

**PROPOSED SPITSKOP WIND ENERGY FACILITY**  
**VISUAL ASSESSMENT - INPUT FOR SCOPING REPORT**

Produced for:  
**Renewable-Energy Systems Southern Africa (Pty) Ltd (RES SA)**

**Produced by:**  
MetroGIS (Pty) Ltd.  
PO Box 384, La Montagne, 0184  
Tel: (012) 349 2884/5 Fax: (012) 349 2880  
E-mail: lourens@metrogis.co.za Web: www.metrogis.co.za



**On behalf of:**  
Savannah Environmental (Pty) Ltd.  
PO Box 148, Sunninghill, 2157  
Tel: (011) 234 6621 Fax: 086 684 0547  
E-mail: karen@savannahSA.co.za Web: www.savannahSA.com



**- April 2010 -**

## CONTENTS

1.	INTRODUCTION	2
2.	SCOPE OF WORK	3
3.	METHODOLOGY	3
4.	ANTICIPATED ISSUES RELATED TO VISUAL IMPACT	4
5.	THE AFFECTED ENVIRONMENT	5
6.	POTENTIAL VISUAL EXPOSURE	10
7.	CONCLUSIONS AND RECOMMENDATIONS	13
8.	REFERENCES/DATA SOURCES	16

## MAPS

**Map 1:** Shaded relief map (indicating the location of the proposed WEF and the topography and elevation above sea level) of the study area.

**Map 2:** Land cover/land use map of the study area.

**Map 3:** Potential visual exposure of the proposed WEF.

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 Spitskop Wind Energy Facility. Neither the author, MetroGIS or V&L Landscape Architects will benefit from the outcome of the project decision-making.

## **1. INTRODUCTION**

Renewable Energy Systems Southern Africa (Pty) Ltd (RES SA) is proposing the establishment of a Wind Energy Facility (WEF) north west of Riebeek East in the Eastern Cape Province.

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

In order to optimise the use of the wind resource and the amount of power generated by the facility, the number of wind turbines erected in the area as well as the careful placement of the turbines in relation to the topography must be considered.

RES SA intends to construct up to 200 turbines over an area of approximately 264km<sup>2</sup>, and the facility will have an energy producing capacity of up to 420 MW. A formal layout of the facility has not been finalised yet, but additional infrastructure would include the following:

- Cabling between the components, laid underground where feasible;
- Internal access roads to each turbine;
- A workshop area for control, maintenance and storage;
- An on-site substation/s to facilitate the connection between the facility and the grid; and
- A new overhead power line(s) likely to be connected to Eskom's existing Poseidon Substation near Cookhouse.

Each wind turbine is expected to consist of a foundation, a steel tower, a hub (between 80m and 120m above ground level, depending on the turbine size decided upon) and three 40-55m long blades attached to the hub. Variations of the above dimensions may occur, depending on the preferred supplier or commercial availability of wind turbines at the time of construction.

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 scope of work for the proposed facility includes a scoping level visual assessment of the issues related to the visual impact. The scoping phase is the process of determining the spatial and temporal boundaries (i.e. extent) and key issues to be addressed in an impact assessment.

The main purpose is to focus the impact assessment on a manageable number of important questions on which decision-making is expected to focus and to ensure that only key issues and reasonable alternatives are examined.

The study area for the visual assessment encompasses a geographical area of approximately 7 112km<sup>2</sup> (the extent of the maps displayed below) and includes a minimum 20km buffer zone from the proposed development area.

The broader study area includes the towns of Grahamstown in the south east, Alicedale in the south and Cookhouse in the north. The N10 and the N2 traverse the study area, which also includes a number of main roads (i.e. the R335, the R400 and the R350).

Agricultural activity (cultivated land) tends to be limited to defined areas along the Great Fish River and its tributaries, while grazing is widespread.

Industrial infrastructure includes the Poseidon and Golden Valley Substations near Cookhouse and the Doornkom Substation near Alicedale. 132kV, 220kV and 400kV Power lines cross the study area in a predominantly northerly direction to converge at the Poseidon Substation.

## **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.

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 (scoping report) sets out to identify the possible visual impacts related to the proposed Spitskop WEF.

