# Alien Vegetation Management Plan, Inyanda-Roodeplaat Wind Energy Facility, Eastern Cape, South Africa

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For

SRK

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**Appointment of Specialist**
Leigh-Ann de Wet (LD Biodiversity Consulting) was commissioned by SRK to develop an alien vegetation management plan. This report thus serves as an addendum to the original Ecological Impact Assessment conducted by CES in 2014, and the Ecological Impact Assessment Update Report completed by LD Biodiversity Consulting in 2016.

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# 1 Introduction

## 1.1 Objective of this Plan

Developments that disturb natural landscapes introduce anthropogenic disturbance, in which most alien invasive species thrive. Invasive species are aggressive competitors and overwhelm natural vegetation, causing biodiversity loss among other impacts. As part of the wider management plan for the Inyanda-Roodeplaat Wind Energy Facility (WEF), alien invasive species already recorded from the site, and those introduced to the site in the future must be controlled throughout the life of the development. The objectives of this plan are to:

- Control alien invasive species present on site;
- Prevent the invasion of new species and those that have been successfully controlled;
- Develop and implement a monitoring programme to ensure invasive species are controlled before they become a threat to the indigenous vegetation;
- Conserve and rehabilitate existing indigenous and conservation important species present on site.

Although this plan provides a section detailing general control measures for alien invasive species, it is recommended that a species-specific approach be taken. As such, a programme for each species already recorded from the site is included. This should be updated each year based on the monitoring schedule to ensure that any new invasive species are also included.

Included in this plan are the three power line alternatives to link the WEF to the national power grid. The management measures described in this report can be used as far as practicable for the power line. However, once the power line route is finalised, this plan should be updated to include that area.

## 1.2 Vegetation of the Inyanda-Roodeplaat WEF

**Nine different vegetation types were described from the study area; these are summarized in**

Table 1.1, with an indication of the general vegetation shown in Figure 1-1. A vegetation map is shown in Figure 1-2. A detailed description of the vegetation of the site can be found in the Ecological Impact Assessment Report for the project (de Wet, 2016).

**Table 1.1: Summary of the vegetation types mapped for the Inyanda-Roodeplaat WEF study area.**

| Vegetation type | Brief description |
|---|---|
| Thicket | Found on rocky outcrops within the fynbos, thicket comprises typical thicket species including *Euclea undulata, Pappea capensis, Brachylaena illicifolia* etc. |
| Proteaceous fynbos | Occurs on steep south and east facing slopes. Dominated sometimes almost exclusivelty of *Leucodendron salugnum* but other species may include *Protea munii* and *Metalasia muricata.* This fynbos type includes the Shale fynbos delineated by CES (Zide & Lubke 2014). |
| Grassy fynbos | On gentle to steep slopes with rocky outcrops containing thicket elements. Dominated by grass species including *Eragrostis curvula, Themeda triandra, Cymbopogon plurinodis* and *Tristcahya rehmanniii.* Other species include geophytes from the Irirdaceae family including *Bobartia orientalis* and Proteacea species including *Protea mundii, Leucodendron salignum* and *Protea nerifolia*. |
| Succulent thicket | Succulent thicket occurs on flat areas to the east of the site and is comprised of an almost completely succulent suite of species dominated by *Portulacaria afra* and other Crassulaceae and Mesembryanthemaceae species. |
| Karoo | Karroo is restricted to the very north of the site where it occurs on both sides of the road. A low succulent shrub interspersed with Euphorbia species characterizes it. This vegetation type is fairly degraded within the study site. |
| Degraded thicket | Degraded thicket occurs near the main farmhouse and in areas that have been grazed by livestock or have been used as agricultural land previously. The thicket is open and characterized by typical thicket species that exhibit a browsing growth-form (a clear-cut umbrella tree shape) and include *Pappea capensis* and *Euclea undulala* as dominant species. This vegetation type contains the majority of the alien invasive species recorded from the site. |
| Renosterveld | Renosterveld is restricted to a small section of the site and is clearly delineated by the presence of Renosterbos (*Elytropappus rhinoceratis*) where it occasionally forms a monoculture. |
| *Acacia* riparian thicket | The primary riparian vegetation type on the site has a road running through it and as such, is degraded. The vegetation type is dominated by *Acacia karroo* although in some areas species such as *Salix mucronata, Schotia afra* and *Dondonea angustifolia* are found. |

