PROPOSED NAMAS WIND FARM, NORTHERN CAPE PROVINCE

VISUAL IMPACT ASSESSMENT

Produced for:

Genesis Namas Wind (Pty) Ltd

On behalf of:

Savannah Environmental (Pty) Ltd
1st Floor, Block 2, 5 Woodlands Drive Office Park,
Cnr Woodlands Drive & Western Service Road
Woodmead, 2191

Produced by:

Lourens du Plessis (PrGISc) t/a LOGIS
PO Box 384, La Montagne, 0184
T: 082 922 9019 E: lourens@logis.co.za W: logis.co.za

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1. STUDY APPROACH

1.1. Qualification and experience of the practitioner

Lourens du Plessis, a specialist in visual impact assessment and Geographical Information Systems (GIS), undertook the Visual Impact Assessment (VIA). Lourens has undertaken a number of VIAs within the region including, Project Blue, Kleinzee and the Koingnaas Wind Energy Facilities (WF).

He has been involved in the application of Geographical Information Systems (GIS) in Environmental Planning and Management since 1990. He has extensive practical knowledge in spatial analysis, environmental modeling and digital mapping, and applies this knowledge in various scientific fields and disciplines. His expertise are often utilised in Environmental Impact Assessments, State of the Environment Reports and Environmental Management Plans.

He 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.

Savannah Environmental appointed Lourens du Plessis as an independent specialist consultant to undertake the visual impact assessment for the proposed Namas Wind Farm (WF). He will not benefit from the outcome of the project decision-making.

1.2. Assumptions and limitations

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

1.3. Level of confidence

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

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

[1] Adapted from Oberholzer (2005).

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

These values are applied as follows:

Table 1: Level of confidence.

	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 and experience of this type of project by the practitioner is rated as **3**.

1.4. Methodology

The study was undertaken using GIS technology as a tool to generate viewshed analyses and to apply relevant spatial criteria to the proposed project alternatives. A detailed Digital Terrain Model (DTM) for the study area was created from 5m interval contours supplied by the Chief Directorate National Geo-Spatial Information.

Visual Impact Assessment (VIA)

The VIA is determined according to the nature, extent, duration, intensity or magnitude, probability and significance of the potential visual impacts, and will propose management actions and/or monitoring programs, and may include recommendations related to the Wind Turbine Generator (WTG) layout.

The visual impact is determined for the highest impact-operating scenario (worst-case scenario) and varying climatic conditions (i.e. different seasons, weather conditions, etc.) are not considered.

The VIA considers potential cumulative visual impacts, or alternatively the potential to concentrate visual exposure/impact within the region.

The following VIA-specific tasks were undertaken:

- **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 (or where) the proposed facility and associated infrastructure were not visible, no impact would occur.

The viewshed analyses of the proposed facility and the related infrastructure are based on a 5m contour interval digital terrain model of the study area.

The first step in determining the visual impact of the proposed facility is to identify the areas from which the structures would be visible. The type of structures, the dimensions, the extent of operations and their support infrastructure are taken into account.

- **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 this type of structure.

Proximity radii for the proposed infrastructure 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 (sensitive visual receptors)**

The next layer of information is the identification of areas of high viewer incidence (i.e. main roads, residential areas, settlements, etc.) that would be exposed to the project infrastructure.

This is done in order to focus attention on areas where the perceived visual impact of the facility will be the highest and where the perception of affected observers will be negative.

Related to this data set, is a land use character map, that further aids in identifying sensitive areas and possible critical features (i.e. tourist facilities, national parks, etc.), that should be addressed.

- **Determine the visual absorption capacity of the landscape**

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

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

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

- **Calculate the visual impact index**

The results of the above analyses are merged in order to determine the areas of likely visual impact and where the viewer perception would be negative. An area with short distance visual exposure to the proposed infrastructure, a high viewer incidence and a predominantly negative perception would therefore have a higher value (greater impact) on the index. This focusses the attention to the critical areas of potential impact and determines the potential **magnitude** of the visual impact.

Geographical Information Systems (GIS) software will be used to perform all the analyses and to overlay relevant geographical data sets in order to generate a visual impact index.

- **Determine impact significance**

The potential visual impacts are quantified in their respective geographical locations in order to determine the significance of the anticipated impact on identified receptors. Significance is determined as a function of extent, duration, magnitude (derived from the visual impact index) and probability. Potential cumulative and residual visual impacts are also addressed. The results of this section are displayed in impact tables and summarised in an impact statement.

- **Propose mitigation measures**

The preferred alternative (or a possible permutation of the alternatives) will be based on its potential to reduce the visual impact. Additional general mitigation measures will be proposed in terms of the planning, construction, operation and decommissioning phases of the project.

- **Reporting and map display**

All the data categories, used to calculate the visual impact index, and the results of the analyses will be displayed as maps in the accompanying report. The methodology of the analyses, the results of the visual impact assessment and the conclusion of the assessment will be addressed in the VIA report.

- **Site visit and photo simulations**

Photographs from strategic viewpoints will be used to simulate a realistic post construction view of the WF. This will aid in visualising the perceived visual impact of the proposed WF and place it in spatial context.

2. BACKGROUND

Genesis Namas Wind (Pty) Ltd is proposing the development of a commercial wind farm and associated infrastructure on a site located approximately 20km south-east of Kleinsee within the Nama Khoi Local Municipality and the Namakwa District Municipality in the Northern Cape Province.

A preferred project site with an extent of ~5092ha has been identified by Genesis Namas Wind (Pty) Ltd as a technically suitable area for the development of the Namas Wind Farm with a contracted capacity of up to 140MW that can accommodate up to 43 turbines. The entire project site is located within Focus Area 8 of the Renewable Energy Development Zones (REDZ), which is known as the Springbok REDZ. Due to the location of the project site within the REDZ, a Basic Assessment (BA) process will be undertaken in accordance with GN114 as formally gazetted on 16 February 2018. The project site comprises the following four farm portions:

- Portion 3 of the Farm Zonnekwa 328
- Portion 4 of the Farm Zonnekwa 328
- Remaining Extent of the Farm Rooivlei 327
- Portion 3 of the Farm Rooivlei 327

The Namas Wind Farm project site is proposed to accommodate the following infrastructure:

- Up to 43 wind turbines with a maximum hub height of up to 130m. The tip height of the turbines will be up to 205m;
- Concrete turbine foundations and turbine hardstands;
- Temporary laydown areas which will accommodate the boom erection, storage and assembly area;
- Cabling between the turbines, to be laid underground where practical;
- An on-site substation of up to 100m x 100m (1ha) in extent to facilitate the connection between the wind farm and the electricity grid;
- An overhead 132kV power line (not assessed in this report), with a servitude of 32m, to connect the wind farm to the existing Gromis Substation;
- Access roads to the site (with a width of up to 10m) and between project components (with a width of approximately 8m);
- A temporary concrete batching plant; and
- Operation and maintenance buildings including a gate house, security building, control centre, offices, warehouses, a workshop and visitors centre.

The power generated from the project will be sold to Eskom and will feed into the national electricity grid. Ultimately, the project is intended to be a part of the renewable energy projects portfolio for South Africa, as contemplated in the Integrated Resource Plan.

The construction phase of the WF is dependent on the number of turbines ultimately erected and is estimated at one week per turbine. The lifespan of the facility is approximated at 20 to 25 years.

3. SCOPE OF WORK

This report is the undertaking of a Visual Impact Assessment (VIA) of the proposed WTG layout as mentioned above.

The determination of the potential visual impacts is undertaken in terms of nature, extent, duration, magnitude, probability and significance of the construction and operation of the proposed infrastructure.

The study area for the visual assessment encompasses a geographical area of approximately 1,865km² (the extent of the maps displayed in this report) and includes a minimum 10km buffer zone from the proposed wind turbine structures.

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

- The visibility of the facility to, and potential visual impact on, observers travelling along arterial (i.e. the R355 to Kleinsee) and secondary roads (Komaggas to Kleinsee and Koingnaas to Kleinsee) in close proximity to the proposed WF.

- The visibility of the facility to, and potential visual impact on, the town of Kleinsee, the settlement of Melkbospunt and homesteads/farmsteads located in close proximity to the proposed WF.

- The potential visual impact of the facility on the visual character of the landscape and sense of place of the region, with specific reference to tourist routes, tourist destinations and tourist potential of the region, especially in terms of events such as the Namaqualand flower displays.

- The potential visual impact of ancillary infrastructure (i.e. the substation, internal access roads, etc.) on observers in close proximity to the facility.

- The potential visual impact of lighting of the facility in terms of light glare, light trespass and sky glow.

- The potential visual impact of shadow flicker.

- The potential cumulative visual impact (or alternatively the consolidation of visual impacts) of the proposed WF in context of its placement within a Renewable Energy Development Zone (REDZ) and in relation to other renewable energy applications in close proximity.

- Potential visual impacts associated with the construction phase.

- Potential residual visual impacts after the decommissioning of the facility.

- The potential to mitigate visual impacts and inform the design process.

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

4. RELEVANT LEGISLATION AND GUIDELINES

The following legislation and guidelines have been considered in the preparation of this report:

- The Environmental Impact Assessment Regulations, 2014 (as amended);
- Guideline on Generic Terms of Reference for EAPS and Project Schedules (DEADP, Provincial Government of the Western Cape, 2011).

5. THE AFFECTED ENVIRONMENT

The project is proposed on portions of a number of different farms with a combined surface area of approximately 51km^2. The final surface area (development footprint) to be utilised for the facility will be smaller, depending on the type of turbine selected, the final site layout and the placement of wind turbines and ancillary infrastructure. The site is located approximately 20km south-east of Kleinsee within the Springbok Renewable Energy Development Zone (REDZ). Access to the site from Kleinsee is provided by the Kleinsee to Komaggas secondary road that traverses near the proposed development site.

Refer to **Figure 1** for the regional locality of the Namas Wind Farm.

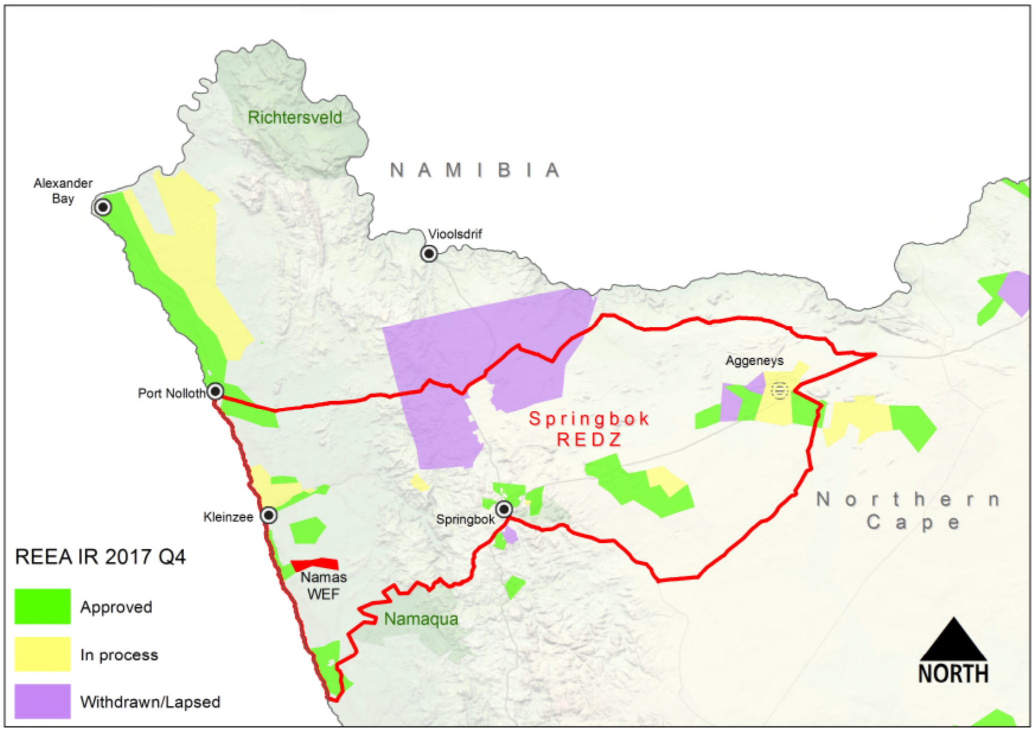


Figure 1: Regional locality of the Namas Wind Farm within the Springbok Renewable Energy Development Zone (REDZ).

