



NICK HELME BOTANICAL SURVEYS

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Pri.Sci.Nat # 400045/08

**ADDENDUM TO THE
SPECIALIST IMPACT ASSESSMENT FOR PROPOSED
SPRINGBOK WIND ENERGY FACILITY, NORTHERN
CAPE: VEGETATION COMPONENT.**

**Prepared for: Holland & Associates Environmental Consultants,
Tokai**

Client: Mulilo Springbok Wind Power (Pty) Ltd., Cape Town

16 Oct 2017

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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.



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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 include:

- Botanical assessment of proposed cultivation on Groot Patrysvlei, Clanwilliam (Cederberg Environmental Assessment Practise 2016)
- Botanical assessment of proposed cultivation on Rem. Andriesgrond 204, Clanwilliam (Cederberg Environmental Assessment Practise 2015)
- Assessment of proposed Zirco mineral sand mine near Garies, N. Cape (CES 2014)
- Ecological impact assessment of proposed PV energy facility on Farm Klipdam, Springbok (Footprint ES 2014)
- Assessment of proposed solar photovoltaic facility near Touwsriver (Sharples Environmental 2014)
- Assessment of proposed Uiekraal substation and powerline, Saldanha (Landscape Dynamics 2013)
- Ecological impact assessment of proposed PV energy facility on Portion 26 of the Farm Melkboskuil 132, Springbok (Footprint ES 2013)
- Assessment of proposed Paleisheuwel solar photovoltaic facility (Sharples Environmental 2013)
- Assessment of proposed Bredasdorp - Arniston powerline (Landscape Dynamics 2013)
- Scoping study of proposed Karookop Wind Energy Facility near Vredendal (CSIR 2012)
- Assessment of proposed Langefontein WEF, near Darling (CSIR 2011)
- 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)

- Scoping study of proposed Wind Energy Facility near Laingsburg (Savannah Environmental 2009)

1. INTRODUCTION

This Addendum to the Botanical Impact Assessment was requested in order to assess proposed changes made to the authorized development layout and specifications for the Mulilo Springbok Wind Energy Facility (WEF), after Environmental Authorisation (EA) for the project was granted in July 2011. This original authorisation is referred to as the No Go alternative for purposes of this Addendum. The original draft botanical Impact Assessment was completed on 3 October 2010 (Helme 2010a), and that was then followed by an updated layout for which a further assessment was undertaken, dated 27 October 2010 (Helme 2010). The changes made then were largely as a response to botanical impacts identified in the draft IA report, and the mitigation proposed therein. In 2015 a further assessment of a proposed amendment (up to 100MW generating capacity, using 25 turbines of up to 4MW each) was undertaken (Helme 2015), but this application was not authorised. The current Amendment application is to allow for a total of 55.5MW of total generating capacity (as per the original authorisation), but using fewer, larger turbines than the original authorisation allowed for. The proposed amendment allows for up to 25 turbines of 2.2MW each (as shown in Figure 1), but the final installation could range from 12 turbines of 4.5MW each up to 25 turbines of 2.2MW each.

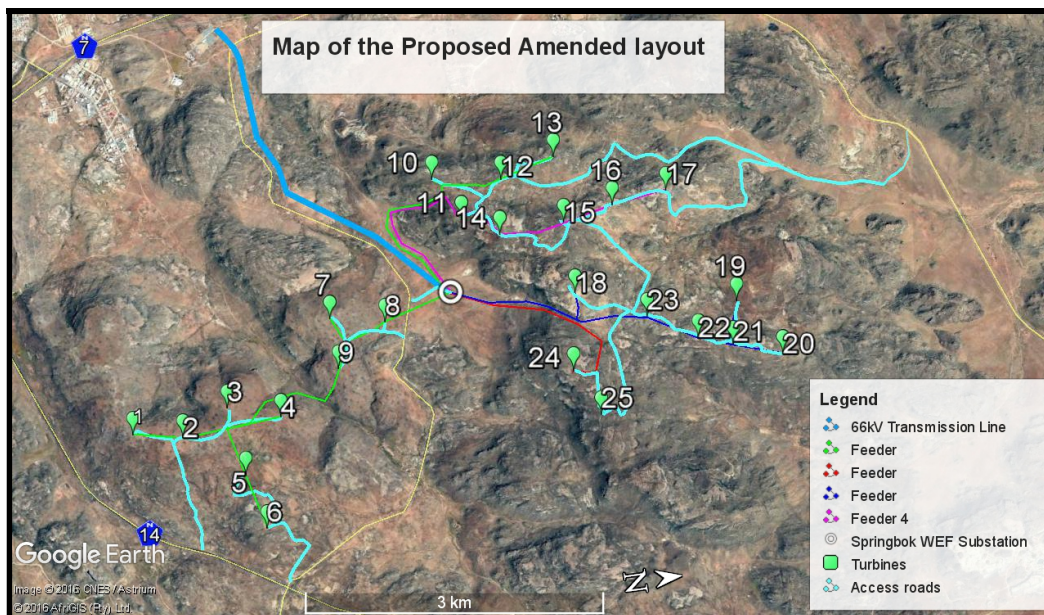


Figure 1: Proposed amended layout with 25 turbines.

