PROPOSED OYSTER BAY WIND ENERGY FACILITY

On a site north of Oyster Bay, Eastern Cape

VISUAL IMPACT ASSESSMENT

Produced for:

Renewable-Energy Systems (RES) Southern Africa (Pty) Ltd

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- September 2011 –

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1. STUDY APPROACH

1.1. Qualification and Experience of the Practitioner

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

1.2. Assumptions and Limitations

This assessment was undertaken during the planning stage of the project and is based on information available at that time.

1.3. Level of Confidence

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

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

[1] Adapted from Oberholzer (2005).

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

These values are applied as follows:

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

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

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

1.4. 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 approach utilised to identify issues related to the visual impact included the following activities:

- The creation of a detailed digital terrain model (DTM) of the potentially affected environment;
- The sourcing of relevant spatial data. This included 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 each type of structure.

  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 landscape**

  This is the capacity of the receiving environment to absorb the potential visual impact of the proposed facility. The VAC is primarily a function of the vegetation, and will be high if the vegetation is tall, dense and

continuous. Conversely, low growing sparse and patchy vegetation will have a low VAC.

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

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

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.

- **Determine Impact significance**

  The potential visual impacts identified and described are quantified in their respective geographical locations in order to determine the significance of the anticipated impact on identified receptors. Significance is determined as a function of extent, duration, magnitude and probability.

2. BACKGROUND

Renewable Energy Systems Southern Africa (Pty) Ltd (RES SA) is proposing the establishment of a Wind Energy Facility (WEF) on a site within the Kouga Local Municipality in the Eastern Cape Province. The site is located approximately 13km south-west of Humansdorp and 6km north of Oyster Bay.

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.

The efficiency of the 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.

RES SA intends to construct the WEF over an area of approximately 23km². RES SA is still investigating which turbine size will be most suitable for the site and local conditions. The options are as follows:

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

The facility will have an energy producing capacity of maximum 160 MW.

A preliminary layout of the WEF infrastructure is shown on **Map 1**. The proposed positions of the turbines (77 as per this proposed layout) have been indicated. Additional infrastructure will include the following:

- Cabling between the components, laid underground where feasible.
- Internal access roads to each turbine (indicated on Map 1).
- A workshop area for control, maintenance and storage.
- An on-site substation to facilitate the connection between the facility and the grid. Two options are being considered (indicated on Map 1), namely:
  - Option 1: the B04 and
  - Option 2: KromRivier Intake/Switching Substation.
- A new overhead power line to connect to Eskom's existing Melkhout (132kV/66kV) substation which is approximately 20km from the site. Three corridor options are under consideration for this power line:
  - The Western Corridor option is approximately 38km in length. The route heads north along the eastern boundary of the site, crosses a ridge and turns north west just before the Mpofu Dam. It follows the boundary of the water purification plant and aligns itself with the existing 22kV power line running north westward. It continues adjacent to the 22kV power line and crosses the upper reaches of the Mpofu Dam. The corridor then follows the R102 for approximately 2.8km turning north over the R102 and heads north easterly to cross the N2. The corridor continues in a north easterly direction until it reaches the 66kV power line feeding into the Melkhout Substation. It then follows this 66kV power line alignment to the Melkhout Substation.
  - The Central Corridor is approximately 26km in length. The route heads north along the Eastern boundary of the wind farm, crosses a ridge and turns south east just before the Mpofu Dam. It then heads towards the dam wall where it aligns itself with the proposed Eskom A route from Thuyspunt to Melkhout Substation.
  - The Eastern Corridor option is approximately 25km in length. The route heads south east, exiting the farm boundary until it reaches the proposed Eskom B route from Thuyspunt to Melkhout Substation. It follows the Eskom route option north for approximately 5.5km then turns east towards the R330. At the R330 the line turns north and aligns itself with the existing 66kV power line. It follows this alignment to the Melkhout Substation.

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. Refer to **Figure 1**.

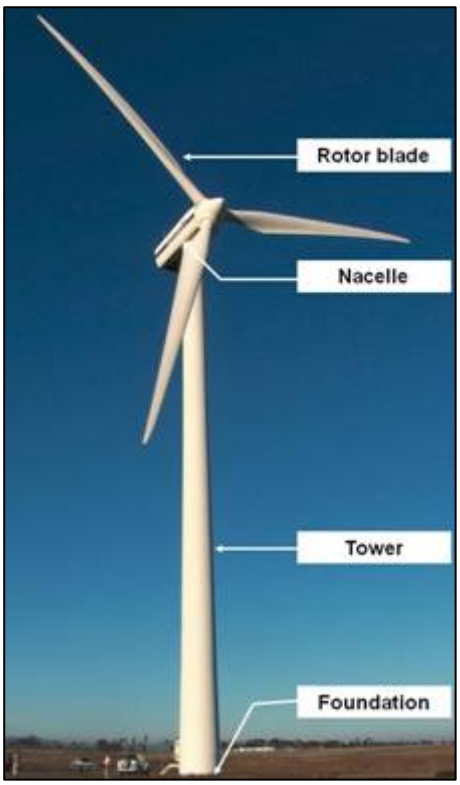


Figure 1: Illustration of the main components of a wind turbine[2]

It is expected, from a visual impact perspective, that the wind turbines would constitute the highest potential visual impact of the WEF.

The construction phase of the WEF is dependent on the number of turbines erected and is estimated to be 24 months in total. This includes all infrastructure related to the wind farm. The lifespan of the facility is approximated at 20 to 25 years.

3. SCOPE OF WORK

The Oyster Bay Wind Energy Facility potentially affects the following farm portions:

- 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 Fontein 681

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

[2] Illustration courtesy of Savannah Environmental.

The scope of work for this assessment 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.

Issues related to the proposed Wind Energy Facility include:

- The potential visual impact on observers travelling along the major roads (i.e. the N2, R62, R102, R332, R330) as well as secondary roads in close proximity[3] to the proposed WEF and within the region[4].
- The potential visual impact on urban centres and populated places in close proximity to the proposed WEF and within the region. These include the towns of Oyster Bay, Humansdorp, Kruisfontein, Jeffrey's Bay, Sea Vista and Cape St Francis.
- The potential visual impact on settlements and homesteads in close proximity to the proposed WEF and within the region.
- The potential visual impact on conservation areas[5] in close proximity to the proposed WEF and within the region.
- The potential visual impact of ancillary infrastructure (i.e. the substation, the workshop, the power lines, the access roads etc.) on observers in close proximity to the proposed facility and/or infrastructure.
- The potential visual impact of the proposed WEF and ancillary infrastructure on the scenic visual character of the landscape and the sense of place of the region, with specific reference to the pastoral landscape and undeveloped coastline.
- The potential visual impact of the proposed WEF and ancillary infrastructure on tourist access routes (i.e. the N2), coastal holiday towns (i.e. St Francis Bay and Oyster Bay) and the tourism potential of the region.
- The potential visual impact on the Thuyspunt / Cape St Francis pre-colonial cultural landscape (extending from Cape St Francis in the east to Klasies River in the west) in close proximity to the proposed WEF and within the region.
- The potential visual impact of operational, safety and security lighting of the facility at night on observers in close proximity to the facility.
- The potential visual impact of shadow flicker.
- Potential visual impacts associated with the construction phase on observers in close proximity to the proposed facility and associated infrastructure.
- The potential cumulative visual impact of the proposed WEF and associated infrastructure, specifically in context of the Authorised Red Cap and Deep River WEF's.
- Potential residual visual impacts after the decommissioning of the facility.
- The potential to mitigate visual impacts and inform the design process.

[3] For the purpose of this study, close proximity is considered to be within 10km of the proposed WEF.

[4] For the purpose of this study, the region is considered to be beyond the 10km radius of the proposed WEF.

[5] For the purpose of this study, these include both private and public nature reserves, game farms, conservation areas, Heritage Sites etc as listed in the SANBI database. They are not limited to conservation areas which have been proclaimed (i.e. municipal and provincial reserves and national parks).

4. THE AFFECTED ENVIRONMENT

Regionally, 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 0m a.s.l. (at the coast) to about 900m a.s.l. at the tops of the local hills. The topography is classed as *slightly undulating plains* along the river valleys and coastline, *low mountains* in the north of the study area, and *moderately undulating plains* in the area between the two.

The terrain surrounding the site is predominantly flat, but is incised by a large number of perennial rivers, including the Klasies, the Tsitsikamma, the Klipdrift, the Krom, the Seekoie, the Swart and the Kabeljous Rivers. The Krom River is the largest of these.

In addition to the above rivers, a number of dams and water bodies occur throughout the coastal plain area, and on the site itself. The largest of these is the Mpofu Dam, which lies adjacent to the site on its northern side. Refer to **Map 1**.

With its temperate coastal climate, the study area receives between 379 mm and 574 mm of rainfall per year in the south, and between 574mm and 725mm per year in the north. The farms comprising the proposed WEF lie within the *Karroid Danthonia Mountain Veld* vegetation type.

The main economic activity of the area is agriculture, including both irrigated agriculture and cattle farming.

The land type is dominated by *planted grassland / pastures* and *agricultural fields.* To the north, the land cover 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. Refer to **Map 2.**

The broader study area includes towns and built up areas as well as a number of farms and homesteads. The latter are concentrated in the agricultural areas, but occur throughout the study area.

The main urban centres are Jeffrey's Bay, Kruisfontein and Humansdorp to the north east of the site, Kareedouw to the west and Sea Vista and Cape St Francis to the south east. Oyster Bay, to the south of the site, is a smaller town. The average population density within the municipality is 30,3 people per km^2.[6] The majority of the population (approx 75%) lives in the urban nodes while approx 25% live in rural villages or homesteads.

[6] *Community Survey, 2007* and *Kouga Local Municipality IDP, 2007-2012.*

Figure 2: Visual quality of the natural rocky shoreline south of St Francis Bay.

Figure 3: Visual quality of the natural thicket and bushland along the shoreline south of St Francis Bay.

Figure 4: Visual quality of typical agricultural land use with mountains in the background.

Figure 5: Typical agricultural homestead.

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.

Industrial type infrastructure includes two major Distribution Power Lines (one running in a north south direction, and the other in an east west direction) as well as three Distribution Substations (i.e. Diep River, St. Francis Bay and Melkhout).

A small industrial area is demarcated within Humansdorp, and a railway line follows the R62 from Kareedouw in the west to Jeffrey's Bay, where after it swings to the north.

In addition, the Authorised RedCap Kouga WEF lies adjacent to the proposed WEF on its eastern side, and in fact stretches across a total area of more than 35km to the west and east of the proposed Oyster Bay WEF. More recently, the Deep River WEF has also been approved. This facility will lie some 10km to the north west of the proposed site.

The study area has a pastoral character and is located within a particularly picturesque part of the country. The site also lies near to the south eastern seaboard of the country. Cape St Francis and Oyster Bay enjoy status as coastal holiday towns and tourist destinations.

The Eastern Cape has 9 tourism routes of which the *Kouga Route*, encompassing Jeffrey's Bay, Cape St Francis and the Gamtoos River Valley, is of relevance within in the study area[7].

Figure 6: Visual quality of St Francis Bay from the Seal Point Nature Reserve.

[7] http://www.ectourism.co.za/experience_eastern_cape

Large areas within the region have been given over to conservation, or remain in a natural state. A number of protected areas of differing status exist within the study area (Refer to **Map 3**)[8].

These protected areas, which include both private and public nature reserves, game farms, conservation areas, etc. (not limited to those which have been formally proclaimed) include the following:

Game Farms:

- Jumanji Game Farm (11km north west of the proposed WEF at its closest point);
- Thaba Manzi Game Farm (11km north east of the proposed WEF at its closest point);
- Lombardini Game Farm (15km north east of the proposed WEF at its closest point).

National Heritage Sites:

- Kromrivierspoort National Heritage Site (12km north west of the proposed WEF at its closest point);
- Thuyspunt National Heritage Site (2km south east of the proposed WEF at its closest point);
- Kabeljous Rivier National Heritage Site (25km north east of the proposed WEF at its closest point);
- Klasies River Cave National Heritage Site (18km west of the proposed WEF at its closest point).

Provincial Nature Reserves:

- Huisklip Nature Reserve (15km west of the proposed WEF at its closest point);
- Kareedouw Nature Reserve (31km north west of the proposed WEF at its closest point);
- Kabeljous River Nature Reserve (25km north east of the proposed WEF at its closest point).

Other Reserves:

- Rebelsrus Private Nature Reserve (7km south east of the proposed WEF at its closest point);
- A number of small coastal reserves, including Seal Point Nature Reserve, Seal Bay Nature Reserve and the Irma Booysen Flora Reserve at Cape St Francis;
- State Forest (14 north-west of the site, as well as in small patches along the coastline).

Note: This study does not include any record of the nature or status of facilities present within these protected areas, or if indeed any facilities exist at all. The visual assessment assumes that visitor access is possible and permitted, and that the potential exists to develop tourist facilities and amenities of a private or public nature.

Refer to **Map 3**.

It is of particular importance that the proposed WEF is located adjacent to one of the richest and best preserved archaeological sites in South Africa, namely the Thuyspunt / Cape St Francis pre-colonial cultural landscape. Anatomically modern

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

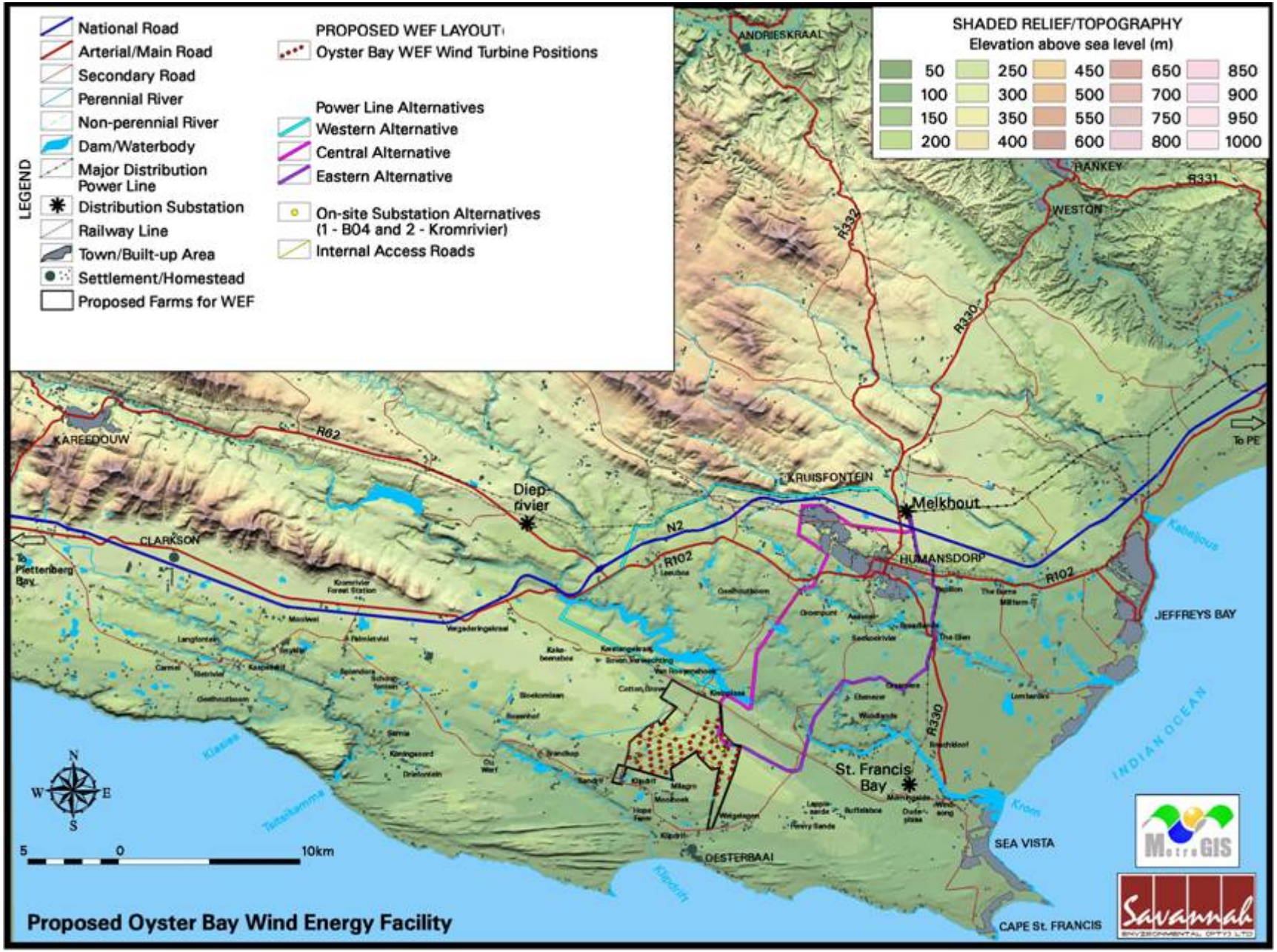
human populations originated here in the wider region and spread to Europe and other parts of the globe.