The map above also indicates the status of Renewable Energy Environmental Applications (REEA) as at the end of 2017 (Department of Environmental Affairs' database). Historical applications for WFs in close proximity to the Namas Wind Farm site include the Kleinzee WF (north and west of the site) and the Project Blue WF north of Kleinsee. According to more recent research by Savannah Environmental (Pty) Ltd it appears that the Kleinzee WF has received environmental authorisation (EA), whilst the Project Blue WF application has lapsed and the EA will need to start over in order to be a valid project.

Additional WF applications, not included in **Figure 1**, are the proposed Genesis Zonnequa Wind Farm (located immediately north of the Namas Wind Farm) and the Juwi Kap Vley Wind Farm (south and east of the site). The former WF's Environmental Impact Assessment (EIA) is underway and is being undertaken concurrent to this EIA. The Juwi Kap Vley Wind Farm's draft EIA was concluded in April 2018 and is currently under review by the DEA. Refer to **Figure 2** below.

Further reference to these proposed WFs are made under **Section 6.2**. (Potential cumulative visual exposure).

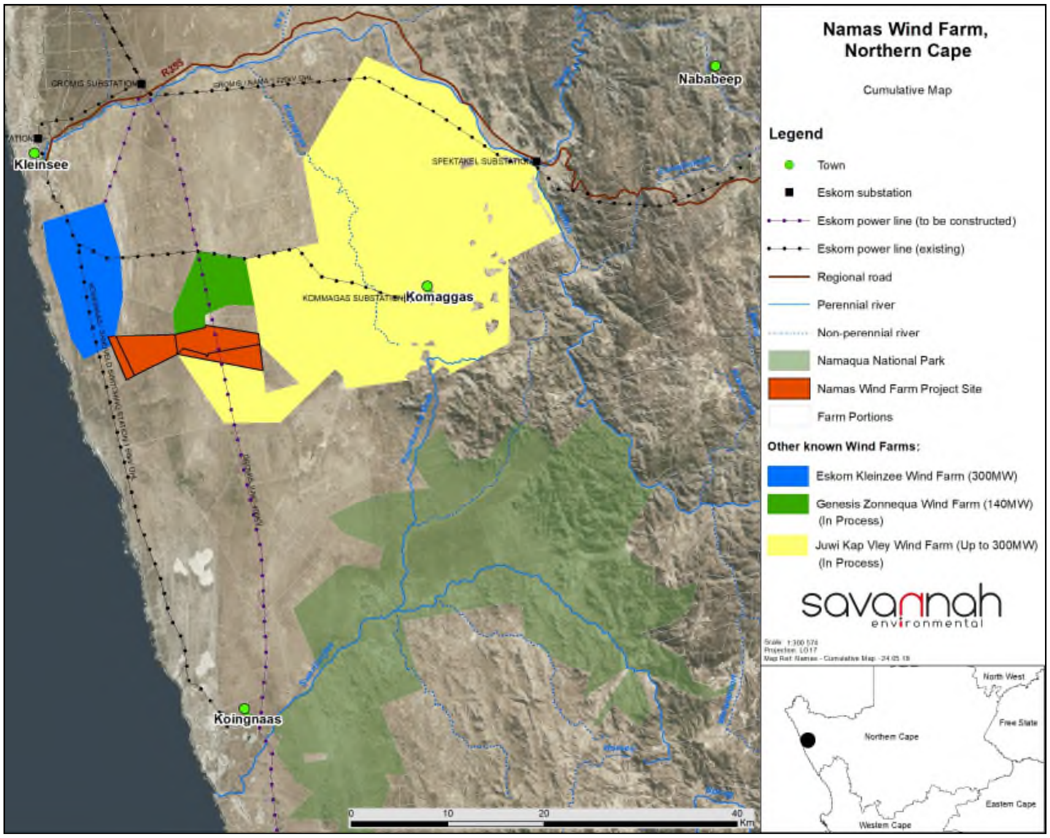


Figure 2: Cumulative map indicating other known Wind Farms which have been confirmed in terms of validity.

Topography, vegetation and hydrology

The study area is located on land that ranges in elevation from sea level at the coast to approximately 526m above sea level at the top of the Brandberg hill. These hills and the Langberg hill further south, are the most prominent topographical features within the region.

The terrain surrounding the proposed site is generally flat, sloping gently westwards towards the shore. The terrain type of the region is described as *slightly undulating plains*. Refer to **Map 1**.

The desert climate of the study area is dry, receiving between 28mm and 123mm of rainfall per annum. Land cover is primarily *low shrubland* with localised areas of *exposed rock and sand* and limited *woodland* or *open bushland*. The vegetation type is *Strandveld of the West Coast.* Refer to **Map 2** for the land cover.

There are no perennial rivers or terrestrial water bodies within the study area. The most prominent drainage lines or water courses are the Buffels River to the north and the Komaggas River in the east of the study area.

Land use and settlement patterns

The region has a very low population density of 3 people per km^2[2]. The small town of Kleinsee lies about 20km north-west of the proposed site. Other than Melkbospunt and Grootmis, this town represents the only populated place or

[2] www.wikipedia.org/wiki/Nama_Khoi_Local_Municipality

settlement within the study area. Individual homesteads/farmsteads are scattered throughout the region. Some of these in closer proximity to the proposed Namas Wind Farm include:

- Doringfontein
- Manelsvlei
- Taaiboskrop
- Steenvlei (Operating as *Die Houthoop* camping and accommodation).
- Geelpan
- Gorab
- Hondevlei
- Hoë Heuwel
- Lewies se Duin
- Vaalkol
- Pienaarsbult
- Kapvlei
- Witduin
- Sonnekwa A
- Sonnekwa
- Graafwater
- Rooivlei
- Droëvlei
- Platvlei
- Paardevlei
- Elandsklip

Large parts of the region are mine-owned, and as a result, significant diamond mining activities are evident, especially within a 7km band along the coast north of Kleinsee. Other than the mining and prospecting activities, industrial infrastructure within the region includes a network of distribution power lines, a distribution substation at Kleinsee and the Gromis Transmission Substation north of the R355 arterial road. The site is further traversed by the alignment of the future north-south spanning Gromis to Juno 400kV overhead power line. This line has been approved and designed, but not yet constructed.

The greater region is generally seen as having a high scenic value and high tourism potential. It is well known for its scenic natural beauty (West Coast as a whole) and annual wild flower displays (Namaqualand)[3]. This occurs once a year between July and October, depending on a number of environmental factors, but mainly the occurance and duration of rainfall. The length of the display is also highly variable.

Within this scenic context, it is noteworthy that the mining areas along the coastline are significantly disturbed and visually apparent due to the scale and nature of the surface based mining. In this respect the visual quality of the receiving environment is already compromised to some extent.

The Namaqua National Park lies approximately 23km to the south east of the proposed site, just beyond the boundary of the Springbok REDZ. Only a small section of the park is visible within the study area maps (bottom right-hand corner). The park is not expected to be visually influenced by the proposed Namas Wind Farm.

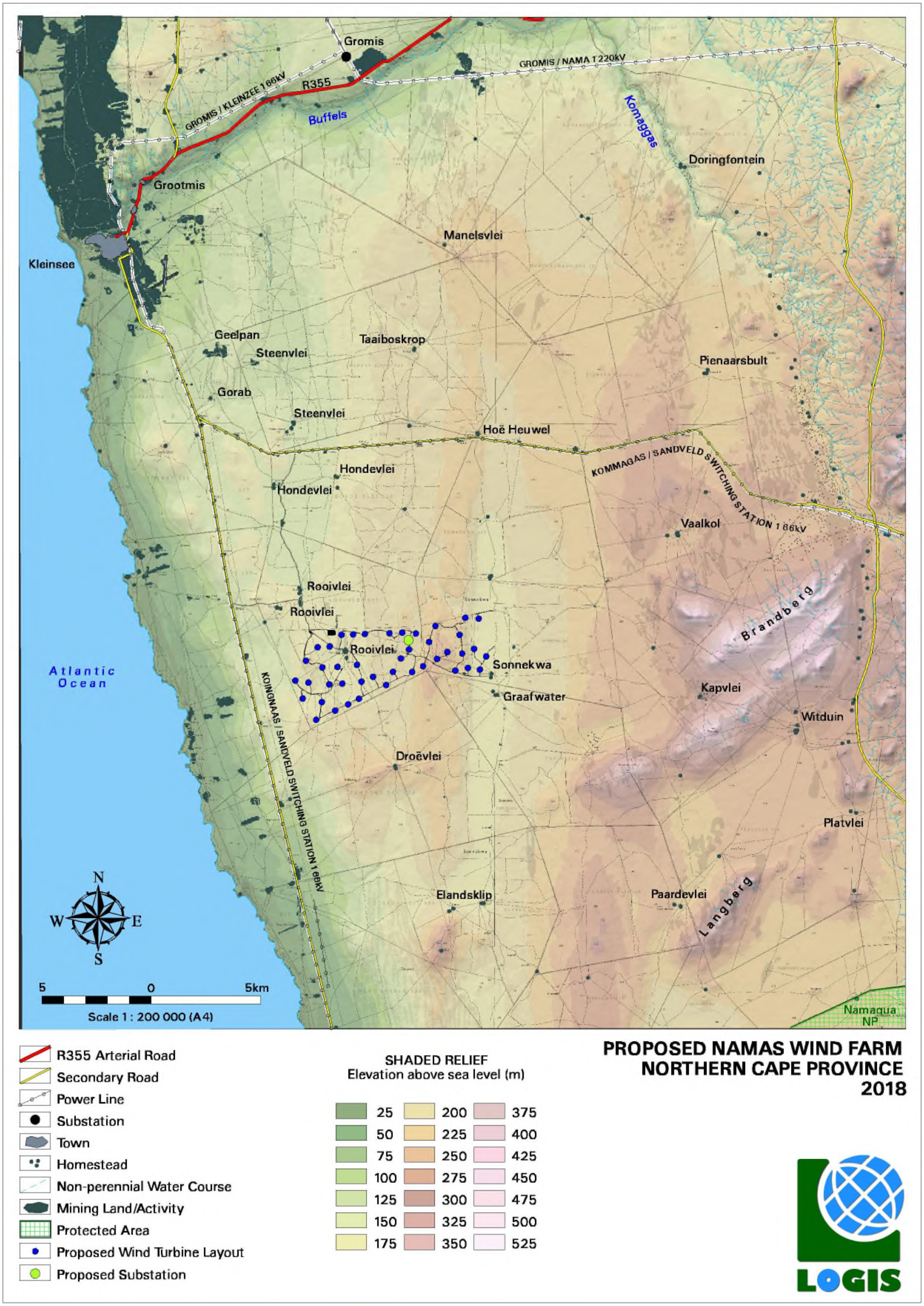
[3] Namaqualand stretches from the small town of Garies in the south to the Orange River to the north, its western border is the wild Atlantic coast, the remote town of Pofadder marks the eastern border (http://www.discoverthecape.com/namaqualand/flower-route.html)

Figure 3: The Koingnaas to Kleinsee road west of the proposed project site.