**Figure 1-1: General vegetation on the upper slopes of the Inyanda-Roodeplaat WEF study site.**

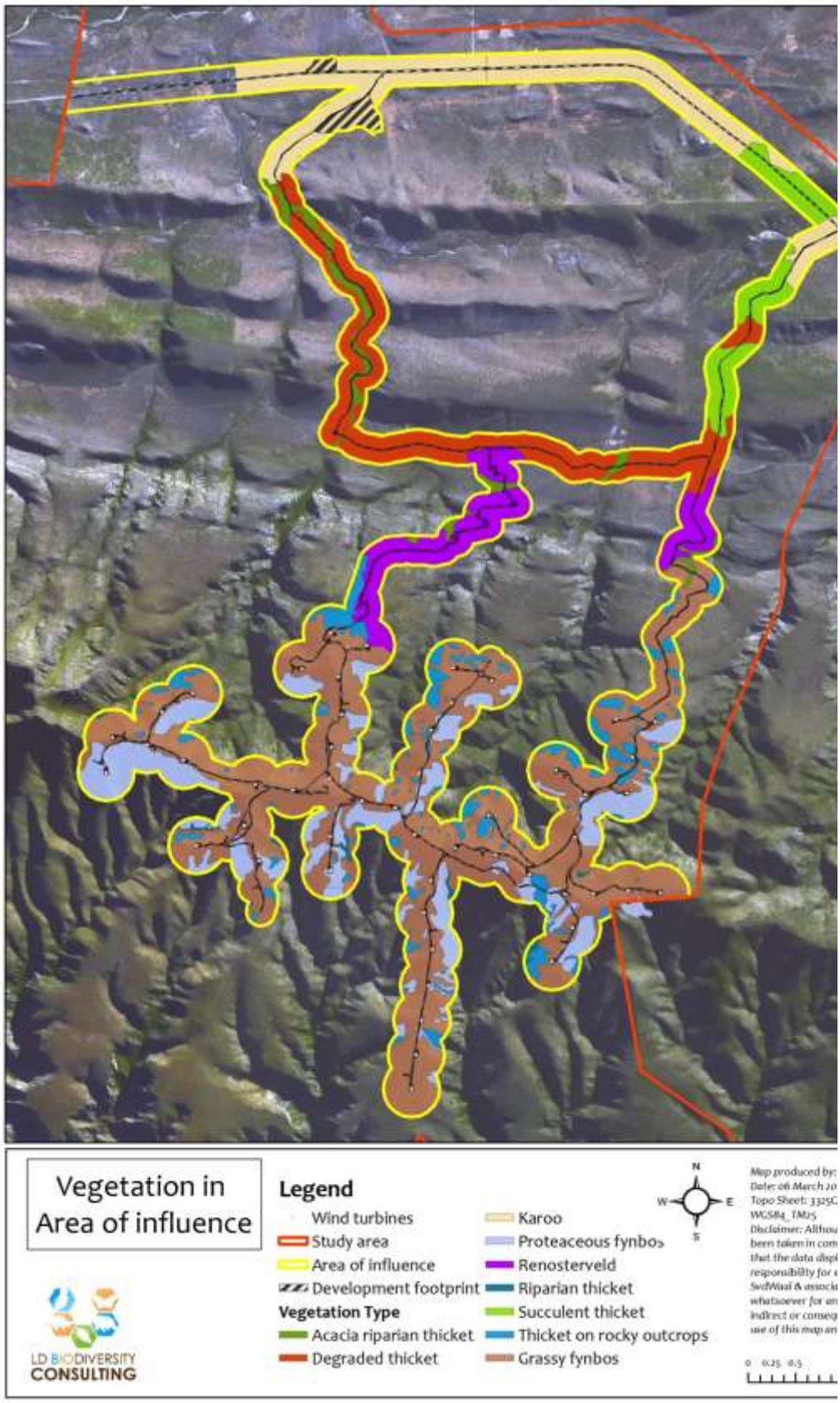



**Figure 1-2: Vegetation map of the Inyanda-Roodeplaat WEF area of influence.**

## 1.3 Vegetation of the Inyanda-Roodeplaat Power line options

All three power line options go through the same vegetation types, both in Mucina & Rutherford (2006) and STEP (Figure 1-3). These vegetation types are shown in Table 1.2. Of the different options, option 2 traverses the largest area of alluvial vegetation.

**Table 1.2: Vegetation types of the three power line options (adapted from Zide and Lubke (2014).**

| Mucina & Rutherford | Description | STEP | Description |
|---|---|---|---|
| Sundays Thicket | Characterised by undulating plains and low mountains and foothills covered with tall dense thicket. The Sundays Thicket is composed of a mosaic of predominantly spinescent species that include trees, shrubs and succulents. It is classified as Least Threatened with a conservation target of 19%. 6% has been transformed by cultivation and urban development. | Sundays Spekboomveld | This vegetation type is dominated by *Pappea capensis* and *Portulacaria afra* while *Euphorbia coerulescens* and *Crassula ovata* are abundant succulent plants that characterize this vegetation type. This spekboomveld is distinguished from adjacent noorsveld by the relatively high cover of *Portulacaria afra*, *Pappea capensis* and *Schotia afra*. This vegetation type is listed as Endangered. |
| | | Sundays Spekboom Thicket | The tree component of this vegetation type is dominated by *Portulacaria afra* and *Pappea capensis*. Other common species include *Euphorbia ledienii* and *Rhigozum obovatum*. This vegetation type is listed as Vulnerable. |

