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SPECIALIST IMPACT ASSESSMENT FOR PROPOSED EXXARO WIND ENERGY FACILITY NEAR BRAND SE BAAI, WESTERN CAPE: VEGETATION COMPONENT

Prepared for: Savannah Environmental (Pty.) Ltd., Johannesburg

Client: Exxaro (Pty) Ltd.

9 November 2010

EXECUTIVE SUMMARY

This botanical impact assessment was requested in order to help inform decisions regarding the establishment of a proposed private wind energy facility (WEF) on a site adjacent to the Exxaro Namakwa Sands mineral sands mining operation at Brand se Baai (Western Cape). The study area consists of a portion of Rietfontein Extension 151, and is part of a much larger area owned by Exxaro. The total area spanned by the turbine and road network is calculated to amount to about 420ha. The study area lies about 5km northeast of the main Exxaro Brand se Baai primary processing plant. The proposal is to install a total of up to 25 wind turbines, with a maximum capacity of 66MW. The proposed WEF would also include 1 substation, a short 132kV power line linking to the existing Namakwa Sands substation, and internal access roads and cable trenches (each about 8km long in total) between the turbines. No alternative WEF layout was presented for assessment, but all the High botanical sensitivity areas identified in the vegetation Scoping study have been avoided by the proposed layout.

The study area falls within the Namaqualand coastal region of the Cape Floristic Region, and actually includes two biomes – the Fynbos biome, and the Succulent Karoo biome (Mucina & Rutherford 2006). The site also falls within the buffer area of the proposed Knersvlakte Biosphere Reserve, although it is located within a very different ecosystem from the core area of the Biosphere, which is a sparsely vegetated arid area (the Knersvlakte) within the Succulent Karoo biome, and is at least 30km to the southeast of the study area.

Four distinct vegetation types occur in the vicinity of the site, although the entire extent of the proposed WEF occurs within a single vegetation type - Namaqualand Strandveld (part of the Succulent Karoo biome). This is an extremely widespread vegetation type along the west coast, and is regarded as a Least Threatened vegetation type in terms of the NSBA (Rouget et al 2004), with over 90% of its original extent still intact. The vegetation in the study area is mostly in good to pristine condition, and is of Medium botanical sensitivity at a regional scale. There is negligible alien invasive vegetation, and the recent and current landuse is livestock grazing, except in a small portion of the site (about 10%) where strip cultivation was practised. No plant Species of Conservation Concern are likely to be present in significant numbers within the proposed development area, and most of the vegetation is very homogenous.

The following negative impacts on the vegetation in the proposed development area have been identified:

- Direct loss of vegetation at the construction phase (turbine foundations and adjacent crane standpads; substation; access roads; powerline footings).
- Temporary loss of vegetation at the construction phase (laydown areas; underground cabling; disturbance around towers; building material storage areas; access route along powerline).
- Indirect ecological impacts at the operational phase (possible introduction and spread of invasive alien plants; possible fragmentation of natural habitat).

The following potentially positive ecological impact has been identified:

- Opportunity to formally conserve and manage all natural habitat on site (basically an on-site conservation contribution), and to prohibit livestock grazing on the site, which would significantly improve natural rehabilitation of the disturbed areas.

The primary negative impacts are the result of direct factors. Direct impacts include loss of natural vegetation (<10ha) in development footprints, and direct, long term loss of natural vegetation (<12ha) in areas that will be disturbed by heavy construction machinery and power line installation, temporary dumping of sand and supplies, etc. Most of these impacts cannot be avoided or reduced, at least not without relocating the WEF to a previously disturbed area (cultivated or mined).

Indirect impacts are often difficult to quantify and avoid. The indirect botanical impacts of the proposed development are likely to be negligible in relation to the impacts associated with the existing and ongoing mineral sand mining operations nearby.

Cumulative effects are in many respects regional effects, and the impacts of this type of development will be significantly less than for various existing and ongoing mining and agricultural operations in the region. There are currently no existing WEFs in the area, although there is an approved WEF within 30km, in similar habitat.

The possible positive direct impact depends to a large degree on the management of the natural vegetation within the study area (at least 400ha of natural vegetation will remain within the study area) as a conservation area, and the removal of livestock from this area during the main flowering season (May – September), and preferably on a permanent basis.

Overall the proposed WEF is likely to have an acceptable Low - Medium negative local (site scale; 420ha site) and Low regional (central west coast; < 200 000ha) negative impact on the vegetation on site, prior to mitigation. This can not be reduced in any meaningful way without either relocating to an area of disturbed vegetation, or by reducing the scale of the project. The only layout change that needs to be made is that turbine 21 should be moved at least 80m to the southeast, to avoid a sensitive area of vegetation on shallow clays.

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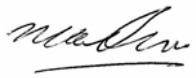
DECLARATION OF INDEPENDENCE

In terms of Chapter 5 of the National Environmental Management Act of 1998 specialists involved in Impact Assessment processes must declare their independence and include an abbreviated Curriculum Vitae.

I, N.A. Helme, do hereby declare that I am financially and otherwise independent of the client and their consultants, and that all opinions expressed in this document are substantially my own.



NA Helme

Abridged CV:

Contact details as per letterhead.

Surname : HELME

First names : NICHOLAS ALEXANDER

Date of birth : 29 January 1969

University of Cape Town, South Africa. BSc (Honours) – Botany (Ecology & Systematics). 1990.

Since 1997 I have been based in Cape Town, and have been working as a specialist botanical consultant, specialising in the diverse flora of the south-western Cape. Since the end of 2001 I have been the Sole Proprietor of Nick Helme Botanical Surveys.

A selection of recent, relevant projects undertaken in the region include:

- Scoping study of Proposed Wind Energy Facility near Swellendam (CSIR 2010)
- Scoping study of proposed Wind Energy Facility near Britannia Bay (Savannah Environmental 2010)
- Scoping study of Proposed Wind Energy Facility near Bredasdorp (CSIR 2010)
- Scoping study of Proposed Wind Energy Facility near Caledon (Arcus Gibb 2009)
- Scoping and Impact Assessment of proposed Wind Energy Facility near Hopefield (Savannah Environmental 2008 & 2009)
- Scoping study of Proposed Wind Energy Facility near Vredendal (DJ Environmental 2009)
- Scoping study of Proposed Wind Energy Facility west of Bitterfontein (DJ Environmental 2009)
- Botanical Scoping and Impact Assessment of proposed St Helena Hills development (DJ Environmental 2009)
- Botanical Impact Assessment of Portion 4 of Farm 560, Yzerfontein (EnviroLogic 2009)
- Botanical Impact Assessment of Portion 9 of Farm 957, Saldanha (EnviroLogic 2008)
- Botanical Impact Assessment of proposed development on Portion 87 of the Farm Witteklip 123, Vredenburg (CCA Environmental 2008)
- Botanical Sensitivity study of Portion 4 of Farm Yzerfontein 560 (De Villiers family 2008)
- Botanical Scoping and Impact Assessment of proposed overnight sites in the West Coast National Park (SANParks 2008 & 2010)
- Fine Scale Vegetation Mapping for Saldanha Municipality (CapeNature 2007)
- Botanical Assessment of Rem. Erf 460 Ptn A, St Helena (Envirodinamik 2007)
- Stewardship assessment of Rainbow Chicken Sites (CapeNature 2007)