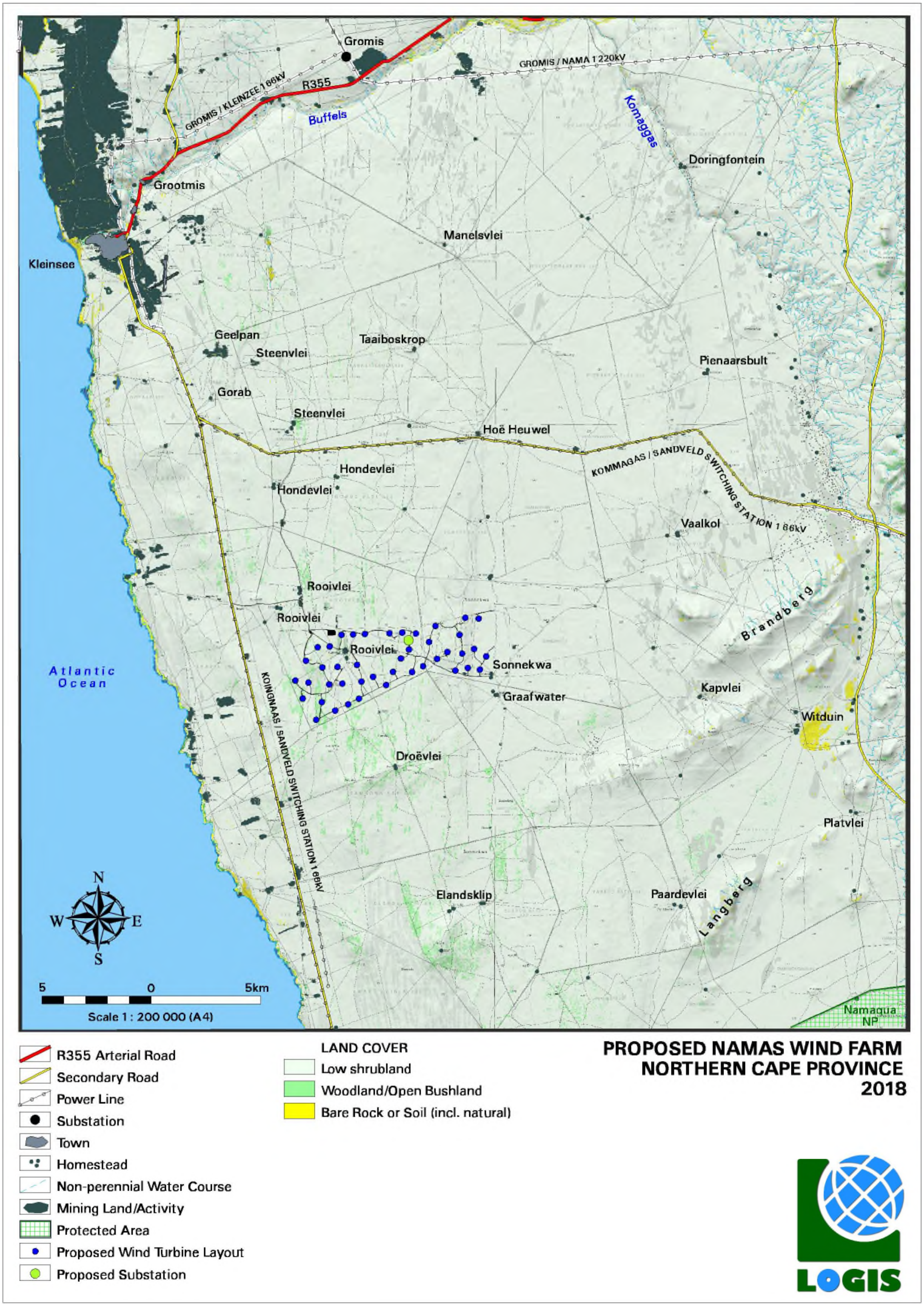
Figure 4: The access road to Rooivlei from the Komaggas to Kleinsee road.

Figure 5: The road and houses at Grootmis.

Figure 6: Mine dumps and mining activity within the study area.



Map 1: Shaded relief map of the study area.



Map 2: Land cover and broad land use patterns.

6. RESULTS

6.1. Potential visual exposure - WF

A visibility analysis was undertaken from each of the wind turbine positions (43 in total) at an offset of 130m (approximate hub-height) above ground level. The result of the visibility analysis is displayed on **Map 3**.

The viewshed analysis does not include the effect of vegetation cover or existing structures on the exposure of the proposed WF, therefore signifying a worst-case scenario.

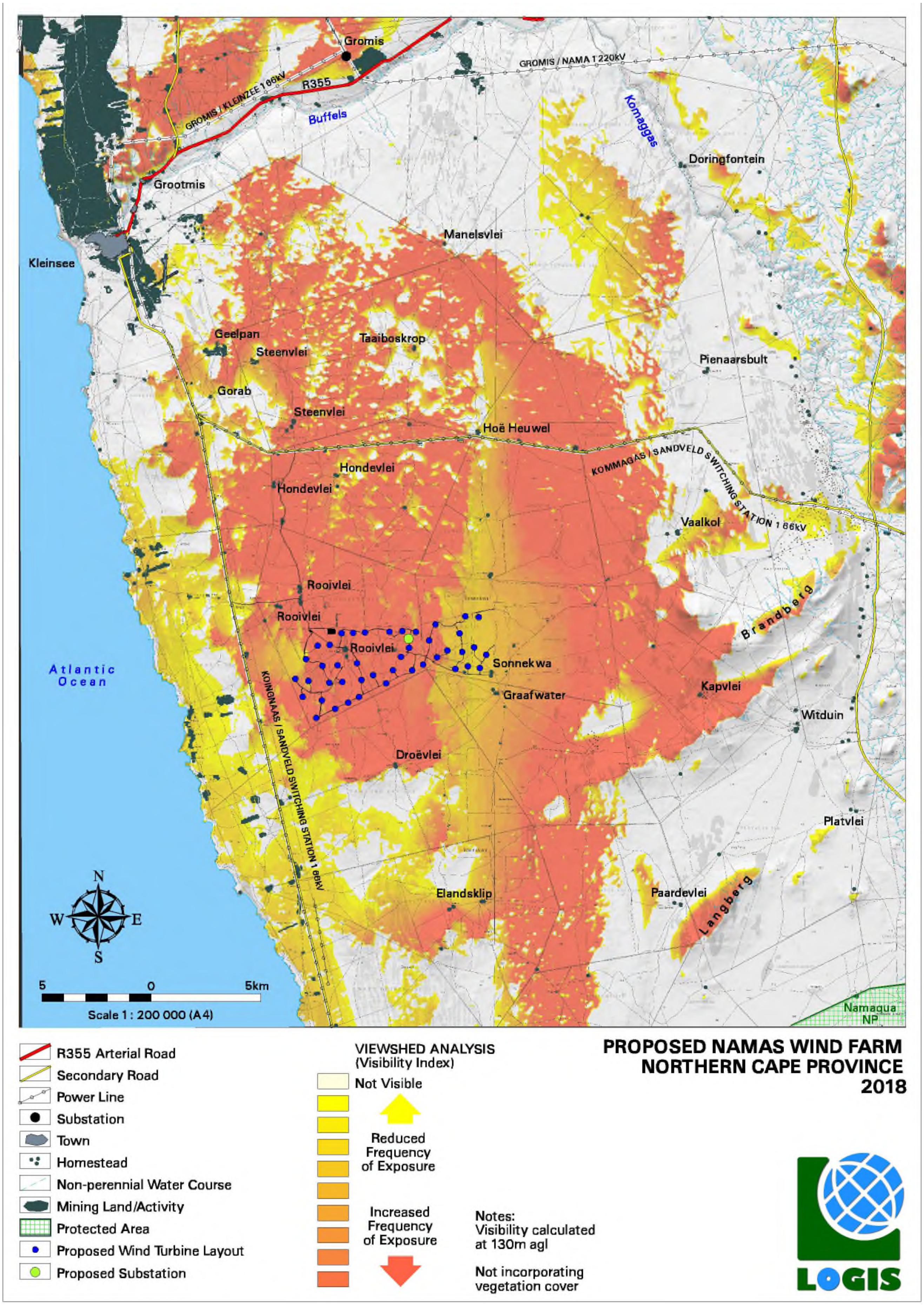
The result of the viewshed analysis displays the potential areas of visual exposure, as well as the potential frequency of exposure. The frequency of exposure indicates the number of turbines that may be exposed i.e. more turbines may be visible in the darker orange areas than in the yellow areas. Land that is more elevated is typically more exposed to the proposed Namas Wind Farm turbines, whilst lower lying areas, such as valleys, are shielded or not exposed to as many turbines.

It is expected that the wind turbines will be exposed to observers travelling along the secondary roads within the study area, as well as from Melkbospunt and farm residences (homesteads) within the region. The turbines will not likely be visible from Kleinsee, Grootmis or the R355 arterial road.

Homesteads and roads expected to be visually influenced include:

- Melkbospunt
- Manelsvlei
- Taaiboskrop
- Steenvlei (*Die Houthoop*).
- Geelpan
- Gorab
- Hondevlei
- Hoë Heuwel
- Lewies se Duin
- Kapvlei
- Sonnekwa A
- Sonnekwa
- Graafwater
- Rooivlei
- Droëvlei
- Elandsklip
- The Komaggas to Kleinsee secondary road
- The Koingnaas to Kleinsee secondary road

It is envisaged that the turbine structures could be highly visible to observers travelling along these roads and residing at these locations, especially within a 10km radius of the structures, potentially resulting in visual impact.



Map 3: Viewshed analysis of the proposed Namas Wind Farm turbine structures.

6.2. Potential cumulative visual exposure

The proposed Namas and Zonnequa Wind Farms are located immediately adjacent to each other. They are also located in close proximity to the authorised (but not yet constructed) Eskom Kleinzee Wind Farm and the proposed Kap Vley Wind Farm (in process). For the purpose of this study, the wind turbines proposed for the three former wind farms are analysed. The wind turbine positions were not available for the Kap Vley Wind Farm and are therefore excluded from this analysis.

The visual exposure of these three WF's turbines is analysed in order to determine whether there is a significant correlation between the three turbine layouts, or whether the construction of these wind farms would contribute to the potential cumulative visual exposure of wind turbine structures within the region.

A visibility analysis of the wind farms were undertaken individually from each of the proposed wind turbine positions (56 for Zonnequa, 43 for Namas and 150 for Kleinzee) at an offset of 130m (approximate hub-height) above ground level. The results of these analyses were merged in order to calculate the combined visual exposure.

