PROPOSED AMAKHALA EMOYENI WIND ENERGY FACILITY
VISUAL IMPACT ASSESSMENT

Produced for:

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(WD)

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

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

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

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

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

1. INTRODUCTION

Windlab Developments South Africa Pty Ltd (Windlab) identified the area south of Cookhouse, Bedford and Adelaide in the Eastern Cape Province as a potential location for the construction and operation of a Wind Energy Facility (WEF).

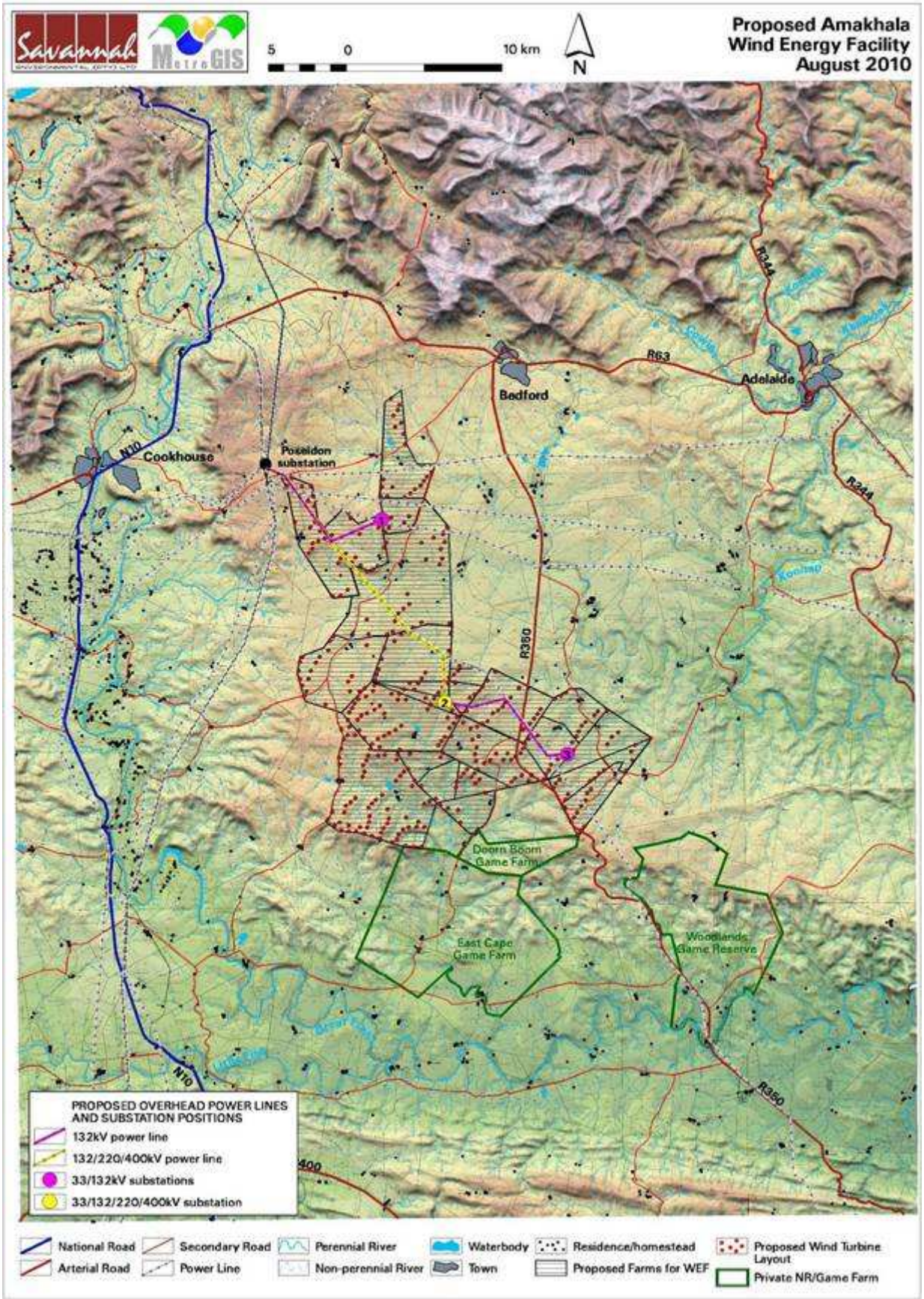
The WEF generates electricity by means of wind turbines that harness the wind of the area as a renewable source of energy. Wind energy generation, or wind farming as it is commonly referred to, is generally considered to be an environmentally friendly electricity generation option.

The effectiveness of a WEF, or amount of power generated by the facility, is dependent on the number of wind turbines erected in the area as well as the careful placement of the turbines in relation to the topography and each other in order to optimise the use of the wind resource. Windlab intends to construct up to 350 wind turbines over an identified area of 273km^2.

A final layout of the WEF (wind turbine positions and ancillary infrastructure) is shown on **Map 1**.

Additional infrastructure includes:

- Two 33/132kV substations.
- One 33/132/220/400 kV substation.
- Two new sections of 132kV overhead power line and one new section of 33/132/220/400kV power line. These new power lines will link all new infrastructure as well as facilitate the connection between the WEF and the existing Eskom transmission power lines at the Poseidon substation.
- Internal access roads.



Map 1: Proposed Amakhala Emoyeni Wind Energy Facility layout (indicating the final placement of 350 wind turbines, 3 substations and power lines).

It is expected, from a visual impact perspective, that the wind turbines (up to 350 turbines may be constructed) would constitute the highest potential visual impact of the WEF.

Each turbine is expected to consist of a concrete foundation, a steel tower, a hub (up to 100m above ground level) and three 55m long blades attached to the hub.

Figure 1 below is a scaled model of the proposed turbines. Slight variations of the above dimensions may occur, depending on the preferred supplier or commercial availability of wind turbines at the time of construction.

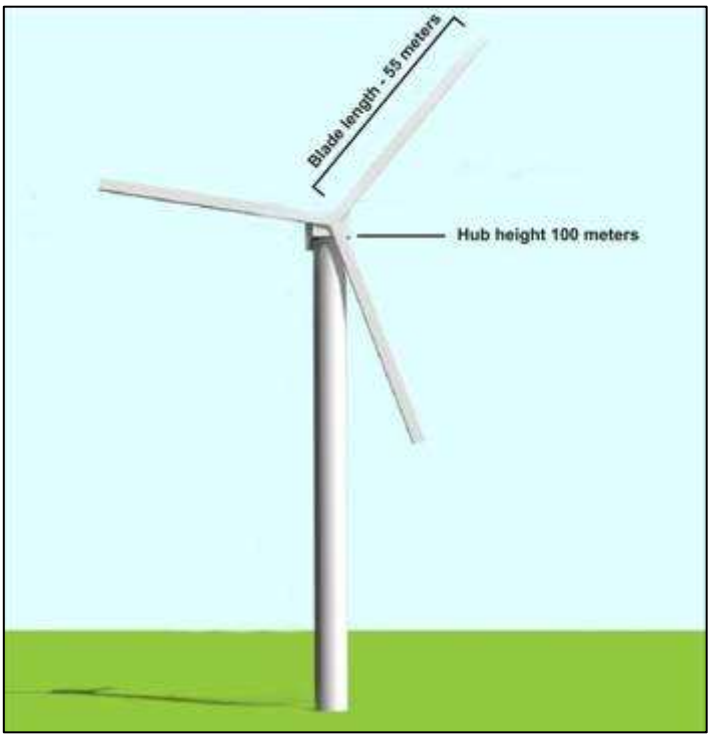


Figure 1: Scaled model of the wind turbine being considered for the WEF.

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

2. SCOPE OF WORK

The study area for the visual assessment encompasses a geographical area of 4,202km^2 and includes a minimum 20km buffer zone from the proposed development area. It includes the towns of Bedford, Cookhouse and Adelaide as well as a section of the N10 national road, the R63, R344 and R350 arterial roads and a number of secondary roads.

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

- The visibility of the facility to, and potential visual impact on, observers travelling along major routes in the area (i.e. the N10 national road, the

R63, R344 and R350 arterial roads and the secondary roads within the study area).

- The visibility of the WEF to, and visual impact on, not only the larger built-up centres or populated places (i.e. the towns of Cookhouse, Bedford and Adelaide) but also individual/isolated landowners/homesteads identified within the study area (some situated within close proximity of the proposed development site include: *Request, Hermon, Summerfield, Brakfontein, Gobas Hope, Geluk, Malangskraal, Review, Herberts Hope, Plathuis, Bakesley, Glencliff, Canary Fontein, Goodwill, Normandale, Clifton, Groothoek, Brakfontein, Vogelfontein, Brakfontein, Arendul, Hopewell, Thorn Park, Merry Dale, Doringboom, Stonehaven, Uitvlugt, Wilgerbosch, Bothaven, Kriegerskraal, Olivewoods, Matjiesfontein, Dassiekop, Quaggaskuil, Klipfontein, Baviaanskrans, Highlands, Robertskraal*).
- The potential impact of the facility on the visual character or sense of place of the region, with special reference to the scenic topographical features (escarpment, mountains and ridges, rivers) and the tourist routes traversing the area.
- The potential visual impact on game farms/reserves in close proximity of the proposed facility.
- The potential visual impact of the construction of ancillary infrastructure (i.e. the substations at the facility and internal access roads) on observers residing in close proximity of the facility.
- The potential visual impact of operational, safety and security lighting of the facility at night on observers residing in close proximity of the facility.
- Potential cumulative visual impacts.
- The visual absorption capacity of the natural vegetation (if applicable).
- Potential visual impacts associated with the construction phase.
- The potential to mitigate visual impacts.

3. METHODOLOGY

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

Site visits were undertaken to source information regarding land use, vegetation cover, topography and general visual quality of the affected environment. It further served the purpose of verifying the results of the spatial analyses and to identify other possible mitigating/aggravating circumstances related to the potential visual impact.