#### **4. ANTICIPATED ISSUES RELATED TO VISUAL IMPACT**

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

- The visibility of the facility to, and potential visual impact on observers travelling along national roads (i.e. the *N10*), arterial roads (i.e. the *R335* and *R400*) and secondary roads in close proximity to the proposed WEF.
- The visibility of the facility to, and potential visual impact on observers travelling along national roads (i.e. the *N10*), arterial roads (i.e. the *R335*, *R400*, *R350* and *R344*) and secondary roads within the region.
- The visibility of the facility to, and visual impact on towns and built up areas (i.e. *Riebeek East*) in close proximity to the proposed WEF.
- The visibility of the facility to, and visual impact on towns and built up areas (i.e. *Cookhouse*, *Grahamstown*, *Somerset East* and *Alicedale*) within the region.
- The visibility of the WEF to, and visual impact on private and public conservation areas (i.e. the *East Cape Game Farm*, *Aylesbury Nature Reserve* and *Frontier Safaris Game Farm*) as well as undeclared protected areas in close proximity to the proposed WEF.
- The visibility of the WEF to, and visual impact on public and private conservation areas (i.e. the *Woodlands Game Reserve*, *Kwandwe Private Game Reserve*, *Rockdale Game Ranch*, *Shamwari Game Reserve*, *Kuzuko Game Reserve* and *Addo Elephant National Park*) as well as undeclared protected areas within the region.
- The visibility of the facility to, and visual impact on rural homesteads and farmsteads within the region.
- The visibility of the WEF to, and visual impact on the visual character and sense of place of the region, with specific reference to the pastoral landscape and historic towns (i.e. *Riebeek East*, *Cookhouse*, *Grahamstown*, *Somerset East* and *Alicedale*).
- The visibility of the WEF to, and visual impact on tourist access routes (*N10*, *R335*, *R400*, *R350*, *R344*) and tourist destinations within the region.
- The visibility of the WEF to, and visual impact on scenic and sensitive topographical features, particularly the rivers and the mountains within the region. These features have an inherent recreational and tourism potential.
- The potential visual impact of the construction of ancillary infrastructure (i.e. the substation, associated power lines, internal access roads etc.).
- The potential impact of lighting of the facility in terms of light glare, light trespass and sky glow.
- The potential visual impact of shadow flicker. This only occurs when the sky is clear, and when the 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, the site itself plus a 500m buffer along the edge of the facility is submitted as the zone within which there is a risk of shadow flicker occurring.
- The potential visual impacts associated with the construction phase.
- The potential cumulative visual impact of the proposed WEF and associated infrastructure in context of the existing power line

infrastructure and the proposed Cookhouse WEF (authorised by DEA) located approximately 30km to the north of the site.

It is envisaged that the issues listed above may constitute a visual impact at a local and/or regional scale. These anticipated visual impacts should be assessed in greater detail during the EIA phase of the project as this report is only focussed on defining the potential visual exposure of the proposed development and identifying the potential issues associated with the visibility of the development.

## **5. THE AFFECTED ENVIRONMENT**

The study area falls within the Cacadu District Municipality of the Eastern Cape Province.

The proposed development site encompasses a surface area of approximately 247km<sup>2</sup>. The final surface area to be utilised for the facility will be smaller, depending on the type of turbine selected, the final site layout and the placement of wind turbines and ancillary infrastructure.

The project is proposed on portions of the following farms:

- Steenkampsberg 590;
- The Remainder of Buffels Drift 61;
- Farm 579;
- Portion 1 of Farm 61 Junction Drift;
- Portions 2,3, the remainder of Portion 1 and the remaining extent of Farm 60;
- Portions 2 and 3 of Groot Fontein 138;
- Portion 1 of the remaining extent of Bosch Fontein 143;
- Portions 2, 3 and the remainder of Portion 1 of Groot Fontein 140;
- Portion 2, the remainder of Portion 1 and the remaining extent of Ebenezer 141;
- Portion 3, 4 and the remaining extent of Farm 144;
- Portion 3 of Modderfontein 302;
- Portion 1 and the remaining extent of Bothas Hoop 358;
- The remaining extent of Draai Van Klein Visch Rivier 254;
- Portion 1 and the remaining extent of Gras Fonteyn 258;
- Springbokvlakte 434;
- Portion 3 and the remaining extent of Driefontein 259;
- The remainder of Portion1, the remainder of Portion 6 and Portion 11 of Witte Poort 262;
- Portions 1 and 2 of Varkens Kuil 269;
- The remaining extent of Brand Rug 268;
- Portion 1 of Commadagga 264;
- Farm 369;
- Portion 2 and the remainder of Portion 1 of Brakfontein 261;
- Portions 1 and 3 of Commadagga 263;
- Portions 2, 6, 7, 8, the remainder of Portion 3, the remainder of Portion 4 and the remaining extent of Commadagga 266;
- Driefontein 436;
- The remaining extent of Farm 267;
- Portions 1, 2 and the remaining extent of Farm 145;
- Portion 1 Bronkos Fontein 139;
- The Remaining extent of Farm 66;

