PROPOSED ISIVUNGUVUNGU WIND FARM, SALDANHA

WESTERN CAPE PROVINCE

VISUAL IMPACT ASSESSMENT

AS PART OF A BASIC ASSESSMENT PROCESS

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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.

Aurecon South Africa appointed MetroGIS (Pty) Ltd as an independent specialist consultant to undertake the visual impact assessment for the Proposed Isivunguvungu Wind Farm near Saldanha in the Western 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.

- The information available, understanding of the study area and experience of this type of project by the practitioner:

[1] Adapted from Oberholzer (2005).

- ➢ 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.

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 facility, including related infrastructure, 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 related infrastructure indicate the potential visibility.

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

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

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

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

- **Determine Viewer Incidence/Viewer Perception**

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

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

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

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

  This is the capacity of the receiving environment to absorb 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 magnitude 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. Significance is determined as a function of extent, duration, magnitude and probability.

2. BACKGROUND

Isivunguvungu Wind Energy Converters (Pty) Ltd (I-WEC) is applying for the proposed construction of a Wind Energy Facility (WEF) approximately 4km north east of the town of Saldanha, within the Saldanha Bay Municipal Area of the Western Cape Province.

The proposed WEF site lies within that of the ArcelorMittal: Saldanha Works (AMSA) steel manufacturing plant, near Saldanha Bay, Western Cape. The proposed turbines will lie less than 2km south of the plant.

The purpose of the construction of the WEF is to provide power (technically known as 'evacuating power') to the AMSA steel manufacturing plant in order to reduce their load on the electricity grid. Should the need arise power could be evacuated directly onto the grid.

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 considered to be an environmentally friendly electricity generation option.

The effectiveness 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.

I-WEC intends to construct 6 wind turbines within an identified area of 200Ha. The facility will ultimately have a generating capacity of approximately 15MW.

The WEF will connect to the electricity grid at the existing Saldanha Steel Distribution Substation at the AMSA steel manufacturing plant site.

Each turbine will have a capacity of 2,5 MW, and will consist of a concrete foundation, a steel tower and nacelle (hub height of 70 - 80m), and a rotor (consisting of 3 blades of 46,9 – 50,3m in length). The rotational power generated by the turbine blades is transmitted to the generator housed within the nacelle via a gearbox and drive train. Refer to **Figure 1**.

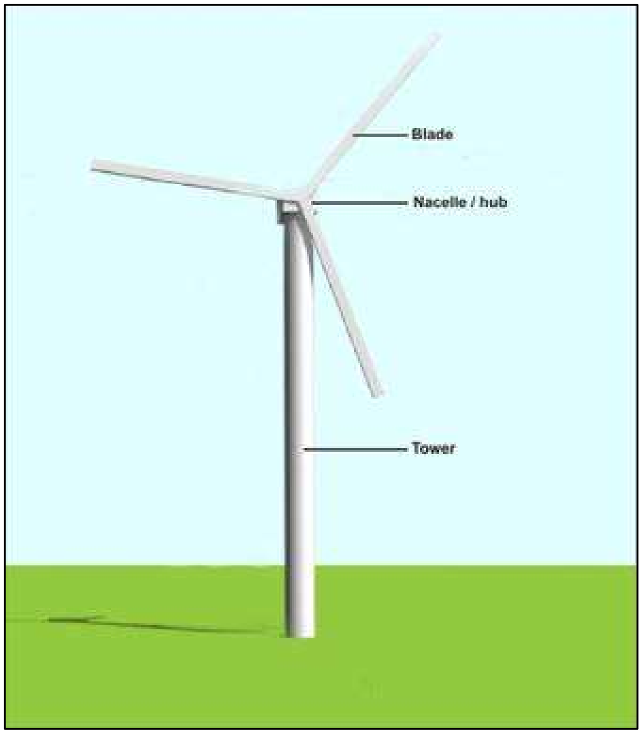

Figure 1: Image of a wind turbine being considered for this project

The proposed layout of the WEF is shown on **Map 1**. Main and ancillary infrastructure will include the following:

- 6 wind turbines with the height of masts between 70m to 80m at a distance of 150m from one another. Each turbine would have a physical footprint of 3350 m^2 (including turbine 17m diameter foundation and hardstanding for crane next to turbine);
- 6 transformer substations with a physical footprint that is included in the turbine footprint;
- Underground cabling between the turbines;
- An 11kV transmission line with approximately 2.4 km constructed underground and 2.2 km constructed above ground;
- A transformer station (3mx3m);
- 1 semi-permanent site office (container) with a physical footprint of 14.5 m^2;
- Upgrading of the existing access road and
- Construction of a new gravel road connecting the turbines of 1.5 km long.

The total area of the site considered for the proposed development is approximately 115 ha in extent, but the actual development footprint area for the proposed WEF is only about 2,68 ha.

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

The construction and commissioning of the WEF is expected to take about 6 months. The lifespan of the facility is approximated at 20 years.

3. SCOPE OF WORK

The project is proposed on Remainder 129 of the Farm Yzervarkensrug, Farm 195/2 Jakkalskloof and Farm 1132 near Saldanha Bay in the Western Cape.

All the wind turbines and associated infrastructure will be constructed on a portion of the Remainder 129 of the Farm Yzervarkensrug and a portion of the Farm 195/2 Jakkalskloof except a portion of the 11kV powerline which will be constructed on Farm 1132.

Remainder 129 of the Farm Yzervarkensrug and Farm 195/2 Jakkalskloof are zoned for agricultural activities however no agricultural activities are currently being undertaken on the property, nor has it been used for agriculture since the land use application for rezoning on the AMSA site in 1995. Farm 1132 is however currently zoned for industrial activities.

The study area for the visual assessment encompasses a geographical area of approximately 1353km² (the extent of the maps displayed below) and includes a minimum 10km buffer zone from the proposed development area.

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 and the recommendation of mitigation measures, where appropriate.

Anticipated issues related to the proposed Wind Energy Facility include:

- The visibility of the facility to, and potential visual impact on, observers travelling along main roads (i.e. the R27, R399 and R45) as well as secondary roads in close proximity[2] to the proposed WEF and within the region[3].
- The visibility of the WEF to, and potential visual impact on residents of homesteads and farm settlements in close proximity to the proposed WEF and within the region.
- The visibility of the WEF to, and potential visual impact on built up places and urban areas (i.e. the towns of Saldanha and Langebaan) within the region.
- The visibility of the facility to, and the potential visual impact on conservation areas[4] in the region, specifically the West Coast National Park.
- The potential visual impact of the facility on the visual character of the landscape and sense of place of the region.
- The potential visual impact of the facility on tourist access routes, scenic drives and tourist destinations within the region.
- The potential visual impact of the ancillary infrastructure (i.e. the overhead power line, the access roads, the transformer station and the office) on observers in close proximity to the proposed WEF.
- The potential visual impact of shadow flicker on observers residing on or in close proximity to the proposed facility. This is the flicker of shadow as the rotor blades pass between the receptor and the sun. It occurs when the

[2] For the purpose of this study, close proximity is considered to be within 5km of the proposed WEF.

[3] For the purpose of this study, the region is considered to be beyond the 5km radius of the proposed WEF.

[4] For the purpose of this study, these include private and public nature reserves, game farms, conservation areas 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).

sky is clear, and when the rotor blades are between the sun and the receptor (i.e. when the sun is low).

- The potential visual impact of operational, safety and security lighting of the facility at night on observers in close proximity to the proposed WEF.
- Potential visual impacts associated with the construction phase on observers in close proximity to the facility.
- Potential cumulative visual impacts of the WEF.
- Potential residual visual impacts after the decommissioning of the facility.
- The potential to mitigate visual impacts and inform the design process.

4. THE AFFECTED ENVIRONMENT

Regionally, the proposed WEF is located approximately 4km north east of Saldanha, 6,5km south of Vredenburg and less than 9km north of Langebaan. The site lies approximately 2km north east of the coastline at Saldanha Bay.

The study area (i.e. the extent of the maps) occurs on land that ranges in elevation from 0m above sea level (asl) along the coast to about 280m asl at the top of the local hills in the north of the study area.

The Great Berg River, which flows in a north westerly direction, is located in the far north eastern part of the study area. This section of the river is characterised by large *mud flats*, *pans* and *wetlands*.

The terrain surrounding the proposed WEF site is generally flat, sloping gently south westwards towards the ocean. The terrain type of the region is described as *moderately undulating plains*. Low hills are present in the north west and to a lesser extent in the south of the study area. Refer to **Map 1**.

Figure 2: Intact coastal vegetation north of Langebaan.

The vegetation type is *Strandveld of the West Coast.* Refer to **Map 2**.

With its Mediterranean climate, the study area receives between 205mm and 350mm of rainfall per year. Land cover is primarily *agricultural land* with smaller pockets of *shrubland and low fynbos* in the vicinity of the site as well as in the west and south east of the study area. Within the latter land cover type, smaller patches of *thicket, bushland, bush clumps and high fynbos* are to be found.

The study area is host to a number of towns and built up areas as well as a number of scattered farms and homesteads. The region has a population density of approximately 65 people per km^2 with the highest concentrations occurring within the towns of Langebaan, Saldanha and Vredenburg.

Arterial roads include the R27, R45 and R399 as well as a number of lower order secondary roads which also traverse the study area.

Figure 3: Pastoral landscape with the urban area of Saldanha in the background.

Figure 4: Typical farming homestead within the study area.

Figure 5: Resort Development north of Langebaan.

A zone of industry and mining occurs in the immediate vicinity of the proposed site, with the AMSA steel manufacturing plant lying less than 2km to the north of the closest turbine.

Additional industrial infrastructure within the region includes a network of distribution power lines converging within the above industrial and mining zone, railway lines (freight), a number of distribution substations and the Langebaanweg Air Force Base.

The terrain immediately surrounding the proposed WEF site has been transformed by industrial activities, and as such, the visual environment is already impacted upon to some extent. This transformation, is however, limited to specific mining and industrial footprints. Refer to **Map 2.**

Conservation areas[5] in the study area are indicated on **Map 3** and include the following:

- The West Coast National Park south east of Langebaan (approximately 12km from the closest turbine) and
- The SAS Saldanha Provincial Nature Reserve south west of Saldanha (approximately 9km from the closest turbine).

Strategic conservation planning features in the study area include the following:

- The West Coast Biosphere Reserve core areas, buffer and transition zones. The core area corresponds with the National Park. This reserve is a UNESCO initiative[6].
- The West Coast National Park *viewshed protection zone*[7] located in the south and south east of the study area (about 2km south of the site).

Outside of the urban and industrial areas, the region has a rural and pastoral character. Pockets of natural vegetation are to be found throughout, and larger areas have been demarcated for conservation purposes (i.e. the National Park). This, in addition to the proximity to the coastline and specifically the picturesque Langebaan Lagoon, renders the overall visual quality of the study area to be high.

The area is a known tourist area and a range of tourist accommodation is to be found in all of the towns (i.e. Saldanha, Langebaan and Vredenburg), as well as within the surrounding coastal and pastoral landscape.

Of relevance in terms of conservation and ecotourism are the West Coast National Park and the picturesque Langebaan Lagoon. In addition, the arterial and secondary routes are likely to be used by tourists accessing the area, as well as for scenic drives.

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[5] For the purpose of this study, conservation areas include both public and private land that is protected for conservation purposes, and are not limited to proclaimed conservation areas.

