PROPOSED KLIPHEUWEL/DASSIESFONTEIN WIND ENERGY FACILITY
VISUAL ASSESSMENT

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MetroGIS (Pty) Ltd, specialising in visual assessment and Geographic Information Systems, undertook this visual assessment in collaboration with V&L Landscape Architects CC.

Lourens du Plessis, the lead practitioner undertaking the assessment, has been involved in the application of Geographical Information Systems (GIS) in Environmental Planning and Management since 1990.

The team undertaking the visual assessment has extensive practical knowledge in spatial analysis, environmental modeling and digital mapping, and applies this knowledge in various scientific fields and disciplines. The expertise of these practitioners is often utilised in Environmental Impact Assessments, State of the Environment Reports and Environmental Management Plans.

The visual assessment team is familiar with the "Guidelines for Involving Visual and Aesthetic Specialists in EIA Processes" (Provincial Government of the Western Cape: Department of Environmental Affairs and Development Planning) and utilises the principles and recommendations stated therein to successfully undertake visual impact assessments. Although the guidelines have been developed with specific reference to the Western Cape province of South Africa, the core elements are more widely applicable.

Savannah Environmental (Pty) Ltd appointed MetroGIS (Pty) Ltd as an independent specialist consultant to undertake the visual impact assessment for the proposed Klipheuwel/Dassiesfontein Wind Energy Facility. Neither the author, MetroGIS or V&L Landscape Architects will benefit from the outcome of the project decision-making.

1. INTRODUCTION

BioTherm Energy Pty (Ltd) identified the area west of Caledon and east of Botrivier in the Western Cape Province as a potential location for the construction and operation of a Wind Energy Facility (WEF).

A WEF generates electricity by means of wind turbines that harness the wind of the area as a renewable source of energy. Wind energy generation, or wind farming as it is commonly referred to, is generally considered to be an environmentally friendly electricity generation option.

BioTherm Energy intends to construct up to sixteen wind turbines over an identified area of approximately 602ha, spanning 2 separate properties.

The preliminary layout of the WEF (wind turbine positions) as proposed by BioTherm Energy is shown on **Map 1**.

Additional infrastructure would include 2 on-site substations (linking directly with the Eskom power lines which traverse the development site), underground cabling and internal access roads to each wind turbine. No additional power lines will be required.

It is expected, from a visual impact perspective, that the wind turbines (up to 16 turbines are to be constructed) would constitute the highest potential visual impact of the WEF.

Each turbine will consist of a concrete foundation, a steel tower, a hub (placed at approximately 100m above ground level) and three 55m long blades attached to the hub.

Figure 1 below is a scaled model of the proposed turbines. Slight variations of the dimensions may occur, depending on the preferred supplier or commercial availability of wind turbines at the time of construction. (The Siemens 3.3 MW turbines are proposed for this project)

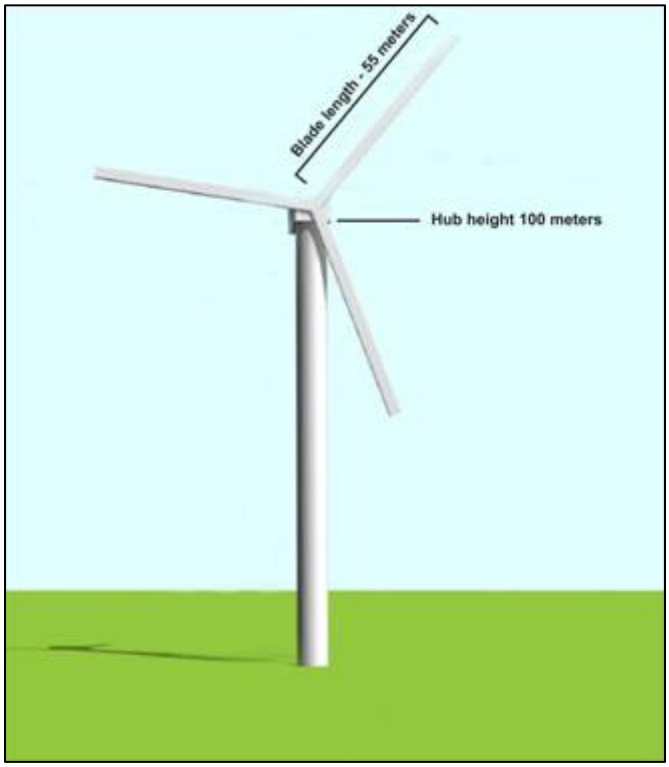
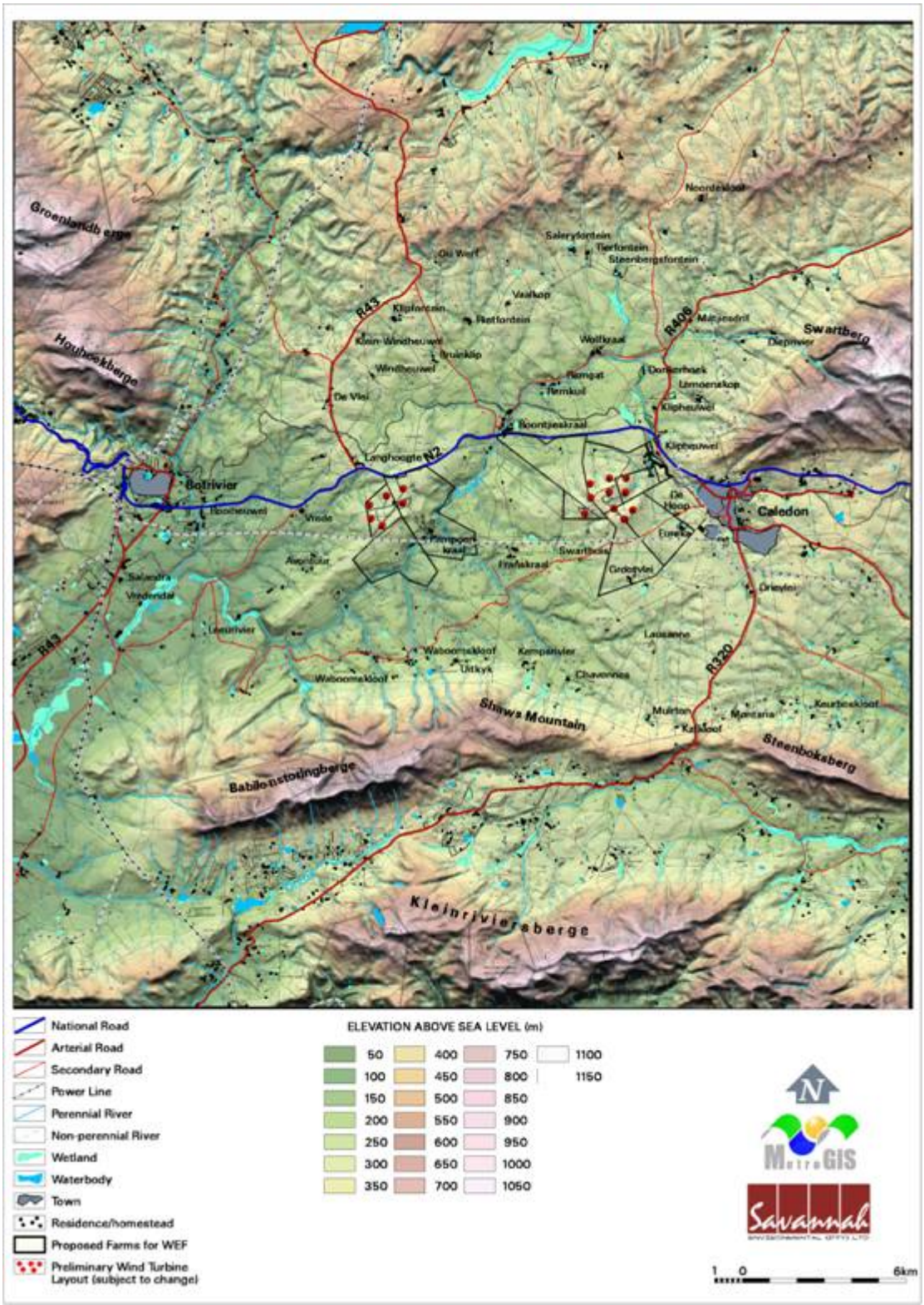


Figure 1: Scaled model of the wind turbine being considered for the WEF.

The 16 turbines will be erected over a 6 week period, at a rate of about 3 per week. Before this, a number of weeks will be spent constructing roads, turbine foundations and installing the electrical infrastructure (cabling etc). The lifespan of the facility is approximated at 20 to 30 years.



Map 1: Locality map and proposed layout of the proposed Klipheuwel/Dassiesfontein WEF showing the provisional placement of infrastructure and shaded relief (topography and elevation above sea level)

2. SCOPE OF WORK

The study area for the visual assessment encompasses a geographical area of 1,180km^2 and includes a minimum 15km buffer zone from the proposed development area. It includes the towns of Caledon and Botrivier, sections of the N2 national road, sections of the R43, the R406 and the R320 arterial roads as well as a number of secondary roads.

The scope of work includes the determination of the potential visual impacts in terms of nature, extent, duration, magnitude, probability and significance of the construction and operation of the proposed infrastructure. In this regard specific issues related to the visual impact were identified during a site visit to the affected environment. Issues related to the proposed Wind Energy Facility include:

- The visibility of the facility to, and potential visual impact on, observers travelling along major routes in the area (primarily the N2 national road, the R43, R406 and R320 arterial roads and the secondary roads within the study area).
- The visibility of the WEF to, and visual impact on, not only the larger built-up centres or populated places (primarily the towns of Caledon and Botrivier) but also individual/isolated landowners/homesteads identified within the study area (some situated within close proximity of the proposed development site include: *Klipheuwel, Remkuil, Ramgat, Wolfkraal, Donkerhoek, Lemoenskop, Klipheuwel, De Hoop, Eureka, Drievlei, Grootvlei, Lausanne, Swarthuis, Franskraal, Pamoenkraal, Waboomskloof, Avontuur, Vrede, Langhoogte, De Vlei, Windheuwel, Bruinklip* etc.).
- The potential impact of the facility on the visual character or sense of place of the region, with special reference to the pastoral landscape and the N2 scenic road/tourist route.
- The visibility of the facility to, and the potential visual impact on protected areas, and private natures reserves (Boontjieskraal Natural Heritage Site) as well as conservancies (Klein Swartberg Conservancy) in close proximity of the proposed site.
- The potential visual impact of the construction of ancillary infrastructure (i.e. the substations at the facility and internal access roads) on observers residing in close proximity of the facility.
- The potential visual impact of operational, safety and security lighting of the facility at night on observers residing in close proximity of the facility.
- Potential cumulative visual impacts of the WEF due to the fragmented nature of the farms earmarked for the development of the facility. In addition, the Caledon WEF is proposed further to the north of the N2 (the EIA process for this proposed WEF is currently in Scoping Phase).
- The visual absorption capacity of the natural vegetation (if applicable).
- Potential visual impacts associated with the construction phase.
- The potential to mitigate visual impacts.