2. LIMITATIONS AND ASSUMPTIONS

The baseline information about the vegetation on most of this site is contained in Helme (2010b) and in a follow up survey of the southern part of the study area undertaken in November 2014 (Helme 2014), and is not repeated in the current report. The constraints identified in the latter report were used to help place the new turbine layouts.

It is assumed that the proposed wind energy facility layouts for both the authorized and the amended layouts, as provided (see Figure 1 for the proposed amendment layout, Figure 2 for authorised layout), are accurate, and a true reflection of the final positions. The authorised layout is regarded for purposes of the current assessment as the No Go alternative.

For the authorized layout the following assumptions were made (in Helme 2010 and current report):

- that wind turbine foundations would permanently disturb an area of up to 20m by 20m and that additional disturbance would be caused at the construction phase due to the blasting required for at least 50% of the turbine sites (Mulilo – pers. comm);
- that permanent gravelled roads will be up to 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;
- 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).
- one proposed construction camp and two laydown areas were indicated, adjacent to the laydown areas, and these (together with the main laydown areas) are assumed to be up to 16ha in total.
- 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 additional (difficult to determine at this stage) areas disturbed by blasting in up to 10% of the total length of 35km).
- in the absence of detailed figures it is assumed that up to 75% of the total length of the cable trenches will be within or next to the access roads, and that the remainder (some 12km) will not be near any access roads. It is also assumed (based on discussions with Mulilo) that all internal cabling in

steep rocky areas (where rock cover is >50% over a 50m length) will be by means of overhead lines raised on towers some 10-15m above the ground, and that the spans between these towers will be between 75 and 120m (depending on topography). It is thus assumed that overhead lines will comprise between 30 and 60% of the total internal cabling distance of about 35km. The proposed roads and cable network shown in the original figures is assumed to be partly schematic, and partly a result of poor digitising, and hence cabling is often not shown as routed along roads, as it presumably should be.

- it was assumed that a single proposed substation and control building will be constructed on site, and that the total footprint thereof will be less than 1ha.
- the proposed 3.8km power line connection to the Eskom grid 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.
- It is assumed that the entire facility infrastructure (excluding foundations and roads) will be removed once the 20yr PPA period is over.

For the amended application the assumptions were similar, with the following notable differences:

- Up to 25 proposed turbines (of up to 2.2MW each, or ranging to 12 turbines of up to 4.5MW each), versus 37 in authorized layout
- temporary construction (crane) pads at each turbine of 40m by 40m (1600m²) versus 800m² in authorized layout
- 3.0m deep foundations, versus 2m in authorized layout
- foundation area about 256m² in both authorised layout and amendment
- above ground electrical cabling for all cabling between turbines and the substation

3. SUMMARY OF BOTANICAL CONSERVATION VALUE/SENSITIVITY

For purposes of this study the area has been divided into areas of Low, Medium and High Sensitivity, and Very High sensitivity (shown in Figures 3 & 4, along with proposed amendment layout). Undisturbed areas of vegetation are of Medium or High Sensitivity, depending on habitat and species present, and disturbed areas are of Low Sensitivity.

About 80% of the vegetation in the study area is essentially undisturbed or only moderately grazed, and the remaining 20% is either previously cultivated and/or heavily grazed by livestock. The latter areas are typically on the lowest parts of the study area (valley bottoms), although there is also a heavily grazed area (around a kraal) in the central plateau.

Very High Sensitivity Areas (No Go Areas)

These are undisturbed areas of natural vegetation that support habitats known to support rare or localised plant species, including the identified Species of Conservation Concern (SCC). All SCC found on site were found within these areas. The key habitats are large areas of exposed rock, especially those with shallow grit pans either on the dome or along the fringes, shallow soils surrounding granite domes, dense clusters of boulders on steep slopes (especially those on south slopes), and any quartzitic ridges or patches.

Based on the mapping undertaken the total area of High Sensitivity vegetation in the study area is about 380ha (calculated using Google Earth Pro), which is about 12% of the study area.

