VISUAL IMPACT ASSESSMENT FOR THE PROPOSED MULILO NEWCASTLE WIND POWER-NORTHERN WIND ENERGY FACILITY, KWAZULU-NATAL, SOUTH AFRICA

PREPARED BY:

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PREPARED FOR:

CES - Environmental and social advisory services

APPLICANT:

Mulilo Renewable Project Developments (Pty) Ltd

DATE:

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Report date:	9 December 2022
Report number:	01

DECLARATION

I, **Bryony van Niekerk**, 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.

____

Bryony van Niekerk
Environmental Assessment Practitioner
EAPASA Reg nr: 2019/655

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1. INTRODUCTION

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, Biodiversity Plans 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;
- 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.

Although Nuleaf exercises due care and diligence in rendering services and preparing documents, Nuleaf accepts no liability, and CES, by receiving this document, indemnifies Nuleaf and its directors, managers, agents and employees against all actions, claims, demands, losses, liabilities, costs, damages and expenses arising from or in connection with the services rendered, directly or indirectly by the use of the information contained in this document.

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:

[1] Adapted from Oberholzer (2005).

	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: Roles and responsibilities outlined for each applicable party on site

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:

- 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 5m interval contours from the National Geo-spatial Information data supplied by the Department: Rural Development and Land Reform.

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 Newcastle Wind Energy Facility (WEF) Complex could have a potential visual impact;
- The creation of viewshed analyses from the proposed affected 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 Newcastle WEF Complex (Northern WEF and Southern WEF).

This report (visual impact assessment) sets out to identify and quantify the possible visual impacts related to the proposed Mulilo Newcastle Wind Power- Northern 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 24 - 26 January 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.

Viewshed analyses of the proposed development indicates the potential visibility.

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.

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.

DETERMINE THE CUMULATIVE VIEWSHED

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 visual assessment for this development includes a cumulative viewshed analysis in order to determine the visual exposure (visibility) of both the Mulilo Newcastle Wind Power- Northern WEF and the Mulilo Newcastle Wind Power 2- Southern WEF.

GENERATE PHOTO SIMULATIONS

Photographs from strategic viewpoints were taken in order to illustrate the potential realistic post construction views of the Mulilo Newcastle Wind Power- Northern WEF and the Mulilo Newcastle Wind Power 2- Southern WEF within its receiving environment. This aids in visualising the perceived visual impact of the proposed WEFs and placing it in spatial context. The purpose of the photo simulation exercise is to support the findings of the VIA, and is not an exercise to illustrate what the facility will look like from all directions.

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 (**Mulilo Renewable Project Developments (Pty) Ltd)** is proposing to develop the Newcastle Wind Energy Facility (WEF) Complex comprising:

- Mulilo Newcastle Wind Power- Northern WEF
- Mulilo Newcastle Wind Power 2- southern WEF
- Mulilo Newcastle Wind Power grid connection
- Mulilo Newcastle Wind Power 2 grid connection

The proposed the Mulilo Newcastle Wind Power- Northern WEF (Northern WEF) will be located approximately 15 km north west of the town of Newcastle in the Kwazulu-Natal Province.

The study area is situated in Ward 1 of the Newcastle Local Municipality (LM) within the Amajuba District Municipality (ADM).

The Newcastle WEF Complex grid connection will connect to the existing Eskom Incandu MTS within Ward 1 and possibly extending into Ward 2, 3 and 4 of Newcastle LM.

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.

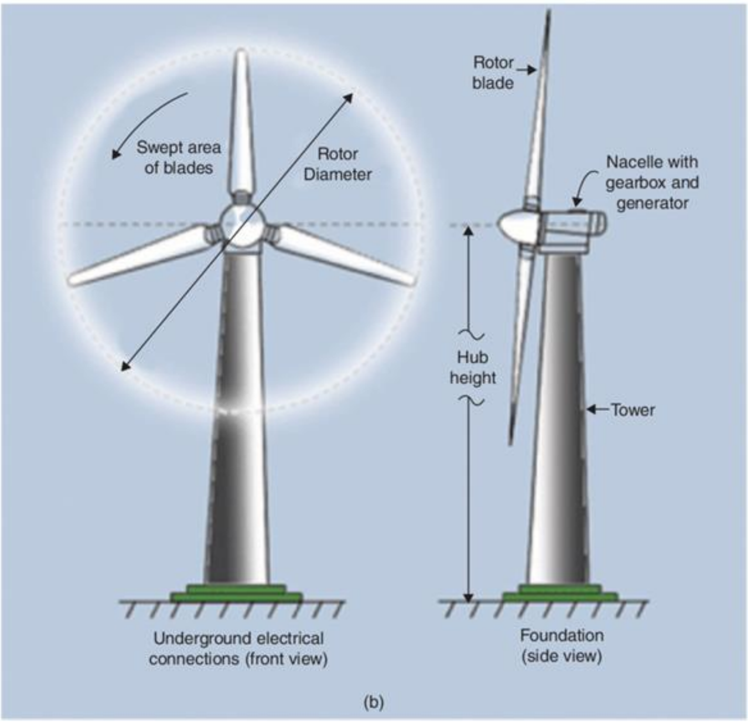


Figure 1: Illustration of the main components of a wind turbine[2]

Each wind turbine is expected to consist of a concrete foundation, a steel tower, a hub (placed at 80m above ground level) and three turbine blades attached to the hub as illustrated in Figure 1. The rotor diameter is expected to be up to 200m,

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

culminating in an overall height of 240m (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.

Turbine design and WEF specifications	
WEF Capacity	Up to 200 MW
Individual turbine capacity	Unspecified
Number of turbines	Up to 37
Hub Height	Up to 140 m
Rotor Diameter	Up to 200 m
Blade length	Up to 100 m

Table 2: Specifications of the proposed turbines as provided by the applicant

The anticipated lifespan is of the WEF is 20-25 years and construction is anticipated to be between 18 and 24 months.

The proposed 200 MW Mulilo Newcastle Wind Power- Northern WEF will comprise of thirty-seven (37) turbines with unspecified individual turbine output capacity with locations currently based on technical considerations such as wind resource, access, etc. but the final locations will be informed by the findings of the Specialist Assessments.

The properties affected by the Northern WEF are all zoned as Agriculture and mostly used for stock grazing. Woodlands or afromontane forests occur in the ravines.

Infrastructure required for the Northern WEF includes operational and maintenance buildings, internal roads, underground electrical cabling linking turbines, an on-site 33 kV to 132 kV collector substation to receive, convert and step-up electricity from the WEF to the 132 kV grid suitable supply and a battery energy storage facility.