| Mucina & Rutherford | Description | STEP | Description |
|---|---|---|---|
| Albany Alluvial | Thornveld and riverine thicket are the two major vegetation types that occur in this vegetation type. It is classified as Endangered with a conservation target of 31%. Only 6% has been statutorily conserved. | Sundays Doringveld | Sundays Doringveld is characterised by a mosaic of thicket clumps and a Nama-karoo matrix. Thicket clumps often have low species diversity with species that are typical of the Sundays Valley Thicket. Dominant species in the Nama-karoo matrix comprise of *Acacia karoo, Lycium sp.* And *Cynodon dactylon* and include a suite of succulents, some of which are rare endemics such as *Haworthia sordida*. This vegetation type is listed as Vulnerable.. |
| Sundays Noorsveld | The Sundays Noorsveld occurs along flat lowlands. It is characterised by succulent thicket consisting of a mosaic of *Euphobia caerulescens* and low karoo shrub vegetation (dominated by *Pentzia incana* and *Rhigozum obovayum*). This vegetation type is classified as Least Threatened with a conservation target of 19%. About 15% is statutorily conserved in the Greater Addo Elephant National Park and some 3% in private game ranches. Approximately 4% of this vegetation type has been transformed by cultivation. | Sundays Noorsveld | The domiant species of this vegetation type is *Euphorbia coerulescens*. Presence of witgat trees (*Boscia oleoides*) and wildegranaat (*Rhigozum obovatum)* is diagnostic.<br><br>Spekboom (*Portulacaria afra)*, only found in the better-preserved veld, was never a dominant component. Palatable grasses (*Cenchrus ciliata, Fingerhuthia africana* and *Panicum maximum*) used to be abundant, but are now sparse. |

