VISUAL IMPACT ASSESSMENT FOR THE PROPOSED TAAIBOS NORTH WIND ENERGY FACILITY, NORTHERN CAPE, SOUTH AFRICA

IMPACT ASSESSMENT PHASE

PREPARED BY:

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PREPARED FOR:

CES - Environmental and social advisory services

DATE:

October 2022

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DOCUMENT CONTROL

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DECLARATION

I, **Tosca de Villiers**, as an independent consultant compiled this Visual Impact Assessment and declare that it correctly reflects the findings made at the time of the report's compilation. I further declare that I, act as an independent consultant in terms of the following:

- Do not have any financial interest in the undertaking of the activity, other than remuneration for the work performed in terms of the National Environmental Management Act, 1998 (Act107 of 1998);
- Undertake to disclose, to the competent authority, any material information that has or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan or document required in terms of the National Environmental Management Act,1998 (Act 107 of 1998);
- Based on information provided to me by the project proponent, and in addition to information obtained during the course of this study, will present the results and conclusion within the associated document to the best of my professional judgement.

_____

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1. INTRODUCTION

This visual impact assessment (VIA) report forms part of the scoping and environmental impact assessment for the Proposed Taaibos North Wind Energy Facility in the Northern Cape Province.

This VIA has been compiled for inclusion in the environmental impact report (EIR) following the approval of the Scoping report.

1.1. QUALIFICATION AND EXPERIENCE OF THE PROFESSIONAL TEAM

Nuleaf Planning and Environmental (Pty) Ltd, specialising in Visual Impact Assessments, undertook the visual assessment for the proposed development.

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.

Nuleaf Planning and Environmental have been appointed as an independent specialist consultant to undertake the visual impact assessment. Neither the author, nor Nuleaf Planning and Environmental will benefit from the outcome of the project decision-making.

1.2. LEGAL FRAMEWORK

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

- The Environmental Impact Assessment Amendment Regulations, 2017;
- Guideline on Generic Terms of Reference for EAPs and Project Schedules (DEADP, Provincial Government of the Western Cape, 2011).
- Guideline for Involving Visual and Aesthetic Specialists in EIA Processes (DEADP, Provincial Government of the Western Cape, 2005).

1.3. INFORMATION BASE

This assessment was based on information from the following sources:

- Topographical maps and GIS generated data were sourced from the Surveyor General, Surveys and Mapping in Mowbray, Cape Town, as well as, the Japan Aerospace Exploration Agency (JAXA), Earth Observation Research Centre, in the form of the ALOS Global Digital Surface Model "ALOS World 3D - 30m" (AW3D30) elevation model.;
- Observations made and photographs taken during site visits;
- Professional judgement based on experience gained from similar projects; and
- Literature research on similar projects.

1.4. ASSUMPTIONS AND LIMITATIONS

This Report has been prepared by Nuleaf on behalf, and at the request, of CES to provide them with an independent specialist assessment and review. Unless otherwise agreed by Nuleaf in writing, Nuleaf does not accept responsibility or legal liability to any person other than the CES for the contents of, or any omissions from, this Report.

To prepare this Report, Nuleaf utilised only the documents and information provided by CES or any third parties directed to provide information and documents by CES. Nuleaf has not consulted any other documents or information in relation to this Report, except where otherwise indicated. The findings, recommendations and conclusions given in this report are based on the author's best scientific and professional knowledge, as well as, the available information. This report is based on survey and assessment techniques which are limited by time and budgetary constraints relevant to the type and level of

investigation undertaken. Nuleaf and its staff reserve the right to modify aspects of the report including the recommendations if and when new information may become available from on-going research or further work in this field, or pertaining to this investigation.

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This report must not be altered or added to without the prior written consent of the author. This also refers to electronic copies of this report which are supplied for the purposes of inclusion as part of other reports. Similarly, any recommendations, statements or conclusions drawn from or based on this report must make reference to this report. If this report is used as part of a main report, the report in its entirety must be included as an appendix or separate section to the main report.

This assessment was undertaken during the planning stage of the project and is based on information available at that time. It is assumed that all information regarding the project details provided by CES and the Applicant is correct and relevant to the proposed project. This Visual Impact Assessment and all associated mapping has been undertaken according to the worst-case scenario.

1.5. 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 project 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 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 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

Table 1: Level of confidence

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 Moderate to High:

[1] Adapted from Oberholzer (2005).

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

2. 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 development. A detailed Digital Terrain Model (DTM) for the study area was created from topographical data provided by the Japan Aerospace Exploration Agency (JAXA), Earth Observation Research Centre, in the form of the ALOS Global Digital Surface Model "ALOS World 3D - 30m" (AW3D30) elevation model.

The approach utilised to identify potential issues related to the visual impact included the following activities:

- Undertaking a site visit;
- The creation of a detailed digital terrain model (DTM) of the potentially affected environment;
- The sourcing of relevant spatial data. This includes cadastral features, vegetation types, land use activities, topographical features, site placement, etc.;
- The identification of sensitive environments upon which the proposed Taaibos North Wind Energy Facility (WEF) could have a potential visual impact;
- The creation of viewshed analyses from the proposed amended 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.
- A cumulative viewshed analysis in order to determine the potential cumulative exposure (visibility) of the proposed Taaibos North WEF together with any other WEF's proposed or already constructed in the region.

This report (visual impact assessment) sets out to identify and quantify the possible visual impacts related to the proposed Taaibos North Wind Energy Facility (WEF), as well as, offer potential mitigation measures, where required. The methodology as described below has been followed for the assessment of visual impact.

UNDERTAKE A SITE VISIT

A site visit was undertaken in order to verify the results of the spatial analyses and to identify any additional site-specific issues that may need to be addressed in the VIA report. The season was not a consideration, nor had any effect on the carrying out of the visual assessment. A photographic survey was made of the site and surrounding potentially affected area from several selected viewpoints. The site visit was undertaken on the 02-03 April 2022.

DETERMINE THE POTENTIAL VISUAL EXPOSURE

The visibility or visual exposure of any development is the point of departure for the visual impact assessment. It stands to reason that if the proposed development were not visible, no impact would occur.

The viewshed analyses of the proposed facility and the related infrastructure are based on a 30m resolution AW3D30 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 THE VISUAL DISTANCE AND OBSERVER PROXIMITY

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

Proximity radii for the proposed alignment corridors are created in order to indicate the scale and viewing distance of the development and to determine the prominence thereof in relation to their environment.

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

DETERMINE VIEWER INCIDENCE, PERCEPTION AND SENSITIVITY

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

This is the capacity of the receiving environment to absorb the potential visual impact of the proposed development. The digital terrain model utilised in the calculation of the visual exposure of the development 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 and other landscape characteristics.

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 discernible detail in visual characteristics of both environment and structure decreases.

DETERMINE THE VISUAL IMPACT INDEX OF THE PROPOSED DEVELOPMENT

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 THE 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.

FORMULATION OF MITIGATION MEASURES

Recommendation of mitigation measures (if possible) to avoid or minimise potential negative visual impacts of the proposed development, for inclusion in the EMPr and authorisation conditions.

3. PROJECT DESCRIPTION

The Applicant is proposing the establishment of a cluster of five (5) Wind Energy Facilities (WEF's) and associated infrastructure, consisting of 20-40 turbines each to generate approximately 270 Megawatts (MW) of renewable energy per facility. The Taaibos North WEF forms part of this cluster. The site is located approximately 50km south west of Victoria West in the Ubuntu Local Municipality in the Northern Cape Province. As such the project is collectively referred to as the **Victoria West WEFs** and it is located within an area of interest of 5000-6000 Ha.

A WEF generates electricity by means of wind turbine generators (WTG) that harness the wind of the area as a renewable source of energy. Wind energy generation, or wind farming as it is commonly referred to, is generally considered to be an environmentally friendly electricity generation option. In order to optimise the use of the wind resource and the amount of power generated by the facility, the number of wind turbines erected in the area, as well as, the careful placement of the turbines in relation to the topography must be considered.

Each wind turbine is expected to consist of a concrete foundation, a steel tower, a hub and three turbine blades attached to the hub as illustrated in Figure 1. The approximate hub height is expected to be 150m per wind turbine. Variations of the above dimensions may occur, depending on the preferred supplier or commercial availability of wind turbines at the time of construction.

Ancillary infrastructure associated with the WEFs may include the following:

- Cabling between the project components, to be lain underground where practical;
- A Grid connection for the evacuation of power (at the time of writing this report no grid connection location had been established, therefore it has not been assessed);
- Internal access roads; and
- A workshop area for maintenance and storage (existing buildings located on the site will be utilised)

The construction phase of the proposed facility is expected to be 1-5 years, whilst the lifespan of the facility is approximated at 20 to 30 years.

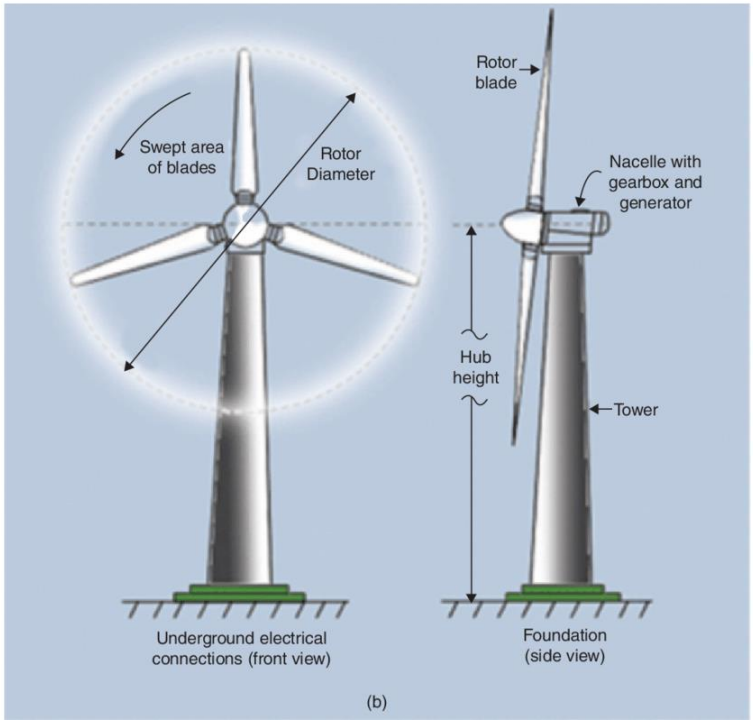


Figure 1: Illustration of the main components of a wind turbine[2]

Each wind turbine is expected to consist of a concrete foundation, a steel tower, a hub (placed at up to 200m above ground level) and three turbine blades attached to the hub as illustrated in Figure 1. The rotor diameter is expected to be 240m, culminating in an overall height of 320m (maximum blade tip height) per wind turbine. Variations of the above dimensions may occur, depending on the preferred supplier or commercial availability of wind turbines at the time of construction.

[2] Illustration courtesy of Charlier, R & Thys, A. (2016). Wind Power—Aeole Turns Marine. 10.1002/9781119066354.ch7.

Component	Info
Rotor diameter	240m max
Hub height	Up to 200m max
Blade tip height	320m max
Number of wind turbines	40 max
Total WEF capacity	270MW max

Table 2: Specifications of the proposed WTG as provided by the Applicant

Ancillary infrastructure associated with the Taaibos North WEF may include the following:

- Laydown areas
- Battery energy storage systems (BESS)
- 33/132kV substation
- Offices and parking
- Collector substation
- 132kV Overhead Powerline;
- Cabling between the project components, to be lain underground where practical;
- Internal access roads;

The construction phase of the proposed facility is expected to be to be between 18 and 24 months, whilst the lifespan of the facility is approximated at 20 to 30 years.

4. SCOPE OF WORK

During the Scoping Phase (i.e. first phase of the assessment) the scope of work included:

- Creation a detailed Digital Terrain Model (DTM) for the potentially affected environment. This constituted the study area and area of analysis for the subsequent VIA (this report).
- Sourcing of relevant spatial data. This included cadastral features, land use categories, natural and topographical features, site placement, design, etc.
- Identification of sensitive environments or areas upon which the activities/infrastructure could have a potential visual impact. Critical areas were highlighted during this phase. These would be identified through, mainly (but not restricted to), the inputs from interested and affected parties.
- Undertake viewshed analyses from proposed site placement or alternatives in order to determine the visual exposure. The viewshed analyses will take into account the dimensions of the relevant structures.
- Stipulate the potential visual impacts of the project and identify issues related to the visual impact that should be addressed during the visual impact assessment phase.
- Make recommendations to inform the design process or alternative selection.
- Provide a Plan of Study for the VIA to be undertaken during the EIA phase of the project.

During the Impact Assessment Phase (i.e. second phase of the assessment) issues that weren't resolved during scoping phase and that require further investigation are taken forward. 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 visual impact will be determined for the highest impact-operating scenario (worst-case scenario) and varying climatic conditions (i.e. different seasons, weather conditions, etc.) will not be considered.

The scope of work for this report 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 Taaibos North WEF. Mitigation measures are recommended where appropriate. Anticipated issues related to the potential visual impact of the proposed WEF include the following:

- Potential visual impacts associated with the construction phase on observers in close proximity to the proposed WEF.

- The Potential visual impact on sensitive visual receptors in close proximity to the proposed Taaibos North WEF.
- The Potential visual impact on sensitive visual receptors in the region.
- The potential visual impact of operational, safety and security lighting of the facility at night in terms of light glare, light trespass and sky glow.
- The visibility of the proposed Taaibos North WEF to, and potential visual impact on, users of arterial and secondary roads.
- The potential visual impact of shadow flicker.
- The potential visual impact of the proposed infrastructure on the visual quality of the landscape and sense of place of the region.
- Potential residual visual impacts after the decommissioning of the proposed Taaibos North WEF.
- The potential cumulative visual impacts of the facility and ancillary infrastructure within the study area.
- 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.