The Northern WEF has six (6) main affected land portions that have a total extent of 2,393 ha, are included in the table below:

Farm Name	**Farm Number**	**Owner**	**Area (ha)**
Geelhoutboom	3350	Kwaggaskop landgoed CC	647
Geelhoutboom	3350	Kwaggaskop Langeod EDMS BPK	567
Bernard	9447	Lentevlei Landgoed EDMS BPK	465
Spitskop	16302	Lentevlei Landgoed Pty Ltd	587
Cliffdale	9439	Lentevlei Landgoed Pty Ltd	280
Byron	9448	Uncertain	392

Table 3: Affected properties of the Northern WEF

4. SCOPE OF WORK

The scope of work for this assessment includes the determination of the potential visual impacts in terms of nature, extent, duration, magnitude, probability and significance of the construction and operation of the proposed Mulilo Newcastle Wind Power- Northern WEF. Mitigation measures are recommended where appropriate. Anticipated issues related to the potential visual impact of the Northern WEF include the following:

- Potential visual impacts associated with the construction phase on observers in close proximity to the proposed Northern WEF.
- The Potential visual impact on sensitive visual receptors in close proximity to the proposed Northern 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 Northern 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.
- The potential cumulative visual impact of the proposed Newcastle WEF Complex.
- Potential residual visual impacts after the decommissioning of the proposed Northern WEF.
- 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

The study area is situated in Ward 1 of the Newcastle Local Municipality within the Amajuba District Municipality. The proposed Mulilo Newcastle Wind Power- Northern WEF is located approximately 15 km north west of the town of Newcastle in the Kwazulu-Natal Province and 20 Km east of Memel, a small town located in the Free State province.

Access to the site is provided by the R34 arterial road and a small private roads leading to the affected properties.

The N11 national road runs through Newcastle, the largest city along the route, to end at the N3, the main connector to Durban. Refer to Map 1 and Map 2 for the topography and land cover maps of the study area.

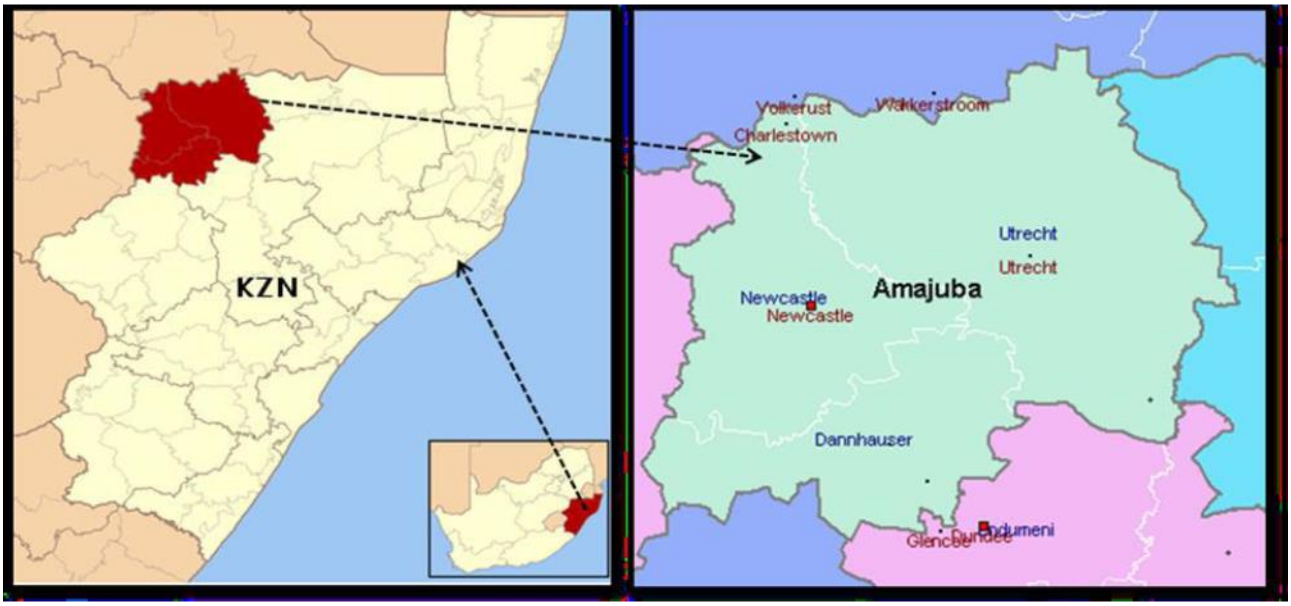


Figure 2: Regional locality o the study area

Newcastle, situated at the foothills of the Drakensberg Mountains, is the third largest city in the KwaZulu-Natal province with a population density of 2207 people per square kilometre. Newcastle is an industrial centre with the main activities being coal mining and steel production. The city also lies on the main road, passenger and freight railway line running between Johannesburg and Durban.

Figure 3: View of the site from the R34

Figure 4: View of the city of Newcastle

The study area is located on land that ranges in elevation 1200 m above sea level at the city of Newcastle to 1950 m above sea level at the location of the wind turbines at Mulilo Newcastle Wind Power- Northern WEF. This undulating topography consists of rolling hills separated by shallow and in some place's deep valleys. Some of the rivers traversing the valleys in the study area are the Klip, Gansvleispruit, Ngogo, Mbizana, Buffels, Ncandu and Ingagane. The proposed Mulilo Newcastle Wind Power- Northern WEF is located on the Drakensberg Mountain.

The site is located within the Grassland Biome and the farms comprising the proposed Mulilo Newcastle Wind Power-Northern WEF are located within the vegetation type known as the Low Escarpment Moist Grassland. The Sub-escarpment Grassland Bioregion is described by Musina and Rutherford *et al* (2006) as occurring at relatively low altitudes on the plains and foothills of the Drakensberg and eastern escarpment from around Volksrus in the north to the Queenstown area in the south. The area where the proposed Grid complex will traverse is located within the vegetation type known as Northern KwaZulu-Natal Moist Grassland with scattered patches of Alluvial Wetlands.

Figure 5: the undulating landscape showing the Drakensberg with grassland vegetation

It should be noted that sections of the study area have been transformed by agricultural activities and is now used mainly for livestock farming (i.e. cattle) while the remaining natural vegetation is primarily found along steeper slopes. Other land uses in the area exotic plantations particularly in the south, dry and irrigated agriculture to the east.

Figure 6: Examples of the livestock farming taking place in the study area

The majority of the study area is sparsely populated and consists of a landscape of wide-open expanses. The site itself is sparsely populated, however, a high concentration of people live in the city of Newcastle located only 15 Km away and to a lesser extent, the small town of Memel. The few built structures located outside of Newcastle and settlements within the region are predominately farm and homesteads associated with the agricultural activities taking place in the study area. Some of which are associated with tourist accommodation (i.e. Drakensbergkloof and Engogo Riverside Lodge both located to the west of Mulilo Newcastle Wind Power- Northern WEF.

Figure 7: Example of tourist accommodation

Other infrastructure within the study area includes the Incandu switching station to which the proposed grid connections will join, numerous overhead high voltage powerlines inclusive of Majuba/Venus 1 400 kV, Majuba/Venus 2 400 kV, Pegasus/Tutuka 1 400 kV, Camden/Incandu 1 400 kV, Camden/Chivelston 2 400 kV, as well as, passenger and freight railway line running between Johannesburg and Durban. Additionally, mining and industrial areas lie to the east of the city of Newcastle.

