul style="list-style-type: none"> • <i>Hoodia gordonii</i> • <i>Avonia albissima</i> • <i>Euphorbia spinea</i> • <i>Lithops julii subsp. fulleri var. fulleri</i> 	<p>Developer or contractor responsible for vegetation clearing</p>	<p>Pre- commencement</p>
<p>Use design-level mitigation measures recommended in respect of habitat and ecosystem intactness and prevent the loss of species:</p> <ul style="list-style-type: none"> • Position development components close together and in close proximity to other existing or planned developments in the area; • Exclude all drainage lines that are considered as very high to highly sensitive areas, including their recommended buffers, from the layout; • Infrastructure including road crossings and trough infrastructure may only be placed within the specified drainage line sections which has already been severely altered and transformed; • Strictly adhere to existing roads where possible to gain access to the site; • Introduced materials including machinery or processing implements must be kept in a botanical least sensitive area. These sites must be clearly indicated in 	<p>Developer</p>	<p>Prior to submission of final construction layout plan.</p>

site plans and the drafting of relevant detailed method statements and management plans.			
Access roads and machinery turning points must be planned to minimise the impacted area, avoid the initiation of accelerated soil erosion, prevent unnecessary soil compaction and prevent the alteration of natural water flow.		Developer	Design phase
Compile a comprehensive stormwater management and erosion control plan for the footprint area and the final design.		Developer and relevant specialist	Design phase
Depending on the final layout and maintenance requirements taken into consideration, the permissible biodiversity needs to be determined: <ul style="list-style-type: none"> • Permissible vegetation: maximum height, desirable density and composition; • Maintenance of this vegetation: Mowing, small livestock grazing, etc. 		Developer with relevant specialist	Design phase
After determining the permissible biodiversity, a comprehensive vegetation rehabilitation management plan needs to be compiled.		Developer and relevant specialist	Design phase
A response and management plan must be drafted and available to deal with accidental breakages and potential release of harmful substances. This plan must include: <ul style="list-style-type: none"> • Specifications of harmful substances that could be released from accidental leakages and breakages; • How such harmful substances can best be removed as soon as an accidental breakage has occurred; • How and where broken components and potential harmful substances can be disposed of. If possible, recycling methods should be described in terms of how and where. This should be incorporated into a waste management plan. 		Developer and relevant waste management specialist	Design phase
Performance Indicator	<ul style="list-style-type: none"> • Ecosystem fragmentation is kept to a minimum; • Ecosystem functionality is retained, and degradation is prevented; • Solar components and associated infrastructure and road alignments meet environmental objectives; • Grid connection and road alignments meet environmental objectives. 		
Monitoring	<ul style="list-style-type: none"> • Ensure that the implemented design meets the objectives. • Review of the design by the Project Manager and the ECO prior to the commencement of activity. 		

2. Construction and Operational Phase

The expected lifetime of the development is approximately 25 years after construction. After that, the development will either be decommissioned or upgraded with newer technology to remain functional and economical. Due to these given timeframes, an irreversible negative shift in natural biodiversity composition may result if impacts are not maximally mitigated.

For optimal implementation and updating of the management plans, it is recommended that the ecological specialist (familiar with the site) visit the site after construction has started and when rehabilitation work is under way. This will support

the ECO and ensure that minimum requirements of the mitigation plans are sufficient to retain adequate functionality of the ecosystem.

The ECO will most likely only be present on site for the duration of construction activities. An EO must be appointed where continued monitoring and possible mitigation is required during operational phase. The revision of the current EMP, after completion of the design and again after the construction phase, is recommended. It is also recommended that new EMPs be drafted for the decommissioning phase to continue with mitigations and prevention of all related environmental impacts.

2.1. Species search and rescue

OBJECTIVE 1	Minimise indigenous biodiversity loss		
Prior to commencement of all activities (grading, road construction, etc.) within the development and footprint area, a plant Search and Rescue program should be developed and implemented, preceded by a thorough investigation of all footprint areas, conducted during the optimal growth season (January to April), by a qualified botanist.			
Project Components	<ul style="list-style-type: none"> • Solar field • Water supply pipeline • Water storage tanks • Water treatment facility • Wastewater treatment facility • Substations; • Access roads (temporary & permanent roads) and fencing around the development area; • Temporary laydown area (workshops, mobile offices, mobile ablution facilities, material storage area, vehicle parking area, water tanks fencing, etc.); • Permanent office/workshop building; • Permanent living quarters for operational phase workers; • Surface run-off control system (trenches, canals, run-off dissipating structures, evaporation ponds, etc.). 		
Potential Impact	<ul style="list-style-type: none"> • Loss of species of conservation concern as well as natural vegetation (during construction phase), waste of on-site plant resources, lack of locally sourced material for rehabilitation of disturbed areas; 		
Activities / Risk Sources	<ul style="list-style-type: none"> • Loss and damage to remaining natural and semi-natural vegetation during construction phase. 		
Mitigation: Target / Objective	<ul style="list-style-type: none"> • Rescue, maintain and replant all protected plant species within the development and footprint areas. 		
Mitigation: Action / Control		Responsibility	Timeframe
Botanical footprint investigation and recording by GPS of localities of all species of conservation concern.		Ecologist	Prior to commencement of activity
<ul style="list-style-type: none"> • Search and Rescue (S&R) of all protected plants that will be affected by the development should take place. The necessary permits must be in place. • Plants that can be considered for rescue and included in subsequent rehabilitation programs are all tubers, bulbs and indigenous succulents. 		Horticultural Contractor monitored and	Prior to construction