3. METHODOLOGY

The study was undertaken using Geographic Information Systems (GIS) software as a tool to generate viewshed analyses and to apply relevant spatial criteria to the proposed facility. A detailed Digital Terrain Model (DTM) for the study area was created from 20m interval contours supplied by the Surveyor General.

Site visits were undertaken to source information regarding land use, vegetation cover, topography and general visual quality of the affected environment. It

further served the purpose of verifying the results of the spatial analyses and to identify other possible mitigating/aggravating circumstances related to the potential visual impact.

The procedure utilised to identify issues related to the visual impact includes the following activities:

- The creation of a detailed digital terrain model (DTM) of the potentially affected environment.
- The sourcing of relevant spatial data. This includes cadastral features, vegetation types, land use activities, topographical features, site placement, etc.
- The identification of sensitive environments upon which the proposed facility could have a potential impact.
- The creation of viewshed analyses from the proposed development area in order to determine the visual exposure and the topography's potential to absorb the potential visual impact. The viewshed analyses take into account the dimensions of the proposed structures.

This report (visual impact assessment) sets out to identify and quantify the possible visual impacts related to the proposed WEF and related infrastructure mentioned above, as well as offer potential mitigation measures, where required.

The following methodology has been followed for the assessment of visual impact:

- **Determine Potential visual exposure**

  The visibility or visual exposure of any structure or activity is the point of departure for the visual impact assessment. It stands to reason that if the proposed WEF and associated infrastructure were not visible, no impact would occur.

  Viewshed analyses of the proposed WEF facility and the related infrastructure, based on a 20 m interval digital terrain model of the study area, indicate the potential visibility.

- **Determine Visual Distance / Observer Proximity to the facility**

  In order to refine the visual exposure of the facility on surrounding areas/receptors, the principle of reduced impact over distance is applied in order to determine the core area of visual influence for the turbine structures.

  Proximity radii for the proposed development site are created in order to indicate the scale and viewing distance of the facility and to determine the prominence of the structures in relation to their environment.

  The visual distance theory and the observer's proximity to the facility are closely related, and especially relevant, when considered from areas with a high viewer incidence and a predominantly negative visual perception of the proposed facility.

- **Determine Viewer Incidence / Viewer Perception**

  The number of observers and their perception of a structure determine the concept of visual impact. If there are no observers, then there would be

no visual impact. If the visual perception of the structure is favourable to all the observers, then the visual impact would be positive.

It is therefore necessary to identify areas of high viewer incidence and to classify certain areas according to the observer's visual sensitivity towards the proposed WEF and its related infrastructure.

It would be impossible not to generalise the viewer incidence and sensitivity to some degree, as there are many variables when trying to determine the perception of the observer; regularity of sighting, cultural background, state of mind, and purpose of sighting which would create a myriad of options.

- **Determine the Visual Absorption Capacity of the natural vegetation**

  This is the capacity of the receiving environment to absorb or screen the potential visual impact of the proposed facility. The VAC is primarily a function of the vegetation, and will be high if the vegetation is tall, dense and continuous. Conversely, low growing sparse and patchy vegetation will have a low VAC.

  The digital terrain model utilised in the calculation of the visual exposure of the facility does not incorporate the potential visual absorption capacity (VAC) of the natural vegetation of the region. It is therefore necessary to determine the VAC by means of the interpretation of the vegetation cover, supplemented with field observations.

- **Determine the Visual impact index**

  The results of the above analyses are merged in order to determine where the areas of likely visual impact would occur. These areas are further analysed in terms of the previously mentioned issues (related to the visual impact) and in order to judge the severity of each impact.

4. THE AFFECTED ENVIRONMENT

The location of the proposed area for the development of the Wind Energy Facility includes portions (parts of) of the following farms:

- Klip Heuvel 410/5 (Remaining Extent) and 410/9
- Klip Heuvel 410/8 (alias Kruis Vley) and 410/10 (alias Haasjes Kop)
- Klipheuwel/Dassiesfontein 417/0 and Farm 418/0 (Remaining Extent)
- Dassiesfontein farm portions 1 (Remaining Extent) and 5
- Huveltjes Kraal 426
- Heuwelkraal a portion of the farm Pampoenkraal 843/0

The above farms are located on two separate sections south of the N2 national road and are referred to as the Dassiesfontein or western section and the Klipheuwel or eastern section. The eastern most boundary of the eastern section lies approximately 1km west of Caledon, while the western most boundary of the western section lies approximately 7km east of Botrivier. The boundaries of the two sections are on average approximately 4km from each other.

The proposed development site (total of all the farms listed above) encompasses a surface area of approximately 30km^2. The final area to be utilised for infrastructure will be smaller (estimated at 602ha).

Wheat and maize farming dominate the general land-use character of this region, and of the proposed development site. The study area falls within the region generally referred to as the Overberg.

The towns of Caledon and Botrivier account for the highest population concentration; within a region that has approximately 25 people per km^2. This region is therefore ill-populated with a low population density.

The dominant topographical unit or terrain type of the study area is described as *plains and hills* with *strongly undulating plains and hills* occurring to the north. Low mountains (*Babilonstoringberge*, Shaw's Mountain, *Steenboksberg* and *Kleinriviersberge*) occur to the south of the study area. The *Swartberg* Mountain is located north-east of Caledon and the *Houhoekberge* and *Groenlandberge* is located north of Botrivier.

The Swart River, that has its origin in the Swartberg Mountain, traverses the western section of the proposed WEF. Refer to **Map 1** for the Topography/Shaded Relief map of the study area.

The region has a pastoral character with a number of farming homesteads/dwellings occurring within the study area. The natural vegetation type is *shrubland and low fynbos* with *thicket* and *bushland* occurring primarily along valleys. A large portion of the natural vegetation types in the study area has been removed to make way for agricultural fields.

The proposed eastern section of the development site predominantly falls within existing agricultural land, whilst about half of the western section covers agricultural land. Refer to **Map 2** and **Figure 2**.

The *Caledon to Houhoek 1* (66kV) Eskom distribution power line traverses both sections of the proposed WEF development site.

Figure 2: General environment within which the proposed Klipheuwel/Dassiesfontein WEF is to be situated.

The Kogelberg Biosphere Reserve (core, buffer and transition areas) is located west of Botrivier, and approximately 7km to the west of the western section of the proposed WEF. See **Map 3**

Biosphere Reserve ***core areas*** represent *"securely protected sites for conserving biological diversity, monitoring minimally disturbed ecosystems, and undertaking non-destructive research and other low-impact uses".* Biosphere Reserves further include ***buffer zones*** that *"surrounds or adjoins the core areas, and is used for co-operative activities compatible with sound ecological practices, including environmental education, recreation, eco-tourism and applied and basic research*" and ***transition zones*** that *"contain a variety of agricultural activities, settlements and other uses".*[1]

There are no protected areas on the proposed development sites. The study area does, however encompass a number of protected areas (i.e. private nature reserves and areas under statutory protection). These protected areas include the following:

- The Boontjieskraal Natural Heritage Site[2], a private reserve located north of the N2 national road (approximately 2km north of the western development section;
- The Babilionstoringsberge Protected Area located approximately 7km south of the western portion of the proposed WEF and
- The Caledon Local Authority Reserve located 2km east of the eastern development section.

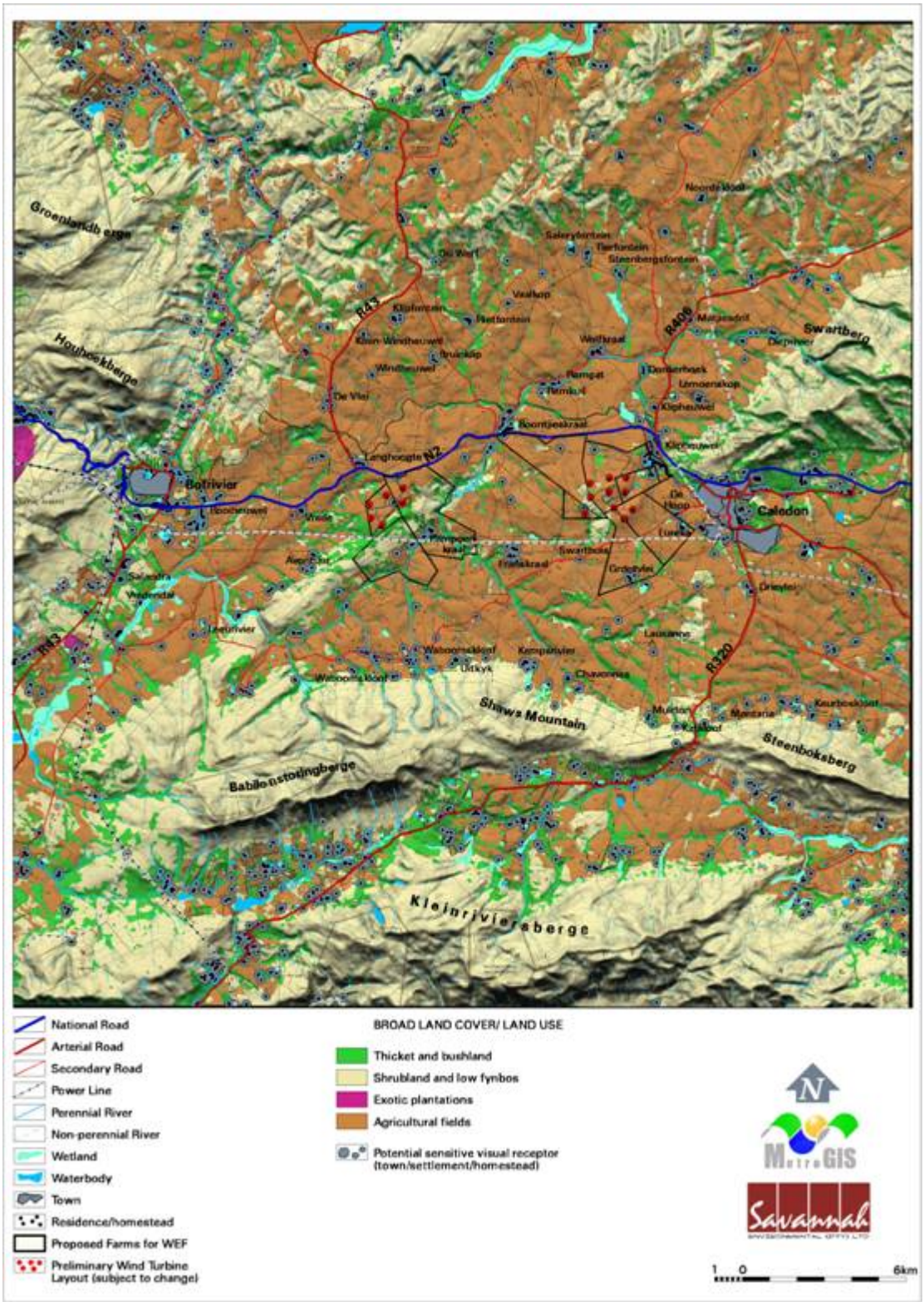
All of the above-mentioned are formally protected areas, none hold national significance in terms of tourism. They are not nationally known tourism destinations, but function rather as regional destinations, frequented by locals, as well as by tourists incidentally passing through or touring within the area.