Figure 8: Examples of small settlements within the foothills

Figure 9: Powerline and railway line infrastructure

Figure 10: Example of powerlines that traverse the study area

Figure 11: Incandu switching station

Figure 12: Mining/industrial areas to the east

The N11 is the national road in the study area, giving access to the area between Limpopo, Middleburg, Ermelo and Newcastle ending at the N3 just after Ladysmith. The R34 is the main arterial road located in the study area, being a local connector between Vrede, Memel, Newcastle and further east to Utrecht. Other than these main roads, a number of secondary and internal farm roads also cross the study area. It must be noted that all secondary roads and internal farm roads are gravel roads unlikely to carry much traffic.

Figure 13: Example of the numerous secondary roads within the area

There are a fair number of protected areas present within the study area. These include:

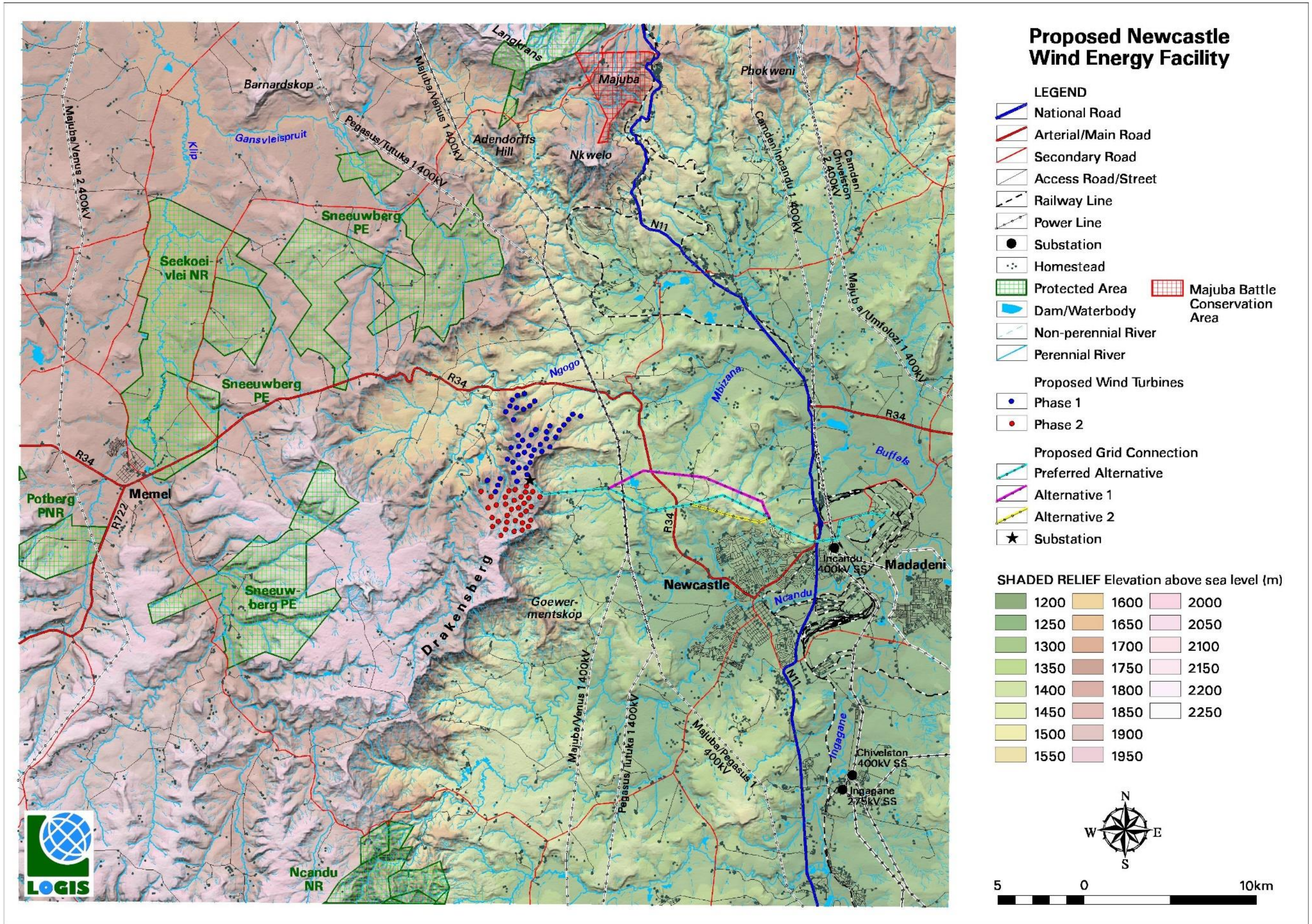
- Sneeuwberg Protected Environment
- Seekoeivlei Nature Reserve
- Potberg Private Nature Reserve
- Ncandu Nature Reserve