<ul style="list-style-type: none"> • The development footprints must be barricaded before an experienced horticulturist undertake the S&R. • All rescued species should be bagged and returned to the site once all construction is completed and rehabilitation is required. • To facilitate establishment, replanting should occur in spring to early summer once sufficient rains have fallen. • List of protected species so far recorded on site: <ul style="list-style-type: none"> ○ <i>Hoodia gordonii</i> ○ <i>Avonia albissima</i> ○ <i>Euphorbia spinea</i> ○ <i>Lithops julii subsp. fulleri var. fulleri</i> 	approved by ECO	
In line with specifications regarding authorised biodiversity and rehabilitation, a minimum percentage vegetation cover must be established and permanently maintained post construction.	Developer and horticultural contractor	After construction and throughout the operational phase
Performance Indicator	<ul style="list-style-type: none"> • Rescue of species of conservation concern. • Re-establishment of rescued species. 	
Monitoring	<ul style="list-style-type: none"> • ECO must monitor Search and Rescue and continue search and rescue operations where necessary. • Geophytic species that were not accounted for in the original S&R plan, may emerge during construction. Once observed the ECO should consult the botanist on identification and S&R possibility. 	

2.2. Retaining agricultural potential on the site

OBJECTIVE 1	Minimise or avoid potential negative impacts on current and future farming activities.	
<p>Loss of productive agricultural land due to either loss of topsoil and soil seed banks (where applicable), loss of natural vegetation, erosion or pollution during construction and operational phase. It is recommended that once it has been determined what the staffing requirements will be during construction and operation of the proposed facility, an open space management plan be drafted in addition to all other management plans, related to ecosystem integrity to ensure the safeguarding of the productivity of the land and the functionality of the ecosystem.</p>		
Project Components	<ul style="list-style-type: none"> • Solar field • Water supply pipeline • Water storage tanks • Water treatment facility • Wastewater treatment facility • Substations; • Access roads (temporary & permanent roads) and fencing around the development area; • Temporary laydown area (workshops, mobile offices, mobile ablution facilities, material storage area, vehicle parking area, water tanks fencing, etc.); • Permanent office/workshop building; • Permanent living quarters for operational phase workers; • Surface run-off control system (trenches, canals, run-off dissipating structures, evaporation ponds, etc.). 	
Potential Impact	<ul style="list-style-type: none"> • The footprint of the development will result in loss of land for productive farming activities. • Decrease in productivity and agricultural potential within the footprint, due to a change in plant species composition. • A decrease in vegetation cover will leave the ecosystem prone to erosion. • Disturbance of indigenous vegetation could lead to the establishment of invasive vegetation or create surfaces that do not support vegetation establishment. 	

Activities / Risk Sources	<ul style="list-style-type: none"> Clearing of vegetation on footprint areas. Introducing the distribution of invasive plant species. Accelerated erosion with loss of topsoil and associated natural seedbanks and nutrients. 	
Mitigation: Target / Objective	<ul style="list-style-type: none"> Minimise the loss of land and indigenous vegetation and enable selected farming activities to continue where possible. 	
Mitigation: Action / Control	Responsibility	Timeframe
Minimise footprint of the development where possible. Avoid all impacts on sensitive habitats. <ul style="list-style-type: none"> The footprint for all development components must be defined before the construction phase. EMPs shall provide for the mitigation of the impacts of the different types of development components. 	Contractor and relevant specialists, to be monitored by ECO	Before and during construction and operational phase
Rehabilitate disturbed areas on completion of the construction phase. <ul style="list-style-type: none"> Rehabilitation targets based on original vegetation. Detailed rehabilitation programme contained in relevant EMP. 	Contractor rehabilitation specialists, to be monitored and approved by ECO	During construction phase
Monitor and manage erosion according to the erosion management plan as stipulated in the Soil Impact Assessment.	Contractor, to be monitored and approved by ECO and EO	From construction to decommissioning phase
<ul style="list-style-type: none"> Remove all weeds and alien invasive plants. Monitor the re-emergence of these species and manage according to the invasive plant management plan. 	Contractor, to be monitored and approved by ECO and EO	From construction to decommissioning phase
Performance Indicator	<ul style="list-style-type: none"> Stable vegetation cover throughout the development area. Footprint of development components included in the EMP. 	
Monitoring	<ul style="list-style-type: none"> Regular monitoring and audits of construction activities and the footprint area by the ECO to prevent degradation of the ecosystem. A photographic record must be established before, during and after mitigation. An incident reporting system used to record non-conformances to the EMP, followed by the necessary action from the developer to ensure full compliance. 	