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

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

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

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

- **Determine Potential visual exposure**

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

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

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

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

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

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

- **Determine Viewer Incidence/Viewer Perception**

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

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

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

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

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

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

- **Determine the Visual impact index**

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

4. THE AFFECTED ENVIRONMENT

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

- Portion 1, 2 and remainder of Farm 222
- Portion 3 of Farm 203 (Platt House)
- Remainder of Farm 205 (Kop Leegte)
- Portion 1 of Farm 206 (Normandale)
- Remainder of Farm 168 (Stompstaart Fontein)
- Remainder of Farm 224 (Taai Fontein)
- Remainder of Farm 221 (Leeuw Fontein)
- Portion 2 and remainder of Farm 223 (Paarde Kloof)
- Remainder of Farm 227 (Wilgem Bush)
- Remainder of Farm 225
- Portion 1, 2 and remainder of Farm 218 (Brakke Fontein)
- Remainder of Farm 259
- Remainder of Farm 260
- Portion 5 of Farm 149 (Great Knoffel Fonteyn)
- Remainder of Farm 242
- Portion 1 and remainder of Farm 220 (Brak Fontein)
- Remainder of Farm 219 (Vogel Fonteyn)
- Remainder of 169 (Olive Woods Estate)
- Portion 3 of Farm 141 (Brakfontein)
- Portion 1 of Farm 187 (Kleine Knoffel Fonteyn)

The closest of these farms is located 12km east of Cookhouse, 6.5km south west of Bedford and 23km south west of Adelaide. The proposed development site (total of all the farms listed above) encompasses a surface area of 273km^2.

Range-land (generally retaining its natural state) used for commercial livestock production dominates the general land-use character of this region. Small sections of the study area, primarily along the rivers and drainage lines, have been cultivated.

The region has a population density of less than 10 people per km^2 with the highest concentrations occurring at the towns of Cookhouse, Bedford and Adelaide.

The study area has a rural character with very few structures outside of the previously mentioned town boundaries.

Figure 2: General environment taken from the R350 of the area east of the Amakhala Emoyeni WEF.

Exceptions occur where power lines (entering/exiting at the existing Eskom Poseidon Substation) traverse the study area. The Pembroke to Poseidon 1 and Neptune to Poseidon 1 transmission lines and the Poseidon to Glenden 1 and Poseidon to Albany 1 distribution lines traverse the proposed development site.

The high concentration of power lines within the study area accounts for a considerable amount of visual disturbance within close proximity of the proposed WEF site. Farming homesteads dot the countryside at irregular intervals.

Figure 3: General environment surrounding the Poseidon substation (taken from within the proposed development area).

Figure 4: Transmission line infrastructure (Delphi-Poseidon and Hydro-Poseidon) crossing the R63 north-west of the proposed development area.

Natural vegetation, in the form of *Thicket and Bushland* and *Shrubland* covers the largest part of the study area, whilst the mountainous terrain to the north predominantly consists of *Natural Grassland*. The status of these vegetation types ranges from virtually pristine in the northern mountainous sections of the study area, to degraded and overgrazed in the centre of the study area.

Figure 5: Natural vegetation cover of the area (*Thicket and Bushland*) surrounding the Amakhala Emoyeni WEF.

Figure 6: Natural vegetation cover (*Thicket and Bushland*) along the Cookhouse to Bedford secondary road north-east of the proposed WEF.

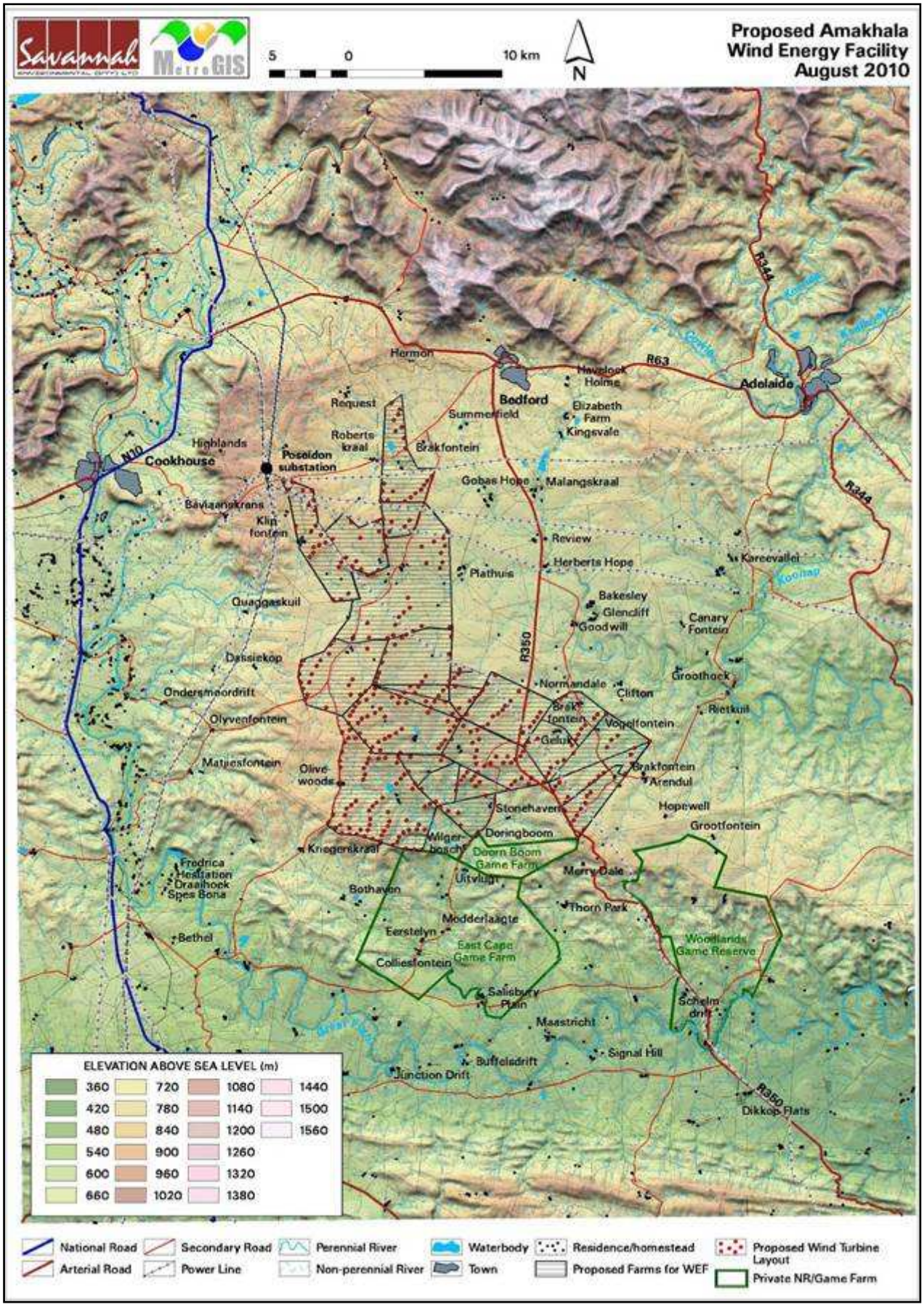
The dominant topographical unit or terrain type of the study area is *hills and lowlands* (to the centre of the study area) and *low mountains* to the north and to the south. The core area earmarked for the development of the WEF is located on a distinct *plateau* (table land) located in the centre of the study area. The mountains in the northern section of the study area are the southern foothills of the *Winterberge* mountain range, which forms part of the mountains of the great escarpment. The Great Fish River, Baviaans River, Cowie River and Koonap River account for the main hydrological features within this region.

Attractions within the greater region include the three private game farms/reserves located south of the proposed development site. These are the Doorn Boom Game Farm, the East Cape Game Farm and the Woodlands Game Reserve.

According to the Social Impact Assessment for the Amakhala Emoyeni Wind Energy Facility (Barbour and Rogatschnig, 2010), the south-eastern portion of the proposed WEF located to the east of the R350 forms part of the Smaldeel Conservancy, which is used for hunting, eco-tourism and photographic safaris.

Other than these, the area as a whole has an inherent scenic value, especially the natural and topographical features (escarpment, mountains and ridges, rivers) which are draw cards for tourists into the region. This area is used as a thoroughfare and "stop over point" for tourists on route to coastal holiday destinations.

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



Map 2: Shaded relief map for the broader study area (indicating topography and elevation above sea level)

Map 3: Land cover/land use map indicating potential sensitive visual receptors.

5. RESULTS

5.1. Potential visual exposure

The visibility analyses were undertaken from each of the preliminary wind turbine positions (350 in total) at an offset of 100m (turbine hub height) above average ground level in order to simulate a worst-case scenario.

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

The potential frequency of visual exposure is based on the number of turbines that will be visible. The dark red areas indicated a high frequency (i.e. up to 350 turbines may be visible), while the light yellow areas represent a low frequency (i.e. between 1 and 35 turbines may be visible).

The visibility map clearly illustrates the influence of the topography and the placement of the wind turbines on ridges within the facility footprint, on the potential frequency of exposure. The highest frequency of exposure is expected towards the north, north-east, to the east and to some extent the far south of the proposed facility. The *Winterberge* north of the site act as an effective visual shield to areas further to the north.

It is evident from the viewshed analyses that the proposed WEF would have a large area of visual exposure on the plateau due to the tall wind turbine structures. The distinct north, west and south-facing escarpments of the plateau interrupt the medium distance visual exposure to the north, west and south, although longer distance sighting would still be possible, especially from higher lying areas to the west and south.

The WEF would be exposed to only scattered areas to the east due to the undulating, mountainous nature of the terrain. The facility would be visible from the south facing slopes of these mountains and from the Baviaans River valley and *Daggaboersnek* mountain pass.

The WEF will potentially be visible from most of the N10 stretch south of Cookhouse, as well as the R350 south of Bedford. The latter road will be exposed to a high frequency of exposure for the most part. Only limited sections of the R63 and the R344 will be visually exposed to the WEF, and the frequency of exposure in these sections will be high. Secondary roads in close proximity of the proposed development site will also be exposed.

The proposed facility would be visible with a high frequency of exposure from the outlying areas south of Bedford, as well as from, outlying areas west of Cookhouse, but with a lower frequency of exposure. It is not expected to be visible from Adelaide, as this town is located north-east of a series of ridges that shield it from the facility.