Three Conservancies are present within the study area. The Klein Swartberg Conservancy (which includes the Caledon Local Authority Reserve) borders the proposed development area in the east of the study area. The second Conservancy overlaps the Kogelberg Biospehere Reserve in the west, but extends a little further to the east and the north. The third conservancy lies to the south of the study area, including Shaws Mountain and the Kleinriviersberge.

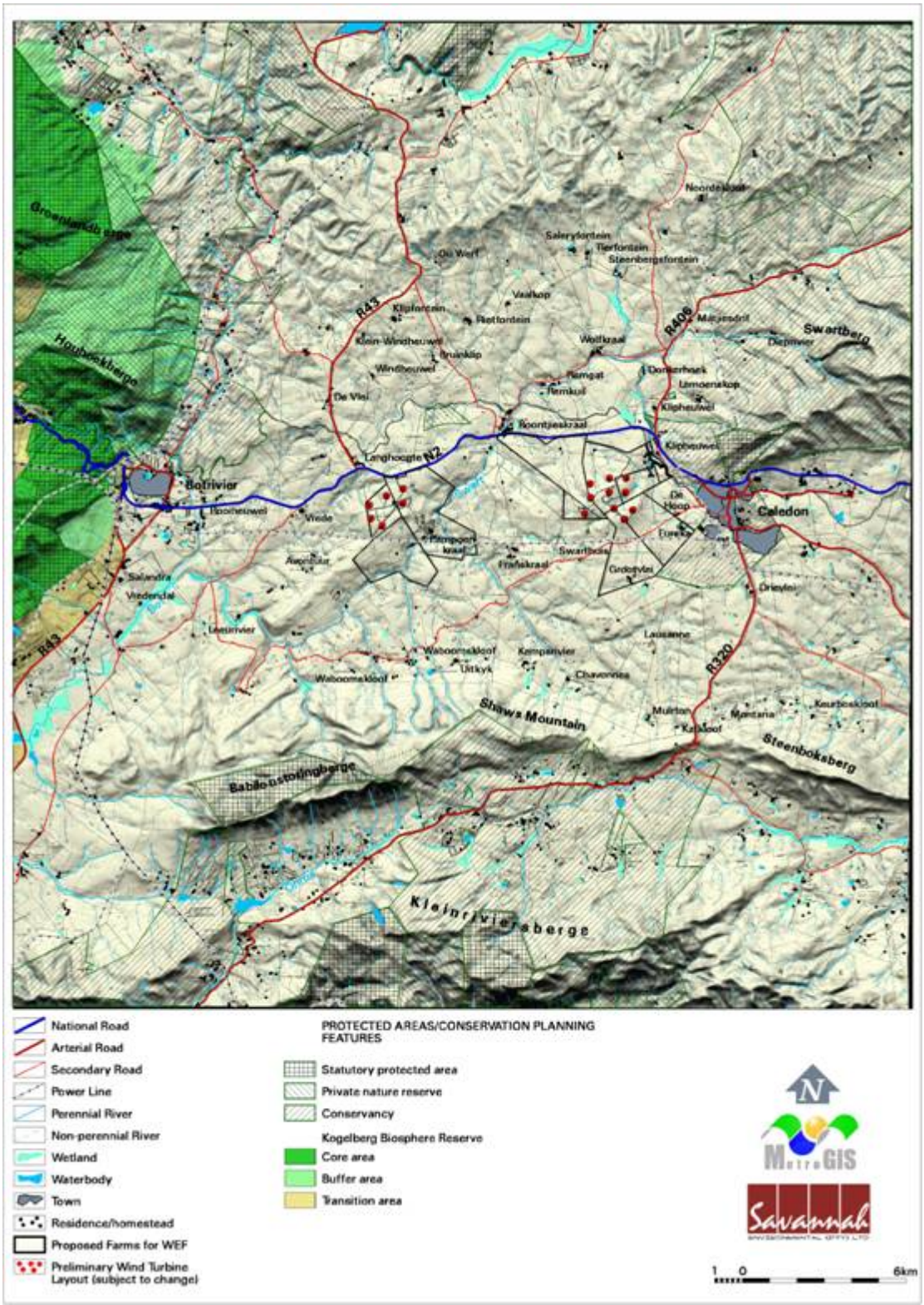
Sources: DEAT (ENPAT Western Cape), NBI (Vegetation Map of South Africa, Lesotho and Swaziland) and NLC2000 (ARC/CSIR).

[1] *Cape Nature, 2008. (Joint statement by biosphere reserve managers/coordinators regarding developments within the core, buffer and transition areas).*

[2] *A Natural Heritage Site is a site with biodiversity importance, earmarked by Cape Nature as a potential candidate for inclusion in their stewardship programme for expansion.*



Map 2: Broad land Cover and Land Use within the study area.



Map 3: Protected Areas and Conservation Planning Features within the study area.

5. RESULTS

5.1. Potential visual exposure

The visibility analysis was undertaken from each of the preliminary wind turbine positions (16 in total) at an offset of 100m (turbine hub height) above average ground level in order to simulate a worst-case scenario.

The result of the viewshed analysis for the proposed WEF's provisional layout is shown on **Map 4**. This viewshed analysis not only indicates areas from where the wind turbines would be visible (any number of turbines with a minimum of one turbine), but also indicates the potential frequency of visibility (i.e. how many turbines are expected to be visually exposed).

The highest frequency of exposure is expected immediately to the north and to the south of the WEF, as well as to the far west of the study area, beyond Botrivier. Visibility further south is restricted by the *Babilonstoringberge* Mountains, *Shaw's Mountain* and the *Steenboksberg* Mountains. Exposure to the far north is similarly restricted to a 5-10km radius due to the undulating nature of the topography.

The proposed facility would be visible with a high frequency of exposure from both Caledon and the western outlying areas of Botrivier. Botrivier itself will be exposed to a somewhat lower frequency. The facility will also be visible from a number of individual homesteads and farmsteads located within a 10km radius. These homesteads and farmsteads usually consist of small settlements of a domestic scale (i.e. a family residence with a few outbuildings and possibly some servants' quarters). The frequency of exposure is anticipated to be mostly high.

The facility would be highly visible from the N2 national road with high frequencies from the eastern outskirts of Caledon and all along the northern boundaries of the facility farm portions. A high frequency of visibility will also be encountered for a small stretch of the N2 to the west of Botrivier.

Visibility from the arterial roads (i.e. the R43, the R406 and the R320) is expected to be high within a 5-10km radius of the site, with a high frequency of exposure. Beyond the above mentioned mountains (i.e. which form visual buffers located at approximately 10km from the proposed facility site), visibility of the facility from these roads is negligible.

The proposed WEF is likely to be visible from sections of the Kogelberg Biosphere Reserve's core, buffer and transition zones immediately to the west of Botrivier.

Only some parts of the Boontjieskraal Natural Heritage Site will be visually affected, and the frequency of visual exposure will be lower. Similarly, the WEF will be visible from parts of the Caledon Local Authority Reserve with the valley having a high frequency of exposure.

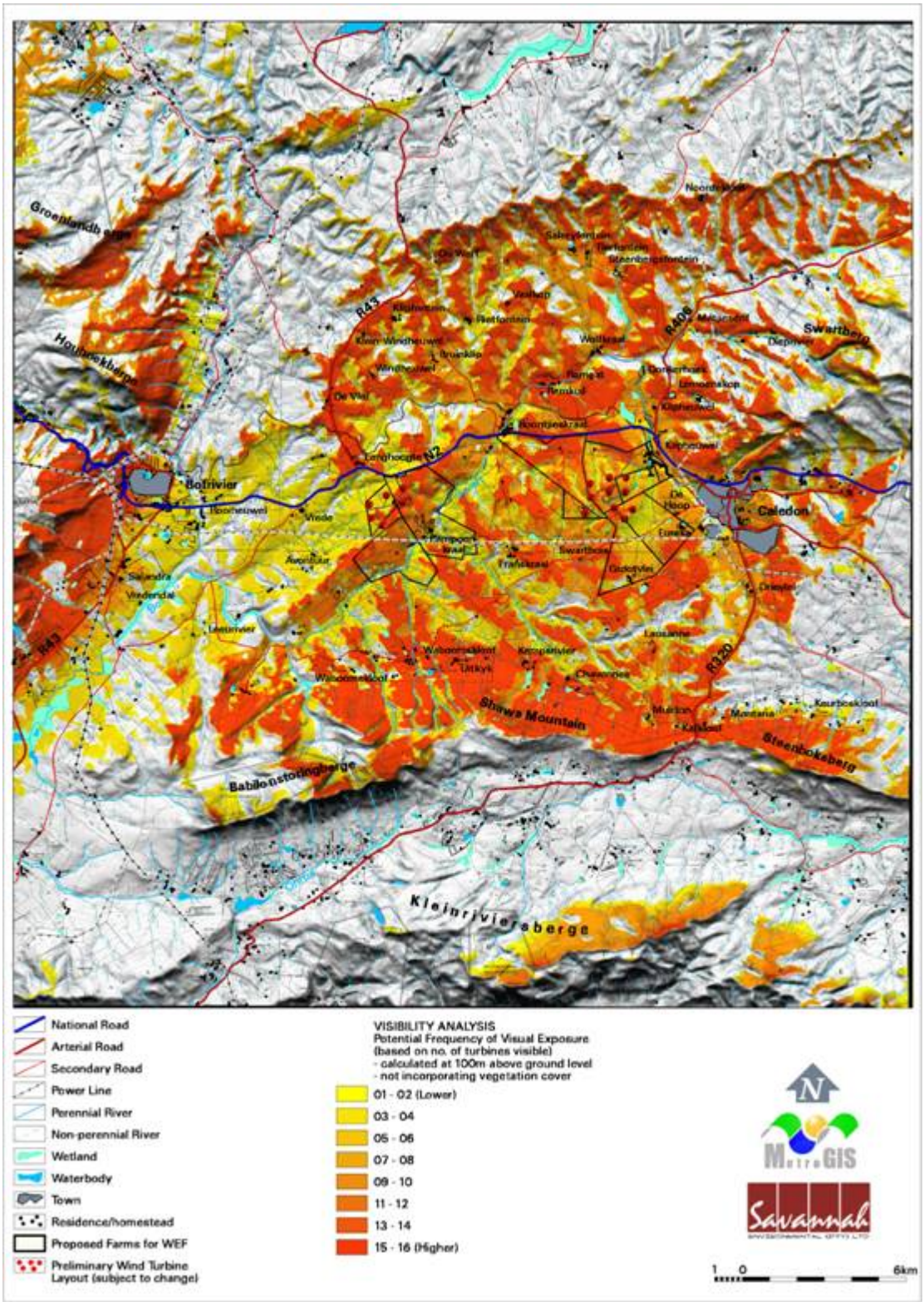
This having been said, it should also be noted that none of the protected areas, hold national significance in terms of tourism. They are not known tourism destinations outside of the province, or even the region, and function as destinations frequented by locals, as well as by tourists incidentally passing through or touring within the area.

The Babilionstoringsberge Protected Area will be subject to a high frequency of visual exposure in the eastern parts, and to a low frequency in limited eastern sections.