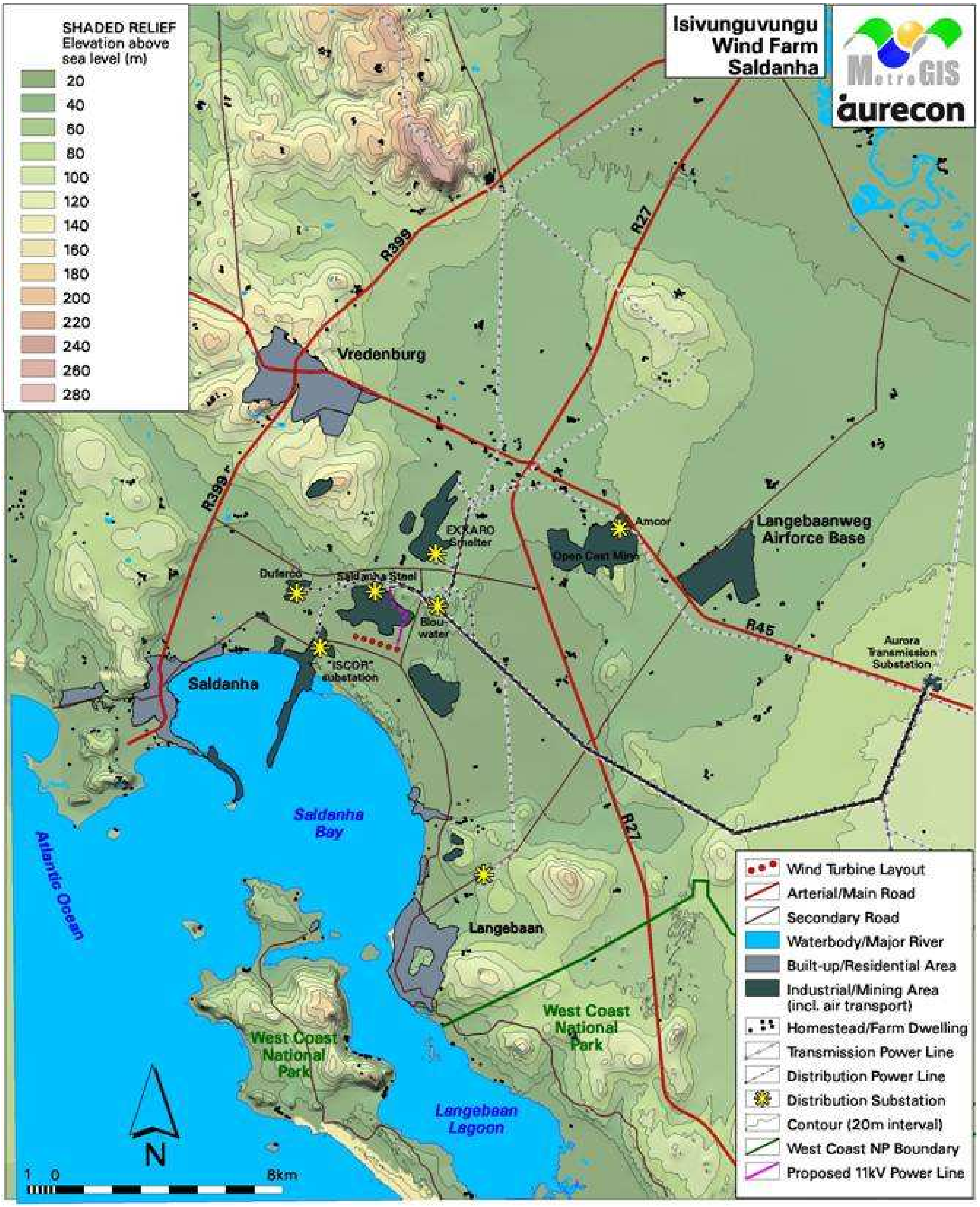
[6] Biosphere Reserve ***core areas*** represent *"securely protected sites for conserving biological diversity, monitoring minimally disturbed ecosystems, and undertaking non-destructive research and other low-impact uses".* Biosphere Reserves further include ***buffer zones*** that *"surrounds or adjoins the core areas, and is used for co-operative activities compatible with sound ecological practices, including environmental education, recreation, eco-tourism and applied and basic research*" and ***transition zones*** that *"contain a variety of agricultural activities, settlements and other uses".*

[7]*These are areas where developments could impact on the aesthetic quality of a visitors experience in a park. This zone is particularly concerned with visual impacts (both day and night). Within these areas, development proposals should be carefully screened to ensure that they do not impact excessively on the aesthetics of the park*.

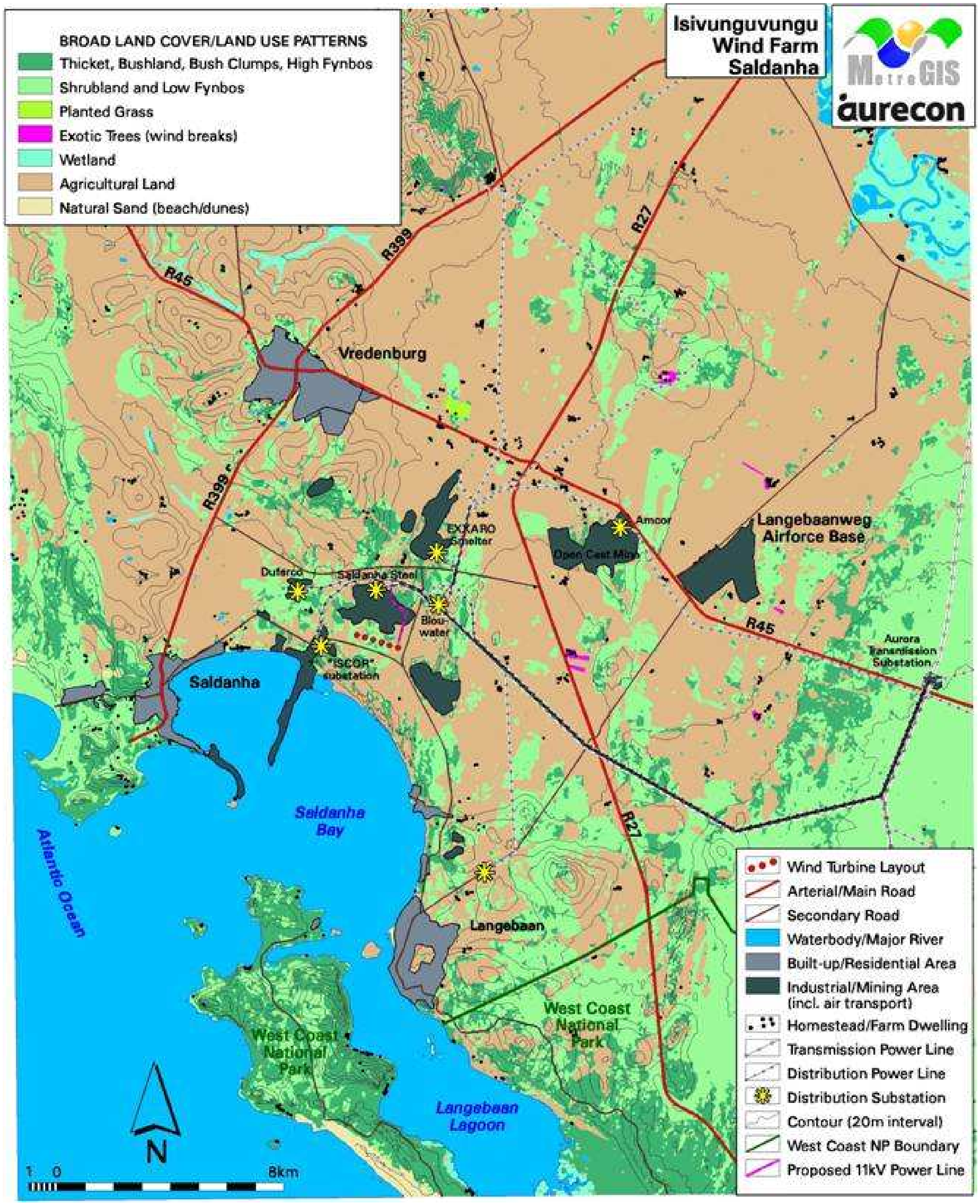
Figure 6: Visual quality of the pastoral landscape off the R27 east of the proposed site.

Figure 7: View towards the site from the north west (approx 2km away).
Note the AMSA steel manufacturing plant in the mid ground and the proposed WEF site beyond.

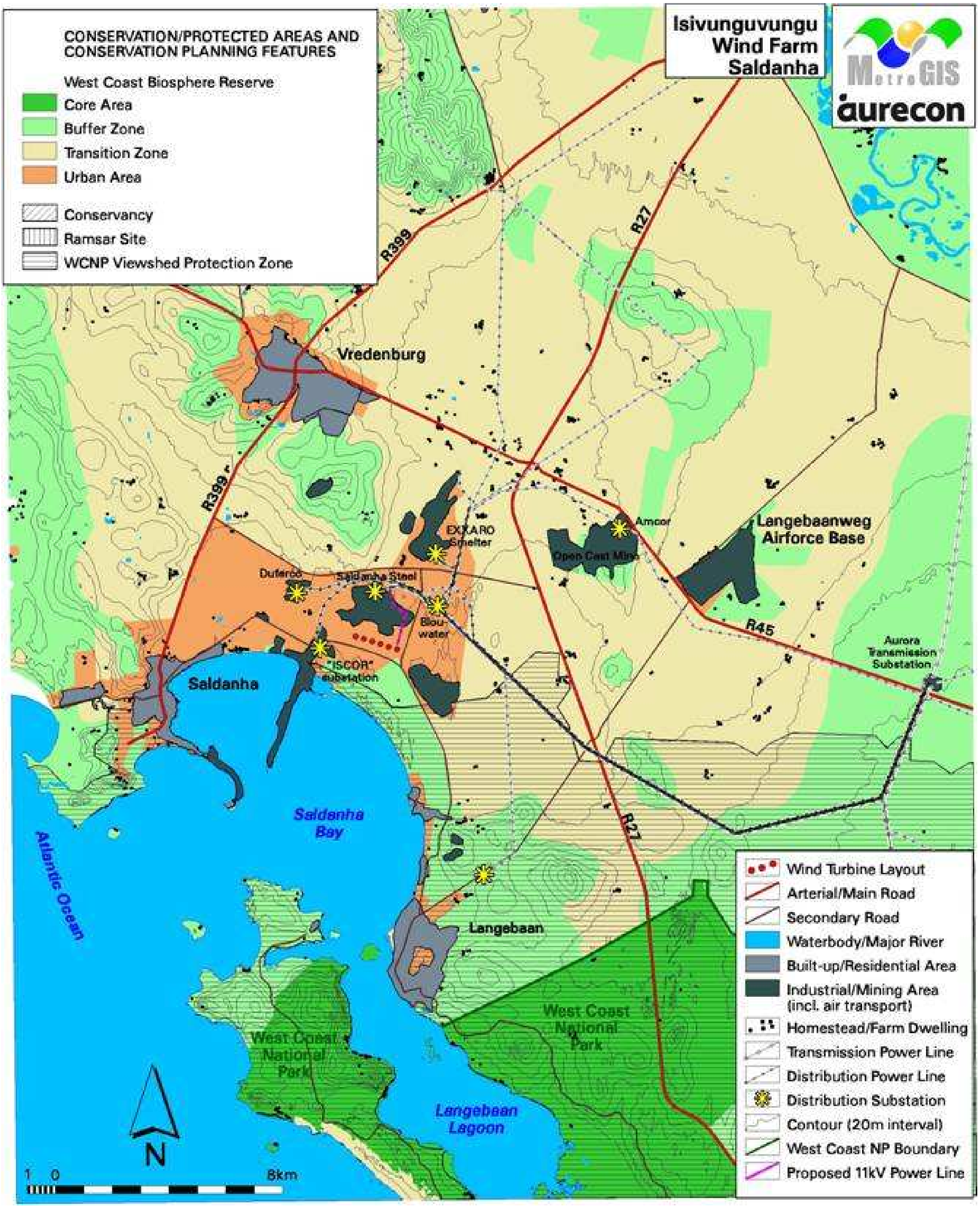
Figure 8: View towards the site from the south east (approx 3km away).



