PROPOSED WIND GARDEN WIND FARM, EASTERN CAPE PROVINCE

VISUAL IMPACT ASSESSMENT

Produced for:

Wind Garden (Pty) Ltd

On behalf of:

Savannah Environmental (Pty) Ltd
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FIGURES

MAPS

TABLES

1. STUDY APPROACH

1.1. Qualification and Experience of the Practitioner

Lourens du Plessis (t/a LOGIS) is a *Professional Geographical Information Sciences (GISc) Practitioner* registered with The South African Geomatics Council (SAGC), and specialises in Environmental GIS and Visual Impact Assessments (VIA).

He has been involved in the application of Geographical Information Systems (GIS) in Environmental Planning and Management since 1990. He has extensive practical knowledge in spatial analysis, environmental modeling and digital mapping, and applies this knowledge in various scientific fields and disciplines. His GIS expertise are often utilised in Environmental Impact Assessments, Environmental Management Frameworks, State of the Environment Reports, Environmental Management Plans, tourism development and environmental awareness projects.

He holds a BA degree in Geography and Anthropology from the University of Pretoria and worked at the GisLAB (Department of Landscape Architecture) from 1990 to 1997. He later became a member of the GisLAB and in 1997, when Q-Data Consulting acquired the GisLAB, worked for GIS Business Solutions for two years as project manager and senior consultant. In 1999 he joined MetroGIS (Pty) Ltd as director and equal partner until December 2015. From January 2016 he worked for SMEC South Africa (Pty) Ltd as a technical specialist until he went independent and began trading as LOGIS in April 2017.

Lourens has received various awards for his work over the past two decades, including EPPIC Awards for ENPAT, a Q-Data Consulting Performance Award and two ESRI (Environmental Systems Research Institute) awards for *Most Analytical* and *Best Cartographic Maps*, at Annual International ESRI User Conferences. He is a co-author of the ENPAT book and has had several of his maps published in various tourism, educational and environmental publications.

He 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 (i.e. within the Eastern Cape Province).

Savannah Environmental appointed Lourens du Plessis as an independent specialist consultant to undertake the visual impact assessment for the proposed Wind Garden Wind Farm (a Wind Energy Facility (WEF)). He will not benefit from the outcome of the project decision-making.

1.2. Assumptions and Limitations

This assessment was undertaken during the planning stage of the project and is based on information available at that time. It is assumed that all information regarding the project details provided by the client is correct and relevant to the proposed project.

1.3. Level of Confidence

Level of confidence[1] is determined as a function of:

- The information available, and understanding of the study area by the practitioner:
    - 3: A high level of information is available of the study area and a thorough knowledge base could be established during site visits, surveys etc. The study area was readily accessible.
    - 2: A moderate level of information is available of the study area and a moderate knowledge base could be established during site visits, surveys etc. Accessibility to the study area was acceptable for the level of assessment.
    - 1: Limited information is available of the study area and a poor knowledge base could be established during site visits and/or surveys, or no site visit and/or surveys were carried out.

- The information available, understanding of the study area and experience of this type of project by the practitioner:
    - 3: A high level of information and knowledge is available of the project and the visual impact assessor is well experienced in this type of project and level of assessment.
    - 2: A moderate level of information and knowledge is available of the project and/or the visual impact assessor is moderately experienced in this type of project and level of assessment.
    - 1: Limited information and knowledge is available of the project and/or the visual impact assessor has a low experience level in this type of project and level of assessment.

These values are applied as follows:

Table 1: Level of confidence.

	Information on the project & experience of the practitioner			
Information on the study area		**3**	**2**	**1**
	3	9	6	3
	2	6	4	2
	1	3	2	1

*The level of confidence for this assessment is determined to be **9** and indicates that the author's confidence in the accuracy of the findings is high:*

- The information available, and understanding of the study area by the practitioner is rated as **3** and
- The information available, understanding and experience of this type of project by the practitioner is rated as **3**.

1.4. Methodology

The study was undertaken using Geographical 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

[1] Adapted from Oberholzer (2005).

study area was created from topographical data provided by NASA in the form of a 30m SRTM (Shuttle Radar Topography Mission) elevation model.

The Plan of Study for the Visual Impact Assessment (VIA) is stated below.

The VIA will be determined according to the nature, extent, duration, intensity or magnitude, probability and significance of the potential visual impacts, and will propose management actions and/or monitoring programs, and may include recommendations related to the wind turbine generator (WTG) layout.

The visual impact will be determined for the highest impact-operating scenario (worst-case scenario) and varying climatic conditions (i.e. different seasons, weather conditions, etc.) will not be considered.

The VIA will consider potential cumulative visual impacts, or alternatively the potential to concentrate visual exposure/impact within the region (if applicable).

The following VIA-specific tasks have been undertaken:

- **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 (or where) the proposed facility and associated infrastructure were not visible, no impact would occur.

The viewshed analyses of the proposed facility and the related infrastructure are based on a 30m SRTM digital terrain model of the study area.

The first step in determining the visual impact of the proposed facility is to identify the areas from which the structures would be visible. The type of structures, the dimensions, the extent of operations and their support infrastructure are taken into account.

- **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 this type of structure.

Proximity radii for the proposed infrastructure 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 (sensitive visual receptors)**

The next layer of information is the identification of areas of high viewer incidence (i.e. main roads, residential areas, settlements, etc.) that would be exposed to the project infrastructure.

This is done in order to focus the attention on areas where the perceived visual impact of the facility will be the highest and where the perception of affected observers will be negative.

Related to this dataset, is a land use character map, that further aids in identifying sensitive areas and possible critical features (i.e. tourist facilities, national parks, etc. – if applicable), that should be addressed.

- **Determine the visual absorption capacity of the landscape**

This is the capacity of the receiving environment to absorb 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 VAC would also be high where the environment can readily absorb the structure in terms of texture, colour, form and light / shade characteristics of the structure. On the other hand, the VAC for a structure contrasting markedly with one or more of the characteristics of the environment would be low.

The VAC also generally increases with distance, where discernable detail in visual characteristics of both environment and structure decreases.

- **Calculate the visual impact index**

The results of the above analyses are merged in order to determine the areas of likely visual impact and where the viewer perception would be negative. An area with short distance visual exposure to the proposed infrastructure, a high viewer incidence and a predominantly negative perception would therefore have a higher value (greater impact) on the index. This focusses the attention to the critical areas of potential impact and determines the potential **magnitude** of the visual impact.

Geographical Information Systems (GIS) software will be used to perform all the analyses and to overlay relevant geographical data sets in order to generate a visual impact index.

- **Determine impact significance**

The potential visual impacts are quantified in their respective geographical locations in order to determine the significance of the anticipated impact on identified receptors. Significance is determined as a function of extent, duration, magnitude (derived from the visual impact index) and probability. Potential cumulative and residual visual impacts are also addressed. The results of this section is displayed in impact tables and summarised in an impact statement.

- **Propose mitigation measures**

The preferred alternative (or a possible permutation of the alternatives) will be based on its potential to reduce the visual impact. Additional general mitigation measures will be proposed in terms of the planning, construction, operation and decommissioning phases of the project.

- **Reporting and map display**

All the data categories, used to calculate the visual impact index, and the results of the analyses will be displayed as maps in the accompanying report. The

methodology of the analyses, the results of the visual impact assessment and the conclusion of the assessment will be addressed in this VIA report.

- **Site visit and photo simulations**

A site visit was undertaken (July 2020) in order to verify the results of the spatial analyses and to identify any additional site specific issues that may need to be addressed in the VIA report.

Photographs from strategic viewpoints were taken in order to simulate realistic post construction views of the WEF. This aids in visualising the perceived visual impact of the proposed WEF and place it in spatial context.

2. BACKGROUND AND PROPOSED INFRASTRUCTURE

Wind Garden (Pty) Ltd is proposing the development of a commercial wind farm and associated infrastructure on a site located approximately 17km north-west of Makhanda (formerly Grahamstown) (measured from the centre of the site) within the Makana Local Municipality and the Sarah Baartman District Municipality in the Eastern Cape Province.

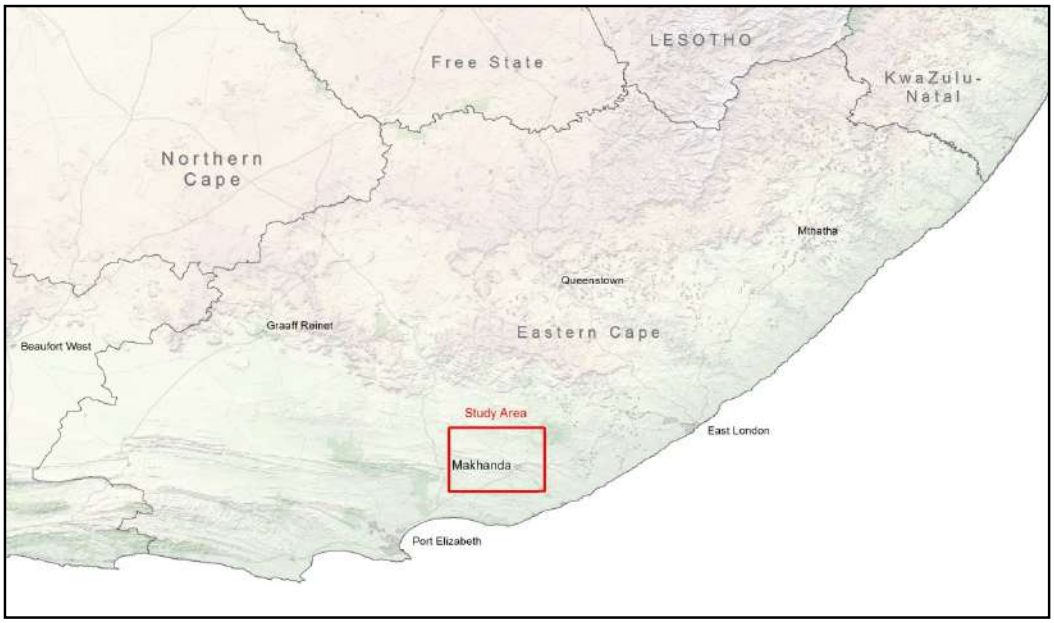


Figure 1: Regional locality of the proposed Wind Garden WEF.

A preferred project site with an extent of ~4,336ha has been identified by Wind Garden (Pty) Ltd as a technically suitable area for the development of the Wind Garden Wind Farm with a contracted capacity of up to 264MW that can accommodate up to 47 turbines. The entire project site is located within the Cookhouse Renewable Energy Development Zone (REDZ). Due to the location of the project site within the REDZ, a Basic Assessment (BA) process will be undertaken in accordance with GN114 as formally gazetted on 16 February 2018. The project site comprises the following five (5) farm portions:

- Remaining Extent of Farm Brackkloof No 183
- Portion 5 of Farm Hilton No 182
- Portion 8 of Farm Hilton No 182
- Portion 4 of Farm Vandermerweskraal No 132
- Portion 1 of Farm Thursford No183

The Wind Garden Wind Farm project site is proposed to accommodate the following infrastructure, which will enable the wind farm to supply a contracted capacity of up to 264MW:

- Up to 47 wind turbines with a maximum hub height of up to 120m. The tip height of the turbines will be up to 200m;
- A 132kV switching station and a 132/33kV on-site collector substation to be connected via a 132kV overhead power line (twin turn dual circuit). The wind farm will be connected to the national grid through a connection from the 132/33kV collector substation via the 132kV power line which will connect to the 132kV switching station that will loop in and loop out of the existing Poseidon – Albany 132kV line;
- Concrete turbine foundations and turbine hardstands;
- Temporary laydown areas which will accommodate the boom erection, storage and assembly area;
- Cabling between the turbines, to be laid underground where practical;
- Access roads to the site and between project components with a width of approximately 4,5m;
- A temporary concrete batching plant;
- Temporary staff accommodation; and
- Operation and maintenance buildings including a gate house, security building, control centre, offices, warehouses, a workshop and visitors centre.

A development envelope for the placement of the wind energy facility infrastructure (i.e. development footprint) has been identified within the project site and assessed as part of the BA process. The development envelope is ~3,400ha in extent and the much smaller development footprint of ~66.6ha will be placed and sited within the development envelope.

The construction phase of the WEF is dependent on the number of turbines ultimately erected and is estimated at one week per turbine. The construction phase is expected to be ~30 months. The lifespan of the facility is approximated at 20 to 25 years.

3. SCOPE OF WORK

This report is the undertaking of a Visual Impact Assessment (VIA) of the proposed Wind Garden WEF as described above.

The determination of the potential visual impacts is undertaken in terms of nature, extent, duration, magnitude, probability and significance of the construction and operation of the proposed infrastructure.

The study area for the visual assessment encompasses a geographical area of approximately 3,852km² (the extent of the full page maps displayed in this report) and includes a minimum 20km buffer zone from the proposed wind turbine structures.

Anticipated issues related to the potential visual impact of the proposed WEF include the following:

- The visibility of the facility to, and potential visual impact on, observers travelling along the national, arterial or secondary roads within the study area.

- The visibility of the facility to, and visual impact on residents of homesteads within the study area.

- The potential visual impact of the facility on the visual character or sense of place of the region.

- The potential visual impact of the facility on tourist routes or tourist destinations (if present).

- The potential visual impact of the construction of ancillary infrastructure (i.e. substations and power line) on observers in close proximity to the facility.

- The visual absorption capacity of the natural vegetation (if applicable).

- The potential cumulative visual impact of the proposed WEF and associated infrastructure in context of the operational Waainek WEF, and the proposed Fronteer and Albany WEFs located within the study area, or potential consolidation of visual impacts, with specific reference to the location of the proposed WEF within the Cookhouse Renewable Energy Development Zone (REDZ).

- The potential visual impact of lighting of the facility in terms of light glare, light trespass and sky glow.

- Potential visual impacts associated with the construction phase.

- The potential visual impact of shadow flicker.

- The potential to mitigate visual impacts and inform the design process.

It is envisaged that the issues listed above may constitute a visual impact at a local and/or regional scale.

4. RELEVANT LEGISLATION AND GUIDELINES

The following legislation and guidelines have been considered in the preparation of this report:

- The Environmental Impact Assessment Regulations, 2014 (as amended);
- Guideline on Generic Terms of Reference for EAPS and Project Schedules (DEADP, Provincial Government of the Western Cape, 2011).

5. THE AFFECTED ENVIRONMENT

The project is proposed within a development envelope with a surface area of approximately 3,400ha. The final surface area to be utilised for the facility will be smaller (~67ha), depending on the type of turbine selected, the final site layout and the placement of wind turbines and ancillary infrastructure. The development

envelope, wind turbine layout, power line and proposed substation sites are indicated on **Figure 2**.

The entire development envelope is located in a rural area, currently zoned as agriculture, at a distance of approximately 17km from Makhanda.

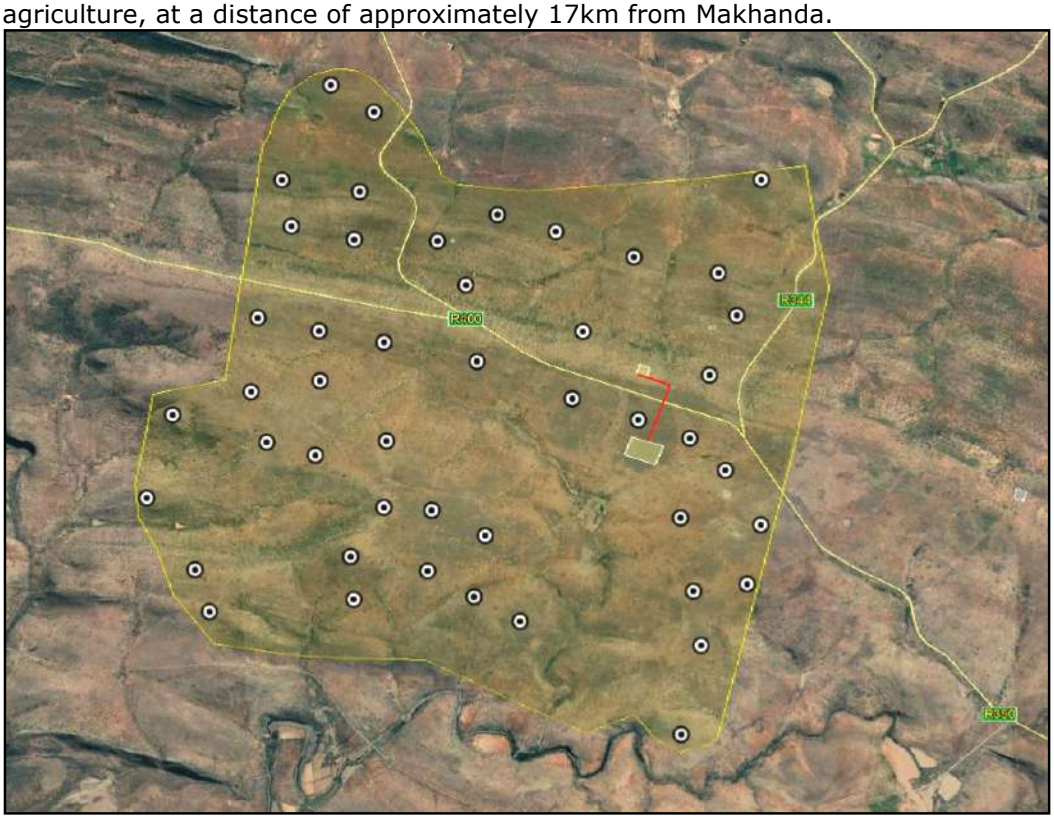


Figure 2: Aerial view of the development envelope indicating the proposed wind turbine layout (white dots), substation site (yellow rectangle) and power line (red line).