Figure 14: Entrance to the Seekoeivlei Nature Reserve

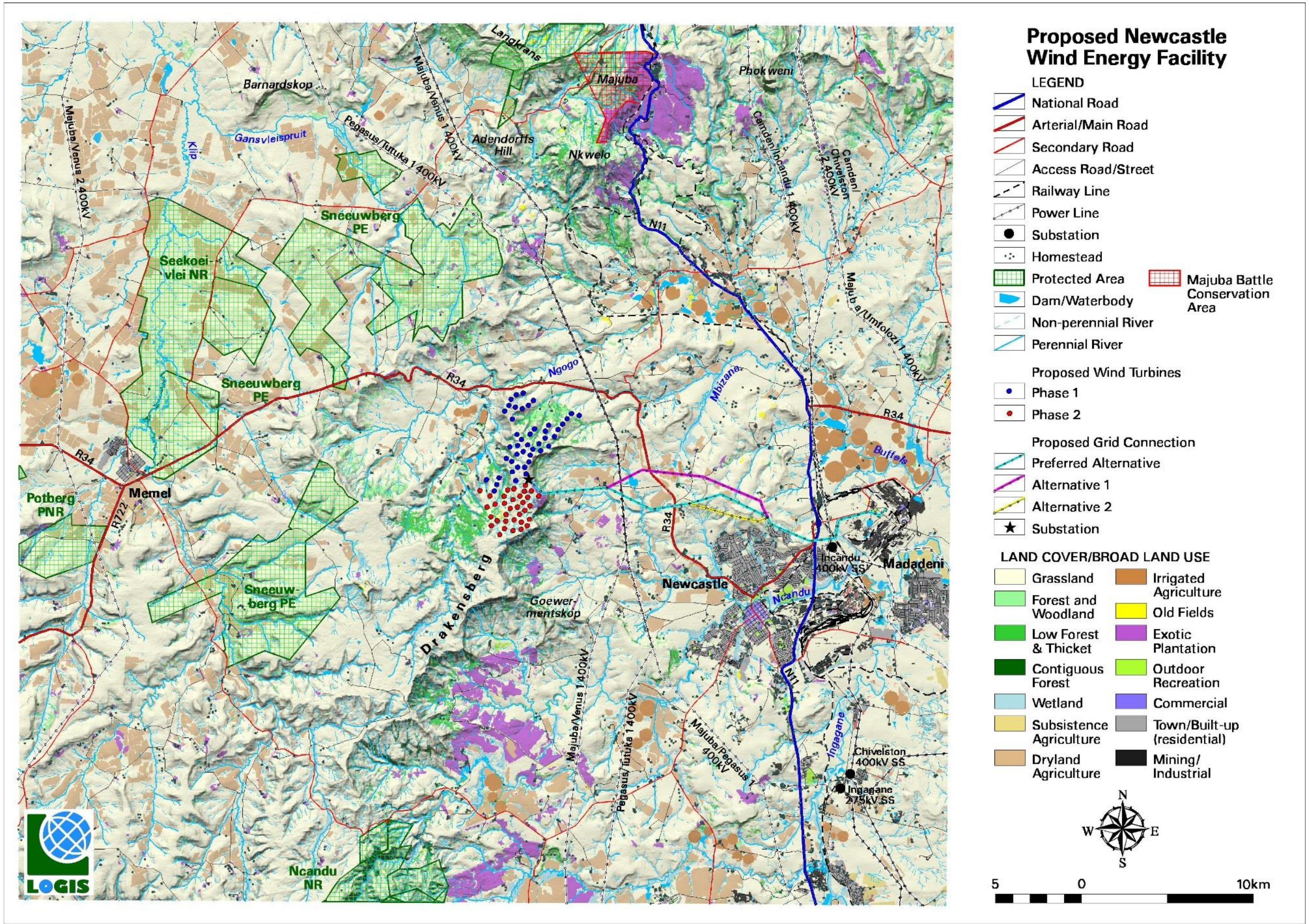
The greater environment with its wide open, undeveloped landscapes is considered to have a high visual quality.

This study area is not known as a tourist destination, but Newcastle is an alternate route for travellers from Gauteng to Durban. Additionally, Newcastle is part of the KZN Battlefields Route where the Majuba Mountain has historical significance.

Figure 15: High visual quality of the study area



Map 1: Shaded relief map of the study area



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

6. PHOTO SIMULATIONS

Photo simulations were undertaken (in addition to the spatial analyses) in order to illustrate the potential visual impact of the proposed Newcastle WEF Complex within the receiving environment. The purpose of the photo simulation exercise is to support the findings of the VIA, and is not an exercise to illustrate what the facility will look like from all directions.

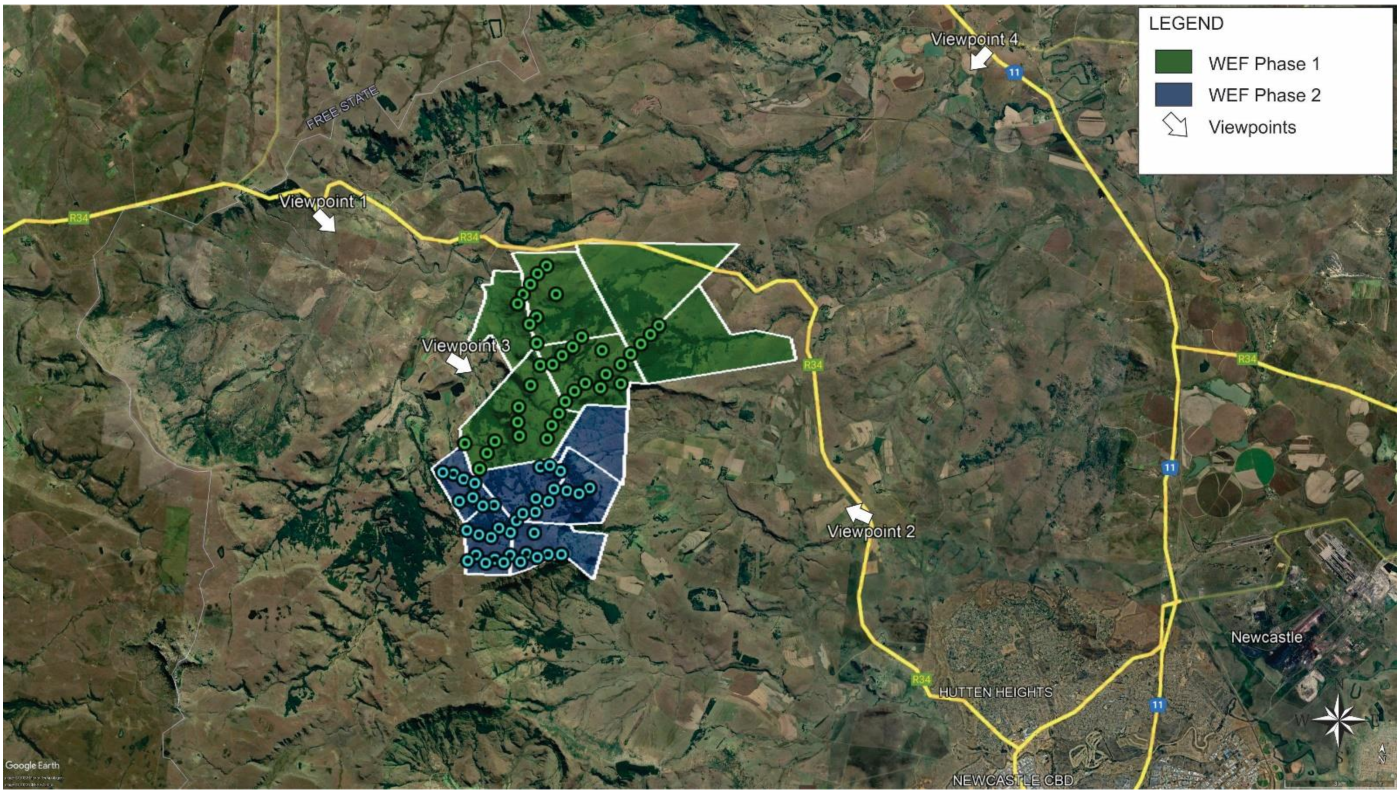
The photo simulations indicate the anticipated visual alteration of the landscape from various points located at different distances from the infrastructure. These points coincide with specific sensitive visual receptors noted during the site visit. The simulations are based on the WTGs actual dimensions and layout.

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

It is assumed that the necessary post-construction phase rehabilitation and mitigation measures, as proposed by the various specialists in the environmental impact assessment report, have been undertaken. These photographs can therefore be seen as an ideal operational scenario (from a visual impact point of view) that should be aspired to. It is, however, crucial that the natural vegetation be restored to its present status in order for these simulations to be as realistic as possible. Additional infrastructure (e.g. access roads, substations, etc.) associated with the facility are not included in the photo simulations.