2.3. Rehabilitation and revegetation

OBJECTIVE 1	Minimising disturbance and loss of topsoil and ecosystem functionality
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After completion of construction erosion stabilisation with the help of vegetation cover (if possible) should be implemented. A 30% perennial vegetation cover is desirable. Species that can be used to rehabilitate the disturbed areas should include the species recorded pre-construction.

Project Components	<ul style="list-style-type: none"> • Solar field • Water supply pipeline • Water storage tanks • Water treatment facility • Wastewater treatment facility • Substations; • Access roads (temporary & permanent roads) and fencing around the development area; • Temporary laydown area (workshops, mobile offices, mobile ablution facilities, material storage area, vehicle parking area, water tanks fencing, etc.); • Permanent office/workshop building; • Permanent living quarters for operational phase workers; • Surface run-off control system (trenches, canals, run-off dissipating structures, evaporation ponds, etc.).
Potential Impact	<ul style="list-style-type: none"> • Lower productivity and agricultural potential within the footprint due to removal, disturbance and continued long-term shading of vegetation. • The ecosystem will be more prone to erosion and irreversible degradation due to reduced vegetation cover. • Disturbance of indigenous vegetation could lead to the establishment of invasive vegetation or create surfaces that do not support vegetation establishment. • Loss of agricultural potential of soils.
Activities / Risk Sources	<ul style="list-style-type: none"> • Site preparation and earthworks. • Excavation of foundations for associated infrastructure. • Construction of site access road. • PV pilon screw-in activities.
Mitigation: Target / Objective	<ul style="list-style-type: none"> • Re-establish a vegetation cover that will facilitate the establishment of desirable and/or indigenous species. • Prevent accelerated erosion.

Mitigation: Action / Control	Responsibility	Timeframe
Rehabilitation of surface		
Based on the Screw-In Technology that will be used, no surface flattening or topsoil stripping will occur during construction of the solar field. In the solar field, some surface disturbance will occur due to vehicles obtaining access to the specified localities where these screw-in pilons will be established. These localities must be marked appropriately in order to minimise surface disturbance.	Contractor, ECO to control	Construction and operational phase
Once localities of surface disturbance have been identified, soil stabilisation can begin. <ul style="list-style-type: none"> • Compacted soil shall be ripped with a mechanical ripper or by hand to a depth of at least 25 cm. • Mulch (if available) shall be applied by hand to achieve a layer of uniform thickness, and rotovated into the upper 10 cm layer of the soil. • In order to protect all areas susceptible to erosion, it is necessary to install temporary and permanent (if applicable) drainage work. • Erosion channels developing shall be backfilled and restored to a proper condition. • Where erosion cannot be remediated with available mulch and rocks, geotextiles shall be used to reduce erosion. 	Contractor, ECO to control	Construction and Operational phase, followed up until desired end state is reached.
Borrow-pits (if required) <ul style="list-style-type: none"> • Shall be shaped to have low-gradient slopes and surfaces that are rough and irregular (suitable for trapping sediments and facilitating vegetation growth). 	Contractor, ECO to control	After construction

<ul style="list-style-type: none"> Upon completion of rehabilitation these reshaped and revegetated areas shall blend into the natural environment. 		
Revegetation		
Revegetation will be done according to an approved planting/landscaping plan according to the desirable end stated and permissible vegetation.	Contractor, ECO to control	Construction and Operational phase, followed up until desired end state is reached.
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. Commercially available seed of grass species naturally occurring on site can be used as alternatives. Re-seeding shall occur at the recommended time to take advantage of the growing season. In the absence of sufficient follow-up rains after germination started, irrigation of the new vegetation cover is necessary, until vegetation has been established. 	Contractor, ECO to control	Construction and Operational Phases, followed up until desired end state is reached.
Planting of species <ul style="list-style-type: none"> The composition of the final acceptable vegetation will be based on the vegetation descriptions of the original botanical EIA investigation, and will include rescued plant material. Geophytic plants shall be planted in groups or as features in selected areas. Limit damage to roots during the transplant. In order to facilitate the new growth and function of roots, plants should be watered immediately after transplanting. 	Contractor, ECO to control	Construction and Operational phases
Traffic on revegetated areas <ul style="list-style-type: none"> Designated tracks shall be created for pedestrians of vehicle traffic where necessary. Disturbance of vegetation must be kept to a practical minimum. No unauthorised off-road driving will be allowed. All livestock shall be excluded from newly revegetated areas, until vegetation is well established. 	Contractor, ECO to control	Construction and operational phases
Monitoring and follow-up treatments		
Monitor success of rehabilitation and revegetation and take remedial actions as needed according to the respective plan. <ul style="list-style-type: none"> Erosion shall be monitored at all times and measures taken as soon as detected. If necessary reseedling or replanting will have to be done of no acceptable plant cover has been created. 	ECO during construction, suitable designated person or contractor after that.	Construction and Operational phases
Weeding <ul style="list-style-type: none"> It can be anticipated that invasive species and weeds will germinate on rehabilitated soils. 	Contractor	Construction and