The result of the cumulative viewshed analysis is displayed on **Map 4** below. The area of combined visual exposure is indicated in orange. This means that wind turbines from all three wind farms could be visible within this area.

The yellow areas are indicative of land where turbines from two WFs may be visible. This could be turbines from any two of the three WFs. Green areas indicate land where only turbines from (any) one WF may be visible.

There is a very good correlation between the visual exposures of the three tested wind turbine layouts. This is due to the close proximity of the wind farms next to each other. The Kleinzee Wind Farm will create additional exposure northwards towards the coast line and Kleinsee (the town), whilst the Namas Wind Farm will spread the visual exposure marginally further southwards. The Zonnequa Wind Farm will extend the visual exposure to the north-east.

The physical wind turbine footprints are generally contained within an 11.5km radius, effectively creating a 23km diameter wind energy generation hub (shown on **Map 4**). The placement of wind turbines and WF infrastructure within this circle is expected to assist in the consolidation of wind energy generation infrastructure within the region, rather than spreading the cumulative visual impact.

Considering the fact that the Kleinzee, Namas and Zonnequa Wind Farms all fall within the Springbok REDZ, the potential cumulative visual impact, even when considering the Kap Vley Wind Farm as well, is expected to be in line with the objectives of the National Strategic Environmental Assessment (SEA) for renewable energy projects.

The objective of this SEA is to: "*facilitate the efficient and effective rollout of wind and solar PV energy in SA***"**. The Phase One analyses undertaken for the SEA includes a first level assessment of a host of positive (e.g. resource, grid capacity, etc.) and negative or masking criteria. The final product is the development or identification of Renewable Energy Development Zones (REDZ) as shown in **Figure 7** below.

The potential cumulative visual impact is therefore expected to be within acceptable limits, considering the REDZ planning criteria, the approved Kleinzee WF and the existing mining disturbance within the region.

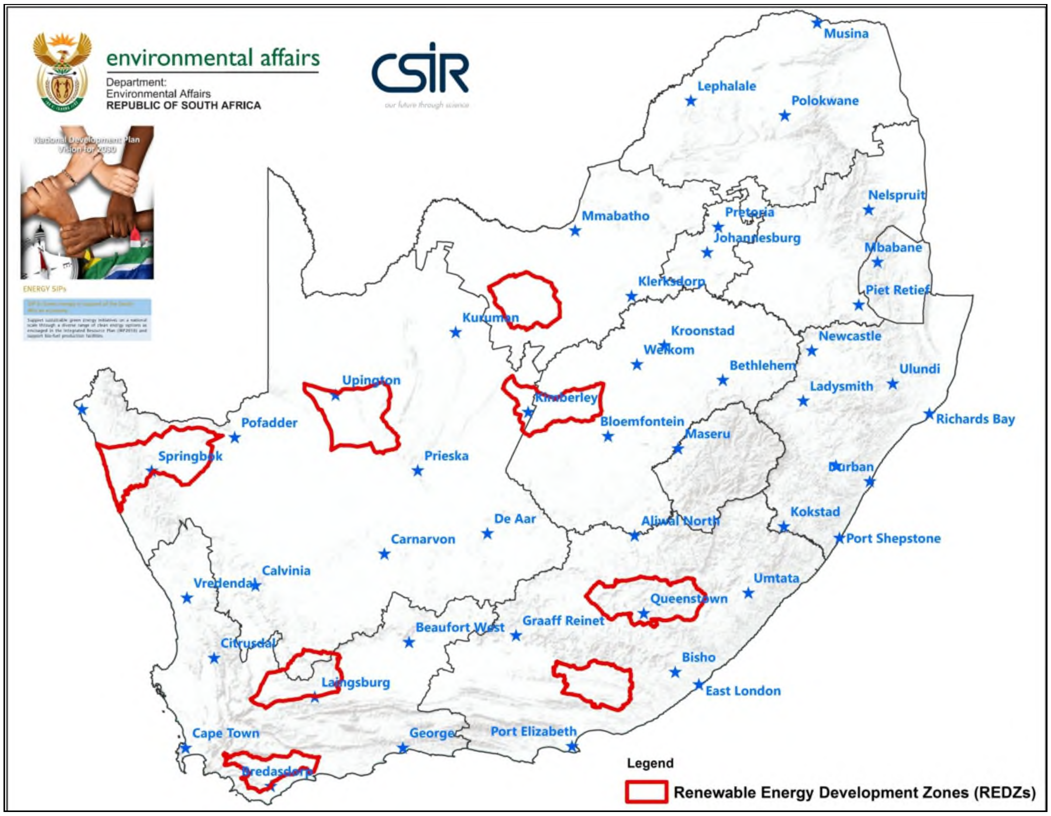
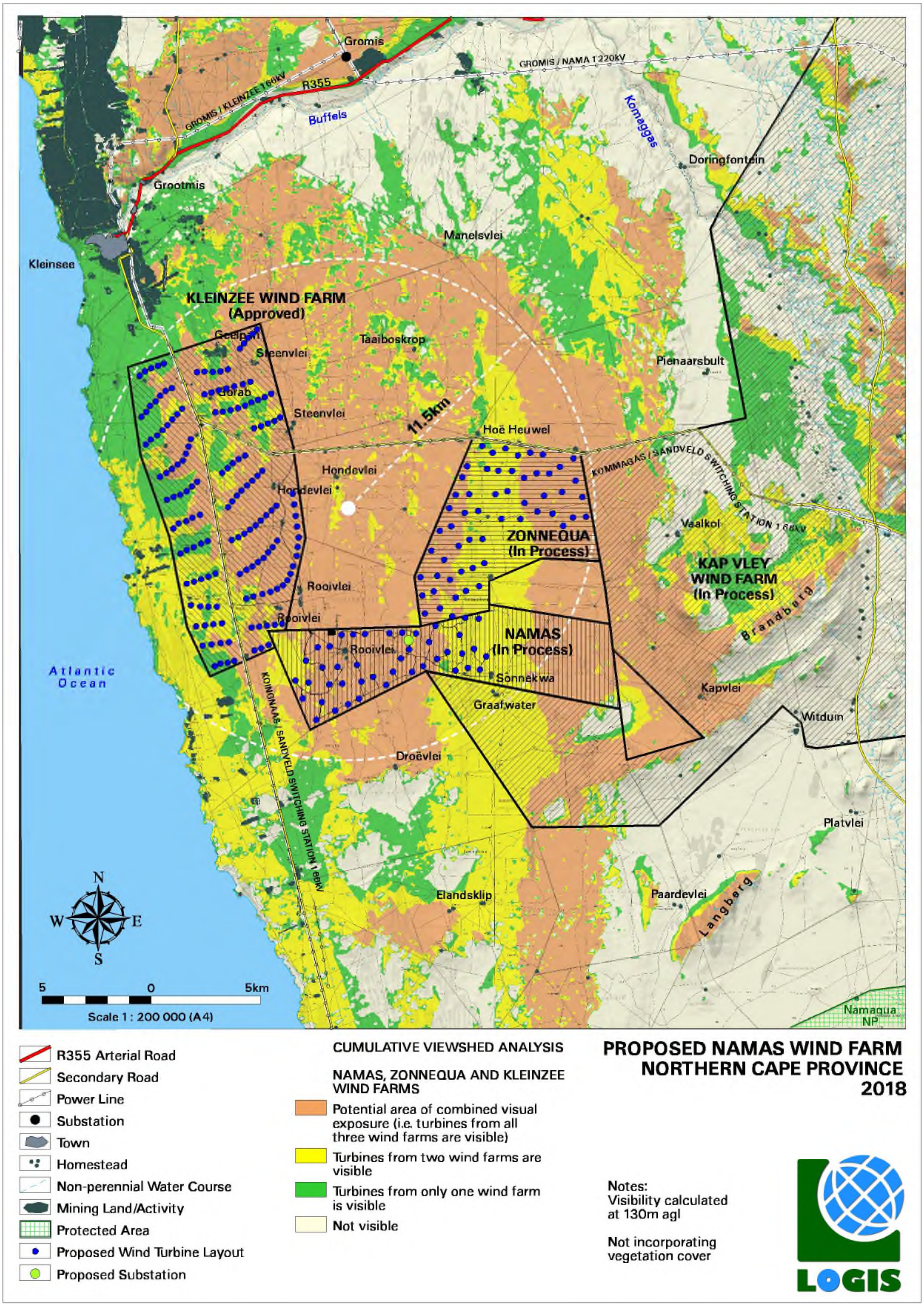


Figure 7: Renewable Energy Development Zones (REDZs).



Map 4: Cumulative viewshed analysis.

6.3. Visual distance / observer proximity to the WF

The proximity radii are based on the anticipated visual experience of the observer over varying distances. The distances are adjusted upwards for larger WFs (e.g. more than 100 wind turbines) and downwards for smaller WFs (e.g. less than 50 turbines). This methodology was developed in the absence of any known and/or accepted standards for South African WFs.

The principle of reduced impact over distance is applied in order to determine the core area of visual influence for these types of structures. It is envisaged that the nature of the structures and the rural character of the study area would create a significant contrast that would make the facility visible and recognisable from greater distances.

The proximity radii for the wind turbines were 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 proximity radii, based on the dimensions of the proposed development area are indicated on **Map 5**, and include the following:

- 0 - 1km. Very short distance view where the WF would dominate the frame of vision and constitute an extremely high visual prominence.
- 1 – 2.5km. Short distance view where the structures would be easily and comfortably visible and constitute a very high visual prominence.
- 2.5 - 5km. Medium distance view where the facility would become part of the visual environment, but would still be visible and recognisable. This zone constitutes a high visual prominence.
- 5 - 10km. Medium to longer distance view of the facility where the facility could potentially still be visible though not as easily recognisable. This zone constitutes a moderate visual prominence for the facility.
- > 10km. Long distance view of the facility where the structures are not expected to be immediately visible and not easily recognisable. This zone constitutes a lower visual prominence for the facility.

Figure 8: Schematic representation of a wind turbine from 1, 2, 5 and 10km under perfect viewing conditions.

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 potentially negative visual perception of the proposed facility.