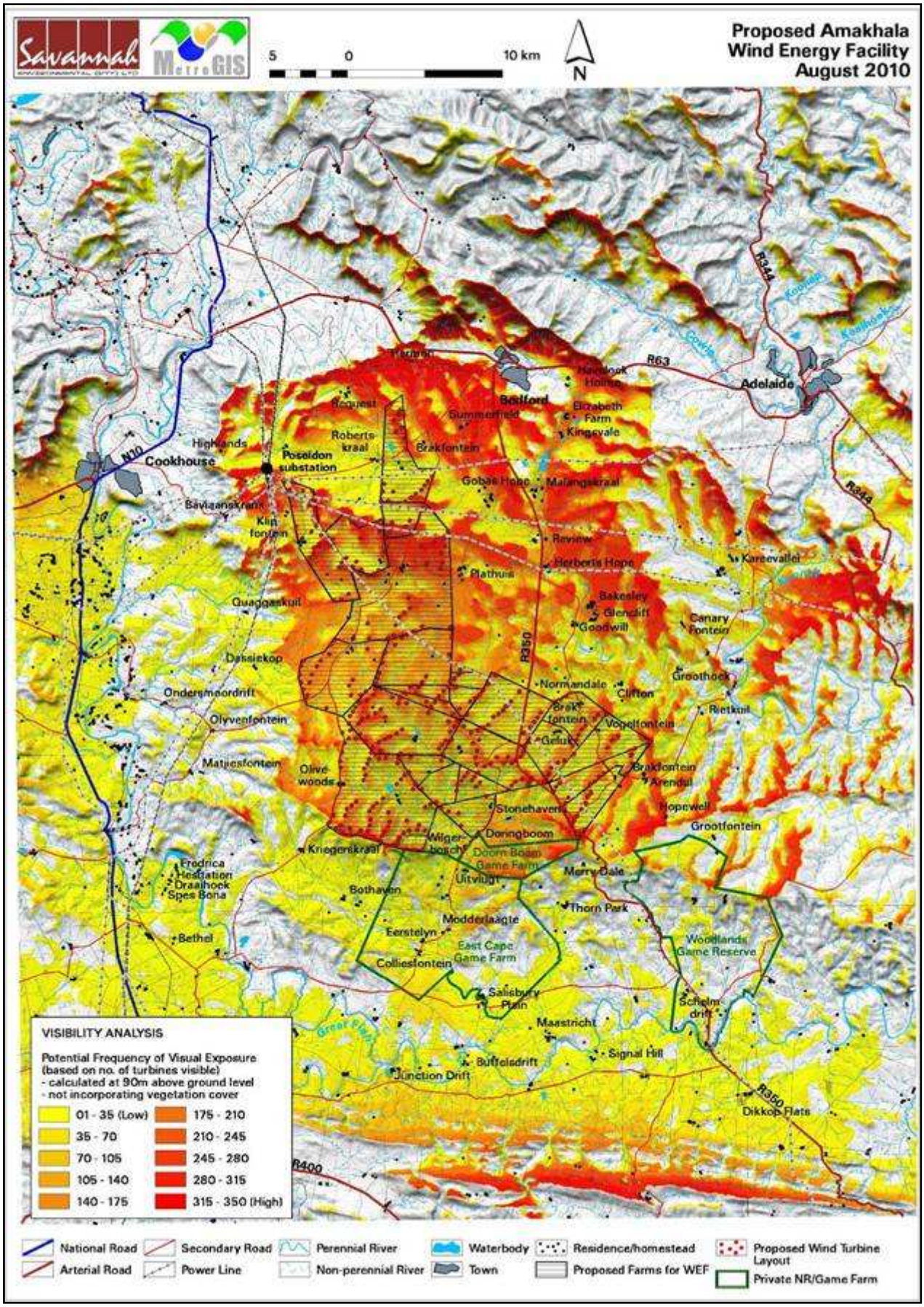
Smaller homesteads, farms and settlements identified within the study area (some situated within close proximity of the proposed development site) may also be impacted on. These have been indicated in **Map 4** and are listed below:

- Request
- Hermon
- Summerfield

- Brakfontein
- Gobas Hope
- Geluk
- Malangskraal
- Review
- Herberts Hope
- Plathuis
- Bakesley
- Glencliff
- Canary Fontein
- Goodwill
- Normandale
- Clifton
- Groothoek
- Brakfontein
- Vogelfontein
- Brakfontein
- Arendul
- Hopewell
- Thorn Park
- Merry Dale
- Doringboom
- Stonehaven
- Uitvlugt
- Wilgerbosch
- Bothaven
- Kriegerskraal
- Olivewoods
- Matjiesfontein
- Dassiekop
- Quaggaskuil
- Klipfontein
- Baviaanskrans
- Highlands
- Robertskraal

Lastly, the proposed WEF will be highly visible from the Doorn Boom Game Farm and to a lesser extent, from the East Cape Game Farm and the Woodlands Game Reserve. Visibility frequency will generally be high from high lying sections within the Doorn Boom Game Farm, while visibility frequency impacting on the latter two game farms will be lower.

It is envisaged that the structures would be easily and comfortably visible, especially within a 5km radius of the WEF and would constitute a high visual prominence, potentially resulting in a high visual impact.



Map 4: Potential visual exposure of the proposed Amakhala Emoyeni WEF.

5.2. Visual distance/observer proximity to the WEF

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

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

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

- 5 - 10km. Medium distance view where the structures would be easily and comfortable visible and constitute a high visual prominence.

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

- Greater than 20km. Long distance view of the facility where the facility could potentially still be visible though not as easily recognisable. This zone constitutes a medium to low visual prominence for the facility.

5.3. Viewer incidence/viewer perception

Viewer incidence is calculated to be the highest along the National, arterial and secondary roads within the study area. Commuters and tourists using these roads will be negatively impacted upon by visual exposure to the WEF. The viewer incidence calculation includes a 200m buffer zone along the Main and arterial roads, which represents the area within which the highest potential sightings of the WEF will occur by people travelling along these roads. The roads buffer zone is shown on **Map 5.**

Although viewer incidence is relatively low within a 5 km radius of the proposed WEF, the region has a high scenic value, and attracts a certain amount of tourism as a result. Residents and visitors to this area are therefore seen as sensitive visual receptors upon which the construction of the WEF could have a negative visual impact.

Within a 10km radius, viewer incidence increases with the presence of larger towns such as Cookhouse and Bedford.

According to the Social Impact Assessment for the Amakhala Emoyeni Wind Energy Facility (Barbour and Rogatschnig, 2010), the tourism sector is small but well established and is dominated by the hospitality industry in the form of guesthouses and hotels. The hunting and fishing industries are also active in the area.

Both Bedford and Cookhouse are significant in their locations along national and arterial roads, and it is assumed that a number of the above-mentioned guest houses and hotels are to be located within these towns. As a result the towns are considered to have both tourism value and tourism potential.

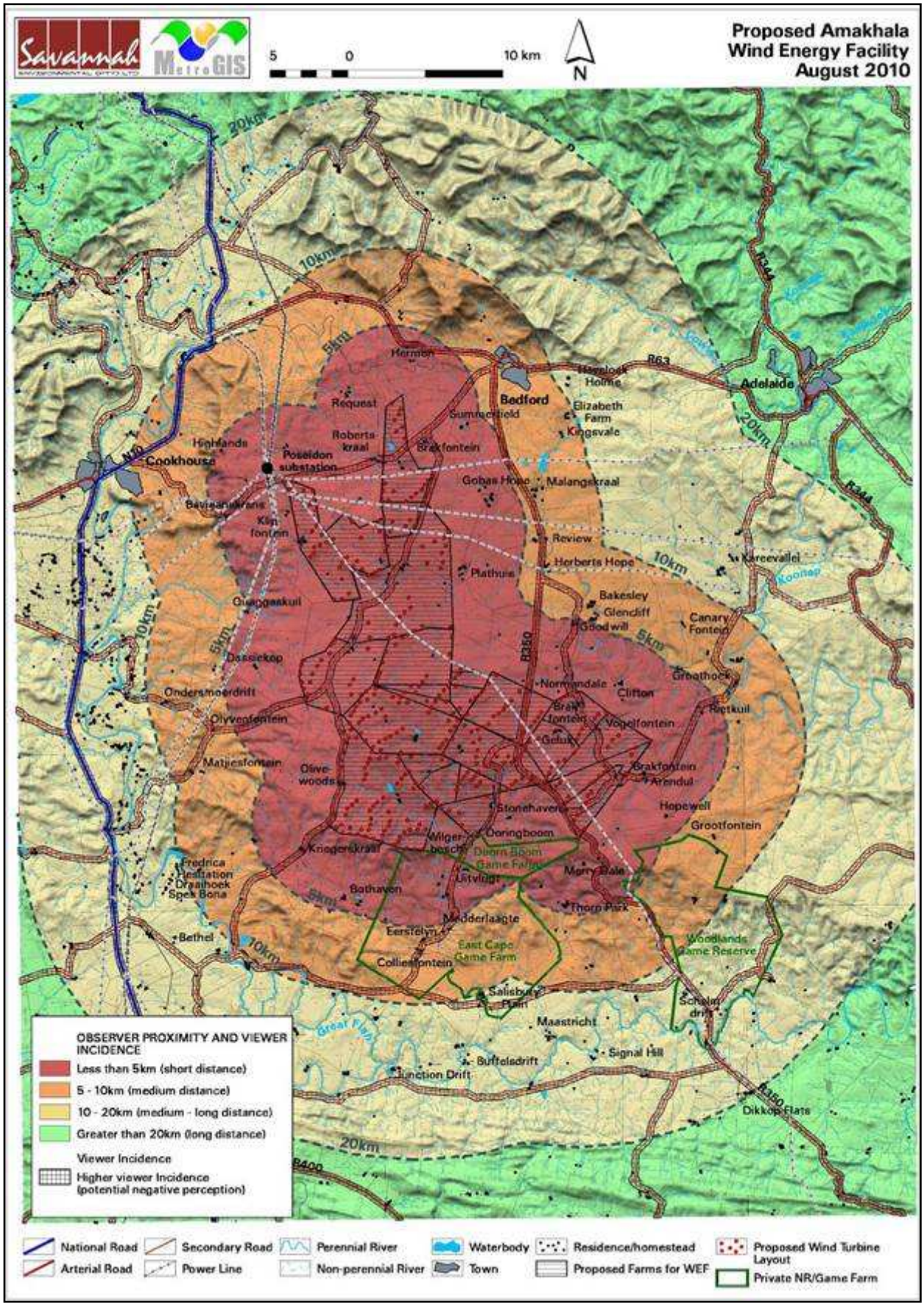
The rest of the study area consists predominantly of grazing land, game farming land or vacant natural land with a low to insignificant occurrence of observers. These observers are however classified as sensitive visual due to their inherent negative visual perception of the proposed WEF.