Map 1: Locality map, shaded relief and elevation above sea level of the study area



Map 2: Land cover and broad land Use patterns within the study area.



Map 3: Protected areas and conservation planning features within the study area.

5. RESULTS

5.1 Potential visual exposure

The visibility analysis was undertaken from each of the proposed wind turbine positions (6 in total) at an offset of 80m above average ground level (i.e. the maximum turbine hub height) in order to simulate a worst-case scenario.

The result of the viewshed analysis for the proposed WEF's provisional layout is shown on **Map 4**.

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. 5-6 turbines may be visible) while the yellow areas represent a low frequency (i.e. 1-2 turbines may be visible).

Potential visual exposure is expected on the site itself and south to the coast, as well as approximately 7,5km to the west, 15km to the north east, 20km to the east and 7,5km to the south east. The topography within these visually exposed areas is relatively flat, thus resulting is a relatively uninterrupted viewshed.

The low mountains in the north west, south, and to a lesser extent to the north east effectively shield visual exposure to the proposed WEF from all the areas lying beyond them.

The frequency of visual exposure is high for most of the viewshed, again due to the flat topography.

High frequencies of visual exposure are expected along long stretches of the R27, the R45 and the R339 and along the secondary road just off Saldanha Bay.

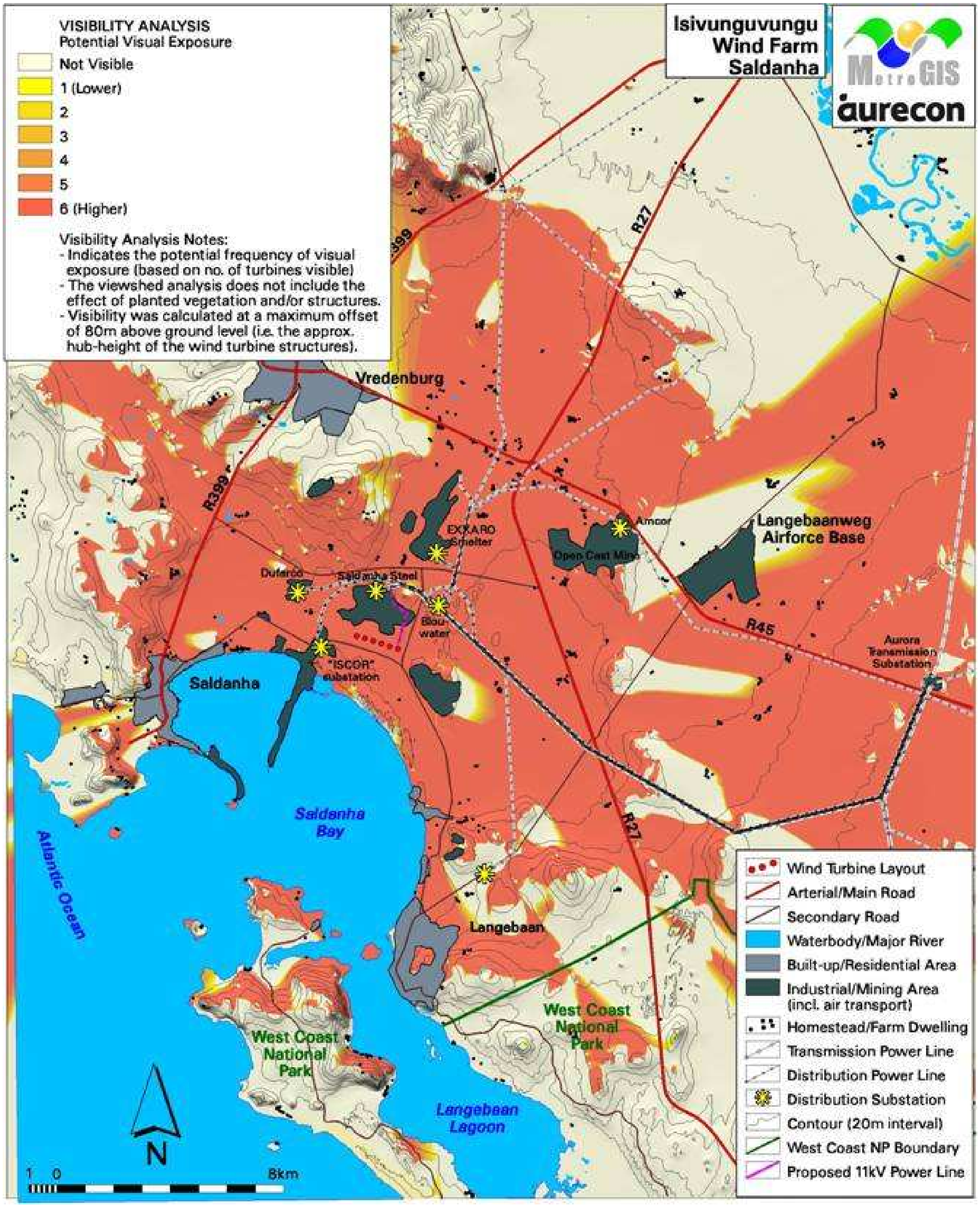
The northern parts of Langebaan and most of the town of Saldanha are also likely to be exposed to potential visual impact. The town of Vredenburg is not likely to be exposed to potential visual impact.

Most of the West Coast National Park lies outside of the zone of potential visual exposure, but parts (especially the north facing slopes of the hills) will be exposed to high frequencies of potential visual exposure.

Map 4 clearly illustrates the influence of the topography on the potential visual exposure of the proposed wind turbines. The proposed WEF is located on the coastal plane, which means it benefits from visual screening by the rising topography to the north west, north east and south.

Within the above visually exposed areas, the context of the proposed WEF adjacent to an existing mining and industrial hub has bearing. The visual environment is already impacted upon to some extent.

Nonetheless, it is anticipated that the turbine structures would be easily and comfortably visible, especially within a 5km radius of the WEF, potentially resulting in a visual impact.



Map 4: Potential visual exposure of the proposed WEF.

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.

These proximity radii (calculated from the boundary lines of the farms) are shown on **Map 5** and are as follows:

- 0 – 2,5km - Short distance view where the facility would dominate the frame of vision and constitute a very high visual prominence.
- 2,5 - 5km - Medium distance views where the facility would be easily and comfortably visible and constitute a high visual prominence.
- 5 - 10km - 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 10 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 5**. Viewer incidence is calculated to be the highest along the arterial and secondary roads within the study area. Commuters using these roads could be negatively impacted upon by visual exposure to the facility.

Other than along the above roads, viewer incidence within a 10km radius of the proposed facility is concentrated in the towns of Saldanha, Vredenburg and Langebaan. The remaining areas consist predominantly of vacant and agricultural land with observers limited mainly to homesteads and farms settlements.

Tourists visiting and travelling through the area are also seen as possible sensitive visual receptors upon which the presence of the proposed facility could have a negative visual impact.

Club Mykonos just north of Langebaan is a holiday village, and as such is considered a receptor particularly sensitive to visual impact.

In addition to the above, the area is a known tourist area and a range of tourist accommodation is to be found in all of the towns (i.e. Saldanha, Langebaan and Vredenburg), as well as within the surrounding coastal and pastoral landscape.

Of relevance in terms of conservation and ecotourism are the West Coast National Park and the picturesque Langebaan Lagoon. Tourist accommodation within these destinations would be of particular sensitivity to visual impact, as would most of the arterial and secondary roads, which function both as tourist access routes and scenic drives. Of particular relevance is the secondary road traversing the West Coast National Park, and the continuation of this road north of Langebaan along Saldanha Bay.

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

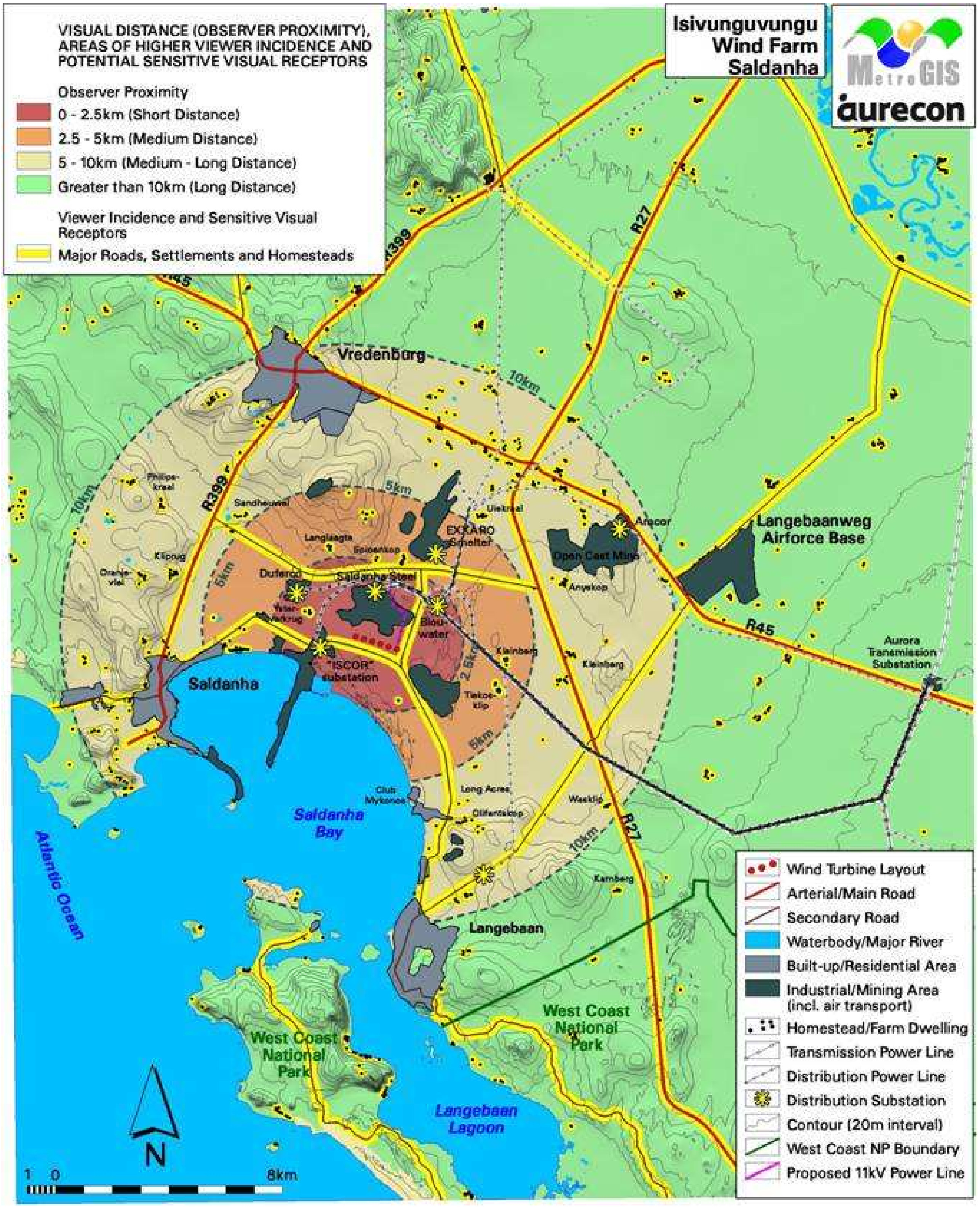
5.4. Visual absorption capacity

The Mediterranean climate of the study area is dry, receiving between 205mm and 350mm of rainfall per annum. Land cover is primarily *agricultural land* and *shrubland and low fynbos. Thicket, bushland, bush clumps and high fynbos* is more localised and limited in extent. The vegetation type is *Strandveld of the West Coast.*

Overall, the Visual Absorption Capacity (VAC) of the receiving environment is low by virtue of the height of the vegetation, the relatively homogenous landform and the overall low occurrence of buildings, structures and infrastructure outside of the urban and industrial areas.