Each photographic simulation, as seen below, is preceded by a panoramic overview of the landscape (as it is presently), ultimately presenting a ‘before’ and ‘after’ scenario from the specified viewpoint being discussed.

The simulated Newcastle WEF Complex, as shown on the photographs, was adapted to the atmospheric conditions present when the original photographs were taken. This implies that factors such as haze and solar glare were also simulated in order to realistically represent the observer's potential view of the infrastructure.



6.1 PHOTO SIMULATION POINT 1- POSITION ON R34 FROM THE NORTH

Photo simulation 1 has been generated from a viewpoint situated on the R34 regional road, north west of the proposed Newcastle WEF Complex, looking south west at the proposed site. This photo simulation shows both the cumulative view of the Newcastle WEF Complex (i.e. Mulilo Newcastle Wind Power- Northern WEF and the Mulilo Newcastle Wind Power 2- Southern WEF), as well as, turbines on just Mulilo Newcastle Wind Power- Northern WEF and the Mulilo Newcastle Wind Power 2- Southern WEF respectively. The point from which the photo was taken is approximately 5km from the facility and is indicative of a close range view that locals and users of the R34 road will experience.

Figure 16: Photo simulation viewpoint 1- before construction

Figure 17: Photo simulation viewpoint 1 after construction- only Mulilo Newcastle Wind Power- Northern WEF depicted, 33 turbines visible

Figure 18: Photo simulation viewpoint 1 after construction- only Mulilo Newcastle Wind Power 2- Southern WEF depicted, 35 turbines visible

Figure 19: Photo simulation viewpoint 1 cumulative impact after construction of the proposed Newcastle WEF Complex

6.2 PHOTOSIMULATION POINT 2- POSITION ON R34 FROM THE EAST

Photo simulation 2 has been generated from a viewpoint situated on the R34 regional road, east of the proposed Newcastle WEF Complex, looking west at the proposed site. This photo simulation shows the cumulative view of the Newcastle WEF Complex (i.e. Mulilo Newcastle Wind Power- Northern WEF and the Mulilo Newcastle Wind Power 2- Southern WEF). The point from which the photo was taken is approximately 8km from the facility and is indicative of a medium range view that locals and users of the R34 road will experience.

Figure 20: Photo simulation viewpoint 2 before construction

Figure 21: Photo simulation viewpoint 2 after construction

6.3 PHOTO SIMULATION POINT 3- D401 ROAD TURN OFF FROM THE R34

Photo simulation 3 has been generated from a viewpoint situated on the District Road, D401 that turns off of the R34 regional road, west of the proposed Newcastle WEF Complex, looking east and south east at the proposed site. This photo simulation shows the cumulative view of the Newcastle WEF Complex (i.e. Mulilo Newcastle Wind Power- Northern WEF and the Mulilo Newcastle Wind Power 2- Southern WEF). The point from which the photo was taken is approximately 1km from Phase 1 and 3Km from Phase 2, indicative of a close range view that locals and users of the secondary road will experience.

Figure 22: Photo simulation viewpoint 3 before construction

Figure 23: Photo simulation viewpoint 3 after construction- 13 turbines will be visible

6.4 PHOTO SIMULATION POINT 4- N11 NATIONAL ROAD

Photo simulation 4 has been generated from a viewpoint situated on the N11 National road, north east of the proposed Newcastle WEF Complex, looking south west at the proposed site. This photo simulation shows the cumulative view of the Newcastle WEF Complex (i.e. Mulilo Newcastle Wind Power- Northern WEF and the Mulilo Newcastle Wind Power 2- Southern WEF). The point from which the photo was taken is approximately 10km from proposed facility, indicative of a long range view that locals and potentially tourists will experience.

Figure 24: Photo simulation viewpoint 4 before construction

Figure 25: Photo simulation viewpoint 4 after construction

7. VIEWSHED ANALYSIS

7.1 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.

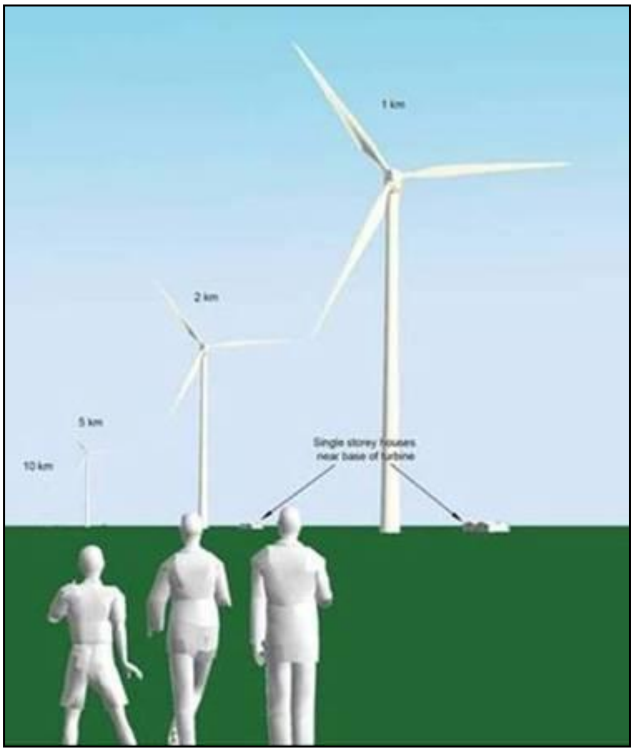
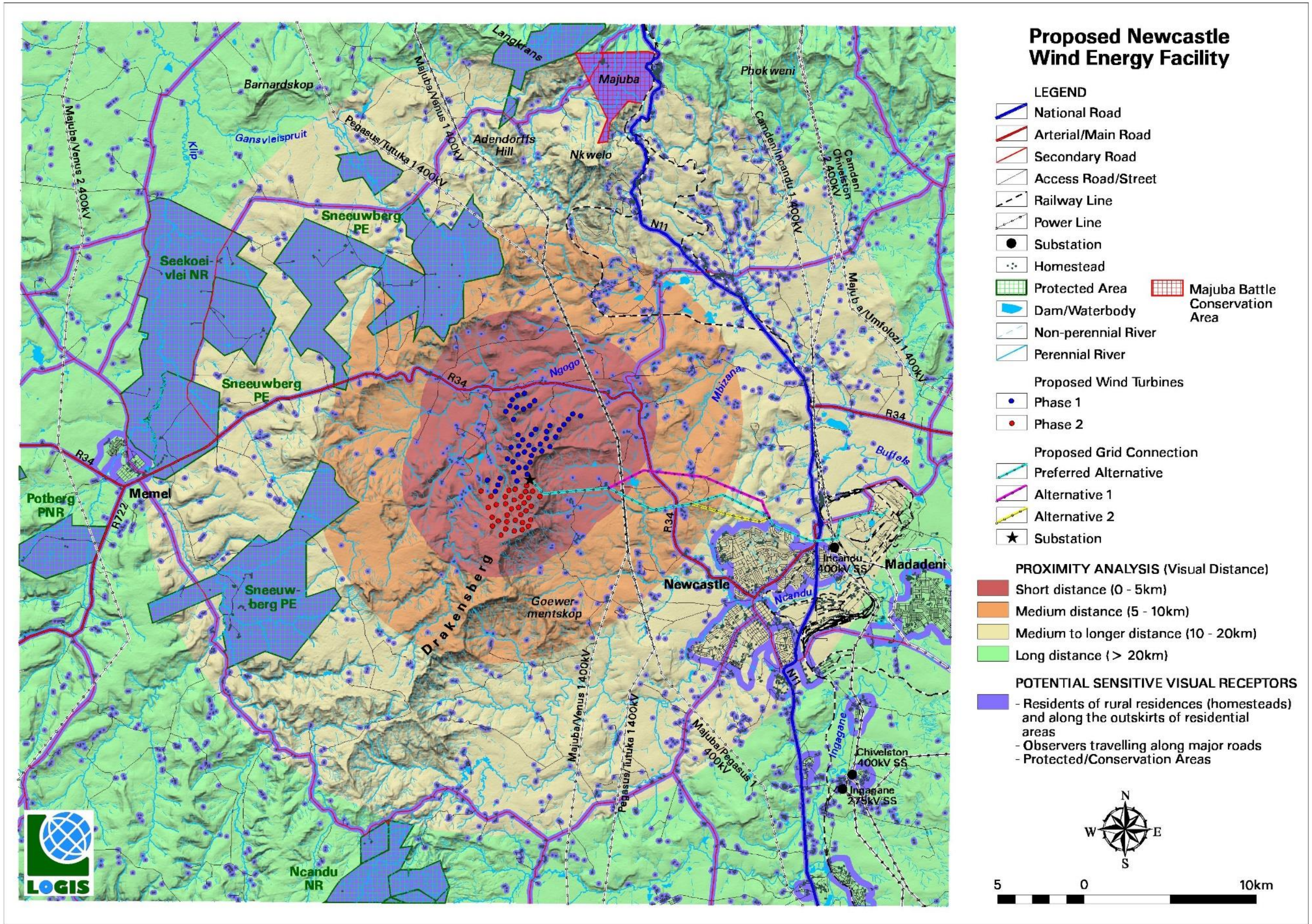