This pre-colonial cultural landscape extends from Cape St Francis in the east to Klasies River in the west, along the coastline for a distance of about 5km from the coast. This is known as the coastal sensitive zone. This pre colonial cultural landscape is expected to extend west of the Tsitsikamma River, to Klippepunt.

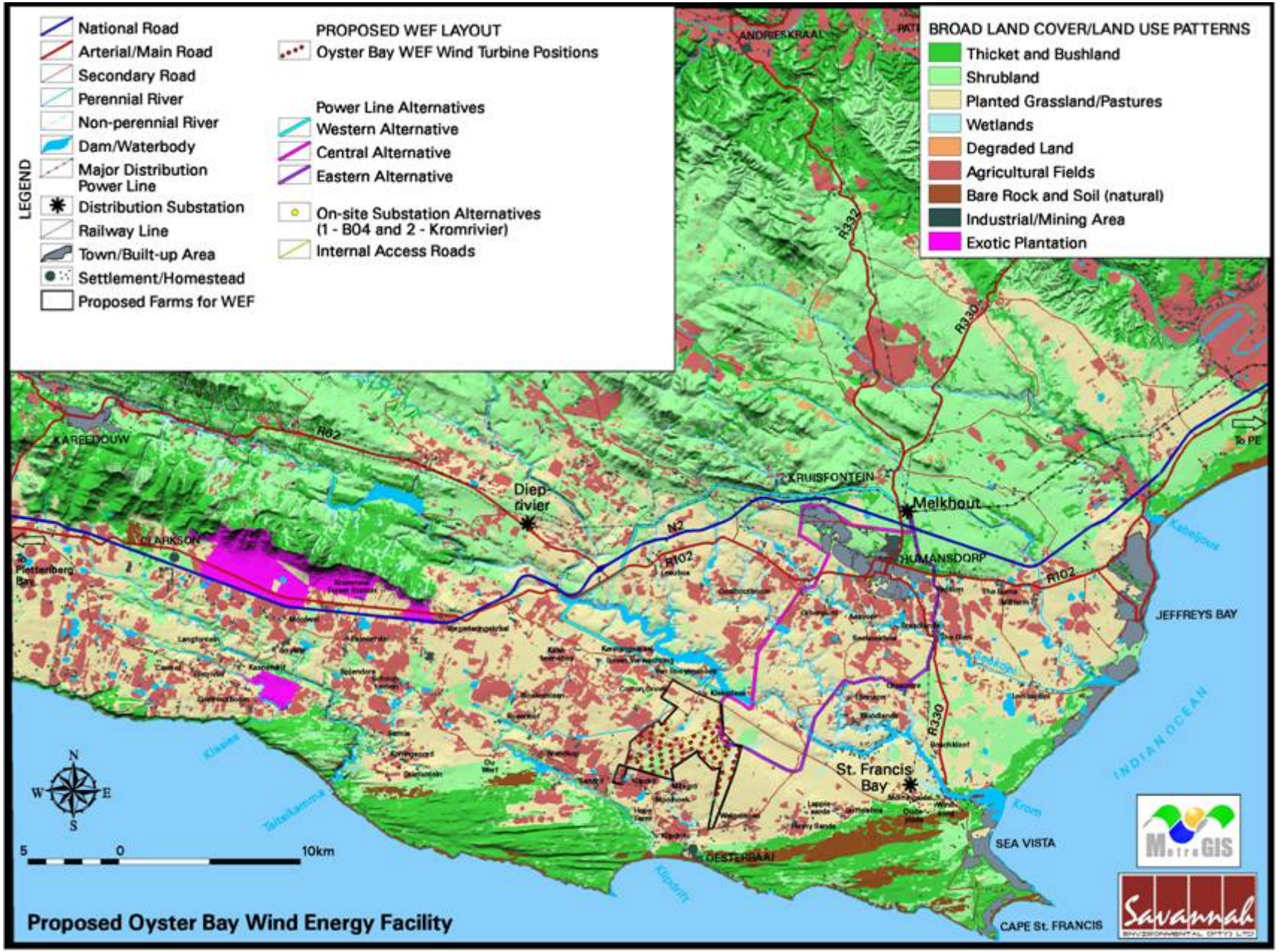
Klasies River consists of a complex of caves and several open air shell middens. This is one of the most significant archaeological cave complexes in the world, and home to the oldest anatomically modern human skeletal remains. The archaeological deposits at the Klasies River Caves (1-5) date to 120 000 years old[9].

The proposed WEF is also situated close to other significant archaeological rich areas, such as the Brandewynkop Dunes, although this site falls partly within the approved RedCap WEF footprint.

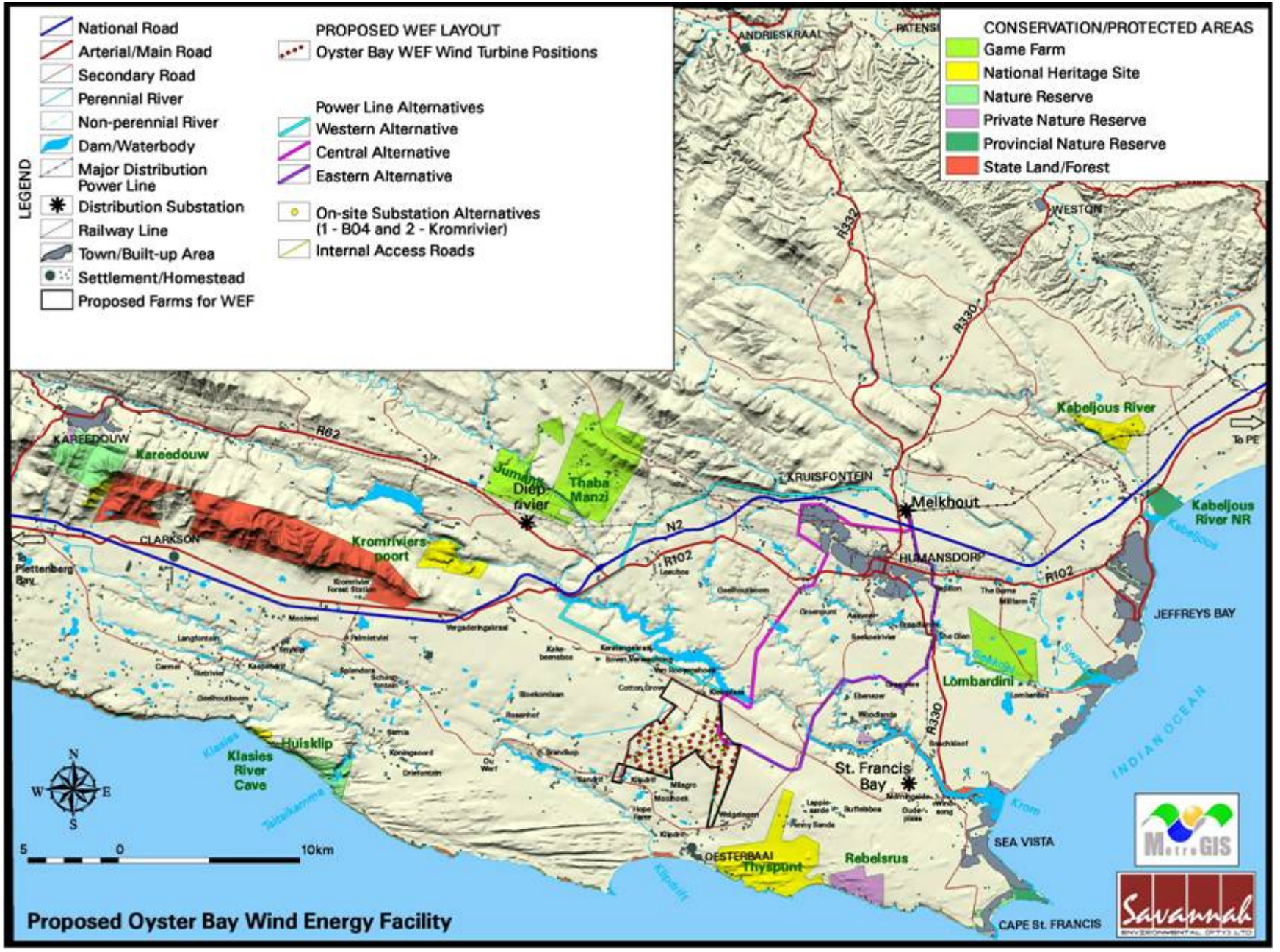
[9] Eastern Cape Heritage Consultants. 2011. *A Phase 1 Archaeological Impact Assessment for the Proposed Oyster Bay Wind Energy Facility, Kouga Local Municipality, Humansdorp District, Eastern Cape Province*. Unpublished Report.



Map 1: Locality Map and proposed layout of the Oyster Bay WEF showing the provisional placement of infrastructure and shaded relief (topography and elevation above sea level).



Map 2: Broad land cover and land use within the study area.



Map 3: Conservation Planning Features within the study area.

5. RESULTS

5.1. Potential visual exposure

The result of the preliminary viewshed analyses for the proposed facility is shown on the map overleaf (**Map 4**). The visibility analysis was undertaken from 77 preliminary wind turbine positions (as provided by RES within a preliminary layout map) at an offset of 120m above average ground level (i.e. the approximate hub height of the proposed turbines) in order to simulate a worst case scenario.

The viewshed analysis not only indicates areas from which the wind turbines would be visible (any number of turbines with a minimum of one turbine), but also indicates the potential frequency of visibility (i.e. how many turbines are exposed). The dark orange areas indicate a high frequency (i.e. 70-77 turbines or parts thereof may be visible) while the yellow areas represent a low frequency (i.e. 1-8 turbines or parts thereof may be visible).

The highest frequency of potential visual exposure is on the site itself and on the coastal plain surrounding the site in all directions. Areas lying further to the north beyond the plateau are mostly screened by the high lying and mountainous topography. The south facing slopes of these mountains are exposed to potential visual impact, while the north facing slopes are visually screened.

Long strips along the drainage lines, especially the Krom, the Seekoei and the Klipdrift River valleys, are visually screened as incision by the rivers into the landscape effectively shields these areas from potential visual exposure. Similarly, many areas along the coastline are visually screened as the landscape drops down to sea level.

Visibility of the WEF will be high, with a high frequency of exposure for long stretches of the N2 and the R102, especially below the plateau in closer proximity to the proposed WEF.

Similarly long stretches of the R330 and the R102 will be exposed to high frequencies of potential visual exposure. The extent of exposure of the R62 further to the north west is lower, but the frequency of exposure remains high.

The towns of Kruisfontein, Humansdorp and Jeffrey's Bay to the north east, are expected to experience a high frequency of visual exposure, both within the towns and in the surrounding area.

The towns of Oyster Bay, Cape St Francis and Sea Vista will be less exposed, with only limited areas on the outskirts likely to be exposed to moderate frequencies of potential visual exposure.

The town of Kareedouw will not be exposed to visual impact.

A large number of settlements and homesteads, especially those located below the plateau will be potentially visually exposed, with a high frequency of exposure. Some of these, located within the river valleys, will be visually screened by virtue of the topography.

The proposed WEF may also be visible from parts of the Thaba Manzi, the Jumanji and Lombardini Game Farms, as well as from the Kromrivierspoort and Thuyspunt Natural Heritage Sites (moderate to high frequencies).

Very limited parts of the Huisklip Nature Reserve and Rebelsrus may also be exposed to moderate to high frequencies of potential visual exposure, while some of the coastal Cape St Francis reserves may experience low frequencies of potential visual exposure in certain parts.

The visibility map clearly illustrates the influence of the topography, and specifically the visual screening the mountains and the plateau offers the facility, which is located on the low lying coastal plain.

Notwithstanding, it is envisaged that the wind turbine structures would be easily and comfortably visible to observers (i.e. travelling along roads, residing in towns and at homesteads or visiting the region), especially within a 5 to 10 km radius (i.e. at short to medium distances) of the WEF and would constitute a high visual prominence, potentially resulting in a high visual impact.

In terms of potential Cumulative Visual Impact, **Map 5** shows the potential cumulative visual exposure of both the proposed Oyster Bay WEF and the authorised Red Cap WEF (Phase 1 authorised turbines only).

The map indicates areas within which turbines from both facilities would potentially be visible (yellow shaded), areas from which only Oyster Bay turbines will be visible (red shaded) and areas from which only Red Cap turbines will be visible (green shaded).