1. INTRODUCTION

This botanical impact assessment was requested in order to help inform decisions regarding the establishment of a proposed private wind energy facility (WEF) on a site adjacent to the Exxaro Namakwa Sands mineral sands mining operation at Brand se Baai (Western Cape). The study area consists of a portion of Rietfontein Extension 151 (see Figure 1), and is owned by Exxaro. The total area spanned by the turbine and road network (referred to in this report as the site or the study area) is calculated to amount to about 420ha. The study area lies about 5km northeast of the main Exxaro Brand se Baai primary processing plant. The proposal is to install a total of up to 25 wind turbines, with a maximum capacity of 66MW. The proposed WEF would also include 1 substation, a short 132kV power line linking to the existing Namakwa Sands substation, and internal access roads and cable trenches (each about 8km long in total) between the turbines.

The botanical Scoping study for this project was completed in July 2010 (Helme 2010). No alternative infrastructure layouts have been presented for assessment, but the proposed layout takes into account the botanical constraints identified in the Scoping report of Helme (2010), and all areas of High botanical sensitivity identified therein have been avoided by the proposed layout.

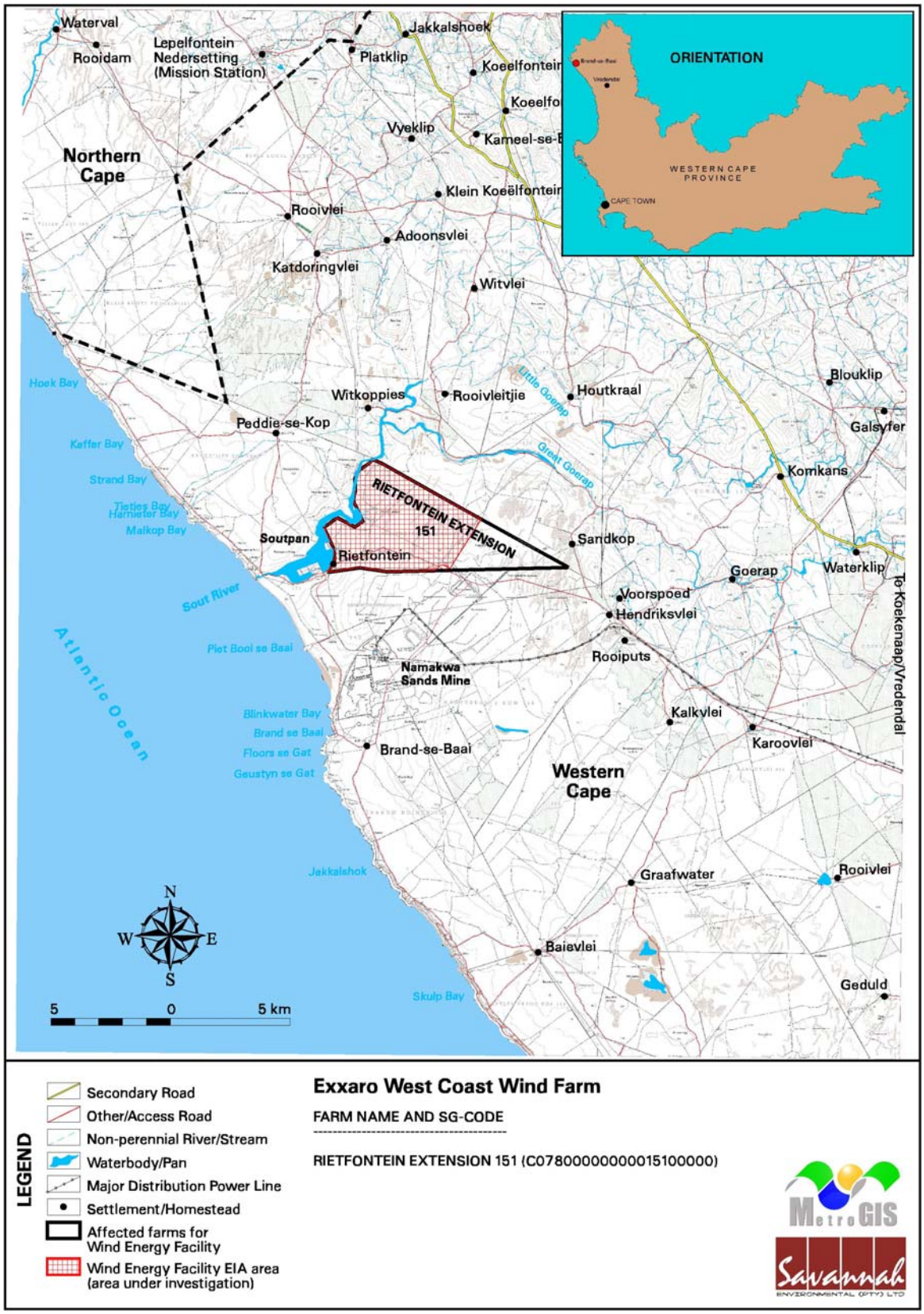


Figure 1: Map showing proposed location and extent of Exxaro Wind Energy Facility (red hatched area).

2. LIMITATIONS AND ASSUMPTIONS

The baseline information about the vegetation of this site is contained in Helme (2010) and is not comprehensively repeated in this Impact Assessment report. Fieldwork for the scoping study was undertaken in July 2010, which is within the optimum winter to spring flowering period, but was slightly too early for peak flowering. The author is familiar with large parts of the study area and adjacent areas, as a result of fieldwork undertaken for the Namakwa Sands expansion Scoping report (Desmet and Helme 2003).

Conservation value and sensitivity of habitats are a product of diversity, rarity of habitat, rarity of species, ecological viability and connectivity, vulnerability to impacts, and reversibility of threats. The confidence level in the botanical sensitivity mapping is regarded as high. A site visit at the Impact Assessment stage is unlikely to have significantly increased the accuracy of the initial findings of Helme 2010.

