WIND ENERGY FACILITY NORTH OF OYSTER BAY

VISUAL ASSESSMENT - INPUT FOR SCOPING REPORT

Produced for:

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CONTENTS

MAPS

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

1. INTRODUCTION

Renewable-Energy Systems (RES) Southern Africa (Pty) Ltd is proposing the establishment of a Wind Energy Facility (WEF) approximately 13km south-west of Humansdorp and 6km north of Oyster Bay 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 intends to construct the WEF over an area of approximately 23km². RES is still investigating which turbine size will be most suitable for the site and conditions. The facility is most likely to host up to a maximum of:

- 50 turbines of size 3MW each or
- 80 turbines of size 1.8MW each.

The facility will have an energy producing capacity of up to 160 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 to facilitate the connection between the facility and the grid; and
- A new overhead power line to connect to Eskom's existing Melkhout (132kV/66kV) substation which is approximately 20km from the site.

Each wind turbine is expected to consist of a concrete foundation, a steel tower, a hub (between 80m or 120m above ground level, depending on the turbine size decided upon) and three 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 800km² (the extent of the maps displayed below) and includes a minimum 20km buffer zone from the proposed development area.

The broader study area includes towns and built up areas as well as a number of scattered farms and homesteads. The towns of Humansdorp and Kruisfontein lie to the north-east of the proposed WEF, St. Francis Bay to the east and Oyster Bay to the south.

Industrial infrastructure includes distribution power lines, both to the north and to the east of the site as well as three distribution substations (i.e. *Diep River, St. Francis Bay* and *Melkhout*).

A number of roads are found in the study area and include the N2 national road, the R62, R102, R332 and R330 arterial routes and a number of lower order secondary roads which also traverse the site.

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 facility.

4. ANTICIPATED ISSUES RELATED TO VISUAL IMPACT

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

- The visibility of the facility to, and potential visual impact on observers travelling along the national (N2), arterial (R62, R102, R332, R330) and secondary roads within the study area.
- The visibility of the WEF to, and visual impact on built-up centres and populated places (i.e. the towns of Humansdorp, Kruisfontein, St Francis Bat and Oyster Bay).
- The visibility of the facility to, and visual impact on farmsteads and homesteads within the study area.
- The visibility of the WEF to, and visual impact on protected and conservation areas. Protected areas situated within close proximity of the site include the *Thyspunt National Heritage Site* (2km to the south east), the *Rebelsrus Private Nature Reserve* (2km east of *Thyspunt*), the *Eastcot Private Nature Reserve* (5km to the north east), the *Lombardini Game Farm* (12km to the north east), *Jumanji* and *Thaba Manzi Game Farms* (14km to the north), the *Kromrivierspoort National Heritage Site* (12km to the north west) and the *Huisklip Provincial Nature Reserve* (16km to the west). State Forest also lies to the north-west of the site, as well as in small patches along the coastline.
- The potential impact of the facility on the pastoral visual character and sense of place of the region, with specific reference to the tourist routes (N2, R102, R330, R62, R332) and tourist destinations (i.e. *St. Francis Bay* and *Oyster Bay*).
- The potential visual impact of the construction of ancillary infrastructure (i.e. the substation, associated power lines, internal access roads etc.) on observers in close proximity of the facility.
- The visual absorption capacity of the natural environment.
- Potential cumulative visual impacts.
- The potential visual impact of operational, safety and security lighting of the facility at night on observers residing in close proximity of the facility.
- 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, a 500m buffer along the edge of the facility is submitted as the zone within which there is a risk of shadow flicker occurring.
- Potential visual impacts associated with the construction phase.
- The potential to mitigate visual impacts and inform the design process.

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

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 project is proposed on portions of the following farms:

- Portion 3 of Farm Klein Rivier 713
- Portion 1, 2, 3, 4, and Remainder of Farm Rebok Rant 715
- Portion 1 and 3 of Farm ou Werf 738
- Portion 5 of Farm Klippedrift 732
- Portion 10 and 12 of Farm Kruis Fontein681

The proposed development site encompasses a surface area of approximately 23km². The final surface area to be utilised for the facility may be smaller, depending on the type of turbine selected, the final site layout and the placement of wind turbines and ancillary infrastructure.

The study area falls within the Kouga Local Municipality which forms part of the Cacadu District Municipality. The farm portions are located approximately 13km south west of Humansdorp and Kruisfontein and about 6km north of the coastline at Oyster Bay.