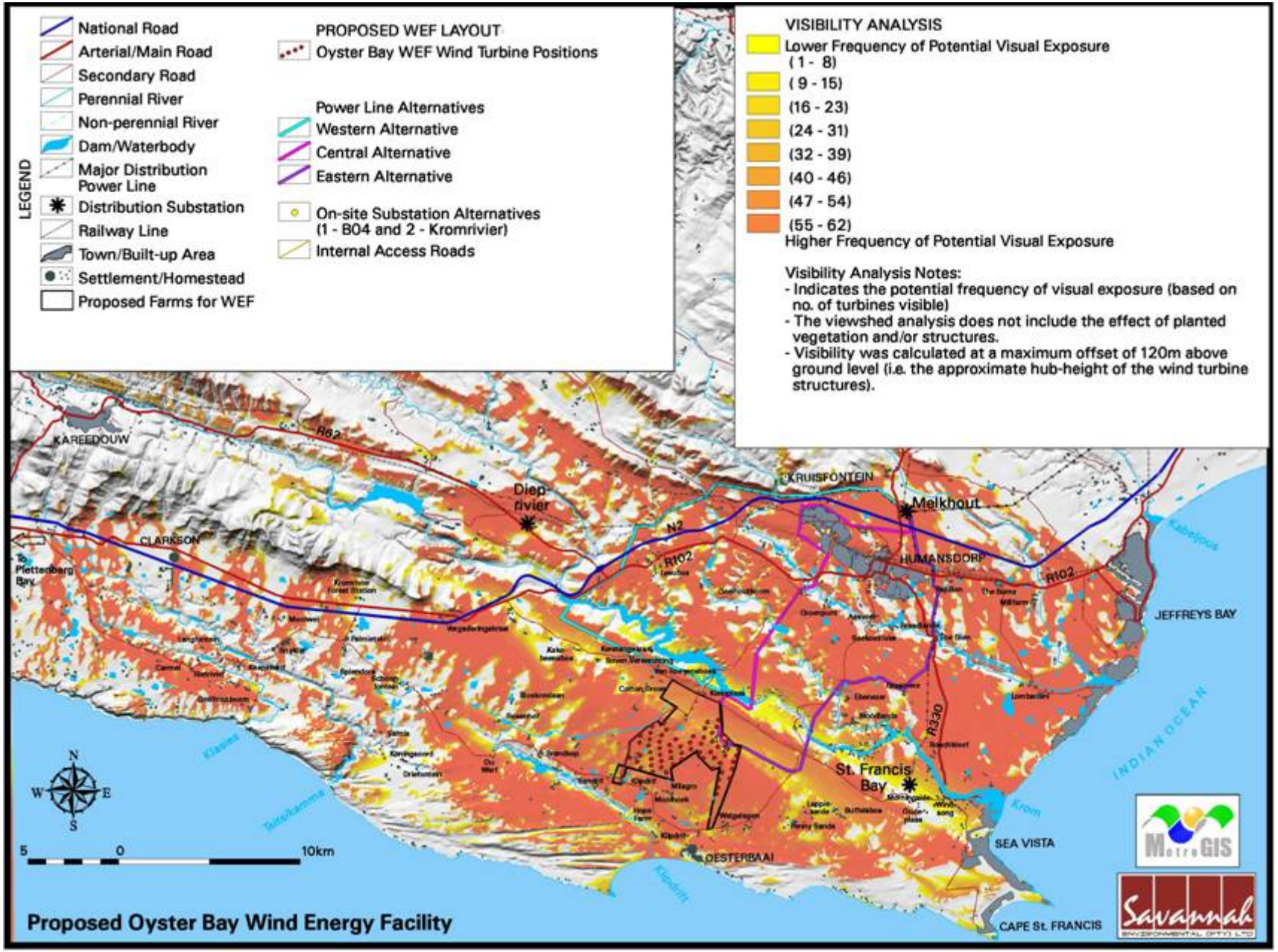
Of note is that the viewsheds of the two facilities largely correspond, meaning that the potential visual impact of the proposed Oyster Bay WEF lies mostly within that of the authorised Red Cap facility.

Additional areas within which the Oyster Bay facility alone will be visible are limited in extent, and lie mostly on the site itself and to the north west.

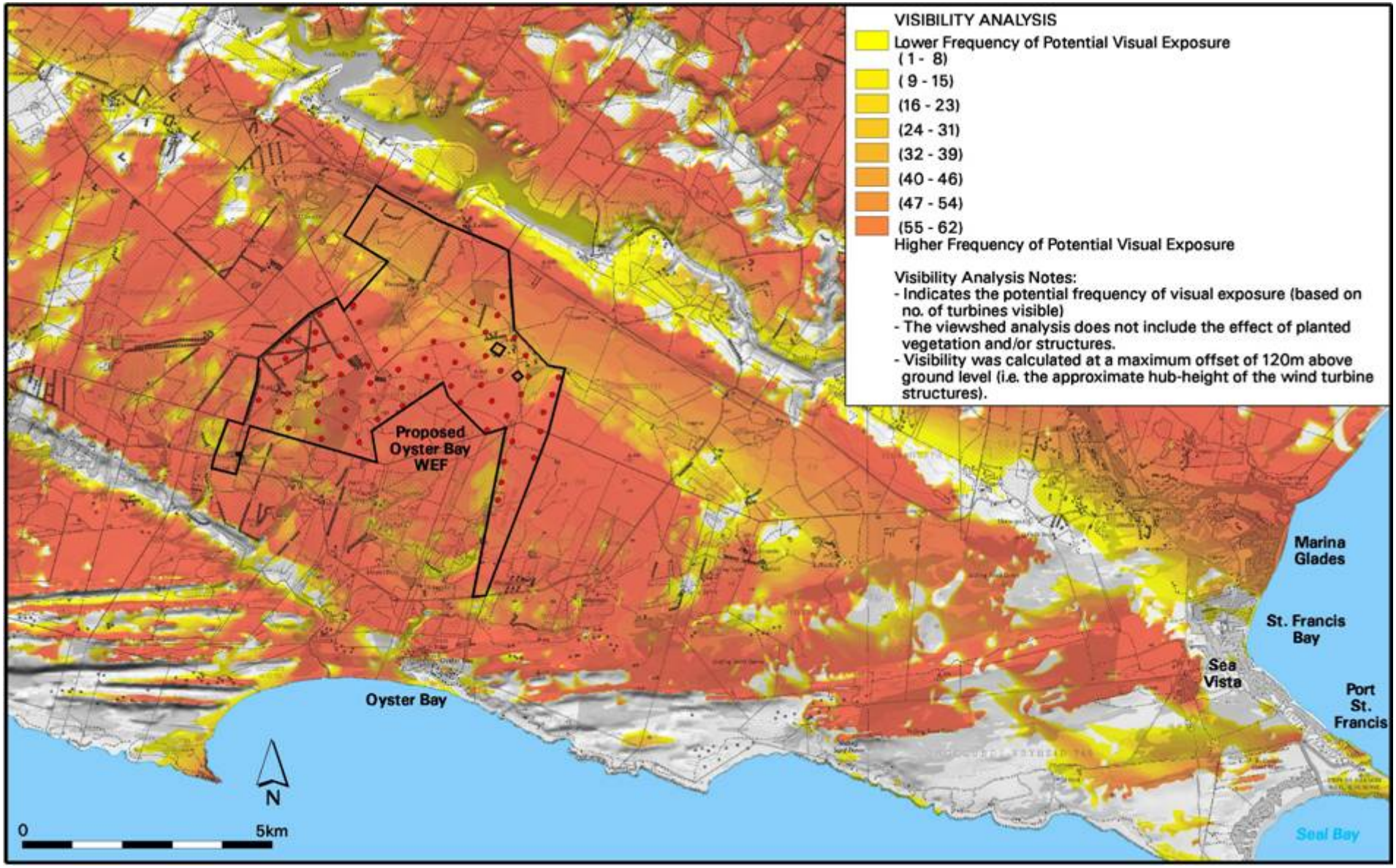
From a visual perspective, this overlapping viewshed is considered favourable, as it represents the consolidation and concentration of potential visual impacts within an existing WEF viewshed.

Within these visually exposed areas, the frequency of visual exposure to turbines will be higher with the addition of the Oyster Bay facility, but the extent of the existing Red Cap viewshed remains largely unchanged.

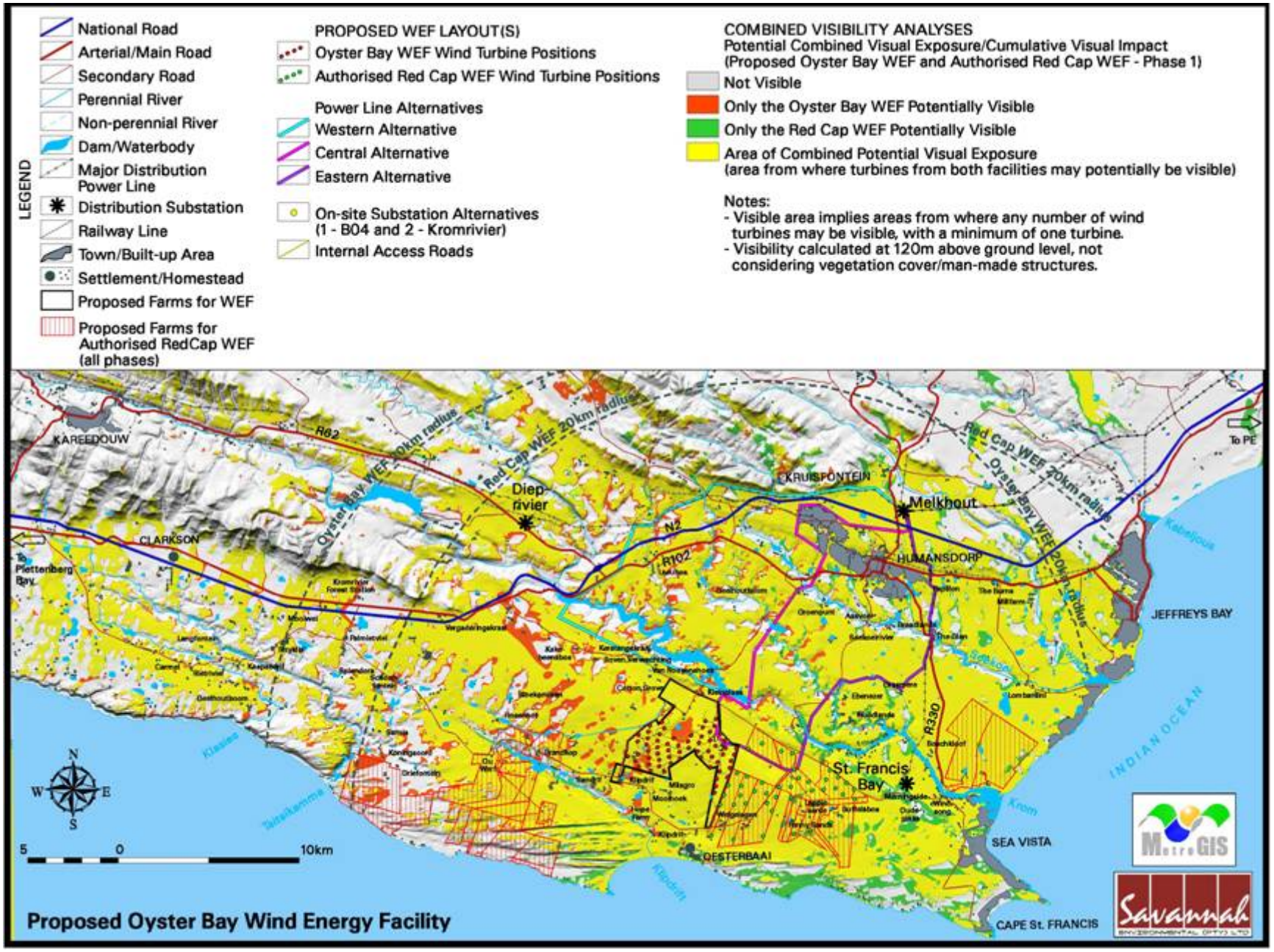
More recently, the Deep River WEF has been approved. The viewshed of this WEF has not been included on Map 5, but this facility, which lies some 10km north west of the proposed Oyster Bay WEF, further represents a consolidation and concentration of visual impacts within the region below the escarpment.



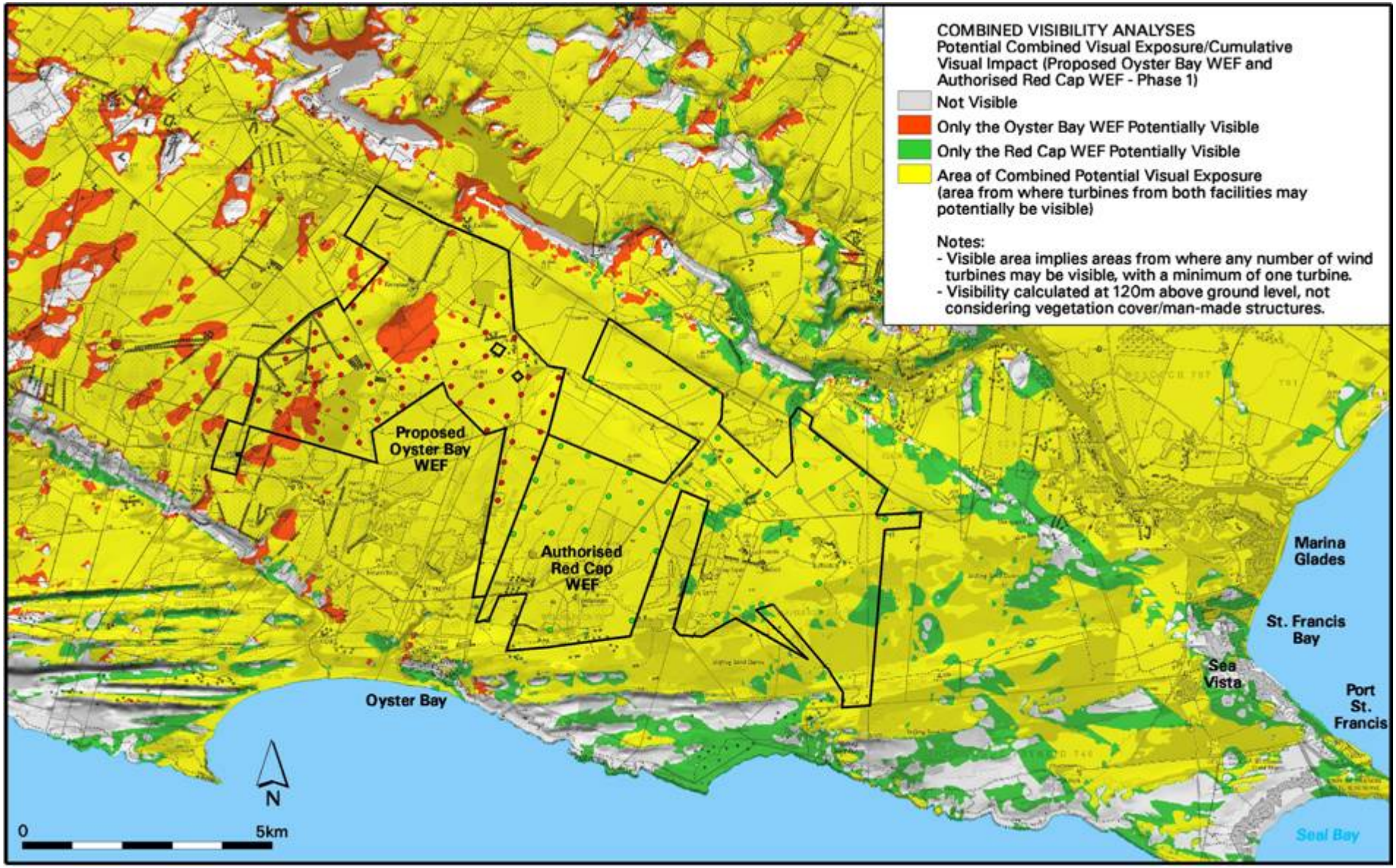
Map 4a: Potential visual exposure the proposed Oyster Bay WEF.



Map 4b: Potential visual exposure the proposed Oyster Bay WEF (enlarged area to show Oyster Bay and surrounds in more detail).