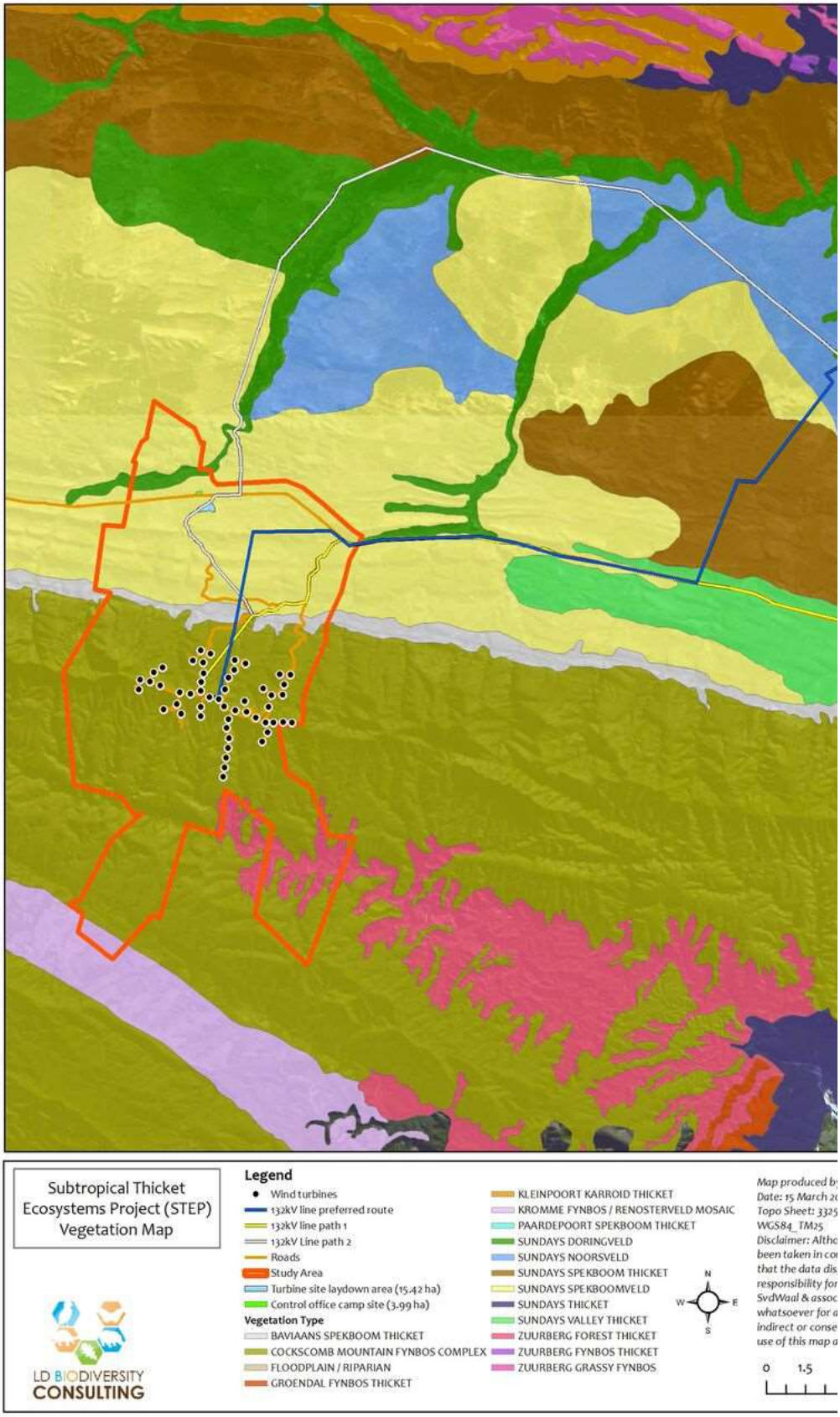



**Figure 1-3: STEP vegetation map of the power line alternatives**

## 2 Legislative background

The control of alien invasive plant species is controlled by the Alien and Invasive Species Regulations (published on the 19 July 2013) under the National Environmental Management: Biodiversity Act (NEM:BA) 2004 (Act NO, 10 of 2004) as well as the Conservation of Agricultural Resources Act, 1983 (Act No 43 of 1983) (CARA). Regulations 15 and 16 under this Act, which concern problem plants, were amended during March 2001. Alien plants that are listed in CARA are exempted from NEM:BA, which implies that the provisions of CARA superseded those of NEM:BA.

According to the National Environmental Management: Biodiversity Act (NEM:BA) 2004 (Act NO, 10 of 2004), there are three categories which include the following:

- **Category 1a**: Invasive species requiring compulsory control. Any individuals that fall into this category must be removed by law. No permits will be issued.
- **Category 1b**: Invasive species requiring some control as part of an invasive species control programme. Species in this category must be removed and destroyed. Species under this category may form part of a government sponsored management programme. No permits may be issued.
- **Category 2**: Invasive species regulated by area. A permit is required to import, possess, grow, breed, move, sell, buy or accept as a gift any plants in this category. No permits for Category 2 plants will be given in riparian zones.
- **Category 3**: Invasive species regulated by activity. A permit is required to import, possess, grow, breed, move, sell, buy or accept as a gift any Category 3 plants. No permits will be issued for riparian zones.

According to the Conservation of Agricultural Resources Act (Act No 43 of 1983) (CARA), all declared aliens must be controlled. Landowners are responsible for the alien invasive species present on their property. Three categories exist in this legislation and include the following:

- **Category 1**: Prohibited and must be controlled.
- **Category 2** (commercially used plants): May be grown in demarcated areas provided that there is a permit and that steps are taken to control their spread.
- **Category 3** (ornamentally used plants): May no longer be planted. Existing plants may be retained (except within the flood line or watercourses and wetlands) as long as all reasonable steps are taken to prevent their spread.

# 3 General Management for Alien Invasive Species

## 3.1 Prevention

The first step is to avoid the introduction of alien species. This should be done primarily in the construction phase of the development and include management measures to ensure that the likelihood of introducing new species and spreading existing species is as low as possible. Monitoring is essential, and any new invasive species should be recorded and a control and management plan drawn up and implemented for these species.

Both thicket and fynbos are known for invasive species, and several can severely impact on these vegetation types. Figure 3-1 indicates which areas are susceptible to typical thicket and fynbos invaders. In addition, areas that are disturbed are more likely to be invaded; these include areas cleared during the construction phase, as well as the areas already degraded, which are susceptible to invasion.

## 3.2 Early Control

Once a species has been recorded, management plans for the species should be drawn up and implemented. A good resource for control is Problem Plants and Alien Weeds of South Africa (Bromilow, 2010). There are various means of controlling invasive species, but the earlier this is done the better as the later it is left the more difficult and costly the control becomes. Control measures may be as simple as manually removing tree seedlings or as complex as the introduction of biological control agents.

As the invasive species on the site have not yet formed dense stands and the threat is not large at this stage it is possible to use simple control measures to eradicate existing aliens. This should be commenced prior to construction of the project.

## 3.3 General management measures

Management should be continuous and adaptive, following the following general model for the site:

- A monitoring plan must be implemented to ensure the identification and recording of new invasive species and new individuals of already recorded species. This should be implemented in the construction phase, and continue into the operation phase to ensure consistent effective management.
- Any alien growth recorded should be promptly removed and should not be allowed to flower; at this stage control is relatively easy and can often be done by hand. Care should be taken that no reproductive material is left at the control sites (especially with the Cactaceae family, where cladodes – leaf sections – can regrow to form adult plants).
- Introduction of alien plants to the site should be avoided wherever possible. Any imported sand or earth should be sterile or invasive free where possible. Vehicles

entering the site should be checked for any cactus cladodes. Soil and sand stockpiles should be checked regularly and any sprouting aliens removed.
- Control should be continuous; often, existing seed banks will continue to germinate. Need for control tapers off as these become depleted.