Figure 26: Visual experience of a 100m high wind turbine structure at a distance of 1km, 2km, 5km and 10km



Map 3: Visual proximity analysis, observer sensitivity and proximity of the proposed Mulilo Newcastle Wind Power- Northern WEF

7.2 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 Mulilo Newcastle Wind Power- Northern WEF.

Homesteads / farmsteads and conservation and tourist areas (i.e. Sneeuwberg Protected Environment, Seekoeivlei Nature Reserve, etc.), by virtue of their visually exposed nature, are considered to be sensitive visual receptors. Viewer incidence is calculated to be the highest for the homesteads and tourism facilities within the areas closest to the facility, as well as, within the local built-up areas (i.e. the town of Newcastle and Madadeni). Second to these are the users along the National (N11), provincial (R34) 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.

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 Newcastle WEF Complex, as no reported stakeholder feedback has been received by the specialist. However, considering the proximity of the proposed facilities to the town of Newcastle and Madadeni and the undeveloped 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.

The potential sensitive visual receptors within a 5km, 10km and 20km radius as identified on
Map 3 are as follows:

- < 5km – Short Distance

  Residents of numerous rural homesteads and along the outskirts of residential areas and observers travelling along the R34.

- 5- 10km – Short to Medium Distance

  Residents of numerous rural homesteads and along the outskirts of residential areas, observers travelling along the R34 and visitors to portions of the Sneeuwberg Protected Environment.

- 10 - 20km – Medium to Long Distance

  Residents of numerous rural homesteads and along the outskirts of residential areas, residents of the town of Newcastle observers travelling along the N11, R34 and other secondary roads, as well as visitors to the Sneeuwberg Protected Environment, Seekoeivlei Nature Reserve and the Majuba Battle Conservation Area.

7.3 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 of open grassland and cultivated land / agricultural fields or pastures, dispersed by thicket, therefore not continuous tall dense vegetation, overall, the VAC of the receiving environment of the Newcastle WEF Complex is deemed to be moderate to low by virtue of the inconsistent nature of the vegetation, as well as, the generally undeveloped nature of the study area. Where homesteads do occur, vegetation and trees may have been planted it is expected that this will contribute to the visual absorption and the VAC will be higher. As this is not a consistent occurrence VAC will not be taken into account for any of the homesteads or settlements, again assuming a worst-case scenario.

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 varied consistency in the vegetation 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 Newcastle WEF Complex.

7.4 POTENTIAL VISUAL EXPOSURE

The result of the viewshed analyses for the proposed Mulilo Newcastle Wind Power- Northern WEF.is shown on **Map 4** that follows. The analyses have 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 240m 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. 240m) 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 viewshed analyses do not include the effect of vegetation cover or existing structures on the exposure of the proposed facility, therefore signifying a worst-case scenario.

The viewshed not only indicates areas from which the wind turbines would be visible (any number of turbines with a minimum of one turbine), but also indicates the potential frequency of visibility (i.e. how many turbines are exposed). The red areas indicate a high frequency (i.e. 36-45 turbines or parts thereof may be visible), orange areas indicate a moderate frequency (i.e. 21-35 turbines), while the yellow areas represent a low frequency (i.e. 1-20 turbines or parts thereof may be visible).

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. Areas to the east, west and far north will have a high visual exposure with 41-45 turbines being visible, while the areas in the immediate vicinity of the turbines will have a lower frequency of visual exposure to 1-10 turbines. The Drakensberg Mountains to the south offers some visual screening to these areas.

  Potential sensitive visual receptors within this visually exposed zone include residents of numerous rural homesteads and observers travelling along the R34.

- Potential visual exposure remains high but scattered in the medium distance (i.e. between 5 and 10km), with visually screened areas predominantly associated with the Drakensberg Mountain to the south and south west. Areas to the north west are also visually screened. Within this zone, the frequency of visual exposure is relatively high, with most areas being exposed to 36-45 turbines.

  Sensitive visual receptors comprise residents of numerous rural homesteads and along the outskirts of residential areas, observers travelling along the R34 and visitors to portions of the Sneeuwberg Protected Environment.

- In the longer distance (i.e. between 10 and 20km offset), the extent of potential visual exposure is significantly reduced, especially in the south, south west, west and north west. Visually exposed areas tend to be concentrated in the east, where the frequency of visual exposure is relatively high with 31-40 turbines being visible.

Sensitive visual receptors include residents of numerous rural homesteads and along the outskirts of residential areas, residents of the town of Newcastle observers travelling along the N11, R34 and other secondary roads, as well as visitors to the Sneeuwberg Protected Environment, Seekoeivlei Nature Reserve and the Majuba Battle Conservation Area.