The rolling hills constituting the parts of the Klein Swartberg Conservancy will be visually affected with a high frequency of visibility on their south western slopes, but will be visually protected on their north eastern slopes. The Kleinriviersberge Conservancy to the south will be mostly shielded from visual exposure, with patches of potential visual exposure limited to north facing slopes.

The visibility map clearly illustrates the influence of the topography on the potential frequency of exposure. The proposed WEF would have a large area of potential visual exposure as a result of its elevated position in the landscape as well as the tall wind turbine infrastructure.

It is envisaged that the wind generation structures would be easily and comfortably visible, especially within a 10km radius of the WEF and would constitute a high visual prominence, potentially resulting in a high visual impact.



Map 4: Potential visual exposure of the proposed Klipheuwel/Dassiesfontein WEF.

5.2. Visual distance / observer proximity to the WEF

MetroGIS determined the proximity radii based on the anticipated visual experience of the observer over varying distances. The distances are adjusted upwards for larger facilities and downwards for smaller facilities (i.e. depending on the size and nature of the proposed infrastructure). MetroGIS developed this methodology in the absence of any known and/or acceptable standards for South African wind energy facilities.

The proximity radii (calculated from the boundary lines of the farm selected for the WEF) are shown on **Map 5** and are as follows:

- 0 - 5km. Short distance view where the WEF would dominate the frame of vision and constitute a very high visual prominence.
- 5 - 10km. Medium distance view where the structures would be easily and comfortable visible and constitute a high visual prominence.
- 10 - 20km. Medium to longer distance view where the facility would become part of the visual environment, but would still be visible and recognisable. This zone constitutes a medium visual prominence.
- Greater than 20km. Long distance view of the facility where the facility could potentially still be visible though not as easily recognisable. This zone constitutes a medium to low visual prominence for the facility.

5.3. Viewer incidence / viewer perception

Refer to **Map 5**. Viewer incidence is calculated to be the highest along the national, arterial and secondary roads within the study area. Commuters and tourists using these roads will be negatively impacted upon by visual exposure to the WEF.

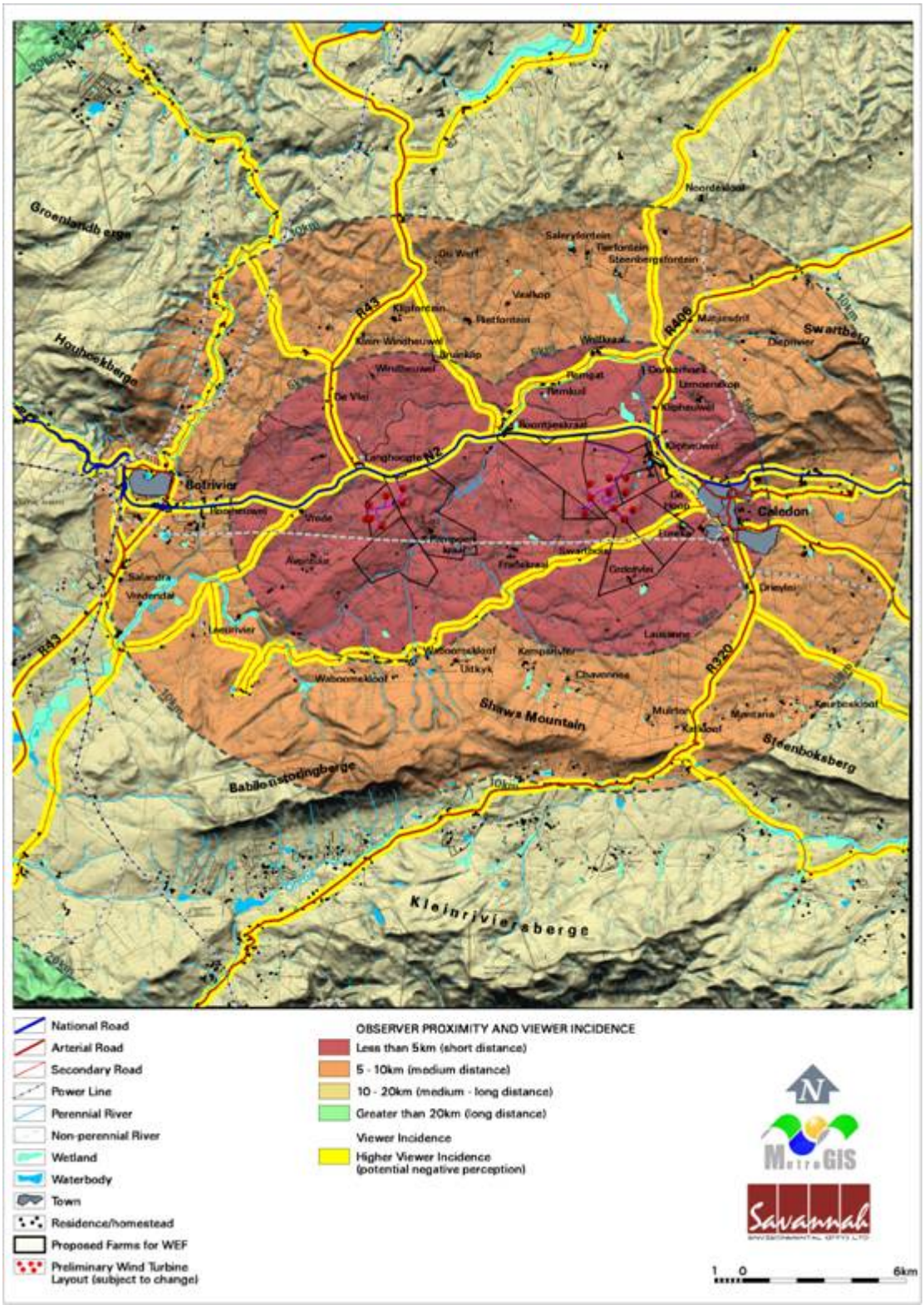
Other than along the above roads, viewer incidence is within a 5 km radius of the proposed WEF is concentrated in Caledon. A handful (i.e. about 19) of homesteads and farmsteads also lie within the zone. These mostly consist of a family residence and a few outbuildings.

Within a 10km radius, viewer incidence is again concentrated within the town of Botrivier. About 26 scattered homesteads and farmsteads are present between the 5km and 10km radius - these are also domestic in size as discussed above.

It is uncertain whether all of the potentially affected farmsteads are inhabited or not. It stands to reason that farmsteads that are not currently inhabited will not be visually impacted upon at present. These farmsteads do, however retain the potential to be affected visually should they ever become inhabited again in the future. For this reason, the author of this document operates under the assumption that they are all inhabited.

The region has a high tourism value and inherent sense of place based on the local (pastoral) culture and history. Residents and visitors to this area are therefore seen as sensitive visual receptors upon which the construction of the WEF could have a negative visual impact.

The majority of the study area consists of agricultural lands or protected areas and there are some visual receptors in the form of farmsteads and homesteads. The severity of the visual impact on these receptors decreases with increased distance from the proposed facility.



Map 5: Observer proximity to the proposed Klipheuwel/Dassiesfontein WEF and areas of high viewer incidence.

5.4. Visual absorption capacity of the natural vegetation

Large portions of the natural vegetation types in the study area have been removed to make way for agricultural fields. In addition, the natural vegetation cover, *shrubland and low fynbos* with *thicket* and *bushland* is largely limited to the valleys. Therefore, the VAC is deemed to be low to negligible for the study area.

In addition, avenues of trees, windbreaks, small plantations and gardens containing large or numerous trees have not been taken into account. Although all of these may act as visual screens for observers on a local level, their influence has not been taken into account on a regional level (i.e. for this study).

5.5. Visual impact index

The combined results of the visual exposure, viewer incidence/perception and visual distance of the proposed WEF, and the substations are displayed on **Map 6**. Here the weighted impact and the likely areas of impact are indicated as a visual impact index. Values were assigned for each potential visual impact per data category and merged in order to calculate the visual impact index (note that this excludes the influence of any vegetation as discussed in 5.4 above).

An area with short distance, high frequency visual exposure to the proposed facility, a high viewer incidence and a predominantly negative perception would therefore have a higher value (greater impact) on the index. This helps in focussing the attention to the critical areas of potential impact when evaluating the issues related to the visual impact.

The visual impact index map clearly indicates the core area of potentially **high** visual impact, within a 5km radius of the proposed WEF and located primarily on the high-lying areas surrounding the intended development.

Potential areas of **very high** visual impact within a 5km radius of the WEF include significant stretches of the national, arterial and secondary roads.

Relatively continuous stretches of the N2, the R43, the R406 and the R320 roads between 5km and 10km from the WEF are likely to experience a **high** visual impact due to the high frequency of observers travelling along these roads.

In addition to the outlying parts of Caledon, homesteads and farmsteads[3] that can expect to be visually influenced (i.e. experience a potentially **very high** visual impact) by the proposed WEF, lie within a 5km radius of the development. These include the following:

- Remkuil
- Ramgat
- Wolfkraal
- Donkerhoek
- Lemoenskop
- Klipheuwel
- De Hoop
- Eureka
- Drievlei

[3] These homesteads and farmsteads are usually small, domestic scale settlements consisting of a family dwelling with a few outbuildings.

- Grootvlei
- Lausanne
- Swarthuis
- Franskraal
- Pamoenkraal
- Waboomskloof
- Avontuur
- Vrede
- Langhoogte
- De Vlei
- Windheuwel
- Bruinklip

Homesteads, farmsteads[4] and towns beyond 5km (roughly 5km to 10km) from the proposed facility may experience **high** visual impact. These include the following:

- Botrivier
- Ou Werf
- Klipfontein
- Klein Windheuwel
- Rietfontein
- Vaalkop
- Saleryfontein
- Tierfontein
- Steenbergsfontein
- Matjiesdrif
- Dieprivier
- Keurbokskloof
- Montana
- Katkloof
- Muirton
- Chavonnes
- Kempsrivier
- Uitkyk
- Vredendal
- Salandra

It is, however, important to note the inherent pastoral sense of place attached to the area, not to mention its value as a tourism route and destination. The construction of the turbines in close proximity of conservation areas and tourist attractions is likely to impact on the sense of place of significant historical sites as well as on a landscape of aesthetic significance.

Notwithstanding this, it should be noted that the proposed facility is relatively small, and the anticipated extent of the impact similarly reduced.

Conservation areas under statutory protection and in close proximity of the WEF include the Caledon Local Authority Reserve to the east of the site. Potential visual impact as a result of the proposed WEF is anticipated to be **high** within this reserve. Limited parts of Boontjieskraal Natural Heritage Site (a private nature reserve) are expected to be exposed to **high** visual impact. The Babilionstoringsberge Protected Area lies more than 7km to the south of the

[4] These homesteads and farmsteads are usually small, domestic scale settlements consisting of a family dwelling with a few outbuildings.

proposed WEF, and may be exposed to mostly low visual impact, with some **moderate** impact in the east.

The Kogelberg Biosphere Reserve lies beyond 7km from the site, so visual impact as a result of the WEF is expected to be **low** to **very low**. Similarly, the majority of Swartberg Conservancy will experience **low** to **very low** visual impact, with the exception of those parts close to the WEF site, which will experience **high** visual impact.