Within the towns of Saldanha, Langebaan and Vredenburg, VAC will be of some relevance, due to the presence of buildings, structures and visual clutter. In this respect, the presence of the urban environment will 'absorb' the visual impact to some extent. VAC will be similarly applicable within industrial areas, especially where tall infrastructure (such as the AMSA steel manufacturing plant) is present.

VAC will therefore only be taken into account within the urban and industrial areas. Outside of these areas, no VAC will be considered, in order to simulate a worst case scenario.



Map 5: Observer proximity to the proposed WEF and areas of high viewer incidence.

5.5. Visual impact index

The combined results of the visual exposure, viewer incidence / perception and visual distance of the proposed WEF are displayed on **Map 6**. Here the weighted impact and the likely areas of impact have been indicated as a visual impact index. Values have been assigned for each potential visual impact per data category and merged in order to calculate the visual impact index.

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 impact) on the index. This helps in focussing the attention to the critical areas of potential impact when evaluating the issues related to the visual impact.

The following is of relevance:

- The visual impact index map clearly indicates a, uninterrupted zone of **moderate** visual impact within a 2,5km radius of the proposed facility. This zone extends to the coast in the south west, but consists largely of mining and industrial land and electricity related infrastructure (power lines and substations).

  Within this 2,5km radius, sensitive visual receptors, which are likely to be users of the secondary roads in the north, south and east, will be exposed to potentially **high** visual impact. The settlement of *Ystervarkrug* lies within this zone, and may similarly be exposed to potentially high visual impact.

- The extent of potential visual impact remains high between the 2,5km and 5km radii. This zone also extends to the coast in the south west, and is still characterised by large areas of industry and mining, as well as significant power line infrastructure. Visual impacts within this zone are likely to be **low.**

  Sensitive visual receptors between 2,5km and 5km include users of secondary roads (extending to the east and west) and a number of settlements, including *Langlaagte, Spioenkop, Kleinberg* and *Tiekosklip*. These receptors are likely to be exposed to **moderate** visual impact.

- Between 5km and 10km, the extent of potential visual impact is somewhat reduced, with visually screened areas evident in the west, north, east and south of the zone by virtue of low mountains. The magnitude of potential visual impact within this zone, which includes the northern parts of Langebaan and of Saldanha, is mostly reduced to **very low**.

  Exceptions are long stretches of the arterial R399 in the west, the R45 in the north, the R27 in the east and the secondary roads. Receptors using these roads could be exposed to potentially **low** visual impacts as a result of the proposed WEF.

  In addition to the above, other sensitive receptors include a number of settlements and homesteads, especially to the north east, and Club Mykonos.

- Remaining impacts beyond the 10km radius are expected to be **very low** to **negligible**.

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

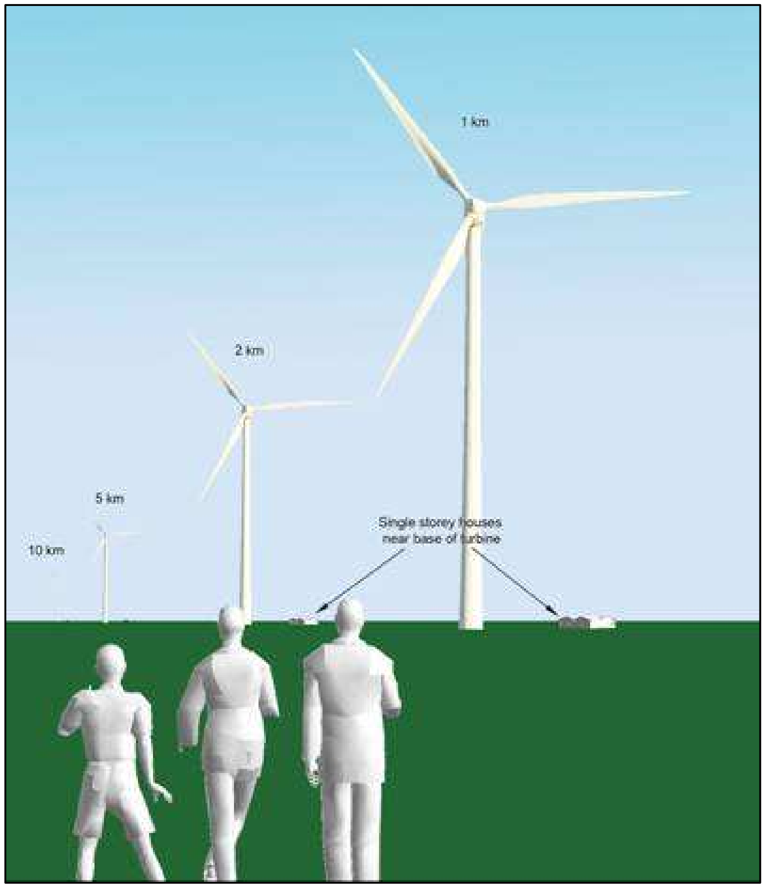
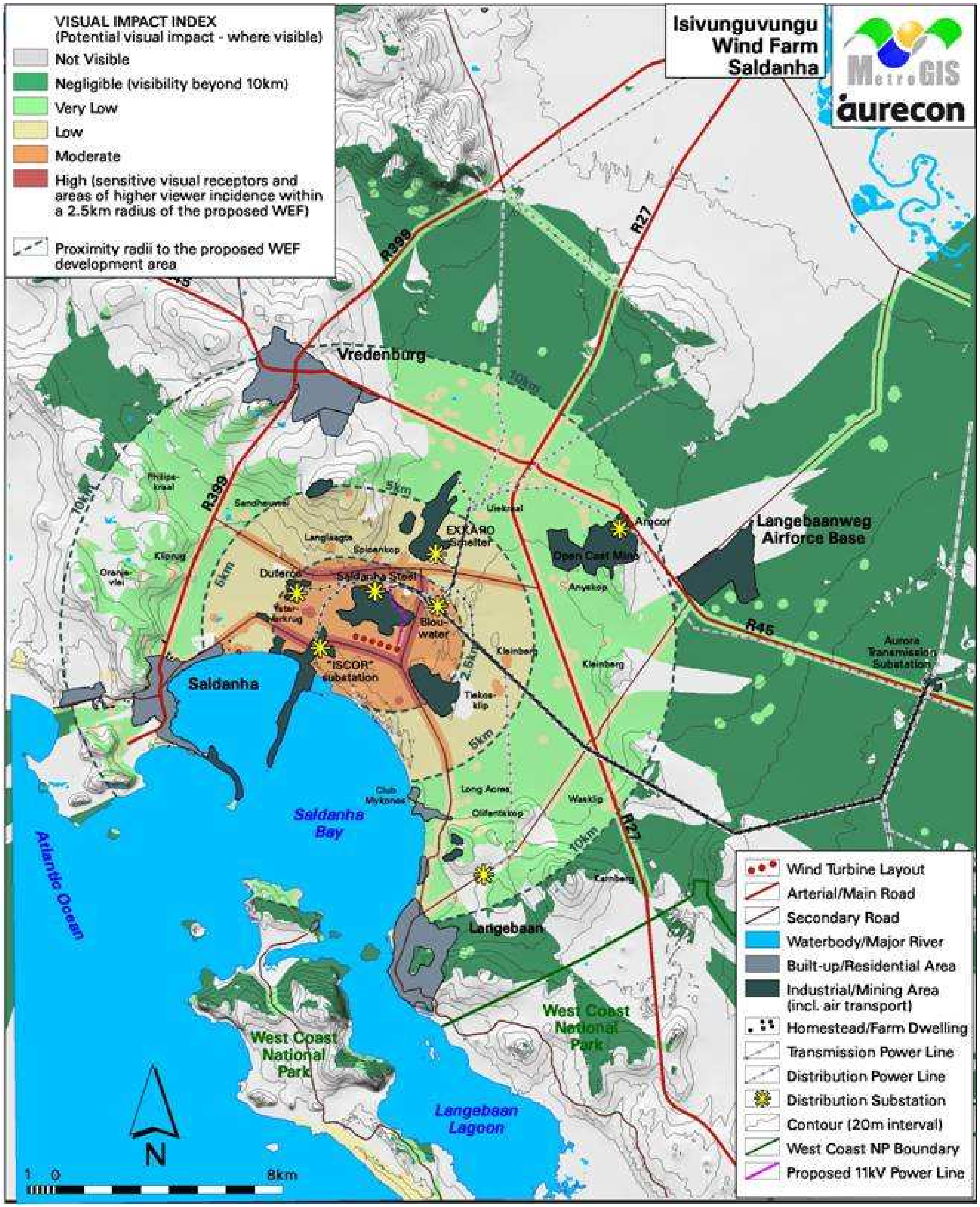


Figure 9: Visual experience of a wind turbine structure at a distance of 1km, 2km, 5km and 10km.

Of relevance to all of the above is that the visual character of the area in close proximity to the proposed site is strongly influenced by the presence of the mining and industrial infrastructure. This existing visual context will be taken into consideration during the assessment of the anticipated visual impacts, which follows.



Map 6: Visual impact index of the proposed 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 2: SCOPE OF WORK) related to the visual impact.

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

- **Extent** - site only (very high = 5), local (high = 4), regional (medium = 3), national (low = 2) or international (very low = 1).
- **Duration** - very short (0-1 yrs = 1), short (2-5 yrs = 2), medium (5-15 yrs = 3), long (>15 yrs = 4), and permanent (= 5).
- **Magnitude** - None (= 0), minor (= 2), low (= 4), medium/moderate (= 6), high (= 8) and very high (= 10). This value is informed by the Visual Impact Index Map. Where more than one value is applicable, then the higher of these will be used in order to simulate a worst case scenario.
- **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.*

5.7 Visual impact assessment: primary impacts

5.7.1 The WEF

Potential visual impact on users of secondary roads in close proximity to the proposed facility.

Visual impacts on secondary roads within a radius of 5km of the proposed facility are expected to be of **moderate** significance. No mitigation of this impact is possible.

The VAC of the industrial and mining activities in the immediate vicinity of the proposed WEF will reduce the probability of this impact occurring.

The table below illustrates this impact assessment.

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

Nature of Impact: Potential visual impact on users of secondary roads in close proximity to the proposed facility		
	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, neutral or negative)	Negative	N/a
Reversibility	Recoverable **(3)**	N/a
Irreplaceable loss of resources?	No	N/a
Can impacts be mitigated?	No	
Mitigation / Management: Planning: ➢ Retain / re-establish and maintain natural vegetation in all areas outside of the development footprint. Operations: ➢ Maintain the general appearance of the facility as a whole. Decommissioning: ➢ Remove infrastructure not required for the post-decommissioning use of the site. ➢ Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications. ➢ Monitor rehabilitated areas post-decommissioning and implement remedial actions.		
Cumulative impacts: The construction of 6 wind turbines together with the associated infrastructure will increase the cumulative visual impact of industrial type infrastructure within the region. This is relevant in light of the industry and mining as well as the power line infrastructure already present in the area.		
Residual impacts: The visual impact will be removed after decommissioning, provided the facility and ancillary infrastructure is removed. Failing this, the visual impact will remain.		