Map 5a: Anticipated combined visual exposure the proposed Oyster Bay WEF and the authorised Red Cap WEF.



Map 5b: Anticipated combined visual exposure the proposed Oyster Bay WEF and the authorised Red Cap WEF (enlarged area to show Oyster Bay and surrounds in more detail).

5.2. Visual distance / observer proximity to the facility

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 6** and 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 views where the facility 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 20 km - Long distance view where the facility would still be visible though not as easily recognisable. This zone constitutes a low visual prominence for the facility.

5.3. Viewer incidence / viewer perception

Refer to **Map 6**. Viewer incidence is calculated to be the highest along the national and arterial roads (i.e. the N2, R102, R62, R330 and R332) as well as the secondary roads within the study area. Commuters and tourists using these roads could be negatively impacted upon by visual exposure to the WEF.

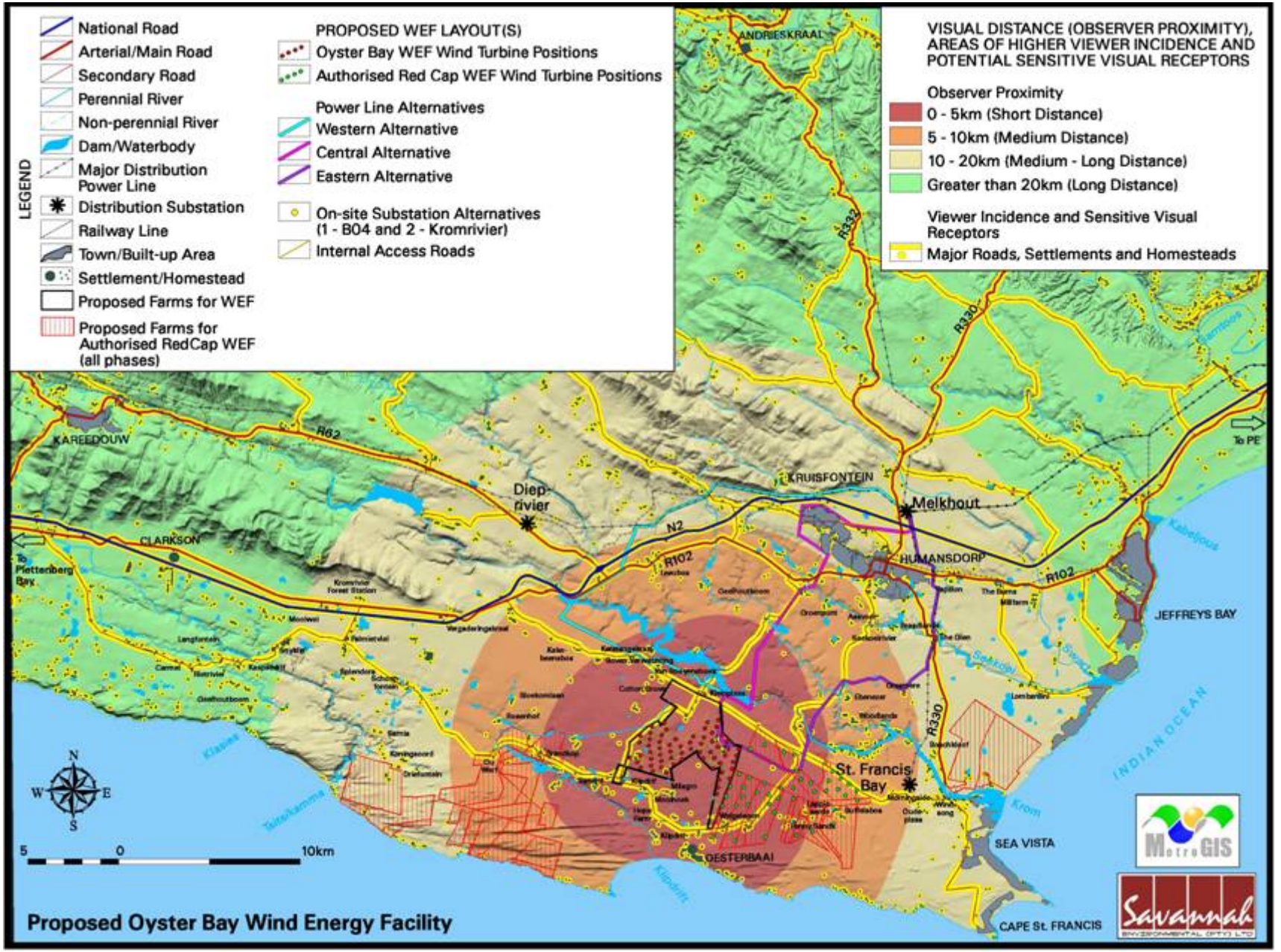
Other than along the above roads, viewer incidence within a 10 km radius of the proposed WEF is concentrated in a relatively high number of homesteads and settlements, and in the town of Oyster Bay.

The remainder of the study area (beyond 10km from the proposed WEF) consists largely of grazing land (cattle), agricultural land or vacant natural land with potential observers located within homesteads and settlements.

It is uncertain whether all of the potentially affected settlements are inhabited or not, so the author of this document operates under the assumption that they are all inhabited.

Kruisfontein, Humansdorp, Sea Vista and Cape St Francis lie between 10 and 20km from the proposed WEF, while Jeffrey's Bay lies further afield beyond the 20km radius. The severity of the visual impact on visual receptors decreases with increased distance from the proposed facility.

In terms of viewer perception, the region as a whole has an aesthetic value and inherent sense of place based on the pastoral landscape, the scenic mountains and the picturesque coast. Residents, visitors to this area and tourists residing in holiday towns and making use of the N2 are seen as sensitive visual receptors upon which the construction and operation of the WEF could have a potentially negative visual impact.



Map 6: Observer proximity to the proposed Oyster Bay WEF and areas of high viewer incidence.

5.4 Visual absorption capacity

Large portions of the natural vegetation types in the study area have been removed to make way for planted grassland, pastures and agricultural fields.

The natural vegetation cover of *shrubland* and *thicket and bushland,* is largely limited to the mountains above the plateau and along the coastline.

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

In addition, the design, appearance and colour of the turbine structures means that it is unlikely that the environment will visually absorb them in terms of texture, colour, form and light / shade characteristics.

In the larger towns and urban areas within the study area, however, VAC will be applicable due to the presence of buildings and structures, and will be taken into account.

VAC will not be taken into account in the smaller towns, outside of the larger urban areas or along the roads.

5.5. Visual impact index

The combined results of the visual exposure, viewer incidence/perception and visual distance of the proposed WEF are displayed on **Map 7**. Here the weighted impact and the likely areas of impact are indicated as a visual impact index. Values are 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 of visual exposure to the proposed facility, a high viewer incidence and a predominantly negative perception would therefore have a higher value (**greater magnitude**) 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 following is of relevance:

- There exists a core area of potentially **high** visual impact on the site itself and within a 5km radius of the proposed WEF. This core area is located entirely on the coastal plain below the plateau, and stretches to the coastline at Oyster Bay. Some low lying areas, strips along the Klipdrift and Krom River valleys and the coast east of Oyster Bay are exposed to only moderate visual impact, or are not exposed at all.

  Potential areas of **very high** visual impact within this 5km radius include various secondary roads giving access to Oyster Bay, Humansdorp, Kruisfontein and the N2. In addition, some outlying parts of Oyster Bay and a number of settlements and homesteads are likely to experience very high visual impact. The homesteads and settlements include the following:

  - Kerstangekraal;
  - Boven Verwachting;
  - Van Rooyenshoek;

- Cotton Grove;
- Brandkop;
- Sandrif;
- Klipdrif;
- Hope Farm;
- Moolhoek;
- Milagro;
- Welgelegen;
- Penny Sands and Kleinplaas.

Much of the Mpofu Dam, especially the lower reaches, will be exposed to **moderate to high** visual impact, and the northern part of the Thuyspunt National Heritage Site will be exposed to high visual impact.

Parts of the Thuyspunt / Cape St Francis pre-colonial cultural landscape will be similarly impacted upon within this zone.

- The extent of potential visual impact is slightly reduced between the 5km and 10km radius, but large areas in all directions are still exposed to potentially **moderate** visual impact. The coastline within this zone is mostly screened from potential visual impact, both to the south west and to the south east of the proposed WEF. Clear zones of visual screening also exist along the river valleys within this radius, including the Klipdrift, the Krom and the Seekoei Rivers.

  Areas of **high** potential visual impact include a continuous stretch of the R102, short parts of the N2 and a number of secondary roads.

  No towns or urban areas occur within this zone, but a number of homesteads and settlements are likely to experience a **high** visual impact. These, which lie between 5km and 10km of the proposed facility, include the following:

  - Lappie-aarde;
  - Buffelbos;
  - Woodlands;
  - Ebenezer;
  - Grasmere;
  - Seekeioriver;
  - Aasvoel;
  - Groenpunt;
  - Leeubos;
  - Rosenhof and
  - Ou werf.

  Limited parts of the Rebelsrus Private Nature Reserve may potentially be exposed to **moderate** visual impact as will some inland parts of the Thuyspunt / Cape St Francis pre-colonial cultural landscape.

- Between 10km and 20km, the extent of potential visual impact decreases in the west and north, as the mountainous and high lying terrain takes form. The extent of potential visual exposure to the east remains high.

  The magnitude of visual impact in the visually exposed areas (which include the south facing slopes of the mountains) is **low** within this zone.

Exceptions are stretches of the N2, the R102, the R330, the R62, various secondary roads and a number of homesteads and settlements. Potential visual impact for receptors on these roads is expected to be **moderate**.

Kruisfontein, Humansdorp, the southern parts of Jeffrey's Bay, the inland parts of Sea Vista and limited parts of Cape St Francis are also likely to be visually exposed, but at a **low** magnitude, due to the elevated VAC within urban areas.

Protected areas likely to be visually affected include parts of the Jumanji, Thaba Manzi and Lombardini Game Farms and very limited parts of the Huisklip Nature Reserve and of the Kromriveirspoort National Heritage Site. Visual impacts are likely to be of **low** magnitude in these protected areas.

Some limited inland parts of the Thuyspunt / Cape St Francis pre-colonial cultural landscape will be similarly impacted upon within this zone

- Remaining impacts beyond the 20km radius are expected to be mostly **very low** to **negligible**. The northern parts of Jeffrey's Bay lie within this zone and are likely to experience **very low** visual impact.

  Stretches of the N2, the R102, the R62 and secondary roads within this zone will potentially experience **low** visual impact.

The figure below helps to place the above explanations in context, illustrating what scale a turbine structure will be perceived at different viewing distances.

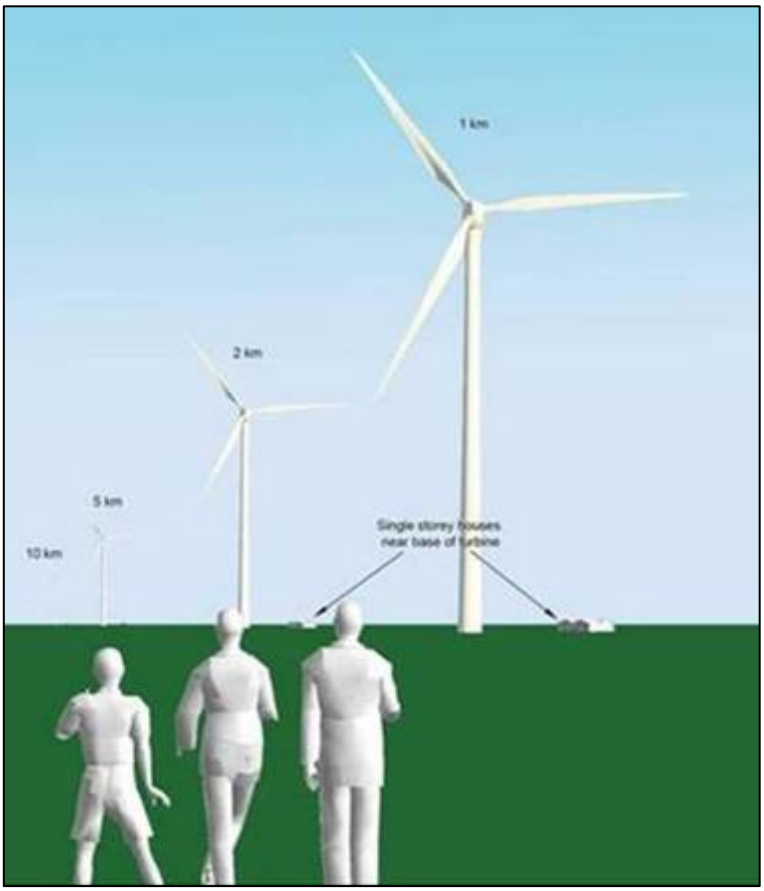
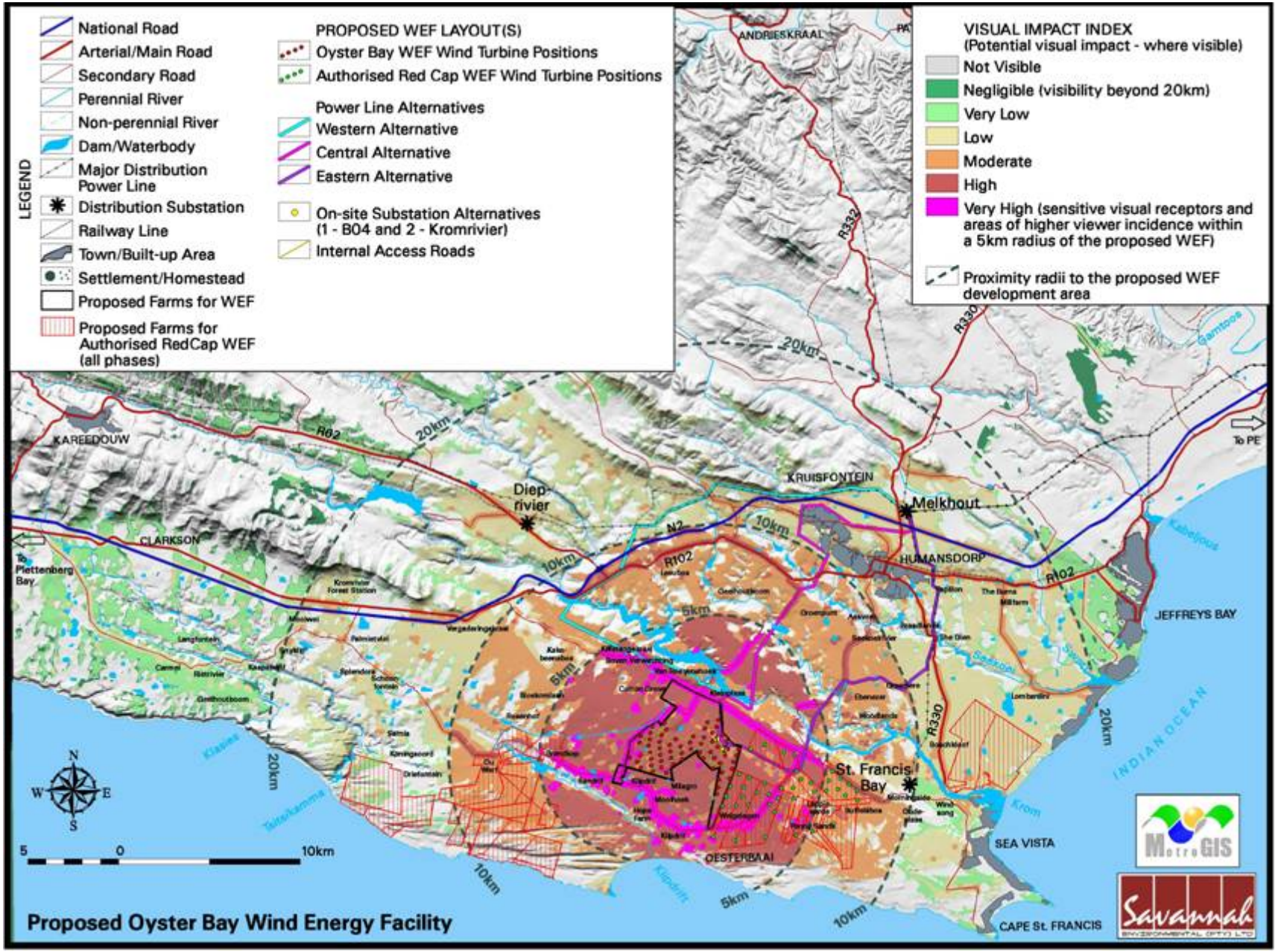


Figure 7: Visual experience of a wind turbine structure at a distance of 1km, 2km, 5km and 10km.