It is assumed that the layout provided by the applicant is at least 90% spatially accurate. It is assumed that wind turbine foundations will permanently disturb an area of up to 20m by 20m; that permanent gravelled roads will be 6m wide; that adjacent laydown areas will temporarily disturb areas of up to 40m by 40m (or 20m by 70m), and possibly permanently disturb areas of up to 20m by 20m; and that the compacted area (long term to permanent disturbance) for crane travel will be up to 13m wide and parallel to and inclusive of the 6m wide gravelled roads (and thus 3m either side of the gravel roads). Disturbance corridors for underground cabling are estimated at up to 6m wide (3m for the trench and digger track, 3m for the temporary placement of soil), and are assumed to lie mostly within 10m of the internal access roads. It is assumed that the proposed substation will be constructed on the indicated site (see Figure 3), and that the total footprint for this will be less than 0.5ha. The short proposed power line connection to the Namakwa Sands substation is not technically part of the study area, but is part of the proposed development and is here assessed. No alternative power line routes were provided.

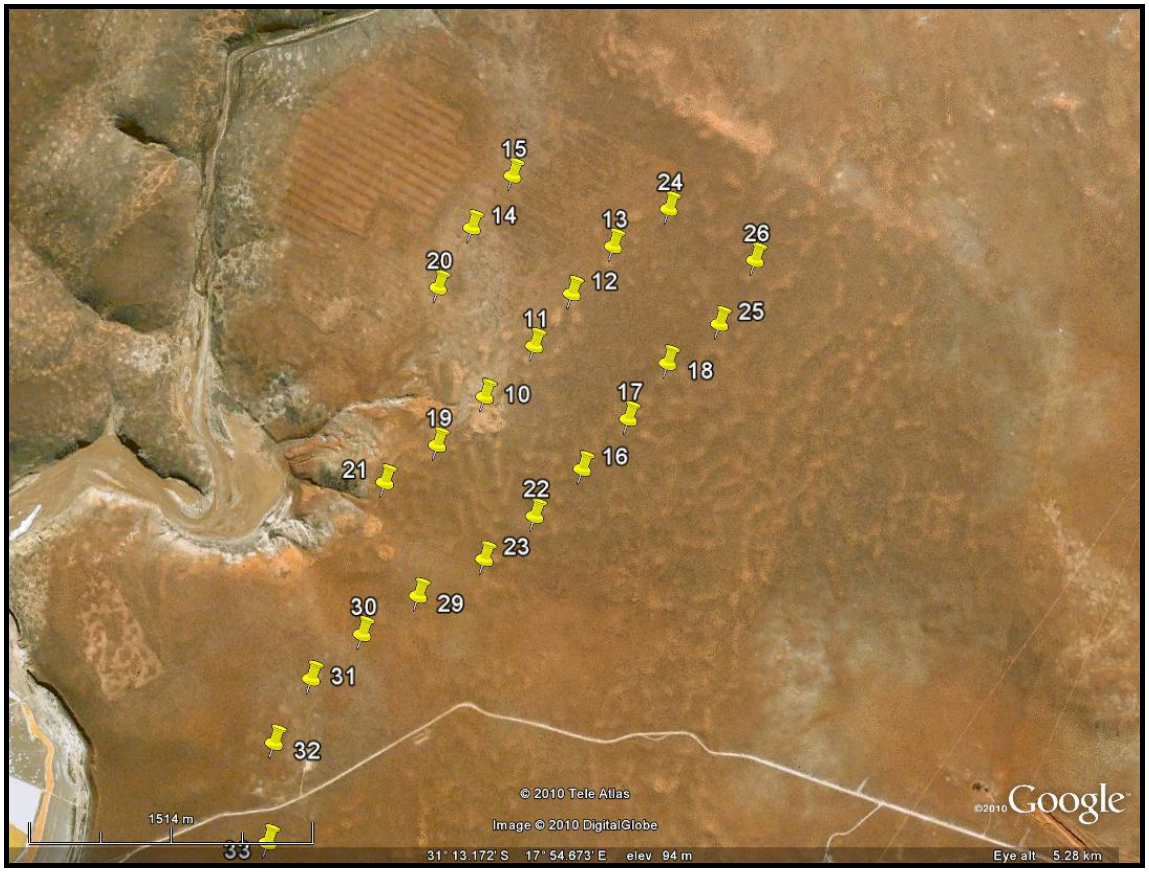


Figure 2: Proposed turbine layout superimposed on satellite imagery, with Goeraap River clearly visible to the west of the site.