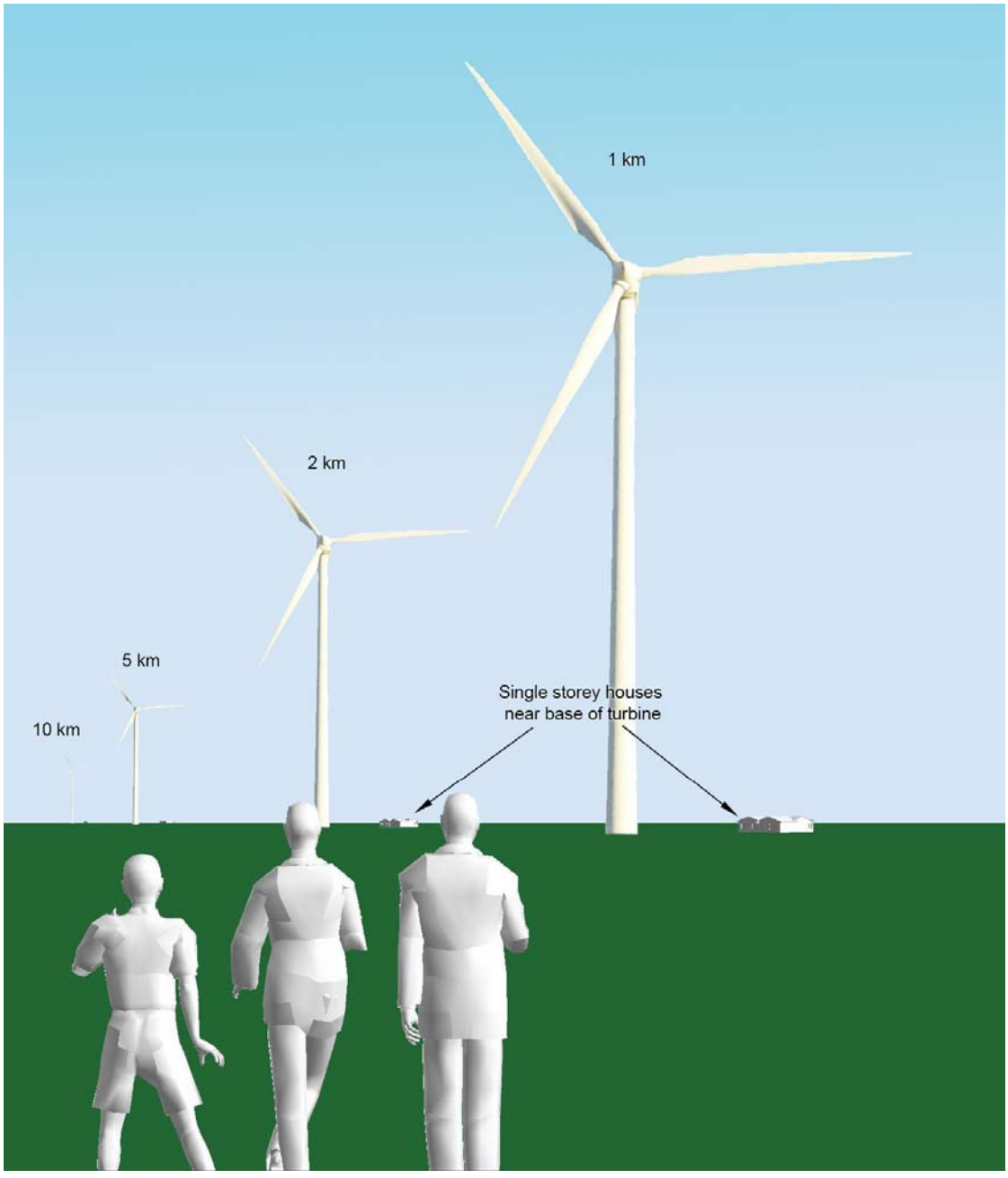
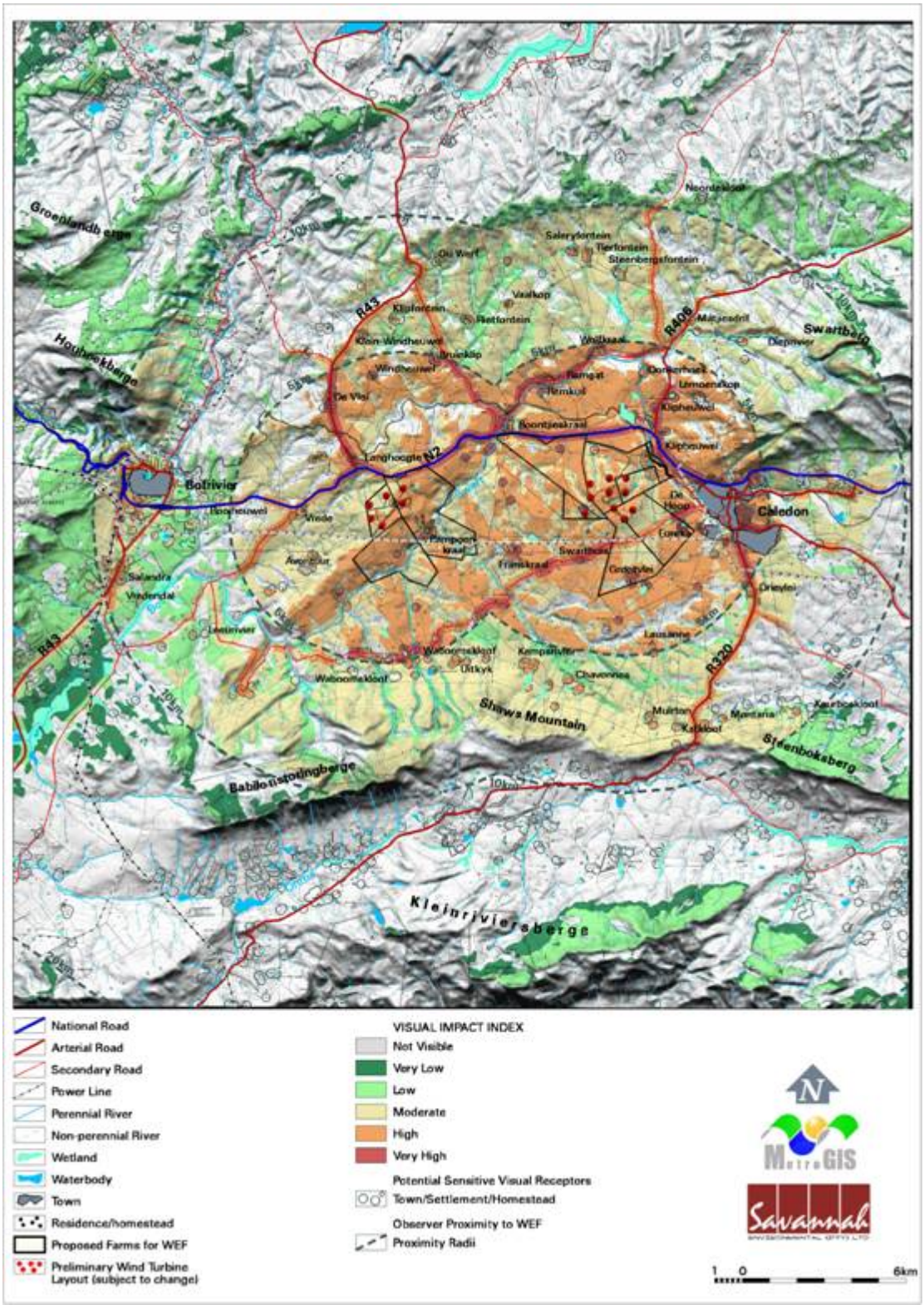


Figure 3: Visual experience of a wind turbine structure at a distance of 1km, 2km, 5km and 10km.



Map 6: Visual impact index of the proposed Klipheuwel/Dassiesfontein WEF.

5.6. Visual impact assessment

The previous section of the report identified specific areas where likely visual impacts would occur. This section will attempt to quantify these potential visual impacts in their respective geographical locations and in terms of the identified issues (see Chapter 2: SCOPE OF WORK) related to the visual impact.

The methodology for the assessment of potential visual impacts states the **nature** of the potential visual impact (e.g. the visual impact on users of major roads in the vicinity of the proposed WEF) and includes a table quantifying the potential visual impact according to the following criteria:

- **Extent** - site only (very high = 5), local (high = 4), regional (medium = 3), national (low = 2) or international (very low = 1)
- **Duration** - very short (0-1 yrs = 1), short (2-5 yrs = 2), medium (5-15 yrs = 3), long (>15 yrs = 4), and permanent (= 5)
- **Magnitude** - None (= 0), minor (= 1), low (= 2), medium/moderate (= 3), high (= 4) and very high (= 5)
- **Probability** - none (= 0), improbable (= 1), low probability (= 2), medium probability (= 3), high probability (= 4) and definite (= 5)
- **Status** (positive, negative or neutral)
- **Reversibility** - reversible (= 1), recoverable (= 3) and irreversible (= 5)
- **Significance** - low, medium or high.

The **significance** of the potential visual impact is equal to the **consequence** multiplied by the **probability** of the impact occurring, where the consequence is determined by the sum of the individual scores for magnitude, reversibility, duration and extent (i.e. **significance = consequence (magnitude + reversibility + duration + extent) x probability**).

The significance weighting for each potential visual impact (as calculated above) is as follows:

- <30 points: Low (where the impact would not have a direct influence on the decision to develop in the area)
- 31-60 points: Medium/moderate (where the impact could influence the decision to develop in the area)
- >60: High (where the impact must have an influence on the decision to develop in the area)

*Please note that due to the declining visual impact over distance, the **extent** (or spatial scale) rating is reversed (i.e. a localised visual impact has a higher value rating than a national or regional value rating). This implies that the visual impact is highly unlikely to have a national or international extent, but that the local or site-specific impact could be of high significance.*

No mitigation measures (e.g. painting the turbines a sky blue colour) is proposed as the colour scheme and lighting fixtures are legally required by the Civil Aviation Authority and cannot be altered.

5.6.1. The WEF

Potential visual impact on users of major roads (N2, R43, R406 and R302) and secondary roads in close proximity of the proposed WEF

Visual impacts on national arterial and secondary roads are expected to be **high** within a 5km radius of the proposed development.

The table below illustrates this impact assessment.

Table 1: Impact table summarising the significance of visual impacts on users of major and secondary roads in close proximity of the WEF

Nature of Impact: Potential visual impact on users of major and secondary roads in close proximity of the WEF		
	No mitigation	***Mitigation considered***
Extent	Local **(4)**	Local **(4)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Very high **(5)**	Very high **(5)**
Probability	Definite **(5)**	Definite **(5)**
Significance	High **(80)**	High **(80)**
Status (positive or negative)	Negative	Negative
Reversibility	Recoverable **(3)**	Recoverable **(3)**
Irreplaceable loss of resources?	No	No
Can impacts be mitigated during operational phase?	No	No
Mitigation: Decommissioning: removal of the wind turbines and ancillary infrastructure after 20 to 30 years.		
Cumulative impacts: The development of 16 turbines over a 6 week period may create the impression of a cumulative visual impact on uninformed observers (i.e. observers who are not aware of the total extent of the facility).		
Residual impacts: None. The visual impact will be removed after decommissioning.		