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

The anticipated visual impact on residents of homesteads and settlements within 5km of the proposed facility is expected to be of **moderate** significance. Affected homesteads include the following:

- Ystervarkrug;
- Langlaagte;
- Spioenkop;
- Kleinberg and
- Tiekosklip.

No mitigation of this impact is possible, although the VAC of the industrial and mining activities in the immediate vicinity of the proposed WEF will reduce the probability of this impact occurring.

The table below illustrates this impact assessment.

Table 2: Impact table summarising the significance of visual impacts on residents of homesteads and settlements in close proximity to the proposed facility.

<table>
<tr><td colspan="3">Nature of Impact:
Potential visual impact on residents of homesteads and settlements in close proximity to the proposed facility</td></tr>
<tr><td></td><td>No mitigation</td><td>Mitigation considered</td></tr>
<tr><td>Extent</td><td>Local (4)</td><td>N/a</td></tr>
<tr><td>Duration</td><td>Long term (4)</td><td>N/a</td></tr>
<tr><td>Magnitude</td><td>High (8)</td><td>N/a</td></tr>
<tr><td>Probability</td><td>Probable (3)</td><td>N/a</td></tr>
<tr><td>Significance</td><td>Moderate (48)</td><td>N/a</td></tr>
<tr><td>Status (positive or negative)</td><td>Negative</td><td>N/a</td></tr>
<tr><td>Reversibility</td><td>Recoverable (3)</td><td>N/a</td></tr>
<tr><td>Irreplaceable loss of resources?</td><td>No</td><td>N/a</td></tr>
<tr><td>Can impacts be mitigated?</td><td colspan="2">No</td></tr>
<tr><td colspan="3">Mitigation / Management:
<u>Planning:</u>
➢ Retain / re-establish and maintain natural vegetation in all areas outside of the development footprint.
<u>Operations:</u>
➢ Maintain the general appearance of the facility as a whole.
<u>Decommissioning:</u>
➢ Remove infrastructure not required for the post-decommissioning use of the site.
➢ Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications.
➢ Monitor rehabilitated areas post-decommissioning and implement remedial actions.</td></tr>
<tr><td colspan="3">Cumulative impacts:
The construction of 6 wind turbines together with the associated infrastructure will increase the cumulative visual impact of industrial type infrastructure within the region. This is relevant in light of the industry and mining as well as the power line infrastructure already present in the area.</td></tr>
<tr><td colspan="3">Residual impacts:
The visual impact will be removed after decommissioning, provided the facility and ancillary infrastructure is removed. Failing this, the visual impact will remain.</td></tr>
</table>

Potential visual impact on sensitive visual receptors within the region

The visual impact users of main and secondary roads and on residents of homesteads and settlements within the region (i.e. beyond the 5km radius), is expected to be of **low** significance. There is no mitigation for this impact.

The VAC of the industrial and mining activities in the immediate vicinity of the proposed WEF will reduce the probability of this impact occurring.

The table below illustrates this impact assessment.

Table 3: 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	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	
Mitigation / Management: Planning: ➢ Retain / re-establish and maintain natural vegetation in all areas outside of the development footprint. Operations: ➢ Maintain the general appearance of the facility as a whole. Decommissioning: ➢ Remove infrastructure not required for the post-decommissioning use of the site. ➢ Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications. ➢ Monitor rehabilitated areas post-decommissioning and implement remedial actions.		
Cumulative impacts: The construction of 6 wind turbines together with the associated infrastructure will increase the cumulative visual impact of industrial type infrastructure within the region. This is relevant in light of the industry and mining as well as the power line infrastructure already present in the area.		
Residual impacts: The visual impact will be removed after decommissioning, provided the facility and ancillary infrastructure is removed. Failing this, the visual impact will remain.		

Potential visual impact on residents of towns within the region.

The visual impact on the towns of Saldanha and Langebaan is expected to be of **low** significance. There is no mitigation for this impact.

The visual clutter within a more urban context will offer some absorption of the visual impact. In addition, the VAC of the industrial and mining activities in the immediate vicinity of the proposed WEF will reduce the probability of this impact occurring. There is no mitigation for this impact.

The table below illustrates this impact assessment.

Table 4: Impact table summarising the significance of visual impacts on residents of towns in close proximity to the proposed facility.

<table>
<tr><td colspan="3">Nature of Impact:
Potential visual impact on residents of towns in close proximity to the proposed facility</td></tr>
<tr><td></td><td>No mitigation</td><td>Mitigation considered</td></tr>
<tr><td>Extent</td><td>Regional (3)</td><td>N/a</td></tr>
<tr><td>Duration</td><td>Long term (4)</td><td>N/a</td></tr>
<tr><td>Magnitude</td><td>Low (4)</td><td>N/a</td></tr>
<tr><td>Probability</td><td>V Improbable (1)</td><td>N/a</td></tr>
<tr><td>Significance</td><td>Low (11)</td><td>N/a</td></tr>
<tr><td>Status (positive or negative)</td><td>Negative</td><td>N/a</td></tr>
<tr><td>Reversibility</td><td>Recoverable (3)</td><td>N/a</td></tr>
<tr><td>Irreplaceable loss of resources?</td><td>No</td><td>N/a</td></tr>
<tr><td>Can impacts be mitigated?</td><td colspan="2">No</td></tr>
<tr><td colspan="3">Mitigation / Management:
<u>Planning:</u>
➢ Retain / re-establish and maintain natural vegetation in all areas outside of the development footprint.
<u>Operations:</u>
➢ Maintain the general appearance of the facility as a whole.
<u>Decommissioning:</u>
➢ Remove infrastructure not required for the post-decommissioning use of the site.
➢ Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications.
➢ Monitor rehabilitated areas post-decommissioning and implement remedial actions.</td></tr>
<tr><td colspan="3">Cumulative impacts:
The construction of 6 wind turbines together with the associated infrastructure will increase the cumulative visual impact of industrial type infrastructure within the region. This is relevant in light of the industry and mining as well as the power line infrastructure already present in the area.</td></tr>
<tr><td colspan="3">Residual impacts:
The visual impact will be removed after decommissioning, provided the facility and ancillary infrastructure is removed. Failing this, the visual impact will remain.</td></tr>
</table>

Potential visual impact on the conservation areas within the region.

The visual impact on tourists and visitors to the West Coast National Park is expected to be **low**. There is no mitigation for this impact.

Of relevance is the proximity of the proposed WEF within this Park's *Viewshed Protection Zone*. However, it should also be noted that this area, which lies within a mining area, is already transformed by existing surface based mining. This, and the distance of the National Park from the proposed WEF reduces the probability of this impact occurring.

The table below illustrates this impact assessment.

Table 5: Impact table summarising the significance of visual impacts on conservation areas within the region.

<table>
<tr><td colspan="3">Nature of Impact:
Potential visual impact on conservation areas within the region.</td></tr>
<tr><td></td><td>No mitigation</td><td>Mitigation considered</td></tr>
<tr><td>Extent</td><td>Regional (3)</td><td>N/a</td></tr>
<tr><td>Duration</td><td>Long term (4)</td><td>N/a</td></tr>
<tr><td>Magnitude</td><td>Minor (2)</td><td>N/a</td></tr>
<tr><td>Probability</td><td>V Improbable (1)</td><td>N/a</td></tr>
<tr><td>Significance</td><td>Low (9)</td><td>N/a</td></tr>
<tr><td>Status (positive or negative)</td><td>Negative</td><td>N/a</td></tr>
<tr><td>Reversibility</td><td>Recoverable (3)</td><td>N/a</td></tr>
<tr><td>Irreplaceable loss of resources?</td><td>No</td><td>N/a</td></tr>
<tr><td>Can impacts be mitigated?</td><td colspan="2">No</td></tr>
<tr><td colspan="3">Mitigation / Management:
<u>Planning:</u>
➢ Retain / re-establish and maintain natural vegetation in all areas outside of the development footprint.
<u>Operations:</u>
➢ Maintain the general appearance of the facility as a whole.
<u>Decommissioning:</u>
➢ Remove infrastructure not required for the post-decommissioning use of the site.
➢ Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications.
➢ Monitor rehabilitated areas post-decommissioning and implement remedial actions.</td></tr>
<tr><td colspan="3">Cumulative impacts:
The construction of 6 wind turbines together with the associated infrastructure will increase the cumulative visual impact of industrial type infrastructure within the region. This is relevant in light of the industry and mining as well as the power line infrastructure already present in the area.</td></tr>
<tr><td colspan="3">Residual impacts:
The visual impact will be removed after decommissioning, provided the facility and ancillary infrastructure is removed. Failing this, the visual impact will remain.</td></tr>
</table>

5.7.2 Ancillary infrastructure

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

Within the facility footprint, the existing access road will be upgraded, and a new 1,5km long gravel road will be required to give access to the turbines. These roads have the potential of manifesting as landscape scarring, and thus a potential visual impact within the viewshed areas.

No dedicated viewshed has been generated for the access roads, but as they have no vertical dimension, it is not likely that they will be highly visible. The VAC of the adjacent industrial and mining land use, as well as that of the vegetation, albeit low growing, will reduce the probability of this impact occurring. The anticipated visual impact resulting from this infrastructure is likely to be of **low** significance both before and after mitigation.

Table 6: Impact table summarising the significance of visual impact of the access roads on observers in close proximity to the proposed facility.

Nature of Impact: Potential visual impact of access roads on observers in close proximity to the proposed facility.		
	No mitigation	***Mitigation considered***
Extent	Local **(4)**	Local **(4)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Low **(4)**	Low **(4)**
Probability	V Improbable **(1)**	V Improbable **(1)**
Significance	Low **(12)**	Low **(12)**
Status (positive or negative)	Negative	Negative
Reversibility	Recoverable **(3)**	Recoverable **(3)**
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation / Management: Planning: ➢ Plan internal roads in such a way and in such a location that clearing of vegetation is minimised. Consolidate existing infrastructure as much as possible, and make use of already disturbed areas rather than pristine sites wherever possible. ➢ Retain / re-establish and maintain natural vegetation in all areas outside of the development footprint. Construction: ➢ Rehabilitation of all construction areas. ➢ Ensure that vegetation is not cleared unnecessarily to make way for access roads and ancillary buildings. Operation: ➢ Maintenance of roads to avoid erosion and suppress dust. Decommissioning: ➢ Removal of infrastructure and roads not required for post decommissioning use and rehabilitation of the footprint areas. ➢ Monitor rehabilitated areas post-decommissioning and implement remedial actions.		
Cumulative impacts: The construction of ancillary infrastructure will increase the cumulative visual impact of industrial type infrastructure within the region. This is relevant in light of the industry and mining as well as the power line infrastructure already present in the area.		
Residual impacts: The visual impact will be removed after decommissioning, provided the access roads are removed and rehabilitated. Failing this, the visual impact will remain.		

Potential visual impact of ancillary buildings on observers in close proximity to the proposed facility.

The transformer station and the office could present a visual impact as these structures are built forms within a natural context. In addition, vegetation will need to be removed for these structures to be built.

Although no dedicated viewshed has been generated for the above infrastructure, it will all be located within the proposed Wind Energy Facility footprint, and will be much smaller in scale in comparison with the turbines. The viewshed will thus lie within that of the primary infrastructure.