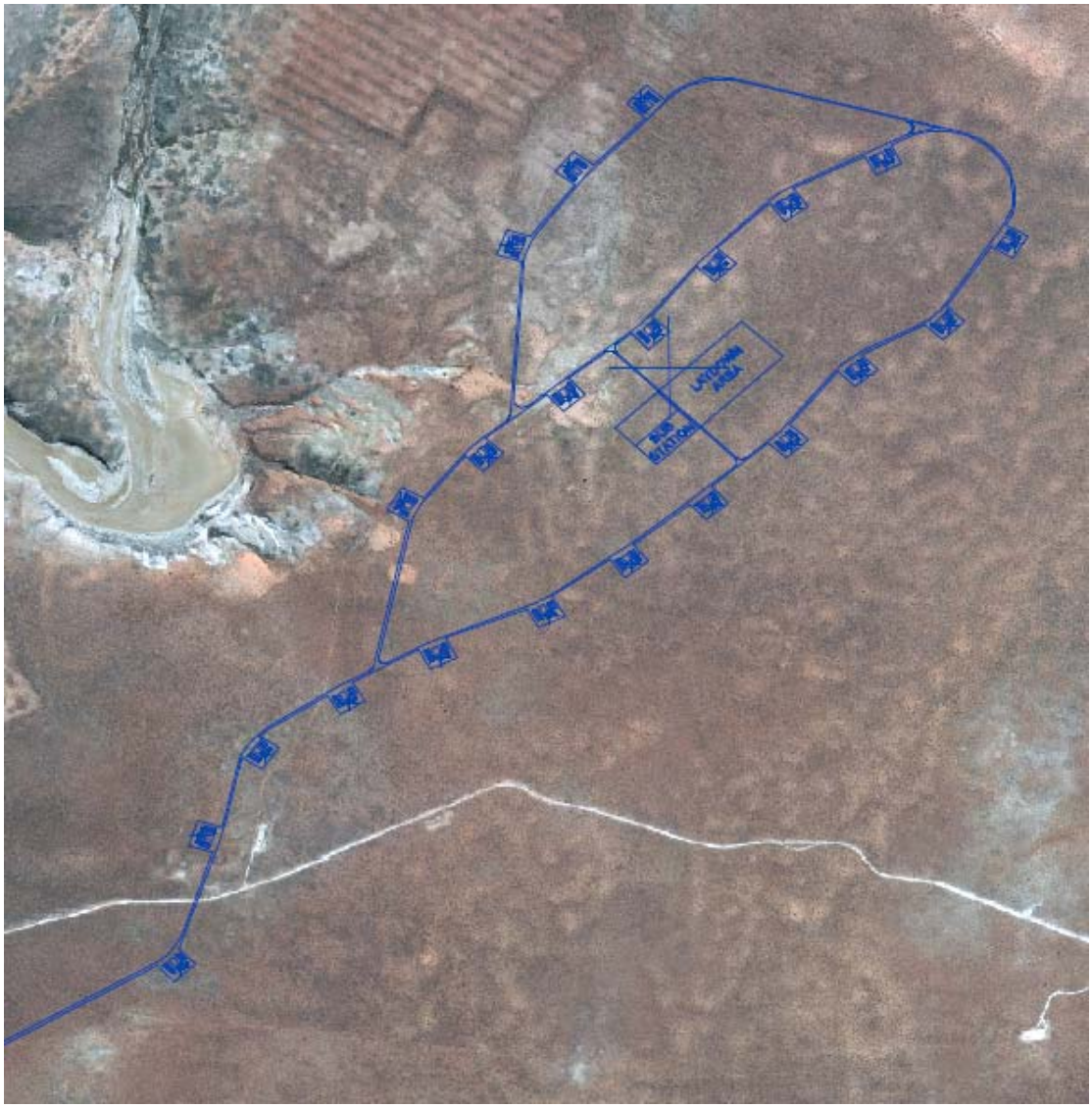


Figure 3: Map of proposed internal road, turbine, substation and laydown area layout.

3. TERMS OF REFERENCE

Terms of reference (TOR) for the Scoping and IA phases were the standard TOR as proposed by CapeNature, and DEA&DP's guidelines for biodiversity assessment (Brownlie 2005) were also adhered to. The CapeNature TOR are as follows:

- Produce a baseline analysis of the botanical attributes of the property as a whole (see Helme 2010).
- This report should clearly indicate any constraints that would need to be taken into account in considering the development proposals further (see Helme 2010).
- The baseline report must include a map of the identified sensitive areas as well as indications of important constraints on the property. It must also (see Helme 2010 for most of below information):

- Describe the broad ecological characteristics of the site and its surrounds in terms of any mapped spatial components of ecological processes and/or patchiness, patch size, relative isolation of patches, connectivity, corridors, disturbance regimes, ecotones, buffering, viability, etc.
- In terms of biodiversity pattern, identify or describe:

Community and ecosystem level

a. The main vegetation type, its aerial extent and interaction with neighbouring types, soils or topography;
b. The types of plant communities that occur in the vicinity of the site
c. Threatened or vulnerable ecosystems (*cf. new SA vegetation map/National Spatial Biodiversity Assessment, etc.)*

Species level

d. The presence of any plant Species of Conservation Concern (SCC)
e. The viability of and estimated population size of the plant SCC present (include the degree of confidence in prediction based on availability of information and specialist knowledge, i.e. High=70-100% confident, Medium 40-70% confident, low 0-40% confident)
f. The likelihood of other SCC occurring in the vicinity (include degree of confidence).

Other pattern issues

g. Any significant landscape features or rare or important vegetation associations such as seasonal wetlands, alluvium, seeps, quartz patches or salt marshes in the vicinity.
h. The extent of alien plant cover of the site, and whether the infestation is the result of prior soil disturbance such as ploughing or quarrying (alien cover resulting from disturbance is generally more difficult to restore than infestation of undisturbed sites).
i. The condition of the site in terms of current or previous land uses.
j. In terms of **biodiversity process**, identify or describe:
k. The key ecological “drivers” of ecosystems on the site and in the vicinity, such as fire.
l. Any mapped spatial component of an ecological process that may occur at the site or in its vicinity (i.e. *corridors* such as watercourses, upland-lowland gradients, migration routes, coastal linkages or inland-trending dunes, and *vegetation boundaries* such as edaphic interfaces, upland-lowland interfaces or biome boundaries)

m. Any possible changes in key processes, e.g. increased fire frequency or drainage/artificial recharge of aquatic systems.
n. Would the conservation of the site lead to greater viability of the adjacent ecosystem?

- Would the site potentially contribute to meeting regional conservation targets for both biodiversity pattern and ecological processes?
- Is this a potential candidate site for conservation stewardship?
- What is the significance of the potential impact of the proposed project – with and without mitigation – on biodiversity pattern and process at the site, landscape, and regional scales? Include comment on cumulative impacts.
- Provide a map, at suitable scale, of key conservation areas and corridors.
- Recommend actions that should be taken to prevent or mitigate impacts. Indicate how these should be scheduled to ensure long-term protection, management and restoration of affected ecosystems and biodiversity.
- Indicate limitations and assumptions, particularly in relation to seasonality.

4. METHODOLOGY

The study approach was partly informed by the guidelines prepared by Brownlie (2005), and also by the TOR. Vegetation types used are as defined in the SA vegetation map (Mucina & Rutherford 2006), and ecosystem status is as per the National Spatial Biodiversity Assessment (Rouget et al 2004) and the subsequent Draft National List of Threatened Ecosystems (DEA 2009). Red List status of plant species is according to Raimondo et al (2009). Reference was made to extensive, detailed work done in the area by Desmet and Helme (2003).

5. DESCRIPTION OF THE AFFECTED ENVIRONMENT

5.1 Regional context and ecological drivers

Namaqualand Strandveld covers the entire proposed development area, and is an extremely widespread vegetation type, especially in the context of the Cape Floristic Region, of which it is a part. This vegetation type extends from the Doringbaai area, some 20km south of the Olifants river mouth, up the west coast for about 300km, to the Hondeklipbaai area, and is thus formally part of the Succulent Karoo biome. The vegetation type typically occurs in a band from 1 to 30km inland, on deep sands, which are often grey, red, brown or orange. Namaqualand Strandveld is regarded as Least Threatened vegetation type in terms of the National Spatial Biodiversity Assessment (NSBA; Rouget et al 2004)

and Draft List of Threatened Ecosystems (DEA 2009), with 92% of its original extent still intact. Although large areas of Namaqualand Strandveld - 358 000ha (Rouget et al 2004) - remain on the west coast, where it is used primarily for small stock grazing, it should be remembered that the NSBA is based on 1996 data, and is thus now 14 years out of date, with significant subsequent habitat losses having occurred in various mining areas, including in the Namakwa Sands mining area (up to 40 000ha; pers.obs.). Furthermore, Namaqualand Strandveld is significantly under-conserved in formal conservation areas, with less than 1% of the national target of 26% under some sort of conservation management (although this has probably closer to 5% now), and it is thus vulnerable to future transformation. A portion of this vegetation type (perhaps as much as an additional 4%, making a total of 9%) is protected within the recently acquired portion of the Namaqua National Park in the area between the Groen and the Spoeg Rivers (pers.obs.). Agriculture typically occurs on the edges of this vegetation type where there is more clay in the soil, as has been the case on this site, where a relatively small area (72ha) in the north has been strip cultivated.