Map 7: Visual impact index of the proposed Oyster Bay WEF.

5.6 Visual impact assessment: methodology

The previous section of the report identified specific areas where likely visual impacts would occur. This section will attempt to quantify these potential visual impacts in their respective geographical locations and in terms of the identified issues (see Chapter 3: SCOPE OF WORK) related to the visual impact.

The methodology for the assessment of potential visual impacts states the **nature** of the potential visual impact (e.g. the visual impact on users of major roads in the vicinity of the proposed facility) 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 (= 2), low (= 4), medium/moderate (= 6), high (= 8) and very high (= 10). This value is read from the visual impact index.
- **Probability** – very improbable (= 1), improbable (= 2), probable (= 3), highly probable (= 4) and definite (= 5).
- **Status** (positive, negative or neutral).
- **Reversibility** - reversible (= 1), recoverable (= 3) and irreversible (= 5).
- **Significance** - low, medium or high.

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

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

- <30 points: Low (where the impact would not have a direct influence on the decision to develop in the area)
- 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 structures a sky blue colour) are proposed as the colour scheme and lighting fixtures are legally required by the Civil Aviation Authority and cannot be altered.

5.7 Visual impact assessment: primary impacts

5.7.1 The WEF

Potential visual impact on users of major (N2, R102, R62 and R330) and secondary roads in close proximity to the proposed WEF.

Potential visual impact on users of national (i.e. N2), arterial (i.e. R102, R62 and R330) and secondary roads in close proximity of the proposed WEF (i.e. within 10km) are expected to be **high**. No mitigation is possible.

The table below illustrates this impact assessment.

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

Nature of Impact: Potential visual impact on users of major and secondary roads in close proximity to the proposed WEF		
	No mitigation	***Mitigation considered***
Extent	Local **(4)**	N/a
Duration	Long term **(4)**	N/a
Magnitude	Very high **(10)**	N/a
Probability	Definite **(5)**	N/a
Significance	High **(90)**	N/a
Status (positive or negative)	Negative	N/a
Reversibility	Recoverable **(3)**	N/a
Irreplaceable loss of resources?	No	N/a
Can impacts be mitigated?	No	N/a
Mitigation: None.		
Cumulative impacts: The construction of 50-80 wind turbines will increase the cumulative visual impact within the region, specifically in light of the authorised Red Cap WEF located to the west and east of the site and the authorised Deep River WEF to the north west. Although the proposed Oyster Bay WEF will fall largely within the Red Cap WEF viewshed, and partially within the Deep River viewshed, the frequency of exposure for receptors within these areas will increase.		
Residual impacts: None. The visual impact of the wind turbines will be removed after decommissioning.		

Potential visual impact on residents of urban centres and populated places (Oyster Bay) in close proximity to the proposed WEF.

Only Oyster Bay is close enough to the proposed WEF to be affected, but it is anticipated that only limited outlying parts of the town will be visually exposed.

The potential visual impact on residents of the northern parts of Oyster Bay (i.e. within a 10km radius of the proposed WEF) is expected to be **high**. No mitigation is possible. No VAC is taken into account for such a small urban centre.

It should be noted, however, that holiday homes within Oyster Bay would in all likelihood orientate towards the ocean, and not inland towards the WEF. Therefore, many of the receptors that are likely to be visually exposed may not be impacted upon permanently or even for long periods of time.

The table below illustrates this impact assessment.

Table 2: Impact table summarising the significance of visual impacts on residents of urban centres and populated places in close proximity to the proposed WEF.

Nature of Impact: Potential visual impact on residents of urban centres and populated places in close proximity to the proposed WEF		
	No mitigation	***Mitigation considered***
Extent	Local **(4)**	N/a
Duration	Long term **(4)**	N/a
Magnitude	Very high **(10)**	N/a
Probability	Definite **(5)**	N/a
Significance	High **(90)**	N/a
Status (positive or negative)	Negative	N/a
Reversibility	Recoverable **(3)**	N/a
Irreplaceable loss of resources?	No	N/a
Can impacts be mitigated?	No	N/a
Mitigation: None.		
Cumulative impacts: The construction of 50-80 wind turbines will increase the cumulative visual impact within the region, specifically in light of the authorised Red Cap WEF located to the west and east of the site and the authorised Deep River WEF to the north west. Although the proposed Oyster Bay WEF will fall largely within the Red Cap WEF viewshed, and partially within the Deep River viewshed, the frequency of exposure for receptors within these areas will increase.		
Residual impacts: None. The visual impact of the wind turbines will be removed after decommissioning.		

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

The potential visual impact on residents of settlements and homesteads within a 10km radius of the proposed WEF is expected to be **high**. No mitigation is possible.

The table below illustrates this impact assessment.

Table 3: Impact table summarising the significance of visual impacts on residents of settlements and homesteads in close proximity to the proposed WEF.

Nature of Impact: Potential visual impact on residents of settlements and homesteads in close proximity to the proposed WEF		
	No mitigation	***Mitigation considered***
Extent	Local **(4)**	N/a
Duration	Long term **(4)**	N/a
Magnitude	Very high **(10)**	N/a
Probability	Definite **(5)**	N/a
Significance	High **(90)**	N/a
Status (positive or negative)	Negative	N/a
Reversibility	Recoverable **(3)**	N/a
Irreplaceable loss of resources?	No	N/a
Can impacts be mitigated?	No	N/a
Mitigation: None.		
Cumulative impacts: The construction of 50-80 wind turbines will increase the cumulative visual impact within the region, specifically in light of the authorised Red Cap WEF located to the west and east of the site and the authorised Deep River WEF to the north west. Although the proposed Oyster Bay WEF will fall largely within the Red Cap WEF viewshed, and partially within the Deep River viewshed, the frequency of exposure for receptors within these areas will increase.		
Residual impacts: None. The visual impact of the wind turbines will be removed after decommissioning.		

Potential visual impact on sensitive visual receptors (users of roads and residents of settlements and homesteads) within the region.

The visual impact on the users of roads and the residents of settlements and homesteads within the region (beyond the 10km radius) is expected to be of **moderate** significance. No mitigation is possible.

The table below illustrates this impact assessment.

Table 4: Impact table summarising the significance of visual impacts on sensitive visual receptors within the region.

Nature of Impact: Potential visual impact on sensitive visual receptors within the region.		
	No mitigation	***Mitigation considered***
Extent	Regional **(3)**	N/a
Duration	Long term **(4)**	N/a
Magnitude	Moderate **(6)**	N/a
Probability	Probable **(3)**	N/a
Significance	Moderate **(39)**	N/a
Status (positive or negative)	Negative	N/a
Reversibility	Recoverable **(3)**	N/a
Irreplaceable loss of resources?	No	N/a
Can impacts be mitigated?	No	N/a
Mitigation: None.		
Cumulative impacts: The construction of 50-80 wind turbines will increase the cumulative visual impact within the region, specifically in light of the authorised Red Cap WEF located to the west and east of the site and the authorised Deep River WEF to the north west. Although the proposed Oyster Bay WEF will fall largely within the Red Cap WEF viewshed, and partially within the Deep River viewshed, the frequency of exposure for receptors within these areas will increase.		
Residual impacts: None. The visual impact of the wind turbines will be removed after decommissioning.		

Potential visual impact on residents of towns within the region.

The visual impact on residents of towns beyond the 10km radius is expected to be of **low** significance.

Relevant towns include Humansdorp, Kruisfontein and Sea Vista and Jeffrey's Bay. VAC is applicable in these towns, reducing probability of this impact occurring. No mitigation is possible.

The table below illustrates this impact assessment.

Table 5: Impact table summarising the significance of visual impacts on residents of towns within the region.

Nature of Impact: Potential visual impact on residents of towns within the region.		
	No mitigation	***Mitigation considered***
Extent	Regional **(3)**	N/a
Duration	Long term **(4)**	N/a
Magnitude	Low **(4)**	N/a
Probability	Improbable **(2)**	N/a
Significance	Low **(22)**	N/a
Status (positive or negative)	Negative	N/a
Reversibility	Recoverable **(3)**	N/a
Irreplaceable loss of resources?	No	N/a
Can impacts be mitigated?	No	N/a
Mitigation: None.		
Cumulative impacts: The construction of 50-80 wind turbines will increase the cumulative visual impact within the region, specifically in light of the authorised Red Cap WEF located to the west and east of the site and the authorised Deep River WEF to the north west. Although the proposed Oyster Bay WEF will fall largely within the Red Cap WEF viewshed, and partially within the Deep River viewshed, the frequency of exposure for receptors within these areas will increase.		
Residual impacts: None. The visual impact of the wind turbines will be removed after decommissioning.		

Potential visual impact on conservation / protected areas in close proximity to the proposed WEF.

The potential visual impact on conservation/protected areas within a 10km radius of the proposed WEF (i.e. Thuyspunt National Heritage Site and limited parts of the Rebelsrus Private Nature Reserve) is expected to be of **low** significance.

As this study does not include any record of the nature or status of facilities present within these protected areas, or if indeed any facilities exist at all, the visual assessment assumes that visitor access is possible and permitted, and that the potential exists to develop tourist facilities and amenities of a private or public nature.

The limited extent of visual exposure, however, reduces the probability of this impact occurring. No mitigation is possible for this impact.

The table below illustrates this impact assessment.

Table 6: Impact table summarising the significance of visual impacts on conservation / protected areas in close proximity to the proposed WEF.

Nature of Impact: Potential visual impact on conservation / protected areas in close proximity to the proposed WEF.		
	No mitigation	***Mitigation considered***
Extent	Local **(4)**	N/a
Duration	Long term **(4)**	N/a
Magnitude	High **(8)**	N/a
Probability	Improbable **(2)**	N/a
Significance	Low **(16)**	N/a
Status (positive or negative)	Negative	N/a
Reversibility	Recoverable **(3)**	N/a
Irreplaceable loss of resources?	No	N/a
Can impacts be mitigated?	No	N/a
Mitigation: None.		
Cumulative impacts: The construction of 50-80 wind turbines will increase the cumulative visual impact within the region, specifically in light of the authorised Red Cap WEF located to the west and east of the site and the authorised Deep River WEF to the north west. Although the proposed Oyster Bay WEF will fall largely within the Red Cap WEF viewshed, and partially within the Deep River viewshed, the frequency of exposure for receptors within these areas will increase.		
Residual impacts: None. The visual impact of the wind turbines will be removed after decommissioning.		

Potential visual impact on protected areas within the region.

The potential visual impact on conservation/protected areas beyond the 10km radius of the proposed WEF (i.e. parts of the Jumanji, Thaba Manzi and Lombardini Game Farms and very limited parts of the Huisklip Nature Reserve and of the Kromriveirspoort National Heritage Site) is also expected to be of **low** significance.

Again, the limited extent of visual exposure reduces the probability of this impact occurring. There is no mitigation.

The table below illustrates this impact assessment.

Table 7: Impact table summarising the significance of visual impacts on protected areas within the region.

Nature of Impact: Potential visual impact on protected areas within the region.		
	No mitigation	***Mitigation considered***
Extent	Regional **(3)**	N/a
Duration	Long term **(4)**	N/a
Magnitude	Low **(4)**	N/a
Probability	V Improbable **(1)**	N/a
Significance	Low **(11)**	N/a
Status (positive or negative)	Negative	N/a
Reversibility	Recoverable **(3)**	N/a
Irreplaceable loss of resources?	No	N/a
Can impacts be mitigated?	No	N/a
Mitigation: None.		
Cumulative impacts: The construction of 50-80 wind turbines will increase the cumulative visual impact within the region, specifically in light of the authorised Red Cap WEF located to the west and east of the site and the authorised Deep River WEF to the north west. Although the proposed Oyster Bay WEF will fall largely within the Red Cap WEF viewshed, and partially within the Deep River viewshed, the frequency of exposure for receptors within these areas will increase.		
Residual impacts: None. The visual impact of the wind turbines will be removed after decommissioning.		

Potential visual impact on the Thuyspunt / Cape St Francis pre-colonial cultural landscape in close proximity to the proposed WEF.

The potential visual impact on the Thuyspunt / Cape St Francis pre-colonial cultural landscape (i.e. the 5km strip along the coastline between Klasies River and Cape St Francis) in close proximity to the proposed WEF is expected to be of **moderate** significance.

The most important sites affected are the Thuyspunt National Heritage Site 2km south east of the site, a zone of Late Stone Age Middens along the coast west of Oyster Bay and the Brandewynkop Dunes some 3km west of the proposed WEF.

No mitigation is possible for this impact. The table below illustrates this impact assessment.

Table 8: Impact table summarising the significance of visual impacts on the Thuyspunt / Cape St Francis pre-colonial cultural landscape in close proximity to the proposed WEF.

Nature of Impact: Potential visual impact on the Thuyspunt / Cape St Francis pre-colonial cultural landscape in close proximity to the proposed WEF.		
	No mitigation	***Mitigation considered***
Extent	Local **(4)**	N/a
Duration	Long term **(4)**	N/a
Magnitude	High **(8)**	N/a
Probability	Probable **(3)**	N/a
Significance	Moderate **(48)**	N/a
Status (positive or negative)	Negative	N/a
Reversibility	Recoverable **(3)**	N/a
Irreplaceable loss of resources?	No	N/a
Can impacts be mitigated?	No	N/a
Mitigation: None.		
Cumulative impacts: The construction of 50-80 wind turbines will increase the cumulative visual impact within the region, specifically in light of the authorised Red Cap WEF located to the west and east of the site and the authorised Deep River WEF to the north west. Although the proposed Oyster Bay WEF will fall largely within the Red Cap WEF viewshed, and partially within the Deep River viewshed, the frequency of exposure for receptors within these areas will increase.		
Residual impacts: None. The visual impact of the wind turbines will be removed after decommissioning.		