Topography, hydrology and vegetation

The study area occurs on land that ranges in elevation from approximately 60m (in the south-eastern corner of the study area) to 932m (at the top of the mountains north of Riebeek East). The terrain surrounding the farms is predominantly flat with an even slope towards the north and the south. The proposed development envelope itself is located at an average elevation of 587m above sea level.

The development site for the proposed Wind Garden WEF is located on a *plateau* that spans 19km from Riebeek East in the west and 17km from Makhanda in the east. The *plateau* is located south of the Great Fish River and provides a flat, yet elevated table-like quality to the landscape. The Great Fish River valley spans the entire width of the study area and is enclosed to the north by the Fish River Rand (ridge or escarpment). The Swartwatersberge (mountains) form the southern escarpment of the *plateau*, dropping down into the New Year's River valley, located south-west of the site.

The terrain morphology of the *plateau* is described as *undulating plains* and *strongly undulating plains and hills*. The escarpments are described as *mountains and tall hills*. Refer to **Maps 1** and **2** for the topography and terrain morphology.

Besides the Great Fish and the New Year's Rivers there are a number of non-perennial rivers or drainage lines spanning across the site and the study area. There are also a number of man-made farm dams throughout the region. The region is relatively arid with the average rainfall indicated at below 300mm per annum.

The study area spans across no less than four biomes, namely; the Albany Thicket, Nama-Karoo, Savanna and Fynbos biomes. Vegetation types associated with these biomes include:

Albany Thicket Biome

- Great Fish Thicket
- Great Fish Noorsveld
- Albany Coastal Belt
- Kowie Thicket

Nama Karoo Biome

- Albany Broken Veld

Savanna Biome

- Bisho Thornveld

Fynbos Biome

- Suurberg Quartzite Fynbos
- Suurberg Shale Fynbos

The study area also includes Azonal Vegetation (Southern Karoo Riviere) along the Great Fish River to the north-west of the study area.

The study area predominantly consists of *grassland* and *shrubland* land cover types, interspersed with *dense forest* and *woodland* in places. The *shrubland* occurs along the steeper slopes of elevated terrain and the *grassland* along more even (flatter) slopes e.g. along the plains.

Refer to **Map 3** for the land cover map of the study area.

Land use and settlement patterns

The study area has a rural and natural character with very few built structures outside of the Makhanda town and surrounds. Exceptions occur where homesteads (rural residences or dwellings) are found and at the Waainek WEF, where eight wind turbines are operational and clearly noticeable from the proposed project site. Other than the Waainek WEF and the Poseidon to Albany 132kV power line traversing the site, there are no major transmission networks or high voltage distribution power lines within the study area.

The region to the north has very limited agricultural activity and crop production, and the general land use is predominantly cattle/sheep farming and game farming. Due to the absence of crop production the larger part of the study area is still in a natural state.

There are a number of protected areas in the region, namely; the Kudu Nature Reserve, Buffalo Kloof Protected Environment, and the Kwandwe, Phumba and Shamwari Nature Reserves. The latter three of these reserves are part of the

Indalo Protected Environment, which was formally recognised and registered in 2018 by the then Department of Environmental Affairs (now known as the Department of Environment, Forestry and Fisheries) as part of the National Protected Area Expansion Strategy (NPAES) for South Africa. It should be noted that these reserves view the construction and operation of wind energy facilities within the region as a threat to their natural environment and eco-tourism[2].

Besides the formally protected areas, there are also a number of informal private protected areas, game farms and stock farms surrounding the proposed Wind Garden WEF site. They have a predominantly similar view (as Indalo Protected Environment) of wind energy facilities, and generally oppose the construction of wind turbines within the region. This opposition to WEFs is largely contributable to the Waainek WEF sensitising land owners to the potential visual impacts of wind turbine structures[3].

The nature reserves and game farms are tourist attractions that operate commercial lodges and game viewing activities, or hunting and other associated outdoor activities. As such they are considered as tourist destinations that rely on the natural environment of the region in order to function effectively.

The study area has a relatively low population density (approximately 23 people per km^2) with the highest concentrations occurring in the towns of Makhanda, Alicedale and Riebeek East. Other than the residents of these towns, there are homesteads (farm residences) located throughout the study area[4].

The N2 national road provides motorised access to the region from the city of Port Elizabeth, the largest urban centre closest to the site (approximately 130km by road to Makhanda). The R350 arterial road will bring you from the Mahkanda CBD to the eastern edge of the proposed site. Other regional roads that traverse the site include the R400 (to Riebeek East) and the R344 (to Adelaide). If you continue northwards along the R350 towards Bedford and Cookhouse you will encounter, amongst others, the Amakhala Emoyeni and Cookhouse WEFs all located within the Cookhouse Renewable Energy Development Zone (REDZ). A comprehensive list of WEFs is provided below.

The entire proposed Wind Garden development envelope is located within the Cookhouse REDZ as well as the Gazetted Eastern Power Corridor. Refer to **Figure 3** for the regional locality of the site in relation to the Cookhouse REDZ. REDZ are described as:

"areas where large scale wind and solar PV energy facilities can be developed in terms of SIP 8 and in a manner that limits significant negative impacts on the environment, while yielding the highest possible socio-economic benefits to the country."

Source: https://redzs.csir.co.za

Figure 3 further indicates the status of Renewable Energy Environmental Applications (REEA) within the Cookhouse REDZ (dated 2020 2nd quarter). It must be noted that the database is not always updated regularly and therefore some projects shown in **Figure 3** may no longer be considered for development, no longer have a valid Environmental Authorisation or are omitted entirely, e.g.

[2] https://www.indaloreserves.com/ (Statement on homepage re. Threats & Challenges).
[3] Information obtained during site visits and consultation with land owners.
[4] Sources: DEAT (ENPAT Eastern Cape), NBI (Vegetation Map of South Africa, Lesotho and Swaziland), NLC2013-14 (ARC/CSIR) and SAPAD2019-20 (DEA).

the proposed Albany WEF located partially within the Cookhouse REDZ, north-east of Makhanda.

Applications that have been approved or constructed include:

- Amakhala Emoyeni Wind Farm
- Cookhouse Wind Farm
- Golden Valley Wind Farm
- Msenge Emoyeni Wind Farm
- Izidluli Wind Farm
- Nxuba Wind Farm
- Nojoli Wind Farm
- Waainek Wind Farm

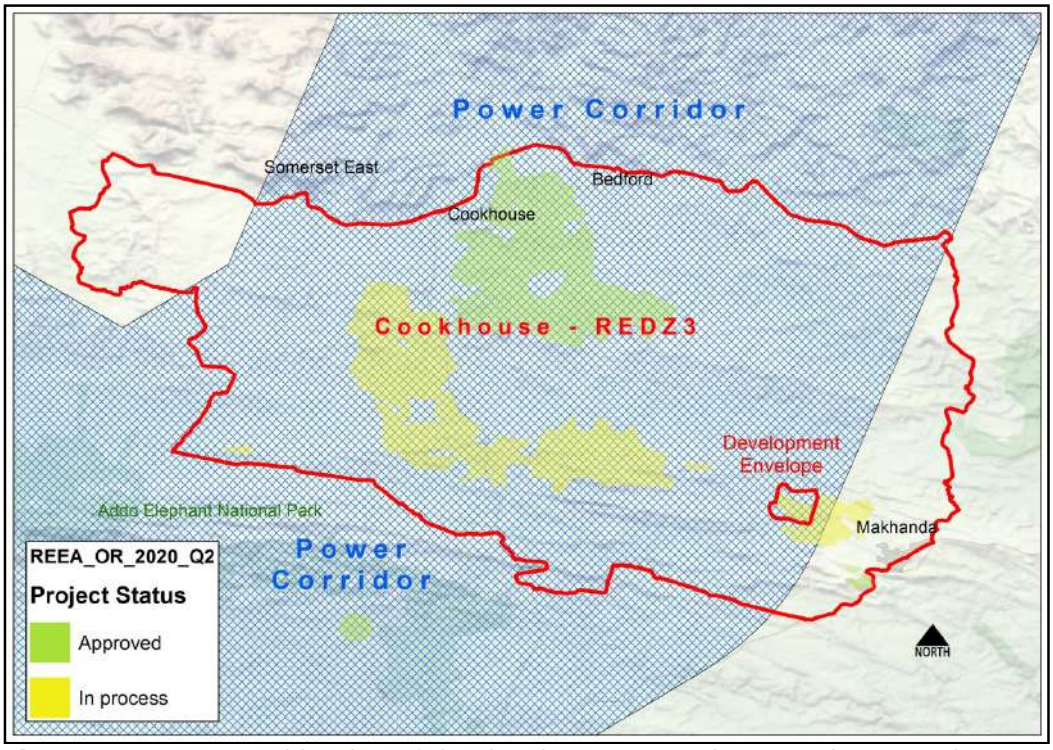


Figure 3: Regional locality of the development envelope in relation to the Cookhouse Renewable Energy Development Zone (REDZ) and Power Corridor (*Source: REEA_OR_2020_Q2*).

The photographs below aid in describing the general environment within the study area and surrounding the proposed development envelope.

Figure 4: Wind turbines at the Waainek WEF.

Figure 5: View from the proposed site to the Waainek WEF.

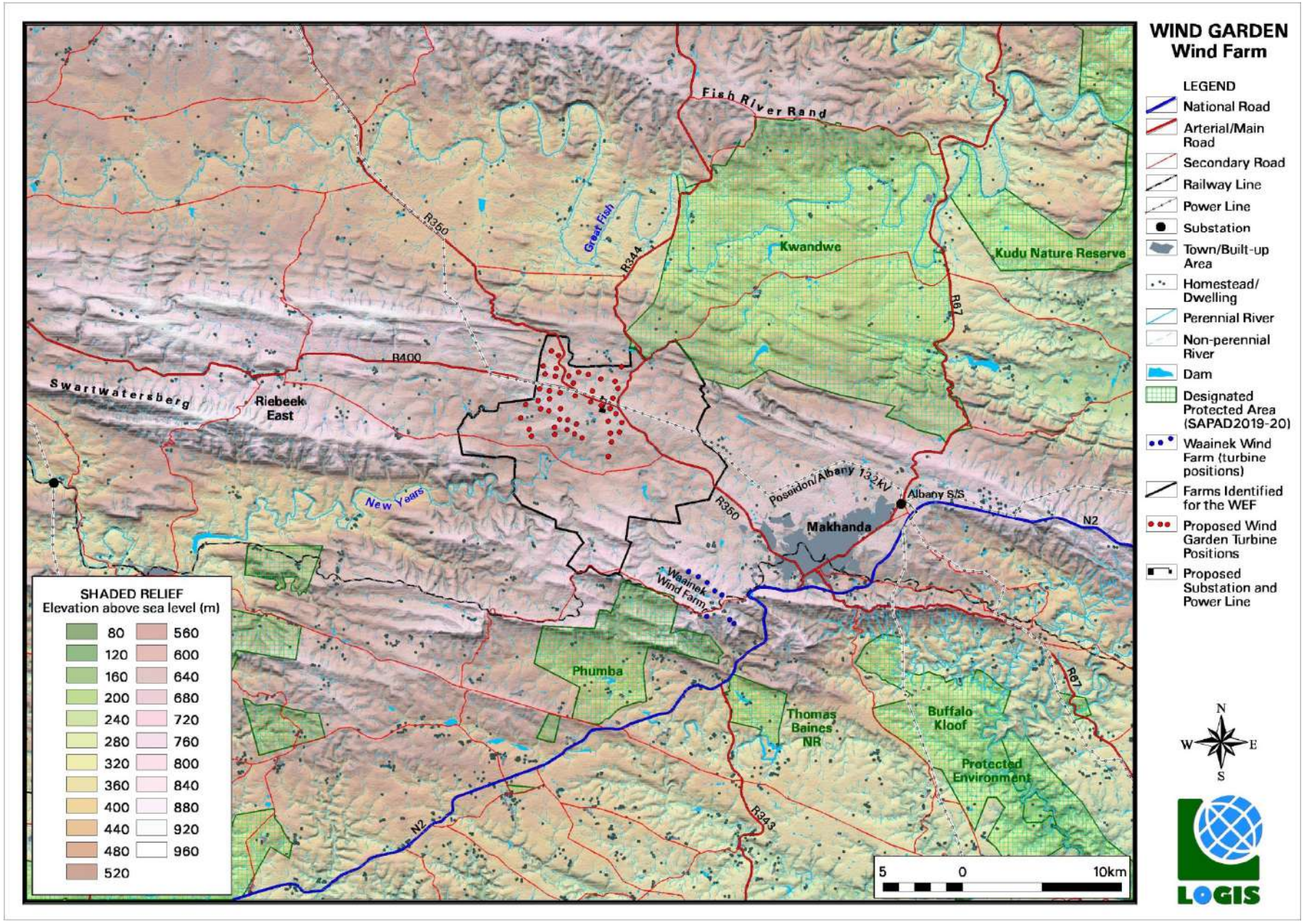
Figure 6: Outskirts of Makhanda.

Figure 7: Kwandwe Nature Reserve.

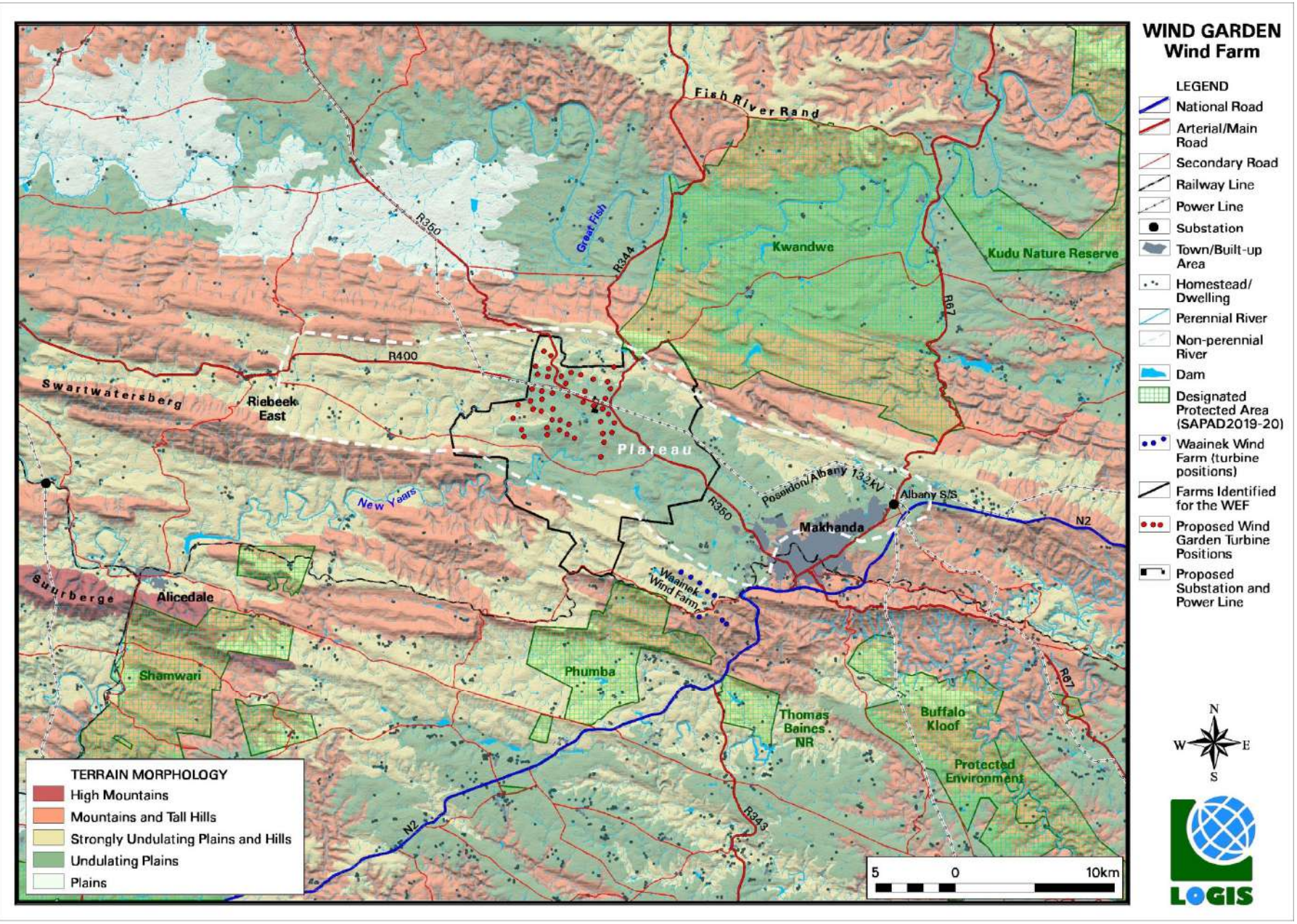
Figure 8: Grassland and woodland north of the proposed development site.