The primary description and mapping of the vegetation in the area can be found within the scoping study (Helme 2010), and is not repeated here in full.

Fire is neither a feature nor a driver of Namaqualand Strandveld dynamics (De Villiers 2005). The primary determinant of vegetation pattern on site is soil type, notably the proportion of sand and clay. No exposed rock occurs on site, and no wetlands or drainage lines are found within the proposed development area, although the ecologically important Goeraap River and estuary occurs just to the west and southwest of the site.

5.2 Plant Species of Conservation Concern

No significant populations of plant Species of Conservation Concern are likely to be located within the proposed development area.

6. METHODOLOGY FOR DETERMINING SIGNIFICANCE OF IMPACTS

Direct, indirect and cumulative impacts of the above issues, as well as all other issues identified, are assessed in terms of the following criteria:

» The **nature**, which shall include a description of what causes the effect, what will be affected and how it will be affected.

» The **extent**, where it will be indicated whether the impact will be local (limited to the immediate area or site of development), regional, national or international. A score between 1 and 5 will be assigned as appropriate (with a score of 1 being low (site only) and a score of 5 being high (national or international extent).
» The **duration**, where it will be indicated whether:
  * the lifetime of the impact will be of a very short duration (0–1 years) – assigned a score of 1;
  * the lifetime of the impact will be of a short duration (2-5 years) - assigned a score of 2;
  * medium-term (5–15 years) – assigned a score of 3;
  * long term (> 15 years) - assigned a score of 4; or
  * permanent - assigned a score of 5.
» The **magnitude**, quantified on a scale from 0-10, where a score is assigned:
  * 0 is small and will have no effect on the environment;
  * 2 is minor and will not result in an impact on processes;
  * 4 is low and will cause a slight impact on processes;
  * 6 is moderate and will result in processes continuing but in a modified way;
  * 8 is high (processes are altered to the extent that they temporarily cease); and
  * 10 is very high and results in complete destruction of patterns and permanent cessation of processes.
» The **probability** *of occurrence*, which shall describe the likelihood of the impact actually occurring. Probability will be estimated on a scale, and a score assigned:
  * Assigned a score of 1–5, where 1 is very improbable (probably will not happen);
  * Assigned a score of 2 is improbable (some possibility, but low likelihood);
  * Assigned a score of 3 is probable (distinct possibility);
  * Assigned a score of 4 is highly probable (most likely); and
  * Assigned a score of 5 is definite (impact will occur regardless of any prevention measures).
» the **significance**, which shall be determined through a synthesis of the characteristics described above (refer formula below) and can be assessed as low, medium or high.
» the **status**, which will be described as either positive, negative or neutral.
» the *degree* to which the impact can be *reversed*.
» the *degree* to which the impact may cause *irreplaceable loss of res*ources.
» the *degree* to which the impact can be *mitigated.*

The **significance** is determined by combining the criteria in the following formula:

S=(E+D+M)P; where

S = Significance weighting
E = Extent
D = Duration
M = Magnitude
P = Probability

The **significance weightings** for each potential impact are as follows:

» < 30 points: Low (i.e. where this impact would not have a direct influence on the decision to develop in the area),
» 30-60 points: Medium (i.e. where the impact could influence the decision to develop in the area unless it is effectively mitigated),
» > 60 points: High (i.e. where the impact must have an influence on the decision process to develop in the area).

7. IDENTIFICATION OF LIKELY BOTANICAL IMPACTS

Impacts may be both direct and indirect, with the former occurring mostly at the construction stage and the latter mostly at the operational stage. Direct impacts will be both permanent and long term temporary.

In the case of this project the primary direct impact is loss of natural vegetation within the development footprint, as the entire WEF is located with currently natural Namaqualand Strandveld vegetation. All hard infrastructure located within natural vegetation will result in the permanent loss of that vegetation. The primary sources of permanent loss include (in descending order of importance, based on the proposed layouts) the internal access roads (<5ha estimated); turbine footprints (including permanent crane standpads; estimated <5ha); and power line tower footprints (insignificant).

The primary sources of temporary, long-term direct vegetation loss are likely to be rather similar, and include road building impact through areas of natural vegetation (<5ha); excavation of the cable trenches (perhaps as much as 5ha), and turning circles, crane tracks, and access roads alongside the proposed power line (these possibly totalling as much as a further 2ha).

Total permanent loss of existing natural vegetation is thus likely to be less than 10ha, and total temporary (but long term) loss of existing natural vegetation is likely to be less than (an additional) 12ha.

Indirect impacts may include habitat fragmentation and introduction and/or spread of invasive alien plants (mainly along roads and around development footprints, due to soil disturbance caused).

8. IMPACT ASSESSMENT

Impacts may be both direct and indirect, with the former occurring mostly at the construction stage and the latter mostly at the operational stage.

In the case of this project the primary impacts are direct impacts. The main direct impact is loss of natural vegetation within the proposed development footprint, as the entire area currently supports natural vegetation. All hard infrastructure located within or partly within natural vegetation will result in the permanent loss of that vegetation. The primary sources of permanent loss include (in descending order of importance, based on the proposed layout) the access roads, the turbine footprints (including permanent crane standpads), the substation, and power line tower footprints. The primary sources of temporary, long-term vegetation loss include excavation and sand piles for very large foundations and cabling, the lay down areas, crane tracks, and roads alongside the power line.

The indirect, negative botanical impacts are not likely to be important for this project, but may include a small degree of habitat fragmentation, and introduction and/or spread of invasive alien plants.

8.1 Direct Impact: Permanent loss of natural vegetation

The entire proposed development footprint will impact on existing natural vegetation (Namaqualand Strandveld) of Medium regional sensitivity. Namaqualand Strandveld is regarded as being a Least threatened vegetation type (Rouget et al 2004), and is widespread on the Cape west coast. It is estimated that about 10ha of good quality Namaqualand Strandveld will be lost within the development footprint.

No direct impacts on plant Species of Conservation Concern are likely within the development footprint.

Table 1:

Nature: Permanent loss of vegetation in development footprint (about 10ha)				
	Without mitigation	**Score**	**With Mitigation**	**Score**
Extent	Local	1	Local	1
Duration	Permanent	5	Permanent	5
Magnitude	Low - Moderate	3	Low-Moderate	3
Probability	Definite	5	Definite	5
Significance	**Medium ***	**45**	**Medium ***	**45**
Status	Negative		Negative	
Is impact reversible?	No		No	
Irreplaceable loss of vegetation?	No		No	
Can impacts be mitigated?	Partially		Partially	
Mitigation: See all points in Sections 10 and 12. Most notably the position of Turbine 21 needs to be moved at least 80m to the southeast.				
Cumulative impacts: Minimal.				
Residual impacts: The residual impacts (some habitat will be lost) are best mitigated by effectively managing the remaining natural vegetation areas (about 400ha) on site, and permanent removal of livestock in this area.				