The severity of the visual impact on the above receptors decreases with increased distance from the proposed facility.

5.4. Visual absorption capacity of the natural vegetation

The natural vegetation cover within the study area is predominantly Bedford Dry Grassland and Great Fish Thicket. Both constitute relatively short to medium plant growth forms. The Bedford Dry Grassland is characteristically open, dry grassland interspersed with *Acacia karroo* woodland, especially along drainage lines. The Great Fish Thicket is generally constituted of short, medium or tall thicket (Hoare et al. 2006).

These vegetation units, where present in the study area, range from 0.2m to 2m in height. This, coupled with the sparse distribution of the plant species and the dimensions of the facility, resulted in the conclusion that the VAC is low to negligible for most of the study area.



Map 5: Observer proximity to the proposed Wind Energy Facility and areas of high viewer incidence.

5.5. Visual impact index

The combined results of the visual exposure, viewer incidence/perception and visual distance of the proposed WEF, the substation and the distribution power lines are displayed on **Map 6**.

Here the weighted impact and the likely areas of impact are indicated as a visual impact index. Values were assigned for each potential visual impact per data category and merged in order to calculate the visual impact index.

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

The visual impact index map clearly indicates the core area of potentially **high** visual impact within a 5km radius of the proposed WEF. Potential areas of **very high** visual impact include the R350 arterial road and all the secondary roads.

Within a 10km radius, visually exposed homesteads and settlements (sensitive visual receptors) represent sites of potentially **very high** visual impact.

Sections of the R350 arterial road and some secondary roads to the east of the site also have a **very high** visual impact rating due to the high frequency of observations of the project infrastructure by observers travelling along this road.

Farm settlements that can expect to experience a potentially **high** or **very high** visual impact as a result of the proposed WEF lie within a 10km radius of the development. These include the following:

- Highlands
- Hermon
- Summerfield
- Brakfontein
- Elizabeth Farm
- Kingsvale
- Gobas Hope
- Klipfontein
- Herbert's Hope
- Plathuis
- Bakesley
- Glencliff
- Goodwill
- Clifton
- Normandale
- Arendul
- Hopewell
- Vogelfontein
- Geluk
- Brakfontein
- Uitvlugt
- Merrydale
- Thorn park
- Bothavel
- Olive wood
- Dassiekop
- Request

- Robert's Kraal
- Stonehaven
- Rietkuil
- Malangskraal
- Canary Fontein
- Groothoek
- Review
- Wilgerbosch
- Modderlaagte
- Eerstelyn
- Colliesfontein
- Doringboom

National and arterial roads that may fall within areas of potentially **low** visual impact include a section of the N10 south of Cookhouse, where partial views of the WEF are expected, a small section of the R63 (between Bedford and Adelaide) and the section of R350 beyond the 5km radius from the proposed WEF.

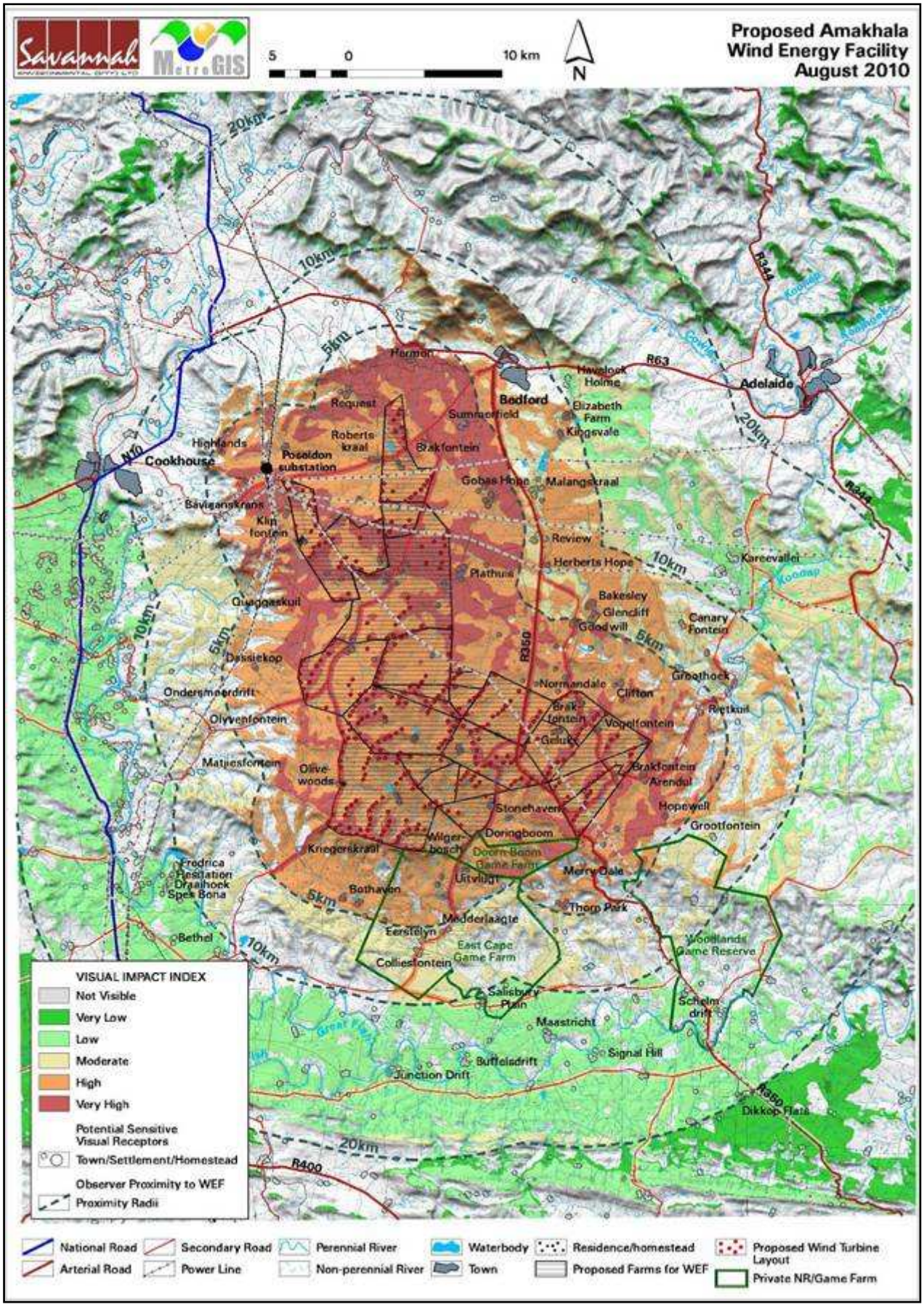
All secondary roads south of the R63 and beyond the 10km radius are expected to be exposed to **moderate** visual impact.

Roads traversing mountainous terrain (e.g. the *Daggaboersnek* mountain pass) within the region may afford observers a clear, yet long distance (beyond 10km), view of the proposed development and may constitute **low** to **very low** visual impact.

Indications are that the development would not be visible from the town of Adelaide and that observers only on the outskirts of Cookhouse may have partial views of the wind farm from distances exceeding 10km, constituting a **low** potential visual impact.

Similarly, the town of Bedford itself would not experience visual impact, but observers on the outskirts of the town may have medium distance views of the facility which will constitute a **high** visual impact. It should be noted, however, that visual clutter on the outskirts of urban areas usually acts as a visual filter, implying that this visual impact may not necessarily be perceived as high, but will be moderated somewhat.

Lastly, in terms of the protected areas in close proximity to the WEF, the entire Doorn Boom Game Farm will be exposed to **high** and **very high** visual impact (i.e. wherever you are on the farm, you will be likely to see the proposed WEF). In addition, the northern parts of the Eastern Cape Game Farm and a small section of the Woodlands Game Reserve will also be exposed to high visual impact.



Map 6: Visual impact index of the proposed Amakhala Emoyeni WEF.

5.6. Visual impact assessment

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

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

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

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

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

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

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

No mitigation measures (e.g. painting the turbines a sky blue colour) is proposed as the colour scheme and lighting fixtures are legally required by the Civil Aviation Authority (see Chapter 5.4 below) and cannot be altered.

5.6.1 The WEF

Potential visual impact on users of arterial and secondary roads in close proximity of the WEF

Visual impacts on arterial and secondary roads are expected to be very high within a 5km radius of the proposed development. Anticipated visual impacts on these roads between 5km and 10km of the proposed development are expected to be **high**.

The table below illustrates this impact assessment.

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

Nature of Impact: Potential visual impact on users of arterial and secondary roads in close proximity of the WEF		
	No mitigation	***Mitigation considered***
Extent	Local **(4)**	Local **(4)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Very high **(5)**	Very high **(5)**
Probability	High **(4)**	High **(4)**
Significance	High **(64)**	High **(64)**
Status (positive or negative)	Negative	Negative
Reversibility	Recoverable **(3)**	Recoverable **(3)**
Irreplaceable loss of resources?	No	No
Can impacts be mitigated during operational phase?	No	No
Mitigation: Decommissioning: removal of the wind turbines and ancillary infrastructure after 20 to 30 years.		
Cumulative impacts: The construction of up to 350 wind turbines together with the existing power line infrastructure and substation as well as infrastructure related to the approved Cookhouse WEF (200 wind turbines) will increase the cumulative visual impact within the region. The construction of 350 turbines over a number of years, including the Cookhouse turbines, may create the impression of a cumulative visual impact on uninformed observers (i.e. observers who are not aware of the total extent of the facility).		
Residual impacts: None. The visual impact will be removed after decommissioning		

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

The visual impact on the towns of Adelaide, Bedford and Cookhouse is expected to be low to negligible and is not reflected in the table below.