○ These need to be hand-pulled before they are fully established and/or reaching a mature stage where they can regenerate.		Operational phases
Performance Indicator	<ul style="list-style-type: none"> No activity in identified no-go areas. Ecosystem function of natural landscapes and their associated vegetation is improved or maintained. 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. 	
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 been established. Inspections should be according to monitoring protocol set out in the rehabilitation plan. Thereafter annual inspections according to the minimal monitoring protocol. 	

2.4. Invasive plant management

OBJECTIVE 1	Manage and reduce the impact of invasive vegetation.	
<p>Invasive species (indigenous and alien) occur within the project area. These species have a potential of reproducing to such an extent that the ecosystem within and beyond the project site could be impaired. Alien invasive plant species confirmed on site that need to be eradicated as much as possible includes the alien invasive plant species confirmed within the project site.</p> <p>Alien Invasive Plants confirmed within the study area: <i>Prosopis glandulosa</i></p> <p>No alien invasive plants however were found within the proposed project site. It might be that additional species be found after the pre-commencement walk-through survey. A detailed Invasive Management Plan need to be drafted after this walk-through. The use of chemicals may only commence with the approval of the relevant authorities.</p>		
Project Components	<ul style="list-style-type: none"> Permanent and temporary infrastructure. Access roads 	
Potential Impact	<ul style="list-style-type: none"> Impacts on natural vegetation Impacts on soil Degradation and loss of agricultural potential. 	
Activities / Risk Sources	<ul style="list-style-type: none"> Transport of construction materials to site. Movement of construction machinery and personnel. Construction of site access road. Site preparation and earthworks causing disturbance to indigenous vegetation. Routine maintenance work. 	
Mitigation: Target / Objective	<ul style="list-style-type: none"> Significantly reduce the presence of weeds and alien invasive species. Avoid the introduction of additional alien invasive plants to the project control area. Avoid the distribution of existing alien plants on the project area. 	
Mitigation: Action / Control	Responsibility	Timeframe
Compile a detailed invasive plant management and monitoring programme as guideline for the entire construction, operational and decommissioning phase. This programme must include a continuous monitoring programme to detect new infestations and must contain WfW-accepted (Work for Water-accepted) species-specific eradication methods.	Specialist	Pre-construction

<p>Avoid or minimise conditions favourable to invasive plants.</p> <ul style="list-style-type: none"> • Keep disturbance of indigenous vegetation to a minimum. • Rehabilitate disturbed areas as soon as possible. • Where possible, destroy seeding material of weeds and invasives by piling burning (in designated areas or suitable containers). • Do not import soil from areas with alien plants 	<p>Contractor, monitored by ECO</p>	<p>Construction and Operational phase</p>
<p>Eradicate all invasive plants that occur within the temporary and permanent footprint areas of the development. Ensure that material from invasive plants that can regenerate are adequately destroyed and not further distributed.</p>	<p>Contractor, monitored by ECO</p>	<p>Construction and Operational phase</p>
<p>Risks from alien invasives do not only arise from invasives present within the development footprint, but also from alien invasives along the verges of the major transport routes, especially invasive grasses and smaller weeds. Similarly, invasives can be spread by construction processes to surrounding areas. To avoid the distribution of weeds and invasive plants, establish a routine amongst contractors/all staff to regularly check:</p> <ul style="list-style-type: none"> • That clothing and shoes are free of mud and seeds; • That foot well inside vehicles and mats are cleared of weed seed; • Radiator and grill, along wheel trims, around wheels, mud flaps, undercarriage of vehicle or other moving machinery for mud and seed. 	<p>Contractor, monitored by ECO</p>	<p>Construction and Operational phases</p>
<p>Performance Indicator</p>	<ul style="list-style-type: none"> • Visible reduction of number and cover of alien invasive plants within the project area. • No establishment of additional alien invasive species. 	
<p>Monitoring</p>	<ul style="list-style-type: none"> • On-going monitoring of area by ECO during construction and operational phases. • Audit every two to three years by a qualified botanist to assess the status of infestation and success of eradication measures. 	