The VAC of the adjacent industrial and mining land use will reduce 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 7: Impact table summarising the significance of visual impact of the ancillary buildings on observers in close proximity to the proposed facility.

<table>
<tr><td colspan="3">Nature of Impact:
Potential visual impact of ancillary buildings on observers in close proximity to the proposed facility.</td></tr>
<tr><td></td><td>No mitigation</td><td>Mitigation considered</td></tr>
<tr><td>Extent</td><td>Local (4)</td><td>Local (4)</td></tr>
<tr><td>Duration</td><td>Long term (4)</td><td>Long term (4)</td></tr>
<tr><td>Magnitude</td><td>Low (4)</td><td>Low (4)</td></tr>
<tr><td>Probability</td><td>Improbable (2)</td><td>Improbable (2)</td></tr>
<tr><td>Significance</td><td>Low (24)</td><td>Low (24)</td></tr>
<tr><td>Status (positive or negative)</td><td>Negative</td><td>Negative</td></tr>
<tr><td>Reversibility</td><td>Recoverable (3)</td><td>Recoverable (3)</td></tr>
<tr><td>Irreplaceable loss of resources?</td><td>No</td><td>No</td></tr>
<tr><td>Can impacts be mitigated?</td><td colspan="2">Yes</td></tr>
<tr><td colspan="3">Mitigation / Management:
<u>Planning:</u>
➢ Plan ancillary infrastructure in such a way and in such a location that clearing of vegetation is minimised. Consolidate existing infrastructure as much as possible, and make use of already disturbed areas rather than pristine sites wherever possible.
➢ Retain / re-establish and maintain natural vegetation in all areas outside of the development footprint.
<u>Construction:</u>
➢ Rehabilitation of all construction areas.
➢ Ensure that vegetation is not cleared unnecessarily to make way for the ancillary buildings.
<u>Operation:</u>
➢ Maintenance of ancillary buildings.
<u>Decommissioning:</u>
➢ Removal of infrastructure and roads not required for post decommissioning use and rehabilitation of the footprint areas.
➢ Monitor rehabilitated areas post-decommissioning and implement remedial actions.</td></tr>
<tr><td colspan="3">Cumulative impacts:
The construction of ancillary infrastructure will increase the cumulative visual impact of industrial type infrastructure within the region. This is relevant in light of the industry and mining as well as the power line infrastructure already present in the area.</td></tr>
<tr><td colspan="3">Residual impacts:
The visual impact will be removed after decommissioning, provided the access roads are removed and rehabilitated. Failing this, the visual impact will remain.</td></tr>
</table>

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

The proposed 11kV power line will run north from the proposed facility to the Saldanha Steel Substation located adjacent to the AMSA steel manufacturing plant. Approximately 2,4km of this line will be constructed undergroung, and about 2,2km will be above ground. The above ground power line itself as well as its servitude, within which vegetation will need to be cleared, could result in visual impact.

No dedicated viewshed has been generated for this power line. The alignment traverses the AMSA steel manufacturing plant site, however, which represents a consolidation and concentration of infrastructure to some extent.

The visual context of industrial and mining land uses, as well as the significant existing power line infrastructure to the immediate north reduces the probability of this impact occurring.

The table below illustrates the assessment of the anticipated visual impact of the new power line, which is likely to be of **low** significance. There is no mitigation for this impact.

Table 8: Impact table summarising the significance of visual impact of the power line on observers in close proximity thereto.

<table>
<tr><td colspan="3">Nature of Impact:
Potential visual impact of the power line on observers in close proximity thereto.</td></tr>
<tr><td></td><td>No mitigation</td><td>Mitigation considered</td></tr>
<tr><td>Extent</td><td>Local (4)</td><td>N/a</td></tr>
<tr><td>Duration</td><td>Long term (4)</td><td>N/a</td></tr>
<tr><td>Magnitude</td><td>Moderate (6)</td><td>N/a</td></tr>
<tr><td>Probability</td><td>Improbable (2)</td><td>N/a</td></tr>
<tr><td>Significance</td><td>Low (28)</td><td>N/a</td></tr>
<tr><td>Status (positive or negative)</td><td>Negative</td><td>N/a</td></tr>
<tr><td>Reversibility</td><td>Recoverable (3)</td><td>N/a</td></tr>
<tr><td>Irreplaceable loss of resources?</td><td>No</td><td>N/a</td></tr>
<tr><td>Can impacts be mitigated?</td><td colspan="2">No.</td></tr>
<tr><td colspan="3">Mitigation / Management:
<u>Construction:</u>
➢ Rehabilitation of all construction areas and servitudes.
➢ Ensure that vegetation is not cleared unnecessarily to make way for the power line and servitude.
<u>Operation:</u>
➢ Maintenance of servitudes to avoid erosion and suppress dust.
<u>Decommissioning:</u>
➢ Removal of infrastructure not required for post decommissioning use and rehabilitation of the footprint areas.</td></tr>
<tr><td colspan="3">Cumulative impacts:
The construction of the power line will increase the cumulative visual impact of industrial type infrastructure within the region. This is relevant in light of the industry and mining as well as the power line infrastructure already present in the area.</td></tr>
<tr><td colspan="3">Residual impacts:
The visual impact will be removed after decommissioning, provided the access roads are removed and rehabilitated. Failing this, the visual impact will remain.</td></tr>
</table>

5.7.3 Shadow flicker

Potential visual impact of shadow flicker on observers in close proximity to the proposed facility.

Shadow flicker only occurs when the sky is clear, and when the rotor blades are between the sun and the receptor (i.e. when the sun is low). De Gryse in Scenic Landscape Architecture (2006) found that "*most shadow impact is associated with 3-4 times the height of the object*". Based on this research, a 320m buffer along the edge of the facility is submitted as the zone within which there is a risk of shadow flicker occurring.

Users of the secondary roads to the south and east of the facility represent the only visual receptors that may be impacted on (if at all) in this regard.

The short duration of the impact for receptors (i.e. the fact that road users will not be stationary when the impact is felt, but driving past) 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. There is no mitigation recommended.

Table 9: Impact table summarising the significance of visual impact of shadow flicker on observers in close proximity thereto.

Nature of Impact: Potential visual impact of shadow flicker on observers in close proximity thereto.		
	No mitigation	***Mitigation considered***
Extent	Local **(4)**	N/a
Duration	Long term **(4)**	N/a
Magnitude	Low **(4)**	N/a
Probability	V Improbable **(1)**	N/a
Significance	Low **(12)**	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	
Mitigation / Management: Decommissioning: Removal of infrastructure not required for post decommissioning use and rehabilitation of the footprint areas.		
Cumulative impacts: The construction of 6 wind turbines together with the associated infrastructure will increase the cumulative visual impact of industrial type infrastructure within the region. This is relevant in light of the industry and mining as well as the power line infrastructure already present in the area.		
Residual impacts: The visual impact will be removed after decommissioning, provided the facility and ancillary infrastructure is removed. Failing this, the visual impact will remain.		

5.7.4 Lighting impacts

The area surrounding the proposed facility has a relatively low incidence of sensitive visual receptors. In addition, the context of the proposed WEF within an existing industrial and mining zone has relevance. These existing light sources represent an existing lighting impact, thus reducing the probability of this impact occurring.

Another source of glare light, albeit not as intense as direct 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. There is no mitigation for this impact.

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

Mitigation of direct lighting impacts and sky glow entails the pro-active design, planning and specification of lighting for the facility. The correct specification and placement of lighting and light fixtures for both the turbines and the ancillary infrastructure will go far to contain rather than spread the light.

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

Table 10: Impact table summarising the significance of visual impact of lighting on visual receptors in close proximity of the proposed facility

Nature of Impact: Potential visual impact of lighting on visual receptors in close proximity of the proposed facility.		
	No mitigation	***Mitigation considered***
Extent	Local **(4)**	Local **(4)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Moderate **(6)**	Moderate **(6)**
Probability	Probable **(3)**	Improbable **(2)**
Significance	Moderate **(42)**	Low **(28)**
Status (positive or negative)	Negative	Negative
Reversibility	Recoverable **(3)**	Recoverable **(3)**
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation: Planning & operation: ➢ 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.		
Cumulative impacts: The existing urban centres of Saldanha, Vredenburg and Langebaan as well as the adjacent industrial and mining areas already generate lighting impacts at night, so the impact of the proposed WEF will contribute to a regional increase in lighting impact.		
Residual impacts: The visual impact will be removed after decommissioning, provided the facility and ancillary infrastructure is removed. Failing this, the visual impact will remain.		

5.7.5 Construction Impacts

Potential visual impact of construction on visual receptors in close proximity to the proposed facility.

During construction, 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. Dust from construction work is also likely to cause visual impact.

The VAC of the adjacent industrial and mining land use will reduce the probability of this impact occurring. 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 11: Impact table summarising the significance of visual impact of construction on visual receptors in close proximity to the proposed facility.

Nature of Impact: Potential visual impact of construction on visual receptors in close proximity to the proposed facility.		
	No mitigation	***Mitigation considered***
Extent	Local **(4)**	Local **(4)**
Duration	Very short term **(1)**	Very short term **(1)**
Magnitude	Moderate **(6)**	Low **(4)**
Probability	Probable **(3)**	Improbable **(2)**
Significance	Moderate **(33)**	Low **(18)**
Status (positive or negative)	Negative	Negative
Reversibility	Recoverable **(3)**	Recoverable **(3)**
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation: ➢ Ensure that vegetation is not unnecessarily cleared or removed during the construction period. ➢ Reduce the construction period through careful logistical planning and productive implementation of resources. ➢ Plan the placement of lay-down areas and temporary construction equipment camps in order to minimise vegetation clearing (i.e. in already disturbed areas) wherever possible. ➢ Restrict the activities and movement of construction workers and vehicles to the immediate construction site and existing access roads. ➢ Ensure that rubble, litter, and disused construction materials are appropriately stored (if not removed daily) and then disposed regularly at licensed waste facilities. ➢ Reduce and control construction dust through the use of approved dust suppression techniques as and when required (i.e. whenever dust becomes apparent). ➢ Restrict construction activities to daylight hours in order to negate or reduce the visual impacts associated with lighting. ➢ Rehabilitate all disturbed areas, construction areas, roads, slopes etc immediately after the completion of construction works.		
Cumulative impacts: In context of the existing industry and mining in the area, which generates heavy vehicle traffic on the secondary roads, the construction phase of the WEF will contribute to a regional increase in heavy vehicles on the roads in the region.		
Residual impacts: None.		

5.8 Visual impact assessment: secondary impacts

5.8.1 The WEF and ancillary infrastructure

Potential visual impact of the proposed facility 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, 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 rural and pastoral character of this part of the west coast, once beyond the mining and industrial areas. Pockets of natural vegetation are to be found throughout, and larger areas have been demarcated for conservation purposes. This, in addition to the proximity to the coastline and specifically the picturesque Langebaan Lagoon, renders the overall visual quality of the study area to be high.

It is important to note, however, that the existing industrial and mining land uses in close proximity to the proposed WEF has relevance. The existing visual impact as a result of this land use will reduce the probability of this impact occurring.

The table overleaf illustrates the assessment of this anticipated impact, which is likely to be of **low** significance. No mitigation is possible.

Table 12: Impact table summarising the significance of visual impacts on the visual character and sense of place of the region.