The above farm portions span an area measuring about 35km long (east to west) and 15 km wide (north to south), and are located approximately 33km south of Cookhouse and some 33km north west of Grahamstown at the closest points.

The study area occurs on land that ranges in elevation from 200m a.s.l. along the rivers to about 1150m a.s.l. at the top of the hills. The topography consists of *hills and lowlands* in the centre the study area, *lowlands with parallel hills* in the south, and *low mountains* in the far south west of the study area. The mountains in the south west are part of the *Suurberge* mountain range, which in turn forms part of the mountains of the Great Escarpment.

The proposed site for the WEF is located along a series of parallel hills and is sandwiched between the Great Fish River drainage system to the north and the Bushmans River drainage system to the south.

The tributaries of these river systems are perennial, and include the *Bushmans, New Years, Gxetu, Great Fish, Little Fish, Koonap and Brak Rivers*. A number of on- and off-stream water bodies are also evident along the rivers and in the lower lying areas. Refer to **Map 1**.

In terms of climate, the study area is located in a transition zone between a mediterranean climate (from the west) and the temperate zone (from the east). It is also on the cusp between the dry interior and the relatively higher rainfall coastal belt. The annual rainfall ranges between approximately 135mm and 725mm.

The classified vegetation types in the study area include *Eastern Province Grassveld, False Central Lower Karoo, False Thornveld of the Eastern Province, False Karroid Broken Veld, and Valley Bushveld*.

Sheep, cattle and game farming dominate the general land-use character of this region. The flatter, low lying areas are characterised by *shrubland and grassland*, while the higher lying and more mountainous areas are covered by *thicket and bushland*. Irrigated agricultural fields and some planted pastures occur along the Great Fish River and its tributaries as well as in scattered areas in the south of the study area.

The towns of Grahamstown, Cookhouse, Somerset East, Alicedale and the hamlet of Riebeek East account for the highest population concentrations within the region, which has an average population density of 10 people per km<sup>2</sup>.