The potential visual impact on residents of homesteads within a 10km radius of the proposed WEF is expected to be **high**.

The table below illustrates this impact assessment.

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

Nature of Impact: Potential visual impact on residents of towns, settlements and homesteads in close proximity (0-10km) to the proposed WEF.		
	No mitigation	***Mitigation considered***
Extent	Local **(4)**	Local **(4)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Very high **(5)**	Very high **(5)**
Probability	High **(4)**	High **(4)**
Significance	High **(64)**	High **(64)**
Status (positive or negative)	Negative	Negative
Reversibility	Recoverable **(3)**	Recoverable **(3)**
Irreplaceable loss of resources?	No	No
Can impacts be mitigated during operational phase?	No	No
Mitigation: Decommissioning: removal of the wind turbines and ancillary infrastructure after 20 to 30 years.		
Cumulative impacts: The construction of up to 350 wind turbines together with the existing power line infrastructure and substation as well as infrastructure related to the approved Cookhouse WEF (200 wind turbines) will increase the cumulative visual impact within the region. The construction of 350 turbines over a number of years, including the Cookhouse turbines, may create the impression of a cumulative visual impact on uninformed observers (i.e. observers who are not aware of the total extent of the facility).		
Residual impacts: None. The visual impact will be removed after decommissioning		

Potential visual impact on scenic natural features, on tourist destinations and on tourists travelling through the area.

The Social Impact Assessment for the Amakhala Emoyeni Wind Energy Facility (Barbour and Rogatschnig, 2010) assessed the anticipated negative impact on tourism *as an industry* to be low. The SIA further assessed a potential positive impact on the tourism industry to be low.

Notwithstanding, the visual impact on *identified tourist destinations and tourist access routes* within 10km of the proposed WEF is expected to be **high**.

According to the Social Impact Assessment for the Amakhala Emoyeni Wind Energy Facility (Barbour and Rogatschnig, 2010), the tourism sector is small but well established and is dominated by the hospitality industry in the form of guesthouses and hotels.

Both Bedford and Cookhouse are significant in their locations along national and arterial roads, and it is assumed that a number of the above-mentioned guest houses and hotels are to be located within these towns.

Potential tourist access routes include the N10, as well as the various arterial routes (i.e. the R63 and the R350), which give access not only to the Bedford and Cookhouse, but also to various Game Farms in close proximity of the WEF.

The table below illustrates this impact assessment.

Table 3: Impact table summarising the significance of visual impacts on scenic natural features, on tourist destinations and on tourists

Nature of Impact: Potential visual impact on scenic natural features, on tourist destinations and on tourists travelling through the area.		
	No mitigation	***Mitigation considered***
Extent	Local **(4)**	Local **(4)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	High **(5)**	High **(5)**
Probability	High **(4)**	High **(4)**
Significance	High **(64)**	High **(64)**
Status (positive or negative)	Negative	Negative
Reversibility	Recoverable **(3)**	Recoverable **(3)**
Irreplaceable loss of resources?	No	No
Can impacts be mitigated during operational phase?	No	No
Mitigation: Decommissioning: removal of the wind turbines and ancillary infrastructure after 20 to 30 years.		
Cumulative impacts: The construction of up to 350 wind turbines together with the existing power line infrastructure and substation as well as infrastructure related to the approved Cookhouse WEF (200 wind turbines) will increase the cumulative visual impact within the region. The construction of 350 turbines over a number of years, including the Cookhouse turbines, may create the impression of a cumulative visual impact on uninformed observers (i.e. observers who are not aware of the total extent of the facility).		
Residual impacts: None. The visual impact will be removed after decommissioning		

Potential visual impact on private nature reserves and conservancies in close proximity to the proposed WEF

Visual impact on the Game Farms and Game Reserves (Doorn Boom, Eastern Cape and Woodlands) will be **high** within 10km of the proposed facility.

The table below illustrates this impact assessment.

Table 4: Impact table summarising the significance of visual impacts on private nature reserves and conservancies in close proximity to the proposed WEF

Nature of Impact: Potential visual impact on private nature reserves and conservancies in close proximity to the proposed WEF.		
	No mitigation	***Mitigation considered***
Extent	Local **(4)**	Local **(4)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Very high **(5)**	Very high **(5)**
Probability	High **(4)**	High **(4)**
Significance	High **(64)**	High **(64)**
Status (positive or negative)	Negative	Negative
Reversibility	Recoverable **(3)**	Recoverable **(3)**
Irreplaceable loss of resources?	No	No
Can impacts be mitigated during operational phase?	No	No
Mitigation: Decommissioning: removal of the wind turbines and ancillary infrastructure after 20 to 30 years.		
Cumulative impacts: The construction of up to 350 wind turbines together with the existing power line infrastructure and substation as well as infrastructure related to the Cookhouse WEF (200 wind turbines) will increase the cumulative visual impact within the region. The phased development approach (i.e. the construction of 550 turbines over a number of years including the Cookhouse turbines) may create the impression of a cumulative visual impact on uninformed observers (i.e. observers who are not aware of the total extent of the facility).		
Residual impacts: None. The visual impact will be removed after decommissioning.		

5.6.2. Ancillary infrastructure

Potential visual impact of the internal access roads.

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

Lastly, if the road network is laid out indiscriminately, not taking cognisance of the topography, then both the roads themselves, and the graded slopes would be vulnerable to erosion over time. The effects of erosion also represent a potential visual impact to observers.

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

Table 5 Impact table summarising the significance of visual impact of the internal access roads

Nature of Impact: Potential visual impact of the internal access road		
	No mitigation	***Mitigation considered***
Extent	Local **(4)**	Local **(4)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Moderate **(3)**	Moderate **(3)**
Probability	Medium **(3)**	Low **(2)**
Significance	Medium **(42)**	Low **(28)**
Status (positive or negative)	Negative	Negative
Reversibility	Recoverable **(3)**	Recoverable **(3)**
Irreplaceable loss of resources?	No	No
Can impacts be mitigated during operational phase?	No	No
Mitigation: Decommissioning: removal of the wind turbines and ancillary infrastructure after 20 to 30 years.		
Cumulative impacts: The construction of 10 wind turbines together with the roads and other ancillary infrastructure will increase the cumulative visual impact within the region. This is specifically relevant in light of the proposed Deep River WEF located to the south west of the site.		
Residual impacts: None. The visual impact of the wind turbines will be removed after decommissioning.		

Potential visual impact of the substations and powerlines.

There are to be two 33/132kV substations and one 33/132/220/400 kV substation located within the WEF development footprint. These will in turn be linked to each other and to existing infrastructure by 132kV overhead powerlines.

Map 7 shows the visual exposure of this proposed substation, while **Map 8** shows the visual exposure of the powerlines. A comparison of these maps with the visual exposure map of the wind turbines (Map 4), reveals that the viewshed of both the substations and powerlines are in fact absorbed by the larger viewshed of the turbines.

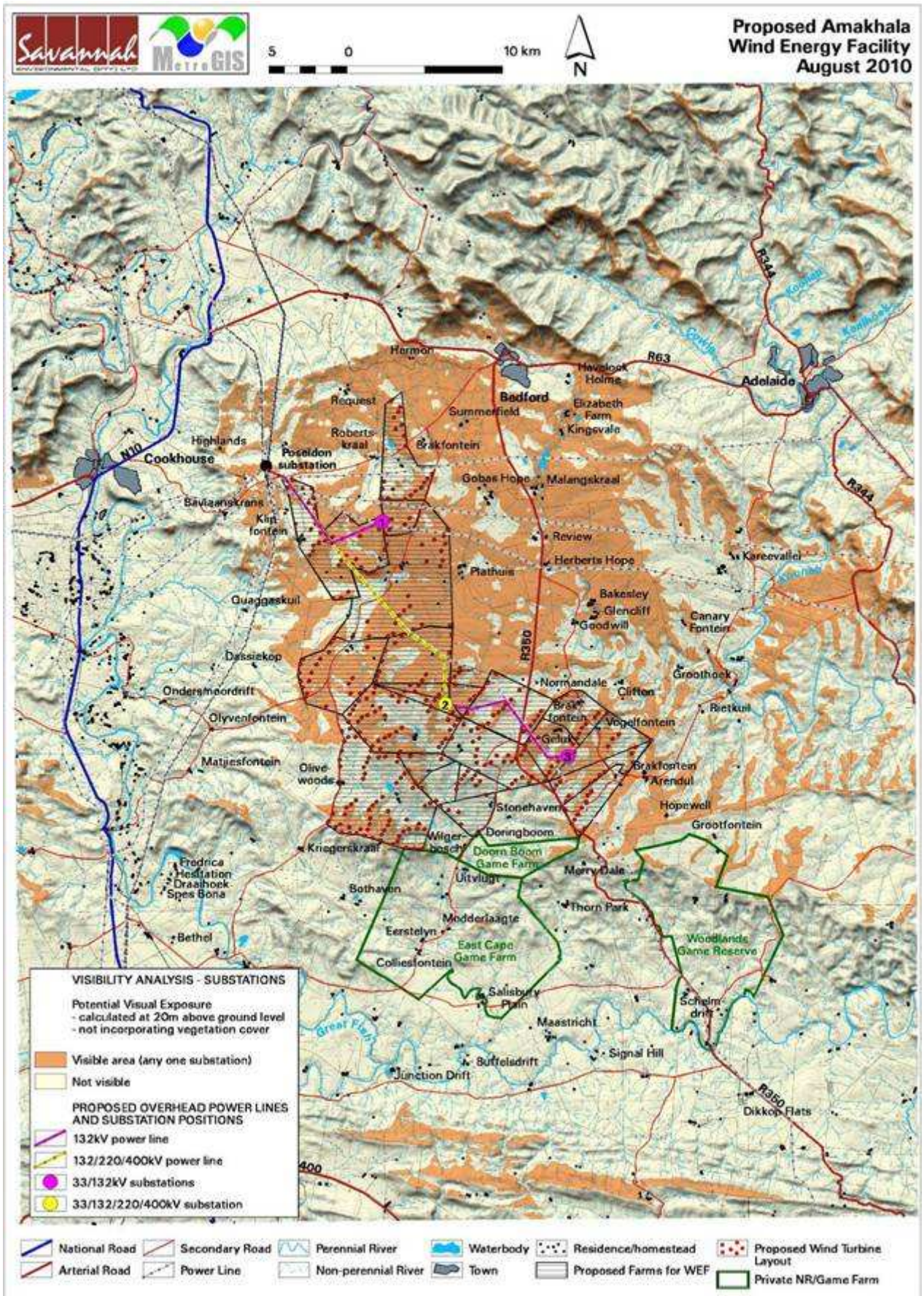
The substations and associated powerlines are not expected to create a major negative visual disturbance, as this smaller scale infrastructure will be dominated by the much taller wind turbines and thus blend in with the WEF. Some localised visual impacts may occur, but are not expected to be significant in comparison to the construction of the wind turbines.