The study area occurs on land that ranges in elevation from less than 40m asl at the coast to 880m asl at the top of the hills. The topography is classed as *lowlands with undulating hills* and is characterised mostly by moderate slopes. In the north of the study area, more mountainous terrain with steeper slopes begins to manifest.

The terrain surrounding the site is predominantly flat, but is incised by a large number of perennial river valleys. The rivers dissecting the study area include the Tsitsikamma River, the Klipdrift River (of which originates in the study area), and the Krom River.

The Mpofu Dam is located adjacent to the proposed site at its northern border. A number of smaller farm dams also occur on the site itself. Refer to **Map 1**.

With its subtropical climate, the study area receives about 552mm of rainfall per year.

The land type is dominated by *planted grassland / pastures* and *agricultural fields.* To the north, the land use changes to s*hrubland* interspersed with *thicket and bushland.* To the south, land use is dominated by *thicket and bushland.* Pockets of *shrubland* and *bare rock/natural soil* can be found along the coastline.

Karroid Danthonia Mountain Veld is the dominant vegetation type in the study area. Refer to **Map 2.**

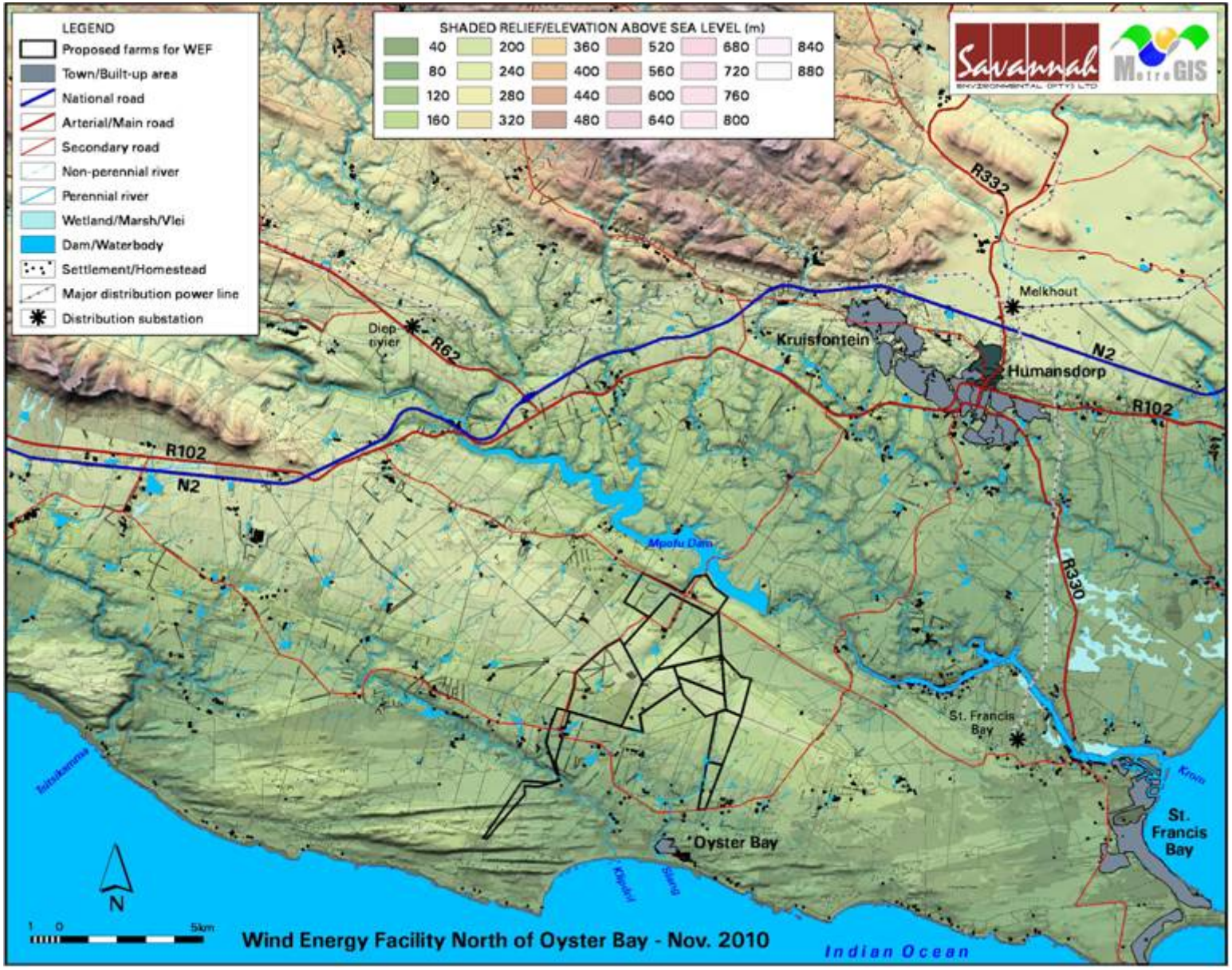
The towns of Humansdorp, Kruisfontein, St Francis Bay and Oyster Bay account for the highest population concentration within the region, which has an average of 7 persons per km^2.