A significant portion of the Medium and High and Very High sensitivity areas are also mapped as Critical Biodiversity Areas (CBAs; Skowno *et al* 2010; see Figure 5).

Medium and High Sensitivity Areas

The bulk of the study area (66%) is deemed to be of Medium and High botanical sensitivity. These two categories are combined for purposes of this report as the actual transition between a medium and a high sensitivity area often occurs repeatedly over a very short distance (due mainly to very localised plant occurrences), and due to scale issues it is thus largely impossible to map properly over a study area that is as large as this. These are areas of intact natural vegetation, but are not known to support any plant SCC, although they may

support iconic and legally Protected Species such as kokerbome (*Aloe dichotoma*). It should also be noted that a large majority of the species present (over 60%) in Medium and High sensitivity areas are in fact legally Protected Species in terms of the Northern Cape ordinance, including all (or most) species in large, common families such as the Crassulaceae, Hyacinthaceae, Amaryllidaceae, Oxalidaceae and Iridaceae.

Low Sensitivity Areas

About 611ha (21%) of the study area has been mapped as being of Low sensitivity. These areas support no plant SCC, and have been either heavily disturbed, previously cultivated, or are overgrazed. Most of these areas are in the valleys, although a significant portion also occurs within the central plateau.

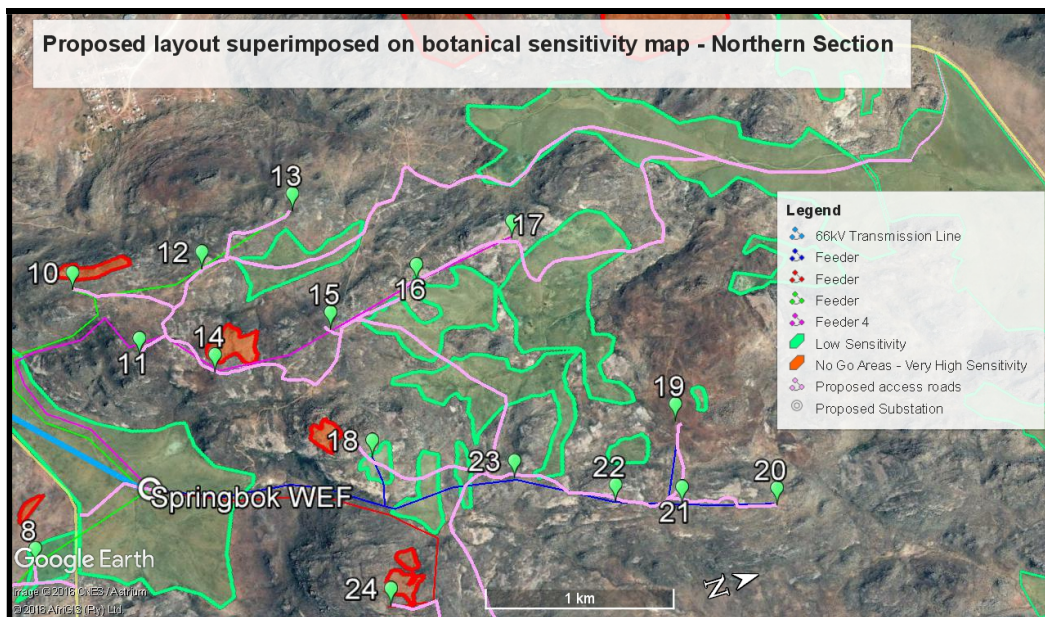


Figure 3: Google Earth image of northern part of the proposed layout superimposed on the botanical sensitivity map. All unshaded areas are of Medium or High botanical sensitivity.