Some degree of cumulative impact is expected as much of the infrastructure including turbines, substations and powerlines will add to impacts caused by infrastructure related to the authorised Cookhouse WEF, adjacent to the site.

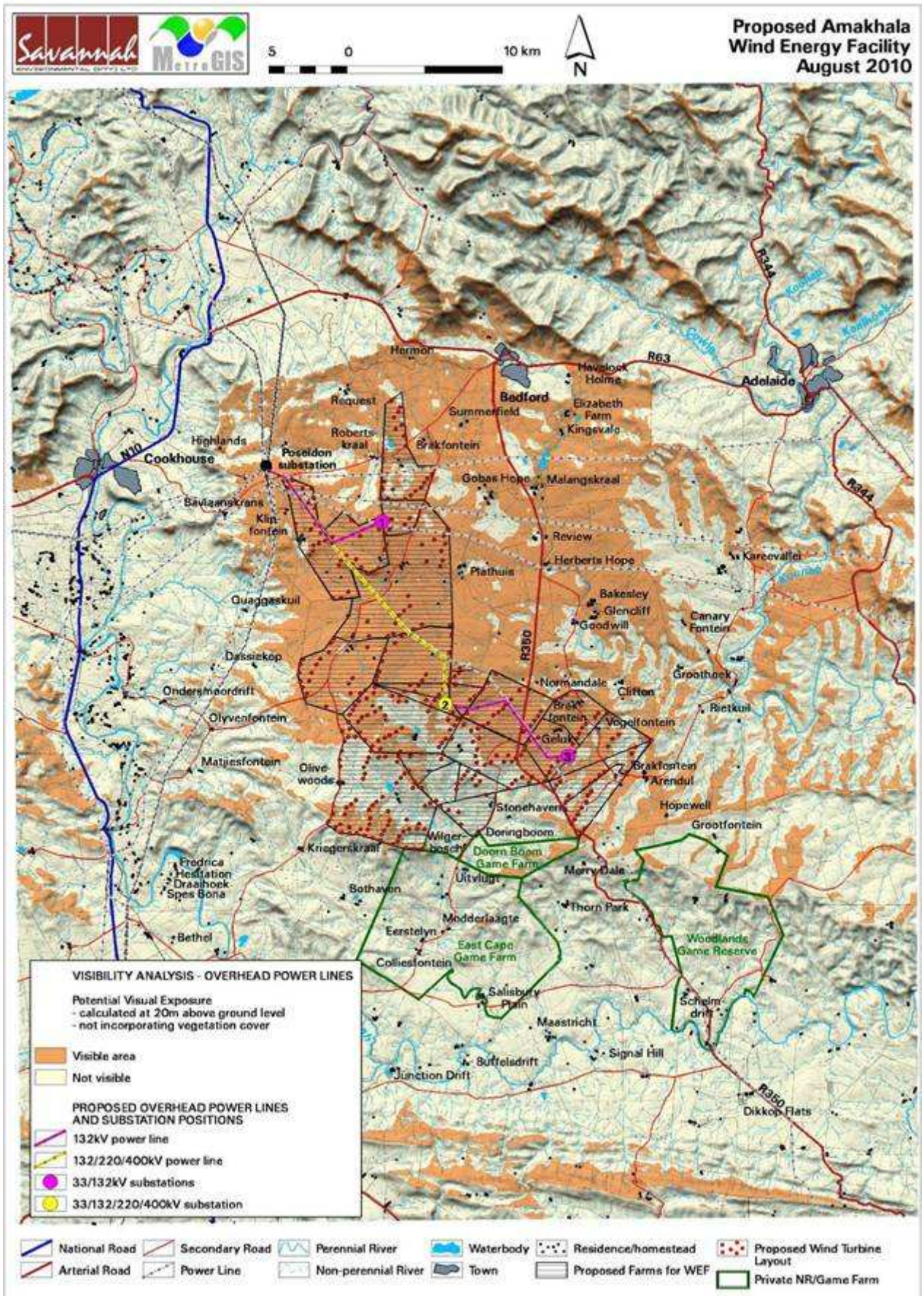
The table below illustrates the assessment of this anticipated impact, which is likely to be of **medium** significance.

Table 6 Impact table summarising the significance of visual impact of the internal access roads

Nature of Impact: Potential visual impact of the internal access road		
	No mitigation	***Mitigation considered***
Extent	Local **(4)**	Local **(4)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Moderate **(3)**	Moderate **(3)**
Probability	Medium **(3)**	Medium **(3)**
Significance	Medium **(42)**	Medium **(42)**
Status (positive or negative)	Negative	Negative
Reversibility	Recoverable **(3)**	Recoverable **(3)**
Irreplaceable loss of resources?	No	No
Can impacts be mitigated during operational phase?	No	No
Mitigation: Decommissioning: removal of the wind turbines and ancillary infrastructure after 20 to 30 years.		
Cumulative impacts: The construction of 10 wind turbines together with the roads and other ancillary infrastructure will increase the cumulative visual impact within the region. This is specifically relevant in light of the proposed Deep River WEF located to the south west of the site.		
Residual impacts: None. The visual impact of the wind turbines will be removed after decommissioning.		



Map 7: Visual exposure of the proposed 33/132/220/400kV substations.



Map 8: Visual exposure of the proposed 33/132/220/400kV powerlines.

5.7. Secondary visual impacts

5.7.1. Lighting impacts

The areas selected for the placement of the 3 substations is within the development footprint, so too is the proposed route for the powerline infrastructure. The surrounding area has a relatively small number of populated places (settlements and farmsteads). Although these are not densely populated areas, the light trespass and glare from the security and after-hours operational lighting (flood lights) for the substations will have some significance. Furthermore, the sense of place and cultural ambiance of the local area increases its sensitivity to such lighting intrusions.

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.

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

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

Last is the potential lighting impact known as sky glow. Sky glow is the condition where the night sky is illuminated when light reflects off particles in the atmosphere such as moisture, dust or smog. The sky glow intensifies with the increase in the amount of light sources. Each new light source, especially upwardly directed lighting, contribute to the increase in sky glow. The WEF may contribute to the effect of sky glow in an otherwise dark environment.

5.7.2. Power line servitudes

Although the primary impact of the 33/132/220/400kV and 132kV power lines is discussed in the preceding section, the required servitude associated with these alignments also represents a potential visual impact. The cutting back of vegetation within the servitudes for fire protection (which is expected to be 8m in width for each line along the length of the power line) will manifest as a definite discernable band or line in the landscape when viewed from elevated areas.

5.7.3. Potential visual impacts associated with the construction phase

The duration of the construction phase of the WEF is dependent on the number of turbines being constructed and is expected to take approximately 350 weeks to complete (a conservative estimation not taking natural weather conditions etc. into account). During this time there will be a noticeable increase in heavy vehicles utilising the roads to the development site that may cause, at the very least, a visual nuisance to other road users and land owners in the area.

5.8. The potential to mitigate visual impacts

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

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

  The analysis of the potential visual exposure of the proposed turbine layout (as indicated in Map 4) reveals the fact that the placement of the turbines on top of prominent topographical features tends to increase the frequency of exposure. The careful placement of the wind turbines in relation to the topography (in cases where the turbine layout has not yet been finalised) does however offer some opportunity for mitigation. However this may have an influence on the potential efficiency of the facility if wind conditions are different (i.e. of wind speeds are lower).

  Removal or relocation of turbines from high lying areas is not feasible as the whole site shares similar characteristics. Relocation of turbines will only result in shifting impacts to another receptor within the area. There is thus no mitigation to ameliorate the negative visual impacts anticipated for the turbine sites.

- Based on the fact that little to no mitigation is possible to ameliorate the primary visual impact, a definite land use conflict exists, especially with regard to the private nature reserves and conservancies affected within 5km of the site (i.e. Doornboon Game Farm and parts of the East Cape Game Farm). The visual intrusion will impose some limitation on conservation based tourism opportunities[1] in the future.

  This land use conflict also extends to other conservation areas that lie between 5km and 10km of the proposed WEF (and which are exposed to visual impact). These include parts of the East Cape Game Farm and the Woodlands Game Reserve. The conflict here is somewhat less, however, according to the magnitude of the impact.

- Mitigation of lighting impacts includes the pro-active design, planning and specification lighting for the facility by a lighting engineer. The correct specification and placement of lighting and light fixtures for both the turbines and the ancillary infrastructure will go far to contain rather than spread the light. Additional 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;

[1] Conservation based tourism refers to tourism opportunities relying on the presence of conservation areas, and the associated visual quality of uninterrupted views of and within these conservation areas.

- Making use of minimum lumen or wattage in fixtures;
- Making use of down-lighters, or shielded fixtures;
- Making use of Low Pressure Sodium lighting or other types of low impact lighting.
- Making use of motion detectors on security lighting. This will allow the site to remain in relative darkness, until lighting is required for security or maintenance purposes.

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

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

- As the power line must follow the most direct route, and the alignment must be protected from fire by means of cutting back vegetation within the servitude, there is no mitigation for this visual impact.

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

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

6. PHOTO SIMULATIONS

Photo simulations were undertaken (in addition to the above spatial analyses) in order to illustrate the potential cumulative visual impact of both the completed Amakhala Emoyeni and Cookhouse WEF's (350 turbines and 200 turbines respectively) within the receiving environment.