Figure 9: Typical homestead or farm residence within the study area.

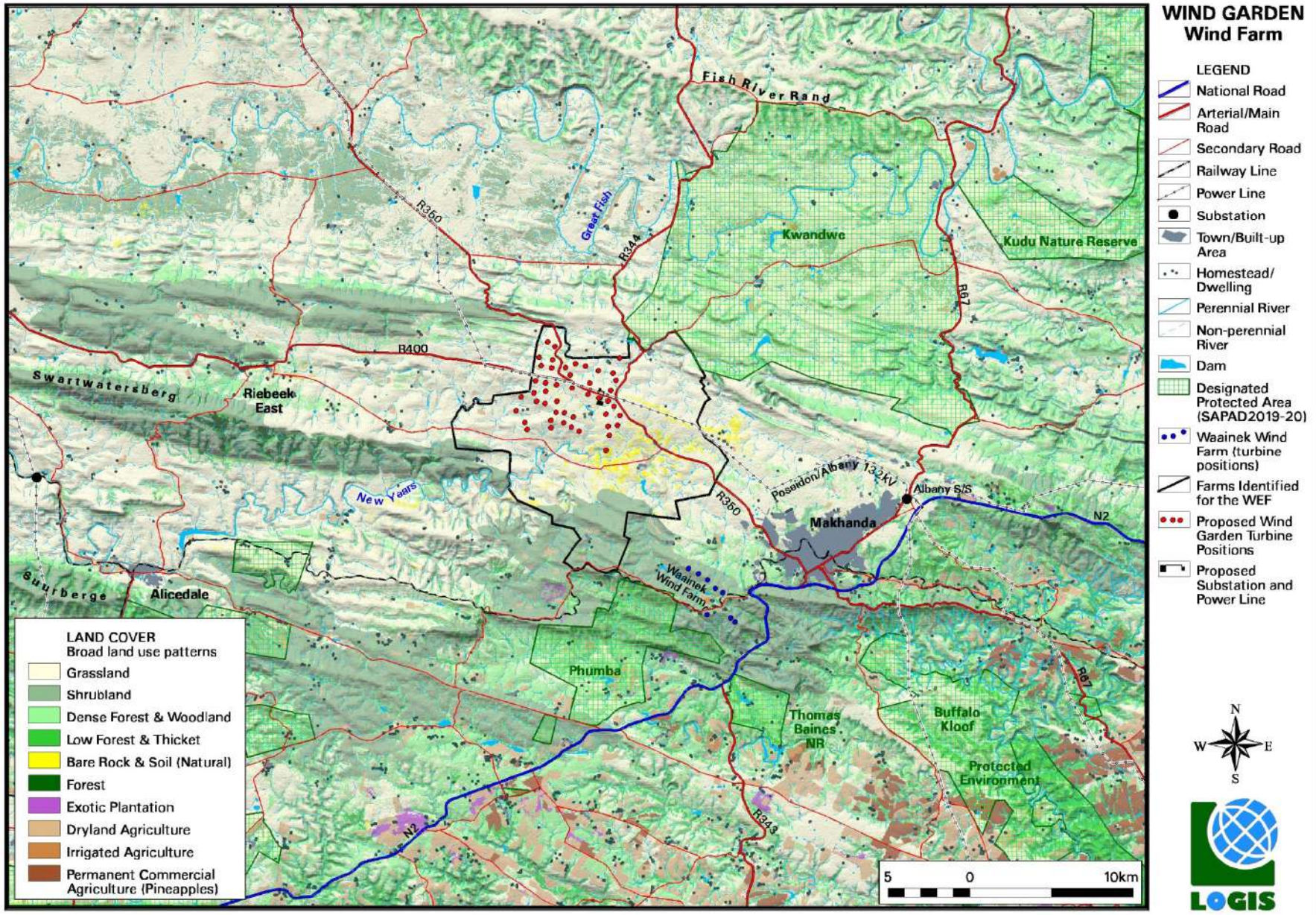
Figure 10: Thicket and shrubland in the study area.



Map 1: Shaded relief map of the study area.



Map 2: Terrain morphology.



Map 3: Land cover and broad land use patterns.

6. RESULTS

6.1. Potential visual exposure

A visibility analysis was undertaken from each of the wind turbine positions (47 in total) at an offset of 200m (approximate blade-tip height) above ground level. The result of the visibility analysis is displayed on **Map 4**.

The viewshed analysis does not include the effect of vegetation cover or existing structures on the exposure of the proposed WEF, therefore signifying a worst-case scenario.

The result of the viewshed analysis displays the potential areas of visual exposure, as well as the potential frequency of exposure. The frequency of exposure indicates the number of turbines that may be exposed i.e. more turbines may be visible in the darker orange areas than in the yellow areas. Land that is more elevated is typically more exposed to the proposed WEF, whilst lower lying areas such as valleys are shielded, or not as exposed.

The core, uninterrupted area of visual exposure of the wind turbines is largely contained within a 5km radius of the structures. This is due to the location of the turbines on the *plateau* with the hills and mountains to the north and the south obstructing the visual exposure. It is expected that the wind turbine structures will be highly visible from homesteads within this zone, as well as from the arterial roads (R400, R350 and R344) traversing it.

Additional visual exposure on the *plateau* between 5 – 10km of the turbine structures is more scattered and primarily occurs west and south-east of the *plateau*. Exposure to the north and north-east occurs along the south facing slopes of the Fish River Rand. The frequency of visual exposure (number of turbines visible) is more reduced to the north (within 5 - 10km) and it is expected that the wind turbines would only be partially visible i.e. mainly the blades.

In the zone between 10 – 20km from the turbines, and higher up along the Fish River Rand, the frequency of exposure will increase again, and the turbine towers and blades may be visible. The largest part of the Kwandwe Nature Reserve falls within this zone. The town of Makhanda also falls within this zone, but visual exposure within the town is highly unlikely. Visibility to the south will be very limited, due to the topography (hills) shielding the turbines.

Visibility beyond 20km from the turbine structures will primarily be to the north-west and potentially the north-east at the Kudu Nature Reserve.

The homesteads and roads expected to be visually influenced are listed below. It should be noted that this section of the report focusses only on the potential visual exposure at varying distances and it does not yet refer to visual impact significance or any correlation thereto.

Less than 5km from the wind turbines:

- Broadfield
- Vaalkrans
- Thornkloof
- Table Farm
- Brakkloof
- Clifton

- Aylesbury 1
- Thursford
- Hounslow
- Hilton
- The R400, R350 and R344 arterial roads

Located within a 5 - 10km radius:

- Oakdale
- Rockdale
- Tea Fountain
- Palmietfontein
- Aylesbury 2
- Burntkraal
- Strowan
- Slaaikraal
- Lynton
- Henley
- Kranzdrift (1 and 2 Kwandwe Nature Reserve)
- Lindsay

Located within a 10 - 20km radius:

- Witteklip
- Shenfield
- Dalton
- Kleindeel
- Coldsprings
- Hillandale
- Coldsprings Annexe
- Mooimeisiesfontein
- Uitspan
- Moreson
- Grootfontein
- Carlisle Bridge
- Middleton
- Rockhurst
- Skelmdrif
- The Echo
- Willowford
- Peninsula
- Mayfair
- Coniston
- Kromkrans
- Markwood
- Kleinfontein
- Die Hoek
- Fonteinskloof (Kwandwe Nature Reserve)
- Douglas Heights (Kwandwe Nature Reserve)
- Cranford (Kwandwe Nature Reserve)
- Heatherton Towers (Kwandwe Nature Reserve)
- Melton (Kwandwe Nature Reserve)
- Beaumont (Kwandwe Nature Reserve)
- Vetteweiden (Kwandwe Nature Reserve)
- Glen Craig
- Mayfield
- Hay

- Cloudlands
- Dikkop Flats
- Signal Kop

Located beyond 20km:

- Nuwejaarsdrif
- Grootfontein
- Grootfontein
- De Hoop
- Steenbokhoek
- Salisbury Plain
- Eerstelyn
- Sunny Side
- Schelmdrift
- Ettrick Hills
- Boschgift (Kwandwe Nature Reserve)
- Killarney
- Rus-oord
- Grasslands
- Munster
- Leinster
- Glen Ovis

It is envisaged that the structures, where visible from short to moderate distances (e.g. less than 20km), may constitute a high visual prominence, potentially resulting in moderate to very high visual impacts.

6.2. Cumulative visual assessment

Cumulative visual impacts can be defined as the additional changes caused by a proposed development in conjunction with other similar developments or as the combined effect of a set of developments. In practice the terms 'effects' and 'impacts' are used interchangeably.

Cumulative visual impacts may be:

- Combined, where the wind turbines of several WEFs are within the observer's arc of vision at the same time;
- Successive, where the observer has to turn his or her head to see the various WEF's wind turbines; and
- Sequential, when the observer has to move to another viewpoint to see different developments, or different views of the same development (such as when travelling along a route).

The visual impact assessor is required (by the competent authority) to identify and quantify the cumulative visual impacts and to propose potential mitigating measures. This is often problematic as most regulatory bodies do not have specific rules, regulations or standards for completing a cumulative visual assessment, nor do they offer meaningful guidance regarding appropriate assessment methods. There are also not any authoritative thresholds or restrictions related to the capacity of certain landscapes to absorb the cumulative visual impacts of wind turbines.

To complicate matters even further, cumulative visual impact is not just the sum of the impacts of two developments. The combined effect of both may be much greater than the sum of the two individual effects, or even less.

The cumulative impact of the WEF development on the landscape and visual amenity is a product of:

- The distance between individual WEFs (or turbines);
- The distance over which the wind turbines are visible;
- The overall character of the landscape and its sensitivity to the structures;
- The siting and design of the WEFs themselves; and
- The way in which the landscape is experienced.

The specialist is required to conclude if the proposed development will result in any unacceptable loss of visual resource considering all the projects existing and proposed in the area.

For the purpose of this study, viewshed analyses were undertaken from all existing and proposed WEFs within a 30km radius of the proposed Wind garden WEF. These include the Wind Garden WEF itself, the proposed Fronteer and Albany WEFs, and the existing Waainek WEF.

The proposed Wind Garden WEF wind turbine layout is located approximately 9km (at the closest) from the operational Waainek WEF. It is located immediately adjacent to the Fronteer WEF and approximately 15km from the closest Albany WEF wind turbine. These are not the only proposed or existing WEFs within the region. Other approved or existing WEFs located further afield, yet still within the Cookhouse REDZ include:

- Amakhala Emoyeni Wind Farm
- Cookhouse Wind Farm
- Golden Valley Wind Farm
- Msenge Emoyeni Wind Farm
- Izidluli Wind Farm
- Nxuba Wind Farm
- Nojoli Wind Farm

These WEFs are all located beyond 32km from the proposed Wind Garden WEF.

Additional proposed WEFs within the Cookhouse REDZ include:

- Hamlett WEF
- Rippon WEF
- Redding WEF
- Aeolus WEF

These four proposed WEFs are located within the western section of the Cookhouse REDZ at distances exceeding 43km from the proposed Wind Garden WEF.

Visibility analyses of the Wind Garden, Fronteer, Waainek and Albany WEFs were undertaken individually from each of the WEF's wind turbine positions, respectively 47, 38, 8 and 43 turbines at an offset off 200m above ground level (the approximate blade-tip height). The results of these viewshed analyses were overlain in order to determine areas where all four WEFs may be visible, areas where three may be visible, areas where two may be visible, or areas where only turbines from a single WEF may be visible.

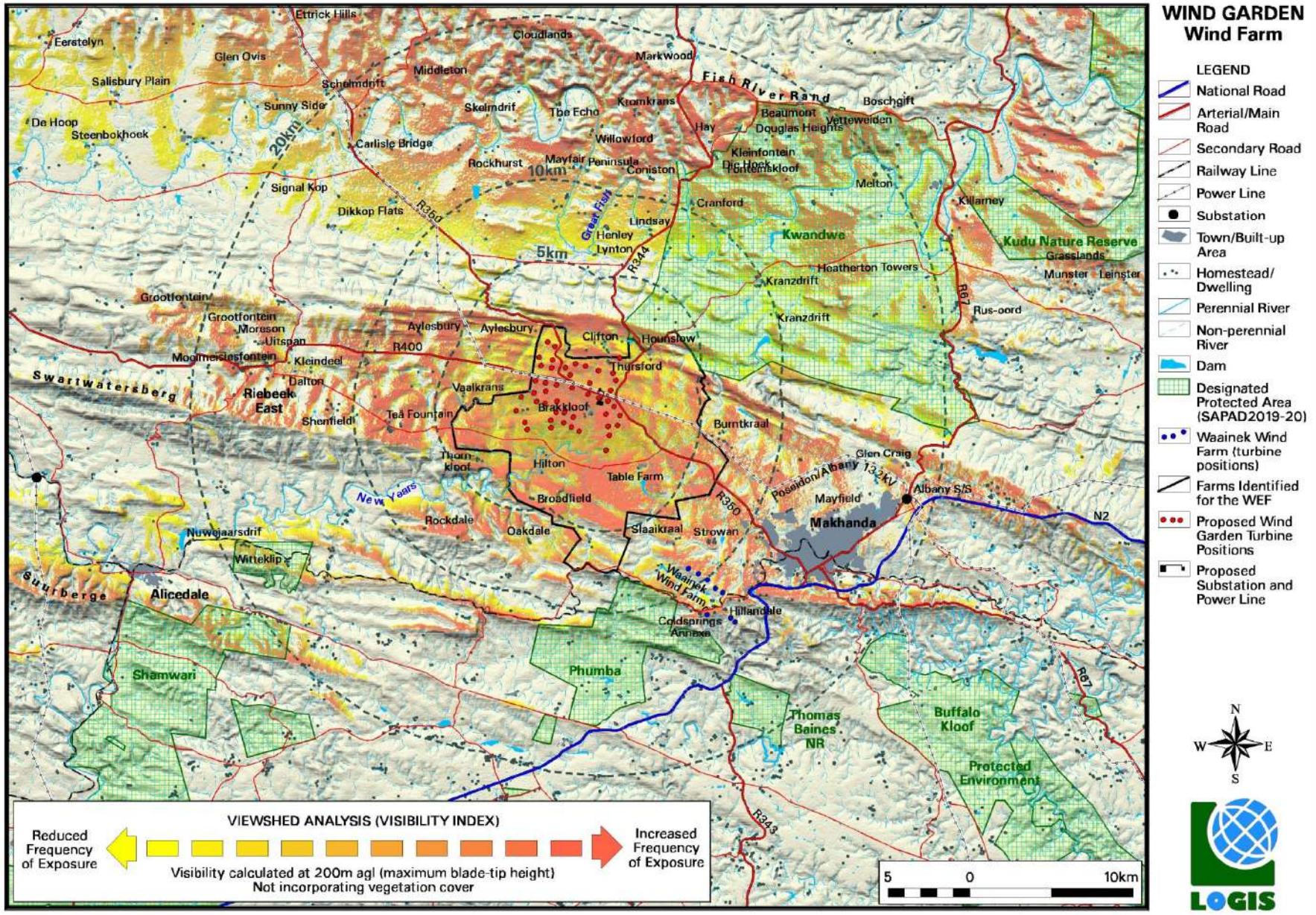
The cumulative viewshed analysis is displayed on **Map 5**. The areas of visual exposure is displayed as an index ranging from one (green), two (yellow), three

(orange) and four (red). This implies that areas that are red or orange have a higher cumulative visual exposure than yellow or green areas.