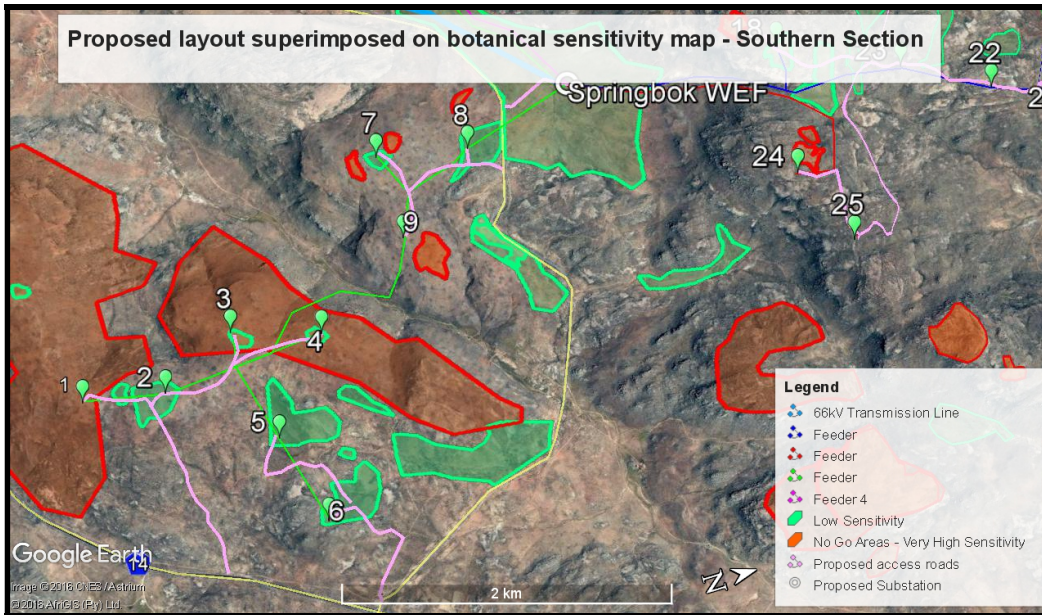


Figure 4: Google Earth image of southern part of the proposed layout superimposed on the botanical sensitivity map. All unshaded areas are of Medium or High botanical sensitivity.

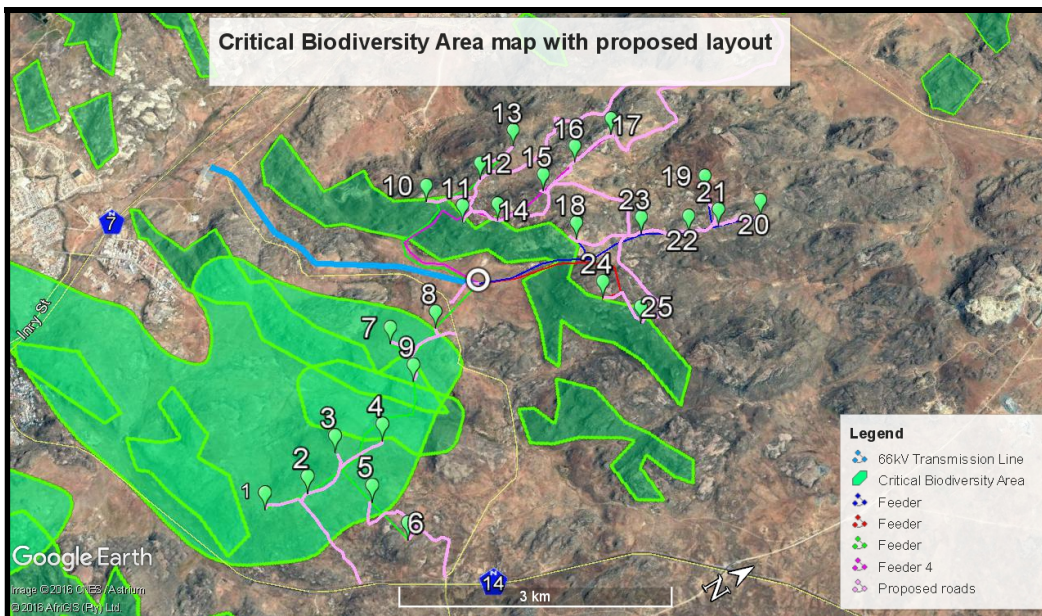


Figure 5: Extract of the Namakwa District Critical Biodiversity Area (CBA) map, overlaid with the proposed, amended layout. Overlapping green polygons are due to the different reasons for selection of the areas as CBAs.

4. IMPACT ASSESSMENT

Key ecological issues associated with the potential development of a wind energy facility in the study area include:

- Degradation and loss of currently largely pristine natural habitat, notably Namaqualand Klipkoppe Shrubland
- Cumulative impacts of loss and degradation of Namaqualand Klipkoppe Shrubland throughout the region
- Loss of literally tens of thousands of plants (most being legally Protected Species) within the development footprints for the roads, crane pads and turbine foundations
- Possible erosion resulting from road construction on relatively steep, rocky slopes
- Minor disruption and loss of current ecological connectivity across the study area, and associated habitat fragmentation
- Loss of significant portions of mapped Critical Biodiversity Areas, and impacts on achievement of national conservation targets for affected habitat units.

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 (irreversible) and temporary (reversible, although only over a very long term of greater than ten years).