Potential visual impact on residents of towns, farmsteads and homesteads in close proximity of the proposed WEF

The visual impact on the town of Caledon, as well as a number of farmsteads and homesteads is expected to be **high** (within 5km radius).

The table below illustrates this impact assessment.

Table 2: Impact table summarising the significance of visual impacts on residents of towns, farmsteads and homesteads in close proximity of the proposed WEF

Nature of Impact: Potential visual impact on residents of towns, farmsteads and homesteads in close proximity of the proposed WEF.		
	No mitigation	***Mitigation considered***
Extent	Local **(4)**	Local **(4)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Very high **(5)**	Very high **(5)**
Probability	Definite **(5)**	Definite **(5)**
Significance	High **(80)**	High **(80)**
Status (positive or negative)	Negative	Negative
Reversibility	Recoverable **(3)**	Recoverable **(3)**
Irreplaceable loss of resources?	No	No
Can impacts be mitigated during operational phase?	No	No
Mitigation: Decommissioning: removal of the wind turbines and ancillary infrastructure after 20 to 30 years.		
Cumulative impacts: None as no other similar facilities exist in the area.		
Residual impacts: None. The visual impact will be removed after decommissioning		

Potential visual impact on sensitive visual receptors (users of roads and residents of towns, farmsteads and homesteads) within the region

The visual impact on the town of Botrivier as well as a number of farmsteads and homesteads within the region (between the 5km and 10km radius) is expected to be **medium**. This impact is expected to be low beyond the 10km radius.

The table below illustrates this impact assessment.

Table 3: Impact table summarising the significance of visual impacts on sensitive visual receptors within the region

Nature of Impact: Potential visual impact on sensitive visual receptors within the region		
	No mitigation	***Mitigation considered***
Extent	Regional **(3)**	Regional **(3)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	High **(4)**	High **(4)**
Probability	High **(4)**	High **(4)**
Significance	Medium **(56)**	Medium **(56)**
Status (positive or negative)	Negative	Negative
Reversibility	Recoverable **(3)**	Recoverable **(3)**
Irreplaceable loss of resources?	No	No
Can impacts be mitigated during operational phase?	No	No
Mitigation: Decommissioning: removal of the wind turbines and ancillary infrastructure after 20 to 30 years.		
Cumulative impacts: None as no other similar facilities exist in the area.		
Residual impacts: None. The visual impact will be removed after decommissioning		

Potential visual impact on the sense of place of tourist routes and destinations within the region

The potential visual impact on the sense of place of tourist routes and destinations is expected to be **medium** within beyond the 5km and 10km radius of the WEF. This impact is expected to be low beyond the 10km radius.

The table below illustrates this impact assessment.

Table 4: Impact table summarising the significance of visual impacts on the sense of place of tourist routes and destinations within the region

Nature of Impact: Potential visual impact on the sense of place of tourist routes and destinations within the region.		
	No mitigation	***Mitigation considered***
Extent	Regional **(3)**	Regional **(3)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	High **(4)**	High **(4)**
Probability	Medium **(3)**	Medium **(3)**
Significance	Medium **(42)**	Medium **(42)**
Status (positive or negative)	Negative	Negative
Reversibility	Recoverable **(3)**	Recoverable **(3)**
Irreplaceable loss of resources?	No	No
Can impacts be mitigated during operational phase?	No	No
Mitigation: Decommissioning: removal of the wind turbines and ancillary infrastructure after 20 to 30 years.		
Cumulative impacts: None as no other similar facilities exist in the area.		
Residual impacts: None. The visual impact will be removed after decommissioning.		

Potential visual impact on protected areas, nature reserves and conservancies in close proximity of the proposed WEF

The majority of the Babilionstoringsberge Protected Area as well as the Kogelberg Biosphere Reserve lies beyond 10km from the site, so visual impact as a result of the WEF is expected to be low. Similarly, those parts of the Swartberg Conservancy beyond the 10km radius will experience low visual impact. These areas have not been reflected in the table below.

Visual impact on the Caledon Local Authority Reserve, as well as parts of the Swartberg Conservancy within 5km of the WEF will be **high**.

The table below illustrates this impact assessment.

Table 5: Impact table summarising the significance of visual impact on protected areas, nature reserves and conservancies in close proximity of the proposed WEF

Nature of Impact: Potential visual impact on protected areas nature reserves and conservancies in close proximity of the proposed WEF.		
	No mitigation	***Mitigation considered***
Extent	Local **(4)**	Local **(4)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	High **(4)**	High **(4)**
Probability	Definite **(5)**	Definite **(5)**
Significance	High **(75)**	High **(75)**
Status (positive or negative)	Negative	Negative
Reversibility	Recoverable **(3)**	Recoverable **(3)**
Irreplaceable loss of resources?	No	No
Can impacts be mitigated during operational phase?	No	No
Mitigation: Decommissioning: removal of the wind turbines and ancillary infrastructure after 20 to 30 years.		
Cumulative impacts: None as no other similar facilities exist in the area.		
Residual impacts: None. The visual impact will be removed after decommissioning.		

5.6.2. Ancillary infrastructure

Potential visual impact of ancillary infrastructure on visual receptors in close proximity of the proposed WEF.

The substations will be located within the WEF development footprint, and will be overshadowed by the much taller wind turbine structures. The substations will thus fall within the anticipated viewshed for the turbines as indicated on **Map 4**.

Within the WEF footprint, access roads will be required, firstly to construct each turbine (construction phase), and secondly to maintain the turbines (operational phase). A network of roads will thus be constructed within the site footprint giving access to the turbines and other infrastructure. This network of roads has the potential of manifesting as a network of landscape scarring, and a potential visual impact within the viewshed areas.

Lastly, if the road network is not planned with due cognisance of the topography, then both the roads themselves, and the graded slopes would be vulnerable to erosion over time. This is particularly applicable to hilly areas where steep slopes are present. The effects of erosion also represent a potential visual impact to observers.

The table below illustrates the assessment of this anticipated impact, which is likely to be of **medium** significance, and may be mitigated to **low.**

Table 6: Impact table summarising the significance of visual impact of ancillary infrastructure on visual receptors in close proximity of the proposed WEF

Nature of Impact: Potential visual impact on of ancillary infrastructure on visual receptors in close proximity of the proposed WEF.		
	No mitigation	***Mitigation considered***
Extent	Local **(4)**	Local **(4)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Moderate **(3)**	Moderate **(3)**
Probability	Medium **(3)**	Low **(2)**
Significance	Medium **(42)**	Low **(28)**
Status (positive or negative)	Negative	Negative
Reversibility	Recoverable **(3)**	Recoverable **(3)**
Irreplaceable loss of resources?	No	No
Can impacts be mitigated during operational phase?	No	No
Mitigation: Decommissioning: removal of the wind turbines and ancillary infrastructure after 20 to 30 years.		
Cumulative impacts: None as no other similar facilities exist in the area.		
Residual impacts: None. The visual impact will be removed after decommissioning.		

5.7. Secondary visual impacts

5.7.1. Lighting impacts

Potential visual impact of lighting on visual receptors in close proximity of the proposed WEF.

The area earmarked for the placement of the substations will be within the development footprint. The immediately adjacent area has a relatively small number of populated places (homesteads and farmsteads), and although these are not densely populated areas, the light trespass and glare from the security and after-hours operational lighting for the substations will have some significance. Although this lighting will be low-intensity in nature, the sense of place and pastoral ambiance of the local area increases its sensitivity to lighting intrusions.

Another source of light, is the aircraft warning lights mounted on top of the hub of the wind turbines. These lights are less aggravating due to the toned-down red colour, but have the potential to be visible from a great distance.

The Civil Aviation Authority (CAA) prescribes these warning lights and the potential to mitigate their visual impacts is low. The WEF is not required to have a light fitted to each turbine, but it is compulsory to have synchronous flashing lights on the turbines representing the outer perimeter of the facility. In this manner, less warning lights can be utilised to delineate the facility as one large obstruction, thereby lessening the potential visual impact.

The regulations for the CAA's *Marking of Obstacles* should be strictly adhered to, as the failure of complying with these guidelines may result in the developer being required to fit additional light fixtures at closer intervals thereby aggravating the visual impact.

Last is the potential lighting impact known as sky glow. Sky glow is the condition where the night sky is illuminated when light reflects off particles in the atmosphere such as moisture, dust or smog. The sky glow intensifies with the increase in the amount of light sources. Each new light source, especially upwardly directed lighting, contribute to the increase in sky glow. The WEF may contribute to the effect of sky glow in an otherwise dark environment (i.e. where there is no presence of urban lighting from homes, shops or streetlights).

The table below illustrates the assessment of this anticipated impact, which is likely to be of **medium** significance, and may be mitigated to **low.**

Table 7: Impact table summarising the significance of visual impact of lighting on visual receptors in close proximity of the proposed WEF

Nature of Impact: Potential visual impact on of lighting on visual receptors in close proximity of the proposed WEF.		
	No mitigation	***Mitigation considered***
Extent	Local **(4)**	Local **(4)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Moderate **(3)**	Moderate **(3)**
Probability	Medium **(3)**	Low **(2)**
Significance	Medium **(42)**	Low **(28)**
Status (positive or negative)	Negative	Negative
Reversibility	Recoverable **(3)**	Recoverable **(3)**
Irreplaceable loss of resources?	No	No
Can impacts be mitigated during operational phase?	No	No
Mitigation: Decommissioning: removal of the wind turbines and ancillary infrastructure after 20 to 30 years.		
Cumulative impacts: None as no other similar facilities exist in the area.		
Residual impacts: None. The visual impact will be removed after decommissioning.		

5.7.2. Potential visual impacts associated with the construction phase

The duration of the construction phase of the WEF is dependent on the number of turbines being constructed and is expected to take approximately 16 weeks to complete (a conservative estimation not taking natural weather conditions etc. into account). During this time there will be a noticeable increase in heavy vehicles utilising the roads to the development site that may cause, at the very least, a visual nuisance to other road users and land owners in the area.

5.8. The potential to mitigate visual impacts

- The primary visual impact, namely the appearance of the Wind Energy Facility (mainly the wind turbines) is not possible to mitigate. The functional design of the structures cannot be changed in order to reduce visual impacts.

  Alternative colour schemes (i.e. painting the turbines sky-blue, grey or darker shades of white) are not permissible as the CAA's *Marking of Obstacles* expressly states, "*Wind turbines shall be painted bright white to provide the maximum daytime conspicuousness*". Failure to adhere to the prescribed colour specifications will result in the fitting of supplementary daytime lighting to the wind turbines, once again aggravating the visual impact. The overall potential for mitigation is thus generally low or non-existent.

- There is no mitigation to ameliorate the negative visual impacts anticipated for Protected Areas. A land use conflict exists with regard to the Caledon Local Authority Reserve and the Klein Swartberg Conservancy, as the visual intrusion could alter the land use character of the region, which could in turn influence tourism within these areas in the future.