## 3.4 Monitoring

Monitoring is important as it provides an initial starting point for the management plan, as well as allowing for adaptive management. General monitoring principles include:

- Clearing should be recorded through photographs.
- Management measures must be recorded including methods used, areas cleared and herbicide used where appropriate.
- Should monitoring result in the recording of new species, or new invaded areas these should be immediately adopted into the management plan.

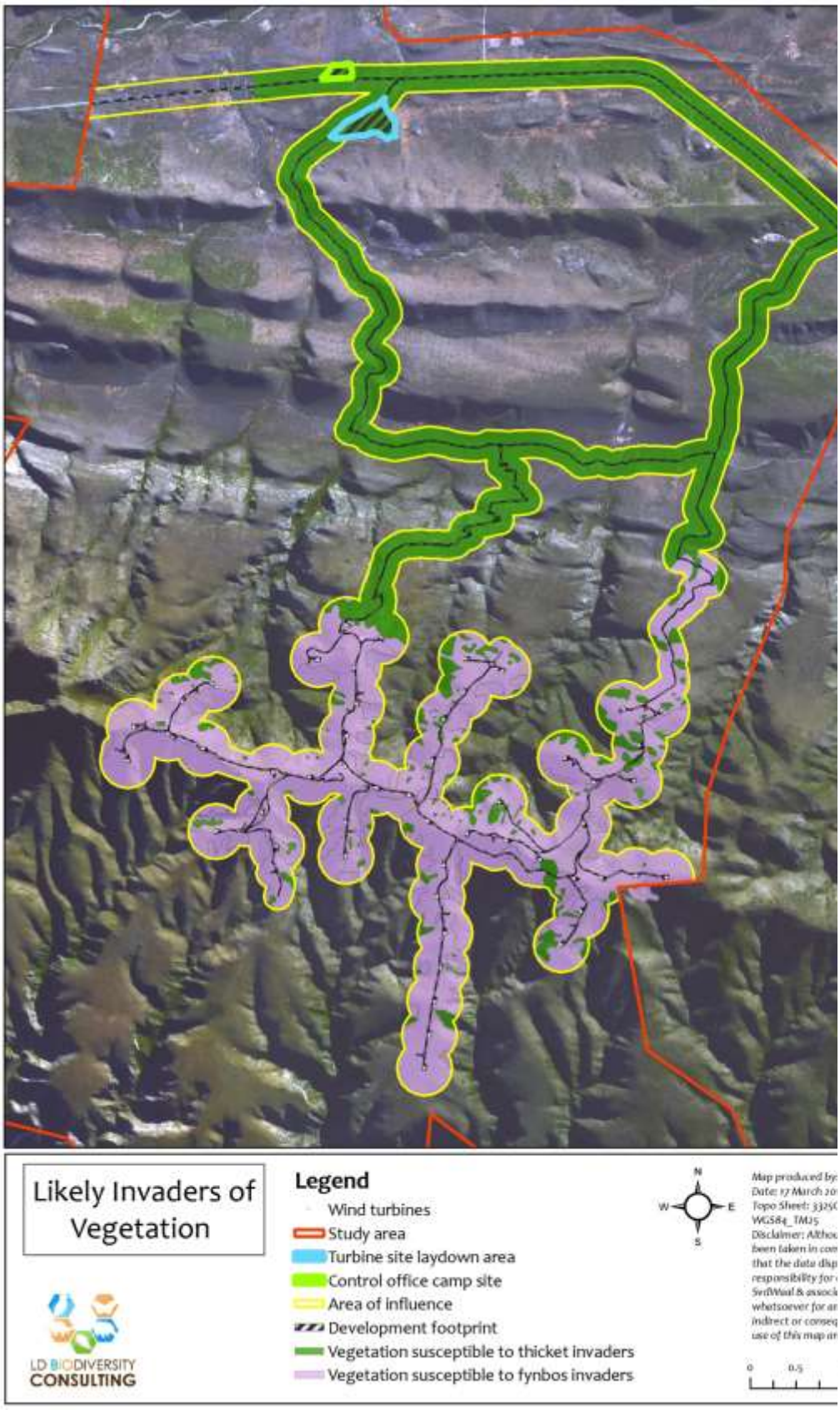


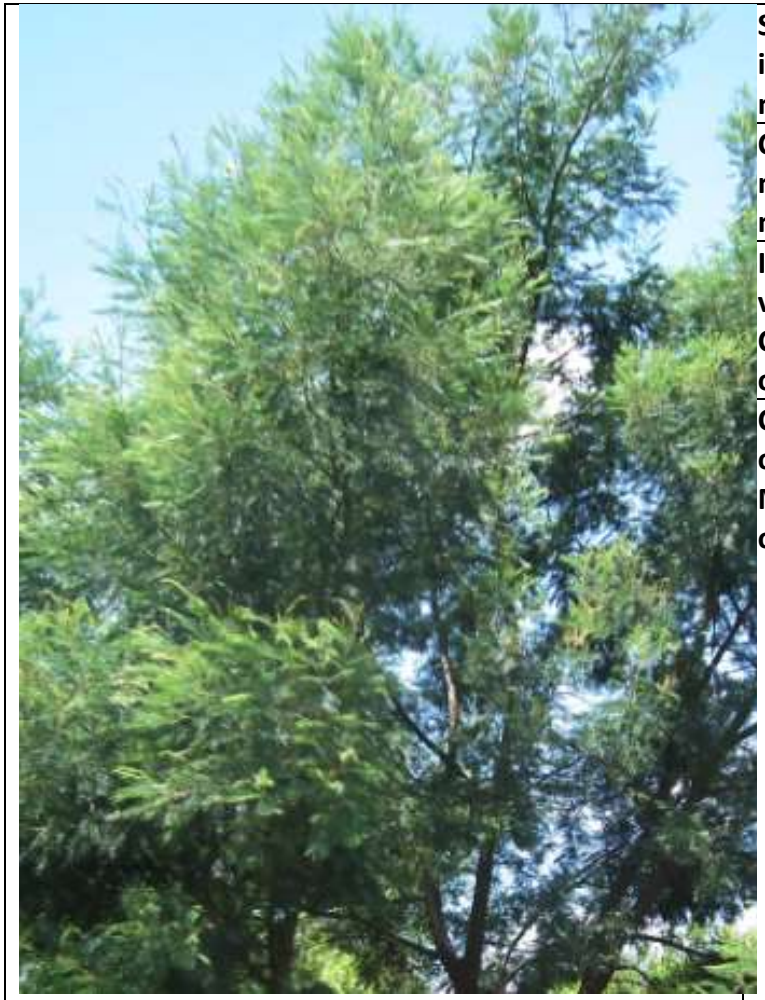

**Figure 3-1: Areas susceptible to thicket and fynbos invaders.**

# 4 Recorded Alien invasive species and control

CES (Zide & Lubke 2014) recorded three invasive species on site including *Acacia mearnsii*, *Cuscuta campestris* and a *Pinus* species. Additional species recorded from the site visit conducted as part of the 2016 updated study include those listed in Table 4.1. Control measures for each of these species follow.

**Table 4.1: Alien invasive species recorded from the proposed Inyanda WEF study site**

| Scientific name | Common name | Category |
|---|---|---|
| *Acacia mearnsii* | Black wattle | 2 |
| *Agave americana* | Century plant | 1b |
| *Agave sisalana* | Sisal | 2 |
| *Cuscuta campestris* | Dodder | 1b |
| *Echinopsis spachiana* | Torch cactus | 1b |
| *Opuntia aurantiaca* | Jointed prickly pear | 1b |
| *Opuntia ficus-indica* | Sweet prickly pear | 1b |
| *Pinus* sp. | Pine | 2 |

| | | |
|---|---|---|
|  | **Scientific name** | *Acacia mearnsii* |
| | **Common name** | Black wattle |
| | **Invasive Category** | 2 |