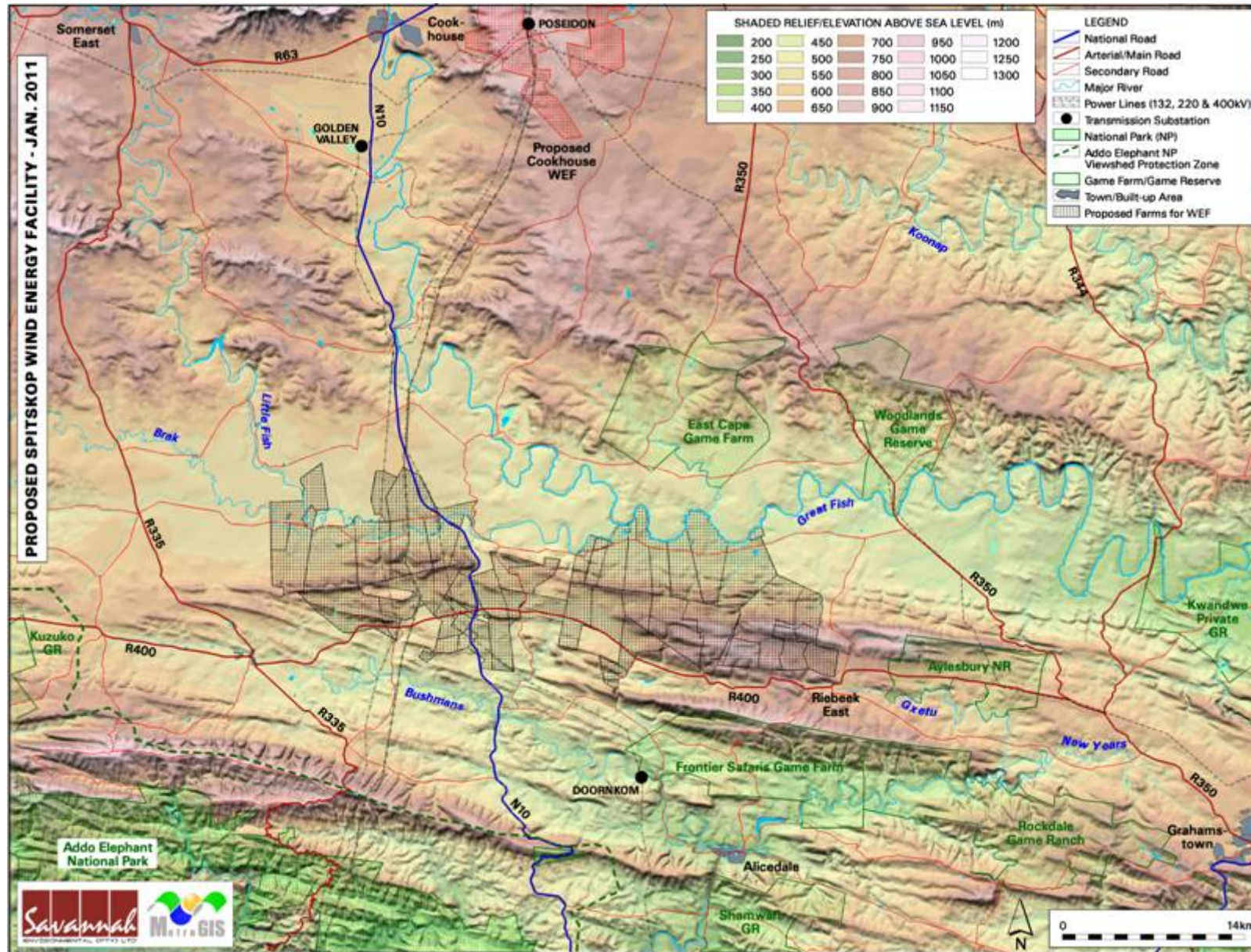
The study area has a rural character with very few structures outside of the above-mentioned town boundaries. Exceptions occur in the form of three transmission substations, and a network of power lines, which all converge at the Eskom Poseidon transmission substation. Refer to **Map 2**.

Conservation areas<sup>1</sup> in the region include the following:

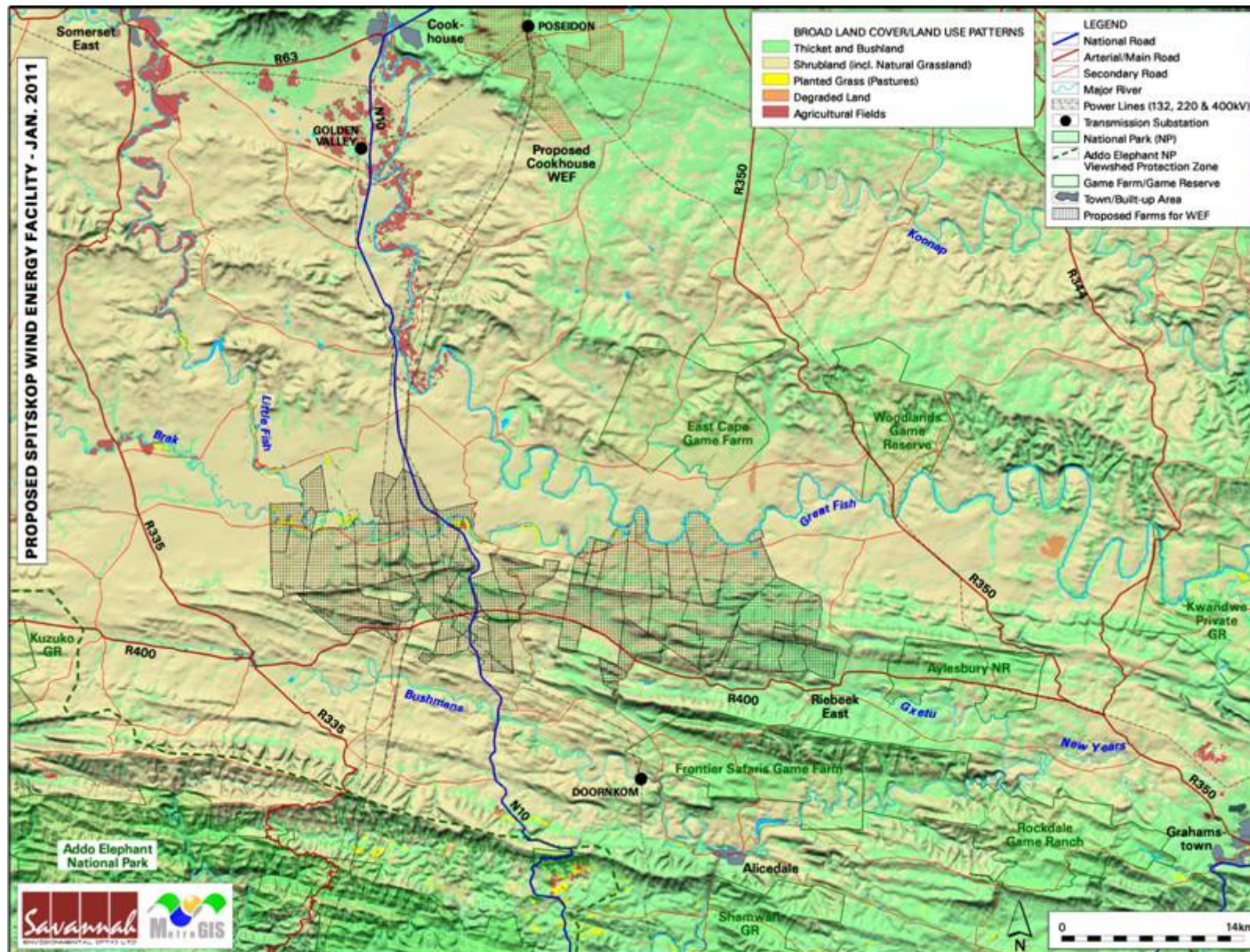
- The *Addo Elephant National Park* located approximately 17km south west of the site.
- Game farms including the *East Cape GF* (3km north of the site) and the *Frontier Safaris GF* (3km south of the site).
- Game Reserves including the *Woodlands GR* (8km to the north east), *Kwandwe Private GR* (23km east of the site), *Shamwari GR* (15km south of the site) and *Kuzuko GR* (20km south west of the site).
- *Aylesbury Nature Reserve* located 4km to the east of the site.
- *Rockdale Game Ranch* located 4km to the south east of the site.

---

<sup>1</sup> For the purpose of this study, conservation areas include all public and private land that is protected for conservation purposes.



**Map 1:** Shaded relief map (indicating the location of the proposed WEF and the topography and elevation above sea level) of the study area.



## 6. POTENTIAL VISUAL EXPOSURE

The result of the preliminary viewshed analyses for the proposed facility is shown on **Map 3**. The initial viewshed analyses were undertaken from 200 theoretical vantage points within the proposed development area at offsets of 120m above average ground level (i.e. the maximum hub height of 3MW proposed wind turbines).

This was done in order to determine the general visual exposure of the area under investigation, simulating the proposed structures associated with the facility. It must be noted that the viewshed analyses do not include the effect of vegetation cover or existing structures on the exposure of the proposed wind turbines, therefore signifying a worst-case scenario.

The viewshed analyses will be refined once a preliminary layout of the wind energy facility is completed and will be regenerated per actual turbine position (and actual proposed turbine height) during the EIA phase of the project.

Map 3 indicates areas from which any number of turbines (with a minimum of one turbine) could potentially be visible as well as proximity offsets from the proposed development area. The following is evident from the viewshed analyses:

- The proposed facility would have a large core area of potential visual exposure on the site itself, and within a 5km offset.

Almost this entire area, which includes the small town of Riebeeck East, the N10, the R400 and a number of secondary roads, will be potentially visually exposed to the proposed WEF. This includes the southern parts of the East Cape Game Farm and the northern tip of the Frontier Safaris Game Farm.