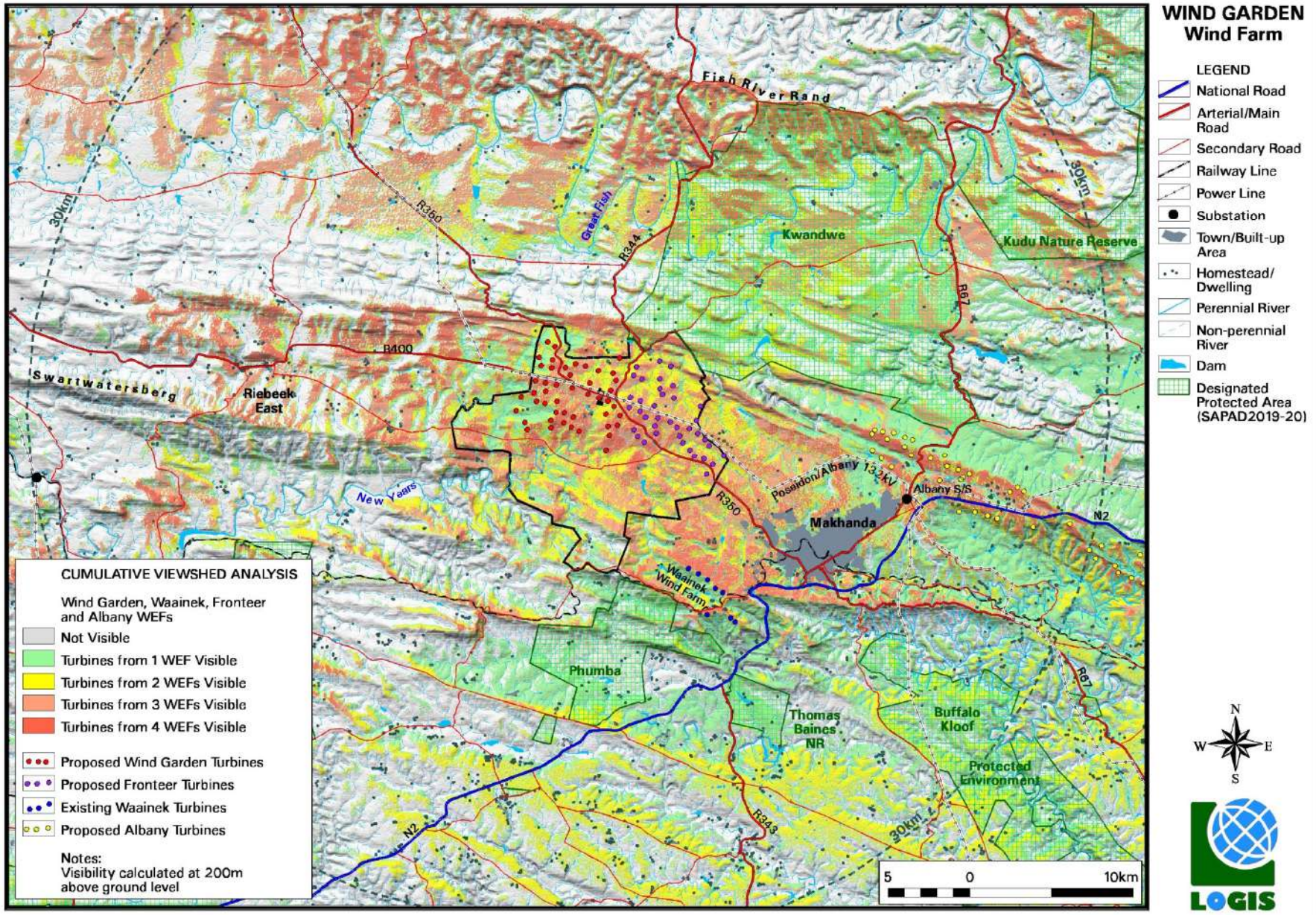
Results

The location of the Waainek and Albany WEFs on ridges to the south and to the north of the *plateau* has as an effect that the wind turbines are visible over larger areas to the south and to the north. The overall combined areas of higher cumulative visual exposure over shorter distances are primarily located on the *plateau*. Longer distance cumulative visual exposure may occur further north along the south facing slopes of the Fish River Rand.

The areas of higher cumulative visual exposure contain sensitive visual receptors in the form of residents of homesteads and observers travelling along the arterial or regional roads traversing the *plateau*. Even though the Waainek WEF only consists of eight wind turbines, the combined number of wind turbines within a 30km radius (should all be constructed) may be up to 136, potentially resulting in cumulative visual impacts ranging from moderate to high significance.



Map 4: Viewshed analysis of the proposed Wind Garden WEF.



Map 5: Cumulative viewshed analysis of the proposed Wind Garden, Fronteer, Albany and Waainek WEF turbines.

6.3. Visual distance / observer proximity to the WEF

The proximity radii are based on the anticipated visual experience of the observer over varying distances. The distances are adjusted upwards for larger WEFs (e.g. more than 50 wind turbines) and downwards for smaller WEFs (e.g. less than 50 turbines). This methodology was developed in the absence of any known and/or accepted standards for South African WEFs.

The principle of reduced impact over distance is applied in order to determine the core area of visual influence for these types of structures. It is envisaged that the nature of the structures and the rural character of the study area would create a significant contrast that would make the facility visible and recognisable from greater distances.

The proximity radii for the wind turbines were 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. It should be noted that even though the proximity radii are indicated as (near) concentric circles from the wind turbines, the visual prominence of the structures will only apply where they are visible, as determined in the previous section (**Section 6.1**) of this report.

The proximity radii, based on the dimensions of the proposed development footprint are indicated on **Map 6**, and include the following:

- 0 - 5km. Short distance view where the WEF would dominate the frame of vision and constitute a very high visual prominence.

- 5 – 10km. Short to medium distance view where the structures would be easily and comfortably visible and constitute a high visual prominence.

- 10 - 20km. Medium to long distance view where the facility would become part of the visual environment, but would still be visible and recognisable. This zone constitutes a moderate visual prominence.

- > 20km. Long distance view of the facility where the structures are not expected to be immediately visible and not easily recognisable. This zone constitutes a lower visual prominence for the facility.

Figure 11: Schematic representation of a wind turbine from 1, 2, 5 and 10km under perfect viewing conditions.

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 potentially negative visual perception of the proposed facility.

6.4. 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 or if the visual perception of the structure is favourable to all the observers, there would be no visual impact.

It is 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, purpose of sighting, etc. which would create a myriad of options.

General

Viewer incidence is calculated to be the highest along the arterial and secondary roads within the study area. Commuters and tourists using these roads may be negatively impacted upon by visual exposure to the WEF. Additional potentially sensitive visual receptors are residents and visitors to the homesteads and rural

residences within the study area, as well as tourists visiting the nature reserves and game farms within the region.

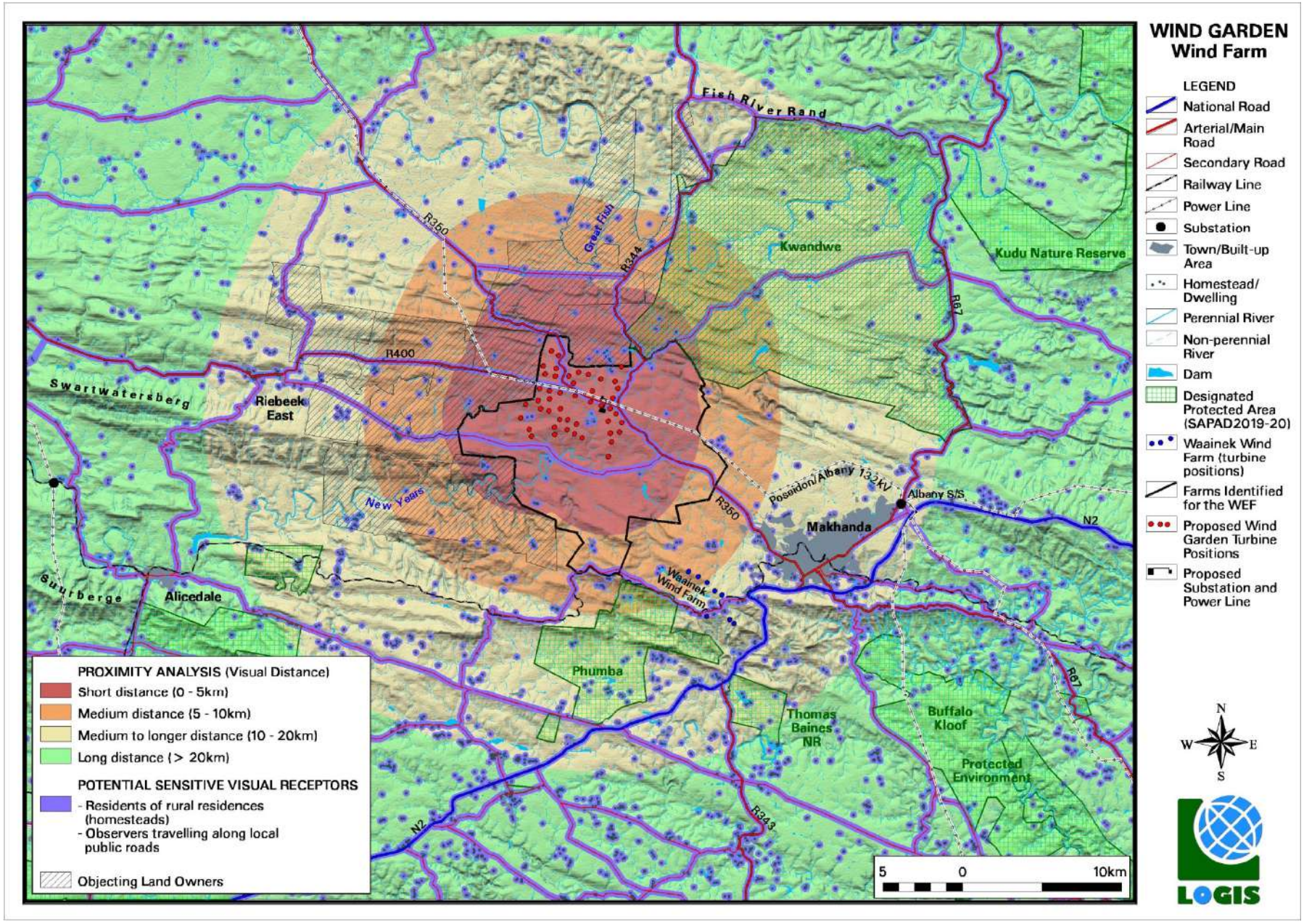
Refer to **Map 6** for the location of the potential sensitive visual receptors discussed above.

Specific objections

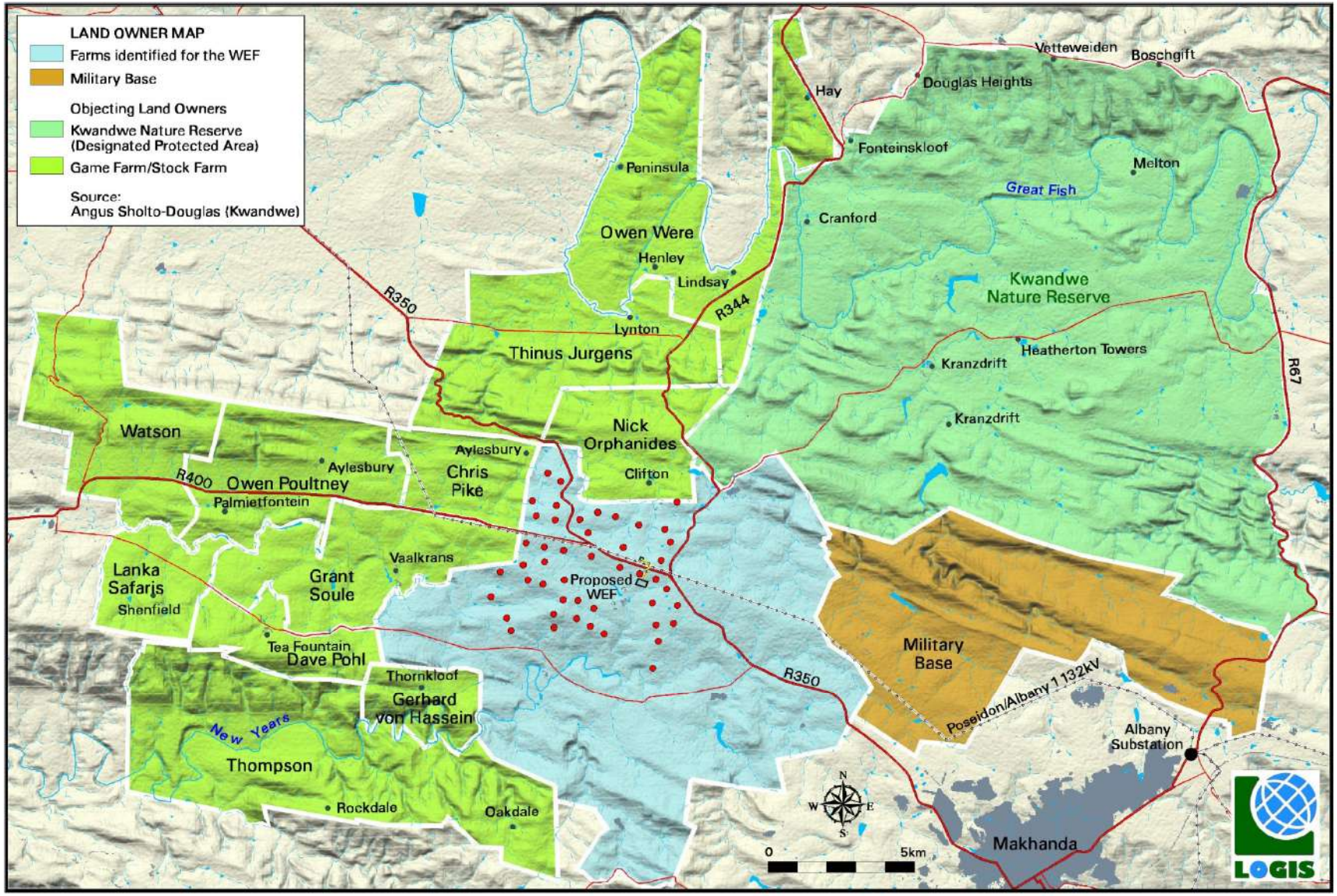
The author received information relating to specific landowners during the fieldwork that have objected to the construction and operation of wind farms within closer proximity to their properties. The landowners' farms are indicated on **Map 7** and are listed as follows:

- Kwandwe Nature Reserve (adjacent)
- Owen Were (nonadjacent landowner)
- Thinus Jurgens (adjacent landowner)
- Nick Orphanides (adjacent landowner)
- Chris Pike (Lukhanyo) (adjacent landowner)
- Owen Poultney (nonadjacent landowner)
- Watson (Sabela Safaris) (nonadjacent landowner)
- Grant Soule (adjacent landowner)
- Lanka Safaris (nonadjacent landowner)
- Dave Pohl (adjacent landowner)
- Thompson (Rockdale) (adjacent landowner)
- Gerhard von Hassein (adjacent landowner)

It is expected that these landowners may experience visual impacts ranging from moderate to high, depending on their farm's proximity to the wind turbine structures, and due to their sensitivity (aversion) to the infrastructure.



Map 6: Proximity analysis and potential sensitive visual receptors.



Map 7: Landowner map.

6.5. Visual absorption capacity

The land cover within the study area is dominated by *grassland* and *shrub land.*

Shrub land and low fynbos is described as:

*Communities dominated by low, **woody**, self-supporting, multi-stemmed plants, branching at or near the ground, between 0.2 and 2 m in height. Total tree cover < 0.1. Typical examples are low Fynbos, Karoo and Lesotho (alpine) communities.*

Grassland is described as:

Natural / semi-natural grass dominated areas, where typically the tree and / or bush canopy densities are typically < ± 20 %, but may include localised denser areas up to ± 40 %, (regardless of canopy heights). It includes open grassland, and sparse bushland and woodland areas, including transitional wooded grasslands. May include planted pasture (i.e. grazing) if not irrigated. Irrigated pastures will typically be classified as cultivated.

Overall, the Visual Absorption Capacity (VAC) of the receiving environment and especially the area in close proximity to the proposed WEF is deemed low by virtue of the nature of the vegetation (grassland) and the low occurrence of urban development.

The significant height of wind turbine structures adds to the potential visual intrusion of the WEF against the background of the horizon. In addition, the scale and form of the structures mean that it is unlikely that the environment will visually absorb them in terms of texture, colour, form and light/shade characteristics.

Where *thicket and dense bushland* occurs, or where exotic vegetation had been planted along roads, or at homesteads and settlements, the VAC will be higher.

Within the built-up areas of Makhanda, Riebeek East and Alicedale the VAC will be of relevance, due to the presence of buildings and structures, referred to as visual clutter. In this respect, the presence of the built-up environment will absorb the visual impact.

6.6. Visual impact index

The combined results of the visual exposure, viewer incidence/perception and visual distance of the proposed Wind Garden WEF are displayed on **Map 8**. Here the weighted impact and the likely areas of impact have been indicated as a visual impact index. Values have been assigned for each potential visual impact per data category and merged in order to calculate the visual impact index.