In the case of this project the primary direct impact is loss of natural vegetation (and associated possible Species of Conservation Concern) within some of the development footprints. All hard infrastructure located within or partly within natural vegetation will result in the permanent loss of that vegetation. Although many annual species may be quick to reestablish in disturbed areas, the succulents and shrubs in this arid area are slow growing and will probably take many decades to reestablish, and their loss can thus be regarded as a very long term to permanent loss (essentially irreversible in terms of most IA definitions).

The primary sources of permanent loss include (in descending order of importance, based on the proposed layouts) the internal access roads (20ha estimated for authorized alternative, and 15ha for amended layout); the turbine footprints (including permanent crane standpads; estimated 7.5ha for authorized alternative, and 4ha for amended layout; blasting will be needed in at least 70% of the authorized layout turbine sites, and perhaps 60% of the amended layout

turbine sites), the substation (<1ha), and power line tower footprints (insignificant).

The primary sources of vegetation loss (mostly irreversible) include excavation and sand piles for very large foundations (possibly about 10ha); blasting for some of the foundations (possibly about 3ha of impact); excavation of the cable trenches (perhaps as much as 13ha, but for authorized alternative only), the lay down areas and construction camp (16ha); and turning circles, crane tracks, and roads alongside the power line (these possibly all totaling as much as a further 10ha). Fewer, larger turbines would mean incrementally smaller overall disturbance areas, but this assessment assumes 25 turbine positions.

It should be noted that, due to the steep and rocky nature of much of the terrain, construction of the necessary access roads will necessitate the use of heavy machinery and probably drilling and blasting of rock, plus extensive cut and fill. This will inevitably and unavoidably cause rocks and fill to roll down slope, causing further (collateral) damage to the natural vegetation in these down slope areas. This disturbance will technically be of a temporary nature, but will in fact be extremely long term, and the natural vegetation in these areas will take at least twenty years to recover to a significant degree. It is estimated that long term disturbance impacts associated with the road construction on the steep terrain could total an additional 20ha.

Loss of significant populations of regionally rare or threatened plant species is not likely to occur in most of the study area.

The indirect, negative botanical impacts are not likely to be very important, but may include a small degree of habitat fragmentation (disruption of existing ecological connectivity), and introduction of invasive alien plants (mainly along tracks, due to soil disturbance associated with construction, and due to surfacing gravel that may be brought in).

7.1 Construction Phase: Permanent loss of natural vegetation

Less than 5% of the proposed permanent development footprints within the study area will impact on natural vegetation of Very High botanical sensitivity, about 70% will be in areas of Medium and High botanical sensitivity, and about 25% will be in areas of Low botanical sensitivity. It is estimated that as much as 27.5ha of

currently natural vegetation will be permanently lost or degraded for the authorized alternative, and about 21ha for the amended alternative.

In a regional context, this permanent loss of 21 - 27.5ha of vegetation of a Least Threatened type is of Medium negative significance.

Infrastructure that will be located within Very High sensitivity areas include Turbine 1, part of the road between Turbines 3 & 4, and short parts of the road to Turbines 14 & 24.

No significant populations of any plant Species of Conservation Concern are likely to be impacted by either the authorized or the amended layouts, although the confidence level in this prediction is rather low, given the seasonal constraints on the site surveys undertaken, the large size of the study area and the localised and cryptic nature of many of these species.

If all the areas of Very High botanical sensitivity and all CBAs were to be avoided by the proposed layout then the overall construction phase impacts could possibly be reduced to Low – Medium negative overall.

Table 1: Impact table for permanent loss of vegetation in development footprint, including impact on plant Species of Conservation Concern.

<u>Alternative</u>	<u>Extent of impact</u>	<u>Duration of impact</u>	<u>Intensity</u>	<u>Impact Reversible</u>	<u>Irreplaceable loss of resources</u>	<u>Probability of occurrence</u>	<u>Status of the impact</u>	<u>Degree of confidence</u>	<u>Level of significance</u>	<u>Significance after mitigation</u>
Authorized layout (about 27ha)	Local	Long term & permanent	High	Most not	High	High	Negative	High	Medium Negative	Medium negative
Proposed Amended layout (about 21ha)	Local	Long term & permanent	High	Most not	Medium - High	High	Negative	High	Medium Negative	Medium negative

7.2 Construction Phase: Long term but reversible 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 (cut and fill, and material sliding down slope), cable trench excavation through sensitive areas (authorized alternative only), the power line construction where this goes through areas of natural vegetation, and

the associated piling and scraping of soil for foundations, roads and crane pads where this is close to or in natural vegetation. Most of these areas (exact area unknown, but estimated to be between 35 and 50ha in the case of the authorized alternative and 25-40ha for the amendment alternative) 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 20 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. Succulent and bulb species, being poorly dispersed and habitat specific, will be particularly impacted. Certain species may not return for many additional years, due to changes in soil structure (compaction or chemical changes).