5. THE AFFECTED ENVIRONMENT

Regionally, the proposed site for the proposed Taaibos North WEF is located approximately 50km south west of Victoria West and 20km south east of Loxton in the Northern Cape Province and some 80km north of Beaufort West in the Western Cape. The Taaibos area of focus boarders on the Northern Cape and Western Cape provincial boundary.

The study area occurs on land that ranges in elevation from about 1050m above sea level (a.s.l.) to about 1850m a.s.l. in the Kwaggashoogte mountains occurring on Taaibos North. Refer to **Map 1** for a shaded relief map of the study area.

The topography consists of flats and gently sloping plains interspersed with hills and rocky areas. These hills form part of the Kwaggahoogte and Wolweberge respectively.

Figure 2: General terrain morphology- flats and sloping plains

The broader study area is situated predominately within the Eastern Upper Karoo vegetation type.

Land cover consists primarily of low shrubland (concentrated in the southern portion of Soutrivier), interspersed with naturally occurring bare rock and soil (concentrated in the northern portion of Soutrivier, as well as, scattered across Taaibos). Refer to **Map 2** for the land cover map of the study area.

Figure 3: General landscape and low shrubland vegetation

This semi-arid Central Karoo region receives approximately 275mm of precipitation per annum and is therefore greatly devoid of any rain fed agriculture or cultivation. Sheep, goat and game farming occur predominately throughout the region.

The site location can be described as remote due to its considerable distance from any major metropolitan centres or populated areas. The study area is sparsely populated (approximately 1,4 persons per km2), with the highest concentration of people living in towns such as Victoria West and to a lesser extent Loxton.

A number of homesteads and settlements are present within the study area. These include Ramfontein, Lakenvlei, Slangfontein, Erasmuskraal, Altona, Quaggasfontein, Spes Bona, Taaiboschfontein, Schimmelfontein, Bitterwater, Boshoek, Slypfontein, Oppermanskraal, Soutrivier, Stampfontein, Liebenbergsdam, Steoifontein, Bonnievale, Boschrug, Buffelshoek, Blindefontein, Drupfontein and Grootfontein which all occur within a 5km radius of the proposed facilities.

Figure 4: Example of the type of homestead found in the area

It is uncertain whether all of the potentially affected farmsteads are inhabited or not. It stands to reason that the farmsteads that are not currently inhabited will not be visually impacted upon at present. These farmsteads do, however retain the potential to be affected visually should they ever become inhabited again in the future. For this reason, the author of this document operates under the assumption that they are all inhabited.

The N12, R63 and R381 are the national and main arterial roads bordering the proposed Taaibos and Soutrivier areas, these roads a regional connector leading to Victoria West, Beaufort West and Loxton respectively. The N12, located to the east of the study area is the main route from Johannesburg to Cape Town, via Kimberley. Other than these main roads, a limited number of secondary roads cross the study area.

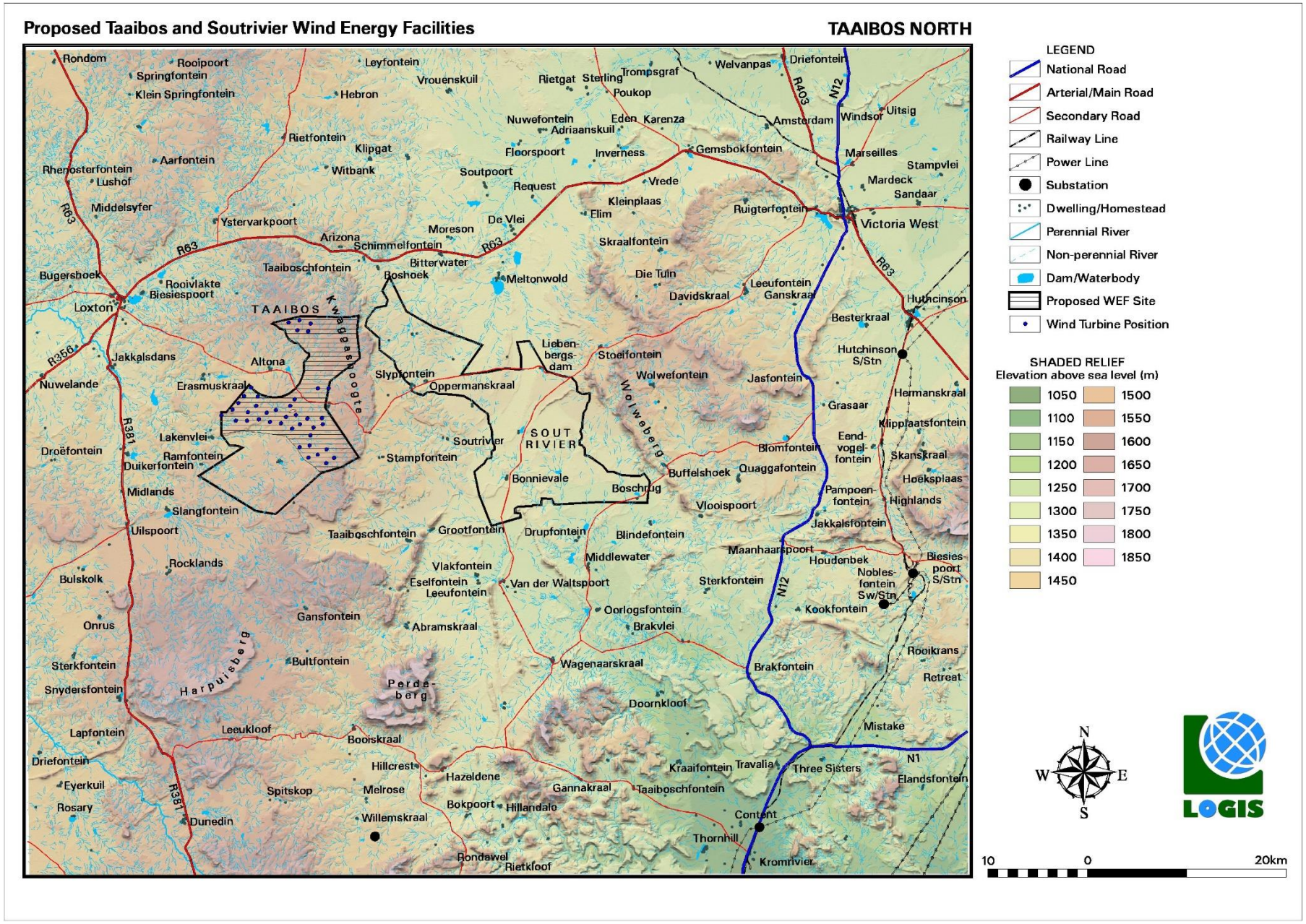
Figure 5: View of the site from the R381

There are no formally protected or conservation areas present within the study area, but the greater environment has a vast, undeveloped and rugged character. Settlements, where these occur, are very limited in extent and domestic in scale.

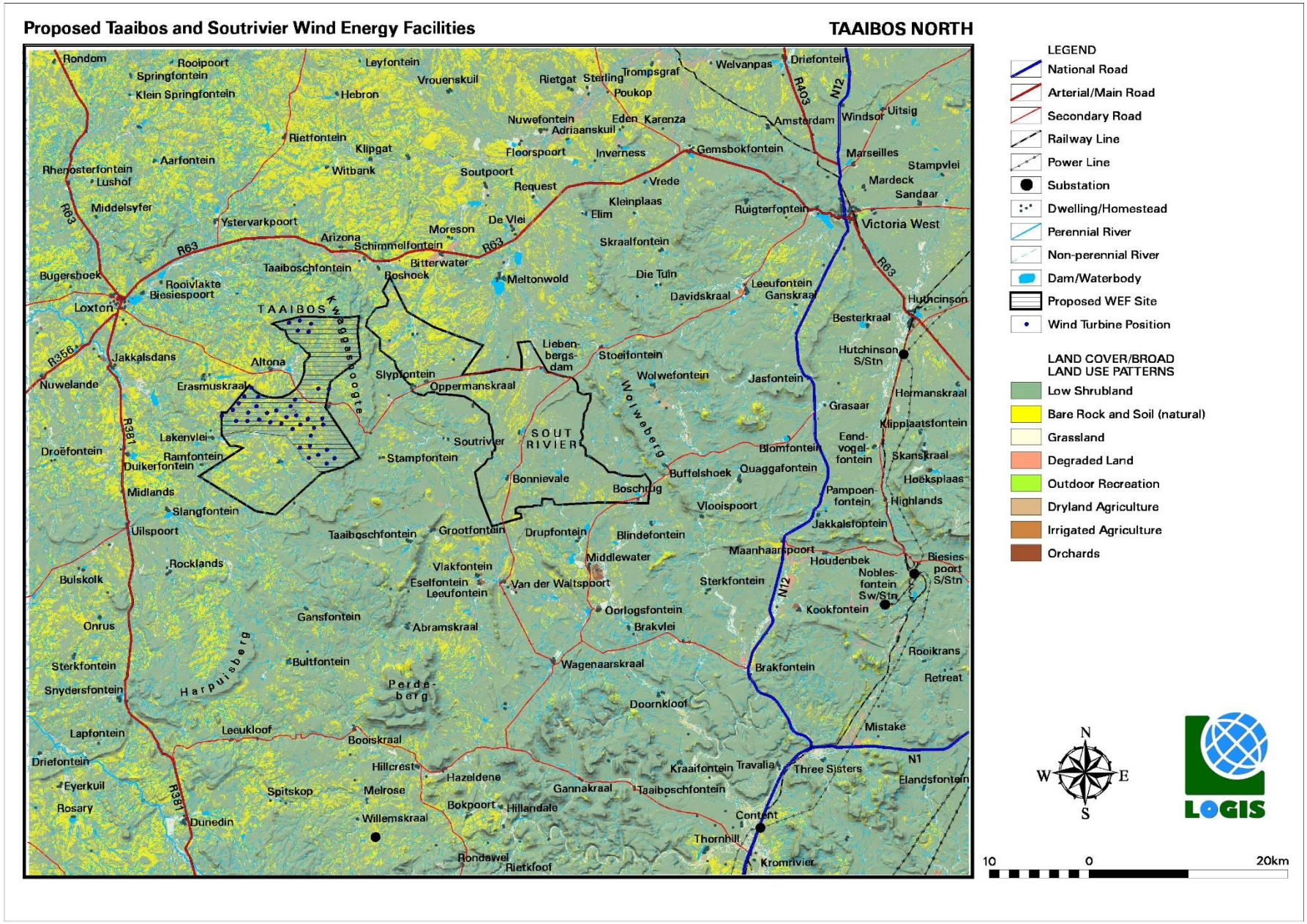
The greater environment with its wide open, undeveloped landscapes is considered to have a high visual quality.

This study area is not known as a tourist destination, but the various connectors discussed above do give access to the area between Kimberly, Garden Route and Cape Town, the area is also famously known as the major wool-producing and largest garlic-producing areas in South Africa.

Figure 6: View of the site from the secondary road in the west and the extreme isolation



Map 1: Shaded relief map of the study area



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

6. VIEWSHED ANALYSIS

6.1. VISUAL DISTANCE AND OBSERVER PROXIMITY

Nuleaf Planning and Environmental determined proximity offsets based on the anticipated visual experience of the observer over varying distances. In general, the severity of the visual impact on visual receptors decreases with increased distance from the proposed infrastructure. Therefore, 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 WEF. Proximity offsets for the proposed development footprint are thus established 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.

These proximity offsets are 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). This rationale was developed in the absence of any known and/or acceptable standards for South African WEFs. Therefore, for the purpose of this study, proximity offsets have been calculated from the expected boundary of the site, as indicated on **Map 3** and as follows:

- 0 – 5km. Short distance view where the facility would dominate the frame of vision and constitute a very high visual prominence.
- 5 - 10km. Short to medium distance view where the structures would be easily and comfortably visible and constitute a high to moderate visual prominence.
- 10 - 20km. Medium to long distance view where the facility would become part of the visual environment, but would still be visible and recognisable. This zone constitutes a moderate visual prominence.
- > 20km. 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.