<table>
<tr><td colspan="3">Nature of Impact:
Potential visual impact of the proposed facility on visual character and sense of place of the region</td></tr>
<tr><td></td><td>No mitigation</td><td>Mitigation considered</td></tr>
<tr><td>Extent</td><td>Regional (3)</td><td>N/a</td></tr>
<tr><td>Duration</td><td>Long term (4)</td><td>N/a</td></tr>
<tr><td>Magnitude</td><td>Low (4)</td><td>N/a</td></tr>
<tr><td>Probability</td><td>Improbable (2)</td><td>N/a</td></tr>
<tr><td>Significance</td><td>Low (22)</td><td>N/a</td></tr>
<tr><td>Status (positive or negative)</td><td>Negative</td><td>N/a</td></tr>
<tr><td>Reversibility</td><td>Recoverable (3)</td><td>N/a</td></tr>
<tr><td>Irreplaceable loss of resources?</td><td>No</td><td>N/a</td></tr>
<tr><td>Can impacts be mitigated?</td><td colspan="2">No</td></tr>
<tr><td colspan="3">Mitigation / Management:
<u>Planning:</u>
➢ Retain / re-establish and maintain natural vegetation in all areas outside of the development footprint.
<u>Operations:</u>
➢ Maintain the general appearance of the facility as a whole.
<u>Decommissioning:</u>
➢ Remove infrastructure not required for the post-decommissioning use of the site.
➢ Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications.
➢ Monitor rehabilitated areas post-decommissioning and implement remedial actions.</td></tr>
<tr><td colspan="3">Cumulative impacts:
The construction of 6 wind turbines together with the associated infrastructure will increase the cumulative visual impact of industrial type infrastructure within the region. This is relevant in light of the industry and mining as well as the power line infrastructure already present in the area.</td></tr>
<tr><td colspan="3">Residual impacts:
The visual impact will be removed after decommissioning, provided the facility and ancillary infrastructure is removed. Failing this, the visual impact will remain.</td></tr>
</table>

Potential visual impact of the proposed facility on tourist access routes, scenic drives and tourist destinations within the region.

The study area is part of a known tourist region, and a range of tourist accommodation is to be found in all of the towns (i.e. Saldanha, Langebaan and Vredenburg), as well as within the surrounding coastal and pastoral landscape.

Club Mykonos, which is a holiday village lies approximately 5km to the south east of the proposed WEF.

Of relevance in terms of conservation and ecotourism are the West Coast National Park and the picturesque Langebaan Lagoon. In addition, the arterial and secondary routes are likely to be used by tourists accessing the area, as well as for scenic drives.

Visual intrusion through the development of industrial type infrastructure within a high profile tourist area could jeopardise the area's tourism value and potential. It is important to note, however, that the existing industrial and mining land uses in close proximity to the proposed WEF represent an existing visual impact, and therefore reduce the probability of this impact occurring.

The table overleaf illustrates the assessment of this anticipated impact, which is likely to be of **low** significance. No mitigation is possible.

Table 13: Impact table summarising the significance of visual impacts on tourist access routes, scenic drives and tourist destinations within the region.

Nature of Impact: Potential visual impact of the proposed facility on tourist access routes, scenic drives and tourist destinations 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	
Mitigation / Management: Planning: ➢ Retain / re-establish and maintain natural vegetation in all areas outside of the development footprint. Operations: ➢ Maintain the general appearance of the facility as a whole. Decommissioning: ➢ Remove infrastructure not required for the post-decommissioning use of the site. ➢ Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications. ➢ Monitor rehabilitated areas post-decommissioning and implement remedial actions.		
Cumulative impacts: The construction of 6 wind turbines together with the associated infrastructure will increase the cumulative visual impact of industrial type infrastructure within the region. This is relevant in light of the industry and mining as well as the power line infrastructure already present in the area.		
Residual impacts: The visual impact will be removed after decommissioning, provided the facility and ancillary infrastructure is removed. Failing this, the visual impact will remain.		

5.9 The potential to mitigate visual impacts

The primary visual impact, namely the appearance of the wind turbines, is not possible to mitigate. The functional design of the structures cannot be changed in order to reduce visual impacts.

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

Secondary impacts anticipated as a result of the proposed facility (i.e. visual character, sense of place, tourism value and tourism potential) are also not possible to mitigate.

The following mitigation is, however possible:

- Retain / re-establish and maintain natural vegetation in all areas outside of the development footprint. This measure will help to soften the appearance of the facility within its context.

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

- The Civil Aviation Authority (CAA) prescribes that the mounting of aircraft warning lights atop the turbines. Therefore, the potential to mitigate their visual impacts is low. The regulations for the CAA's Marking of Obstacles should be strictly adhered to (unless otherwise agreed with the CAA), as the failure to comply with these guidelines may result in the developer being required to fit additional light fixtures at closer intervals thereby aggravating the visual impact.

- Possible mitigation of other lighting impacts includes the pro-active design, planning and specification lighting for the facility. The correct specification and placement of lighting and light fixtures for the wind energy facility and the ancillary infrastructure will go far to contain rather than spread the light. Mitigation measures include the following:

    - Shielding the sources of light by physical barriers (walls, vegetation, or the structure itself);
    - Limiting mounting heights of lighting fixtures, or alternatively using foot-lights or bollard level lights;
    - Making use of minimum lumen or wattage in fixtures;
    - Making use of down-lighters, or shielded fixtures;
    - Making use of Low Pressure Sodium lighting or other types of low impact lighting.
    - Making use of motion detectors on security lighting. This will allow the site to remain in relative darkness, until lighting is required for security or maintenance purposes.

- Mitigation of visual impacts associated with the construction phase, albeit temporary, would entail proper planning, management and rehabilitation of the construction site. Recommended mitigation measures include the following:

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

- During operation, the maintenance of the turbines, the internal roads, the power line servitude and other ancillary structures and infrastructure will ensure that the facility does not degrade, thus aggravating visual impact.

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

- Once the Wind Energy Facility 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. An ecologist should be consulted to give input into rehabilitation specifications.

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

Good practice requires that the mitigation of both primary and secondary visual impacts as listed above 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 Isivunguvungu Wind Farm 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 7** 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.

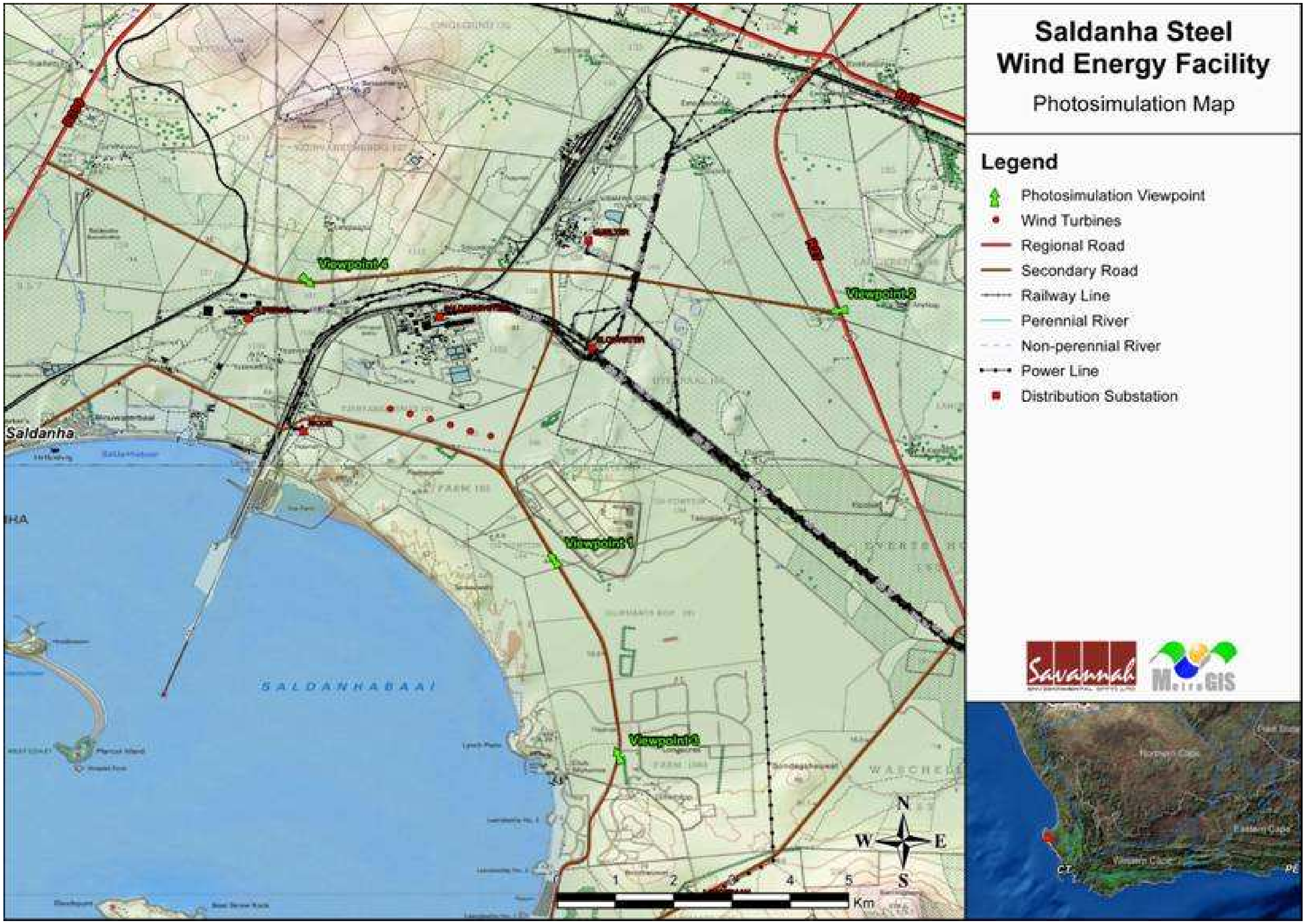
- 3D models from such applications as 3D StudioMax or Sketchup are compatible with the ArcScene environment and work by assigning a model to be rendered at points geographically specified by a point shapefile. Each model itself consists of many polygons, and depending on the number of models used, can 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 7: Photograph positions for photo simulations.

6.1 Viewpoint 1

Viewpoint 1 is located on the secondary road linking Langebaan with Saldanha, and which runs along the Saldanha Bay. The point is located approximately 2,5km away from the closest turbine and is indicative of a close range view that residents and tourists to the area will potentially see when travelling north westwards along this road towards Saldanha. The viewing direction is north westerly and all 6 turbines are fully to partially visible in the landscape. Note also the visual context of the industrial area to the west (i.e. the right of the photo) and the AMSA steel manufacturing plant in the background.

Figure 10a: Pre construction panoramic overview from Viewpoint 1

Figure 10b: Post construction panoramic overview from Viewpoint 1.
This viewpoint is located 2,5km away from the closest turbine. Note the Visual Absorption Capacity of the existing industrial structures and infrastructure.

6.2 Viewpoint 2

Viewpoint 2 is located on the junction of the R27 and the secondary road linking the R27 and the R399 north of the proposed site. The point is located just more than 5km away from the closest turbine. This viewpoint is indicative of a medium to long distance view that residents and visitors to the area will potentially see while travelling along the R27. It is also indicative of the view from the R399, which is situated at the same distance. The viewing direction is westerly and all 6 turbine are fully to partially visible in the landscape. Again, note the visual context of the industrial area and specifically the AMSA steel manufacturing plant in the background.

Figure 11a: Pre construction panoramic overview from Viewpoint 2

Figure 11b: Post construction panoramic overview from Viewpoint 2.
This viewpoint is located 5km away from the closest turbine. Note the Visual Absorption Capacity of the existing industrial structures and infrastructure.