Primary sources of long term disturbance will be the large crane that is used to put up the turbines, which may be as much as 13m wide; laydown areas next to the turbines; at least 21km of cable trenches that will not be associated with any proposed access roads (authorized alternative only); turning circles and adequate space for long trucks (significant on these very steep, rocky hills); blasting for turbine foundations; construction damage associated with the access roads, notably the down slope sliding of bulk material (lots of cut and fill needed on these steep slopes); the construction of the new 3.8km long power line.

In a regional context, this reversible but long term loss of 35 – 50ha (authorized alternative) or 25-40ha (amendment alternative) of natural vegetation of a Least Threatened type is of Medium significance.

Table 2: Impact table for reversible but long term loss of vegetation in development footprint (35 – 50ha for authorized layout and 25-40ha for amended layout).

<u>Alternative</u>	<u>Extent of impact</u>	<u>Duration of impact</u>	<u>Intensity</u>	<u>Impact Reversible</u>	<u>Irreplaceable loss of resources</u>	<u>Probability of occurrence</u>	<u>Status of the impact</u>	<u>Degree of confidence</u>	<u>Level of significance</u>	<u>Significance after mitigation</u>
Authorized layout (35-50ha)	Local	Long term & permanent	High	Mostly, but over a long period	Medium - High	High	Negative	High	Medium Negative	Medium negative
Proposed Amended layout (about 25-40ha)	Local	Long term & permanent	High	Mostly, but over a long period	Medium	High	Negative	High	Medium Negative	Medium negative

7.3 Operational Phase impacts

Indirect ecological and botanical impacts usually take place at the operational phase, and are often difficult to identify, and even more difficult to quantify. Many will require pre-installation baseline monitoring in order to be able to detect the changes in a post-installation scenario, and this is something that is very seldom undertaken in South Africa. Some possible indirect negative effects on the vegetation (shading, disturbance of wind flow, etc.) are likely to be minimal and are not assessed further.

Indirect impacts are likely to have only a minor impact on this site, due to the extensive areas of available habitat that will not be disturbed by the proposed installation. Perhaps the most important of these is habitat fragmentation, which will be a result of putting new infrastructure into undisturbed natural habitat. The primary source of habitat fragmentation will probably be the extensive network of internal access roads that will have to be built, but all other infrastructure will also have some negative impact on habitat integrity, albeit to a lesser degree.

The construction of the many new access roads will also require extensive cut and fill, and the soil disturbance caused will provide ideal conditions for the introduction and establishment of invasive alien species - notably in the form of annuals, grasses and herbs.

Table 3: Impact table for indirect botanical impacts (construction phase).

<u>Alternative</u>	<u>Extent of impact</u>	<u>Duration of impact</u>	<u>Intensity</u>	<u>Impact Reversible</u>	<u>Irreplaceable loss of resources</u>	<u>Probability of occurrence</u>	<u>Status of the impact</u>	<u>Degree of confidence</u>	<u>Level of significance</u>	<u>Significance after mitigation</u>
Authorized layout	Local	Long term	Low	Alien invasives – Yes Fragmentation - No	Low	Medium	Negative	Medium	Low negative	Low negative
Proposed Amended layout	Local	Long term	Low	Alien invasives – Yes Fragmentation - No	Low	Medium	Negative	Medium	Low negative	Low negative

7.4 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 proposed WEF is likely to have a Very Low negative cumulative impact in the region, as there are very large areas of undisturbed natural habitat remaining in the region, with few current threats to habitat integrity other than overgrazing and fairly small scale quarrying and mining, and no other WEFs are present in the area.

It should be noted that the establishment of a WEF in this area may encourage and facilitate the establishment of other WEFs in the area (this typically happens in many areas overseas, due to the presence of established transmission line infrastructure), and that these would then have an important negative, cumulative impact.

7.5 Positive impacts

The proposed WEF is unlikely to have any direct positive botanical or ecological impacts, apart from the small global scale positive impact of helping to reduce CO₂ emissions by generating "clean energy".

Complete removal of livestock from the area could have a strong 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 can also lead to erosion. Ideally this reduction in grazing pressure should be a requirement of any project approval, but given the land ownership and tenure in the area, and the largely unfenced nature of the area, it is difficult to see how this could or would be achieved, and in addition, such a recommendation is likely to be in conflict with the avifaunal recommendations, and so has not been made a mandatory condition of approval.