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

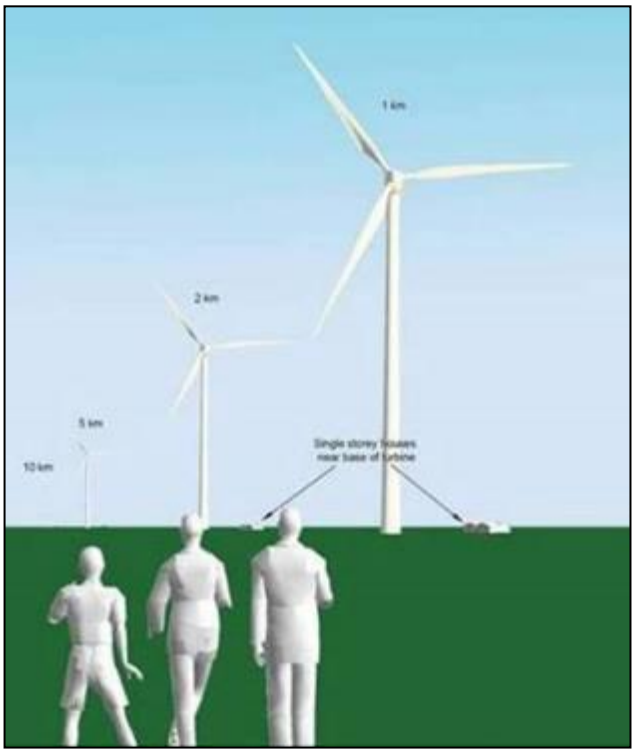
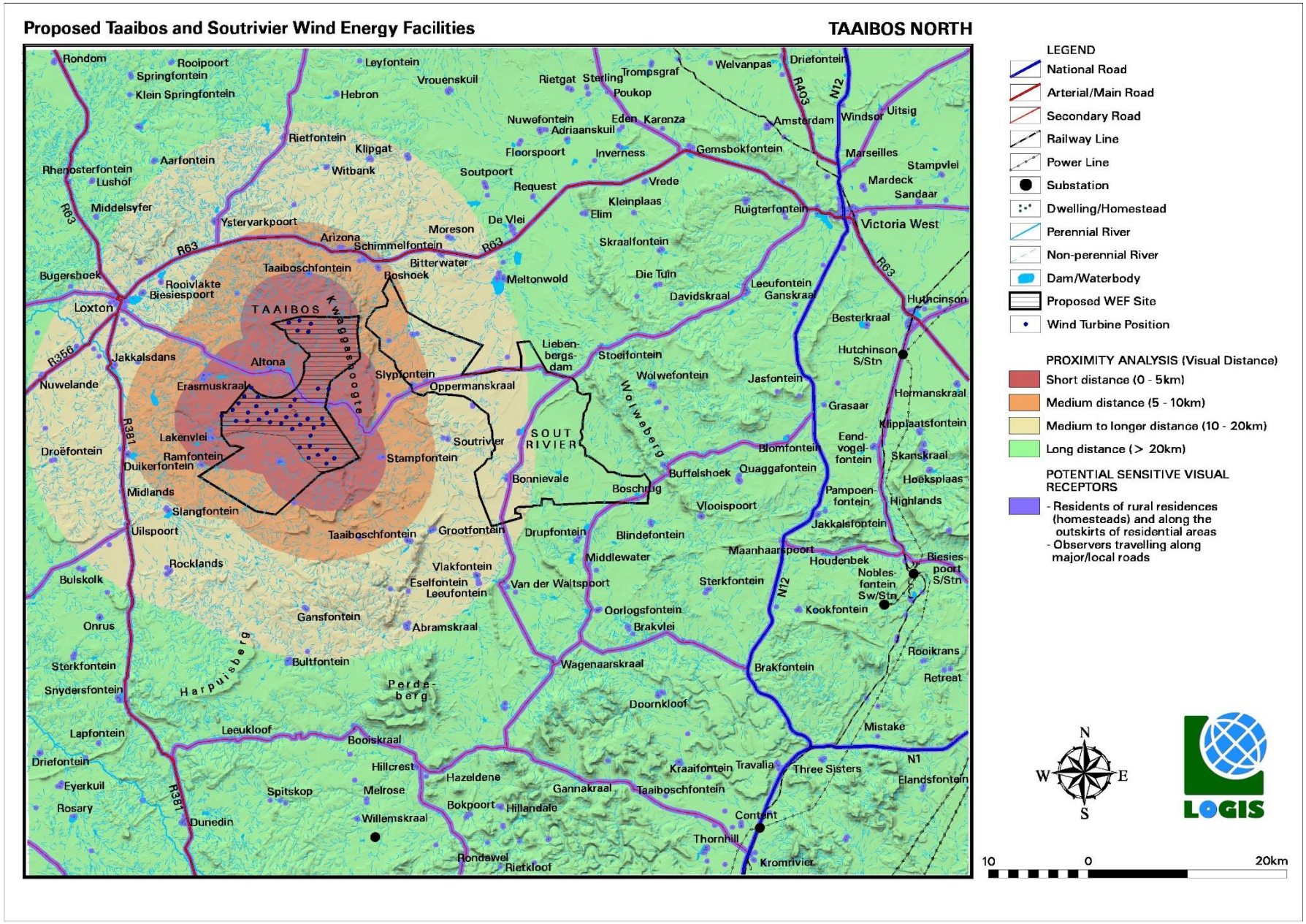


Figure 7: Visual experience of a 100m high wind turbine structure at a distance of 1km, 2km, 5km and 10km



Map 3: Visual proximity analysis, observer sensitivity and proximity of the proposed Taaibos North WEF

6.2. VIEWER INCIDENCE, PERCEPTION AND SENSITIVITY

Since the number of potential sensitive receptors and their perception of the development in question ultimately determines the concept of a visual impact (i.e. without receptors there would be no impact), the visual distance theory and the receptors proximity to the development works hand in hand, and is especially relevant, when considered from areas with a high viewer incidence and a potentially negative visual perception of the proposed facility. 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 Taaibos North WEF.

Homesteads, by virtue of their visually exposed nature, are considered to be sensitive visual receptors. Viewer incidence is calculated to be the highest for homesteads within the areas closest to the facility. Second to these are the users along the provincial and secondary roads within the study area. Commuters and possible tourists using these roads may be negatively impacted upon by visual exposure to the proposed infrastructure should they find themselves in the region.

Residential receptors in natural contexts are more sensitive than those in more built-up contexts, due to the absence of visual clutter in these undeveloped and undisturbed areas. Receptors within built up areas are less sensitive to potential visual impact due to the presence of structures, infrastructure and general visual clutter. Those dwelling on the periphery may be more aware of visual intrusion and may thus be considered somewhat more sensitive.

No specific report can be made on viewer perception regarding the proposed Taaibos North WEF, as no reported stakeholder feedback has been received by the specialist. However, considering the proximity of the proposed facilities to various homesteads and the rural nature of the surrounding area, it is expected that any potential visual impact would be viewed in a negative light. Therefore, overall viewer perception of receptors within the study area will be assumed to be mostly negative.

It must be noted that while some sensitive receptors are identified based on homestead locations it is understood that the residents of these homesteads are not necessarily stationary at these identified points and that often these homesteads are associated with much larger properties or farms. Therefore, where these properties fall within the potential visual exposure it is assumed that the residents of these homesteads and any associated visitors to these homesteads will likely experience a visual impact as a result of the proposed development beyond the bounds of their homesteads. The potential sensitive visual receptors[3] within a 5km, 10km and 20km radius as identified on **Map 3** are as follows:

- < 5km – Short Distance

  Residents of homesteads, namely Altona, Erasmuskraal, Taaiboschfontein, Stampfontein and Lakenvlei as well as, observers travelling along the secondary road that bisects the site.

  It should be noted that Altona and Lakenvlei are located within the affected farm portions earmarked for the proposed development. Stampfontein is also located within farm portions earmarked for the proposed WEF developments associated with the collective Victoria West WEF.

- 5- 10km – Short to Medium Distance

  Residents of rural homesteads namely Arizona, Schimmelfontein, Boshoek, Slypfontein, Taaiboschfontein, Ramfontein and unknown residences to the east. Observers travelling along the various secondary roads and the R63 located to the north.

  It should be noted that Boshoek and Slypfontein are located within farm portions earmarked for the proposed WEF developments associated with the collective Victoria West WEF.

- 10 - 20km – Medium to Long Distance

  Residents of numerous rural homesteads namely Rietfontein, Klipgat, Witbank, Ystervarkpoort, Moreson, Bitterwater, Meltonwold, Soutrivier, Bonnievale, Grootfontein, Vlakfontein, Eselfontein, Leeufontein, Gansfontein, Abramskraal,

[3] The names listed here are of the homestead or farm dwelling as indicated on the SA 1: 50 000 topographical maps and do not refer to the registered farm name.

Rocklands, Uilspport, Slangfontein, Droefontein, Duikerfontein, Nuwelande, Jakkalsdans, Rooivlakte and Biesiespoort, as well as, the town of Loxton and observers travelling along the arterial R63, R356 road and various secondary roads.

It should be noted that Soutrivier and Bonnievale are located within farm portions earmarked for the proposed WEF developments associated with the collective Victoria West WEF.

6.3. VISUAL ABSORPTION CAPACITY

Visual Absorption Capacity (VAC) is the capacity of the receiving environment to absorb the potential visual impact of the proposed development. 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.

Since the land cover within the study area consists primarily of low shrubland and bare soil, overall, the VAC of the receiving environment of the Taaibos North WEF is deemed to be low by virtue of the low growing nature of the vegetation, as well as, the generally rural nature of the study area.

The VAC would also be high where the environment can readily absorb the development in terms of texture, colour, form and light / shade characteristics. On the other hand, the VAC for a development contrasting markedly with one or more of the characteristics of the environment would be low. Since the significant height of WTG's adds to the potential visual intrusion of the WEF in the landscape and against the background of the horizon, 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, therefore VAC in this case would be considered low.

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

As a result of the low growing nature of the vegetation, the high elevated placement of the WTG's and the high contrast of the WTGs with the surrounding receiving environment VAC will not be taken into account for the visual impact assessment of the Taaibos North WEF thereby representing the worst-case scenario.

6.4. POTENTIAL VISUAL EXPOSURE

The result of the viewshed analysis for the proposed Taaibos North WEF is shown on **Map 4** that follows. The analysis has been undertaken from each proposed turbine position as indicated within the proposed development areas in order to determine the general visual exposure (visibility) of the area under investigation. A height of 320m was used in order to illustrate the anticipated visual exposure of the wind turbines (i.e., the approximate maximum tip height of the proposed wind turbines). Typically, structures of this height (i.e., 320m) may be visible from up to 20km away. In this respect, the anticipated Zone of Visual Influence for this facility as calculated from the development footprint (i.e., determined from the edge of the outer most turbines) has been indicated at 20km. The extent of visual exposure within this zone is very high.

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 WEF, whilst lower lying areas such as valleys are shielded, or not as exposed.

The viewshed analysis does not include the effect of vegetation cover or existing structures on the exposure of the proposed facility, therefore signifying a worst-case scenario. **Map 4** indicates areas from which any number of turbines could potentially be visible as well as proximity offsets from the proposed development area. The following is an overview of the findings of the viewshed, based on the layout illustrated on the Map provided:

- The proposed facility will have a large core area of potential visual exposure on the project site itself, and within a **5km** radius thereof. Increased frequency of exposure is likely to be experienced on top of the plateau of the Kwaggasboogte themselves with reduced frequency to the far north and east in the valleys.

  Potential sensitive visual receptors within this visually exposed zone include observers travelling along the various secondary roads that bisects the site. Additionally, residents of the following rural homestead are likely to be affected:

- Taaibosfontein
- Altona
- Erasmuskraal
- Spes Bona
- Lakenvlei
- Stampfontein
- Quaggasfontein
- Ramfontein

- Potential visual exposure remains high but scattered in the medium distance (i.e., between **5 and 10km**), with visually screened areas predominantly associated with deeper valleys located beyond undulating hills or ridgelines in the north, east and south east of the site. Increased frequency of exposure is likely to be experienced by higher lying areas in this zone.

  Sensitive visual receptors comprise users of the arterial R63, various secondary roads in the area, as well as, residents of a number of homesteads. Residents of the following rural homestead are likely to be affected:

  - Arizona
  - Schimmelfontein
  - Boshoek
  - Taaibosfontein
  - Suikerkolk
  - Oppermanskraal
  - Slypfontein
  - Duikerfontein
  - Stampfontein
  - Ramfontein

- In the longer distance (i.e. between **10 and 20km** offset), the extent of potential visual exposure becomes fragmented. Visually exposed areas and increased frequency of exposure tend to be concentrated in the higher lying areas in this zone. Visually screened areas can be found to the south and south east owing to the shielding effect of the mountains and ridgelines.

  Sensitive visual receptors include residents of the town of Loxton, observers travelling along portions of the arterial R63 and various secondary roads. In addition, residents of rural homesteads, may be visually exposed. Residents of the following homestead are likely to be affected:

  - Rietfontein
  - Klipgat
  - Witbank
  - Ystervarkpoort
  - Moreson
  - Bitterwater
  - Meltonwold
  - Rooivlakte
  - Biesiespoort
  - Burgershoek
  - Suikerkolk
  - Jakkalsdans
  - Nuwelande
  - Oppermanskraal
  - Soutrivier
  - Duikerfontein
  - Droëfontein
  - Bonnievale
  - Midlands
  - Slangfontein

- Uilspoort
- Grootfontein
- Taaiboschfontein
- Rocklands
- Vlakfontein
- Leeufontein
- Gansfontein
- Bultfontein

- Beyond the **20km** offset from the proposed site, potential sensitive visual receptors are not likely to be visually exposed to the proposed facility, despite lying within the viewshed.

  Sensitive visual receptors comprise residents of the following rural homesteads:

  - Rondom
  - Driefontein
  - Rooipoort
  - Trompsgraf
  - Welvanpas
  - Leyfontein
  - Springfontein
  - Sterling
  - Rietgat
  - Vrouenskuil
  - Poukop
  - Hebron
  - Klein Springfontein
  - Eden
  - Nuwefontein
  - Floorspoort
  - Adriaanskuil
  - Inverness
  - Gemsbokfontein
  - Aarfontein
  - Rhenosterfontein
  - Soutpoort
  - Lushof
  - Request
  - Elim
  - Kleinplaas
  - Middelsyfer
  - De Vlei
  - Skraalfontein
  - Meltonwold
  - Bugershoek
  - Stoeifontein
  - Liebenbergsdam
  - Klipplaatsfontein
  - Quaggafontein
  - Boschrug
  - Highlands
  - Blindefontein
  - Drupfontein
  - Houdenbek
  - Middlewater
  - Bulskolk
  - Van der Waltspoort

- Kookfontein
- Brakvlei
- Wagenaarskraal
- Rooikrans
- Bultfontein
- Brakfontein
- Doornkloof
- Booiskraal
- Melrose
- Willemskraal

In general, the Taaibos North WEF may constitute a high visual prominence, potentially resulting in a high visual impact.