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

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

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

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

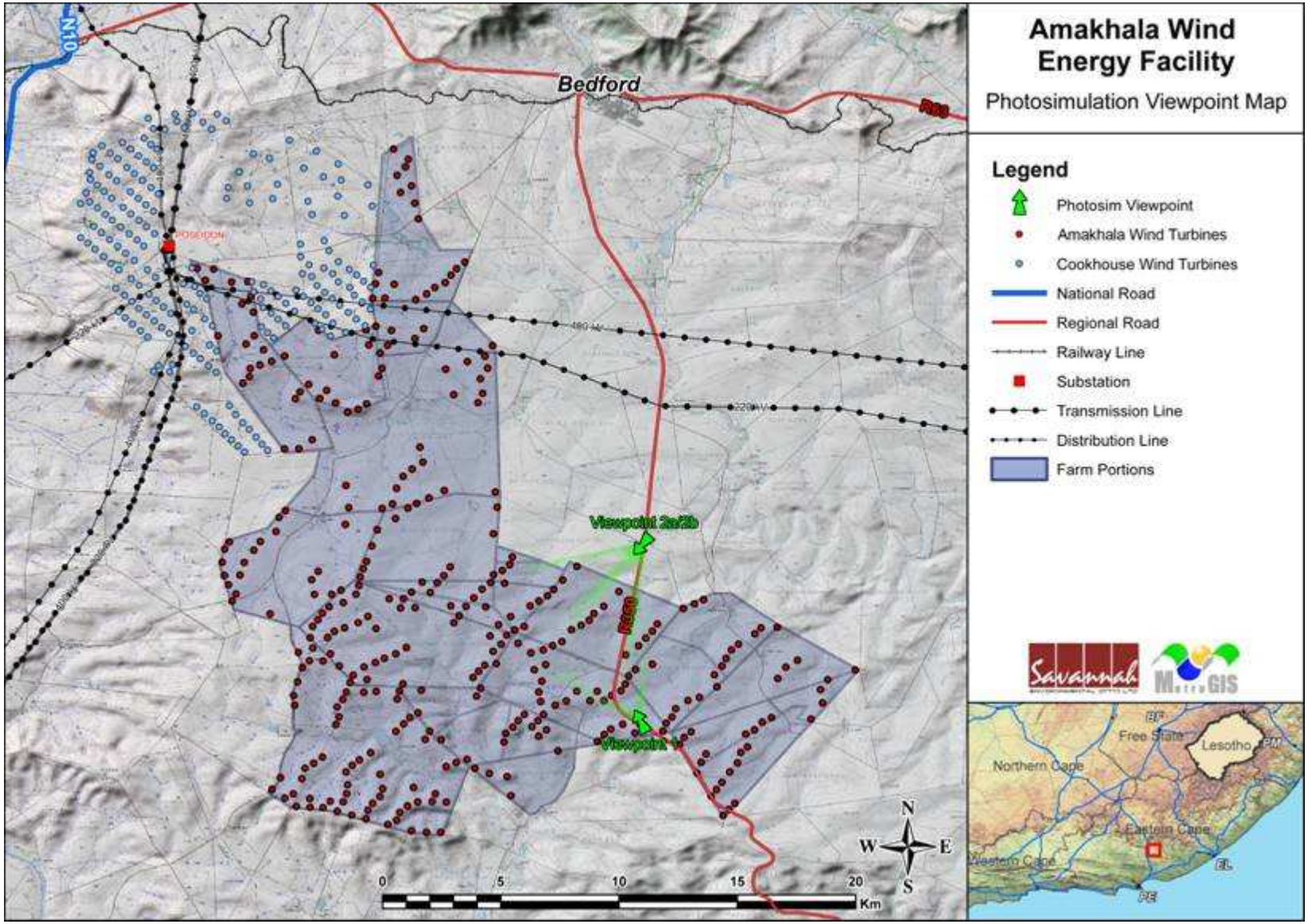
Each photographic simulation is preceded by a panoramic overview of the landscape from the specified viewpoint being discussed. The panoramic overview allows for a more realistic viewer scale that would be representative of the distance over which the turbines are viewed. Each panoramic overview indicates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

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

The following technical data are of relevance:

- The camera used to take the initial photographs iss a standard Canon EOS 1000D with an 18-55mm lens.
- Photos intended for panoramas are taken with focal length at 55mm to minimize edge distortion and to facilitate the panoramic software’s stitching process.
- Canon’s stitching software (Photostitch v3.1.21) is used to create the panoramas. This software automatically compensates for slight variations in the focal length on each photo used in the panorama (i.e. the camera model, focal length, F-number, etc are embedded into each photo, so the software recognizes these parameters and adjusts the output image accordingly).
- The photo simulation process begins with the DTM, as this is effectively the "ground surface" of the virtual environment. The accuracy of the DTM in representing the Earth's surface is very much dependent on the quality of available contour data as this is what it is derived from. The raster DTM that is used to show shaded relief in a map is usually the same dataset that is used as the virtual ground surface.
- The DTM is visualised in 3D with an application called ArcScene. ArcScene works in much the same way as ArcMap except that the geometry and attributes of shapefiles cannot be edited, and of course, dat is displayed in a Cartesian plane. Any existing shapefile can be added into the 3D environment and will automatically be displayed in it's correct geographic position. Shapes that do not contain Z-values (height above mean sea level) can be assigned height values using the DTM. Point shapefiles, for example, will typically already have X/Y coordinates but can be placed at the virtual ground level, or at any height above ground level as specified in the attribute table. Lines and polygons work in the same way, thus enabling any vector shapefile to be "draped" onto the 3D terrain surface. Furthermore, points can be extruded to create lines of any specified length; lines may be extruded to create 3D polygons; and 3D polygons may be extruded to create 3D volumes.

- 3D models from such applications as 3D StudioMax or Sketchup are compatible with the ArcScene environment and work by assigning a model to be rendered at points geographically specified by a point shapefile. Each model itself consists of many polygons, and depending on the number of models used, can impact severely on a computer's performance in displaying the virtual environment.
- For the purposes of placing wind turbines onto a virtual landscape, a layout of the exact turbine positions is required in the form of a point shapefile. This shapefile is added three times to the environment. The first instance is displayed as a point at ground level to indicate where the turbine tower meets the ground level. The second instance is extruded to half the height of the tower and displayed in a certain colour. The third instance is extruded from half to the full height of the tower and displayed in a different colour. Thus, from any virtual viewpoint on the landscape, it can be determined which turbines will be in full view and which will be partially obscured by undulations of the terrain. The terrain can also be made semi-transparent to check whether anything is completely obscured.
- Each photo viewpoint is then recreated within the virtual environment by setting the "camera" coordinates to those of the GPS coordinates logged when each photo was taken. Several other data may be added for landmark purposes, such as roads, rivers, power lines, or even trees if they can be accurately digitized. The virtual output is then rendered at a focal length matching that of the photos originally used to create the panoramas (using a field-of-view calculator that also compensates for the digital equivalent of 35mm film cameras). Several virtual "snapshots" are taken in sequence in the same manner as for the panoramic photos as the virtual output suffers from the same edge distortion as a photo. These are then stitched in the same manner as the photographs.
- Both the panoramic photos and the virtual simulation output are now graphic formats that are loaded into Adobe Photoshop. Some enhancements of the panoramas may be necessary as weather conditions tend to adversely affect image quality. The horizon and landscape of the virtual viewpoint is then matched up to what can be seen in the panoramas and sample images of the wind turbines are then overlaid where the extruded points are visible. Scaling is maintained since the top and mid-point of the tower are usually visible, so the ground point can be established even though it may be obscured by the landscape. Some graphic editing is usually necessary to address such things invervening vegetation or power lines as well as sufficient blurring to mimic the effect of distance.
- The scene is then typically rendered twice as "before" and "after" views.



Map 9: Photograph positions.

6.1 North-westerly view

Viewpoint 1 (short distance view)

Viewpoint 1 is located on the R350 as it enters the site from the south. This position is very close to the closest turbines and is indicative of what will be seen from the western sections within the WEF footprint.

The viewing direction is north westerly and roughly 100 turbines may be fully to partially visible in the landscape. This view is representative of a short distance visual experience of travellers moving northwards along the R350 towards Bedford.

Figure 7a: Panoramic overview from Viewpoint 1.

Figure 7b: Panoramic overview from Viewpoint 1 (indicating enlarged photograph sections).

Figure 7c: View 1a (enlarged photograph section from Viewpoint 1).

Figure 7d: View 1b (enlarged photograph section from Viewpoint 1).

6.2 North-westerly view including ROD approved Cookhouse WEF turbines

Viewpoint 1 (short distance view including ROD approved Cookhouse WEF turbines)

Viewpoint 1 is located on the R350 as it enters the site from the south. This position is very close to the closest turbines and is indicative of what will be seen from the western sections within the WEF footprint.

This view includes the cumulative view combining both proposed Amakhala Emoyeni and approved Cookhouse WEF turbine positions.

The viewing direction is north westerly and roughly 100 turbines may be fully to partially visible in the landscape. This view is representative of a short distance visual experience of travellers moving northwards along the R350 towards Bedford.

Figure 8a: Panoramic overview from Viewpoint 1 also including ROD approved Cookhouse turbines.

Figure 8b: Panoramic overview from Viewpoint 1 also including ROD approved Cookhouse turbines (indicating enlarged photograph sections).

Figure 8c: View 2a (enlarged photograph section from Viewpoint 1 also including ROD approved Cookhouse turbines).

Figure 8d: View 2b (enlarged photograph section from Viewpoint 1 also including ROD approved Cookhouse turbines).

6.3 South-westerly view

Viewpoint 2 (short distance view)

Viewpoint 2 is located on the R350 some 20km south of Bedford. This position is indicative of what will be seen from close quarters while driving south towards the facility. The viewing direction is south-westerly and roughly 122 turbines may be fully to partially visible in the landscape.

Figure 9a: Pre-construction panoramic overview from Viewpoint 2.