- 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.

In general, despite the scattered and lower population density of the study area, the Mulilo Newcastle Wind Power- Northern WEF may constitute a high visual prominence, potentially resulting in a high visual impact.

7.5 POTENTIAL CUMULATIVE VISUAL EXPOSURE

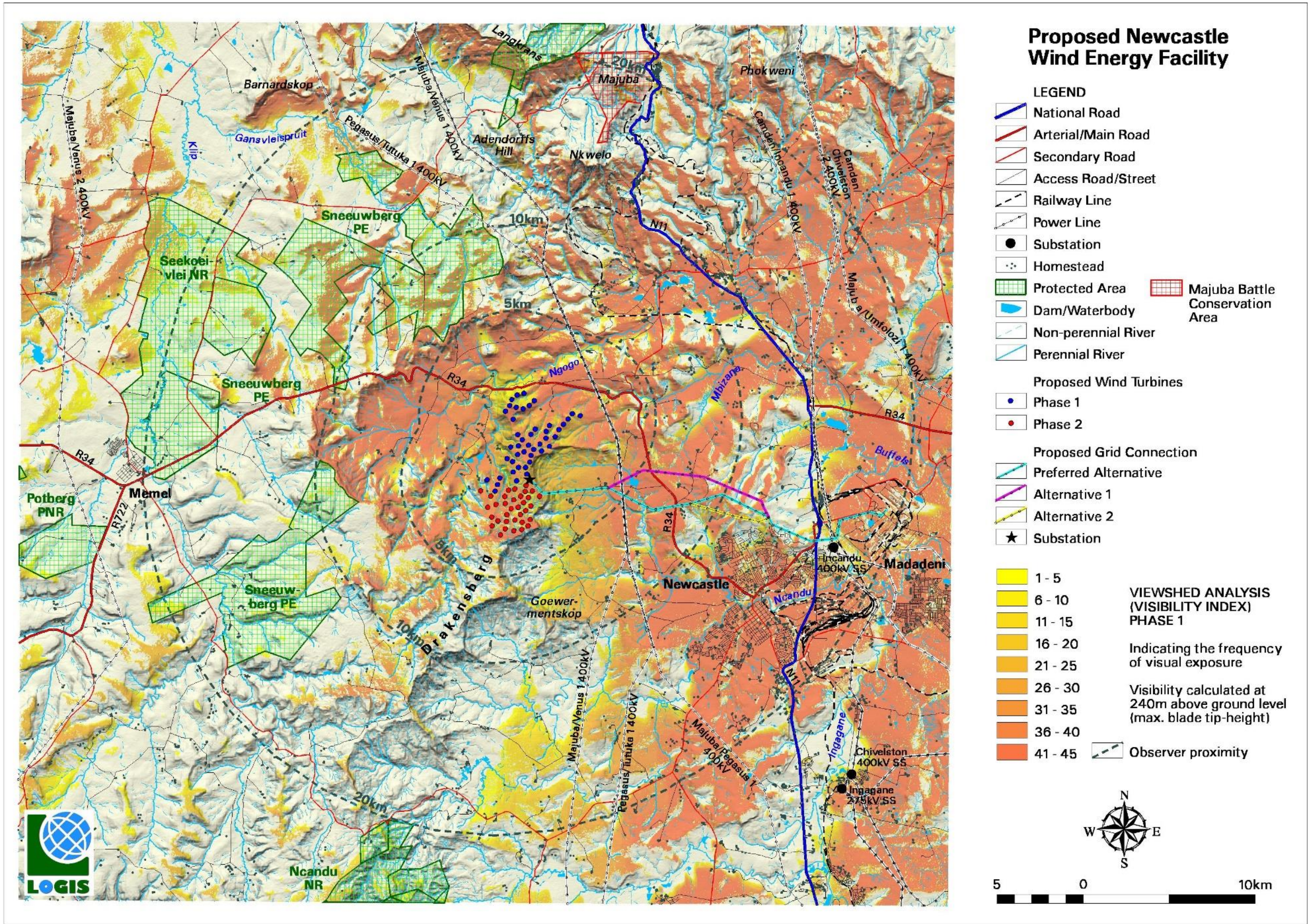
It is a requirement that a visual specialist identify and quantify the cumulative visual impacts of a proposed development, propose potential mitigating measures and conclude if the proposed development will result in any acceptable loss of visual resources taking into consideration the other proposed 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. Therefore, the visual assessment for this development includes a cumulative viewshed analysis in order to determine the visual exposure (visibility) of the 2 WEF components that makes up the Newcastle WEF Complex i.e. Mulilo Newcastle Wind Power- Northern WEF and the Mulilo Newcastle Wind Power 2- Southern WEF.

Cumulative visual impacts may be experienced as a result of the following; where a combination of several WEFs 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 WEFs and 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).

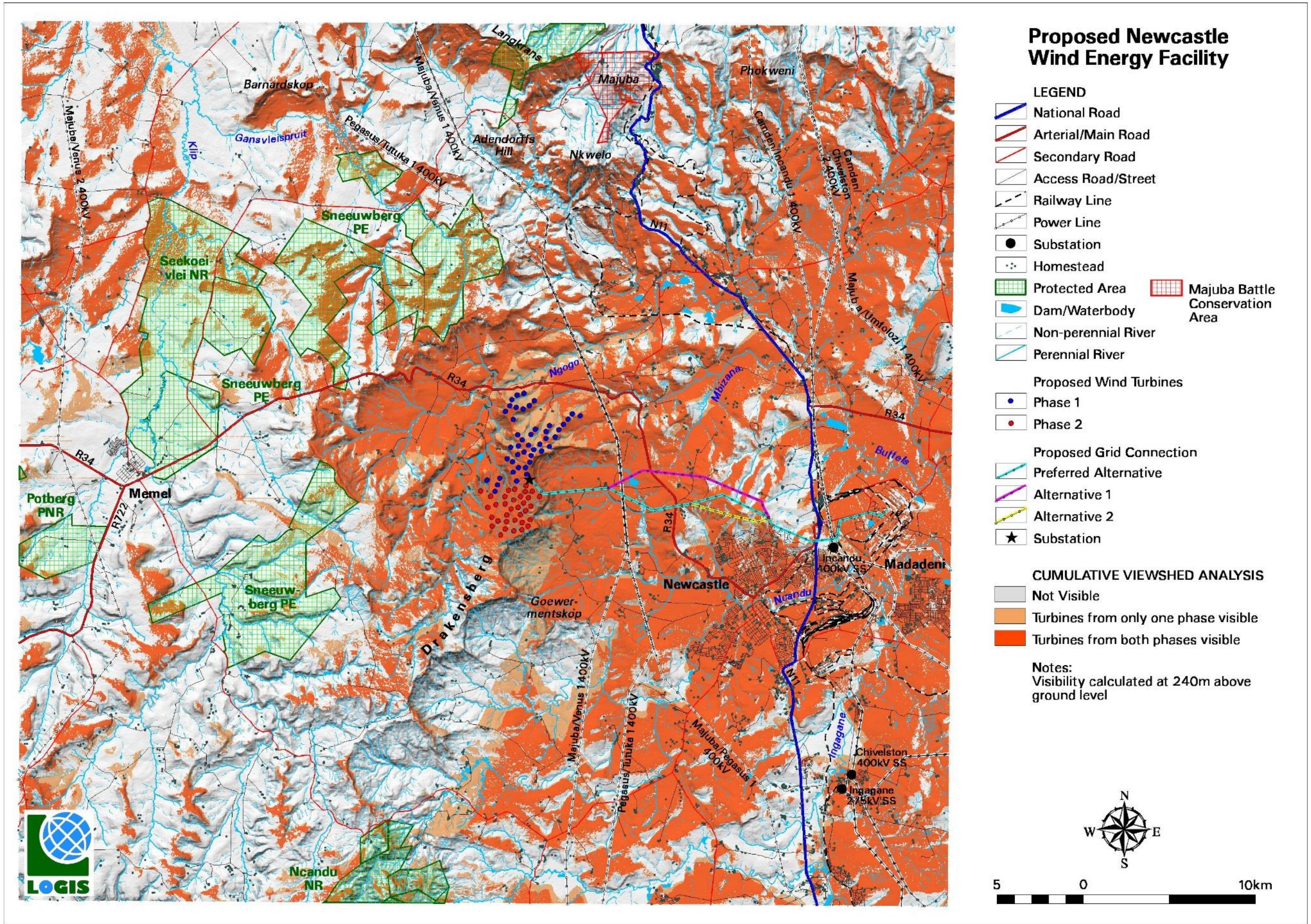
The cumulative visual impact is not just the totality of the impacts of two developments. The combined impact may be greater than the sum of the two individual developments, or in rare cases even less. The cumulative visual impact is assessed as the product of the distance between the individual WEFs (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.