6.5. CUMULATIVE VISUAL ASSESSMENT

Cumulative visual impacts can be defined as the additional changes caused by a proposed development in conjunction with other similar developments or as the combined effect of a set of developments. In practice, the terms 'effects' and 'impacts' are used interchangeably. Cumulative visual impacts may be:

- Combined, where the wind turbines of several WEFs are within the observer's arc of vision at the same time;
- Successive, where the observer has to turn his or her head to see the various WEF's wind turbines; and
- Sequential, when the observer has to move to another viewpoint to see different developments, or different views of the same development (such as when travelling along a route).

The visual impact assessor is required (by the competent authority) to identify and quantify the cumulative visual impacts and to propose potential mitigating measures. This is often problematic as most regulatory bodies do not have specific rules, regulations or standards for completing a cumulative visual assessment, nor do they offer meaningful guidance regarding appropriate assessment methods. There are also not any authoritative thresholds or restrictions related to the capacity of certain landscapes to absorb the cumulative visual impacts of wind turbines.

To complicate matters even further, cumulative visual impact is not just the sum of the impacts of two developments. The combined effect of both may be much greater than the sum of the two individual effects, or even less.

The cumulative impact of the WEF development on the landscape and visual amenity is a product of:

- The distance between individual WEFs (or turbines);
- The distance over which the wind turbines are visible;
- The overall character of the landscape and its sensitivity to the structures;
- The siting and design of the WEFs themselves; and
- The way in which the landscape is experienced.

The specialist is required to conclude if the proposed development will result in any unacceptable loss of visual resource considering all the projects existing and proposed in the area.

Taaibos North WEF addressed in this report is only one component of a larger wind energy cluster consisting of up to five (5) different facilities known as Victoria West Wind Energy Facility.

Map 5 illustrates the anticipated cumulative visual impact of Victoria West WEF and specifically the anticipated frequency of visual exposure. Areas shaded magenta are likely to be exposed to 5 of the facilities; areas shaded in red are likely to be exposed to four of the facilities, orange to 3 of the facilities, yellow to two of the facilities and green to a single facility.

The western portion of the study area, including over the Taaibos WEF's will be predominately be exposed to only two WEF's, while the central portion of the study area, where the Soutrivier WEF's are located, will be exposed to all five proposed facilities. Large portions to the north east, south east and south west will not be exposed to any of the facilities and will be visually screened by the mountains (Wolweberg) and other ridges located within the study area.

The proposed Victoria West WEF, although in line with current development and land use trends in the greater region, will certainly contribute to the increased cumulative visual impact of wind energy facilities in the region, especially considering

its close proximity to the Beaufort West Renewable Energy Development Zone (REDZ) and the already constructed Noblesfontein Wind Farm (located to the east).

Figure 8: View of the existing Noblesfontein Wind Farm located to the east of the proposed Victoria West WEF

Sensitive visual receptors, not involved in the development, who are likely to be negatively affected by the cumulative impact of the Victoria West WEF will include:

- < 5km – Short Distance[4]
    - Observers travelling along portions of the R63 and various secondary roads (1 – 5 WEFs)[5]
    - Residents of the following homesteads:
        - Slangfontein (2 WEFs)
        - Ramfontein (2 WEFs)
        - Erasmuskraal (2 – 5 WEFs)
        - Taaiboschfontein – north (1 – 2 WEFs)
        - Schimmelfontein (3 – 4 WEFs)
        - Stoeifontein (2 – 4 WEFs)

- 5- 10km – Short to Medium Distance
    - Observers travelling along portions of the R63, R381 and various secondary roads (1 – 5 WEFs)
    - Residents of the following homesteads:
        - Van der Waltspoort (2 – 4 WEFs)
        - Vlakfontein (3 – 4 WEFs)
        - Grootfontein (2 WEFs)
        - Leeufontein (3 – 4 WEFs)
        - Taaiboschfontein – south (5 WEFs)
        - Rocklands (2 – 5 WEFs)
        - Uilspoort (2 – 3 WEFs)
        - Midlands (2 WEFs)
        - Duikerfontein (1 – 2 WEFs)
        - Moreson (3 – 4 WEFs)
        - Meltonwold (2 – 5 WEFs)
        - Wolwefontein (1 – 2 WEFs)
        - Quaggafontein (1 – 4 WEFs)

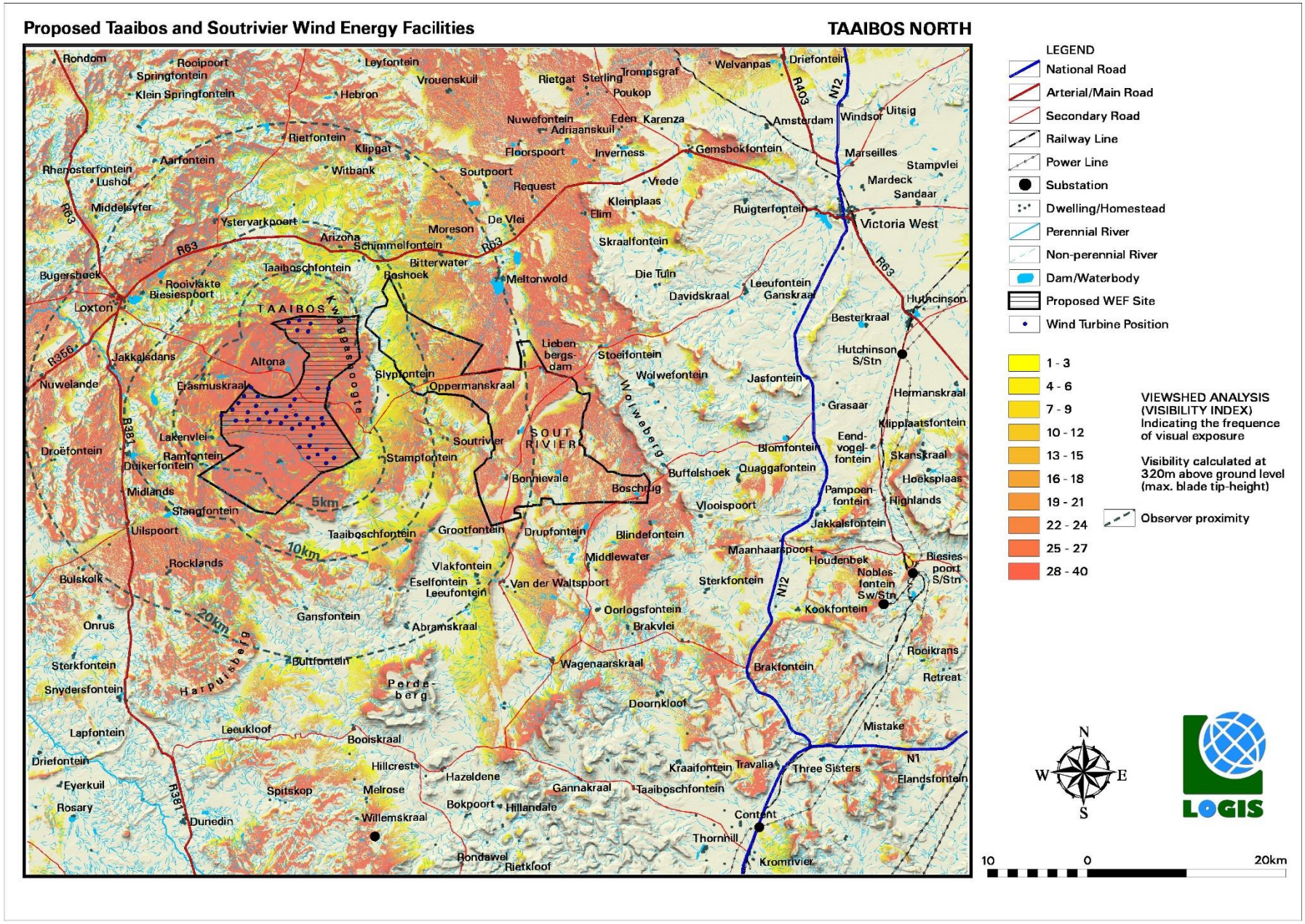
- 10 - 20km – Medium to Long Distance

[4] Distances a determined from the boundary of the proposed development footprint of the whole Victoria West WEF and not the five individual WEFs.
[5] Number of potential WEFs (forming part of the Victoria West WEF cluster only) that may be visible from these sensitive receptors.

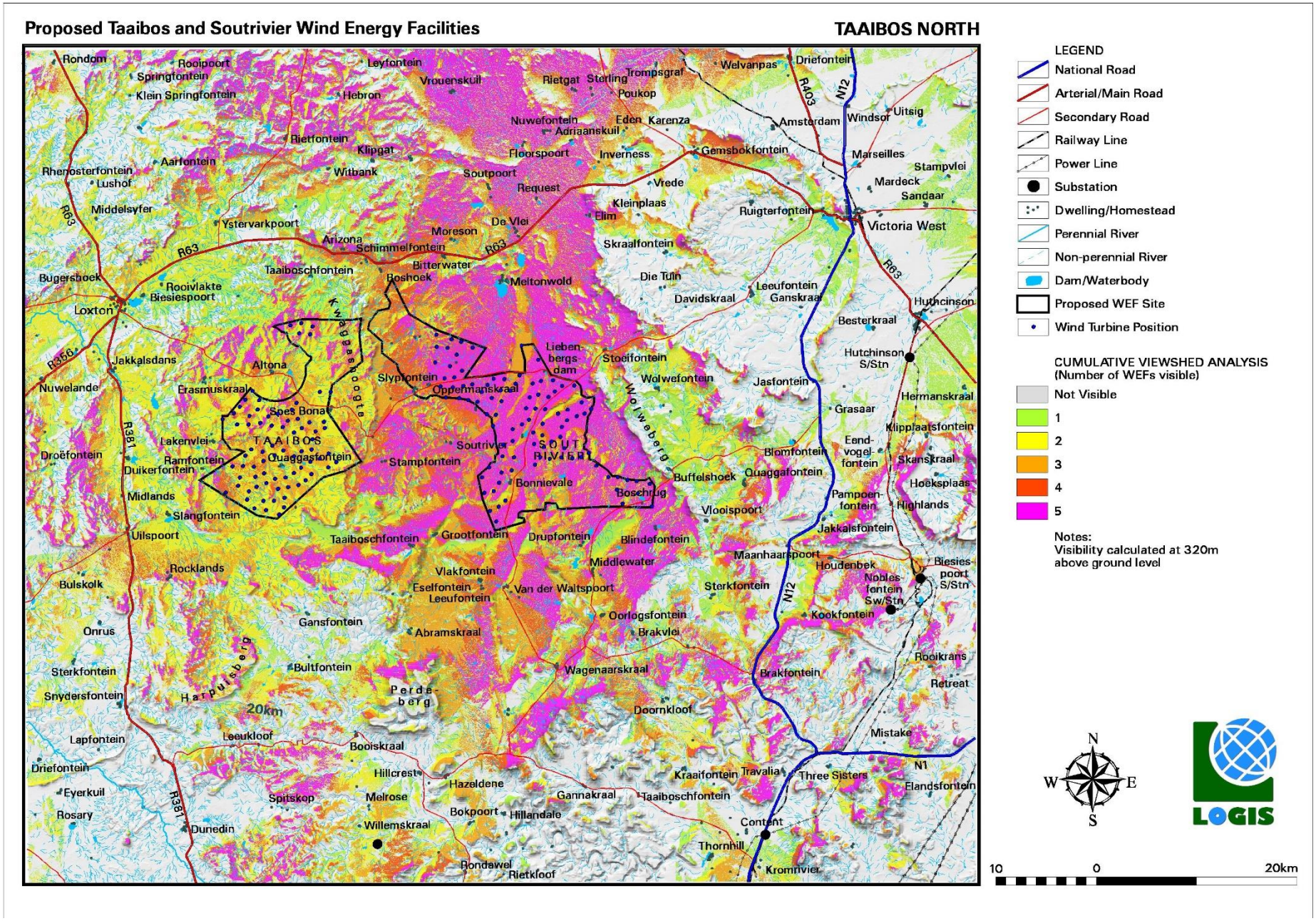
- Observers travelling along portions of the R63, R381, N12 and various secondary roads (1 – 5 WEFs)
- The town of Loxton (1 – 2 WEFs)
- Residents of the following homesteads:
    - Brakvlei (2 – 4 WEFs)
    - Doornkloof (1 WEF)
    - Wagenaarskraal (2 – 4 WEFs)
    - Abramskraal (1 – 3 WEFs)
    - Bultfontein (1 WEF)
    - Gansfontein (1 WEF)
    - Bulskolk (1 – 2 WEFs)
    - Droëfontein (1 – 2 WEFs)
    - Nuwelande (1 – 2 WEFs)
    - Bugershoek (2 – 3 WEFs)
    - Rooivlakte (1 – 2 WEFs)
    - Ystervarkpoort (2 WEFs)
    - Rietfontein (2 – 5 WEFs)
    - Witbank (1 – 2 WEFs)
    - Soutpoort (3 – 5 WEFs)
    - Floorspoort (3 – 5 WEFs)
    - Request (3 – 5 WEFs)
    - Elim (5 WEFs)
    - Jasfontein (5 WEFs)
    - Blomfontein (1 WEF)
    - Houdenbek (3 – 5 WEFs)
    - Kookfoontein (2 – 5 WEFs)
    - Sterkfontein (1 – 2 WEFs)
    - Brakvlei (2 – 5 WEFs)

The sensitive receptors identified above are expected to experience a cumulative visual impact significance ranging from low to high, depending on their distance from the proposed Victoria West WEF Cluster, as well as, the number of WEFs in the cluster they will be exposed to.