The criteria (previously discussed in this report) which inform the visual impact index are:

- Visibility or visual exposure of the structures
- Observer proximity or visual distance from the structures
- The presence of sensitive visual receptors
- The perceived negative perception or objections to the structures
- The visual absorption capacity of the vegetation cover or built structures (if applicable)

An area with short distance visual exposure to the proposed infrastructure, a high viewer incidence and a potentially negative perception (i.e. a sensitive visual receptor) would therefore have a **higher** value (greater impact) on the index. This helps in focussing the attention to the critical areas of potential impact and determining the potential **magnitude** of the visual impact.

General

The index indicates that **potentially sensitive visual receptors** within a 5km radius of the WEF may experience a **very high** visual impact. The magnitude of visual impact on sensitive visual receptors subsequently subsides with distance to; **high** within a 5 – 10km radius (where sensitive receptors are present) and **moderate** within a 10 – 20km radius. Receptors beyond 20km are expected to have a **low** potential visual impact.

Specific objections

Where specific objections were raised against the construction and operation of the WEF (see **Section 6.4**) the 10 – 20km radius category includes a potentially **high** classification, due to the expressed sensitivity or aversion of the landowners to wind turbine structures. This aversion to wind energy infrastructure was explicitly communicated to the author during site visits to the potentially affected properties. The author cannot disregard these objections and cannot speculate as to the legitimacy thereof or motivation therefor i.e. it is accepted at face value and is therefore addressed in this report.

Potentially affected visual receptors with specific objections to the proposed WEF located within a 20km radius of the proposed WEF are shown on **Map 9**.

Magnitude of the potential visual impact

The WEF may have a **very high** visual impact on the following observers (within a 5km radius):

Residents of/visitors to:

- Broadfield
- Table Farm
- Brakkloof
- Thursford
- Hounslow
- Hilton

Note:

The location of these properties on the farms earmarked for the Wind Garden WEF reduces the probability of this impact occurring i.e. it is assumed that they are supportive of the WEF development on the affected properties.

Residents of/visitors to:

- Vaalkrans (Grant Soule)
- Aylesbury 1 (Chris Pike)
- Thornkloof (Gerhard von Haissein)
- Clifton (Nick Orphanides)

Observers travelling along the:

- The R400, R350 and R344 arterial roads
- The Riebeek East secondary road

The WEF may have a **high** visual impact on the following observers (5 – 10km radius):

Residents of/visitors to:

- Oakdale and Rockdale (Thompson)
- Tea Fountain (Dave Pohl)
- Palmietfontein and Aylesbury 2 (Owen Poultney)
- Burntkraal
- Strowan
- Slaaikraal
- Lynton (Thinus Jurgens)
- Henley and Lindsay (Owen Were)
- Kranzdrift (1 and 2 Kwandwe Nature Reserve)

The WEF may have a **high** visual impact on the following **objecting landowners** located between a 10 – 20km radius of the wind turbine structures:

Residents of/visitors to:

- Shenfield (Lanka Safaris)
- Peninsula (Owen Were)
- Douglas Heights, Cranford, Heatherton Towers, Melton, Beaumont and Vetteweiden (all located within the Kwandwe Nature Reserve)

The WEF may have a **moderate** visual impact on the following observers located between a 10 – 20km radius of the wind turbine structures:

Residents of/visitors to:

- Witteklip
- Dalton
- Kleindeel
- Coldsprings
- Hillandale
- Coldsprings Annexe
- Mooimeisiesfontein
- Uitspan
- Moreson
- Grootfontein
- Carlisle Bridge
- Middleton
- Rockhurst
- Skelmdrif
- The Echo
- Willowford
- Mayfair
- Coniston
- Kromkrans
- Markwood
- Kleinfontein
- Die Hoek
- Glen Craig
- Mayfield
- Hay

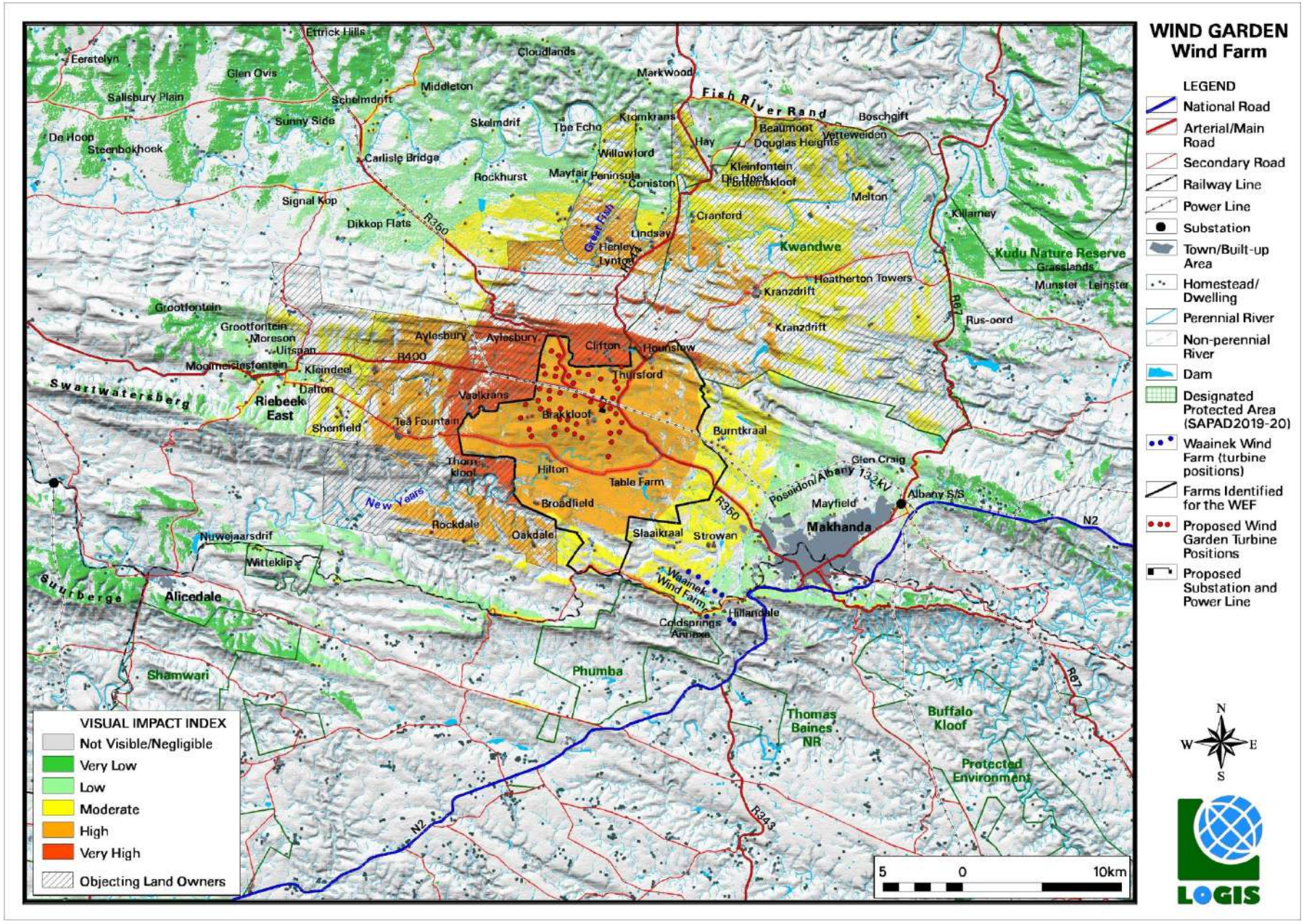
- Cloudlands
- Dikkop Flats
- Signal Kop
- Boschgift (Kwandwe Nature Reserve)

The WEF may have a **low** visual impact on the following observers located beyond a 20km radius of the wind turbine structures:

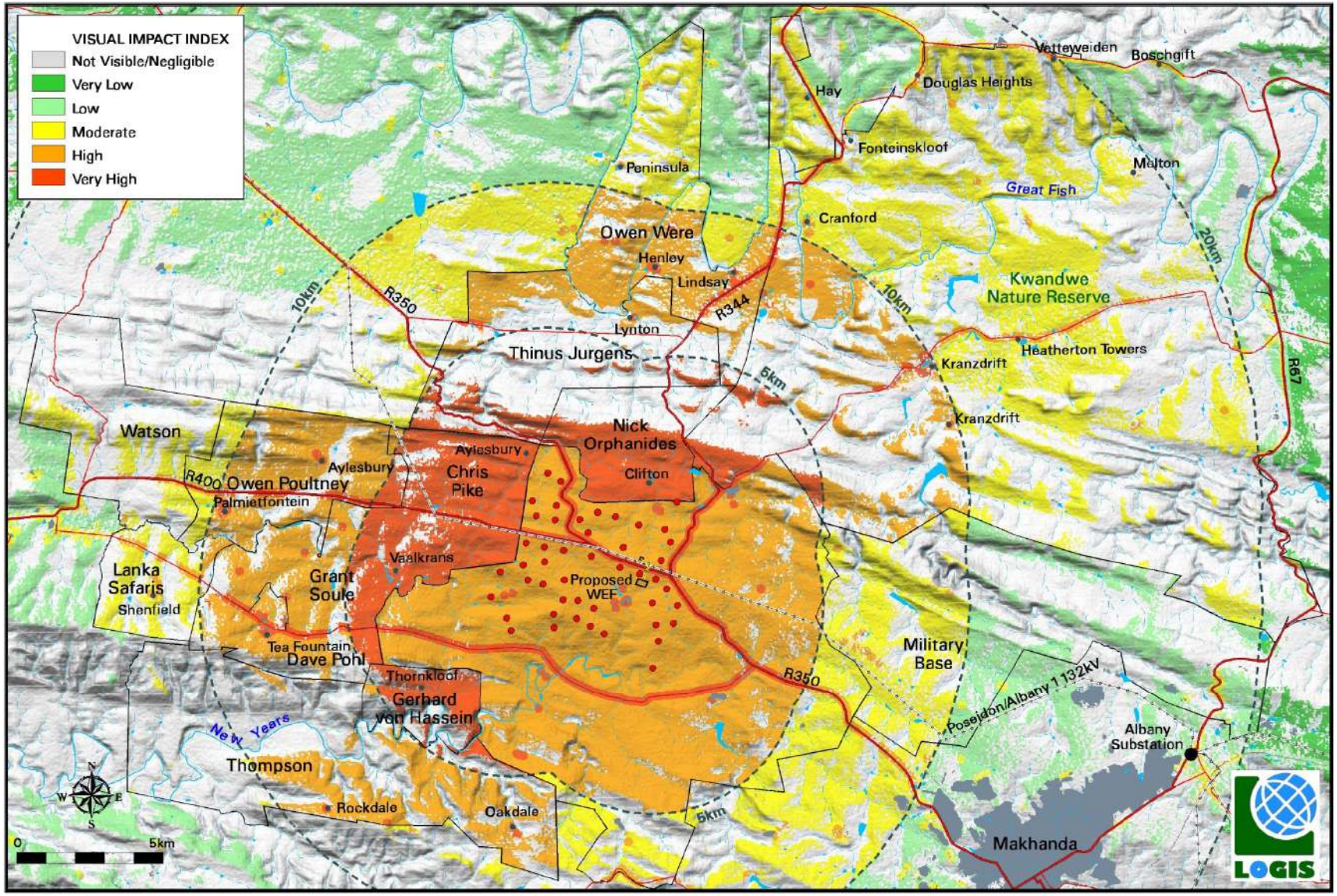
Residents of/visitors to:

- Nuwejaarsdrif
- Grootfontein (1 and 2)
- De Hoop
- Steenbokhoek
- Salisbury Plain
- Eerstelyn
- Sunny Side
- Schelmdrift
- Ettrick Hills
- Killarney
- Rus-oord
- Grasslands
- Munster
- Leinster
- Glen Ovis

Note:
Where homesteads are derelict or deserted, the visual impact will be non-existent, until such time as it is inhabited again.



Map 8: Visual impact index.



Map 9: Visual impact index for objecting landowners.

7. PHOTO SIMULATIONS

Photo simulations were undertaken (in addition to the above spatial analyses) in order to illustrate the potential visual impact of the proposed Wind Garden WEF within the receiving environment. The purpose of the photo simulation exercise is to support/verify the findings of the VIA, and is not an exercise to illustrate what the facility will look like from all directions (i.e. it is not an artist's impression).

The photo simulations indicate the anticipated visual alteration of the landscape from various sensitive visual receptors located at different distances from the facility. The simulations are based on the wind turbine dimensions and layout.

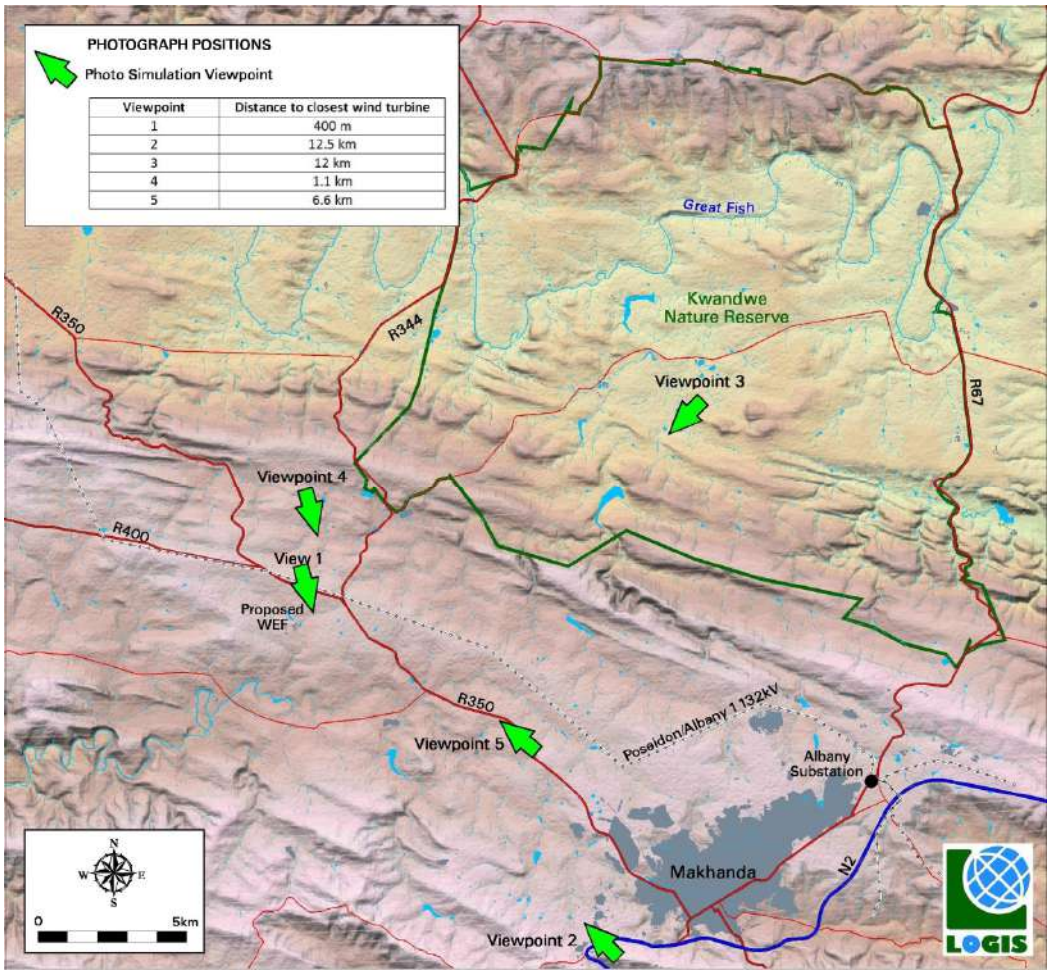
The photograph positions are indicated on **Map 10** below and should be referenced with the photo simulation being viewed in order to place the observer in spatial context.

The simulated views show the placement of the wind turbines during the long-term operation 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. The additional infrastructure (e.g. the proposed substation, access roads, etc.) associated with the facility is not included in the photo simulations.

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 photo simulations are displayed as "before" and "after" views of the affected landscape. Due to the limitation of displaying the photo-montages at the correct scale within an A4 report, each photo-simulation will be provided with an additional enlarged section of the photo at the approximate correct scale. Ideally the original photo-simulations should be distributed as digital appendixes with this report.



Map 10: Photograph positions.