| | **Control Method** | Control of these species need to e continuous as the plants easily coppice and produce large quantities of seed that remain dormant for extended |

| | | |
|---|---|---|
| | | periods of time. Seeds germination is stimulated by fire. Any large-scale clearing must be followed up with several rounds of manual removal of seedlings. And herbicide application.<br><br>Control of this species is difficult and long-term. |

| | | |
|---|---|---|
| | | *Picture taken from www.ispot.org.za (this should be replaced with an image from site) |

| | |
|---|---|
| **Scientific name** | *Agave americana* |
| **Common name** | Century Plant |
| **Invasive Category** | 1b |
| **Control Method** | Direct injection of concentrated MSMA into the bole. Plants can be removed once they have died and dried out.<br><br>Physical removal is only possible with bulldozers, which then have impacts on the indigenous vegetation, which is not recommended. |

| | |
|---|---|
| **Scientific name** | *Agave sisalana* |
| **Common name** | Sisal |
| **Invasive Category** | 2 |
| **Control Method** | Direct injection of concentrated MSMA into the bole. Plants can be removed once they have died and dried out.<br><br>Physical removal is only possible with bulldozers, which then have impacts on the indigenous vegetation, which is not recommended. |

| | |
|---|---|
| **Scientific name** | *Cuscuta campestris* |
| **Common name** | Dodder |
| **Invasive Category** | 1b |
| **Control Method** | The plants must be cut out and burned before producing seeds.<br><br>*Picture taken from www.ispot.org.za (this should be replaced with an image from site) |