* Note: This assessment is deemed artificially high, and is a product of the use of a formula, and the high rating for a definite probability. A more realistic overall assessment would be Low – Medium negative.

8.2 Direct Impact: Long term but temporary loss of natural vegetation

The existing natural vegetation will be severely disturbed (but not totally lost) in various areas, mostly as a result of heavy machinery movement through some sensitive areas, road construction, cable trench excavation through sensitive areas, the power line construction where this goes through areas of natural vegetation, and the associated piling and scraping of soil for foundations where this is close to or in natural vegetation. Most of these areas should eventually recover to a significant degree (if natural vegetation is retained in the adjacent areas), but the crushed and dug up vegetation will take at least 12 years (and possibly much longer if rainfall is below normal) in order to recover to a point where at least 80% of the original diversity is once again present. Certain species may not return for many additional years, due to changes in soil structure

(compaction or chemical changes). The impacts in this case thus rate as being long term.

Primary sources of disturbance will be the large crane that is used to put up the machinery, which has caterpillar tracks and a width of 13m; laydown areas next to the turbines; turning circles for long trucks; the construction of the new power line; and the burying of the underground cabling on site. It is estimated that a total of 12ha of natural vegetation will be impacted by long term disturbance.

Table 2:

Nature: Long term but temporary loss of vegetation in footprint				
	Without mitigation	**Score**	**With Mitigation**	**Score**
Extent	Local	1	Local	1
Duration	Long Term	4	Long Term	4
Magnitude	Low - Moderate	3	Low-Moderate	3
Probability	Definite	5	Definite	5
Significance	**Medium ***	**40**	**Medium ***	**40**
Status	Negative		Negative	
Is impact reversible?	No		No	
Irreplaceable loss of vegetation?	No		No	
Can impacts be mitigated?	Partially		Partially	
Mitigation: See all points in Sections 10 and 12.				
Cumulative impacts: Minimal				
Residual impacts: The residual impacts (some habitat will be lost) are best mitigated by effectively managing the remaining natural vegetation areas (about 400ha) on site, and permanent removal of livestock in this area.				

* Note: This assessment is deemed artificially high, and is a product of the use of a formula, and the high rating for a definite probability. A more realistic overall assessment would be Low – Medium negative.

8.3 Direct Impact: Power line infrastructure

A new 132kV power line will need to be constructed between the proposed WEF and the existing Namakwa Sands substation.

Power lines usually have relatively small footprints and have little influence on the vegetation, except where the servitude is too frequently and inappropriately bushcut, but this should not be an issue within this short vegetation. The actual service and installation tracks (typically one and the same) have significantly greater botanical impact than the power line itself. Temporary tracks required for installation should recover over a period of 5 years, and the road that will be used for installation will also become the permanent service road.

It is very unlikely that any populations of threatened plant species will be negatively impacted by the proposed power line.

Table 3:

Nature: Permanent and long term but temporary loss of vegetation in power line and servitude footprint				
	Without mitigation	**Score**	**With Mitigation**	**Score**
Extent	Local	1	Local	1
Duration	Permanent	5	Long Term	4
Magnitude	Low	2	Low	2
Probability	Definite	5	Definite	5
Significance	**Medium ***	**40**	**Medium ***	**35**
Status	Negative		Negative	
Is impact reversible?	No		No	
Irreplaceable loss of vegetation?	No		No	
Can impacts be mitigated?	Partially		Partially	
Mitigation: No special mitigation is proposed.				
Cumulative impacts: Minimal				
Residual impacts: The residual impacts (habitat will be lost or degraded) are not easily mitigated, other than by effectively managing the proposed conservation areas on site, being all remaining areas (about 400ha) of natural habitat on site.				

* Note: This assessment is deemed artificially high, and is a product of the use of a formula, and the high rating for a definite probability. A more realistic overall assessment would be Low negative.

8.4 Indirect impacts

Indirect ecological impacts are often difficult to identify, and even more difficult to quantify. Some possible indirect negative effects on the vegetation (shading, disturbance of wind flow, etc.) are likely to be minimal and are not assessed further.

The effects of **habitat fragmentation** may also be of minor importance on site, but the proposed development should not result in significant fragmentation of the natural habitat on this site.

The soil disturbance associated with all construction provides the ideal conditions for the invasion and spread of alien invasive plants. Not many such species are currently present within the proposed development area and this factor will hopefully help limit the extent of alien plant invasion during and post construction. Nevertheless, this is one of the few aspects that is easily mitigated at the operational stage, by means of regular alien plant management on the site.

Table 4:

Nature: Various indirect impacts: mainly minor habitat fragmentation and alien plant invasion.				
	Without mitigation	**Score**	**With Mitigation**	**Score**
Extent	Local	2	Local	1
Duration	Long term to Permanent	4	Long term	4
Magnitude	Low to Moderate	5	Low	4
Probability	Probable	3	Improbable	2
Significance	**Medium***	**33**	**Low**	**28**
Status	Negative		Negative	
Is impact reversible?	Partly – in the case of alien plant invasion.		Partly	
Irreplaceable loss of vegetation?	No		No	
Can impacts be mitigated?	Partly		Partly	
Mitigation: Ongoing, annual alien invasive vegetation control				

Cumulative impacts: Very Low
Residual impacts: The relatively minor residual impacts (some habitat fragmentation will occur) are best mitigated by effectively managing the proposed conservation areas on site, being all (approximately 400ha) remaining areas of natural habitat on site.

* Note: This assessment is deemed artificially high, and is a product of the use of a formula, and the high rating for probability. A more realistic overall assessment would be Low negative.

8.5 Cumulative impacts

To some extent a cumulative impact is a regional impact, rather than the local site scale impact, *i.e*. if something has a regional impact it also has a cumulative impact.

The impacts of this type of development will be significantly less than for various existing and ongoing agricultural and mining operations in the region.

The proposed WEF is thus likely to have a Very Low negative cumulative impact in the region.

8.6 Positive impacts

The proposed WEF could have a slight positive impact, in addition to the small global scale positive impact of helping to reduce CO_2 emissions by generating "clean energy". As climate change is predicted to hit the west coast particularly hard it is perhaps appropriate that wind energy facilities should be located in this area.

The second potentially positive impact will only come about if recommendations noted under Mitigation (Sects. 10 & 12) are effectively implemented and enforced.