7.1. Viewpoint 1: before construction (**Figure 12:** Photo simulation 1 - before).

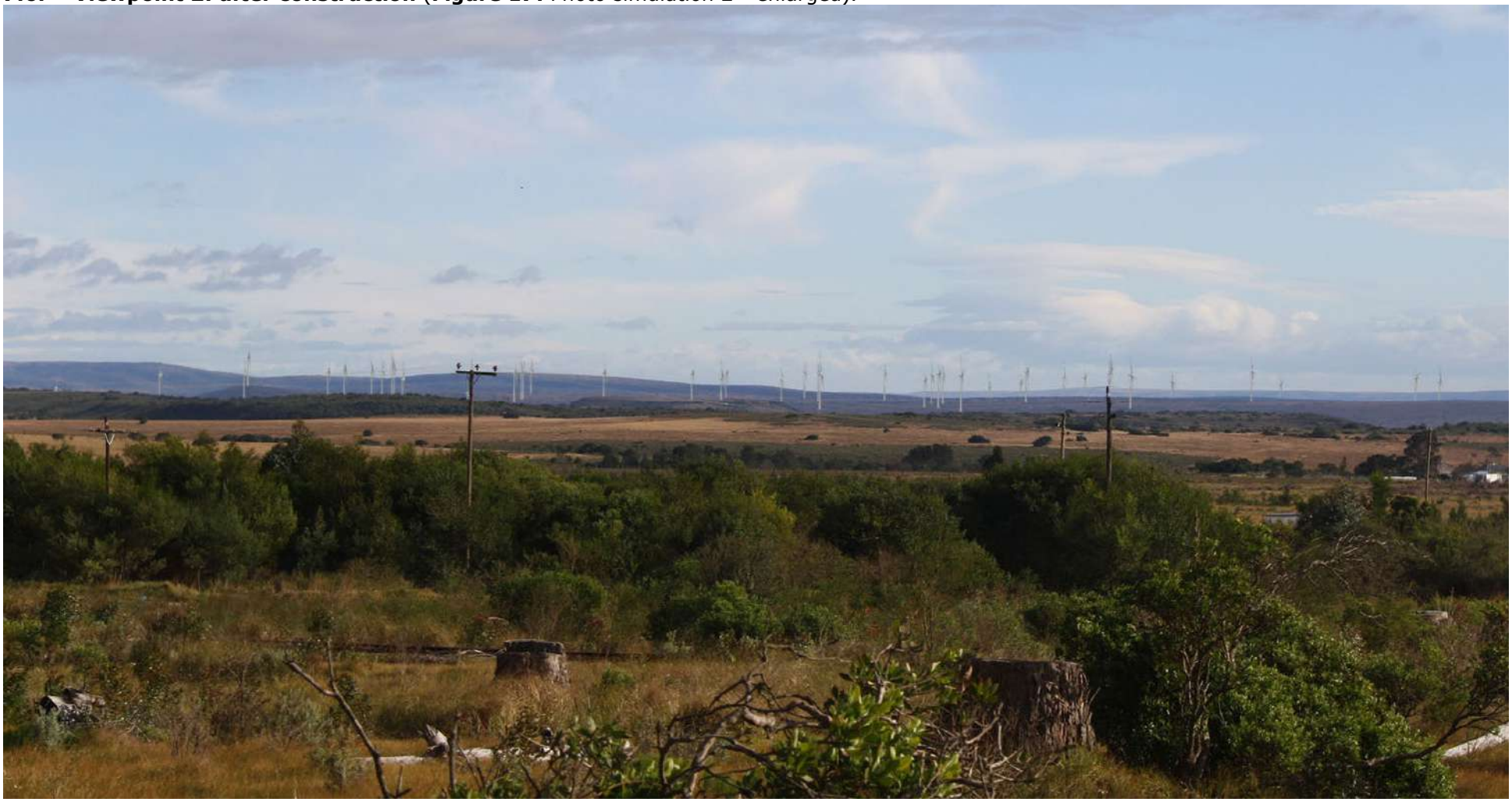
7.2. Viewpoint 1: after construction (Figure 13: Photo simulation 1 - after). *The closest wind turbine is 400m from this point*.

7.3. Viewpoint 1: after construction (Figure 14: Photo simulation 1 - enlarged).

7.4. Viewpoint 2: before construction (**Figure 15:** Photo simulation 2 - before).

7.5. Viewpoint 2: after construction (**Figure 16:** Photo simulation 2 - after). *The closest wind turbine is 12.5km from this point*.

7.6. Viewpoint 2: after construction (**Figure 17:** Photo simulation 2 - enlarged).



7.7. Viewpoint 3: before construction (**Figure 18:** Photo simulation 3 - before).

7.8. Viewpoint 3: after construction (**Figure 19:** Photo simulation 3 - after). *The closest wind turbine is 12km from this point*.

7.9. Viewpoint 3: after construction (**Figure 20:** Photo simulation 3 - enlarged).

7.10. Viewpoint 4: before construction (**Figure 21:** Photo simulation 4 - before).

7.11. Viewpoint 4: after construction (**Figure 22:** Photo simulation 4 - after). *The closest wind turbine is 1.1km from this point*.

7.12. Viewpoint 4: after construction (**Figure 23:** Photo simulation 4 - enlarged).

7.13. Viewpoint 5: before construction (**Figure 24:** Photo simulation 5 - before).

7.14. Viewpoint 5: after construction (**Figure 25:** Photo simulation 5 - after). *The closest wind turbine is 6.6km from this point*.

7.15. Viewpoint 5: after construction (**Figure 26:** Photo simulation 5 - enlarged).

8. VISUAL IMPACT ASSESSMENT

8.1. Impact rating methodology

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 3: 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 alignment) and includes a table quantifying the potential visual impact according to the following criteria:

- **Extent** - site only (very low = 1), local (low = 2), regional (medium = 3), national (high = 4) or international (very high = 5)[5].
- **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 (= 2), low (= 4), medium/moderate (= 6), high (= 8) and very high (= 10)[6].
- **Probability** – very improbable (= 1), improbable (= 2), probable (= 3), highly probable (= 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, duration and extent (i.e. **significance = consequence (magnitude + 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)
- 30-60 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)

[5] Local = within 5km of the development site. Regional = between 5-10km (and potentially up to 20km) from the development site.

[6] This value is read from the visual impact index. Where more than one value is applicable, the higher of these will be used as a worst case scenario.

8.2. Visual impact assessment

The primary visual impacts of the proposed WEF are assessed as follows:

8.2.1. Construction impacts

Potential visual impact of construction activities on sensitive visual receptors in close proximity to the proposed WEF.

During construction, there may 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 landowners in the area.

Construction activities may potentially result in a **moderate** (significance rating = 48) temporary visual impact, both before and after mitigation (significance rating = 30).

Table 2: Visual impact of construction on sensitive visual receptors in close proximity to the proposed WEF.

Nature of Impact: Visual impact of construction activities on sensitive visual receptors in close proximity to the proposed WEF.		
	Without mitigation	***With mitigation***
Extent	Local **(2)**	Local **(2)**
Duration	Short term **(2)**	Short term **(2)**
Magnitude	High **(8)**	Moderate **(6)**
Probability	Highly Probable **(4)**	Probable **(3)**
Significance	Moderate **(48)**	Moderate **(30)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible (1)	Reversible (1)
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation: Planning: ➢ Retain and maintain natural vegetation in all areas outside of the development footprint. Construction: ➢ Ensure that vegetation is not unnecessarily removed during the construction period. ➢ Plan the placement of lay-down areas and temporary construction equipment camps in order to minimise vegetation clearing (i.e. in already disturbed areas) where possible. ➢ Restrict the activities and movement of construction workers and vehicles to the immediate construction site and existing access roads. ➢ Ensure that rubble, litter, and disused construction materials are appropriately stored (if not removed daily) and then disposed of regularly at licensed waste facilities. ➢ Reduce and control construction dust using approved dust suppression techniques as and when required (i.e. whenever dust becomes apparent). ➢ Restrict construction activities to daylight hours whenever possible in order to reduce lighting impacts. ➢ Rehabilitate all disturbed areas immediately after the completion of construction works.		

Cumulative impacts: None.
Residual impacts: None, provided that rehabilitation works are carried out as required.

8.2.2. Potential visual impact on sensitive visual receptors (residents and visitors) located within a 5km radius of the wind turbine structures

The operation of the Wind Garden WEF is expected to have a **high** visual impact (significance rating = 64) on observers/visitors residing at homesteads within a 5km radius of the wind turbine structures. This includes:

- Vaalkrans (Grant Soule)
- Aylesbury 1 (Chris Pike)
- Thornkloof (Gerhard von Haissein)
- Clifton (Nick Orphanides)

The following WEF properties are provisionally included, due to their assumed support for the WEF.

- Broadfield
- Table Farm
- Brakkloof
- Thursford
- Hounslow
- Hilton

No mitigation of this impact is possible (i.e. the structures will be visible regardless), but general mitigation and management measures are recommended as best practice. The table below illustrates this impact assessment.

Table 3: Visual impact on observers (residents and visitors) in close proximity to the proposed wind turbine structures.

Nature of Impact: Visual impact on observers (residents at homesteads and visitors/tourists) in close proximity (i.e. within 5km) to the wind turbine structures		
	Without mitigation	***With mitigation***
Extent	Local **(2)**	Local **(2)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Very high **(10)**	Very high **(10)**
Probability	Highly probable **(4)**	Highly probable **(4)**
Significance	High **(64)**	High **(64)**
Status (positive, neutral or negative)	Negative	Negative
Reversibility	Reversible (1)	Reversible (1)
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	No, only best practice management measures can be implemented.	

Generic best practise mitigation/management measures: Planning: ➢ Retain/re-establish and maintain natural vegetation in all areas outside of the development footprint/servitude. Operations: ➢ Maintain the general appearance of the facility as a whole. Decommissioning: ➢ Remove infrastructure not required for the post-decommissioning use. ➢ Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications.
Residual impacts: The visual impact will be removed after decommissioning, provided the WEF infrastructure is removed and the area rehabilitated. Failing this, the visual impact will remain.

8.2.3. Potential visual impact on sensitive visual receptors (observers travelling along roads) located within a 5km radius of the wind turbine structures

The operation of the Wind Garden WEF is expected to have a **high** visual impact (significance rating = 64) on observers traveling along the roads within a 5km radius of the wind turbine structures. This includes observers travelling along the:

- The R400, R350 and R344 arterial roads
- The Riebeek East and Kwandwe secondary roads

No mitigation of this impact is possible (i.e. the structures will be visible regardless), but general mitigation and management measures are recommended as best practice. The table below illustrates this impact assessment.

Table 4: Visual impact on observers travelling along roads in close proximity to the proposed wind turbine structures.

Nature of Impact: Visual impact on observers travelling along the roads in close proximity (i.e. within 5km) to the wind turbine structures		
	Without mitigation	***With mitigation***
Extent	Local **(2)**	Local **(2)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Very high **(10)**	Very high **(10)**
Probability	Highly probable **(4)**	Highly probable **(4)**
Significance	High **(64)**	High **(64)**
Status (positive, neutral or negative)	Negative	Negative
Reversibility	Reversible (1)	Reversible (1)
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	No, only best practice management measures can be implemented.	

Generic best practise mitigation/management measures: Planning: ➢ Retain/re-establish and maintain natural vegetation in all areas outside of the development footprint/servitude. Operations: ➢ Maintain the general appearance of the facility as a whole. Decommissioning: ➢ Remove infrastructure not required for the post-decommissioning use. ➢ Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications.
Residual impacts: The visual impact will be removed after decommissioning, provided the WEF infrastructure is removed and the area rehabilitated. Failing this, the visual impact will remain.

8.2.4. Potential visual impact on sensitive visual receptors within the region (5 – 10km radius)

The Wind Garden WEF could have a **high** visual impact (significance rating = 60) on residents of (or visitors to) homesteads within a 5 - 10km radius of the wind turbine structures.

Residents of/visitors to:

- Oakdale and Rockdale (Thompson)
- Tea Fountain (Dave Pohl)
- Palmietfontein and Aylesbury 2 (Owen Poultney)
- Burntkraal
- Strowan
- Slaaikraal
- Lynton (Thinus Jurgens)
- Henley and Lindsay (Owen Were)
- Kranzdrift (1 and 2 Kwandwe Nature Reserve)

No mitigation of this impact is possible (i.e. the structures will be visible regardless), but general mitigation and management measures are recommended as best practice. The table below illustrates this impact assessment.

Table 5: Visual impact of the proposed wind turbine structures within the region (5 – 10km).

Nature of Impact: Visual impact on observers travelling along the roads and residents at homesteads within a 5 – 10km radius of the wind turbine structures		
	Without mitigation	***With mitigation***
Extent	Regional **(3)**	Regional **(3)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	High **(8)**	High **(8)**
Probability	Highly probable **(4)**	Highly probable **(4)**
Significance	High **(60)**	High **(60)**
Status (positive, neutral or negative)	Negative	Negative
Reversibility	Reversible (1)	Reversible (1)
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	No, only best practise measures can be implemented	

Generic best practise mitigation/management measures: Planning: ➢ Retain/re-establish and maintain natural vegetation in all areas outside of the development footprint/servitude. Operations: ➢ Maintain the general appearance of the facility as a whole. Decommissioning: ➢ Remove infrastructure not required for the post-decommissioning use. ➢ Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications.
Residual impacts: The visual impact will be removed after decommissioning, provided the WEF infrastructure is removed and the area rehabilitated. Failing this, the visual impact will remain.

8.2.5. Potential visual impact on objecting sensitive visual receptors within the region (10 – 20km radius)

The Wind Garden WEF could have a **high** visual impact (significance rating = 60) on objecting landowners and residents of (or visitors to) homesteads and tourist facilities within a 10 - 20km radius of the wind turbine structures.

Residents of/visitors to:

- Shenfield (Lanka Safaris)
- Peninsula (Owen Were)
- Fonteinskloof, Douglas Heights, Cranford, Heatherton Towers, Melton, Beaumont and Vetteweiden (al located within Kwandwe Nature Reserve)

Even though the above impact rating could be high, and in spite of the fact that no mitigation of this impact is possible (i.e. the structures will be visible regardless), the rating should be viewed in the context of the following potential moderating factors:

- In most instances the wind turbines will only be partially exposed.
- Fewer turbines is expected to be exposed to the north due to the shielding effect of the escarpment.
- The generally longer distances of observation (i.e. beyond 10km) is expected to mitigate the impact to some degree.

Additional to this, and according to the Socio-Economic Impact Assessment (SEIA) for this project, objections are more likely to be received during the pre-construction stage of the WEF, with more tolerance shown during operations. This is attributed to the fact that initially perceived negative impacts associated with WEFs do not always come to fruition.

It was further found that the construction of the Wind Garden WEF wind turbines would not significantly negatively influence the tourism industry or impede the influx of visitors to tourist facilities or lodges within the region, nor is it expected to negatively impact on property and land values.[7]

The table below illustrates this impact assessment.

[7] Source: Urban Econ Development Economists, 2021.

Table 6: Visual impact on objecting sensitive visual receptors within the region (10 – 20km).

Nature of Impact: Visual impact on objecting sensitive visual receptors within a 10 – 20km radius of the wind turbine structures		
	Without mitigation	***With mitigation***
Extent	Regional **(3)**	Regional **(3)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	High **(8)**	High **(8)**
Probability	Highly probable **(4)**	Highly probable **(4)**
Significance	High **(60)**	High **(60)**
Status (positive, neutral or negative)	Negative	Negative
Reversibility	Reversible (1)	Reversible (1)
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	No, only best practise measures can be implemented	
Generic best practise mitigation/management measures: Planning: ➢ Retain/re-establish and maintain natural vegetation in all areas outside of the development footprint/servitude. Operations: ➢ Maintain the general appearance of the facility as a whole. Decommissioning: ➢ Remove infrastructure not required for the post-decommissioning use. ➢ Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications.		
Residual impacts: The visual impact will be removed after decommissioning, provided the WEF infrastructure is removed and the area rehabilitated. Failing this, the visual impact will remain.		

8.2.6. Potential visual impact on sensitive visual receptors within the region (10 – 20km radius)

The Wind Garden WEF could have a **moderate** visual impact (significance rating = 52) on residents of (or visitors to) homesteads within a 10 - 20km radius of the wind turbine structures.

Residents of/visitors to:

- Witteklip
- Dalton
- Kleindeel
- Coldsprings
- Hillandale
- Coldsprings Annexe
- Mooimeisiesfontein
- Uitspan
- Moreson
- Grootfontein
- Carlisle Bridge
- Middleton
- Rockhurst
- Skelmdrif
- The Echo

- Willowford
- Mayfair
- Coniston
- Kromkrans
- Markwood
- Kleinfontein
- Die Hoek
- Glen Craig
- Mayfield
- Hay
- Cloudlands
- Dikkop Flats
- Signal Kop
- Boschgift (Kwandwe Nature Reserve)

No mitigation of this impact is possible (i.e. the structures will be visible regardless), but general mitigation and management measures are recommended as best practice. The table below illustrates this impact assessment.

Table 7: Visual impact of the proposed wind turbine structures within the region (10 – 20km).