6.4. Viewer incidence / viewer perception

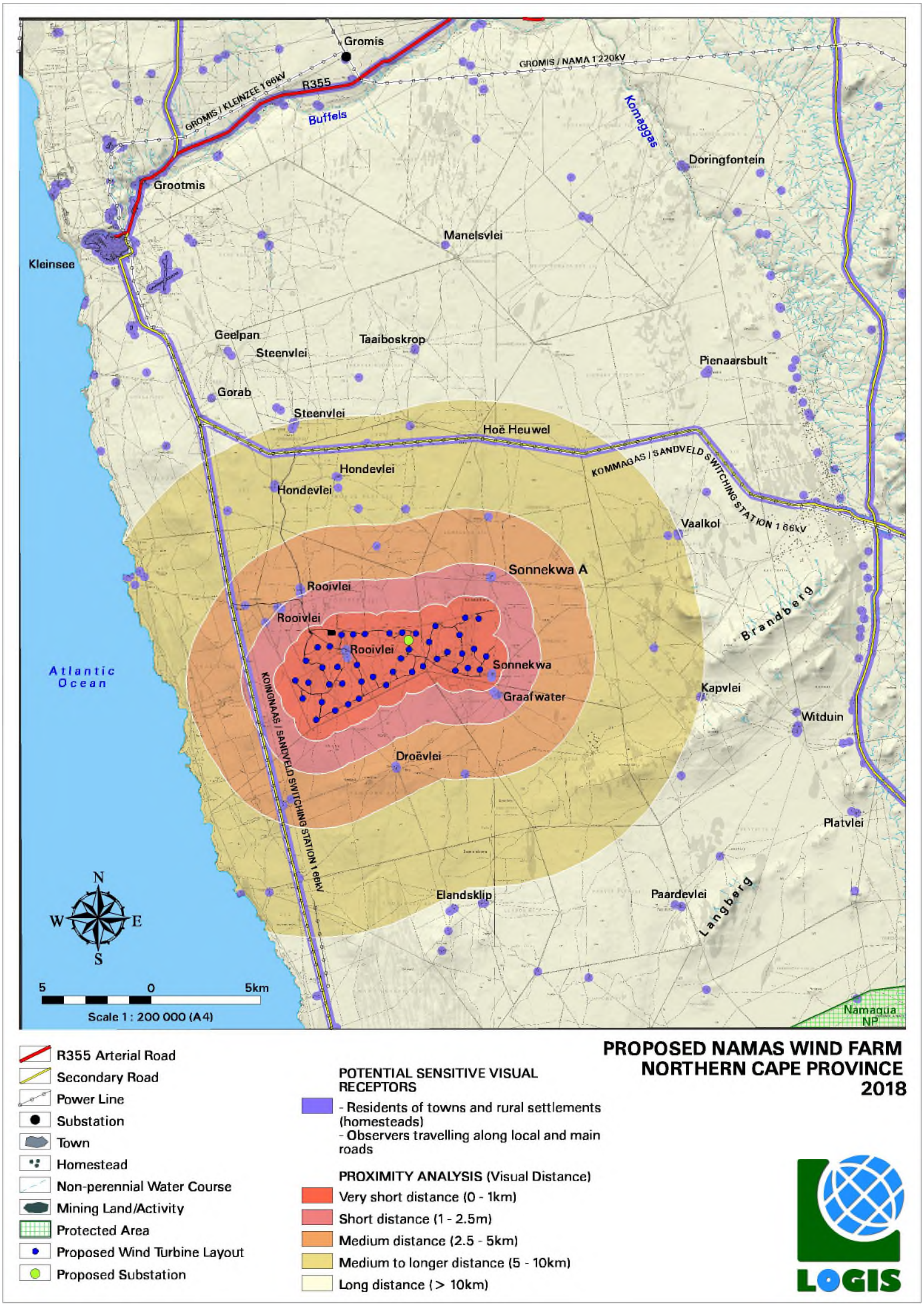
The number of observers and their perception of a structure determine the concept of visual impact. If there are no observers or if the visual perception of the structure is favourable to all the observers, there would be no visual impact.

It is necessary to identify areas of high viewer incidence and to classify certain areas according to the observer's visual sensitivity towards the proposed wind energy facility and its related infrastructure. It would be impossible not to generalise the viewer incidence and sensitivity to some degree, as there are many variables when trying to determine the perception of the observer: regularity of sighting, cultural background, state of mind, purpose of sighting, etc. which would create a myriad of options.

Viewer incidence is calculated to be the highest along the arterial and secondary roads within the study area. Commuters and tourists using these roads may be negatively impacted upon by visual exposure to the WF.

Viewer incidence is generally low within the region, but may fluctuate according to tourism activity. Typically, during peak holiday seasons, over weekends, and particularly the flowering season in early spring, viewer incidence is expected to be higher than normal.

Additional sensitive visual receptors are located at the farm residences (homesteads) throughout the study area. It is expected that the viewer's perception, unless the observer is associated with (or supportive of) the WF, would generally be negative. These potential sensitive visual receptors are listed in **Section 6.1** and displayed on **Map 5** below.



Map 5: Proximity analysis and potential sensitive visual receptors.

6.5. Visual absorption capacity

The land cover within the study area is dominated by *low shrubland.*

Low shrubland is described as:

Natural / semi-natural low shrub dominated areas, typically with < ± 2m canopy height, specifically associated with the Fynbos Biome. It includes a range of canopy densities encompassing sparse to dense canopy covers. Very sparse covers may be associated with the bare ground class. Note that taller tree / bush / shrub communities within this vegetation type are typically classified separately as one of the other tree or bush dominated cover classes.

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

The significant height of wind turbine structures adds to the potential visual intrusion of the WF against the background of the horizon. In addition, the scale and form of the structures mean that it is unlikely that the environment will visually absorb them in terms of texture, colour, form and light/shade characteristics.

Where homesteads and settlements occur, some more significant vegetation and trees may have been planted, which would contribute to visual absorption. As this is not a consistent occurrence, however, VAC will not be taken into account for any of the homesteads or settlements, therefore assuming a worst-case scenario in the impact assessment.

Figure 9: Photograph indicating the low VAC of the study area.

6.6. Visual impact index

The combined results of the visual exposure, viewer incidence/perception and visual distance of the proposed Namas Wind Farm project 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 visual exposure to the proposed infrastructure, a high viewer incidence and a potentially 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 and determining the potential **magnitude** of the visual impact.

General
The index indicates that potentially sensitive visual receptors within a 1km radius of the WF may experience a very high visual impact. The magnitude of visual impact on sensitive visual receptors subsides with distance to: high within a 1 – 2.5km radius, moderate within a 2.5 – 5km radius and low between a 5 – 10km radius. Receptors beyond 10km are expected to have a very low potential visual impact. Potentially affected visual receptors are shown on **Map 7**.

The WF may have a **very high** visual impact on the following observers:

Residents of:

- Rooivlei (two northern residences)
- Sonnekwa A
- Sonnekwa
- Graafwater

Observers travelling along the:

- Koingnaas-Kleinsee secondary road (the magnitude spans from very high to moderate)

The WF may have a **high** visual impact on the following observers:

Residents of:

- Droëvlei

Note:
The location of Sonnekwa, Rooivlei (south) and Sonnekwa A on properties earmarked for the Namas Wind Farm or located on the proposed Zonnequa Wind farm properties reduces the probability of this impact occurring. Where homesteads are derelict or deserted, the visual impact will be non-existent, until such time as it is inhabited again.

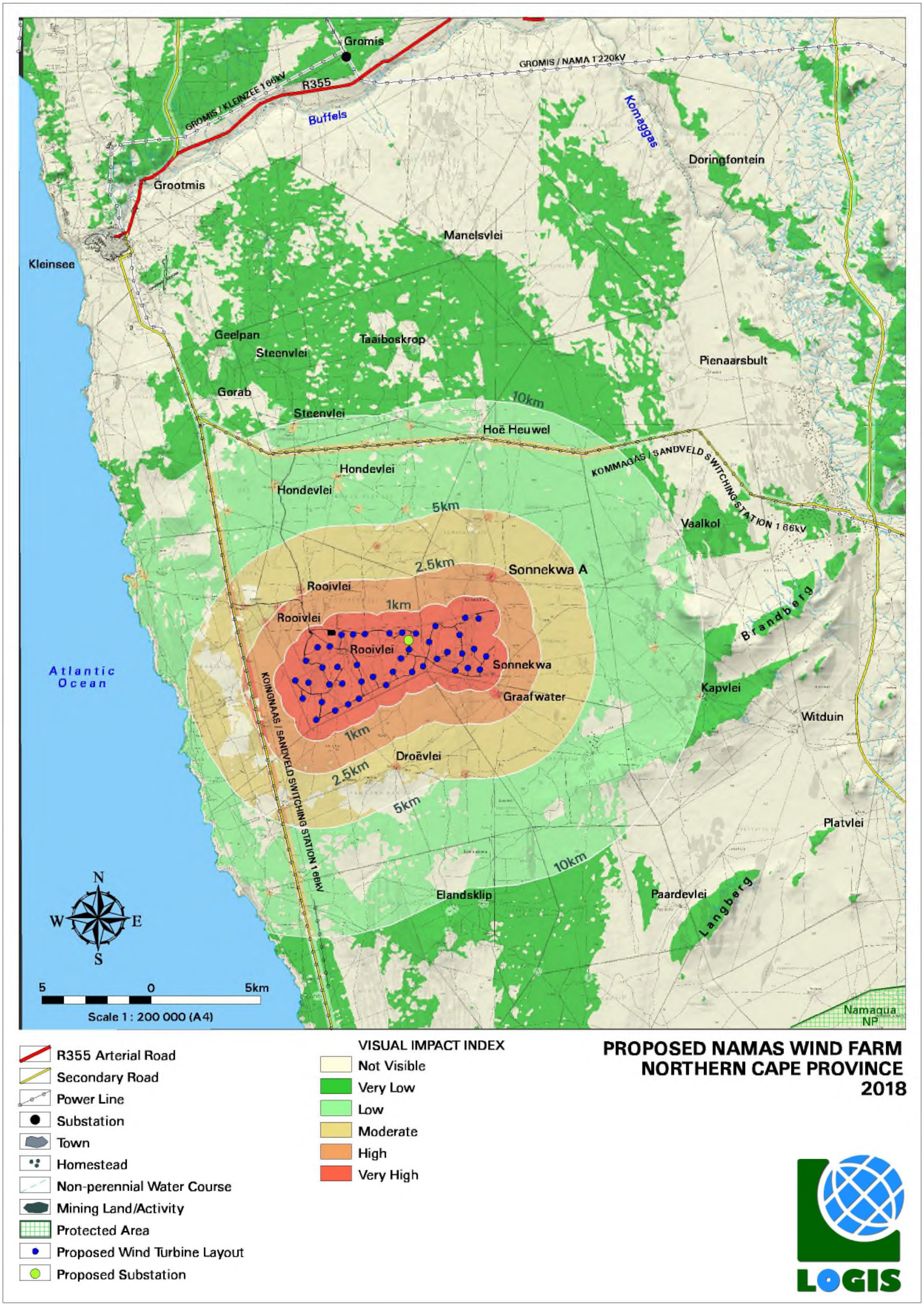
The WF may have a **moderate** visual impact on the following observers:

Residents of/visitors to:

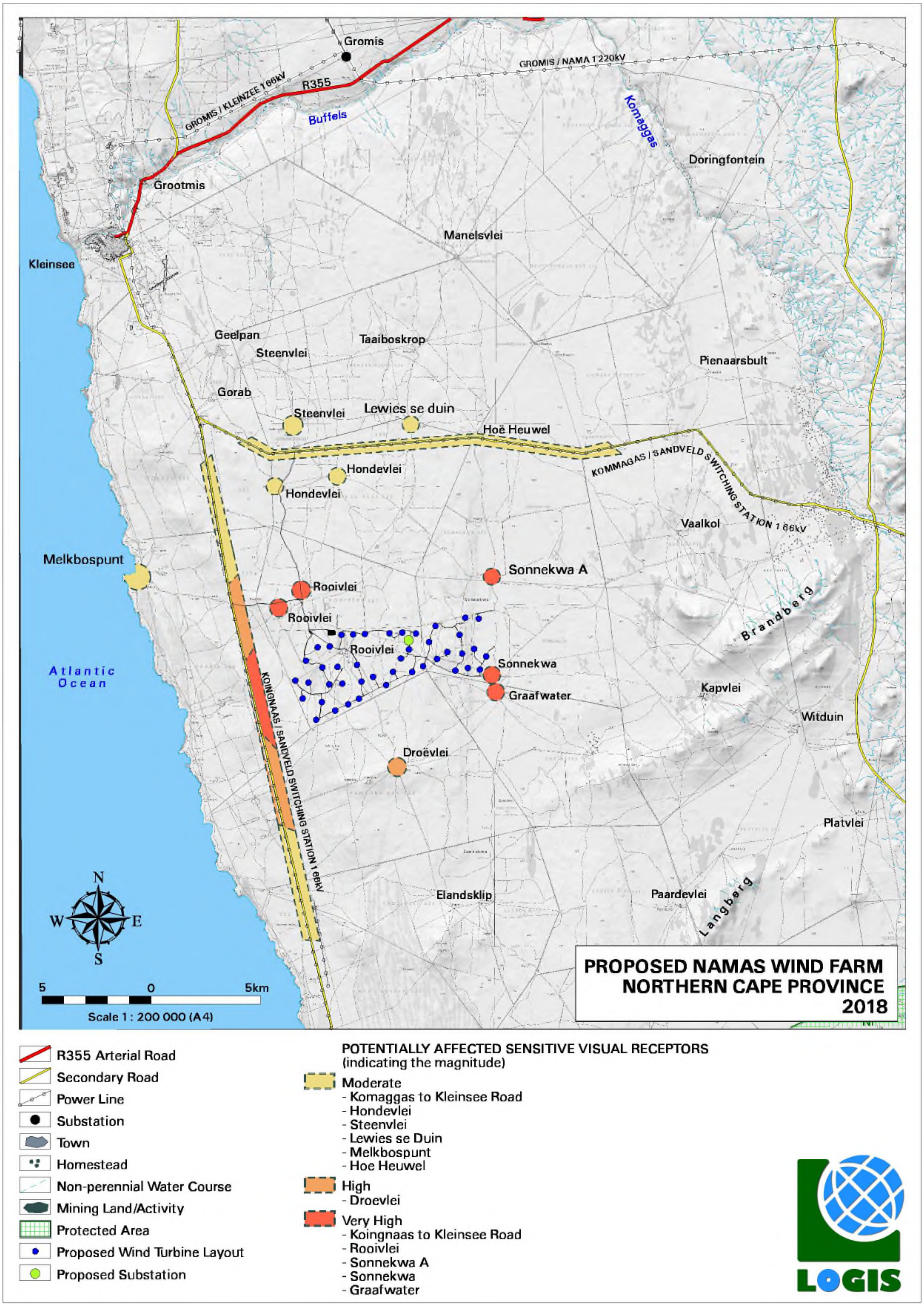
- Melkbospunt
- Hondevlei 1 and 2
- Steenvlei
- Lewies se Duin
- Hoë Heuwel

Observers travelling along the:

- Komaggas-Kleinsee secondary road



Map 6: Visual impact index.



Map 7: Potentially affected sensitive visual receptors.

6.7. Visual impact assessment: impact rating 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 **Section 3:** SCOPE OF WORK) related to the visual impact.

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

- **Extent** - site only (very low = 1), local (low = 2), regional (medium = 3), national (high = 4) or international (very high = 5)[4].
- **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)[5].
- **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)

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[4] Local = within 5km of the development site. Regional = between 5-10km from the development site.

[5] This value is read from the visual impact index. Where more than one value is applicable, the higher of these will be used as a worst case scenario.

6.8. Visual impact assessment

The primary visual impacts of the proposed Namas Wind Farm are assessed as follows:

6.8.1. Construction impacts

Potential visual impact of construction activities on sensitive visual receptors in close proximity to the proposed WF.

During construction, there may 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 landowners in the area.

Construction activities may potentially result in a **moderate** (significance rating = 40), temporary visual impact, that may be mitigated to **low** (significance rating = 24)

Table 2: Visual impact of construction activities on sensitive visual receptors in close proximity to the proposed WF.

Nature of Impact: Visual impact of construction activities on sensitive visual receptors in close proximity to the proposed WF.		
	Without mitigation	***With mitigation***
Extent	Local **(2)**	Local **(2)**
Duration	Short term **(2)**	Short term **(2)**
Magnitude	Moderate **(6)**	Low **(4)**
Probability	Highly Probable **(4)**	Probable **(3)**
Significance	Moderate **(40)**	Low **(24)**
Status (positive or negative)	Negative	Negative
Reversibility	Recoverable **(3)**	Recoverable **(3)**
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	

Mitigation: Planning: ➢ Retain and maintain natural vegetation immediately adjacent to the development footprint. Construction: ➢ Ensure that vegetation is not unnecessarily removed during 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. ➢ 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 using approved dust suppression techniques as and when required (i.e. whenever dust becomes apparent). ➢ Restrict construction activities to daylight hours whenever possible in order to reduce lighting impacts. ➢ Rehabilitate all disturbed areas immediately after the completion of construction works.
Cumulative impacts: None.
Residual impacts: None, provided rehabilitation works are carried out as specified.

6.8.2. Potential visual impact on sensitive visual receptors located within a 5km radius of the wind turbine structures

The Namas Wind Farm is expected to have a **high** visual impact (significance rating = 64) on observers traveling along the roads and residents of homesteads within a 5km radius of the wind turbine structures.

No mitigation of this impact is possible (i.e. the structures will be visible regardless), but general mitigation and management measures are recommended as best practice. The table below illustrates this impact assessment.

Table 3: Visual impact on observers in close proximity to the proposed wind turbine structures.

Nature of Impact: Visual impact on observers travelling along the roads and residents at homesteads in close proximity to the wind turbine structures		
	Without mitigation	***With mitigation***
Extent	Local **(2)**	Local **(2)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Very high **(10)**	Very high **(10)**
Probability	Highly probable **(4)**	Highly probable **(4)**
Significance	High **(64)**	High **(64)**
Status (positive, neutral or negative)	Negative	Negative
Reversibility	Recoverable **(3)**	Recoverable **(3)**
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	No	

Mitigation / Management: Planning: ➢ Retain/re-establish and maintain natural vegetation immediately adjacent to the development footprint. Operations: ➢ Maintain the general appearance of the facility as a whole. Decommissioning: ➢ Remove infrastructure not required for the post-decommissioning use. ➢ Rehabilitate all affected areas. Consult an ecologist regarding rehabilitation specifications.
Cumulative impacts: The construction of the Namas, Zonnequa, Kleinzee and Kap Vley WFs will increase the cumulative visual impact of industrial type infrastructure within the region. On the other hand, the location of these WFs within a REDZ will contribute to the consolidation of wind turbine structures to this locality and avoid a potentially scattered proliferation of wind energy infrastructure throughout the region.
Residual impacts: The visual impact will be removed after decommissioning, provided the WF infrastructure is removed. Failing this, the visual impact will remain.

6.8.3. Potential visual impact on sensitive visual receptors within the region (5 – 10km radius)

The Namas Wind Farm could have a **moderate** visual impact (significance rating = 39) on observers traveling along the roads and residents of homesteads within a 5 - 10km radius of the wind turbine structures.

No mitigation of this impact is possible (i.e. the structures will be visible regardless), but general mitigation and management measures are recommended as best practice. The table below illustrates this impact assessment.

Table 4: Visual impact of the proposed wind turbine structures within the region.

Nature of Impact: Visual impact on observers travelling along the roads and residents at homesteads within a 5 – 10km radius of the wind turbine structures		
	Without mitigation	***With mitigation***
Extent	Regional **(3)**	Regional **(3)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Moderate **(6)**	Moderate **(6)**
Probability	Probable **(3)**	Probable **(3)**
Significance	Moderate **(39)**	Moderate **(39)**
Status (positive, neutral or negative)	Negative	Negative
Reversibility	Recoverable **(3)**	Recoverable **(3)**
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	No	

Mitigation / Management: Planning: ➢ Retain/re-establish and maintain natural vegetation immediately adjacent to the development footprint/servitude. Operations: ➢ Maintain the general appearance of the facility as a whole. Decommissioning: ➢ Remove infrastructure not required for the post-decommissioning use. ➢ Rehabilitate all affected areas. Consult an ecologist regarding rehabilitation specifications.
Cumulative impacts: The construction of the Namas, Zonnequa, Kleinzee and Kap Vley WFs will increase the cumulative visual impact of industrial type infrastructure within the region. On the other hand the location of these WFs within a REDZ will contribute to the consolidation of wind turbine structures to this locality and avoid a potentially scattered proliferation of wind energy infrastructure throughout the region.
Residual impacts: The visual impact will be removed after decommissioning, provided the WF infrastructure is removed. Failing this, the visual impact will remain.

6.8.4. Shadow flicker

Shadow flicker only occurs when the sky is clear, and when the turbine 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 480m buffer along the edge of the outer most turbines is submitted as the zone within which there is a risk of shadow flicker occurring.

There are no major roads or places of residence within the 480m buffer. The significance of shadow flicker is therefore anticipated to be **low** to **negligible**.

Table 5: Visual impact of shadow flicker on sensitive visual receptors in close proximity to the proposed WF.

Nature of Impact: Visual impact of shadow flicker on sensitive visual receptors in close proximity to the proposed WF.		
	Without mitigation	***With mitigation***
Extent	Local **(2)**	Local **(2)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Low **(4)**	Low **(4)**
Probability	Improbable **(2)**	Improbable **(2)**
Significance	Low **(20)**	Low **(20)**
Status (positive, neutral or negative)	Negative	Negative
Reversibility	Recoverable **(3)**	Recoverable **(3)**
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	N.A. due to the low probability of occurrence	
Generic best practise mitigation/management measures: N.A.		
Residual impacts: N.A.		

6.8.5. Lighting impacts

Potential visual impact of operational, safety and security lighting of the facility at night on observers in close proximity to the proposed WF.

The area immediately surrounding the proposed facility has a relatively low incidence of receptors and light sources, so light trespass and glare from the security and after-hours operational lighting for the facility will have some significance for visual receptors in close proximity.

Another source of glare light, albeit not as intense as flood lighting, is the aircraft warning lights mounted on top of the hub of the wind turbines. These lights are less aggravating due to the toned-down red colour, but have the potential to be visible from a great distance. The Civil Aviation Authority (CAA) prescribes these warning lights and the potential to mitigate their visual impacts is low.

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

This anticipated lighting impact is likely to be of **moderate** significance (rating = 42), and may be mitigated to **low** (rating = 24).

Table 6: Impact table summarising the significance of visual impact of lighting at night on visual receptors in close proximity to the proposed WF.

Nature of Impact: Visual impact of lighting at night on sensitive visual receptors in close proximity to the proposed facility.		
	Without mitigation	***With mitigation***
Extent	Local **(2)**	Local **(2)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	High **(8)**	Moderate **(6)**
Probability	Probable **(3)**	Improbable **(2)**
Significance	Moderate **(42)**	Low **(24)**
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: ➢ Limit aircraft warning lights to the turbines on the perimeter, thereby reducing the overall requirement. ➢ Investigate aircraft warning lights that only activate when the presence of an aircraft is detected. ➢ Shield the sources of light by physical barriers (walls, vegetation, or the structure itself). ➢ Limit mounting heights of lighting fixtures, or alternatively use foot-lights or bollard level lights. ➢ Make use of minimum lumen or wattage in fixtures. ➢ Make use of down-lighters, or shielded fixtures.		