Potential visual impact on the Thuyspunt / Cape St Francis pre-colonial cultural landscape within the region.

The potential visual impact on the Thuyspunt / Cape St Francis pre-colonial cultural landscape (i.e. the 5km strip along the coastline between Klasies River and Cape St Francis) beyond the 10km radius of the proposed WEF is expected to be of **low** significance.

The most important site within this zone is Klasies River, which will not be visually impacted upon.

No mitigation is possible for this impact. The table below illustrates this impact assessment.

Table 9: Impact table summarising the significance of visual impacts on the Thuyspunt / Cape St Francis pre-colonial cultural landscape within the region.

Nature of Impact: Potential visual impact on the Thuyspunt / Cape St Francis pre-colonial cultural landscape within the region.		
	No mitigation	***Mitigation considered***
Extent	Regional **(3)**	N/a
Duration	Long term **(4)**	N/a
Magnitude	Low **(4)**	N/a
Probability	Improbable **(2)**	N/a
Significance	Low **(22)**	N/a
Status (positive or negative)	Negative	N/a
Reversibility	Recoverable **(3)**	N/a
Irreplaceable loss of resources?	No	N/a
Can impacts be mitigated?	No	N/a
Mitigation: None.		
Cumulative impacts: The construction of 50-80 wind turbines will increase the cumulative visual impact within the region, specifically in light of the authorised Red Cap WEF located to the west and east of the site and the authorised Deep River WEF to the north west. Although the proposed Oyster Bay WEF will fall largely within the Red Cap WEF viewshed, and partially within the Deep River viewshed, the frequency of exposure for receptors within these areas will increase.		
Residual impacts: None. The visual impact of the wind turbines will be removed after decommissioning.		

5.7.2. Ancillary infrastructure

Potential visual impact of internal access roads on observers in close proximity to the proposed WEF.

Within the WEF footprint, existing roads will be used wherever possible. It may, however be necessary to build additional roads either to construct each turbine (construction phase), or to maintain the turbines (operational phase).

The network of roads has the potential of manifesting as a network of landscape scarring, and thus a potential visual impact within the viewshed areas.

No dedicated viewshed has been generated for the access roads, but the area of potential visual exposure will lie within that of the turbines. They will not be as highly visible as the turbines, however, as they posses no height and lie on relatively flat ground. This reduces the probability of this impact occurring.

The table below illustrates the assessment of this anticipated impact, which is likely to be of **low** significance both before and after mitigation.

Table 10: Impact table summarising the significance of visual impact of internal access roads on observers in close proximity to the proposed WEF.

Nature of Impact: Potential visual impact of internal access roads on observers in close proximity to the proposed WEF.		
	No mitigation	***Mitigation considered***
Extent	Local **(4)**	Local **(4)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Low **(4)**	Low **(4)**
Probability	Improbable **(2)**	V Improbable **(1)**
Significance	Low **(24)**	Low **(12)**
Status (positive or negative)	Negative	Negative
Reversibility	Recoverable **(3)**	Recoverable **(3)**
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	N/a
Mitigation: Planning: Make use of existing roads wherever possible and plan the layout and construction of roads and infrastructure with due cognisance of the topography. Construction: rehabilitation of construction areas. Decommissioning: ripping and rehabilitation of the road and servitude not required for post decommissioning use.		
Cumulative impacts: The construction of access roads will contribute to the cumulative visual impact of road infrastructure within the region, specifically in light of the authorised Red Cap WEF located to the west and east of the site and the authorised Deep River WEF to the north west. These sites will also require access roads.		
Residual impacts: None. The visual impact of the roads will be removed after decommissioning.		

Potential visual impact of the substation and workshop areas on observers in close proximity to the proposed WEF.

The substation, regardless of which alternative location is selected, and the workshop areas required for this WEF could present a visual impact. Areas of vegetation will need to be removed and structures will be built within an undeveloped environment.

No dedicated viewshed has been generated for the above infrastructure, but the area of potential visual exposure for both alternatives will lie within that of the turbines. This infrastructure is not likely to be as highly visible as the turbines, however, as the height of the structures will be much lower. This reduces the probability of this impact occurring.

In terms of preference from, both substations are considered equal from a visual perspective, and neither is favoured or disfavoured.

The table below illustrates the assessment of this anticipated impact, which is likely to be of **low** significance for either of the substation alternatives both before and after mitigation.

Table 11: Impact table summarising the significance of visual impact of the substation and workshop areas on observers in close proximity to the proposed WEF.

Nature of Impact: Potential visual impact of the substation and workshop areas on observers in close proximity to the proposed WEF		
	No mitigation	***Mitigation considered***
Extent	Local **(4)**	Local **(4)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Low **(4)**	Low **(4)**
Probability	Improbable **(2)**	Improbable **(2)**
Significance	Low **(24)**	Low **(24)**
Status (positive or negative)	Negative	Negative
Reversibility	Recoverable **(3)**	Recoverable **(3)**
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	No	N/a
Mitigation: Planning: make use of low profile construction technology for the substation design.		
Cumulative impacts: The construction of the substation and workshop will contribute to the cumulative visual impact of built and electrical infrastructure within the region, specifically in light of the authorised Red Cap WEF located to the west and east of the site and the authorised Deep River WEF to the north west. These sites will also require built and electrical infrastructure.		
Residual impacts: None. The visual impact of the infrastructure will be removed after decommissioning.		

Potential visual impact of the power line on observers in close proximity to the proposed power line.

There are three alternative alignments proposed for the new 132kV overhead power line required to connect the proposed WEF to Eskom's national grid.

The 3 alignment options have been indicated on **Map 8**. This map also shows the potential visual exposure of all three power line options, calculated at a height of 20m above ground level, for a distance of 2km on either side of the alignment.

It is clear from this map that the power line will be highly visible along all three alignment options. Small areas of visual screening occur in areas of undulating topography and along incised river valleys. The following is of relevance:

- The Western Corridor is the longest alignment, and therefore displays the largest extent of potential visual exposure. Visual receptors include long stretches of the N2 and shorter stretches of the R102, the R330 and 3 secondary roads. The town of Kruisfontein and up to 50 settlements and homesteads also appear to fall within this viewshed. This corridor follows an existing power line for about half of its length, but crosses 3 rivers, including the upper reaches of the Mpofu Dam.

- The Central Corridor is the second shortest alignment. Visual receptors include short stretches of the N2, the R102, the R330 and 3 secondary roads. The town of Kruisfontein and up to 40 settlements and homesteads also appear to fall within this viewshed. This corridor crosses 3 rivers, including the lower reaches of the Mpofu Dam (i.e. at the dam wall).

- The Eastern Corridor is the shortest alignment, and therefore displays the smallest extent of potential visual exposure. Visual receptors include short stretches of the N2, the R102, the R330 and 1 secondary road. The eastern parts of Humansdorp and up to 40 settlements and homesteads also appear to fall within this viewshed. This corridor crosses 3 rivers.

None of the Corridors are likely to visually impact on the Thuyspunt / Cape St Francis pre-colonial cultural landscape.

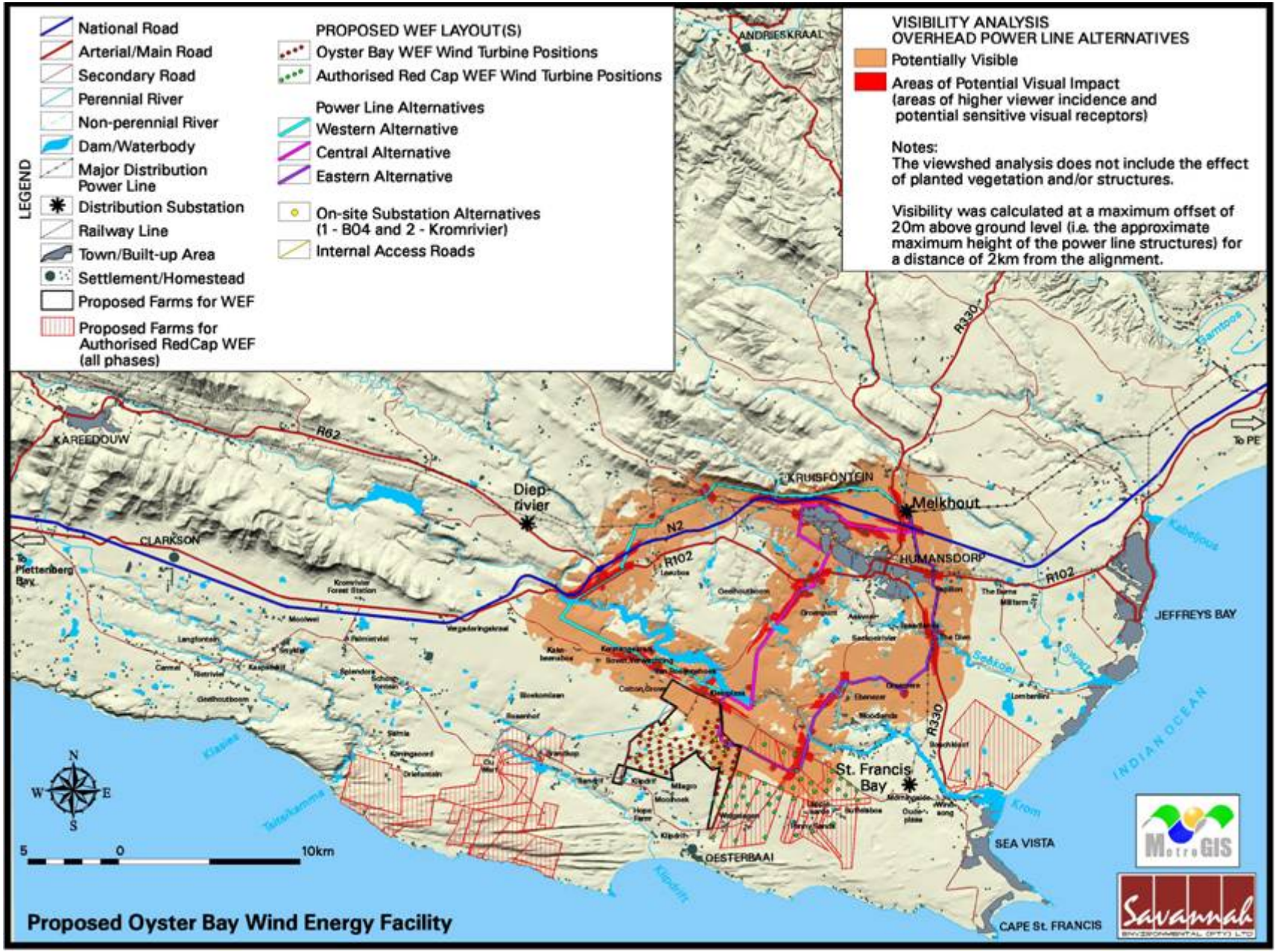
The above comparison reveals that the Western and Central Corridors are likely to result in a higher potential visual impact than the Eastern Corridor. This is based both on the anticipated extent of visual exposure (i.e. the length of the line) and the number of potential visual receptors likely to be visually exposed.

In order of preference, the Eastern Corridor is favoured from a visual perspective. Despite the fact that the Western Corridor follows existing infrastructure for at least half of its length, its longer length and exposure to long stretches of the N2 renders it the least favourable from a visual perspective.

The table overleaf illustrates the assessment of the anticipated impact of the Eastern Corridor, which is likely to be of **moderate** significance. There is no mitigation for this impact.

Table 12: Impact table summarising the significance of visual impact of the power line on observers in close proximity to the proposed power line.

Nature of Impact: Potential visual impact of the power line on observers in close proximity to the proposed power line.		
	No mitigation	***Mitigation considered***
Extent	Local **(4)**	N/a
Duration	Long term **(4)**	N/a
Magnitude	Moderate **(6)**	N/a
Probability	High **(4)**	N/a
Significance	Moderate **(56)**	N/a
Status (positive or negative)	Negative	N/a
Reversibility	Recoverable **(3)**	N/a
Irreplaceable loss of resources?	No	N/a
Can impacts be mitigated?	No	N/a
Mitigation: None.		
Cumulative impacts: The construction of the power line will contribute to the cumulative visual impact of electrical infrastructure within the region, specifically in light of the authorised Red Cap WEF located to the west and east of the site and the authorised Deep River WEF to the north west. These sites will also require power lines.		
Residual impacts: The visual impact will be removed after decommissioning, provided the power lines are also removed. If this is not the case, then the visual impact will remain.		



Map 8: Potential visual exposure the proposed power line options.

5.7.3. Lighting impacts

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

The receiving environment in close proximity to the proposed WEF has a relatively small number of populated places (i.e. mostly settlements and homesteads) and it can be expected that the light trespass and glare from the security and after-hours operational lighting (flood lights) for the substation and other WEF infrastructure will have some significance.

Furthermore, the sense of place and rural coastal ambiance of the local area increases its sensitivity to such lighting intrusions. It is also important that note be taken of the protected areas and the tourist town of Oyster Bay within close proximity to the proposed WEF.

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.

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, contributes to the increase in sky glow. The WEF may contribute to the effect of sky glow in an otherwise dark environment.

The table overleaf illustrates the assessment of this anticipated impact, which is likely to be of **moderate** significance both before and after mitigation.

Table 13: Impact table summarising the significance of visual impact of lighting at night on visual receptors in close proximity to the proposed WEF

Nature of Impact: Potential visual impact on of lighting at night on visual receptors in close proximity to the proposed WEF.		
	No mitigation	***Mitigation considered***
Extent	Local **(4)**	Local **(4)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Moderate **(6)**	Low **(4)**
Probability	Probable **(3)**	Probable **(3)**
Significance	Moderate **(42)**	Moderate **(36)**
Status (positive or negative)	Negative	Negative
Reversibility	Recoverable **(3)**	Recoverable **(3)**
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	N/a
Mitigation: Planning: mounting aircraft warning on the turbines representing the outer perimeter of the facility. Planning: pro-active lighting design and planning. Decommissioning: removal of the wind turbines and ancillary infrastructure after 20 to 25 years.		
Cumulative impacts: The construction of 50-80 wind turbines with their aircraft warning lights will increase the cumulative visual impact of such warning lights within the region. This is specifically relevant in context of the authorised Red Cap WEF located to the west and east of the site and the authorised Deep River WEF to the north west.		
Residual impacts: None. The visual impact of lighting will be removed after decommissioning and the removal of the wind turbines.		

5.7.4. Shadow flicker

Potential visual impact of shadow flicker on visual receptors in close proximity to the proposed WEF.

Shadow flicker 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.

In this respect, settlements and homesteads within the WEF site, as well as those within 500m of the property boundary may experience a visual impact of **low** significance both before and after mitigation.

Table 14: Impact table summarising the significance of visual impact of shadow flicker on visual receptors in close proximity to the proposed WEF.

Nature of Impact: Potential visual impact of shadow flicker on visual receptors in close proximity to the proposed WEF.		
	No mitigation	***Mitigation considered***
Extent	Local **(4)**	Local **(4)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Low **(4)**	Low **(4)**
Probability	Improbable **(2)**	V Improbable **(1)**
Significance	Low **(24)**	Low **(12)**
Status (positive or negative)	Negative	Negative
Reversibility	Recoverable **(3)**	Recoverable **(3)**
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	N/a
Mitigation: Planning: ensure that all wind turbines are 500m or further from the nearest inhabited homestead of settlement. Decommissioning: removal of the wind turbines and ancillary infrastructure after 20 to 25 years		
Cumulative impacts: None.		
Residual impacts: None. The visual impact of shadow flicker will be removed after decommissioning and the removal of the wind turbines.		