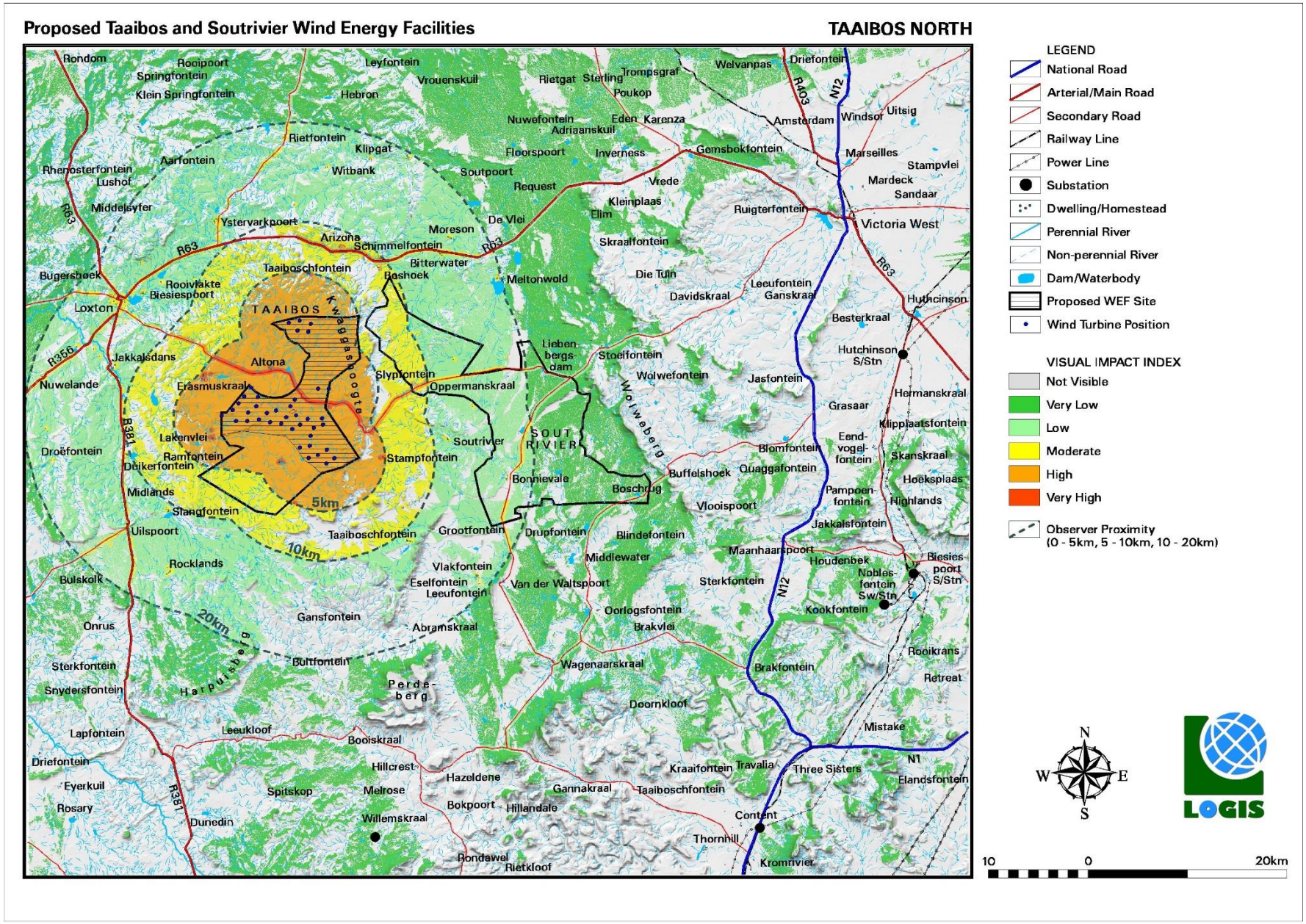
The overall cumulative visual impact of Victoria West is ultimately expected to be of **high** significance on the region due to its remote location, its proximity to the Beaufort West REDZ and existing Noblesfontein Wind Farm, as well as, the sensitivity of the identified receptors to this kind of development.



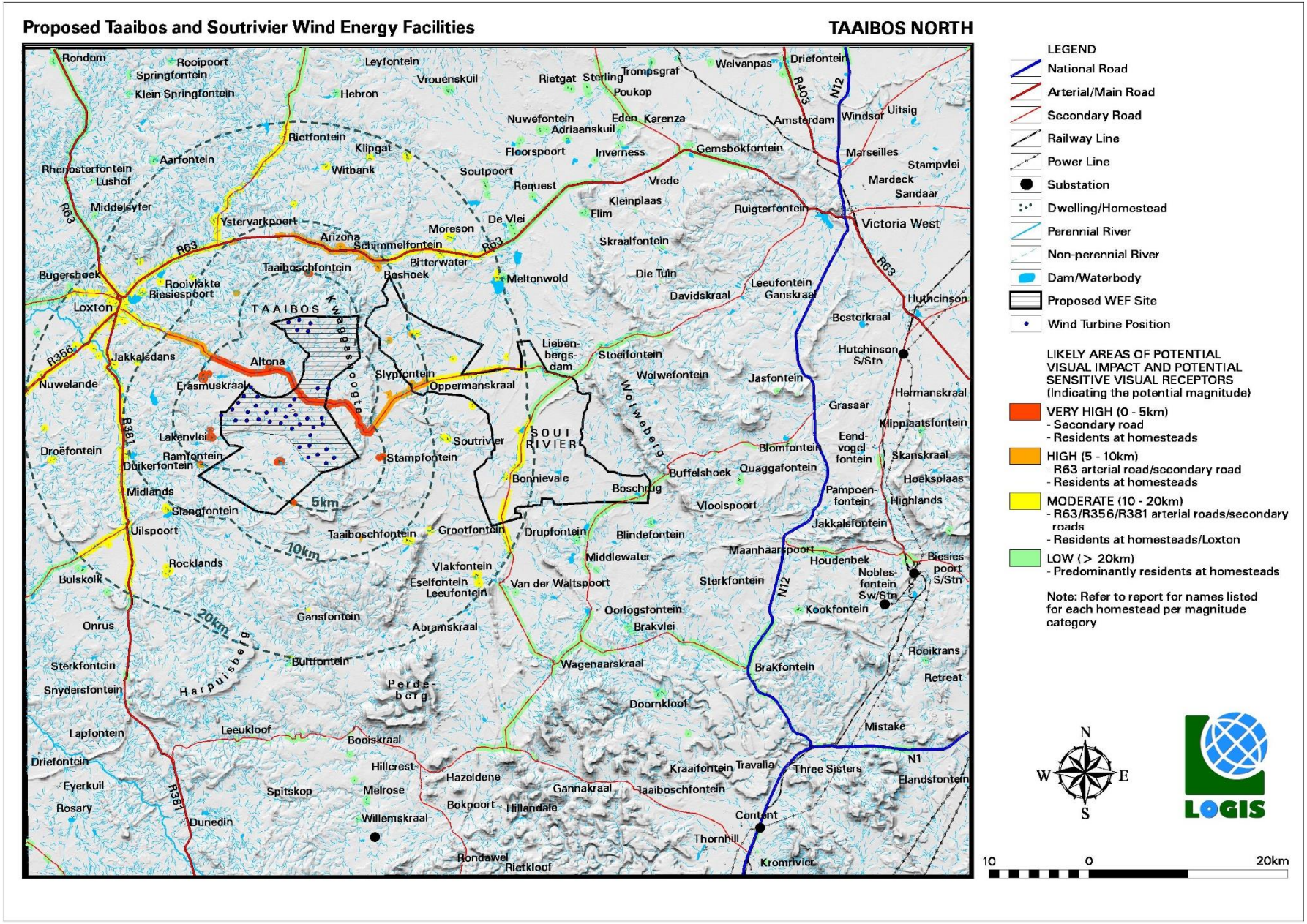
Map 4: Potential visual exposure (viewshed analysis) of the proposed Taaibos North WEF



Map 5: Cumulative viewshed analysis for Victoria West WEF cluster



Map 6: Visibility Index illustrating the frequency of exposure of the proposed Taaibos North WEF layout



Map 7: Likely areas of potential visual impact and potential sensitive visual receptors.

6.6. VISUAL IMPACT INDEX

The combined results of visual exposure, viewer incidence / perception and visual distance of the proposed facility 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, 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 visual impact index for the proposed facility is further described as follows.

- The visual impact index map indicates a core zone of **high** visual impact within 5km of the proposed facility. While the identified receptors within 5km of the proposed expansion, as listed below, are likely to experience **very high** visual impact, mitigation not be possible or not be undertaken. Sensitive visual receptors within this zone comprise mainly of the following:
    - Users of the secondary road
    - Residents of the following rural homesteads:
        - Taaibosfontein
        - Altona
        - Erasmuskraal
        - Spes Bona
        - Lakenvlei
        - Stampfontein
        - Quaggasfontein
        - Ramfontein

  Note: *The location of the homesteads Altona, Spes Bona, Lakenvlei, Stampfontein and Quaggasfontein are on farm portions earmarked for the Victoria West WEF, thereby reducing the probability of this impact occurring (i.e. it is assumed that these landowners are supportive of WEF developments within the region).*

- Visual impact is prominently **moderate** between 5km and 10km of the proposed facility. The identified receptors between 5km and 10km of the proposed facility, as listed below, are likely to experience **high** visual impact, should mitigation not be possible or not be undertaken. Sensitive visual receptors within this zone comprise mainly of the following:
    - Users traveling along the various secondary roads and R63, potential visibility is however scattered along the length of these roads and visual intrusion where possible will be brief.
    - Residents of the following rural homesteads:
        - Arizona
        - Schimmelfontein
        - Boshoek
        - Taaibosfontein
        - Suikerkolk
        - Oppermanskraal
        - Slypfontein
        - Duikerfontein
        - Stampfontein
        - Ramfontein

  Note: *The location of the homesteads Boshoek, Oppermanskraal, Slypfontein and Stampfontein are on farm portions earmarked for the Victoria West WEF, thereby reducing the probability of this impact occurring (i.e. it is assumed that these landowners are supportive of WEF developments within the region).*

- Visual impact is prominently **low** between 10 km and 20 km of the proposed facility. The identified receptors between 10km and 20km of the proposed facility, as listed below, are likely to experience **moderate** visual impact, should mitigation not be possible or not be undertaken. Sensitive visual receptors within this zone comprise mainly of the following:

- Users traveling along various secondary roads and the arterial R63, R381 and R356, potential visibility is however scattered along the length of these roads and visual intrusion where possible will be brief.
- Residents of the outskirts of the town of Loxton.
- Residents of the following rural homesteads:
    - Rietfontein
    - Klipgat
    - Witbank
    - Ystervarkpoort
    - Moreson
    - Bitterwater
    - Meltonwold
    - Rooivlakte
    - Biesiespoort
    - Burgershoek
    - Suikerkolk
    - Jakkalsdans
    - Nuwelande
    - Oppermanskraal
    - Soutrivier
    - Duikerfontein
    - Droëfontein
    - Bonnievale
    - Midlands
    - Slangfontein
    - Uilspoort
    - Grootfontein
    - Taaiboschfontein
    - Rocklands
    - Vlakfontein
    - Leeufontein
    - Gansfontein
    - Bultfontein

Note: *The location of the homesteads Oppermanskraal, Soutrivier and Bonnievale are on farm portions earmarked for the Victoria West WEF, thereby reducing the probability of this impact occurring (i.e. it is assumed that these landowners are supportive of WEF developments within the region).*

- Beyond the 20km of the proposed facility, the extent of potential visual impact is somewhat reduced, and the magnitude is predominantly **very low**. The identified receptors beyond 20km of the proposed facility, as listed below, are likely to experience **low** visual impact, should mitigation not be possible or not be undertaken. Sensitive visual receptors within this zone comprise mainly of the following:

    - Rondom
    - Driefontein
    - Rooipoort
    - Trompsgraf
    - Welvanpas
    - Leyfontein
    - Springfontein
    - Sterling
    - Rietgat
    - Vrouenskuil
    - Poukop
    - Hebron
    - Klein Springfontein
    - Eden

- Nuwefontein
- Floorspoort
- Adriaanskuil
- Inverness
- Gemsbokfontein
- Aarfontein
- Rhenosterfontein
- Soutpoort
- Lushof
- Request
- Elim
- Kleinplaas
- Middelsyfer
- De Vlei
- Skraalfontein
- Meltonwold
- Bugershoek
- Stoeifontein
- Liebenbergsdam
- Klipplaatsfontein
- Quaggafontein
- Boschrug
- Highlands
- Blindefontein
- Drupfontein
- Houdenbek
- Middlewater
- Bulskolk
- Van der Waltspoort
- Kookfontein
- Brakvlei
- Wagenaarskraal
- Rooikrans
- Bultfontein
- Brakfontein
- Doornkloof
- Booiskraal
- Melrose
- Willemskraal

Note: *The location of the homesteads Liebenbergsdam, Boschrug, Blindefontein, Drupfontein, and Middlewater are on farm portions earmarked for the Victoria West WEF, thereby reducing the probability of this impact occurring (i.e. it is assumed that these landowners are supportive of WEF developments within the region).*

6.7. SHADOW FLICKER ASSESSMENT

Shadow flicker is an effect which is caused when the shadow of an object repeatedly passes or pulsates over the same point in the landscape. Shadow flicker can be caused by the wind turbines when the sun passes behind the hub or rotor blades of a wind turbine and casts a shadow that continually passes over the same point as the rotor blades of the wind turbine rotate. Shadow flicker only occurs when the sky is clear, and when the turbine rotor blades are between the sun and the receptor.