➢ Make use of Low Pressure Sodium lighting or other types of low impact lighting. ➢ Make 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 construction and operation of WFs may potentially increase the visual impacts associated with light pollution within an otherwise rural setting.
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.

6.8.6 Ancillary infrastructure

On-site ancillary infrastructure associated with the WF includes a 132kV substation, smaller substations (inverters), 33kV cabling between the wind turbines, internal access roads, workshop and office buildings.

No dedicated viewshed analyses have been generated for the ancillary infrastructure, as the range of visual exposure will fall within that of the turbines. The anticipated visual impact resulting from this infrastructure is likely to be of **low** significance both before and after mitigation.

Table 7: Visual impact of the ancillary infrastructure.

Nature of Impact: Visual impact of the ancillary infrastructure during the operation phase on observers in close proximity to the structures.		
	Without mitigation	***With mitigation***
Extent	Local **(2)**	Local **(2)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Low **(4)**	Low **(4)**
Probability	Improbable **(2)**	Improbable **(2)**
Significance	Low **(20)**	Low **(20)**
Status (positive, neutral or negative)	Negative	Negative
Reversibility	Recoverable **(3)**	Recoverable **(3)**
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	No, only best practise measures can be implemented	
Generic best practise mitigation/management measures: Planning: ➢ Retain/re-establish and maintain natural vegetation immediately adjacent to the development footprint/servitude. Operations: ➢ Maintain the general appearance of the infrastructure. Decommissioning: ➢ Remove infrastructure not required for the post-decommissioning use. ➢ Rehabilitate all affected areas. Consult an ecologist regarding rehabilitation specifications.		
Residual impacts: The visual impact will be removed after decommissioning, provided the ancillary infrastructure is removed. Failing this, the visual impact will remain.		

6.9. Visual impact assessment: secondary impacts

The potential visual impact of the proposed WF on the 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.), plays a significant role.

An 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.

The greater environment has a rural, undeveloped character and a natural appearance. These generally undeveloped landscapes are considered to have a high visual quality. The coastal areas have an even greater visual attraction due to their ocean views and West Coast character.

The anticipated visual impact of the proposed WF on the regional visual quality, and by implication, on the sense of place, is difficult to quantify, but is generally expected to be of **moderate** significance. This is due to the relatively low viewer incidence within close proximity to the proposed development site and the presence of the existing mining activities and electricity infrastructure.

Table 8: The potential impact on the sense of place of the region.

Nature of Impact: The potential impact on the sense of place of the region.		
	Without mitigation	***With mitigation***
Extent	Regional **(3)**	Regional **(3)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Moderate **(6)**	Moderate **(6)**
Probability	Probable **(3)**	Probable **(3)**
Significance	Moderate **(39)**	Moderate **(39)**
Status (positive, neutral or negative)	Negative	Negative
Reversibility	Recoverable **(3)**	Recoverable **(3)**
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	No, only best practise measures can be implemented	
Generic best practise mitigation/management measures: <u>Planning:</u> ➢ Retain/re-establish and maintain natural vegetation immediately adjacent to 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. ➢ Rehabilitate all affected areas. Consult an ecologist regarding rehabilitation specifications.		
Residual impacts: The visual impact will be removed after decommissioning, provided the WF infrastructure is removed. Failing this, the visual impact will remain.		

The potential cumulative visual impact of the wind farms on the visual quality of the landscape.

The construction of the Namas, Zonnequa, Kleinzee and Kap Vley WFs will increase the cumulative visual impact of industrial type infrastructure within the region.

On the other hand the location of these WFs within a REDZ will contribute to the consolidation of wind turbine structures to this locality and avoid a potentially scattered proliferation of wind energy infrastructure throughout the region.

The anticipated cumulative visual impact of the proposed WFs is expected to be of **moderate** significance, which is considered to be acceptable from a visual perspective. This is once again due to the relatively low viewer incidence within close proximity to the proposed development sites and the presence of the existing mining activities and electricity infrastructure.

Table 9: The potential cumulative visual impact of the wind farms on the visual quality of the landscape.

<table>
<tr><td colspan="3">Nature of Impact:
The potential cumulative visual impact of the wind farms on the visual quality of the landscape.</td></tr>
<tr><td></td><td>Overall impact of the proposed project considered in isolation</td><td>Cumulative impact of the project and other projects within the area</td></tr>
<tr><td>Extent</td><td>Regional (3)</td><td>Regional (3)</td></tr>
<tr><td>Duration</td><td>Long term (4)</td><td>Long term (4)</td></tr>
<tr><td>Magnitude</td><td>Moderate (6)</td><td>High (8)</td></tr>
<tr><td>Probability</td><td>Probable (3)</td><td>Probable (3)</td></tr>
<tr><td>Significance</td><td>Moderate (39)</td><td>Moderate (45)</td></tr>
<tr><td>Status (positive, neutral 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">No, only best practise measures can be implemented</td></tr>
<tr><td colspan="3">Generic best practise mitigation/management measures:
<u>Planning:</u>
➢ Retain/re-establish and maintain natural vegetation immediately adjacent to 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.
➢ Rehabilitate all affected areas. Consult an ecologist regarding rehabilitation specifications.</td></tr>
<tr><td colspan="3">Residual impacts:
The visual impact will be removed after decommissioning, provided the WF infrastructure is removed. Failing this, the visual impact will remain.</td></tr>
</table>

6.10. The potential to mitigate visual impacts

The primary visual impact, namely the appearance of the WF (the wind turbines) is not possible to mitigate. The appearance of the turbines cannot be changed in order to reduce visual impacts due to the limited design variations of commercially available wind turbines.

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 therefore generally low or non-existent. The following mitigation is, however possible:

- It is recommended that vegetation cover (i.e. either natural or cultivated) immediately adjacent to the development footprint be maintained, both during construction and operation of the proposed facility. This will minimise visual impact as a result of cleared areas and areas denuded of vegetation.

- Existing roads should be utilised wherever possible. New roads should be planned taking due cognisance of the topography to limit cut and fill requirements. Construction/upgrade of roads should be undertaken properly, with adequate drainage structures in place to forego potential erosion problems.

- In terms of onsite ancillary buildings and structures, it is recommended that it be planned so that clearing of vegetation is minimised. This implies consolidating this infrastructure as much as possible and making use of already disturbed areas rather than undisturbed sites wherever possible.

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

- Investigate aircraft warning lights that only activate when the presence of an aircraft is detected.

- 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 proposed WF and 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:

    - 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 any potential temporary construction 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. If necessary, an ecologist should be consulted to assist or give input into rehabilitation specifications.

- During operation, the maintenance of the turbines and ancillary structures and infrastructure will ensure that the facility does not degrade, therefore aggravating the 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 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.

- Secondary impacts anticipated as a result of the proposed WF (i.e. visual character and sense of place) are not possible to mitigate. There is also no mitigation to ameliorate the negative visual impacts on tourist routes and tourist destinations within the region.

- Where sensitive visual receptors are likely to be affected, it is recommended that the developer enter into negotiations regarding the potential screening of visual impacts at the receptor site. This may entail the planting of vegetation, trees or the construction of screens. Ultimately, visual screening is most effective when placed at the receptor itself.

Good practice requires that the mitigation of both primary and secondary visual impacts, as listed above, be implemented and maintained on an ongoing basis.

7. PHOTO SIMULATIONS

Photo simulations were undertaken (in addition to the above spatial analyses) in order to illustrate the potential visual impact of the proposed Namas Wind Farm within the receiving environment. The purpose of the photo simulation exercise is to support/verify the findings of the VIA, and is not an exercise to illustrate what the facility will look like from all directions (i.e. it is not an artist’s impression).

The photo simulations indicate the anticipated visual alteration of the landscape from various sensitive visual receptors located at different distances from the facility.

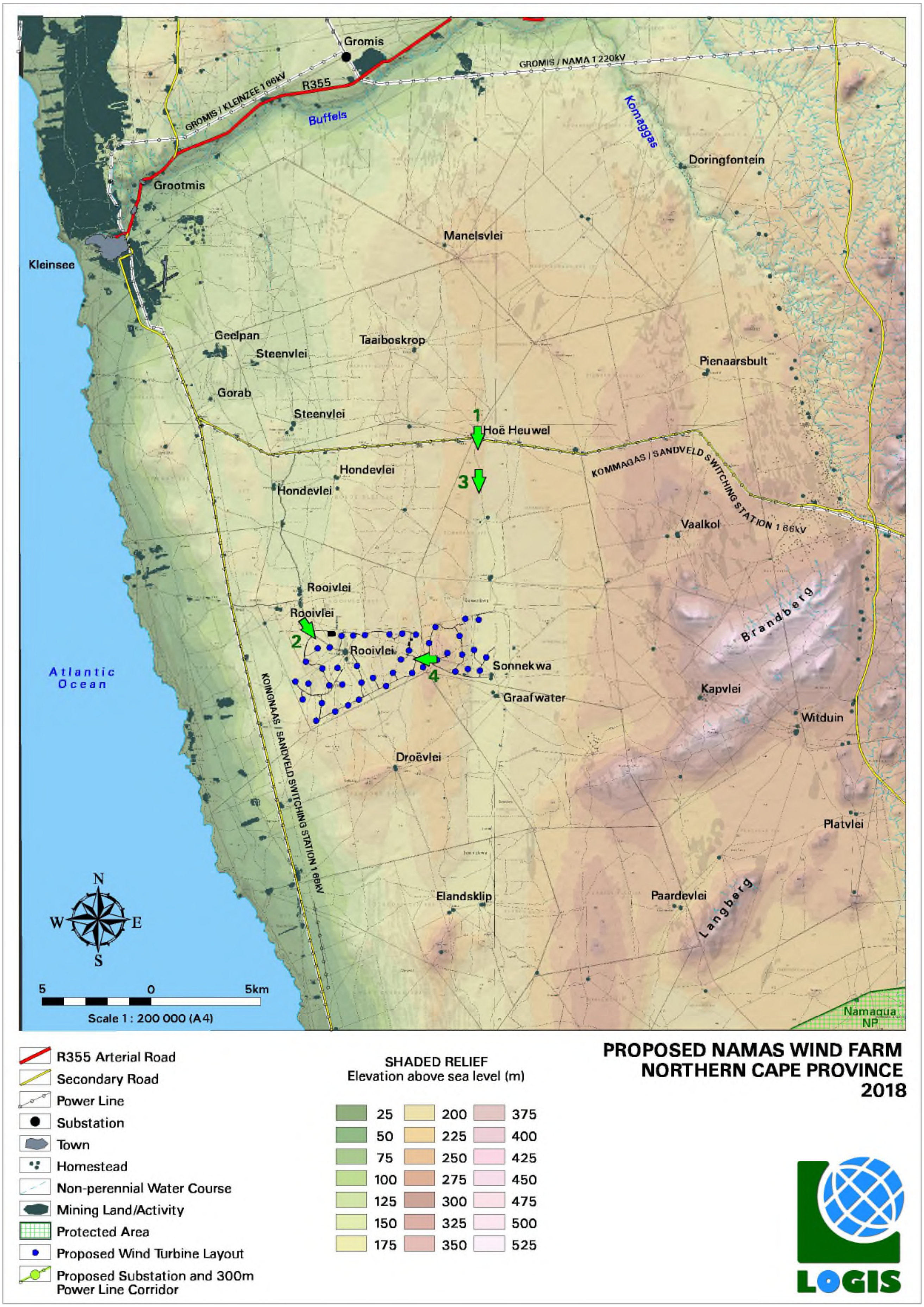
The photograph positions are indicated on **Map 8** below and should be referenced with the photo simulation being viewed in order to place the observer in spatial context.