The mountains in the south of this zone afford some visual screening to a patchwork of areas to the south west, the south and east.

- Potential visual exposure is somewhat reduced, but remains high, in the medium distance (i.e. between 5 and 10km).

Visually exposed areas include interrupted stretches of the N10, the R400, the R355 and a short stretch of the R350. A number of secondary roads will also be visually exposed.

Large parts of the East Cape Game Farm and the southern tip of the Woodlands Game Reserve also fall within this zone of potential visual exposure.

Increasingly large areas in the south east and east of this zone are afforded partial visual screening by the mountains. These partly screened areas include most of the Frontier Safaris Game Farm and parts of the Aylesbury Nature Reserve.

Smaller areas of partial visual screening are also evident in the south, south west and north of the zone.

- In the medium to long distance (i.e. between 10 and 20km), areas of potential visual exposure to the proposed WEF are significantly reduced.

Visually exposed areas occur in a sparse patchwork throughout the zone, with the exception of the south west, which is entirely screened by the mountains.

Visually exposed areas include very limited stretches of the N10, the R400, the R335 and the R350. In addition, the northern parts of the East Cape Game Farm, the Woodlands Game Reserve, the eastern half of Aylesbury NR, some central parts of Rockdale GR and the northern section of Shamwari GR will be visually exposed.

The town of Alicedale, parts of the Kuzuko GR and the north eastern section of the Addo Elephant National Park also fall within this zone, but neither will be exposed to potential visual impact.

- In the longer distance (i.e. beyond 20km), visual exposure is drastically reduced, with sparse patches of potentially exposed areas in the north west and south east only.

The outskirts of Cookhouse, Grahamstown and Somerset West could potentially be exposed to visual impact, as could parts of the N10, the R335 and the R400 and the R63 in the north west of the study area. Similarly, parts of the R350 in the east of the study area could be visually exposed.

Conservation areas potentially subject to visual impact within this zone include the Kwandwe Private NR, the eastern section of the Rockdale GR and the southern part of the Shamwari GR.



## 7. CONCLUSIONS AND RECOMMENDATIONS

It is envisaged that the proposed Spitskop WEF will have a visual impact on a number of potentially sensitive visual receptors especially within (but not restricted to) a 10km radius of the facility.

Such visual receptors include people travelling along roads and residing in towns and tourists visiting conservation areas or other destinations in the region.

The area potentially affected by the proposed development is generally seen as having a high tourism value and tourism potential based on the presence of well known national and arterial access routes (i.e. the N10, the R335, the R400, the R350 and the R344), as well as the historic towns of Riebeeck East, Grahamstown, Alicedale, Cookhouse and Somerset East. The high occurrence of conservation areas and the National Park within the study area also contributes to this value.

Furthermore, the pastoral landscape is considered to have a pleasing sense of place based on the aesthetic quality of the receiving environment.

It is therefore recommended that the severity of the potential visual impact on sensitive receptors be assessed in further detail in the EIA. Additional spatial analyses must be undertaken in order to create a visual impact index that will further aid in determining potential visual impact.

Specific spatial criteria need to be applied to the visual exposure of the proposed facility in order to successfully determine visual impact and ultimately the significance of the visual impact. In addition, photo simulations of critical viewpoints should be undertaken where required, in order to aid in the visualisation of the envisaged visual impact.

This recommended work must be undertaken during the Environmental Impact Phase of reporting for this proposed project.

In this respect, the Plan of Study for EIA is as follows:

- **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.

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 facility) are as follows:

- 0 - 5km. Short distance view where the facility 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 comfortably 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.

- **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 facility 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 landscape**

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 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.

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 region. It is therefore necessary to determine the VAC by means of the interpretation of the natural visual characteristics, 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.

The above exercise should be undertaken for the core wind energy facility as well as the ancillary infrastructure, as these structures (e.g. the substation and power lines) are envisaged to have varying levels of visual impact at a more localised scale.

The site-specific issues (as mentioned earlier in the report) and potential sensitive visual receptors should be measured against this visual impact index and be addressed individually in terms of nature, extent, duration, probability, severity and significance of visual impact, as well as suggested mitigation measures.

## **8. REFERENCES/DATA SOURCES**

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

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

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

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