If a biodiversity offset is implemented as part of the authorization requirements then this could also have a strong positive ecological impact, particularly if it

facilitates the expansion of an existing conservation area such as the nearby Goegap NR into priority conservation areas.

8. IMPACT STATEMENT AND SUMMARY TABLE

Authorized Alternative

Overall the authorized alternative is likely to have a Medium local (site scale; 3200ha site) and Medium regional (Springbok plateau; >200 000ha) negative impact on the vegetation on site, prior to mitigation. Without significantly altering the layout (or moving it into the plains to the east, off the granite and quartzite hills) and reducing the scale and total footprint of the project the impact cannot be substantially reduced. At least 75ha of Medium, High and Very High sensitivity natural vegetation is likely to be degraded or permanently lost due to the authorized development layout.

If livestock is not removed from the project area and no biodiversity offset is implemented (neither is a requirement of the EA) then the impacts after mitigation would be similar to those before mitigation (Medium negative).

Proposed Amended Alternative

The overall development disturbance footprint for the amended alternative is likely to be about 20-30% smaller than for the authorized alternative, and will thus have a slightly lower botanical impact. The amended alternative will impact on largely the same type of habitat and species as the authorized alternative.

Anywhere from 40 - 60ha (depending on the number of turbines) of Medium, High and Very High sensitivity natural vegetation is likely to be degraded or permanently lost due to the proposed amended development layout. Overall botanical impact, although clearly slightly lower than for the authorized alternative, is still best described as Medium negative at a regional scale, before mitigation.

If livestock is not removed from the project area during the operational phase but a suitable biodiversity offset is implemented (the latter being a strongly recommended mitigation requirement), then the overall botanical impact after mitigation could be reduced to Low negative.

Source of Impacts

The primary negative impacts on the site are mainly the result of direct, construction phase impacts, including permanent loss of up to 27.5ha of natural vegetation in the development footprints (authorized alternative; about 20ha for amended alternative), and medium to long term loss of natural vegetation (of a further 35 - 50ha for authorized alternative; 25-40ha for amended alternative) in adjacent areas that will be disturbed by heavy construction machinery, temporary dumping, etc. Most of the known plant Species of Conservation Concern on site are found on the main northeast summit ridge, which will not be developed in either of the alternatives under discussion. In terms of the internal cabling the authorized alternative has a notably greater botanical impact than the amended alternative, assuming that all electrical cabling will be overhead in the latter.

Most of the remaining botanical impacts cannot be avoided or mitigated (on this site) without downscaling the proposed development and simply reducing the total development footprint. The extensive cut and fill that will be required to construct the required roads on this rocky, steep terrain is a serious and valid concern.

The presence of about eleven proposed turbines and associated infrastructure (both Alternatives) within the mapped Critical Biodiversity Area on the site is of concern, and is one of the primary reasons for the minimum Medium negative significance rating. An appropriate biodiversity offset which supports and increases a nearby formal conservation area is the only mitigation that could reduce this particular impact (other than layout redesign).

Additional but very minor direct impacts will occur off-site, in the area associated with the proposed 3.8km power line.

Indirect impacts usually occur at the operational phase are often difficult to quantify and measure, and are often equally difficult to avoid or mitigate. However, the indirect impacts on the vegetation on site are likely to be Low negative, but cannot be easily mitigated, other than by ongoing alien vegetation removal from the whole site.

No significant positive direct botanical impacts are likely to result from the development of the development, other than a small indirect positive impact via the small contribution that this WEF would make to reducing CO₂ emissions, and

the associated very small reduction in global warming effects. However, if a suitable biodiversity offset is implemented (for the amended layout application), then the overall botanical impact after mitigation could be reduced to Low negative.

Table 4: Summary table for overall (combined direct & indirect) botanical impacts of the two development alternatives assessed.

<u>Alternative</u>	<u>Extent of impact</u>	<u>Duration of impact</u>	<u>Intensity</u>	<u>Impact Reversible</u>	<u>Irreplaceable loss of resources</u>	<u>Probability of occurrence</u>	<u>Status of the impact</u>	<u>Degree of confidence</u>	<u>Level of significance (before mitigation)</u>	<u>Significance after mitigation</u>
Authorised alternative	Local	Long term to Permanent	Medium	Mostly not	Medium-High	High	Negative	High	Medium negative	Medium negative
Proposed, Amended Alternative	Local	Long term to Permanent	Medium	Mostly not	Medium	High	Negative	High	Medium negative (although slightly lower than for the authorized alternative)	Low negative

9. ASSESSMENT OF ALTERNATIVES

The **authorized alternative** is likely to have a **Medium negative** overall botanical impact, before and after mitigation.