Nature of Impact: Visual impact on observers travelling along the roads and residents at homesteads within a 10 – 20km radius of the wind turbine structures		
	Without mitigation	***With mitigation***
Extent	Regional **(3)**	Regional **(3)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Moderate **(6)**	Moderate **(6)**
Probability	Probable **(4)**	Probable **(4)**
Significance	Moderate **(52)**	Moderate **(52)**
Status (positive, neutral or negative)	Negative	Negative
Reversibility	Reversible (1)	Reversible (1)
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	No, only best practise measures can be implemented	
Generic best practise mitigation/management measures: Planning: ➢ Retain/re-establish and maintain natural vegetation in all areas outside of the development footprint/servitude. Operations: ➢ Maintain the general appearance of the facility as a whole. Decommissioning: ➢ Remove infrastructure not required for the post-decommissioning use. ➢ Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications.		
Residual impacts: The visual impact will be removed after decommissioning, provided the WEF infrastructure is removed and the area rehabilitated. Failing this, the visual impact will remain.		

8.2.7. Shadow flicker

Shadow flicker only occurs when the sky is clear, and when the turbine rotor blades are between the sun and the receptor (i.e. when the sun is low). De Gryse in Scenic Landscape Architecture (2006) found that "*most shadow impact is*

associated with 3-4 times the height of the object". Based on this research, an 800m buffer along the edge of the outer most turbines is identified as the zone within which there is a risk of shadow flicker occurring.

There are no places of residence within the 800m buffer. The significance of shadow flicker is therefore anticipated to be **low** to **negligible**.

Table 8: Visual impact of shadow flicker on sensitive visual receptors in close proximity to the proposed WEF.

Nature of Impact: Visual impact of shadow flicker on sensitive visual receptors in close proximity to the proposed WEF.		
	Without mitigation	***With mitigation***
Extent	Local **(2)**	Local **(2)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Low **(4)**	Low **(4)**
Probability	Improbable **(2)**	Improbable **(2)**
Significance	Low **(20)**	Low **(20)**
Status (positive, neutral or negative)	Negative	Negative
Reversibility	Reversible (1)	Reversible (1)
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	N.A. due to the low probability of occurrence	
Generic best practise mitigation/management measures: N.A.		
Residual impacts: N.A.		

8.2.8. Lighting impacts

Potential visual impact of operational, safety and security lighting of the facility at night.

The area immediately surrounding the proposed facility has a relatively low incidence of receptors and light sources, so light trespass and glare from the security and after-hours operational lighting for the facility will have some significance for visual receptors in close proximity.

Another source of glare light, albeit not as intense as flood lighting, 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. This is especially true due to the strobing effect of the lights, a function specifically designed to attract the observer's attention. The Civil Aviation Authority (CAA) prescribes these warning lights and the potential to mitigate their visual impacts have traditionally been very low other than to restrict the number of lights to turbines that delineate the outer perimeter of the facility.

Figure 27: Aircraft warning lights fitted to the wind turbine hubs (Source: http://www.pinchercreekecho.com/2015/04/29/md-of-pincher-creek-takes-on-wind-turbine-lights.)

Some ground-breaking new technology in the development of strobing lights that only activate when an aircraft is detected nearby may aid in restricting light pollution at night and should be investigated and implemented by the project proponent, if available and permissible by the CAA. This new technology is referred to as *needs-based night lights,* which basically deactivates the wind turbine's night lights when there is no flying object within the airspace of the WEF. The system relies on the active detection of aircraft by radar sensors, which relays a switch-on signal to the central wind farm control to activate the obstacle lights. See diagram in **Figure 13** below.[8]

[8] Source: Nordex Energy GmbH, 2019

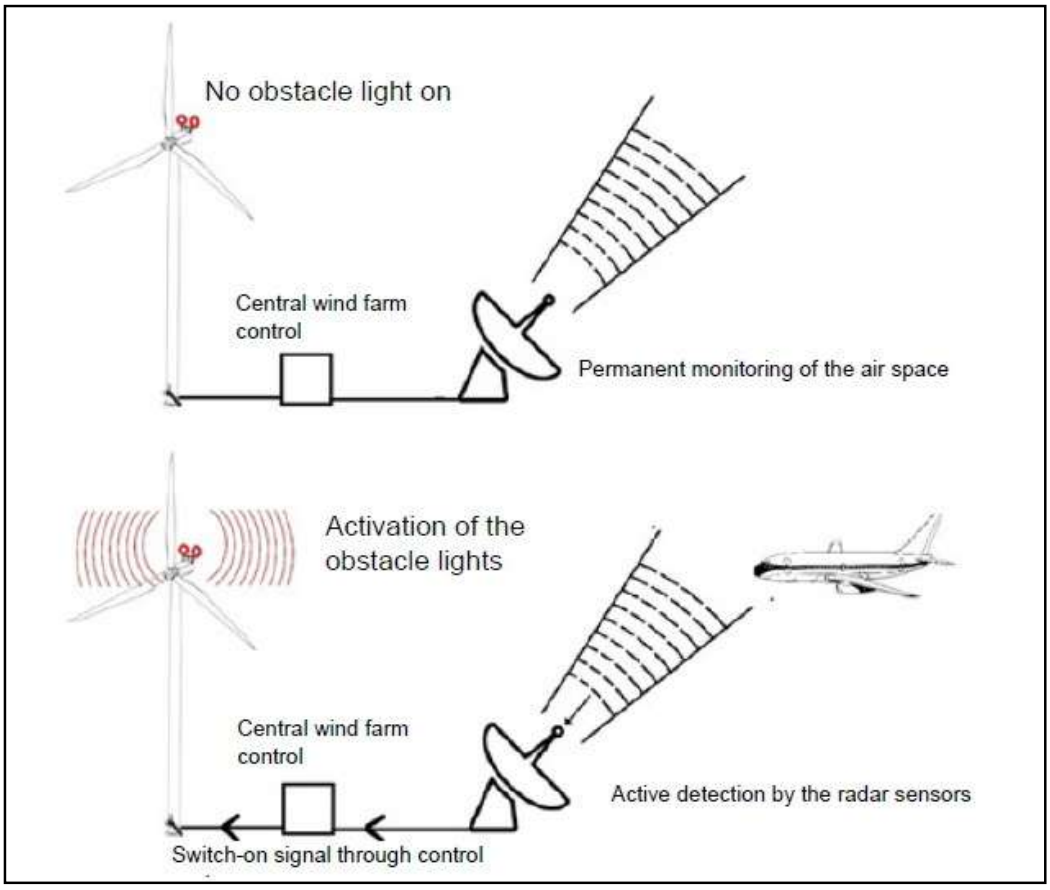


Figure 28: Diagram of the functional principle of the needs-based night lights.

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.

This anticipated lighting impact is likely to be of **high** significance (rating = 60), and may be mitigated to **moderate** (rating = 45) especially within a 5 to 10km radius of the wind turbine structures.

Table 9: Impact table summarising the significance of visual impact of lighting at night on visual receptors in close to medium proximity (5-10km) to the proposed WEF.

Nature of Impact: Visual impact of lighting at night on sensitive visual receptors.		
	No mitigation	***Mitigation considered***
Extent	Local/Regional **(3)**	Local/Regional **(3)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	High **(8)**	High **(8)**
Probability	Highly probable **(4)**	Probable **(3)**
Significance	High **(60)**	Moderate **(45)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible (1)	Reversible (1)
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	

Mitigation: Planning & operation: ➢ Implement needs-based night lighting if considered acceptable by the CAA. ➢ Limit aircraft warning lights to the turbines on the perimeter according to CAA requirements, thereby reducing the overall impact. ➢ Shield the sources of light by physical barriers (walls, vegetation, or the structure itself). ➢ Limit mounting heights of lighting fixtures, or alternatively use foot-lights or bollard level lights. ➢ Make use of minimum lumen or wattage in fixtures. ➢ Make use of down-lighters, or shielded fixtures. ➢ Make use of Low Pressure Sodium lighting or other types of low impact lighting. ➢ Make 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.
Cumulative impacts: The construction of additional WEFs (i.e. Wind Garden and Fronteer WEFs) may potentially increase the visual impacts associated with light pollution within an otherwise rural setting.
Residual impacts: The visual impact will be removed after decommissioning, provided the facility and ancillary infrastructure is removed and the area rehabilitated. Failing this, the visual impact will remain.

8.2.9. Ancillary infrastructure

On-site ancillary infrastructure associated with the WEF includes a 33/132kV substation and collector substation, 132kV power line, underground 33kV cabling between the wind turbines, internal access roads, workshop and office and staff accommodation. No dedicated viewshed analyses have been generated for the ancillary infrastructure, as the range of visual exposure will fall within that of the turbines. The anticipated visual impact resulting from this infrastructure is likely to be of **low** significance both before and after mitigation.

Table 10: Visual impact of the ancillary infrastructure.

Nature of Impact: Visual impact of the ancillary infrastructure on observers in close proximity to the structures.		
	Without mitigation	***With mitigation***
Extent	Local **(2)**	Local **(2)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Low **(4)**	Low **(4)**
Probability	Improbable **(2)**	Improbable **(2)**
Significance	Low **(20)**	Low **(20)**
Status (positive, neutral or negative)	Negative	Negative
Reversibility	Reversible (1)	Reversible (1)
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	No, only best practise measures can be implemented	
Generic best practise mitigation/management measures: Planning: ➢ Retain/re-establish and maintain natural vegetation in all areas outside of the development footprint/servitude. Operations: ➢ Maintain the general appearance of the infrastructure. Decommissioning: ➢ Remove infrastructure not required for the post-decommissioning use. ➢ Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications.		

Cumulative impacts: The construction of additional ancillary infrastructure associated with WEFs in the area (i.e. Wind Garden and Fronteer WEFs) may potentially increase the potential cumulative visual impact.
Residual impacts: The visual impact will be removed after decommissioning, provided the ancillary infrastructure is removed and the area rehabilitated. Failing this, the visual impact will remain.

8.3. Visual impact assessment: secondary impacts

8.3.1. The potential impact on the sense of place of the region.

Sense of place refers to a unique experience of an environment by a user, based on his or her cognitive experience of the place. Visual criteria, specifically the visual character of an area (informed by a combination of aspects such as topography, level of development, vegetation, noteworthy features, cultural / historical features, etc.), play a significant role.

An impact on the sense of place is one that alters the visual landscape to such an extent that the user experiences the environment differently, and more specifically, in a less appealing or less positive light.

The greater environment has a rural, undeveloped character and a natural appearance. These generally undeveloped landscapes are considered to have a high visual quality.

The significance of the visual impacts on the sense of place within the **region** (i.e. beyond a 20km radius of the development and within the greater region) is expected to be of **low** significance.

No mitigation of this impact is possible (i.e. the structures will be visible regardless), but general mitigation and management measures are recommended as best practice. The table below illustrates this impact assessment.

Table 11: The potential impact on the sense of place of the region.

Nature of Impact: The potential impact on the sense of place of the region.		
	Without mitigation	***With mitigation***
Extent	Regional **(3)**	Regional **(3)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Low **(4)**	Low **(4)**
Probability	Improbable **(2)**	Improbable **(2)**
Significance	Low **(22)**	Low **(22)**
Status (positive, neutral or negative)	Negative	Negative
Reversibility	Reversible (1)	Reversible (1)
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	No, only best practise measures can be implemented	

Generic best practise mitigation/management measures: Planning: ➢ Retain/re-establish and maintain natural vegetation in all areas outside of the development footprint/servitude. Operations: ➢ Maintain the general appearance of the facility as a whole. Decommissioning: ➢ Remove infrastructure not required for the post-decommissioning use. ➢ Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications.
Residual impacts: The visual impact will be removed after decommissioning, provided the WEF infrastructure is removed and the area rehabilitated. Failing this, the visual impact will remain.

8.3.2. The potential cumulative visual impact of the wind farms on the visual quality of the landscape.

The cumulative visual impact of the proposed Wind Garden, Waainek, Fronteer and Albany WEFs will primarily occur on the *plateau*, but may also occur further north along the south facing slopes of the Fish River Rand.

The cumulative visual impact is expected to be **high**, depending on the observer's sensitivity to wind turbine structures. This impact is relevant in spite of the fact that the wind farms are located in the Cookhouse REDZ.

Table 12: The potential cumulative visual impact of wind farms on the visual quality of the landscape.

Nature of Impact: The potential cumulative visual impact of wind farms on the visual quality of the landscape.		
	Overall impact of the proposed project considered in isolation	***Cumulative impact of the project and other projects in the area***
Extent	Regional **(3)**	Regional **(3)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	High **(8)**	High **(8)**
Probability	Highly probable **(4)**	Highly probable **(4)**
Significance	High **(60)**	High **(60)**
Status (positive, neutral or negative)	Negative	Negative
Reversibility	Reversible (1)	Reversible (1)
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	No	
Mitigation measures: N.A.		
Residual impacts: The visual impact will be removed after decommissioning, provided the WEF infrastructure is removed and the area rehabilitated. Failing this, the visual impact will remain.		

8.4. The potential to mitigate visual impacts

The primary visual impact, namely the appearance of the WEF (the wind turbines) is not possible to mitigate. The functional design of the turbines 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.

Additional to this; any recommendations (refer to the *Avifauna Impact Assessment Report for the Wind Garden Wind Farm*) regarding the painting of one of the three wind turbine blades black to increase the turbine visibility during rotation (as a mitigation measure against bird collisions), will also aggravate the visual impact. In spite of the fact that this recommendation is only relevant for the wind turbines located within *cautionary nest buffer zones,* this recommendation is not supported from a visual impact mitigation perspective.

The overall potential for mitigation is generally low or non-existent. The following mitigation is, however possible:

- It is recommended that vegetation cover (i.e. either natural or cultivated) be maintained in all areas outside of the actual development footprint, both during construction and operation of the proposed WEF. This will minimise visual impact as a result of cleared areas, power line servitudes and areas denuded of vegetation.

- Existing roads should be utilised wherever possible. New roads should be planned taking due cognisance of the topography to limit cut and fill requirements. Construction/upgrade of roads should be undertaken properly, with adequate drainage structures in place to forego potential erosion problems.

- In terms of onsite ancillary buildings and structures, it is recommended that it be planned so that the clearing of vegetation is minimised. This implies consolidating this infrastructure as much as possible and making use of already disturbed areas rather than undisturbed sites wherever possible.

- Install aircraft warning lights that only activate when the presence of an aircraft is detected, if permitted by CAA, and where deemed feasible.

- The Civil Aviation Authority (CAA) prescribes that aircraft warning lights be mounted on the turbines. However, it is possible to mount these lights on the turbines representing the outer perimeter of the facility. In this manner, fewer warning lights can be utilised to delineate the facility as one large obstruction, thereby lessening the potential visual impact.

- Mitigation of other lighting impacts includes the pro-active design, planning and specification lighting for the facility. The correct specification and placement of lighting and light fixtures for the proposed WEF and ancillary infrastructure will go far to contain rather than spread the light. Mitigation measures 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 visual impacts associated with the construction phase, albeit temporary, would entail proper planning, management and rehabilitation of the construction site. Recommended mitigation measures include the following:

  - Ensure that vegetation is not unnecessarily cleared or removed during the construction period.
  - Reduce the construction period through careful logistical planning and productive implementation of resources.
  - Plan the placement of laydown areas and any potential temporary construction camps in order to minimise vegetation clearing (i.e. in already disturbed areas) wherever possible.
  - Restrict the activities and movement of construction workers and vehicles to the immediate construction site and existing access roads.
  - Ensure that rubble, litter, and disused construction materials are appropriately stored (if not removed daily) and then disposed regularly at licensed waste facilities.
  - Reduce and control construction dust through the use of approved dust suppression techniques as and when required (i.e. whenever dust becomes apparent).
  - Restrict construction activities to daylight hours in order to negate or reduce the visual impacts associated with lighting.
  - Rehabilitate all disturbed areas, construction areas, roads, slopes etc. immediately after the completion of construction works. If necessary, an ecologist should be consulted to assist or give input into rehabilitation specifications.

- During operation, the maintenance of the turbines and ancillary structures and infrastructure must be undertaken to ensure that the facility does not degrade, therefore aggravating the visual impact.

- Roads must be maintained to forego erosion and to suppress dust, and rehabilitated areas must be monitored for rehabilitation failure. Remedial actions must be implemented as a when required.

- Once the facility has exhausted its life span, the main facility and all associated infrastructure not required for the post rehabilitation use of the site must be removed and all disturbed areas appropriately rehabilitated. An ecologist must be consulted to give input into rehabilitation specifications.

- All rehabilitated areas should be monitored for at least a year following decommissioning, and remedial actions implemented as and when required.

- Secondary impacts anticipated as a result of the proposed WEF (i.e. visual character and sense of place) are not possible to mitigate. There is also no mitigation to ameliorate the negative visual impacts on roads

frequented by tourists and which provides access to tourist destinations within the region.

Where sensitive visual receptors (as identified in **Section 6.8.2.**) are likely to be affected and where valid objections (as determined by the visual specialist) are raised by these receptors during the application process, it is recommended that the developer investigate the receptor's willingness (and the viability) of screening of visual impacts at the receptor site prior to construction commencing. This may entail the planting of natural vegetation, natural trees or the construction of screens in the pre-dominant direction of impact likely to be experienced by the principal receptor at the site. Ultimately, visual screening is most effective when placed at the receptor itself and should be considered in this context only.