Permanent (until project decommissioning) removal of livestock from all areas of natural vegetation on the site could have a positive effect on the natural vegetation, in that it would allow plants to flower and set seed more readily, without being heavily grazed. Disturbed areas will not only rehabilitate faster without livestock grazing but many rarer, currently heavily grazed species may have a chance of increasing their numbers. Heavy grazing and trampling by stock can also lead to erosion.

9. IMPACT STATEMENT AND SUMMARY TABLE

Overall the proposed WEF is likely to have a Low - Medium local (site scale; 420ha site) and Low regional (central west coast; <200 000ha) negative impact on the vegetation on site, prior to mitigation. This is unlikely to change after mitigation, as the proposed mitigation is relatively minor.

The primary negative impacts on the site are mainly the result of direct impacts, including permanent loss of natural vegetation (<10ha) in the development footprints, and medium to long term loss of natural vegetation (<12ha) in adjacent areas that will be disturbed by heavy construction machinery, temporary dumping, etc. No threatened plant species are likely to be impacted by the proposed development. Most of these impacts cannot be avoided or further reduced (without moving the development to previously disturbed areas or reducing the scale of the development), as the proposed development lies entirely within currently natural Namaqualand Strandveld vegetation (as Least Threatened vegetation type).

Indirect impacts are often difficult to quantify and measure, and are often equally difficult to avoid or mitigate. If the mitigation recommendations (See Sects. 10 & 12) are all implemented then indirect impacts on the vegetation on site could be reduced to Low negative.

The primary potential positive impact of the development will depend to a large degree on the proper management of the remaining natural vegetation on site (about 400ha) as a formal conservation area, and the increased likelihood of natural rehabilitation in response to a suggested prohibition on livestock grazing on site. The likelihood of this being implemented is not known, but there is no reason why it should not happen. An indirect positive impact is obviously the small contribution that this WEF would make to reducing CO_2 emissions, and the associated very small reduction in global warming effects.

Table 5: Overall summary table of proposed WEF impacts on vegetation on site (regional scale)

Nature: Long term to permanent loss of vegetation and threatened species, as well as disruption of ecological processes				
	Without mitigation	**Score**	**With Mitigation**	**Score**
Extent	Local	1	Local	1

Duration	Long term to Permanent	4	Mostly long term; some permanent	4
Magnitude	Low to Moderate	3	Low - Moderate	3
Probability	Definite	5	Highly probable	4
Significance	**Medium***	**40**	**Low**	**32**
Status	Negative		Negative	
Is impact reversible?	Not in direct building footprints (<10ha), but some are in other disturbance areas (<12ha), although will take many years; habitat fragmentation impacts difficult to reverse.		Not in direct building footprints (<10ha), but some are in other disturbance areas (<12ha), although will take many years; habitat fragmentation impacts difficult to reverse.	
Irreplaceable loss of vegetation?	No		No	
Can impacts be mitigated?	Partially		Partially	
Mitigation: See all points in Sections 10 & 12.				
Cumulative impacts: Very Low negative				
Residual impacts: The residual impacts (some habitat will be lost or degraded) are best mitigated by effectively managing the proposed conservation areas on site, being all remaining areas of natural habitat on site (about 400ha), and the permanent removal of livestock grazing in this area.				

* Note: This assessment is deemed artificially high, and is a product of the use of a formula, and the high rating for probability. A more realistic overall assessment would be Low negative.

10. REHABILITATION GUIDELINES AND CEMP & OEMP REQUIREMENTS

Areas requiring rehabilitation will include all areas of natural vegetation disturbed during the construction phase and that are not required for regular maintenance operations. The main areas thus requiring rehabilitation will be recent disturbance to the edges of all crane standpads and turbine foundation sites, along all new

access roads, the crane tracks alongside the permanent 6m roads, and all cable routings (assuming these mostly lie next to the access roads).

Any formal rehabilitation should only commence once all construction related disturbance associated with the project has been completed. Natural (unassisted) rehabilitation is the primary recommended form of rehabilitation, as there is abundant natural vegetation surrounding and within the proposed development area, which will provide an adequate and appropriate seed source for rehabilitation of the disturbed areas.

Detailed requirements for the Construction Phase Environmental Management Plan (CEMP) are as follows:

1) All development footprints (for roads, buildings, underground cables, laydown areas and turbine footings) within natural vegetation should be surveyed and fenced off with two strand wire and clearly indicated with flags and/or coloured rope prior to any site development. Only once this has been done can anything else proceed. It should be made very clear to all contractors that there is to be no disturbance outside these demarcated areas, at least not without the permission of the ECO.

Objective: Fencing of development footprints in areas of natural vegetation in order to minimise disturbance to natural vegetation and to make it clear to contractors where they should and should not go.

Project component/s	All phases of construction
Potential impact	Substantially increased damage to adjacent vegetation.
Activity risk/source	There is no reason why this objective should not be achieved, although it will carry minor cost implications.
Mitigation: target/objective	No loss of or damage to vegetation in areas outside immediate development footprint; <1ha of construction related disturbance in natural vegetation areas outside fenced footprints; measured monthly during duration of construction.

Mitigation: Action/control	Responsibility	Timeframe
One or two strand wire or coloured rope fencing with droppers every 10m, around all development footprints in areas of natural	ECO	To be completed prior to any construction

vegetation; signage saying "Sensitive Area – Keep Out" placed on fences every 50m.		related activity on site; auditing monthly.

Performance indicator	No damage to surrounding natural vegetation
Monitoring	ECO to monitor all construction areas on a weekly and monthly basis until all construction is completed; immediate report backs to site manager; and ECO to speak to contractors responsible for any infringements

2) An ECO must be present during the duration of the construction phase.

3) Any excavations within natural vegetation areas, including those for cables, must be supervised by the ECO. No excavations may be left open for more than 1 week, and they should preferably be closed up within 1 day, using the carefully stockpiled soil that came out of the trench.

Objective: Minimise disturbance associated with cabling and trench digging; maximise rehabilitation success of these disturbed areas

Project component/s	All phases of construction; rehabilitation immediately post disturbance cessation	
Potential impact	Substantially increased disturbance to areas around cabling trenches and reduced rehabilitation success; open trenches have negative impact on fauna	
Activity risk/source	There is no reason why this objective should not be achieved	
Mitigation: target/objective	Minimise period of sand stockpiling alongside trenches and make sure that it is less than one week before trenches are infilled and rehabilitated; target should be one day.	
Mitigation: Action/control	Responsibility	Timeframe
All cable trenches through areas of natural vegetation should be dug carefully in order to minimise damage to surrounding areas; all stockpiled sand should be replaced within one week of trench opening; all disturbed areas to be immediately mulched and sown with	ECO and appointed horticultural subcontractor	Infilling to be complete within one week of cable trench commencement (ideally within 1 day);

previously stockpiled local mulch containing indigenous seed.		rehabilitation to be undertaken within one week of infilling.
Performance indicator	Trenches should ideally not disturb an area more than 8m wide in total (including tracks and sand pile areas); trenches should not lie open for more than 7 days and should ideally be closed up the same day.	
Monitoring	ECO to monitor trenching and rehabilitation.	