De Gryse in Scenic Landscape Architecture (2006) notes that "*shadow flickering associated with the rotation of the rotor blades has the potential to alter the viewed landscape, and to detract from the experience of people …*". Therefore, the effect of shadow flicker is likely to be experienced by people situated directly within the shadow cast by the rotor blades of

the wind turbine. As such, shadow flicker is expected to have an impact on people residing in homesteads located within close proximity of a wind turbine and at a specific orientation, particularly in areas where there is little screening present.

Since the proposed Taaibos North WEF is located in the Southern Hemisphere it can be expected that shadow flicker will be experienced by sensitive receptors who are predominately located on the southern half of the potential flicker zones, namely to the west, south west, south, south east and east following the traction of the sun from east to west. It is expected that the shadow flicker zone of influence will be its greatest early in the mornings and later afternoons when the sun is at its lowest casting a longer shadow.

Shadow flicker may also be experienced by, and impact on motorists, if a wind turbine is located in close proximity to an existing road. It is however expected that the shadow flicker experienced by motorist traveling along roads will be fleeting and not constitute a shadow flicker visual impact of concern.

The impact of shadow flicker can be effectively mitigated by choosing the correct site and layout for the wind turbines, taking the orientation of the turbines relative to the nearby homesteads / roads and the latitude of the site into consideration. Tall structures and trees will also obstruct shadows and prevent the effect of shadow flicker from impacting on surrounding sensitive receptors, however, since this is not a consistent factor or given to occur around any of the structures within the study area it will not be considered in this assessment.

De Gryse found that "*most shadow impact is associated with 3-4 times the height of the object. While shadows may extend further than this, they become insignificant in their visual intrusion because of the reduced intensity of the shadow at such distances.*" Based on this research, the area of potential shadow flicker impact for the proposed Taaibos North WEF based on a blade tip height of 320m blade tip height (hub height of up to 200m and rotor diamter of 240m) is predicted to occur within 1.3km of a turbine. As such, sensitive receptors who fall within this zone are likely to be impacted upon.

Based on the above, various secondary roads located within the development site are likely to have a shadow flicker impact on motorists using these roads. It is, however, expected that the number of motorists travelling on these roads will be very limited and the level of exposure will be brief, thereby, not constituting a shadow flicker visual impact of concern for these receptors.

No residents of the homestead are likely to experience shadow flicker from any of the proposed turbines.

7. VISUAL IMPACT ASSESSMENT

7.1. 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 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 infrastructure) and includes a table quantifying the potential visual impact according to the following criteria:

Extent – The distance the visual impact extends from the proposed development and to what extent it will have the highest impact. In the case of this type of development the extent of the visual impact is most likely to have a higher impact on receptors closer to the development and decrease as the distance increases.

- (1) Very low: *Region*, long distance > 20km
- (2) Low: *District*, medium to long distance between 10 – 20km
- (3) Medium: *Local*, short distance between 5 – 10 km
- (4) High: *Neighbourhood*, very short distance < 5km
- (5) Very high: *Site* specific, within the development site only

Duration - The timeframe over which the effects of the impact will be felt.

- (1) Very short: 0-1 years
- (2) Short: 2-5 years
- (3) Medium: 5-15 years

- (4) Long: >15 years
- (5) Permanent

Magnitude - The severity or size of the impact. This value is read off the Visual Impact Index maps.

- (0) None
- (2) Minor
- (4) Low
- (6) Moderate
- (8) High
- (10) Very High

Probability - The likelihood of the impact actually occurring.

- (1) Very improbable: Less than 20% sure of the likelihood of an impact occurring
- (2) Improbable: 20-40% sure of the likelihood of an impact occurring
- (3) Probable: 40-60% sure of the likelihood of an impact occurring
- (4) Highly probable: 60-80% sure of the likelihood of that impact occurring
- (5) Definite: More than 80% sure of the likelihood of that impact occurring

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

- ***(0-12) Negligible:***
  Where the impact would have no direct influence on the decision to develop in the area. The impact would be of a very low order. In the case of negative impacts, almost no mitigation and or remedial activity would be needed, and any minor steps, which might be needed, would be easy, cheap, and simple.
- ***(13-30) Low:***
  Where the impact would have a very limited direct influence on the decision to develop in the area. The impact would be of a low order and with little real effect. In the case of negative impacts, mitigation and / or remedial activity would be either easily achieved or little would be required, or both.
- ***(31-60) Moderate:***
  Where the impact could influence the decision to develop in the area. The impact would be real but not substantial. In the case of negative impacts, mitigation and / or remedial activity would be both feasible and fairly easily possible.
- ***(61-80) High:***
  Where the impact must have an influence on the decision to develop in the area. The impacts are of a substantial order. In the case of negative impacts, mitigation and / or remedial activity would be feasible but difficult, expensive, time-consuming or some combination of these.
- ***(81-100) Very High:***
  Where the impact will definitely have an influence on the decision to develop in the area. The impacts are of the highest order possible. In the case of negative impacts, there would be no possible mitigation and / or remedial activity possible.

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**).

Status – The perception of Interested and Affected Parties towards the proposed development.

- Positive
- Negative
- Neutral

Reversibility – The possibility of visual recovery of the impact following the decommissioning of the proposed development

- (1) Reversible
- (3) Recoverable
- (5) Irreversible

7.2. PRIMARY IMPACTS

The primary visual impacts of the proposed Taaibos North WEF are assessed as follows:

7.2.1. POTENTIAL VISUAL IMPACT OF CONSTRUCTION ON SENSITIVE VISUAL RECEPTORS IN CLOSE PROXIMITY TO THE FACILITY

During the construction period, there will be an increase in heavy vehicles utilising the roads to the construction sites that may cause, at the very least, a visual nuisance to other road users and landowners in the area in close proximity (within 5km). Within the region, dust as a result of construction activities may also be visible, as such it will result in a visual impact occurring during construction.

This impact is likely to be of **high** significance before mitigation and **moderate** significance post mitigation on the identified sensitive visual receptors within this zone:

- Users of the various secondary roads
- Residents of the following homesteads:
  - Taaibosfontein
  - Erasmuskraal
  - Ramfontein

The following homesteads are located on farm portions earmarked for the Victoria West WEF, thereby reducing the probability of this impact occurring on these specific receptors (i.e. it is assumed that these landowners are supportive of WEF developments and their associated visual impacts):

- Altona
- Spes Bona
- Lakenvlei
- Stampfontein
- Quaggasfontein

Mitigation entails proper planning, management and rehabilitation of all construction sites to forego the visual impacts of the construction activities only.

Table 3: Impact table summarising the significance of visual impact of construction on visual receptors in close proximity to the proposed WEF

Nature of Impact: Visual impact of construction on sensitive visual receptors in close proximity (< 5km) to the proposed development		
	No mitigation	***Mitigation considered***
Extent	Neighbourhood **(4)**	Neighbourhood **(4)**
Duration	Short term **(2)**	Short term **(2)**
Magnitude	Very High **(10)**	High **(8)**
Probability	Highly Probable **(4)**	Probable **(3)**
Significance	High **(64)**	Moderate **(42)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible **(1)**	Reversible **(1)**
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation potential	Achievable	
Mitigation / Management: Construction: ➢ Ensure that vegetation is not unnecessarily 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 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: No cumulative impacts as a result of the construction activities are expected.
Residual impacts: None, provided that rehabilitation works are carried out as specified.

7.2.2. POTENTIAL VISUAL IMPACT OF FACILITY OPERATIONS ON SENSITIVE VISUAL RECEPTORS IN CLOSE PROXIMITY (< 5KM) TO THE PROPOSED DEVELOPMENT

The visual impacts of facility operations on sensitive visual receptors (i.e., residents of homesteads, as well as, observers travelling along the secondary road) in close proximity to the proposed Taaibos North WEF (within 5km) is expected to be of **very high** significance.

Sensitive visual receptors within this zone include:

- Users of the various secondary roads
- Residents of the following homesteads:
  - Taaibosfontein
  - Erasmuskraal
  - Ramfontein

The following homesteads are located on farm portions earmarked for the Victoria West WEF, thereby reducing the probability of this impact occurring on these specific receptors (i.e. it is assumed that these landowners are supportive of WEF developments and their associated visual impacts):

- Altona
- Spes Bona
- Lakenvlei
- Stampfontein
- Quaggasfontein

No mitigation is possible for a facility of this scale, but measures have been included as best practice guidelines. The table below illustrates this impact assessment.

Table 4: Impact table summarising the significance of facility operations on sensitive visual receptors in close proximity (within 5km) to the proposed WEF

Nature of Impact: Visual impact on sensitive receptors within 5km (residents of homesteads, as well as, observers travelling along the secondary road), in close proximity to the proposed development.		
	No mitigation	***Mitigation considered***
Extent	Neighbourhood **(4)**	Neighbourhood **(4)**
Duration	Long **(4)**	Long **(4)**
Magnitude	Very High **(10)**	Very High **(10)**
Probability	Definite **(5)**	Definite **(5)**
Significance	Very high **(90)**	Very high **(90)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible **(1)**	Reversible **(1)**
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	No	
Mitigation potential	Very difficult	
Mitigation / Management: <u>Operations:</u> ➢ Retain / re-establish and maintain natural vegetation in all areas outside of the development footprint. ➢ Maintain the general appearance of the facility as a whole. ➢ Monitor rehabilitated areas, and implement remedial action as and when required. <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.
Cumulative impacts: The construction of the Taaibos North WEF (40 turbines) together with the other four proposed facilities that form part of the Victoria West WEF is expected to contribute to the increased cumulative visual impact of renewable energy facilities in the region.
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.

7.2.3. POTENTIAL VISUAL IMPACT OF FACILITY OPERATIONS ON SENSITIVE VISUAL RECEPTORS WITHIN THE LOCAL AREA (BETWEEN 5 - 10KM) SURROUNDING THE PROPOSED DEVELOPMENT

The visual impact of facility operations on sensitive visual receptors (i.e. users of the various secondary roads, R63 and residents of homesteads) within the local area (between 5 - 10km offset) is expected to be of **high** significance.

Sensitive visual receptors within this zone include:

- Users traveling along the various secondary roads and R63, potential visibility is however scattered along the length of these roads and visual intrusion where possible will be brief.
- Residents of the following homesteads:
  - Arizona
  - Schimmelfontein
  - Taaibosfontein
  - Suikerkolk
  - Duikerfontein
  - Ramfontein

The following homesteads are located on farm portions earmarked for the Victoria West WEF, thereby reducing the probability of this impact occurring on these specific receptors (i.e. it is assumed that these landowners are supportive of WEF developments and their associated visual impacts):

- Boshoek
- Oppermanskraal
- Slypfontein
- Stampfontein

No mitigation is possible within this environment and for a facility of this scale, but measures have been included as best practice guidelines. The table below illustrates this impact assessment.

Table 5: Impact table summarising the significance of visual impacts of the facility operations on sensitive visual receptors within the local area (between the 5 - 10km offset)

Nature of Impact: Visual impact on the users of various secondary roads, residents of homesteads and visitors to the local area (between 5 - 10km offset) surrounding the proposed development.		
	No mitigation	***Mitigation considered***
Extent	Local **(3)**	Local **(3)**
Duration	Long **(4)**	Long **(4)**
Magnitude	High **(8)**	High **(8)**
Probability	Definite **(5)**	Definite **(5)**
Significance	High **(75)**	High **(75)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible **(1)**	Reversible **(1)**
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	No	
Mitigation potential	Very difficult	
Mitigation / Management: Site development & Operation:		

➢ Retain / re-establish and maintain large trees, natural features and noteworthy natural vegetation in all areas outside of the activity footprint. ➢ Retain natural pockets (wetland, river and other sensitive vegetation zones) as buffers within the property and along the perimeter. ➢ Dust suppression techniques should be in place at all times during the site development and operational phases. ➢ Access roads will require an effective dust suppression management programme, such as regular wetting and/or the use of non-polluting chemicals that will retain moisture in the road surface. ➢ Downscaling of operations. ➢ Keeping infrastructure at minimum heights. ➢ Introducing landscaping measures such as vegetating berms. ➢ Avoid the use of highly reflective material. ➢ Metal surfaces, where they occur, should be painted in natural soft colours that would blend in with the environment. ➢ Maintain the general appearance of the site as a whole. <u>Lighting</u> ➢ Lighting should be kept to a minimum wherever possible. ➢ Install light fixtures that provide precisely directed illumination to reduce light "spillage" beyond the immediate surrounds of the activity – this is especially relevant where the edge of the activity is exposed to residential properties. ➢ Wherever possible, lights should be directed downwards to avoid illuminating the sky. ➢ Avoid high pole top security lighting along the periphery of the site and use only lights that are activated on movement. <u>Decommissioning:</u> ➢ Remove infrastructure not required for the post-decommissioning use of the site. ➢ Rehabilitate all areas as per the rehabilitation plan undertaken. Consult an ecologist regarding rehabilitation specifications. ➢ Monitor rehabilitated areas post-decommissioning and implement remedial actions as required.
Cumulative impacts: The construction of the Taaibos North WEF (40 turbines) together with the other four proposed facilities that form part of the Victoria West WEF is expected to contribute to the increased cumulative visual impact of renewable energy facilities in the region.
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.