| | | |
|---|---|---|
|  | **Scientific name** | *Echinopsis spachiana* |
| | **Common name** | Torch cactus |
| | **Invasive Category** | 1b |
| | **Control Method** | Use of cactus-specific herbicide is recommended.<br><br>Where possible, herbicides should be avoided and manual removal should be the preferred method. |

| | |
|---|---|
| **Scientific name** | *Opuntia aurantiaca* |
| **Common name** | Jointed prickly pear |
| **Invasive Category** | 1b |
| **Control Method** | If the invasion is large, herbicides can be costly and time-consuming. There is a biocontrol agent called *Cactoblastis cactorum,* which can aid in control.<br><br>However, at the Roodeplaat WEF site, this species is not yet a large problem and manual removal is recommended. Care should be taken to ensure that all sections (cladodes) of the cactus are removed as each can generate into a new plant. |

| | |
|---|---|
| **Scientific name** | *Opuntia ficus-indica* |
| **Common name** | Sweet prickly pear |
| **Invasive Category** | 1b |
| **Control Method** | Chemical control is possible with the use of MSMA and gycophosphate. However, biocontrol agents have been extremely successful with this species and additional control is rarely necessary.<br><br>Should the WEF require complete eradication of this species application of herbicides is recommended for its control. |

| | |
|---|---|
| **Scientific name** | *Pinus sp.* |
| **Common name** | Pine |
| **Invasive Category** | 2 |
| **Control Method** | Small saplings can be manually removed with tree poppers.<br><br>Seedlings can be manually removed.<br><br>Large trees can be ring barked and felled. |

# 5 Monitoring and Management Plan

The site comprises three spatial zones:

- The footprint of the study area
- The Area of Influence, which is the area most likely to receive the majority of the impacts of the development and
- The Study Area, comprising the farms containing the development.

Each of these areas needs to be monitored and managed for alien invasive species. However, it must be done at different scales.

The footprint of the development will receive the most disturbance and thus will be the most likely to be invaded by alien species. This will need to be managed and monitored more regularly than the other areas.

The Area of Influence, which is not directly impacted by the development will likely be sensitive to the nearby disturbance and is sensitive to alien invasive species that may result from this disturbance. Some of these areas already degraded due to prior land use already play host to recorded invasive species.

The Study Site has invasives present already; as does the Area of Influence, specifically in already disturbed or degraded areas. These areas have been formed from land that was used in the past for grazing lands or agriculture. These areas may form a source of the invasives in the rest of the defined areas and need to be controlled. However, this environment will not suffer additional disturbance and is more stable, requiring less monitoring.

Figure 5-1 Indicates the Monitoring intensity relative to the Inyanda-Roodeplaat WEF with the intensity of monitoring the lowest for the general study area, followed by moderate monitoring intensity for the Area of Influence and High Monitoring Intensity for the Footprint.

The management and monitoring plans follow; these tables are designed to be freestanding (with reference to the maps) and to be utilized in the field by the responsible parties.


**Figure 5-1: Intensity of monitoring required throughout the site.**

| Inyanda-Roodeplaat WEF Alien Invasive Management Plan | | | | | |
|---|---|---|---|---|---|
| 1: Construction Phase | | | | | |
| Number | Task | Responsible Party | Frequency | | |
| | | | Footprint | Area of Influence | Study Site |
| 1.1 | Clearing of alien species must be organized and approved | Contractor | Daily | Daily | Daily |
| 1.2 | All manually cleared alien plants must be disposed of carefully and must not be dumped in any areas of indigenous vegetation, even temporarily. | Contractor | Daily | Daily | Daily |
| 1.3 | No mass clearing of vegetation should be done, but rather vegetation should be cleared as work progresses. No large areas should be cleared unless surfacing occurs immediately after. | Contractor | Weekly | N/A | N/A |
| 1.4 | Cleared areas that will not be surfaced for an extended period of time (over 2 weeks) should be stabilized with packed brush (from indigenous plants cleared from the site), or with jute pegged over the area. | Contractor | Weekly | N/A | N/A |
| 1.5 | Any exposed construction areas that have become invaded can be sprayed with herbicides (only those that break down on contact with the soil) | Contractor | Weekly | N/A | N/A |
| 1.6 | Any soil stockpiles that have become invaded should be cleared through manual control methods (weeding). | Contractor | Weekly | N/A | N/A |
| 1.7 | Areas that will be vegetated though rehabilitation must be done so through the rehabilitation plan. No organic matter from outside the site should be used to encourage regrowth of vegetation. | Contractor | Monthly | N/A | N/A |
| 1.8 | Introduction of alien plant species to the site should be prevented as far as practicable. Vehicles entering should be | Contractor | Daily | | |