4) No dumping or temporary storage of any materials may take place outside designated and demarcated laydown areas.

5) No exotic or invasive species should be used for rehabilitation, and this includes commonly used invasive grass species such as ryegrass (*Lolium* species).

Operational Phase EMP Requirements:

6) There should be no livestock grazing within the development area during the lifespan and operational phase of the WEF. The primary reason for this is that removal of livestock grazing pressure will have a beneficial effect on the natural vegetation, particularly in terms of natural rehabilitation, in that flowering and seed set of the remaining natural plants (especially pioneers such as the annuals) will be significantly better in the absence of grazing (which removes the flowers). If the nearby annuals and other plants are not grazed this means that natural rehabilitation of the areas disturbed by the project (about 12ha) will be significantly improved, as there will be much more locally indigenous seed available nearby for establishment in the disturbed areas, and the site may also act as a seed source for some nearby overgrazed areas.

Objective: No grazing of livestock on the WEF area during the construction and operational life of the facility.

Project component/s	Construction and Operational phase; ongoing
Potential impact	Grazing and trampling substantially decrease rehabilitation success, posing a risk of erosion and biodiversity loss; grazing and trampling impacts negatively on flowering and seed set of many rare plant species

Activity risk/source	There is no reason why this objective should not be achieved, as the applicant is also the landowner.
Mitigation: target/objective	Ecologically functional and flourishing natural vegetation in the area; rare species, indigenous grasses, annuals and bulbs flowering and setting seed successfully.

Mitigation: Action/control	Responsibility	Timeframe
Removal of all livestock from the WEF area for the duration of the WEF construction and operational phases.	ECO (construction phase) and Exxaro management (operational phase)	Ongoing from construction into operational phase

Performance indicator	No livestock on site from project inception to final decommissioning of WEF. No evidence of livestock grazing or trampling in these areas during this period, and good flowering and seed set in palatable plant species.
Monitoring	Botanist to review regeneration and seed set success in palatable species every two years, and to check site for compliance in terms of livestock.

7) All temporary fencing and coloured rope should be removed once the construction phase has been completed.

8) Ongoing alien plant monitoring and removal should be undertaken on all areas of natural vegetation within the project area on an annual basis. DWA approved methodology should be employed for all alien clearing operations. No bulldozing or mechanical removal is allowed, as this disturbs the soil and creates ideal conditions for re-invasion. No herbicide spraying should be undertaken anywhere within natural vegetation, due to the extensive collateral damage. Annual follow ups may be required in areas that have been previously cleared. Small seedlings and most plants smaller than 50cm tall should be hand pulled.

Objective: Removal of all alien invasive vegetation on the site within two years of project commencement. To be undertaken from project inception, on an ongoing basis.

Project component/s	Construction and Operational phase; ongoing
Potential impact	Alien invasive vegetation is currently a minor threat to the natural vegetation on site, but the development

	related disturbance will create suitable conditions for alien plant invasion, which may displace rare species and alter the soil chemistry.		
Activity risk/source	There is no reason why this objective should not be achieved.		
Mitigation: target/objective	Ecologically functional natural vegetation in WEF area; entire 420ha of WEF area are clear of alien vegetation within 2 years of project inception, and thereafter during project operational phase.		
Mitigation: Action/control		Responsibility	Timeframe
DWA approved methodology should be employed for all alien clearing operations, and it is strongly suggested that someone who has extensive training in this regard be employed to manage the program. No bulldozing or removal by any machinery is allowed, as this disturbs the soil and creates ideal conditions for re-invasion. No herbicide spraying should be undertaken anywhere, due to the extensive collateral damage. Annual follow ups may be required in areas that have been previously cleared (to be undertaken Oct-April). All invasives less than 50cm tall may be hand pulled. *Atriplex* spp. and *Salsola kali* likely to the primary invasives.		ECO (construction phase) and appointed alien clearing contractors (operational phase and perhaps also overlapping with construction phase)	Ongoing from construction into operational phase. All follow ups only from Oct – April, to minimise damage to indigenous, seasonal species.
Performance indicator	420ha of WEF area to be cleared of invasive aliens within 2 years of project inception (initial clearing); <0.1% alien cover in these areas in following years.		
Monitoring	Audits every two years during the operational phase of the project, to be undertaken by independent botanist, to determine compliance and to suggest any changes to program.		

9) The applicant must ensure that there is sufficient budget to implement all management recommendations noted above.

11. CONCLUSIONS

- There is a single natural vegetation type on site (Namaqualand Strandveld), which is a very widespread vegetation type and which is regarded as Least Threatened on a national basis. The entire proposed development site currently supports natural vegetation in good to pristine condition, and was mapped as being of Medium sensitivity in the baseline study of Helme (2010). No plant Species of Conservation Concern are likely to occur in significant numbers within the proposed development area.
- Overall the proposed WEF is likely to have a Low - Medium negative regional (central west coast; <200 000ha) impact on the vegetation on site, prior to mitigation. As only minor mitigation is proposed or required the post-mitigation significance is also **Low – Medium negative** (at both site and regional scales).

12. RECOMMENDED SITE SPECIFIC MITIGATION

- The only layout change that needs to be made is that turbine 21 should be moved at least 80m to the southeast, to avoid a sensitive area of vegetation on shallow clays.
- Any construction camp and laydown areas must be located within currently disturbed areas as close to the site as possible. No natural vegetation may be disturbed for these requirements.
- An ECO must be permanently on site throughout the road construction, cable laying, turbine foundation excavation, and during the erection of the turbines, and at other times should visit the site at least once a week until the construction phase is completed.
- Any excavation, including those for cables, must be supervised by the ECO. No excavations may be left open for more than 1 week, and they should preferably be closed up within 1 day, using the carefully stockpiled soil that came out of the trench. In the case of turbine footings some 45m^3 of soil will presumably be displaced by the concrete, and this should be used to create the adjacent crane standpads.
- No dumping or temporary storage of any materials may take place outside designated and demarcated laydown areas.
- No livestock should be permitted to graze the project area (at least 420ha in extent) during the construction and operational phase of the project.

- Ongoing alien vegetation removal and management should be undertaken throughout the operational phase of the project, which should be independently audited every two years by a qualified botanist.
- A CEMP and OEMP should be drawn up, which must outline management steps for all the areas of natural vegetation on the site. See Section 10 for detailed guidelines.
- A botanist familiar with the vegetation of the area should ensure that adequate botanical inputs are made into the construction and operational phase EMPs.

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