Good practice requires that the mitigation of both primary and secondary visual impacts, as listed above, be implemented and maintained on an ongoing basis.

9. CONCLUSION AND RECOMMENDATIONS

The visual impact assessment (VIA) practitioner takes great care to ensure that all the spatial analyses and mapping is as accurate as possible. The intention is to quantify, using visibility analyses, proximity analyses, photo simulations and the identification of sensitive receptors, the potential visual impacts associated with the proposed Wind Garden WEF. These processes are deemed to be transparent and scientifically defensible when interrogated.

However, visual impact is ultimately a subjective concept. The *subjects* in this case are the residents of, and visitors to the region. The author has attempted to accurately capture the location of these *subjects* (i.e. sensitive visual receptors and areas of likely visual impact) to the best of his ability, drawing on years of experience as a VIA practitioner. The VIA further adopts a risk averse approach in so far as to assume that the perception of most (if not all) of the sensitive visual receptors (bar the landowners of the properties earmarked for the development), would be predominantly negative towards the development of a WEF in the region, especially during the pre-construction stage.

There are likely to be supporters of the Wind Garden WEF (as renewable energy generation is a global priority) amongst the population of the larger region, but they are largely expected to be indifferent to the construction of the WEF and not as vocal in their support for the wind farm as the detractors thereof.

The construction and operation of the proposed Wind Garden WEF and its associated infrastructure, will have a high visual impact on the study area, especially within (but not restricted to) a 5-10km radius of the proposed facility. The visual impact will differ amongst places, depending on the distance from the facility, but will generally be restricted to the *plateau* and the south-facing slopes of the Fish River Rand. Tourists travelling through the region, or visiting tourist facilities within the study area, will however be visually impacted. Residents of settlements and homesteads will likely experience similar visual impacts, where the wind turbine structures are visible.

The combined visual impact or cumulative impact of up to four wind energy facilities (i.e. the existing Waainek WEF, and the proposed Wind Garden, Fronteer and Albany WEFs) is expected to increase the area of potential visual impact within the region. The intensity of visual impact (number of turbines visible) to exposed receptors, especially those located within a 5-10km radius of the proposed Wind Garden WEF, is expected to increase when considered in conjunction with the other existing or proposed WEFs. The fact that these WEFs

are located within a REDZ is not likely to mitigate the potential visual impact on affected sensitive visual receptors.

Overall, the significance of the visual impacts associated with the proposed Wind Garden WEF is expected to be high as a result of the generally undeveloped character of the landscape. The facility would be visible within an area that contains certain sensitive visual receptors who would consider visual exposure to this type of infrastructure to be intrusive. Such visual receptors include people travelling along roads, residents of rural homesteads and settlements and tourists passing through or holidaying in the region.

Conventional mitigation (e.g. such as screening of the structures) of the potential visual impacts is highly unlikely to succeed due to the nature of the development and the receiving environment. A number of mitigation measures have been proposed (**Section 6.10**). The proposed mitigation measures will primarily be effective in terms of mitigating lighting and construction phase visual impacts.

Note: Regardless of whether or not mitigation measures will reduce the significance of the anticipated visual impacts, they are considered to be good practice and should all be implemented and maintained throughout the construction, operation and decommissioning phases of the proposed facility, should it be authorised.

10. IMPACT STATEMENT

The findings of the Visual Impact Assessment undertaken for the proposed Wind Garden WEF is that the visual environment surrounding the site, especially within a 5-10km radius (and potentially up to 20km), will be visually impacted upon for the anticipated operational lifespan of the facility (i.e. 20 - 25 years).

The following is a summary of impacts remaining:

- Construction phase activities may potentially result in a **moderate** temporary visual impact, both before and after mitigation

- The operation of the Wind Garden WEF is expected to have a **high** visual impact on observers/visitors residing at homesteads within a 5km radius of the wind turbine structures. No mitigation of this impact is possible.

- The operation of the Wind Garden WEF is expected to have a **high** visual impact on observers traveling along the roads within a 5km radius of the wind turbine structures. No mitigation of this impact is possible.

- The operation of the Wind Garden WEF could have a **high** visual impact on sensitive visual receptors within the region (5-10km radius of the wind turbine structures). No mitigation of this impact is possible.

- The Fronteer WEF could have a **high** visual impact on **objecting** landowners and residents of (or visitors to) homesteads and tourist facilities within a 10 - 20km radius of the wind turbine structures. However, the operational WEF is not expected to significantly influence the tourism industry negatively or impede the influx of visitors to tourist facilities or lodges within the region.[9]

[9] Source: Urban Econ Development Economists, 2021.

- The Wind Garden WEF could have a **moderate** visual impact on **non-objecting** residents of (or visitors to) homesteads within a 10 - 20km radius of the wind turbine structures.

- There are no places of residence within an 800m buffer from the wind turbine structures. The significance of shadow flicker is therefore anticipated to be **low** to **negligible**.

- The anticipated night-time lighting impact is likely to be of **high** significance and may be mitigated to **moderate**, provided that *needs-based aircraft warning lights* (if permitted by the CAA and deemed feasible), is installed.

- The anticipated visual impact resulting from ancillary infrastructure is likely to be of **low** significance both before and after mitigation.

- The significance of the visual impacts on the sense of place within the region (i.e. beyond a 20km radius of the development and within the greater region) is expected to be of **low** significance.

- The cumulative visual impact of the existing Waainek WEF, and the proposed Wind Garden, Fronteer and Albany WEFs is expected to be of **high** significance.

The anticipated visual impacts listed above (i.e. post mitigation impacts) range from **high** to **low** significance. Anticipated visual impacts on sensitive visual receptors in close proximity to the proposed facility remain high and are not possible to mitigate. Even though it is possible that the potential visual impacts may exceed acceptable levels within the context of the receiving environment (an area with an established tourism industry), the proposed WEF development is not considered to be fatally flawed.

A fatal flaw occurs when:

- There is non-compliance with Acts, Ordinances, By-laws and adopted policies relating to visual pollution, scenic routes, special areas or proclaimed heritage sites.

- Non-compliance with conditions of existing Records of Decision.

- Impacts that may be evaluated to be of high significance and that are considered by the **majority** of stakeholders and decision-makers to be unacceptable.[10]

In terms of the proposed wind turbine layout, the project proponent needs to adhere to all relevant National, Provincial and Local Government regulations and ordinances, including all prescribed health and safety guidelines. If these are not adhered to, the layout may be deemed non-compliant, and may need to be revised in order to ensure compliance. The author is not aware of any non-compliance and the layout is deemed acceptable within this (legal) context.

It is likely that the WEF development will be met with (largely valid) concern and potential opposition from affected land owners and tour operators within the region. The fact that the visual impact is expected to be of high significance is undisputed. However, this report cannot categorically state that any of the above

[10] Source: Oberholzer, B. 2005

conditions were transgressed, nor can it (with the information available to the VIA practitioner) be empirically determined that the *statistical majority* of objecting stakeholders were exceeded. If evidence to the contrary surfaces during the progression of the development application, this statement may need to be revised.

11. MANAGEMENT PROGRAMME

The following 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.

Refer to the tables overleaf.

Table 13: Management programme – Planning.

OBJECTIVE: The mitigation and possible negation of visual impacts associated with the planning of the Proposed Wind Garden WEF.		
Project Component/s	The WEF and ancillary infrastructure (i.e. turbines, access roads, substation, workshop and power line).	
Potential Impact	Primary visual impact of the facility due to the presence of the turbines and associated infrastructure as well as the visual impact of lighting at night.	
Activity/Risk Source	The viewing of the above mentioned by observers on or near the site (i.e. within 5-10km of the site) as well as within the region.	
Mitigation: Target/Objective	Optimal planning of infrastructure to minimise visual impact.	
Mitigation: Action/control	**Responsibility**	**Timeframe**
Retain and maintain natural and / or cultivated vegetation in all areas outside of the development footprint.	Project proponent/ design consultant/ Engineering, Procurement and Construction (EPC) contractor	Early in the planning phase.
Make use of existing roads wherever possible and plan the layout and construction of roads and infrastructure with due cognisance of the topography to limit cut and fill requirements.	Project proponent/ design consultant/ EPC contractor	Early in the planning phase.
Plan all roads, ancillary buildings and ancillary infrastructure in such a way that clearing of vegetation is minimised. Consolidate infrastructure and make use of already disturbed sites rather than undisturbed areas.	Project proponent/ design consultant/ EPC contractor	Early in the planning phase.
Consult a lighting engineer in the design and planning of lighting to ensure the correct specification and placement of lighting and light fixtures for the WEF and the ancillary infrastructure. The following is recommended: o Install aircraft warning lights that only activate when an aircraft is detected (CAA regulations/conditions permitting, and where deemed feasible). o Limit aircraft warning lights for the proposed WEF to the turbines on the perimeter, thereby reducing the overall requirement (CAA regulations/conditions permitting). o Shield the sources of light by physical barriers (walls, vegetation, or the structure itself); o Limit mounting heights of fixtures, or use foot-lights or bollard lights; o Make use of minimum lumen or wattage in fixtures; o Making use of down-lighters or shielded fixtures; o Make use of Low Pressure Sodium lighting or other low impact lighting. o Make use of motion detectors on security lighting, so allowing the site to remain in	Project proponent/ design consultant/ EPC contractor	Early in the planning phase.

darkness until lighting is required for security or maintenance purposes.		
Performance Indicator	Minimal exposure (limited or no complaints from I&APs) of ancillary infrastructure and lighting at night to observers on or near the site (i.e. within 5-10km) and within the region.	
Monitoring	Not applicable.	

Table 14: Management programme – Construction.

OBJECTIVE: The mitigation and possible negation of visual impacts associated with the construction of the Proposed Wind Garden WEF.		
Project Component/s	Construction site and activities	
Potential Impact	Visual impact of general construction activities, and the potential scarring of the landscape due to vegetation clearing and resulting erosion.	
Activity/Risk Source	The viewing of the above mentioned by observers on or near the site.	
Mitigation: Target/Objective	Minimal visual intrusion by construction activities and intact vegetation cover outside of immediate construction work areas.	
Mitigation: Action/control	**Responsibility**	**Timeframe**
Ensure that vegetation is not unnecessarily cleared or removed during the construction period.	Project proponent/ EPC contractor	Early in the construction phase.
Reduce the construction period through careful logistical planning and productive implementation of resources.	Project proponent/ EPC contractor	Early in the construction phase.
Plan the placement of laydown areas and temporary construction equipment camps in order to minimise vegetation clearing (i.e. in already disturbed areas) wherever possible.	Project proponent/ EPC contractor	Early in and throughout the construction phase.
Restrict the activities and movement of construction workers and vehicles to the immediate construction site and existing access roads.	Project proponent/ EPC contractor	Throughout the construction phase.
Ensure that rubble, litter, and disused construction materials are appropriately stored (if not removed daily) and then disposed regularly at licensed waste facilities.	Project proponent/ EPC contractor	Throughout the construction phase.
Reduce and control construction dust through the use of approved dust suppression techniques as and when required (i.e. whenever dust becomes apparent).	Project proponent/ EPC contractor	Throughout the construction phase.
Restrict construction activities to daylight hours in order to negate or reduce the visual impacts associated with lighting.	Project proponent/ EPC contractor	Throughout the construction phase.
Rehabilitate all disturbed areas, construction areas, servitudes etc. immediately after the completion of construction works. If necessary, an ecologist should be consulted to assist or give input into rehabilitation specifications.	Project proponent/ EPC contractor	Throughout and at the end of the construction phase.
Performance Indicator	Vegetation cover on and in the vicinity of the site is intact (i.e. full cover as per natural vegetation within the environment) with no evidence of degradation or erosion.	
Monitoring	Monitoring of vegetation clearing during construction (by contractor as part of the construction contract).	

	Monitoring of rehabilitated areas quarterly for at least a year following the end of construction (by contractor as part of construction contract).

Table 15: Management programme – Operation.

OBJECTIVE: The mitigation and possible negation of visual impacts associated with the operation of the Proposed Wind Garden WEF.		
Project Component/s	The WEF and ancillary infrastructure (i.e. turbines, access roads, substations, workshop and power lines).	
Potential Impact	Visual impact of facility degradation (including operational wind turbines) and vegetation rehabilitation failure.	
Activity/Risk Source	The viewing of the above mentioned by observers on or near the site.	
Mitigation: Target/Objective	Well maintained and neat facility.	
Mitigation: Action/control	**Responsibility**	**Timeframe**
Maintain the general appearance of the facility as a whole, including the turbines, servitudes and the ancillary buildings.	Project proponent/ operator	Throughout the operation phase.
Maintain roads and servitudes to forego erosion and to suppress dust.	Project proponent/ operator	Throughout the operation phase.
Monitor rehabilitated areas, and implement remedial action as and when required.	Project proponent/ operator	Throughout the operation phase.
Performance Indicator	Well maintained and neat facility with intact vegetation on and in the vicinity of the facility.	
Monitoring	Monitoring of the entire site on an ongoing basis (by operator).	

Table 16: Management programme – Decommissioning.

OBJECTIVE: The mitigation and possible negation of visual impacts associated with the decommissioning of the Proposed Wind Garden WEF.		
Project Component/s	The WEF and ancillary infrastructure (i.e. turbines, access roads, substations, workshop and power lines).	
Potential Impact	Visual impact of residual visual scarring and vegetation rehabilitation failure.	
Activity/Risk Source	The viewing of the above mentioned by observers on or near the site.	
Mitigation: Target/Objective	Only the infrastructure required for post decommissioning use of the site retained and rehabilitated vegetation in all disturbed areas.	
Mitigation: Action/control	**Responsibility**	**Timeframe**
Remove infrastructure not required for the post-decommissioning use of the site. This may include the turbines, substations, power lines, ancillary buildings, masts etc.	Project proponent/ operator	During the decommissioning phase.
Rehabilitate access roads and servitudes not required for the post-decommissioning use of the site. If necessary, an ecologist should be consulted to give input into rehabilitation specifications.	Project proponent/ operator	During the decommissioning phase.
Monitor rehabilitated areas quarterly for at least a year following decommissioning, and implement remedial action as and when required.	Project proponent/ operator	Post decommissioning.
Performance Indicator	Vegetation cover on and in the vicinity of the site is intact (i.e. full cover as per natural vegetation within the environment) with no evidence of degradation or erosion.	
Monitoring	Monitoring of rehabilitated areas quarterly for at least a year following	

decommissioning.

12. REFERENCES/DATA SOURCES

CSIR, 2017. *Delineation of the first draft focus areas for Phase 2 of the Wind and Solar PV Strategic Environmental Assessment.*

CSIR, 2015. *The Strategic Environmental Assessment for wind and solar photovoltaic energy in South Africa.*

Chief Directorate National Geo-Spatial Information, varying dates. *1:50 000 Topo-cadastral Maps and Data.*

DEA, 2014. *National Land-cover Database 2013-14 (NLC2013-14).*

DEA, 2019. *South African Protected Areas Database (SAPAD_OR_2019_Q4).*

DEA&DP, 2011. Provincial Government of the Western Cape. *Guideline on Generic Terms of Reference for EAPS and Project Schedules.*

DEA&DP, 2016. *Western Cape Regional Environmental Assessment for Wind Energy Facility Developments.*

Department of Environmental Affairs and Tourism (DEA&T), 2001. *Environmental Potential Atlas (ENPAT) for the Eastern Cape Province.*

https://www.indaloreserves.com/ (Indalo Protected Environment website)

https://www.windpowerengineering.com/projects/site-assessment/assessing-cumulative-visual-impacts-for-wind-projects/

http://www.pinchercreekecho.com/2015/04/29/md-of-pincher-creek-takes-on-wind-turbine-lights

Landscape Institute, 2018. *Guidelines for Landscape and Visual Impact Assessment (3rd edition).*

LUC (Environmental Planning, Design and Management), 2014. *Cumulative Landscape and Visual Assessment of Wind Energy in Caithness.*

NASA, 2018. *Earth Observing System Data and Information System (EOSDIS).*

National Botanical Institute (NBI), 2004. *Vegetation Map of South Africa, Lesotho and Swaziland (Unpublished Beta Version 3.0)*

Nordex Energy GmbH, 2019*. Interface for needs-based night light (Document No. 2003253EN).*

Oberholzer, B. (2005). *Guideline for involving visual and aesthetic specialists in EIA processes: Edition 1.*

Scottish Natural Heritage, 2012. *Assessing the cumulative impact of onshore wind energy developments*.

The Environmental Impact Assessment Amendment Regulations. In Government Gazette Nr 33306, 18 June 2010.

Urban Econ Development Economists, 2021. *Environmental Impact Assessment for the Proposed Wind Garden (Pty) Ltd Wind Energy Facility and Associated Infrastructure in the Eastern Cape. Socio-Economic Impact Assessment Report*.