6.3 Viewpoint 3

Viewpoint 3 is located on the same secondary road as Viewpoint 1. This road runs alongside the Saldanha Bay and links Langebaan in the south with Saldanha in the north west. The point is located about 6,5km from the closest turbine, and is indicative of a medium to long distance view that residents of and visitors to the area would have of the turbines lying to the north west. Club Mykonos lies close to this point at the same viewing distance. The viewing direction is north westerly and all 6 turbine are fully to partially visible in the landscape. Again, note the visual context of the AMSA steel manufacturing plant in the background.

Figure 12a: Pre construction panoramic overview from Viewpoint 3

Figure 12b: Post construction panoramic overview from Viewpoint 3.
This viewpoint is located 6,5km away from the closest turbine. Note the Visual Absorption Capacity of the existing buildings and structures.

6.4 Viewpoint 4

Viewpoint 4 is located on the same secondary road as Viewpoint 2. This road links the R27 and the R399 north of the proposed site. The point is located about 2km from the closest turbine and even closer (i.e. about 1km) away from the AMSA steel manufacturing plant. This view is indicative of a close distance view that residents of and visitors to the area would have of the turbines lying to the south east. The viewing direction is south easterly and all 6 turbines are fully to partially visible in the landscape. Note the AMSA steel manufacturing plant to the immediate east (i.e. the left of the photo).

Figure 13a: Pre construction panoramic overview from Viewpoint 4

Figure 13b: Post construction panoramic overview from Viewpoint 4.
This viewpoint is located 2km away from the closest turbine. Note the Visual Absorption Capacity of the existing industrial structures and infrastructure.

7. CONCLUSION AND RECOMMENDATIONS

The construction and operation of the Proposed Isivunguvungu Wind Farm and its associated infrastructure will have a visual impact on the study area, specifically within 5km of the proposed facility.

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 facility can become an attraction or a landmark within the region, that people would actually want to come and see.

These positive aspects should not distract from the fact that the facility would be visible within an area that incorporates certain sensitive visual receptors. Such receptors include commuters and tourists using the local and arterial roads, accessing farms and visiting the area.

The area is a known tourist area and a range of tourist accommodation is to be found in the towns as well as within the surrounding coastal and pastoral landscape. In addition, the arterial and secondary routes are likely to be used by tourists accessing the area, as well as for scenic drives.

Outside of the urban and industrial areas, the region has a rural and pastoral character. Pockets of natural vegetation are to be found throughout, and larger areas have been demarcated for conservation purposes. This, in addition to the proximity to the coastline and specifically the picturesque Langebaan Lagoon, renders the overall visual quality of the study area to be high.

However, it is noteworthy that the terrain immediately surrounding the proposed WEF site has been transformed by industrial activities, and as such, the visual environment is already impacted upon to some extent.

In light of the above, and considering all factors, it is concluded that the significance of anticipated visual impacts are of acceptable levels, especially considering the existing industrial nature of the immediate surrounding environment.

A number of mitigation measures have been proposed (section 5.9). Although these will not reduce the significance of the anticipated visual impacts, they are considered to be good practice and should be implemented and maintained throughout the life span of the proposed facility.

8. IMPACT STATEMENT

The finding of the Visual Impact Assessment undertaken for the Proposed Isivunguvungu Wind Farm is that the visual environment surrounding the site will be visually impacted upon for the anticipated operational lifespan of the facility (i.e. 20 - 30 years).

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

- The potential visual impact of the facility on users of secondary roads in close proximity to the proposed facility will be of **moderate** significance.
- The anticipated visual impact on residents of homesteads and settlements in close proximity to the proposed facility will be of **moderate** significance.
- Within the greater region, the potential visual impact on sensitive visual receptors (i.e. users of roads and residents of homesteads and settlements) will be of **low** significance.
- Similarly, the potential visual impact on residents of Saldanha and Langebaan is likely to be of **low** significance.
- Potential visual impact on conservation areas, specifically the West Coast National Park will be of **low** significance.
- In terms of ancillary infrastructure, the anticipated visual impact of the access roads, transformer station, office and power line will be of **low** significance.
- The potential visual impact of shadow flicker will be of **low** significance.
- Similarly, visual impacts related to lighting will be of **low** significance as will the anticipated visual impact of construction.
- 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 **low** significance, as will the anticipated impact on tourist access routes, scenic drives and tourist destinations within the region.

The anticipated visual impacts listed above (i.e. post mitigation impacts) range from moderate to low, and none are considered to be fatal flaws for the proposed wind energy facility.

The main considerations in this regard include the limited extent of the proposed WEF (i.e. only 6 turbines), and the visual context of existing industrial, mining and electrical infrastructure in close proximity to the proposed site.

Furthermore, it is the opinion of the author that the anticipated visual impact is not likely to detract from the regional tourism appeal, numbers of tourists or tourism potential of the area.

It is therefore recommended that the development of the facility as proposed be supported, subject to the implementation of the recommended mitigation measures (Chapter 5.9) and management plan (Chapter 8).

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 14: Management Programme – Planning.

<table>
<tr><td colspan="3">OBJECTIVE: The mitigation and possible negation of visual impacts associated with the planning of the Proposed Isivunguvungu Wind Farm.</td></tr>
<tr><td>Project Component/s</td><td colspan="2">Wind energy facility ancillary infrastructure (i.e. transformer, roads and ancillary buildings).</td></tr>
<tr><td>Potential Impact</td><td colspan="2">Primary visual impact of the facility due to the presence of ancillary infrastructure as well as the visual impact of lighting at night.</td></tr>
<tr><td>Activity/Risk Source</td><td colspan="2">The viewing of the above mentioned by observers on or near the site (i.e. within 5 km of the site) as well as within the region.</td></tr>
<tr><td>Mitigation: Target/Objective</td><td colspan="2">Optimal planning of infrastructure to minimise visual impact.</td></tr>
<tr><td>Mitigation: Action/control</td><td>Responsibility</td><td>Timeframe</td></tr>
<tr><td>Retain and maintain natural vegetation in all areas outside of the development footprint.</td><td>I-WEC / design consultant</td><td>Early in the planning phase.</td></tr>
<tr><td>Plan the transformer, access roads and ancillary buildings in such a way and in such a location that clearing of vegetation is minimised.

Consolidate infrastructure and make use of already disturbed sites rather than pristine areas.</td><td>I-WEC / design consultant</td><td>Early in the planning phase.</td></tr>
<tr><td>Consult a lighting engineer in the design and planning of lighting to ensure the correct specification and placement of lighting and light fixtures for the facility and the ancillary infrastructure. The following is recommended:
o Shielding the sources of light by physical barriers (walls, vegetation, or the structure itself);
o Limiting mounting heights of lighting fixtures, or alternatively using foot-lights or bollard level lights;
o Making use of minimum lumen or wattage in fixtures;
o Making use of down-lighters, or shielded fixtures;
o Making use of Low Pressure Sodium lighting or other types of low impact lighting.
o 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.</td><td>I-WEC / design consultant</td><td>Early in the planning phase.</td></tr>
<tr><td>Performance Indicator</td><td colspan="2">No ancillary infrastructure is apparent from surrounding areas and lighting impact is minimal.</td></tr>
<tr><td>Monitoring</td><td colspan="2">Not applicable.</td></tr>
</table>

Table 15: Management Programme – Construction.

OBJECTIVE: The mitigation and possible negation of visual impacts associated with the construction of the Proposed Isivunguvungu Wind Farm.		
Project Component/s	Construction site	
Potential Impact	Visual impact of general construction activities, and the potential scarring of the landscape due to vegetation clearing and resulting erosion.	
Activity/Risk Source	The viewing of the above mentioned by observers on or near the site (i.e. within 5 km of 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**
Ensure that vegetation is not unnecessarily cleared or removed during the construction period.	I-WEC / contractor	Early in the construction phase.
Reduce the construction period through careful logistical planning and productive implementation of resources.	I-WEC / contractor	Early in the construction phase.
Plan the placement of lay-down areas and temporary construction equipment camps in order to minimise vegetation clearing (i.e. in already disturbed areas) wherever possible.	I-WEC / contractor	Early in and throughout the construction phase.
Restrict the activities and movement of construction workers and vehicles to the immediate construction site and existing access roads.	I-WEC / contractor	Throughout the construction phase.
Ensure that rubble, litter, and disused construction materials are appropriately stored (if not removed daily) and then disposed regularly at licensed waste facilities.	I-WEC / contractor	Throughout the construction phase.
Reduce and control construction dust through the use of approved dust suppression techniques as and when required (i.e. whenever dust becomes apparent).	I-WEC / contractor	Throughout the construction phase.
Restrict construction activities to daylight hours in order to negate or reduce the visual impacts associated with lighting.	I-WEC / contractor	Throughout the construction phase.
Rehabilitate all disturbed areas, construction areas, servitudes etc immediately after the completion of construction works. Consult an ecologist to give input into rehabilitation specifications.	I-WEC / contractor	Throughout and at the end of the construction phase.
Performance Indicator	Vegetation cover on and in the vicinity of the site is intact (i.e. full cover as per natural vegetation within the environment) with no evidence of degradation or erosion.	
Monitoring	Monitoring of vegetation clearing during construction (by contractor as part of construction contract). Monitoring of rehabilitated areas quarterly for at least a year following the end of construction (by contractor as part of construction contract).	

Table 16: Management Programme – Operation.

OBJECTIVE: The mitigation and possible negation of visual impacts associated with the operation of the Proposed Isivunguvungu Wind Farm.		
Project Component/s	Wind energy facility and ancillary infrastructure (i.e. turbines, power lines, transformers, roads and ancillary buildings).	
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 (i.e. within 5 km of the site).	
Mitigation: Target/Objective	Well maintained and neat facility.	
Mitigation: Action/control	**Responsibility**	**Timeframe**
Maintain the general appearance of the facility as a whole, including the turbines the internal roads, servitudes and the ancillary buildings.	I-WEC / operator	Throughout the operational phase.
Maintain roads to forego erosion and to suppress dust.	I-WEC / operator	Throughout the operational phase.
Monitor rehabilitated areas, and implement remedial action as and when required.	I-WEC / operator	Throughout the operational phase.
Performance Indicator	Well maintained and neat facility with intact vegetation on and in the vicinity of the facility.	
Monitoring	Monitoring of the entire site on an ongoing basis (by operator).	

Table 17: Management Programme – Decommissioning.

OBJECTIVE: The mitigation and possible negation of visual impacts associated with the decommissioning of the Proposed Isivunguvungu Wind Farm.		
Project Component/s	Wind energy facility and ancillary infrastructure (i.e. turbines, power lines, transformers, roads and ancillary buildings).	
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 (i.e. within 5 km of the site).	
Mitigation: Target/Objective	Only the infrastructure required for post decommissioning use of the site retained and rehabilitated vegetation in all disturbed areas.	
Mitigation: Action/control	**Responsibility**	**Timeframe**
Remove infrastructure not required for the post-decommissioning use of the site. This may include the internal roads, substation, power line, ancillary buildings etc.	I-WEC / operator	During the decommissioning phase.
Rehabilitate access roads not required for the post-decommissioning use of the site. Consult an ecologist to give input into rehabilitation specifications.	I-WEC / operator	During the decommissioning phase.
Monitor rehabilitated areas quarterly for at least a year following decommissioning, and implement remedial action as and when required.	I-WEC / operator	Post decommissioning.
Performance Indicator	Vegetation cover on and in the vicinity of the site is intact (i.e. full cover as per natural vegetation within the environment) with no evidence of degradation or erosion.	
Monitoring	Monitoring of rehabilitated areas quarterly for at least a year following decommissioning.	

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