- Mitigation of lighting impacts includes the pro-active design, planning and specification lighting for the facility by a lighting engineer. The correct specification and placement of lighting and light fixtures for both the turbines and the ancillary infrastructure will go far to contain rather than spread the light. The principles for the design and installation of lighting for the facility include the following:
    - Shielding the sources of light by physical barriers (walls, vegetation, or the structure itself);
    - Limiting mounting heights of lighting fixtures, or alternatively using foot-lights or bollard level lights;
    - Making use of minimum lumen or wattage in fixtures;
    - Making use of down-lighters, or shielded fixtures;
    - Making use of Low Pressure Sodium lighting or other types of low impact lighting.
    - Making use of motion detectors on security lighting. This will allow the site to remain in relative darkness, until lighting is required for security or maintenance purposes.

- Mitigation of secondary visual impacts associated with the construction of roads include careful planning of the access road network, taking due cognisance of the topography. Roads should be laid out along the contour wherever possible, and should never traverse slopes at 90 degrees. Construction of roads should be undertaken properly, with adequate drainage structures in place to forego potential erosion problems.

  Also, the construction areas, including road servitudes and cut and fill slopes must be appropriately rehabilitated after construction. This rehabilitation must also be monitored and maintained in order to minimise the visual impact of the access roads.

- Visual impacts associated with the construction phase, albeit temporary, should be managed according to the following principles:
    - Reduce the construction period through careful planning and productive implementation of resources.
    - Restrict the activities and movement of construction workers and vehicles to the immediate construction site.
    - Ensure that the general appearance of construction activities, construction camps (if required) and lay-down areas are maintained by means of the timely removal of rubble and disused construction materials.
    - Restrict construction activities to daylight hours (if possible) in order to negate or reduce the visual impacts associated with lighting.

The possible mitigation of both primary and secondary visual impacts as listed above should be implemented and maintained on an ongoing basis.

6. PHOTO SIMULATIONS

Photo simulations were undertaken (in addition to the above spatial analyses) in order to illustrate the potential cumulative visual impact of both the completed Klipheuwel/Dassiesfontein WEF's (16 turbines) within the receiving environment.

The purpose of the photo simulation exercise is to support the findings of the VIA, and is not an exercise to illustrate what the facility will look like from all directions. The photo simulations indicate the anticipated visual alteration of the landscape from various sensitive visual receptors located at different distances from the WEFs. The simulations are based on the wind turbine dimensions and layout as indicated on Figure 1 and Map 1 respectively.

The photograph positions are indicated on the map below and should be referenced with the photo simulation being viewed in order to place the observer in spatial context.

The simulated views show the placement of the wind turbines during the longer-term operational phase of the facility's lifespan. It is assumed that the necessary post-construction phase rehabilitation and mitigation measures, as proposed by the various specialists in the environmental impact assessment report, have been undertaken.

It is imperative that the natural vegetation be restored to its original (current) status for these simulated views to ultimately be realistic. These photographs can therefore be seen as an ideal operational scenario (from a visual impact point of view) that should be aspired to. The additional infrastructure (e.g. the proposed power lines, substations, access roads, etc.) associated with the facility is not included in the photo simulations as detailed layout and design information is not finalised.

Each photographic simulation is preceded by a panoramic overview of the landscape from the specified viewpoint being discussed. The panoramic overview allows for a more realistic viewer scale that would be representative of the distance over which the turbines are viewed. Each panoramic overview indicates the section that was enlarged to show a more detailed view of the WEF.

The simulated wind turbines, as shown on the photographs, were adapted to the atmospheric conditions present when the original photographs were taken. This implies that factors such as haze and solar glare were also simulated in order to realistically represent the observer's potential view of the facility.

The following technical data are of relevance:

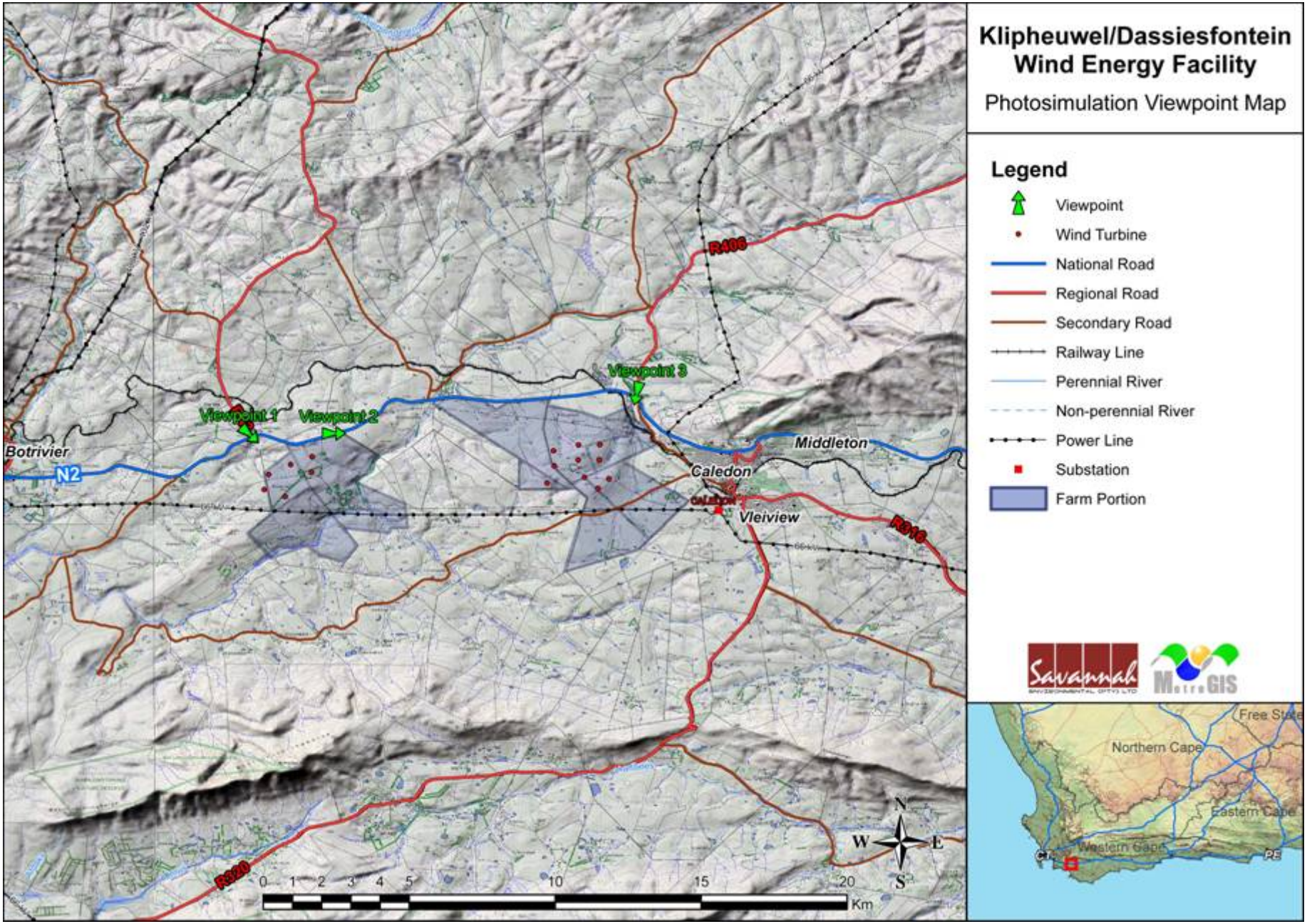
- The camera used to take the initial photographs iss a standard Canon EOS 1000D with an 18-55mm lens.
- Photos intended for panoramas are taken with focal length at 55mm to minimize edge distortion and to facilitate the panoramic software's stitching process.
- Canon's stitching software (Photostitch v3.1.21) is used to create the panoramas. This software automatically compensates for slight variations in the focal length on each photo used in the panorama (i.e. the camera model, focal length, F-number, etc are embedded into each photo, so the software recognizes these parameters and adjusts the output image accordingly).
- The photo simulation process begins with the DTM, as this is effectively the "ground surface" of the virtual environment. The accuracy of the DTM

in representing the Earth's surface is very much dependent on the quality of available contour data as this is what it is derived from. The raster DTM that is used to show shaded relief in a map is usually the same dataset that is used as the virtual ground surface.

- The DTM is visualised in 3D with an application called ArcScene. ArcScene works in much the same way as ArcMap except that the geometry and attributes of shapefiles cannot be edited, and of course, dat is displayed in a Cartesian plane. Any existing shapefile can be added into the 3D environment and will automatically be displayed in it's correct geographic position. Shapes that do not contain Z-values (height above mean sea level) can be assigned height values using the DTM. Point shapefiles, for example, will typically already have X/Y coordinates but can be placed at the virtual ground level, or at any height above ground level as specified in the attribute table. Lines and polygons work in the same way, thus enabling any vector shapefile to be "draped" onto the 3D terrain surface. Furthermore, points can be extruded to create lines of any specified length; lines may be extruded to create 3D polygons; and 3D polygons may be extruded to create 3D volumes.
- 3D models from such applications as 3D StudioMax or Sketchup are compatible with the ArcScene environment and work by assigning a model to be rendered at points geographically specified by a point shapefile. Each model itself consists of many polygons, and depending on the number of models used, can impact severely on a computer's performance in displaying the virtual environment.
- For the purposes of placing wind turbines onto a virtual landscape, a layout of the exact turbine positions is required in the form of a point shapefile. This shapefile is added three times to the environment. The first instance is displayed as a point at ground level to indicate where the turbine tower meets the ground level. The second instance is extruded to half the height of the tower and displayed in a certain colour. The third instance is extruded from half to the full height of the tower and displayed in a different colour. Thus, from any virtual viewpoint on the landscape, it can be determined which turbines will be in full view and which will be partially obscured by undulations of the terrain. The terrain can also be made semi-transparent to check whether anything is completely obscured.
- Each photo viewpoint is then recreated within the virtual environment by setting the "camera" coordinates to those of the GPS coordinates logged when each photo was taken. Several other data may be added for landmark purposes, such as roads, rivers, power lines, or even trees if they can be accurately digitized. The virtual output is then rendered at a focal length matching that of the photos originally used to create the panoramas (using a field-of-view calculator that also compensates for the digital equivalent of 35mm film cameras). Several virtual "snapshots" are taken in sequence in the same manner as for the panoramic photos as the virtual output suffers from the same edge distortion as a photo. These are then stitched in the same manner as the photographs.
- Both the panoramic photos and the virtual simulation output are now graphic formats that are loaded into Adobe Photoshop. Some enhancements of the panoramas may be necessary as weather conditions tend to adversely affect image quality. The horizon and landscape of the virtual viewpoint is then matched up to what can be seen in the panoramas and sample images of the wind turbines are then overlaid where the extruded points are visible. Scaling is maintained since the top and mid-point of the tower are usually visible, so the ground point can be established even though it may be obscured by the landscape. Some graphic editing is usually necessary to address such things intervening

vegetation or power lines as well as sufficient blurring to mimic the effect of distance.

- The scene is then typically rendered twice as "before" and "after" views.