7.2.4. POTENTIAL VISUAL IMPACT OF FACILITY OPERATIONS ON SENSITIVE VISUAL RECEPTORS WITHIN THE DISTRICT (BETWEEN 10 - 20KM) SURROUNDING THE PROPOSED DEVELOPMENT

The visual impact of facility operations on sensitive visual receptors (i.e. users of the various secondary road, arterial R63 and R356 roads, visitors to region, and residents of homesteads) within the district (between 10 - 20km offset) is expected to be of **moderate** significance.

Sensitive visual receptors within this zone include:

- Users traveling along various secondary roads and the arterial R63, R381 and R356, potential visibility is however scattered along the length of these roads and visual intrusion where possible will be brief.
- Residents of the outskirts of the town of Loxton.
- Residents of the following homesteads:
    - Rietfontein
    - Klipgat
    - Witbank
    - Ystervarkpoort
    - Moreson
    - Bitterwater
    - Meltonwold
    - Rooivlakte
    - Biesiespoort
    - Burgershoek
    - Suikerkolk
    - Jakkalsdans

- Nuwelande
- Duikerfontein
- Droëfontein
- Midlands
- Slangfontein
- Uilspoort
- Grootfontein
- Taaiboschfontein
- Rocklands
- Vlakfontein
- Leeufontein
- Gansfontein
- Bultfontein

The following homesteads are located on farm portions earmarked for the Victoria West WEF, thereby reducing the probability of this impact occurring on these specific receptors (i.e. it is assumed that these landowners are supportive of WEF developments and their associated visual impacts):

- Oppermanskraal
- Soutrivier
- Bonnievale

No mitigation is possible within this environment and for a facility of this scale, but measures have been included as best practice guidelines. The table below illustrates this impact assessment.

Table 6: Impact table summarising the significance of visual impacts of the facility operations on sensitive visual receptors within the district (between the 10 – 20km offset)

Nature of Impact: Visual impact on the users of the users of the arterial roads, secondary roads, residents of homesteads, and visitors to the district (between 10 - 20km offset) surrounding the proposed development.		
	No mitigation	***Mitigation considered***
Extent	District **(2)**	District **(2)**
Duration	Long **(4)**	Long **(4)**
Magnitude	Moderate **(6)**	Moderate **(6)**
Probability	Highly Probable **(4)**	Highly Probable **(4)**
Significance	Moderate **(48)**	Moderate **(48)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible **(1)**	Reversible **(1)**
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	No	
Mitigation potential	Very difficult	
Mitigation / Management: <u>Site development & Operation:</u> ➢ Retain / re-establish and maintain large trees, natural features and noteworthy natural vegetation in all areas outside of the activity footprint. ➢ Retain natural pockets (wetland, river and other sensitive vegetation zones) as buffers within the property and along the perimeter. ➢ Dust suppression techniques should be in place at all times during the site development and operational phases. ➢ Access roads will require an effective dust suppression management programme, such as regular wetting and/or the use of non-polluting chemicals that will retain moisture in the road surface. ➢ Downscaling of operations. ➢ Keeping infrastructure at minimum heights. ➢ Introducing landscaping measures such as vegetating berms. ➢ Avoid the use of highly reflective material. ➢ Metal surfaces, where they occur, should be painted in natural soft colours that would blend in with the environment. ➢ Maintain the general appearance of the site as a whole. <u>Lighting</u> ➢ Lighting should be kept to a minimum wherever possible.		

➢ Install light fixtures that provide precisely directed illumination to reduce light "spillage" beyond the immediate surrounds of the activity – this is especially relevant where the edge of the activity is exposed to residential properties. ➢ Wherever possible, lights should be directed downwards to avoid illuminating the sky. ➢ Avoid high pole top security lighting along the periphery of the site and use only lights that are activated on movement. Decommissioning: ➢ Remove infrastructure not required for the post-decommissioning use of the site. ➢ Rehabilitate all areas as per the rehabilitation plan undertaken. Consult an ecologist regarding rehabilitation specifications. ➢ Monitor rehabilitated areas post-decommissioning and implement remedial actions as required.
Cumulative impacts: The construction of the Taaibos North WEF (40 turbines) together with the other four proposed facilities that form part of the Victoria West WEF is expected to contribute to the increased cumulative visual impact of renewable energy facilities in the region.
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.

7.2.5. POTENTIAL VISUAL IMPACT OF FACILITY OPERATIONS ON SENSITIVE VISUAL RECEPTORS WITHIN THE REGION (> 20KM)

The visual impact of facility operations on sensitive visual receptors (i.e., users of the various secondary roads, visitors to the region, and residents of homesteads) within the region (beyond the 20km offset) is expected to be of **low** significance.

Sensitive visual receptors within this zone include:

- Users traveling along portions of the N12, R63, R381 and various secondary roads, potential visibility is however scattered along the length of these roads and visual intrusion where possible will be brief.
- Residents of various homesteads (refer to Section **Error! Reference source not found.** for a full list).

The following homesteads are located on farm portions earmarked for the Victoria West WEF, thereby reducing the probability of this impact occurring on these specific receptors (i.e. it is assumed that these landowners are supportive of WEF developments and their associated visual impacts):

- Liebenbergsdam
- Boschrug
- Blindefontein
- Drupfontein
- Middlewater

No mitigation is possible within this environment and for a facility of this scale, but measures have been included as best practice guidelines. The table below illustrates this impact assessment.

Table 7: Impact table summarising the significance of visual impacts of the facility operations on sensitive visual receptors within the region (beyond the 20km offset)

Nature of Impact: Visual impact on the users of the various secondary roads, visitors to region, and residents of homesteads within the region (beyond the 20km offset)		
	No mitigation	***Mitigation considered***
Extent	Region **(1)**	Region **(1)**
Duration	Long **(4)**	Long **(4)**
Magnitude	Low **(4)**	Low **(4)**
Probability	Improbable **(2)**	Improbable **(2)**
Significance	Low **(18)**	Low **(18)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible **(1)**	Reversible **(1)**
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	No	
Mitigation potential	Very difficult	

Mitigation / Management: Site development & Operation: ➢ Retain / re-establish and maintain large trees, natural features and noteworthy natural vegetation in all areas outside of the activity footprint. ➢ Retain natural pockets (wetland, river and other sensitive vegetation zones) as buffers within the property and along the perimeter. ➢ Dust suppression techniques should be in place at all times during the site development and operational phases. ➢ Access roads will require an effective dust suppression management programme, such as regular wetting and/or the use of non-polluting chemicals that will retain moisture in the road surface. ➢ Downscaling of operations. ➢ Keeping infrastructure at minimum heights. ➢ Introducing landscaping measures such as vegetating berms. ➢ Avoid the use of highly reflective material. ➢ Metal surfaces, where they occur, should be painted in natural soft colours that would blend in with the environment. ➢ Maintain the general appearance of the site as a whole. Lighting ➢ Lighting should be kept to a minimum wherever possible. ➢ Install light fixtures that provide precisely directed illumination to reduce light "spillage" beyond the immediate surrounds of the activity – this is especially relevant where the edge of the activity is exposed to residential properties. ➢ Wherever possible, lights should be directed downwards to avoid illuminating the sky. ➢ Avoid high pole top security lighting along the periphery of the site and use only lights that are activated on movement. Decommissioning: ➢ Remove infrastructure not required for the post-decommissioning use of the site. ➢ Rehabilitate all areas as per the rehabilitation plan undertaken. Consult an ecologist regarding rehabilitation specifications. ➢ Monitor rehabilitated areas post-decommissioning and implement remedial actions as required.
Cumulative impacts: The construction of the Taaibos North WEF (40 turbines) together with the other four proposed facilities that form part of the Victoria West WEF is expected to contribute to the increased cumulative visual impact of renewable energy facilities in the region.
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.

7.2.6. POTENTIAL VISUAL IMPACT OF OPERATIONAL LIGHTING AT NIGHT ON SENSITIVE VISUAL RECEPTORS IN THE REGION

The receiving environment has a relatively small number of populated places, and it can be expected that any light trespass and glare from the security and after-hours operational lighting for the facility will have some significance. In addition, the remote sense of place and rural ambiance of the local area increases its sensitivity to such lighting intrusions.

Another source of glare light is the aircraft warning lights mounted on top of the hub of the wind turbines. While these lights are less aggravating due to the toned-down red colour, they do have the potential to be visible from a greater distance then general operational lighting, especially due to the strobing effect of the lights, a function specially designed to attract the viewers' attention. The Civil Aviation Authority (CAA) prescribes these warning lights and the potential to mitigate their visual impacts is low. The possibility of limiting aircraft warning lights to the turbines on the perimeter according to CAA requirements, thereby reducing the overall impact, is recommended to be investigated.

Figure 9: Example of aircraft warning lights fitted to the turbines as prescribed by the CAA[6]

Some ground breaking new technology in the development of strobing lights that only activate when an aircraft is detected nearby. This may aid in restricting light pollution at night and should be investigated and implemented by the project proponent, if available and permissible by the CAA. This new technology is referred to as *needs-based night lights*, which basically deactivates the wind turbine's night lights when there is no flying object within the airspace of the WEF. The system relies on the active detection of aircraft by radar sensors, which relays a switch-on signal to the central wind farm control to activate the obstacle lights.

Last is the potential lighting impact is 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 number of light sources. Each new light source, especially upwardly directed lighting, contributes to the increase in sky glow. The general lighting of the facility may contribute to the effect of sky glow in an otherwise dark environment.

The visual impacts as a result of operational lighting at night on sensitive visual receptors in the region is likely to be of **high** significance and may be mitigated to **moderate** should the required CAA lighting be approved to be installed on the perimeter and/or the installation of *needs-based night lights* be allowed. Best practice guidelines for other general site lighting that may occur on the site have also been taken into consideration. The table below illustrates this impact assessment.

Table 8: Impact table summarising the significance of visual impact of operational lighting at night on visual receptors in close proximity to the proposed facility

Nature of Impact: Visual impact of lighting at night on sensitive visual receptors in the region		
	No mitigation	***Mitigation considered***
Extent	Region **(1)**	Region **(1)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	High **(8)**	High **(8)**
Probability	Definite **(5)**	Probable **(3)**
Significance	High **(65)**	Moderate **(39)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible **(1)**	Reversible **(1)**
Irreplaceable loss of resources?	No	No

[6] Image Source: https://kythira-windturbines.com/en/wind-turbines-remain-visible-all-night/

Can impacts be mitigated?	Yes
Mitigation potential	Difficult
Mitigation: Planning & operation: ➢ Aviation standards and CAA Regulations for turbine lighting must be followed. ➢ The possibility of limiting aircraft warning lights to the turbines on the perimeter according to CAA requirements, thereby reducing the overall impact, must be investigated. ➢ Install aircraft warning lights that only activate when the presence of an aircraft is detected, if permitted by CAA. ➢ 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 operation of the Taaibos North WEF (40 turbines) together with the other four proposed facilities that form part of the Victoria West WEF is expected to contribute to the increased lighting and light pollution in an otherwise natural area increasing the cumulative visual impact of renewable energy facilities in the region.	
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.	

7.2.7. POTENTIAL VISUAL IMPACT OF SHADOW FLICKER ON SENSITIVE VISUAL RECEPTORS IN CLOSE PROXIMITY TO THE PROPOSED DEVELOPMENT

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 1.3km buffer along the edge of the outer most turbines is identified as the zone within which there is a risk of shadow flicker occurring.

No homesteads are located within the 1.3km buffer.

The significance of shadow flicker is therefore anticipated to be **low**.

Table 9: Impact table summarising the significance of shadow flicker on sensitive receptors in close proximity to the proposed development

Nature of Impact: Visual impact of shadow flicker on sensitive receptors in close proximity to the proposed development		
	No mitigation	***Mitigation considered***
Extent	Neighbourhood **(4)**	Neighbourhood **(4)**
Duration	Long **(4)**	Long **(4)**
Magnitude	Moderate **(6)**	Moderate **(6)**
Probability	Improbable **(2)**	Improbable **(2)**
Significance	Low **(28)**	Low **(28)**
Status (positive or negative)	Negative	Negative
Reversibility	Recoverable **(3)**	Recoverable **(3)**
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	No	
Mitigation potential	Difficult	
Mitigation / Management: Not Applicable		
Residual impacts: Not Applicable		

2.2.1. ANCILLARY INFRASTRUCTURE

On-site ancillary infrastructure associated with the Taaibos North WEF includes a 132kV collector substation, 132kV overhead powerline, underground 33kV cabling between the wind turbines, internal access roads, operations and

maintenance buildings and a Battery Energy Storage System (BESS). No dedicated viewshed analyses have been generated for the ancillary infrastructure, as the range of visual exposure will fall within (and be overshadowed by) that of the turbines.

The anticipated visual impact resulting from this infrastructure is likely to be of **moderate** significance both before and after mitigation.

Table 10: Impact table summarising the visual impact of the ancillary infrastructure

Nature of Impact: Visual impact of shadow flicker on sensitive receptors in close proximity to the proposed development		
	No mitigation	***Mitigation considered***
Extent	Neighbourhood **(4)**	Neighbourhood **(4)**
Duration	Long **(4)**	Long **(4)**
Magnitude	Moderate **(6)**	Moderate **(6)**
Probability	Probable **(3)**	Probable **(3)**
Significance	Moderate **(42)**	Moderate **(42)**
Status (positive or negative)	Negative	Negative
Reversibility	Recoverable **(3)**	Recoverable **(3)**
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	No	
Mitigation potential	Difficult	
Mitigation / Management: Not Applicable		
Residual impacts: Not Applicable		

7.3. SECONDARY IMPACTS

7.3.1. POTENTIAL VISUAL IMPACT OF FACILITY OPERATIONS ON THE VISUAL CHARACTER OF THE LANDSCAPE AND SENSE OF PLACE OF THE REGION

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

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

In general, the landscape character of the greater study area and site itself presents as rural in character. The visual quality of the region is generally high with tracts of intact vegetation as well as, mountainous vistas characterising most of the visual environment. As such, the entire study area is considered sensitive to visual impacts due to its generally low levels of transformation.