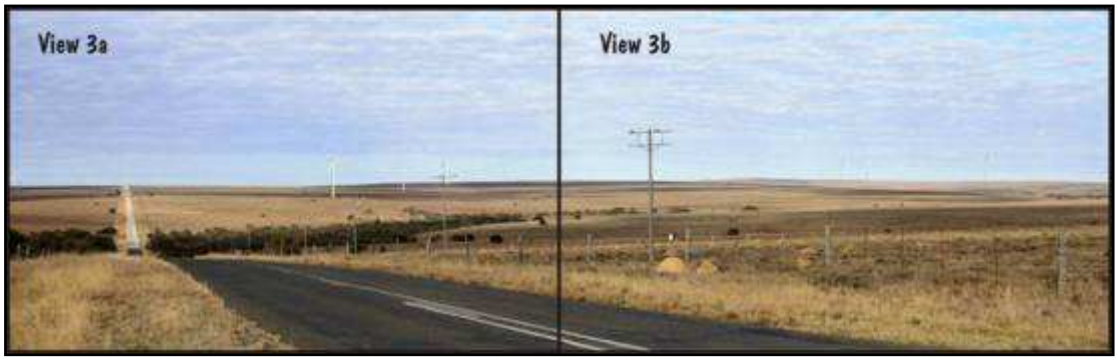


Figure 9b: Post-construction panoramic overview from Viewpoint 2 (showing photo sections).

Figure 9c: View 3a (enlarged photograph section from Viewpoint 2).

Figure 9d: View 3b (enlarged photograph section from Viewpoint 2).

7. CONCLUSION/RECOMMENDATIONS

The construction and operation of the Amakhala Emoyeni Wind Energy Facility and its associated infrastructure, adjacent to the Cookhouse WEF (ROD authorised) will have a visual impact on the natural scenic resources and rural character of this region.

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

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

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

Furthermore, this area acts as a gateway for many tourists en-route to coastal holiday destinations as well as National Parks such as the Addo Elephant National Park.

Due to the Cookhouse WEF being authorised in the same area, there exists a possibility that both facilities may ultimately be built. In this respect, one must consider the combined cumulative impacts of both the Cookhouse and Amakhala Emoyeni facilities on the receiving environment.

This could be seen as an ameliorating factor, as the potential visual impacts for both facilities will be localised within a constrained and defined geographical area. Also, the visual impact of the new facility will be absorbed to some extent by the existing visual impact of the existing facility.

Although this will not necessarily reduce the significance of the visual impact, it is considered to be best practice to position new activities near to an existing visual intrusion rather than within a new, 'visual impact free' area.

There are not many recommendations as to the mitigation of the visual impact of the core facility, as there is no opportunity to place the wind turbines on lower ground, and no amount of vegetation screening or landscaping would be able to hide structures of these dimensions.

There remains a potential land use conflict with regard to the private nature reserves, as there is no opportunity to mitigate the negative effects of the WEF.

As a result, there could potentially be some limitation on conservation based tourism opportunities[2] in the future. The Social Impact Assessment for the

[2],Conservation based tourism refers to tourism opportunities relying on the presence of conservation areas, and the associated visual quality of uninterrupted views of and within these conservation areas.

Amakhala Emoyeni Wind Energy Facility (Barbour and Rogatschnig, 2010) confirms that representatives of the Doornboom, East Cape and Woodlands Game Reserves consider the proposed WEF to potentially have a negative impact on the current activities (primarily hunting) as well as future eco-tourism opportunities.

It is recommended that open and direct discussions be held with the owners of the Doornboom, East Cape and Woodlands Game Farms regarding the potential future limitations on conservation based tourism opportunities[3] as a result of the expected visual impact of the WEF.

It is also recommended that the ancillary infrastructure (distribution lines, substations, access roads, etc.) be appropriately planned with due cognisance of the topography, that all disturbed areas be properly rehabilitated, and that all infrastructure and the general surrounds are maintained in a neat and appealing way.

The construction phase of the facility should be sensitive to potential observers in the vicinity of the construction site. The placement of lay-down areas and temporary construction camps should be carefully considered in order to not negatively influence the future perception of the facility.

Secondary visual impacts associated with the construction phase, such as the sight of construction vehicles, dust and construction litter must be managed to reduce visual impacts. The use of dust-suppression techniques on the access roads (where required), timely removal of rubble and litter, and the erection of temporary screening will assist in doing this.

A lighting engineer should be consulted to assist in the planning and placement of light fixtures in order to reduce visual impacts associated with glare and light trespass.

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

8. IMPACT STATEMENT

In light of the results and findings of the Visual Impact Assessment undertaken for the proposed Amakhala Emoyeni Wind Energy Facility, it is acknowledged that the rural, natural and relatively unspoiled wide-open views surrounding the site will be transformed for the entire operational lifespan (approximately 30 years) of the facility.

The potential visual impact on users of major and secondary roads in close proximity to the proposed WEF, as well as on residents of nearby towns and settlements, will be of high significance.

The significance of the potential visual impact on protected areas in close proximity to the facility (0 – 5 km) will also be high as will the potential visual impact on tourist access routes and tourist destinations.

This anticipated visual impact is not, however, considered to be a fatal flaw from a visual perspective, considering the relatively low incidence of visual receptors in the region, the relatively contained area of potential visual exposure. Furthermore, it is the opinion of the author that this impact is not likely to detract

[3] Conservation based tourism refers to tourism opportunities relying on the presence of conservation areas, and the associated visual quality of uninterrupted views of and within these conservation areas.

from the regional tourism appeal, numbers of tourists or tourism potential of the existing centres. In addition, most of the roads act as tourist access routes rather than scenic drives. This finding is supported by the findings of the Social Impact Assessment for the Amakhala Emoyeni Wind Energy Facility (Barbour and Rogatschnig, 2010) which assessed the anticipated negative impact on tourism as an industry to be low.

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

9. MANAGEMENT PLAN

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

Table 7: Management plan - Amakhala Emoyeni Wind Energy Facility

OBJECTIVE: The mitigation and possible negation of the additional visual impacts associated with the construction and operation of the Amakhala Emoyeni Wind Energy Facility.		
Project component/s	Amakhala Emoyeni Wind Energy facility construction site, access roads, substations and distribution power lines.	
Potential Impact	The potential scarring of the landscape due to the creation of new access roads/tracks or the unnecessary removal of vegetation.	
Activity/risk source	The viewing of the abovementioned visual scarring by observers in the vicinity of the WEF or from the roads traversing the site.	
Mitigation: Target/Objective	Minimal disturbance to vegetation cover in close vicinity to the proposed WEF and its related infrastructure.	
Mitigation: Action/control	**Responsibility**	**Timeframe**
Implement an environmentally responsive planning approach to roads and infrastructure to limit cut and fill requirements.	Windlab/contractors	During construction
Adopt responsible construction practices aimed at containing the construction activities to specifically demarcated areas thereby limiting the removal of natural vegetation to the minimum.	Windlab/contractors	During construction
Limit access to the construction sites (during both construction and operational phases) along existing access roads.	Windlab/contractors	Construction / operational phases
Rehabilitate all disturbed areas, including cut and fill slopes to acceptable visual standards.	Windlab/contractors	Construction / operational phases
Maintain the general appearance of the facility in an aesthetically pleasing way.	Windlab	Operational phase
Performance Indicator	Vegetation cover that remains intact with no new access roads or erosion scarring in close proximity of the WEF.	
Monitoring	Monitoring of vegetation clearing during the construction phase.	

Table 8: Management plan – 33/132/220/400kV and 132kV distribution power lines

OBJECTIVE: The mitigation of potential visual impacts caused by the unnecessary removal (clearing) of vegetation cover for the power line servitude or the creation of new access roads during the construction phase.

Project component/s	Distribution power line servitude.		
Potential Impact	The potential scarring of the landscape due to the creation of cleared cut-lines and new roads/tracks.		
Activity/risk source	The viewing of the abovementioned cut lines/roads by observers.		
Mitigation: Target/Objective	Minimal disturbance to vegetation cover in close vicinity to the proposed distribution power line.		
Mitigation: Action/control		Responsibility	Timeframe
Avoid the unnecessary removal of vegetation for the distribution power line servitudes and limit access to the servitudes (during both construction and operational phases) along existing access roads.		Windlab	Construction/Operation.
Performance Indicator	Vegetation cover that remains intact with no visible cut lines, access roads or erosion scarring in and around the power line servitude.		
Monitoring	The monitoring of vegetation clearing during the construction and operational phases of the project.		

Table 9: Management plan - Amakhala Emoyeni Wind Energy Facility (lighting impacts)

OBJECTIVE: The mitigation and possible negation of the potential visual impact of lighting at the WEF substations.		
Project component/s	WEF substations lighting fixtures.	
The potential night time visual impact of lighting fixtures on observers in proximity to the WEF.	The potential night time visual impact of lighting fixtures on observers in proximity to the WEF.	
Activity/risk source	The effects of glare and light trespass on motorists and observers.	
Mitigation: Target/Objective	The containment of light emitted from the substations in order to eliminate the risk of additional night time visual impacts. Minimal usage of security and other lighting. Minimal usage of red warning lights – limit placement to outer structures but still adhere to CAA rules and regulations.	
Mitigation: Action/control	Responsibility	Timeframe
Ensure that proper planning is undertaken regarding the placement of lighting structures and that light fixtures only illuminate areas inside the substation sites. Undertake regular maintenance of light fixtures.	Windlab/lighting engineer.	Construction/Operation.
Performance Indicator	The effective containment of the light to the substation site.	
Monitoring	The monitoring of the condition and functioning of the light fixtures during the operational phase of the project.	

10. REFERENCES/DATA SOURCES

Barbour, T and Rogatschnig, D. 2010. *Social Impact Assessment for Amakhala Emoyeni Wind Energy Facility*. Unpublished report.

Civil Aviation Authority (CAA), *SA-CATS AH 139.01.33: Obstacle Limitations and Markings Outside Aerodrome or Heliport (Marking of Obstacles)* and *Aviation Act, 1962 (Act No. 74 of 1962) Thirteenth Amendment of the Civil Aviations Regulations (CAR's) 1997*

Chief Director of Surveys and Mapping, varying dates. *1:50 000 Topo-cadastral maps and data*

CSIR/ARC, 2000. *National Land-cover Database 2000 (NLC 2000)*

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

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