| | | | | | |
|---|---|---|---|---|---|
| | inspected, outside sources of soil and sand should be clear of invasive species. | | | | |
| 1.9 | Alien invasive species must be controlled throughout the entire site during the construction process. | Contractor | Monthly | Every 2 months | Every 6 months |
| 1.10 | Species-specific control measures should be used. These are provided in this plan for species recorded from the site. If any new species are recorded, best practice means of control must be researched and used. | Contractor | Monthly | Every 2 months | Every 6 months |
| 1.11 | Clearing must be restricted to the footprint of the site as defined in the Ecological Impact Assessment. (15m wide for roads on the site, turbine platforms and 31m for powerline servitudes) | Contractor | Weekly | Weekly | Monthly |
| 1.12 | Any no-go areas (such as wetlands) should be demarcated and workers should be informed that no activities are to occur in these areas. | Contractor | Daily | N/A | N/A |
| 2: Operational Phase | | | | | |
| Number | Task | Responsible Party | Frequency | | |
| | | | Footprint | Area of Influence | Study Site |
| 2.1 | Surveys of the site for alien invasive species must be conducted throughout the life of the project. These include new invasions by recorded species and new species on site. | Contractor | Monthly for 2 years (the defects notification period), then every 3 months. | Once a year for two years, then every second year. | Once in the first two years, then every 5 years. |
| 2.2 | To prevent increased invasion in areas cleared for construction but not needed for operation, rehabilitation of | Contractor | Refer to Rehabilitation Plan | | |

| | | | | | |
|---|---|---|---|---|---|
| | the natural vegetation should be done. This should follow the prescribed Rehabilitation Plan. | | | | |
| 2.3 | Areas where vegetation is required to be kept low (such as along power line servitudes), should be managed using weedeaters above the soil line to maintain the indigenous vegetation and reduce invasion potential. | Contractor | When necessary | N/A | N/A |

| **Inyanda-Roodeplaat WEF Alien Invasive Monitoring Plan** | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1: Construction Phase | | | | | | | |
| Number | Task | Method | Outcome | Responsible Party | Frequency | | |
| | | | | | Footprint | Area of Influence | Study Site |
| 1.1 | Document all alien invasive species on site | Where feasible, use aerial imagery for the full site, with walking restricted to the footprint and Area of Influence.<br><br>Walking though the areas on foot with a GPS, noting:<br>• all alien invasive species<br>• the GPS location of each population<br>• the number of individuals in each | • A list of alien invasive species present on site.<br>• A map of the location of populations of each species. | Contractor | Preconstruction | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | population. | | | | | |
| 1.2 | Document changes in alien vegetation on site. | Where feasible, use aerial imagery for the full site, with walking restricted to the footprint and Area of Influence.<br><br>Walking though the areas on foot with a GPS, noting:<br>• all alien invasive species<br>• the GPS location of each population<br>• the number of individuals in each population. | • An updated list of alien invasive species present on site.<br>• An updated map of the location of populations of each species<br>• A record of any changes in population size. | Contractor | Monthly | Every 6 months | Once just after construction in finished. |
| 1.3 | Document and record alien control measures used. | For each population for which control is implemented record:<br>• The method used for control<br>• The quantity and type of herbicides used (if any)<br>• The cost associated with control | A ledger of control measures and the populations that were controlled, allowing for comparisons of success. | Contractor | Monthly | Every 6 months | Once just after construction in finished. |
| 1.4 | Evaluate and | For each population for | A ledger of control | Contractor | Monthly | Every 6 | Once just after |

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| | review control methods and success. | which control is implemented record:<br>• The number of individuals remaining in the population,<br>• If follow-up treatment is required. | measures and the populations that were controlled, allowing for comparisons of success. | | | months | construction in finished. |
| 2: Operational Phase | | | | | | | |
| Number | Task | Method | Outcome | Responsible Party | Frequency | | |
| | | | | | Footprint | Area of Influence | Study Site |
| 2.1 | Document changes in alien vegetation on site. | Where feasible, use aerial imagery for the full site, with walking restricted to the footprint and Area of Influence.<br><br>Walking though the areas on foot with a GPS, noting:<br>• all alien invasive species<br>• the GPS location of each population<br>the number of individuals in each | • An updated list of alien invasive species present on site.<br>• An updated map of the location of populations of each species<br>• A record of any changes in population size. | Contractor | Every 6 months for the first 2 years, then every 2 years. | Once a year for the first two years, then every 3 years. | Once during the first two years then every 5 years. |

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|---|---|---|---|---|---|---|---|
| | | population. | | | | | |
| 2.2 | Document and record alien control measures used. | For each population for which control is implemented record:<br>• The method used for control<br>• The quantity and type of herbicides used (if any)<br>The cost associated with control | A ledger of control measures and the populations that were controlled, allowing for comparisons of success. | Contractor | Every 6 months for the first 2 years, then every 2 years. | Once a year for the first two years, then every 3 years. | Once during the first two years then every 5 years. |
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# 6 References

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