The overall development disturbance footprint for the **proposed, amended alternative** is likely to be about 20-30% smaller than for the authorized alternative, and will thus have a slightly lower botanical impact. The amended alternative will impact on largely the same type of habitat and species as the authorized alternative. At least 40-50ha of Medium, High and Very High sensitivity natural vegetation is likely to be degraded or permanently lost due to the proposed amended development layout. Overall botanical impact, although clearly **slightly lower** than for the authorized alternative, is still best described as **Medium negative** at a regional scale, before mitigation. The proposed, amended alternative is thus the **preferred development alternative**.

If a suitable biodiversity offset is implemented then the overall botanical impact of the amended alternative after mitigation could be reduced to **Low negative**.

10. CONCLUSIONS

- The entire site supports Namaqualand Klipkoppe Shrubland vegetation, which is not regarded as a threatened vegetation type on a national basis. However, there are significant areas of botanical sensitivity on site, including a large area designated as a terrestrial Critical Biodiversity Area (mainly in the southern half). Both alternatives avoid the main northeast ridge where the only recorded plant Species of Conservation Concern were found, but will still also result in fairly extensive infrastructure within the Critical Biodiversity Area.
- From a botanical perspective the facility would be better located in a lower sensitivity area on the surrounding plains, where it would have a lower overall botanical impact.
- The **authorized alternative** is likely to have a Medium negative botanical impact (before and after mitigation, which unfortunately did not include a biodiversity offset).
- The overall development disturbance footprint for the **proposed, amended alternative** is likely to be about 20-30% smaller than for the authorized alternative, and will thus have a slightly lower botanical impact. The amended alternative will impact on largely the same type of habitat and species as the authorized alternative.
- From 40-60ha (depending on the number of turbines) of Medium, High and Very High sensitivity natural vegetation is likely to be degraded or permanently lost due to the proposed amended development layout, including significant areas within mapped Critical Biodiversity Areas.
- Overall botanical impact, although clearly slightly lower than for the authorized alternative, is still best described as **Medium negative** at a regional scale, before mitigation.
- If a suitable biodiversity offset is implemented then the overall botanical impact of the amended alternative after mitigation could be reduced to **Low negative**, and this is consequently strongly recommended.

11. REQUIRED MITIGATION

The following mitigation is regarded as reasonable and feasible and is factored into the assessment of the proposed, amended alternative, and is thus regarded as essential:

- Turbine 1 should be moved at least 80m east, out of the Very High sensitivity area. This new position would be at the same altitude and

would still be more than 360m from Turbine 2, and is unlikely to compromise its efficiency.

- An ECO must be permanently on site throughout the road construction, cable laying, turbine foundation excavation and blasting, and during the erection of the turbines.
- Any excavation, including those for any 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 or rock that came out of the trench. In the case of turbine foundations large volumes of soil and rock will be displaced by the concrete, and this should not be dumped on any undisturbed natural vegetation, but must rather be set aside within a portion of the turning circle of the trucks that deliver the components, or within the crane pad area, and must be spread over the foundations once the turbines are erected, or used as access road fill elsewhere on the site.
- In order to minimize blasting and excavation disturbance all electrical cabling between turbines and between turbines and the substation must be above ground rather than buried.
- Construction operations in all areas other than mapped Low sensitivity areas (see Figures 3 & 4) should be restricted to the dry season (15 October to 1 May) to minimise damage to seasonal plants such as bulbs.
- No dumping or temporary storage of any materials may take place outside the designated and demarcated laydown areas.
- No cement or concrete may be spilled, dropped or offloaded anywhere except within designated development footprints.
- A CEMP and OEMP should be drawn up, which must outline management steps for all the areas of natural vegetation on the site.
- Appropriate alien vegetation management must be undertaken in the 3.8km long powerline servitude and along the edges of all on-site infrastructure on an annual basis for the first four years after construction, and this should be audited by a qualified botanist or conservation official every two years (in August or September). No spraying of herbicide should be allowed anywhere on site, due to impacts on adjacent non-target species.
- Should the amended layout be authorized and should the project become operational a suitable biodiversity offset must be implemented within one year of any such operational commencement. This means that the applicant must appoint a suitably qualified and experienced biodiversity

offset specialist to facilitate this process within 3 months of the project becoming operational. The biodiversity offset specialist will work together with the botanical specialist and the Northern Cape conservation authorities (who manage the nearby Goegap NR) to plan all aspects of the offset required. This offset will be the primary means of mitigating the Medium negative residual botanical impacts, and depending on the quantum could reduce the botanical impacts to Low negative or even Neutral.

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