5.7.5. Construction impacts

Potential visual impact of construction on visual receptors in close proximity to the proposed WEF and associated infrastructure.

During the construction period for the proposed turbines and the ancillary on-site infrastructure (including the power lines), 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.

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

Table 15: Impact table summarising the significance of visual impact of construction on visual receptors in close proximity to the proposed WEF and associated infrastructure.

Nature of Impact: Potential visual impact of construction on visual receptors in close proximity to the proposed WEF and associated infrastructure.		
	No mitigation	***Mitigation considered***
Extent	Local **(4)**	Local **(4)**
Duration	Very short term **(1)**	Very short term **(1)**
Magnitude	Moderate **(6)**	Low **(4)**
Probability	High **(4)**	Improbable **(2)**
Significance	Moderate **(44)**	Low **(18)**
Status (positive or negative)	Negative	Negative
Reversibility	Recoverable **(3)**	Recoverable **(3)**
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	N/a
Mitigation: Construction: Proper planning, management and rehabilitation of the construction site		
Cumulative impacts: None.		
Residual impacts: None.		

5.8 Visual impact assessment: secondary impacts

5.8.1 The WEF and ancillary infrastructure

Potential visual impacts on the visual character and sense of place of the region.

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

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

Specific aspects contributing to the sense of place of this region include the pastoral visual quality of the farmland and the scenic beauty of the coastline and of the mountains inland.

The anticipated visual impact of the facility on the regional visual character, and by implication, on the sense of place, is expected to be **moderate**. There is no mitigation for this impact.

The table below illustrates the assessment of this anticipated impact.

Table 16: Impact table summarising the significance of visual impacts on the visual character and sense of place of the region.

Nature of Impact: Potential visual impact on the visual character and sense of place of the region.		
	No mitigation	***Mitigation considered***
Extent	Regional **(3)**	N/a
Duration	Long term **(4)**	N/a
Magnitude	Moderate **(6)**	N/a
Probability	Probable **(3)**	N/a
Significance	Moderate **(39)**	N/a
Status (positive or negative)	Negative	N/a
Reversibility	Recoverable **(3)**	N/a
Irreplaceable loss of resources?	No	N/a
Can impacts be mitigated?	No	N/a
Mitigation: Decommissioning: removal of the wind turbines and ancillary infrastructure after 20 to 25 years		
Cumulative impacts: The construction of 50-80 wind turbines will increase the cumulative visual impact within the region, specifically in light of the authorised Red Cap WEF located to the west and east of the site and the authorised Deep River WEF to the north west. Although the proposed Oyster Bay WEF will fall largely within the Red Cap WEF viewshed, and partially within the Deep River viewshed, the frequency of exposure for receptors within these areas will increase.		
Residual impacts: None. The visual impact of the wind turbines will be removed after decommissioning.		

Potential visual impact of the proposed facility on tourist routes, tourist destinations and tourism potential within the region.

The study area has a pastoral character and is located within a particularly picturesque part of the country. The site also lies less than 3km from the coastline, and the coastal town of Oyster Bay. In addition to Oyster Bay, Jeffrey's Bay, Sea Vista and Cape St Francis enjoy status as coastal holiday towns.

The Eastern Cape also has 9 tourism routes of which the *Kouga Route*, encompassing Jeffrey's Bay, Cape St Francis and the Gamtoos River Valley, is of relevance within in the study area. In addition, the N2 is a well known and well used tourist access route, and many arterial and secondary roads make for scenic drives.

Visual intrusion through the development of the WEF within this environment could have a negative effect on the area's tourism value and potential.

Note: Studies have reportedly shown varied (i.e. both positive and negative) and inconclusive results regarding the effect of wind farms on tourism. For this study, a worst case scenario is assumed, and the anticipated visual impact of the proposed WEF on tourism is taken to be negative.

The anticipated visual impact of the facility on existing tourist routes, coastal holiday towns and on the long term tourism potential of the region, is expected to be **moderate**. There is no mitigation for this impact. The table below illustrates the assessment of this anticipated impact from a visual perspective.

Table 17: Impact table summarising the significance of visual impacts on tourist routes, tourist destinations and tourist potential within the region.

Nature of Impact: Potential visual impact of the proposed facility on tourist routes, tourist destinations and tourist potential within the region.		
	No mitigation	***Mitigation considered***
Extent	Regional **(3)**	N/a
Duration	Long term **(4)**	N/a
Magnitude	Moderate **(6)**	N/a
Probability	Probable **(3)**	N/a
Significance	Moderate **(39)**	N/a
Status (positive or negative)	Negative	N/a
Reversibility	Recoverable **(3)**	N/a
Irreplaceable loss of resources?	No	N/a
Can impacts be mitigated?	No	N/a
Mitigation: Decommissioning: removal of the wind turbines and ancillary infrastructure after 20 to 25 years		
Cumulative impacts: The construction of 50-80 wind turbines and the ancillary infrastructure required for the WEF will increase the cumulative visual impact on tourism and tourism potential within the region. This is specifically in light of the authorised Red Cap WEF located to the west and east of the site and the authorised Deep River WEF to the north west. Although the proposed Oyster Bay WEF will fall largely within the Red Cap WEF viewshed, and partially within the Deep River viewshed, the frequency of exposure for receptors within these areas will increase.		
Residual impacts: None. The visual impact of the wind turbines will be removed after decommissioning.		

5.9. The potential to mitigate visual impacts

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

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

- Mitigation of visual impacts associated with the construction of roads includes the use of existing roads wherever possible.

  Where new roads are required, these should be planned taking due cognisance of the topography. Construction of roads should be undertaken properly, with adequate drainage structures in place to forego potential erosion problems.

  Access roads not required for the post-decommissioning use of the site should be ripped and rehabilitated during decommissioning.

- It is recommended that the substation design makes use of low profile construction technology to mitigate visual impact on the surrounding area.

- The preferred power line alignment is the Eastern Corridor option, as this alignment will result in the least visual impact.

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

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

- Mitigation of other 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 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;
  - 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 potential shadow flicker impacts includes ensuring that all wind turbines are located 500m or further from the nearest inhabited homestead of settlement.

- Mitigation of visual impacts associated with the construction phase, albeit temporary, entails proper planning, management and rehabilitation of the construction site. Construction should be managed according to the following principles:

    - Reduce the construction period through careful planning and productive implementation of resources.
    - Plan the placement of lay-down areas and any potential temporary construction camps in order to minimise vegetation clearing.
    - Restrict the activities and movement of construction workers and vehicles to the immediate construction site and existing access roads.
    - Ensure that rubble, litter and disused construction materials are managed and removed regularly.
    - Ensure that all infrastructure and the site and general surrounds are maintained in a neat and appealing way
    - Reduce and control construction dust through the use of approved dust suppression techniques.
    - Restrict construction activities to daylight hours in order to negate or reduce the visual impacts associated with lighting.
    - Rehabilitate all disturbed areas, construction areas, road servitudes and cut and fill slopes to acceptable visual standards.

- Secondary impacts anticipated as a result of the proposed WEF (i.e. visual character and sense of place) are not possible to mitigate.

- There is no mitigation to ameliorate the negative visual impacts on tourist routes, destinations and potential of the region.

- Once the WEF has exhausted its life span, the main facility and all associated infrastructure not required for the post rehabilitation use of the site should be removed and all disturbed areas appropriately rehabilitated.

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 visual impact of the proposed Oyster Bay WEF 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

facility. The simulations are based on the wind turbine dimensions and layout as indicated on **Map 1**.

The photograph positions are indicated on **Map 9** 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, substation, access roads, etc.) associated with the facility is not included in the photo simulations.

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. Where relevant, 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 is 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, that is displayed in a Cartesian plane. Any existing shapefile can be added into the 3D environment and will automatically be displayed in its 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.

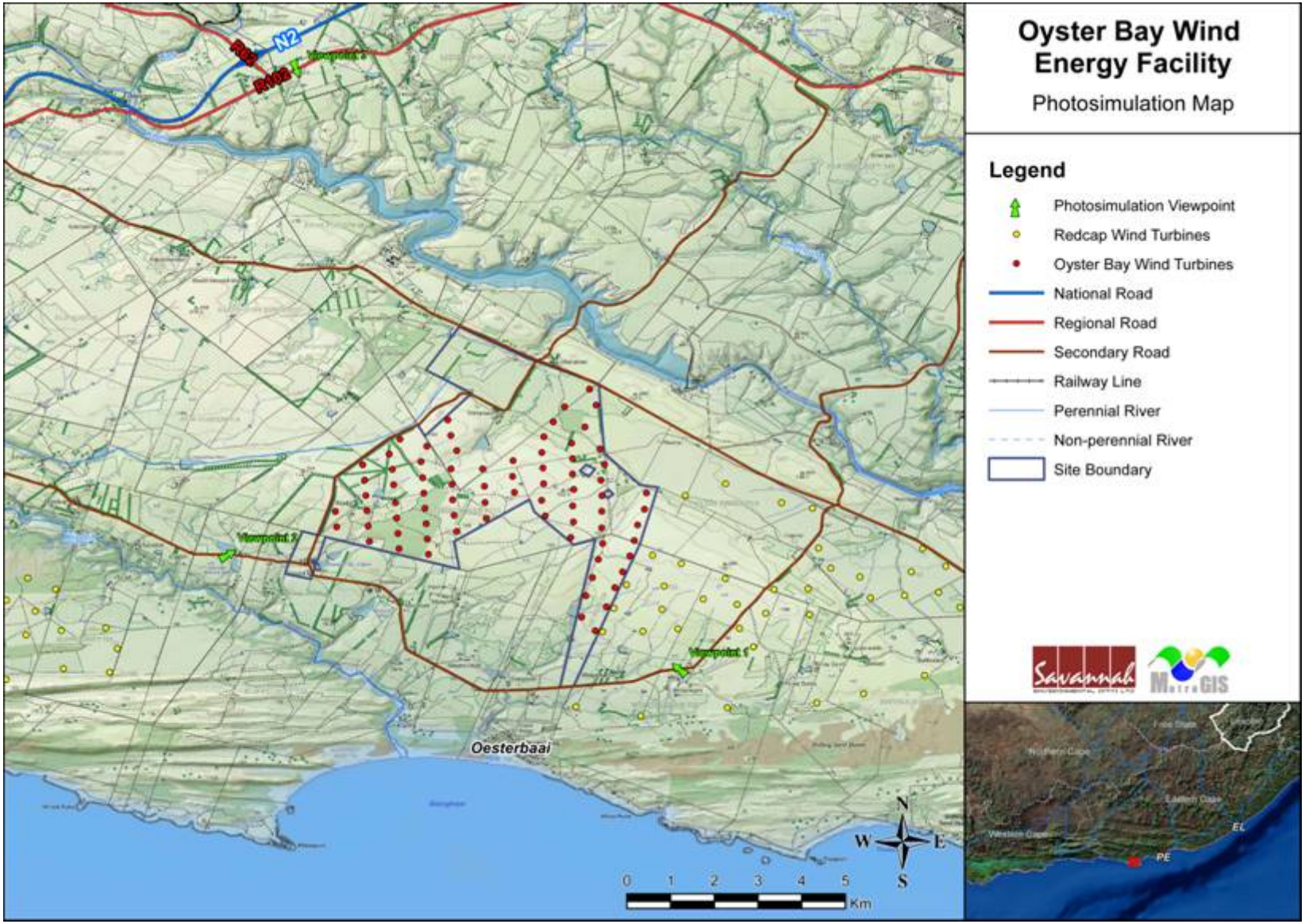
- 3D models from such applications as 3D StudioMax or Sketchup are compatible with the ArcScene environment and work by assigning a model to be rendered at points geographically specified by a point shapefile. Each model itself consists of many polygons, and depending on the number of models used, can impact severely on a computer's performance in displaying the virtual environment.

- For the purposes of placing wind turbines onto a virtual landscape, a layout of the exact turbine positions is required in the form of a point shapefile. This shapefile is added three times to the environment. The first instance is displayed as a point at ground level to indicate where the turbine tower meets the ground level. The second instance is extruded to half the height of the tower and displayed in a certain colour. The third instance is extruded from half to the full height of the tower and displayed in a different colour. Thus, from any virtual viewpoint on the landscape, it can be determined which turbines will be in full view and which will be partially obscured by undulations of the terrain. The terrain can also be made semi-transparent to check whether anything is completely obscured.

- Each photo viewpoint is then recreated within the virtual environment by setting the "camera" coordinates to those of the GPS coordinates logged when each photo was taken. Several other data may be added for landmark purposes, such as roads, rivers, power lines, or even trees if they can be accurately digitized. The virtual output is then rendered at a focal length matching that of the photos originally used to create the panoramas (using a field-of-view calculator that also compensates for the digital equivalent of 35mm film cameras). Several virtual "snapshots" are taken in sequence in the same manner as for the panoramic photos as the virtual output suffers from the same edge distortion as a photo. These are then stitched in the same manner as the photographs.

- Both the panoramic photos and the virtual simulation output are now graphic formats that are loaded into Adobe Photoshop. Some enhancements of the panoramas may be necessary as weather conditions tend to adversely affect image quality. The horizon and landscape of the virtual viewpoint is then matched up to what can be seen in the panoramas and sample images of the wind turbines are then overlaid where the extruded points are visible. Scaling is maintained since the top and mid-point of the tower are usually visible, so the ground point can be established even though it may be obscured by the landscape. Some graphic editing is usually necessary to address such things intervening vegetation or power lines as well as sufficient blurring to mimic the effect of distance.

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



Map 9: Photograph positions for Photo Simulations.

6.1 Short distance view 1

Viewpoint 1 is located on a secondary road which bypasses the site to the immediate south, linking the N2 in the west, Oyster Bay in the south and Humansdorp in the east. The point is located about 1,6km east of the site boundary.

This position is approximately 1,6km away from the closest turbine and is indicative of a close range view that residents of homesteads living in close proximity to the facility would have of the turbines. It is also representative of what residents of and visitors to Oyster Bay will potentially see when travelling towards the town from the east.

It is also noteworthy that this point is located within the authorised Red Cap WEF site, meaning that turbines from both facilities may ultimately be visible in the short distance. In this respect, Figure 8a shows the pre-construction environment (i.e. no wind turbines are visible), Figure 8b shows the Red Cap Turbines only and Figure 8c shows the combined Oyster Bay and Red Cap Turbines.

The viewing direction is north westerly and in Figure 8c, 71 turbines are fully to partially visible in the landscape. 6 of these turbines belong to the authorised Red Cap Facility.

Figure 8a: Pre construction panoramic overview from Viewpoint 1

Figure 8b: Pre construction panoramic overview from Viewpoint 1 (indicating the authorised Red Cap turbines only).

Figure 8c: Post construction panoramic overview from Viewpoint 1 (indicating the authorised Red Cap turbines as well as the proposed Oyster Bay turbines and enlarged photograph sections).
This viewpoint is located 1,6km away from the closest turbine.