Outside of the urban and industrial areas, the region has an agricultural, rural and pastoral character, with scattered farmsteads and homesteads. Large areas have been given over to conservation, or remain in a natural state.

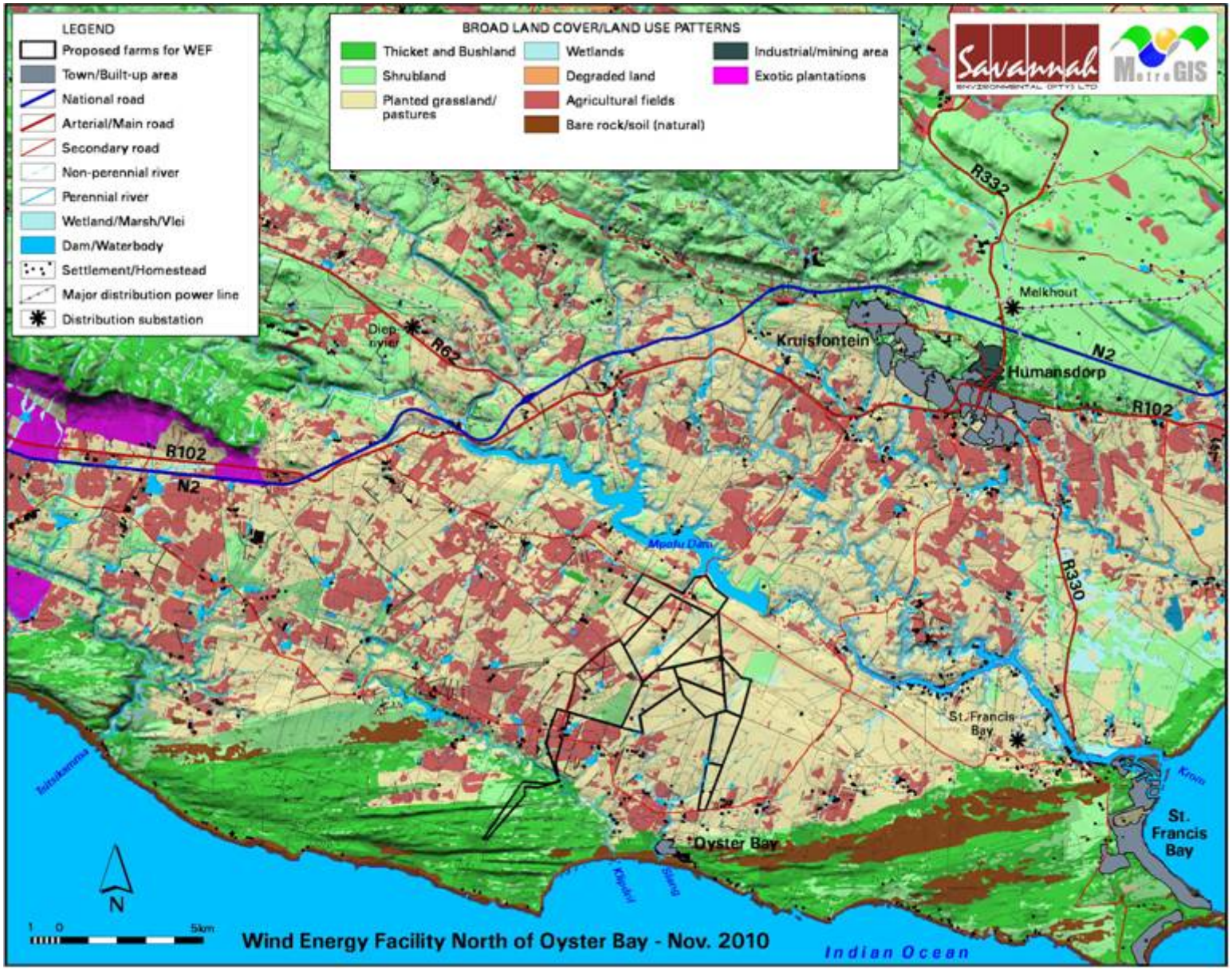
Conservation areas in the region include the following:

- A number of game farms including *Jumanji* and *Thaba Manzi Game Farms* (14km to the north) and *Lombardini Game Farm* (12km to the north east).
- The *Huisklip Provincial Nature Reserve* (16km to the west).
- Private nature reserves including the *Rebelsrus Private Nature Reserve* (2km east of *Thyspunt*) and the *Eastcot Private Nature Reserve* (5km to the north east).
- National heritage sites including the *Thyspunt National Heritage Site* (2km to the south east) and the *Kromrivierspoort National Heritage Site* (12km to the north west).
- A number of small conservation areas are also dotted along the coastline.
- State Forest to the north-west of the site, as well as in small patches along the coastline.

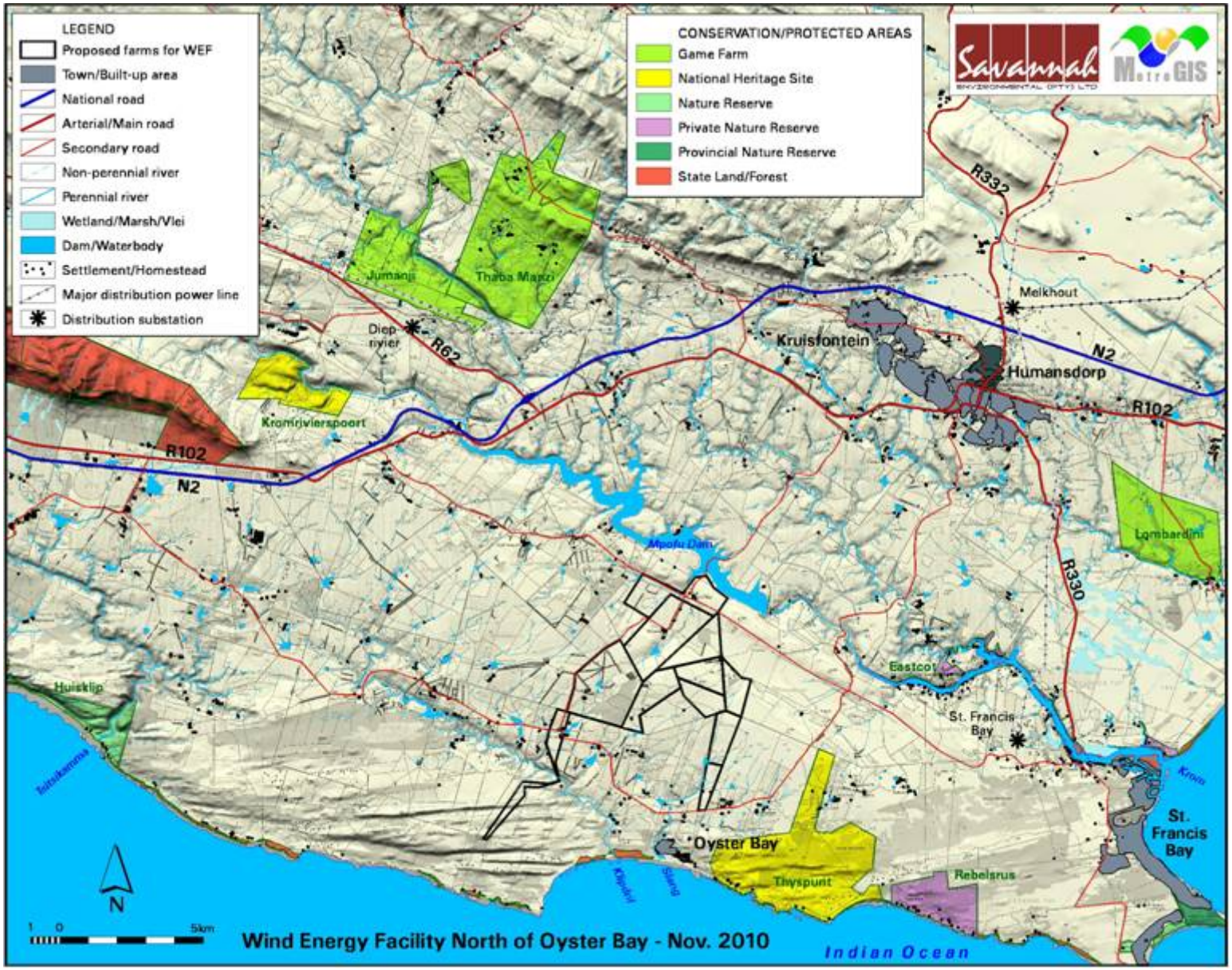
Refer to **Map 3**.