The simulated views show the placement of the wind turbines during the longer-term operation 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 basic 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 substation, access roads, etc.) associated with the facility is not included in the photo simulations.

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 photo simulations are displayed as "before" and "after" views of the affected landscape.



Map 8: Photograph positions.

7.1. Viewpoint 1: before

Figure 10: Photo simulation 1 (before construction).

7.2. Viewpoint 1: after

Figure 11: Photo simulation 1 (after construction). Distance to closest turbine = 8km.

7.3. Viewpoint 2: before

Figure 12: Photo simulation 2 (before construction).

7.4. Viewpoint 2: after

Figure 13: Photo simulation 2 (after construction). Distance to closest turbine = 1km.

7.5. Viewpoint 3: before

Figure 14: Photo simulation 3 (before construction).

7.6. Viewpoint 3: after

Figure 15: Photo simulation 3 (after construction). Distance to closest turbine = 6km.

7.7. Viewpoint 4: before

Figure 16: Photo simulation 4 (before construction).

7.8. Viewpoint 4: after

Figure 17: Photo simulation 4 (after construction). Distance to closest turbine = 3km.

8. CONCLUSION AND RECOMMENDATIONS

The construction and operation of the proposed Namas Wind Farm and its associated infrastructure, will have a visual impact on the study area, especially within (but not restricted to) a 5km radius of the proposed facility. The visual impact will differ amongst places, depending on the distance from the facility.

The combined visual impact or cumulative visual impact of up to four wind energy facilities (i.e. the Namas, Zonnequa, Kleinzee and Kap Vley Wind Farms) is expected to increase the area of potential visual impact within the region. The intensity of visual impact (number of turbines visible) to exposed receptors, especially those located within a 5km radius, is expected to be greater than it would be for a single WF. It is however still more preferable that these wind energy developments are all concentrated within this area (a designated Renewable Energy Development Zone), than being spread further afield.

Overall, the significance of the visual impacts is expected to range from high to low as a result of the generally undeveloped character of the landscape. The facility would be visible within an area that incorporates certain sensitive visual receptors who would consider visual exposure to this type of infrastructure to be intrusive. Such visual receptors include people travelling along roads, residents of rural homesteads and settlements, and tourists passing through or holidaying in the region. See Impact Statement below.

Potential mitigation factors for the Namas Wind Farm include the fact that 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.

A number of mitigation measures have been proposed (**Section 6.11.**). Mitigation will be effective in terms of lighting and construction. Regardless of whether or not mitigation measures will reduce the significance of the anticipated visual impacts, they are considered to be good practice and should all be implemented and maintained throughout the construction, operation and decommissioning phases of the proposed facility.

If mitigation is undertaken as recommended, it is concluded that the significance of most of the anticipated visual impacts will remain at or be managed to acceptable levels. As such, the Namas Wind Farm would be considered to be acceptable from a visual impact perspective.

9. IMPACT STATEMENT

The findings of the Visual Impact Assessment undertaken for the proposed Namas Wind Farm is that the visual environment surrounding the site, especially within a 5km radius, will be visually impacted upon for the anticipated operational lifespan of the facility (i.e. 20 - 30 years).

This impact is applicable to the individual Namas Wind Farm and to the potential cumulative visual impact of the facility in relation to the proposed Zonnequa and Kap Vley Wind Farms, and the authorised Kleinzee Wind Farm, where the combined frequency of visual impact may be greater. The potential area of cumulative visual exposure is however not expected to increase significantly and is deemed to be within acceptable limits.

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

- During construction, there may 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 landowners in the area. Construction activities may potentially result in a **moderate**, temporary visual impact that may be mitigated to **low**.

- The Namas Wind Farm is expected to have a **high** visual impact on observers traveling along the roads and residents of homesteads within a 5km radius of the wind turbine structures. No mitigation of this impact is possible (i.e. the structures will be visible regardless), but general mitigation and management measures are recommended as best practice.

- The Namas Wind Farm could have a **moderate** visual impact on observers traveling along the roads and residents of homesteads within the region (i.e. 5 - 10km radius from the wind turbine structures). No mitigation of this impact is possible (i.e. the structures will be visible regardless), but general mitigation and management measures are recommended as best practice.

- There are no major roads or places of residence within a 480m buffer of the wind turbine structures. The significance of shadow flicker is therefore anticipated to be **low** to **negligible**.

- The anticipated impact of lighting at the WF is likely to be of **moderate** significance, and may be mitigated to **low**.

- The anticipated visual impact resulting from the construction of ancillary infrastructure is likely to be of **low** significance both before and after mitigation.

- The anticipated visual impact of the proposed WF on the regional visual quality, and by implication, on the sense of place, is generally expected to be of **moderate** significance. This is due to the relatively low viewer incidence within close proximity to the proposed development site and the presence of the existing mining activities and electricity infrastructure.

- The anticipated cumulative visual impact of the proposed WFs is expected to be of **moderate** significance. This is once again due to the relatively low viewer incidence within close proximity to the proposed development sites and the presence of the existing mining activities and electricity infrastructure.

The anticipated visual impacts listed above (i.e. post mitigation impacts) range from **high** to **low** significance. Anticipated visual impacts on sensitive visual receptors in close proximity to the proposed facility remain high, but are, nonetheless not considered to be fatal flaws for the proposed WF.

Considering all factors, it is recommended that the development of the facility as proposed be supported, subject to the implementation of the recommended mitigation measures (**Section 6.11.**) and management programme (**Section 10.**).

Where sensitive visual receptors are likely to be affected (i.e. residents of homesteads and settlements in close proximity), it is recommended that the developer enter into negotiations regarding the potential screening of visual impacts at the receptor site. This may entail the planting of vegetation, trees or the construction of screens. Ultimately, visual screening is most effective when placed at the receptor itself.

10. MANAGEMENT PROGRAMME

The following management plan tables aim to summarise the key findings of the visual impact report and suggest possible management actions in order to mitigate the potential visual impacts.

(Refer to tables overleaf).

Table 10: Management programme – Planning.

OBJECTIVE: The mitigation and possible negation of visual impacts associated with the planning of the proposed Namas Wind Farm.		
Project Component/s	The WF and ancillary infrastructure (i.e. turbines, access roads, substation and workshop).	
Potential Impact	Primary visual impact of the facility due to the presence of the turbines and associated infrastructure as well as the visual impact of lighting at night.	
Activity/Risk Source	The viewing of the above mentioned by observers on or near the site (i.e. within 5km of the site) as well as within the region.	
Mitigation: Target/Objective	Optimal planning of infrastructure to minimise visual impact.	
Mitigation: Action/control	**Responsibility**	**Timeframe**
Retain and maintain natural and / or cultivated vegetation immediately adjacent to the development footprint.	Project proponent/ design consultant	Early in the planning phase.
Make use of existing roads wherever possible and plan the layout and construction of roads and infrastructure with due cognisance of the topography to limit cut and fill requirements.	Project proponent/ design consultant	Early in the planning phase.
Plan all roads, ancillary buildings and ancillary infrastructure in such a way that clearing of vegetation is minimised. Consolidate infrastructure and make use of already disturbed sites rather than undisturbed areas.	Project proponent/ design consultant	Early in the planning phase.
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 WF and the ancillary infrastructure. The following is recommended: o Limit aircraft warning lights for the proposed WF to the turbines on the perimeter, thereby reducing the overall requirement (CAA regulations/conditions permitting). o Investigate aircraft warning lights that only activate when an aircraft is detected. o Shield the sources of light by physical barriers (walls, vegetation, or the structure itself). o Limit mounting heights of fixtures, or use foot-lights or bollard lights; o Make use of minimum lumen or wattage in fixtures o Making use of down-lighters or shielded fixtures. o Make use of Low Pressure Sodium lighting or other low impact lighting. o Make use of motion detectors on security lighting, so allowing the site to remain in darkness until lighting is required for security or maintenance purposes.	Project proponent / design consultant	Early in the planning phase.
Performance Indicator	Minimal exposure (limited or no complaints from I&APs) of ancillary infrastructure and lighting at night to observers on or near the site (i.e. within 5km) and within the region.	

Monitoring	Not applicable.

Table 11: Management programme – Construction.

OBJECTIVE: The mitigation and possible negation of visual impacts associated with the construction of the proposed Namas Wind Farm.		
Project Component/s	Construction site and activities	
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.	
Mitigation: Target/Objective	Minimal visual intrusion by construction activities and intact vegetation cover outside of immediate construction work areas.	
Mitigation: Action/control	**Responsibility**	**Timeframe**
Ensure that vegetation is not unnecessarily cleared or removed during the construction phase.	Project proponent / contractor	Early in the construction phase.
Reduce the construction phase through careful logistical planning and productive implementation of resources.	Project proponent / 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.	Project proponent / 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.	Project proponent / 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.	Project proponent / 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).	Project proponent / contractor	Throughout the construction phase.
Restrict construction activities to daylight hours in order to negate or reduce the visual impacts associated with lighting.	Project proponent / contractor	Throughout the construction phase.
Rehabilitate all disturbed areas, construction areas, servitudes etc. immediately after the completion of construction works. If necessary, an ecologist should be consulted to assist or give input into rehabilitation specifications.	Project proponent / 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 12: Management programme – Operation.

OBJECTIVE: The mitigation and possible negation of visual impacts associated with the operation of the proposed Namas Wind Farm.		
Project Component/s	The WF and ancillary infrastructure (i.e. turbines, access roads, substation and workshop).	
Potential Impact	Visual impact of facility degradation (including operational wind turbines) and vegetation rehabilitation failure.	
Activity/Risk Source	The viewing of the above mentioned by observers on or near the site.	
Mitigation: Target/Objective	Well maintained and neat facility.	
Mitigation: Action/control	**Responsibility**	**Timeframe**
Maintain the general appearance of the facility as a whole, including the turbines, servitudes and the ancillary buildings.	Project proponent / operator	Throughout the operation phase.
Maintain roads and servitudes to forego erosion and to suppress dust.	Project proponent / operator	Throughout the operation phase.
Monitor rehabilitated areas, and implement remedial action as and when required.	Project proponent / operator	Throughout the operation 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 13: Management programme – Decommissioning.

OBJECTIVE: The mitigation and possible negation of visual impacts associated with the decommissioning of the proposed Namas Wind Farm.		
Project Component/s	The WF and ancillary infrastructure (i.e. turbines, access roads, substation and workshop).	
Potential Impact	Visual impact of residual visual scarring and vegetation rehabilitation failure.	
Activity/Risk Source	The viewing of the above mentioned by observers on or near the site.	
Mitigation: Target/Objective	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 turbines, substation, ancillary buildings, masts etc.	Project proponent / operator	During the decommissioning phase.
Rehabilitate access roads and servitudes not required for the post-decommissioning use of the site. If necessary, an ecologist should be consulted to give input into rehabilitation specifications.	Project proponent / operator	During the decommissioning phase.
Monitor rehabilitated areas quarterly for at least a year following decommissioning, and implement remedial action as and when required.	Project proponent / 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.	

11. REFERENCES/DATA SOURCES

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