Map 7: Photograph positions for Photo Simulations.

6.1 East south-easterly view

Viewpoint 1 (short distance view of Dassiesfontein section and medium to long distance view of Klipheuwel portion)

Viewpoint 1 is located at the junction of the N2 and the R43. This viewpoint is located approximately 2km from the Dassiesfontein section boundary, and 2km from the closest turbine proposed for that section. This area is located on the right 2 thirds of the photo.

This position is also approximately 7km from the Klipheuwel section boundary and about 10km from the closest turbine proposed for that section. This area is located on the left third of the photo and photo simulation.

The simulation is indicative of what will be seen by people travelling along the N2 in an easterly direction, as well as those travelling south on the R43.

The viewing direction is east south-easterly. Three turbines are fully visible in this photo simulation, but in actual fact, 6 turbines will be visible in the visual foreground from viewpoint 1 (refer to figure 4b below, which shows the western extension of the simulated view from viewpoint 1). Approximately 10 turbines are visible in the medium to long distance (i.e. of the Klipheuwel portion).

This view is representative of a short and a medium to long distance visual experience that regional commuters, local residents, visitors and tourists using the N2 and the R43 will have of the proposed facility.

Figure 4a: Pre-construction panoramic overview from Viewpoint 1, looking at the Dassiesfontein and Klipheuwel portions of the proposed WEF facility.

Figure 4b: Post-construction panoramic overview from Viewpoint 1 showing simulated turbines on the Dassiesfontein and Klipheuwel portions of the proposed WEF facility. The closest turbine lies approximately 2km away.

Figure 4c: Post-construction view from Viewpoint 1 showing simulated turbines on the Klipheuwel portion of the proposed WEF facility. The closest turbine lies approximately 10km away.

6.2 South south-easterly view

Viewpoint 1 (short distance view of Dassiesfontein portion)

Viewpoint 1 is located at the junction of the N2 and the R43. This position is approximately 2km from the Dassiesfontein section boundary, and about 2km from the closest turbine proposed for that section. The Klipheuwel section is not visible in this photo.

The simulation is indicative of what will be seen by people travelling along the N2 in an easterly direction, as well as those travelling south on the R43.

The viewing direction is south south-easterly. Four turbines are fully visible in this photo simulation, but in actual fact, 6 turbines will be visible in the visual foreground from viewpoint 1 (refer to figure 3b above, which shows the eastern extension of the simulated view from viewpoint 1).

This view is representative of a short distance visual experience that regional commuters, local residents, visitors and tourists using the N2 and the R43 will have of the proposed facility.

Figure 5a: Pre-construction panoramic overview from Viewpoint 1, looking at the Dassiesfontein portion of the proposed WEF facility.

Figure 5b: Post-construction panoramic overview from Viewpoint 1 showing simulated turbines on the Dassiesfontein portion of the proposed WEF facility. The closest turbine lies approximately 2km away.

6.3 Easterly view

Viewpoint 2 (medium distance view of Klipheuwel portion)

Viewpoint 2 is located on the N2, about 3km east of the R43 junction. This position is located about is approximately 5km from the Klipheuwel section boundary, and about 7km from the closest turbine proposed for that section. The Dassiesfontein section is not visible in this photo.

The simulation is indicative of what will be seen by people travelling along the N2 in an easterly direction, and the viewing direction is due east. Ten turbines are fully visible the visual middle ground.

This view is representative of a medium distance visual experience that regional commuters, local residents, visitors and tourists using the N2 will have of the proposed facility.

Figure 6a: Pre-construction panoramic overview from Viewpoint 2, looking at the Klipheuwel portion of the proposed WEF facility.

Figure 6b: Post-construction panoramic overview from Viewpoint 2 showing simulated turbines on the Klipheuwel portion of the proposed WEF facility. The closest turbine lies approximately 7km away.

6.4 South south-westerly view

Viewpoint 3 (short distance view of Klipheuwel portion)

Viewpoint 3 is located on the R406, just north of its intersection with the N2. This position is located about 0,5km from the Klipheuwel section boundary, and about 3km from the closest turbine proposed for that section. The Dassiesfontein section is not visible in this photo.

The simulation is indicative of what will be seen by people travelling along the N2 in both an easterly and a westerly direction, as well as those travelling south on the R406. The viewing direction is south south-west. Seven turbines are fully visible the visual middle ground.

This view is representative of a short distance visual experience that regional commuters, local residents, visitors and tourists using the N2 and the R406 will have of the proposed facility.

Figure 7a: Pre-construction panoramic overview from Viewpoint 3, looking at the Klipheuwel portion of the proposed WEF facility.

Figure 7b: Post-construction panoramic overview from Viewpoint 3 showing simulated turbines on the Klipheuwel portion of the proposed WEF facility. The closest turbine lies approximately 3km away.

7. CONCLUSIONS AND RECOMMENDATIONS

The construction and operation of the Klipheuwel/Dassiesfontein Wind Energy Facility and its associated infrastructure will have a visual impact on the scenic resources and pastoral character of this region.

The author is, however, of the opinion that the WEF has an advantage over other more conventional power generating plants (e.g. coal-fired power stations). The facility utilises a renewable source of energy (considered as an international priority) to generate power and is therefore generally perceived in a more favourable light. It does not emit any harmful by-products or pollutants and is therefore not negatively associated with possible health risks to observers.

The facility further has a generally unfamiliar novel and futuristic design that invokes a curiosity factor not generally present with other conventional power generating plants. The advantage being that the WEF can become an attraction or a landmark within the region, that people would actually want to come and see. As it is impossible to hide the facility, the only option would be to promote it.

However, this opinion should not distract from the fact that the facility would be visible within an area that is generally seen as having a pleasing landscape character and a resultant tourism value. The facility would thus visually impact on various sensitive visual receptors that should ideally not be exposed to industrial style structures.

In addition, the conservation value of the region must not be overlooked, specifically the proximity to the nearby Caledon Local Authority Reserve, the Boontjieskraal Natural Heritage Site and the Klein Swartberg Conservancy. Although none of these areas are nationally recognised tourism destinations, they do function as regional destinations, frequented by locals, as well as by tourists incidentally passing through or touring within the area.

There are also not many options as to the mitigation of the visual impact of the core facility as no amount of vegetation screening or landscaping would be able to hide structures of these dimensions. The following is, however ecommedned:

- Ancillary infrastructure (on site substations, internal access roads, etc.) must be properly planned with due cognisance of the topography. In addition, all disturbed areas must be properly rehabilitated and all infrastructure and the site and general surrounds must be maintained in a neat and appealing way.
- The construction phase of the facility should be sensitive to potential observers in the vicinity of the construction site. The placement of lay-down areas and temporary construction camps should be carefully considered in order to not negatively influence the future perception of the facility.
- Secondary visual impacts associated with the construction phase, such as the sight of construction vehicles, dust and construction litter must be managed to reduce visual impacts. The use of dust-suppression techniques on the access roads (where required), timely removal of rubble and litter, and the erection of temporary screening will assist in doing this.
- A lighting engineer should be consulted to assist in the planning and placement of light fixtures in order to reduce visual impacts associated with glare and light trespass.

- The facility should be dismantled upon decommissioning and the site and surrounding area should be rehabilitated to its original (current) visual status.

8. IMPACT STATEMENT

In light of the results and findings of the Visual Impact Assessment undertaken for the proposed Klipheuwel/Dassiesfontein Wind Energy Facility, it is acknowledged that the wide-open views of the pastoral landscape surrounding the site will be transformed for the entire operational lifespan (approximately 30 years) of the facility.

The potential visual impact on users of major and secondary roads in close proximity of the proposed WEF, as well as on residents of nearby towns and farmsteads, will be of high significance. The significance of the potential visual impact on protected areas in close proximity of the facility (0 – 5 km) will also be high.

Within the greater region, the potential visual impact on sensitive visual receptors, and on the sense of place of tourist routes and destinations, will be of medium significance.

This anticipated visual impact is not, however, considered to be a fatal flaw from a visual perspective, considering the relatively low incidence of visual receptors in the region, the relatively small size of the proposed facility and the contained area of potential visual exposure. Furthermore, it is the opinion of the author that this impact is not likely to detract from the regional tourism appeal, numbers of tourists or tourism potential of the existing centres.

It is therefore recommended that the development of the facility as proposed be supported, subject to the implementation of the recommended mitigation measures (chapter 7) and management actions (chapter 9).

9. MANAGEMENT PLAN

The management plan tables aim to summarise the key findings of the visual impact report and to suggest possible management actions in order to mitigate the potential visual impacts. The management plan primarily focuses on the mitigation and management of potential secondary visual impacts, due to the fact that the primary visual impact (i.e. the wind turbines) has very low or limited mitigation potential.

Table 8: Management plan - Klipheuwel/Dassiesfontein Wind Energy Facility

OBJECTIVE: The mitigation and possible negation of the additional visual impacts associated with the construction and operation of the Klipheuwel/Dassiesfontein Wind Energy Facility.

Project component/s	Construction site, access roads, substations, and underground cabling.		
Potential Impact	Potential scarring and erosion due to the unnecessary removal of vegetation		
Activity/risk source	The viewing of the abovementioned by observers on or near the site		
Mitigation: Target/Objective	Minimal disturbance to vegetation cover in close vicinity to the proposed WEF and its related infrastructure.		
Mitigation: Action/control		Responsibility	Timeframe
Implement an environmentally responsive planning approach to roads and infrastructure to limit cut and fill requirements.		BioTherm/contractors	During construction
Adopt responsible construction practices aimed at containing the construction activities to specifically demarcated areas thereby limiting the unnecessary removal of natural vegetation to the minimum.		BioTherm/contractors	During construction
Limit access to the construction sites to existing access roads.		BioTherm/contractors	During construction
Rehabilitate all disturbed areas, including cut and fill slopes to acceptable visual standards.		BioTherm/contractors	During construction
Maintain the general appearance of the facility in an aesthetically pleasing way.		BioTherm	During Operation
Performance Indicator	Vegetation cover that remains intact with no erosion.		
Monitoring	Monitoring of vegetation clearing during the construction phase.		

Table 9: Management plan - Lighting impacts

OBJECTIVE: The mitigation and possible negation of the potential visual impact of lighting at the WEF substations.		
Project component/s	WEF substations lighting fixtures.	
Potential Impact	The potential night time visual impact of lighting fixtures on observers in proximity to the WEF.	
Activity/risk source	The effects of glare and light trespass on motorists and observers.	
Mitigation: Target/Objective	The containment of light emitted from the substations in order to eliminate the risk of additional night time visual impacts. Minimal usage of security and other lighting. Minimal usage of red warning lights – limit placement to outer structures but still adhere to CAA rules and regulations.	
Mitigation: Action/control	Responsibility	Timeframe
Ensure that proper planning is undertaken regarding the placement of lighting structures and that light fixtures only illuminate areas inside the substation sites. Undertake regular maintenance of light fixtures.	BioTherm/lighting engineer.	Construction/Operation.
Performance Indicator	The effective containment of the light on the site and no complaints from observers.	
Monitoring	The monitoring of the condition and functioning of the light fixtures during the operational phase of the project	

10. REFERENCES / DATA SOURCES

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