Map 1: Shaded relief map (indicating the location of the proposed facility 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: Conservation/protected areas within the study area.

6. POTENTIAL VISUAL EXPOSURE

The result of the preliminary viewshed analyses for the proposed facility is shown on the map overleaf (**Map 4**). The initial viewshed analyses were undertaken from 50 preliminary vantage points within the proposed development area at offsets of 120m above average ground level (i.e. the approximate hub height of the 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 - maximum number of turbines.

The viewshed analyses will be refined once a preliminary layout of the wind energy facility is completed and will be regenerated per turbine position (and actual proposed turbine height) during the EIA phase of the project. This will be undertaken for the worst case scenario - which would be a maximum of 80 turbines and the proposed layout(s) of the project that are to be assessed during this phase.

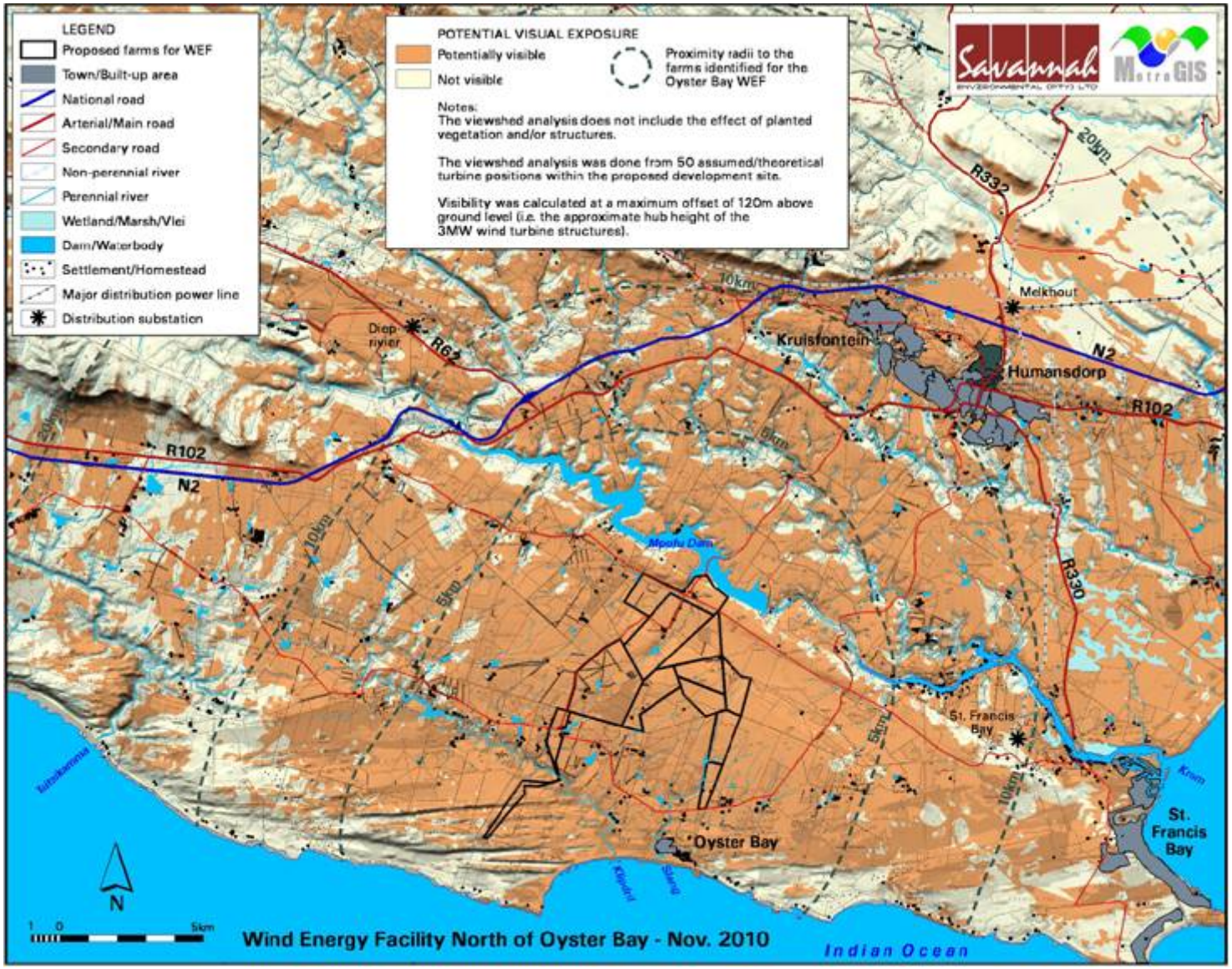
Map 4 indicates areas from which any number of turbines (with a minimum of one turbine) could potentially be visible as well as proximity offsets from the proposed development area, for the worst case scenario as described above. The following is evident from the viewshed analyses:

- The proposed facility would have a large core area of potential visual exposure on the site itself, and within a 5km offset of the site. Almost the entire area within 5km is visually exposed to the WEF. This includes the Mpofu Dam and a number of farms/homesteads and the town of Oyster Bay.
- Potential visual exposure is also high in the medium distance (i.e. between 5 and 10km). The receptors that are visually exposed to the proposed WEF include the town of Kruisfontein and a number of individual farms/homesteads. Only narrow strips along the incised river valleys and pockets along the coastline are visually shielded from the proposed WEF by virtue of the topography.
- In the longer distance (i.e. beyond 10km), visual exposure is somewhat reduced and becomes interrupted by the undulating topography in the west and north. Visual exposure to the east remains high. Receptors exposed to potential visual exposure include most parts of the towns of Kruisfontein, Humansdorp and St Francis Bay as well as most of the individual farms/homesteads which occur in this range.
- The facility will be visible for almost the entire length of the N2 and the R102 which cross the entire study area (and bypass the site in the medium distance).
- Most of the R330 (beyond 10km) will experience potential visual impact and interrupted sections of the R62 and the R332 will be visually exposed beyond the 10km radius.
- All the secondary roads within 10km of the proposed WEF will potentially be exposed to visual impact for long, continuous stretches.
- Conservation areas within the study area are also visually exposed to the proposed WEF. The visual exposure of these areas is as follows:

    - *Thyspunt National Heritage Site* (3km to 7km away) will experience high visual exposure in the north of the site.

- *Rebelsrus Private Nature Reserve* (8km to 10km away) will be visually screened, except on its northern boundary.
- *Eastcot Private Nature Reserve* (7km away) will be almost entirely exposed.
- *Lombardini Game Farm* (15km away) is will also be likely almost entirely visually exposed.
- *Jumanji* and *Thabe Manzi Game Farms* and the *Kromrivierspoort National Heritage Site* (10km to 15km away) as well as are likely to be visually exposed for discontinuous patches within the reserves.
- The *Huisklip Provincial Reserve* (12km to 16km away) and the *State Forest* (>12km away) will be mostly screened from potential visual exposure, with the exception of isolated patches within the reserves.

It is envisaged that the facility structures would be largely visible to observers (i.e. people travelling along roads, residing at homesteads or in the towns, and tourists visiting the region), especially within a 0-10km radius of the site and would constitute a high visual prominence, potentially resulting in a visual impact.



Map 4: Potential visual exposure of the proposed facility.
(Note: the visible area indicates areas from which any number of wind turbines (with a minimum of one turbine) may be visible.

7. CONCLUSIONS AND RECOMMENDATIONS

The construction and operation of the WEF north of Oyster Bay will in all likelihood have a visual impact on a number of potentially sensitive visual receptors especially within (but not restricted to) a 10km radius of the facility.

These sensitive receptors should be identified and the severity of the visual impact assessed within the EIA phase of the project. Photo simulations of critical viewpoints should be undertaken (as part of VIA), where required, in order to aid in the visualisation of the envisaged visual impact.

The area potentially affected by the proposed development is generally seen as having a high tourism value and potential based on the presence of the well known national and arterial access routes (i.e. the N2, the R62, R102, R332, and R330) traversing the area close to the site, as well as the tourist towns of Oyster Bay and St. Francis Bay. The high occurrence of conservation areas 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 additional spatial analyses be undertaken in order to create a visual impact index that will further aid in determining potential areas of visual impact.

Specific spatial criteria need to be applied to the visual exposure of the proposed facility in order to successfully determine the issues related to the visual impact and ultimately the significance of the visual impact. The Plan of Study for the EIA phase will include the following:

- **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 / solar 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

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