The anticipated visual impact on the visual character and sense of place of the study area is expected to be of **high** significance. No mitigation is possible within this environment and for a facility of this scale, but measures have been included as best practice guidelines. The table below illustrates the assessment of this anticipated impact.

Table 11: Impact table summarising the significance of visual impacts of facility operations on landscape character and sense of place within the region

Nature of Impact: Visual impact of the proposed development on the visual quality of the landscape and sense of place of the region		
	No mitigation	***Mitigation considered***
Extent	Region **(1)**	Region **(1)**
Duration	Long **(4)**	Long **(4)**
Magnitude	High **(8)**	High **(8)**
Probability	Definite **(5)**	Definite **(5)**
Significance	High **(65)**	High **(65)**

Status (positive or negative)	Negative	Negative
Reversibility	Reversible **(1)**	Reversible **(1)**
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	No	
Mitigation potential	Very Difficult	
Mitigation / Management: Planning: ➢ Retain / re-establish and maintain natural vegetation in all areas outside of the development footprint. ➢ Plan ancillary infrastructure in such a way and in such a location that clearing of vegetation is minimised. ➢ Use existing roads wherever possible. Where new roads are required to be constructed, these should be planned carefully, taking due cognisance of the local topography. Roads should be laid out along the contour wherever possible, and should never traverse slopes at 90 degrees. Construction of roads should be undertaken properly, with adequate drainage structures in place to forego potential erosion problems. Construction: ➢ Rehabilitate all construction areas. ➢ Ensure that vegetation is not cleared unnecessarily to make way for infrastructure. Operations: ➢ Maintain the general appearance of the facility as a whole. ➢ Monitor rehabilitated areas, and implement remedial action as and when required. ➢ 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 and operation of the Taaibos North WEF (40 turbines) together with the other four proposed facilities that form part of the Victoria West WEF is expected to contribute to the increased cumulative visual impact of renewable energy facilities in the region.		
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.		

7.3.2. POTENTIAL CUMULATIVE VISUAL IMPACT OF WIND ENERGY FACILITIES WITHIN THE REGION

It is a requirement that a visual specialist identify and quantify the cumulative visual impacts of a proposed development, propose potential mitigating measures and conclude if the proposed development will result in any acceptable loss of visual resources taking into consideration the other proposed and operational projects in the area. A cumulative visual impact can be defined as the combined or incremental effects resulting from changes caused by a proposed development in conjunction with other existing or proposed activities. The cumulative impact assessed in the table below will consist of the combined impact of the proposed Taaibos North WEF and the four other proposed facilities that form part of the Victoria West WEF.

Cumulative visual impacts may be experienced as a result of where a combination of several WEF's turbines is within a receptors line of sight at the same time, where the receptor has to turn their head to see several of the WTGs of the different WEF's or when the receptor has to move from one viewpoint to another to either see different developments or different views of the same development (such as when travelling along a road).

The cumulative visual impact is not just the totality of the impacts of two developments. The combined impact may be greater than the sum of the two individual developments, or in rare cases even less. The cumulative visual impact is assessed as the product of the distance between the individual WEFs (or WTG), the total distance over which the WTG are visible, the general character of the landscape and its sensitivity to that specific typology of development, the location and design of the WEFs themselves and lastly the way in which the landscape is experienced by the sensitive receptors.

The table below illustrates the assessment of the anticipated cumulative visual impact of infrastructure on sensitive visual receptors within the region. The cumulative visual impacts are likely to be of **high** significance when the proposed Taaibos North WEF and the four other proposed facilities that form part of the Victoria West WEF.

Table 12: Impact table summarising the significance of the cumulative visual impact of the proposed Taaibos North WEF and the four other proposed facilities that form part of the Victoria West WEF on sensitive visual receptors within the region

Nature of Impact: The potential cumulative visual impact of the proposed Taaibos North WEF and the four other proposed facilities that form part of the Victoria West WEF on sensitive visual receptors within the region		
	Overall impact of the proposed project considered in isolation	***Cumulative impact of the project and other projects in the area***
Extent	Region **(1)**	Region **(1)**
Duration	Long **(4)**	Long **(4)**
Magnitude	High **(8)**	Very High **(10)**
Probability	Highly Probable **(4)**	Definite **(5)**
Significance	Moderate **(52)**	High **(75)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible **(1)**	Reversible **(1)**
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	No	
Mitigation potential	Very Difficult	
Mitigation / Management: Not Applicable		
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.		

7.4. THE POTENTIAL TO MITIGATE VISUAL IMPACTS

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

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

The overall potential for mitigation is therefore generally low or non-existent. The following mitigations are however possible:

- Retain / re-establish and maintain natural vegetation in all areas outside of the development footprint.
- Plan ancillary infrastructure (i.e., substation and workshop) 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.
- Use existing roads wherever possible. Where new roads are required to be constructed, these should be planned carefully, taking due cognisance of the local topography. Roads should be laid out along the contour wherever possible, and should never traverse slopes at 90 degrees. Construction of roads should be undertaken properly, with adequate drainage structures in place to forego potential erosion problems.
- Access roads, which are not required post-construction, should be ripped and rehabilitated.
- No mitigation is possible for visual impacts associated with the on-site monitoring and telecommunications masts.
- The Civil Aviation Authority (CAA) prescribes that aircraft warning lights be mounted on the turbines. However, it is possible to obtain permission 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. It is therefore recommended that the possibility of this be investigated.
- Install aircraft warning lights that only activate when the presence of an aircraft is detected, if permitted by CAA.

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

    - 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 along the corridor in order to minimise vegetation clearing.
- Restrict the activities and movement of construction workers and vehicles to the immediate construction site and existing access roads.
- Ensure that rubble, litter, and disused construction materials are 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.
- Ensure that all infrastructure and the site and general surrounds are maintained and kept neat.
- 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.
- Monitor all rehabilitated areas for at least a year for rehabilitation failure and implement remedial action as required. If necessary, an ecologist should be consulted to assist or give input into rehabilitation specifications.

- 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 will go far to contain rather than spread the light. Additional measures include the following:

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

- During Operations, monitor the general appearance of the facility as a whole, as well as, all rehabilitated areas.
  - The maintenance of the turbines and ancillary structures and infrastructure will ensure that the facility does not degrade, thus aggravating visual impact. Implement remedial action where required.
  - Where sensitive visual receptors are likely to 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 even the construction of screens. Ultimately, visual screening is most effective when placed at the receptor itself.
  - 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.

- After decommissioning, all infrastructure should be removed and all disturbed areas appropriately rehabilitated. Monitor rehabilitated areas post-decommissioning and implement remedial actions and consult an ecologist regarding rehabilitation specifications if necessary.

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

8. SUMMARY OF VISUAL IMPACTS ASSESSED

In light of the results and findings of the Visual Impact Assessment undertaken for the Taaibos North WEF proposed, it is acknowledged that the receiving environment will be significantly visually transformed for the entire operational lifespan of the facility.

The following is a summary of the impacts assessed:

- The potential visual impact of construction on sensitive visual receptors in close proximity to the facility is likely to be of **high** significance before mitigation and **moderate** significance post mitigation.

- The potential visual impact of facility operations on sensitive visual receptors in close proximity (within 5km) to the proposed facility is likely to be of **very high** significance. No mitigation is possible for a facility of this scale.
- The potential visual impact of facility operations on sensitive visual receptors within the local area (between 5 - 10km offset) to the proposed facility is likely to be of **high** significance. No mitigation is possible for a facility of this scale.
- The potential visual impact of facility operations on sensitive visual receptors within the district (between 10 - 20km offset) to the proposed facility is likely to be of **moderate** significance. No mitigation is possible for a facility of this scale.
- The potential visual impact of facility operations on sensitive visual receptors within the region (beyond the 20km offset) to the proposed facility is likely to be of **low** significance. No mitigation is possible for a facility of this scale.
- The anticipated visual impact of operational lighting at night on sensitive visual receptors within the study area is likely to be of **high** significance and may be mitigated to **moderate** should the possible best practice mitigation measures be implemented and approval for changes to the CAA lighting is approved.
- The expected visual impact of shadow flicker on sensitive receptors in close proximity to the proposed development is likely to be of **low** significance.
- The expected visual impact of ancillary infrastructure on sensitive receptors in close proximity to the proposed development is likely to be of **moderate** significance.
- The potential visual impact of the proposed facility operations on the visual quality of the landscape and sense of place of the region is likely to be of **high** significance. No mitigation is possible for a facility of this scale.
- The cumulative visual impacts are likely to be of **high** significance when the proposed Taaibos North WEF and the four other proposed facilities that form part of the Victoria West WEF within the study area.

9. CONCLUSION AND RECOMMENDATIONS

The visual assessment indicates that the construction and operation of the proposed Taaibos North WEF will have a high visual effect on both the rural landscape and on sensitive receptors in the study area. The visual impact will differ amongst places, depending on the distance from the facility, but it is expected to be of the highest significance within (but not restricted to) a 5km radius of the proposed facility. Within this distance it will generally be restricted to residents of homesteads, as well as, observers travelling along the various secondary road that bisects the site. This is largely due to the relatively close distance between the observers and the wind turbines, as well as, the generally flat topography

Overall, the significance of the visual impacts is predominately **moderate** to **high,** as a result of the generally rural character of the landscape and the fair number of homesteads located within the study area (increasing the number of sensitive receptors affected). A significance of **very high** is expected on sensitive receptors in close proximity (within 5km) of the proposed facility during the operational phase. Some impacts, post mitigations (if applicable), are expected to of **high** significant (visual impacts on sensitive receptors within the local area between 5 - 10km offset, visual quality of the landscape and the cumulative impact), **moderate** significance (visual impacts of construction, on sensitive receptors within the within the district between 10 - 20km offset, lighting at nights and ancillary infrastructure) and others **low** significance (visual impacts on sensitive receptors within the region beyond the 20km offset, shadow flicker). The facility would be visible within an area that contains 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 and residents of the homesteads scattered throughout the region.

Conventional mitigation (e.g., such as screening of the structures) of the potential visual impacts is highly unlikely to succeed due to the nature of this type of development (tip height exceeding 320m) and the receiving environment. However, a number of best practice mitigation measures have been proposed (Section 7.4) in order to limit the impacts that can be mitigated. Additionally, irrespective of whether or not mitigation measures will reduce the significance of the anticipated visual impacts, they are considered to be best practice and should all be implemented and maintained throughout the construction, operation and decommissioning phases of the proposed facility, should it be authorized. Impacts deemed possible to mitigate are general lighting of the facility and the construction activities on sensitive receptors in close proximity of the proposed facility.

In order to ensure that all the spatial analyses and mapping undertaken in this report is as accurate as possible, a transparent and scientifically defensible approach, in line with best practice methodology for this type of assessment, has been utilised. The objective of this process is to quantify the potential visual impacts associated with the proposed Taaibos North WEF, using visibility analyses, proximity analyses and the identification of sensitive receptors. However, it must be noted that

visual impact is a very subjective concept, personal to each individuals' backgrounds, opinions and perceptions. The subjects in this case are the identified sensitive receptors such as the residents of the homesteads, observers travelling along public roads and visitors to the region.

According to the Provincial Government of the Western Cape, Department of Environmental Affairs and Development Planning (DEA&DP) Guideline for Involving Visual and Aesthetic Specialists in the EIA Process (Oberholzer, 2005), the criteria that determine whether or not a visual impact constitutes a potential fatal flaw are categorised as follows:

1. Non-compliance with Acts, Ordinances, By-laws and adopted policies relating to visual pollution, scenic routes, special areas or proclaimed heritage sites.
2. Non-compliance with conditions of existing Records of Decision.
3. Impacts that may be evaluated to be of high significance and that are considered by the majority of the stakeholders and decision-makers to be unacceptable.

In terms of the above and to the knowledge of the author the proposed development is compliant with all Acts, Ordinances, By-laws and adopted policies relating to visual pollution, scenic routes, special areas or proclaimed heritage sites, as well as, conditions of existing Records of Decisions.

Since no reported objections from stakeholders or decision-makers within the region have been communicated by the EAP to the author of this report, this assessment has adopted a risk averse approach by assuming that the perception of most (if not all) of the sensitive visual receptors (bar the landowners of the properties earmarked for the development), would be predominantly negative towards the development of a WEF in the region. While still keeping in mind that there are also likely to be supporters of the Taaibos North WEF (as renewable energy generation is a global priority) amongst the population of the larger region, but they are largely expected to be indifferent to the construction of the WEF and not as vocal in their support for the wind farm as the detractors thereof.

Therefore, with the information available to the specialist at the time of writing this report, it cannot be empirically determined that the statistical majority of objecting stakeholders were exceeded. If evidence to the contrary surfaces during the progression of the development application, the specialist reserves the right to revise the statement below.

In spite of the predominantly high residual ratings (as assessed in Section 7) and the likelihood that the proposed development will be met with concern and objections from some of the affected sensitive receptors and landowners in the region, this report cannot categorically state that any of the above conditions were transgressed. As such these visual impacts are not considered to be fatal flaws for a development of this nature. It is, therefore, suggested that the proposed Taaibos North WEF, as per the assessed layout be supported from a visual perspective, subject to the implementation of the suggested best practice mitigation measures, as provided in this report.

10. REFERENCES

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