Figure 8d: View 1a (enlarged photograph section from Viewpoint 1).

Figure 8e: View 1b (enlarged photograph section from Viewpoint 1).

6.2 Short distance view 2

Viewpoint 2 is located on the same secondary road which bypasses the site to the immediate south, linking the N2 in the west, Oyster Bay in the south and Humansdorp in the east. The point is located about 1,6km west of the site boundary.

This position is approximately 2km away from the closest turbine and is indicative of a close range view that residents of homesteads living in close proximity to the facility would have of the turbines. It is also representative of what residents of and visitors to Oyster Bay will see when travelling towards the town from the west.

The viewing direction is north easterly and 45 turbines are 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 (indicating enlarged photograph sections).
This viewpoint is located 2km away from the closest turbine.

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

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

6.3 Medium distance view

Viewpoint 3 is located on the R102, about 1km to the east of the junction with the R62. The point is located about 7km north of the site boundary.

This position is approximately 8km away from the closest turbine and is indicative of a medium range view that users of the R102 and residents of homesteads within 10km of the facility would have of the turbines lying to the south.

It is also representative of what users of the N2 would see of the facility (the N2 is located about 1km to the north of the R102 at this point).

It is noteworthy that the authorised Red Cap WEF site will also be visible from this point, meaning that turbines from both facilities may ultimately be visible in the medium distance. In this respect, Figure 10a shows the pre-construction environment (i.e. no wind turbines are visible), Figure 10b shows the Red Cap Turbines only and Figure 10c shows the combined Oyster Bay and Red Cap Turbines.

The viewing direction is south easterly and in Figure 10c, 98 turbines are fully to partially visible in the landscape. 30 of these turbines belong to the authorised Red Cap Facility.

Figure 10a: Pre construction panoramic overview from Viewpoint 3

Figure 10b: Post construction panoramic overview from Viewpoint 3, (indicating enlarged photograph sections).

Figure 10c: Post construction panoramic overview from Viewpoint 3 (indicating the authorised Red Cap turbines as well as the proposed Oyster Bay turbines and enlarged photograph sections).
This viewpoint is located 8km away from the closest turbine.

Figure 10d: View 3a (enlarged photograph section from Viewpoint 3).

Figure 10e: View 3b (enlarged photograph section from Viewpoint 3).

7. CONCLUSION AND RECOMMENDATIONS

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

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

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

However, this opinion should not distract from the fact that the facility and associated infrastructure would be visible within an area that is generally seen as having a high quality natural and pastoral landscape character.

Within this context, sensitive visual receptors include residents of Oyster Bay and surrounds, as well as a number of rural settlements and homesteads in close proximity to the proposed facility.

The N2 is a known tourist access route to the south coast and the scenic nature of the area and the proximity to coastal holiday towns lends the study area some tourism value. The potential to promote scenic drives and to tie in with the *Kouga Tourism Route* add to the potential of the area to develop in terms of tourism in the future.

Conservation areas in close proximity to the proposed WEF, and potentially affected by visual exposure thereto, are limited to the Thuyspunt National Heritage Site and the Rebelsrus Private Nature Reserve. Neither of these is under statutory protection, but they do represent part of a picturesque and undeveloped coastline.

Last is the context of the proposed site within Thuyspunt / Cape St Francis pre-colonial cultural landscape, which is one of the richest and best preserved archaeological sites in South Africa. According to the Phase 1 Archaeological Impact Assessment for the Proposed Oyster Bay Wind Energy Facility[10], the visual impact of the turbines will be the single largest change to the Thuyspunt / Cape St Francis pre-colonial cultural landscape.

The most important sites affected are the Thuyspunt National Heritage Site 2km south east of the site, a zone of Late Stone Age Middens along the coast west of Oyster Bay and the Bramdewynkop Dunes some 3km west of the proposed WEF.

It is thus concluded that the facility will visually impact on various sensitive visual receptors who would consider visual exposure to this type of infrastructure to be intrusive. Furthermore, in light of the authorised Red Cap WEF adjacent to the

[10] Eastern Cape Heritage Consultants. 2011.

proposed Oyster Bay WEF, these visual receptors would be subject to a cumulative visual impact (i.e. turbines from 2 rather than 1 WEF will be visible).

There also are not many options as to the mitigation of the visual impact of the core facility. No amount of vegetation screening or landscaping would be able to hide structures of these dimensions.

The following (as detailed in section 5.9) is, however recommended:

- Mitigate impacts associated with the construction of roads through the use of existing roads wherever possible.

  Where new roads are required, these should be planned taking due cognisance of the topography. Construction of roads should be undertaken properly, with adequate drainage structures in place to forego potential erosion problems.

  Access roads not required for the post-decommissioning use of the site should be ripped and rehabilitated during decommissioning.

- That the substation design must make use of low profile construction technology.

- The preferred power line alignment is the Eastern Corridor option, as this alignment will result in the least visual impact.

- Mount aircraft warning lights on the turbines representing the outer perimeter of the facility. In this manner, fewer warning lights can be utilised to delineate the facility as one large obstruction, thereby lessening the potential visual impact.

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

- Mitigate other lighting impacts through 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 the turbines and the ancillary infrastructure will go far to contain rather than spread the light.

- Mitigate potential shadow flicker impacts by ensuring that all wind turbines are located 500m or further from the nearest inhabited homestead of settlement.

- Mitigate visual impacts associated with the construction phase, albeit temporary, through proper planning, management and rehabilitation of the construction site.

- Once the WEF has exhausted its life span, remove the main facility and all associated infrastructure not required for the post rehabilitation use of the site and ensure that all disturbed areas are appropriately rehabilitated.

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

Lastly, on a more strategic level, it is recommended that the need for a Regional Plan be investigated for the greater study area (and beyond) to guide the development of future Wind Energy Facilities.

Such a plan should be developed by the Authorities for use as a planning tool by both themselves and by prospective WEF developers, and should indicate both preferential and no-go zones for WEF development as well as recommended capacities. This plan should be based on (amongst others) visual considerations.

8. IMPACT STATEMENT

In light of the results and findings of the Visual Impact Assessment undertaken for the proposed Oyster Bay Wind Energy Facility, it is acknowledged that the pastoral and natural views surrounding the site will be transformed for the entire operational lifespan (20-25 years) of the facility.

The following is a summary of impacts remaining, assuming mitigation as recommended is exercised:

- The potential visual impact of the facility on users of national, arterial and secondary roads in close proximity to the proposed facility (i.e. within 10km) will be of **high** significance.
- The anticipated visual impact on residents of urban centres and populated places in close proximity to the proposed facility (i.e. Oyster Bay) will be of **high** significance. It should be noted, however, that limited outlying parts of the town are likely to experience this visual impact.
- The anticipated visual impact on residents of settlements and homesteads in close proximity to the proposed facility will also be of **high** significance.
- Within the greater region, the potential visual impact on sensitive visual receptors (i.e. users of roads and residents of settlements and homesteads) will be of **moderate** significance.
- The anticipated visual impact on residents of towns beyond the 10km of the proposed facility will be of **low** significance.
- Conservation / protected areas in close proximity to the proposed facility will experience visual impacts of **low** significance, as will those within the greater region.
- The anticipated visual impact on the Thuyspunt / Cape St Francis pre-colonial cultural landscape in close proximity to the proposed facility is expected to be of **moderate** significance.
- Within the region, the potential visual impact on the Thuyspunt / Cape St Francis pre-colonial cultural landscape is expected to be of **low** significance.
- In terms of ancillary infrastructure, the anticipated visual impact of the substation and workshop will be of **low** significance, as will that of the internal access roads.
- Visual impacts of the proposed power line will be of **moderate** significance.
- Anticipated visual impacts related to lighting will be of **moderate** significance, while that of shadow flicker will be **low**.
- Similarly, the visual impact of construction is also expected to be of **low** significance.
- In terms of secondary visual impacts, the significance of the anticipated impact on the visual character and sense of place of the region will be of **moderate** significance, as will the anticipated impact on tourist routes, tourist destinations and tourism potential.

The above anticipated visual impacts are not, however, considered to be fatal flaws from a visual perspective. Considerations include the relatively low incidence of visual receptors in the region, the low lying locality of the proposed site and the relatively contained area of potential visual exposure.

Of additional relevance is the proximity of the proposed WEF to the authorised Red Cap facility, and their corresponding zones of potential visual exposure. From a visual perspective, this overlapping viewshed is considered favourable, as it represents the consolidation and concentration of potential visual impacts within an existing WEF viewshed.

Within these visually exposed areas, the frequency of visual exposure to turbines will be higher with the addition of the Oyster Bay facility, but the extent of the existing Red Cap viewshed will remain largely unchanged.

The potential visual impact is not likely to detract from the regional tourism appeal, numbers of tourists or tourism potential of the existing centres such as Jeffrey's Bay, Sea Vista or Cape St Francis.

In addition, it is the opinion of the author that the visual impact on the Thuyspunt / Cape St Francis pre-colonial cultural landscape is not likely to detract from the significance or importance of the National Heritage or other archaeological sites.

Only Oyster Bay is close enough to the proposed WEF to be affected, but it is anticipated that only limited outlying parts of the town will be visually exposed. Furthermore, it is assumed that holiday homes within this town would orientate towards the ocean, and not inland towards the WEF. Therefore, receptors are not likely to be exposed permanently or even for long periods of time.

It is therefore recommended that the development of the facility as proposed be supported, subject to the implementation of the recommended mitigation measures 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.

Table 18: Management plan – Planning.

OBJECTIVE: The mitigation and possible negation of visual impacts associated with the planning of the Proposed Oyster Bay Wind Energy Facility.

Project component/s	The WEF and ancillary infrastructure (i.e. power line, substation, workshop and internal access roads).
Potential Impact	Primary visual impact of the facility due to the presence of the turbines, the substation, the workshop, the power line and the access roads in the landscape as well as the visual impact of lighting at night.
Activity/risk source	The viewing of the above mentioned by observers on or near the site as well as within the region.
Mitigation: Target/Objective	Optimal planning of infrastructure so as to minimise visual impact.

Mitigation: Action/control	Responsibility	Timeframe
Make use of existing roads wherever possible.	RESSA / design consultant	Planning.
Implement an environmentally responsive planning approach to roads and infrastructure to limit cut and fill requirements. Plan with due cognisance of the topography.	RESSA / design consultant	Planning.
Make use of low profile construction technology for the substation design.	RESSA / design consultant	Planning.
Implement the eastern Corridor power line alignment.	RESSA / design consultant.	Planning.
Ensure that all wind turbines are located 500m or further from the nearest inhabited homestead of settlement	RESSA / design consultant	Planning
Mount aircraft warning lights on the turbines representing the outer perimeter of the facility. The regulations for the CAA's *Marking of Obstacles* should be strictly adhered to	RESSA / design consultant	Planning
Consult a lighting engineer in the planning and placement of light fixtures for the turbines and the ancillary infrastructure.	RESSA / design consultant	Planning

Performance Indicator	No internal access roads are visible from surrounding areas and lighting impact is minimal. The power line is visible to the least number of receptors.
Monitoring	Not applicable.

Table 19: Management plan – Construction.

OBJECTIVE: The mitigation and possible negation of visual impacts associated with the construction of the Proposed Oyster Bay Wind Energy Facility.

Project component/s	Construction site.		
Potential Impact	Visual impact of general construction activities, and the potential scarring of the landscape due to vegetation clearing.		
Activity/risk source	The viewing of the above mentioned by observers on or near the site.		
Mitigation: Target/Objective	Minimal visual intrusion by construction activities and intact vegetation cover outside of immediate works areas.		
Mitigation: Action/control		Responsibility	Timeframe
Reduce the construction period through careful planning and productive implementation of resources.		RESSA / contractor	Construction
Plan the placement of lay-down areas and temporary construction equipment camps in order to minimise vegetation clearing.		RESSA / contractor	Construction
Restrict the activities and movement of construction workers and vehicles to the immediate construction site and existing access roads.		RESSA / contractor	Construction
Ensure that rubble, litter and disused construction materials are managed and removed regularly.		RESSA / contractor	Construction
Ensure that all infrastructure and the site and general surrounds are maintained in a neat and appealing way		RESSA / contractor	Construction
Reduce and control construction dust through the use of approved dust suppression techniques.		RESSA / contractor	Construction
Restrict construction activities to daylight hours in order to negate or reduce the visual impacts associated with lighting.		RESSA / contractor	Construction
Rehabilitate all disturbed areas, construction areas, road servitudes and cut and fill slopes to acceptable visual standards.		RESSA / contractor	Construction
Performance Indicator	Vegetation cover on and in the vicinity of the site is intact with no evidence of degradation or erosion.		
Monitoring	Monitoring of vegetation clearing during construction. Monitoring of rehabilitated areas post construction.		

Table 20: Management plan – Operation.

OBJECTIVE: The mitigation and possible negation of visual impacts associated with the operation of the Proposed Oyster Bay Wind Energy Facility.		
Project component/s	The WEF and ancillary infrastructure (i.e. power line, substation, workshop and internal access roads).	
Potential Impact	Visual impact of facility degradation and vegetation rehabilitation failure.	
Activity/risk source	The viewing of the above mentioned by observers on or near the site.	
Mitigation: Target/Objective	Well maintained and neat facility.	
Mitigation: Action/control	Responsibility	Timeframe
Maintain the general appearance of the facility in an aesthetically pleasing way.	RESSA / operator	Operation.
Monitor rehabilitated areas, and implement remedial action as and when required.	RESSA / operator	Operation.
Performance Indicator	Well maintained and neat facility with intact vegetation on and in the vicinity of the facility.	
Monitoring	Monitoring of rehabilitated areas.	

Table 21: Management plan – Decommissioning.

OBJECTIVE: The mitigation and possible negation of visual impacts associated with the decommissioning of the Proposed Oyster Bay Wind Energy Facility.		
Project component/s	The WEF and ancillary infrastructure (i.e. power line, substation, workshop and internal access roads).	
Potential Impact	Visual impact of residual visual scarring and vegetation rehabilitation failure.	
Activity/risk source	The viewing of the above mentioned by observers on or near the site.	
Mitigation: Target/Objective	Infrastructure required for post decommissioning use of the site and rehabilitated vegetation in all disturbed areas.	
Mitigation: Action/control	Responsibility	Timeframe
Remove wind turbines and other infrastructure not required for the post-decommissioning use of the site,	RESSA / operator	Operation.
Rip and rehabilitate access roads not required for the post-decommissioning use of the site.	RESSA / operator	Operation.
Monitor rehabilitated areas, and implement remedial action as and when required.	RESSA / operator	Operation.
Performance Indicator	Site with intact vegetation on and in the vicinity of the facility.	
Monitoring	Monitoring of rehabilitated areas.	

10. REFERENCES / DATA SOURCES

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 (DEA&T), 2001. *Environmental Potential Atlas (ENPAT) for the Eastern Cape Province*

Eastern Cape Heritage Consultants. 2011. *A Phase 1 Archaeological Impact Assessment for the Proposed Oyster Bay Wind Energy Facility, Kouga Local Municipality, Humansdorp District, Eastern Cape Province*. Unpublished Report.

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

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

Scenic Landscape Architecture (2006). *Cullerin Range Wind Farm; Visual Impact Assessment.* Unpublished Report.