For the purpose of this study, viewshed analyses from each WEFs turbines were undertaken in order to determine the area of potential combined visual exposure. A visibility analysis of the WTGs of the proposed Newcastle WEF Complex was undertaken individually from each of the proposed turbine positions (74 in total) at an offset of 240m above ground level. **Map** 5 illustrates essentially the area of potential visual overlap, where observers may view turbine structures from both facilities. Areas shaded in dark orange are likely to be exposed to both WEF facilities (Northern WEF and Southern WEF), where areas shaded in peach are likely to be exposed to only one of the WEF facilities (either Northern WEF OR Southern WEF).

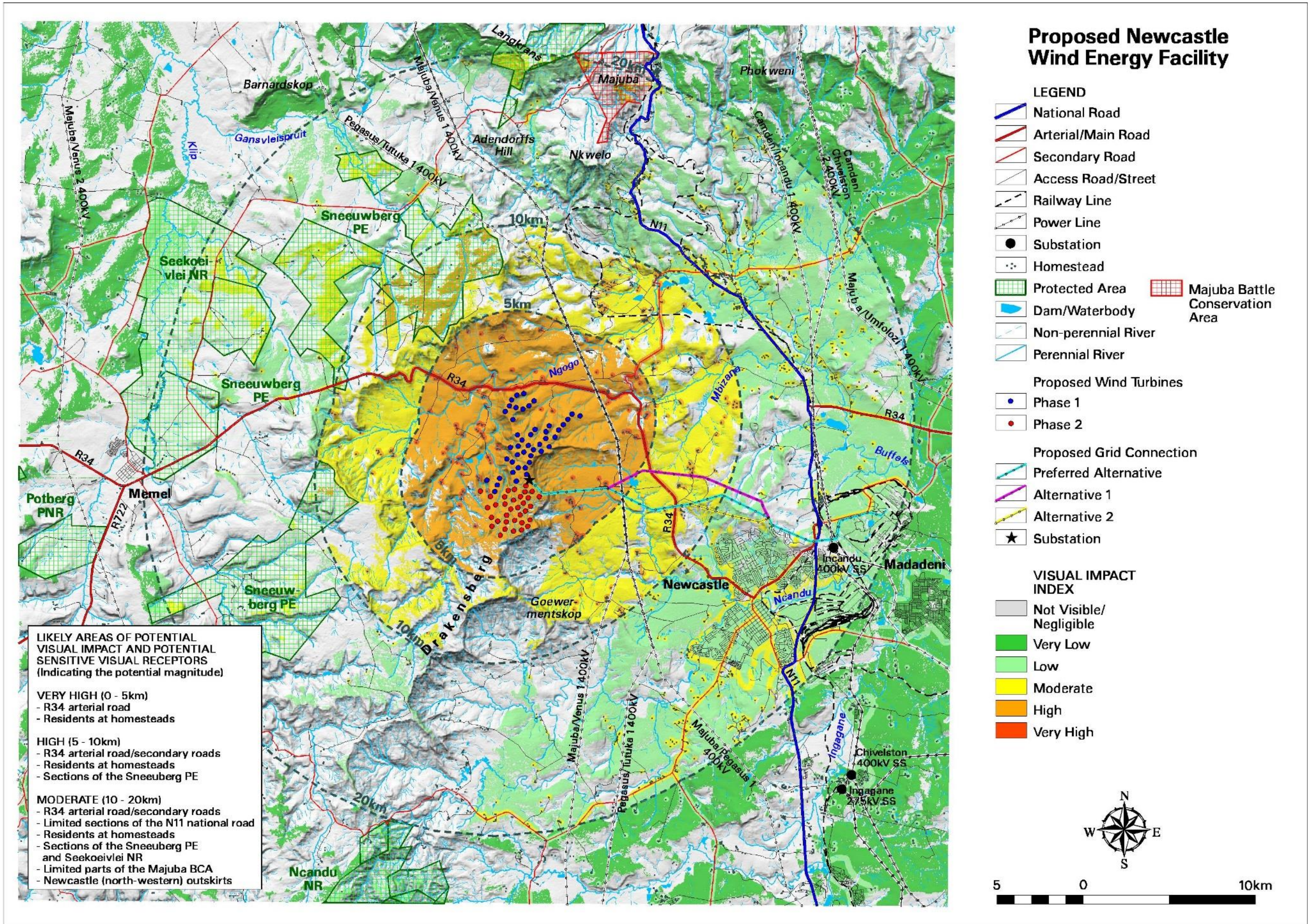
A large overlap between the visual exposures of the two WEF layouts is noted, due to the two facilities close proximity to each other. Areas on the site itself and to the east will predominately be exposed to both facilities. Potential areas where the cumulative visual impact will be experienced the most will be residents of homesteads in the outlying areas, as well as Newcastle, users of the N11, R34 and other secondary roads and visitors to portions of the Sneeuwberg Protected Environment. It is therefore concluded that the overall cumulative visual impact is expected to be moderate.



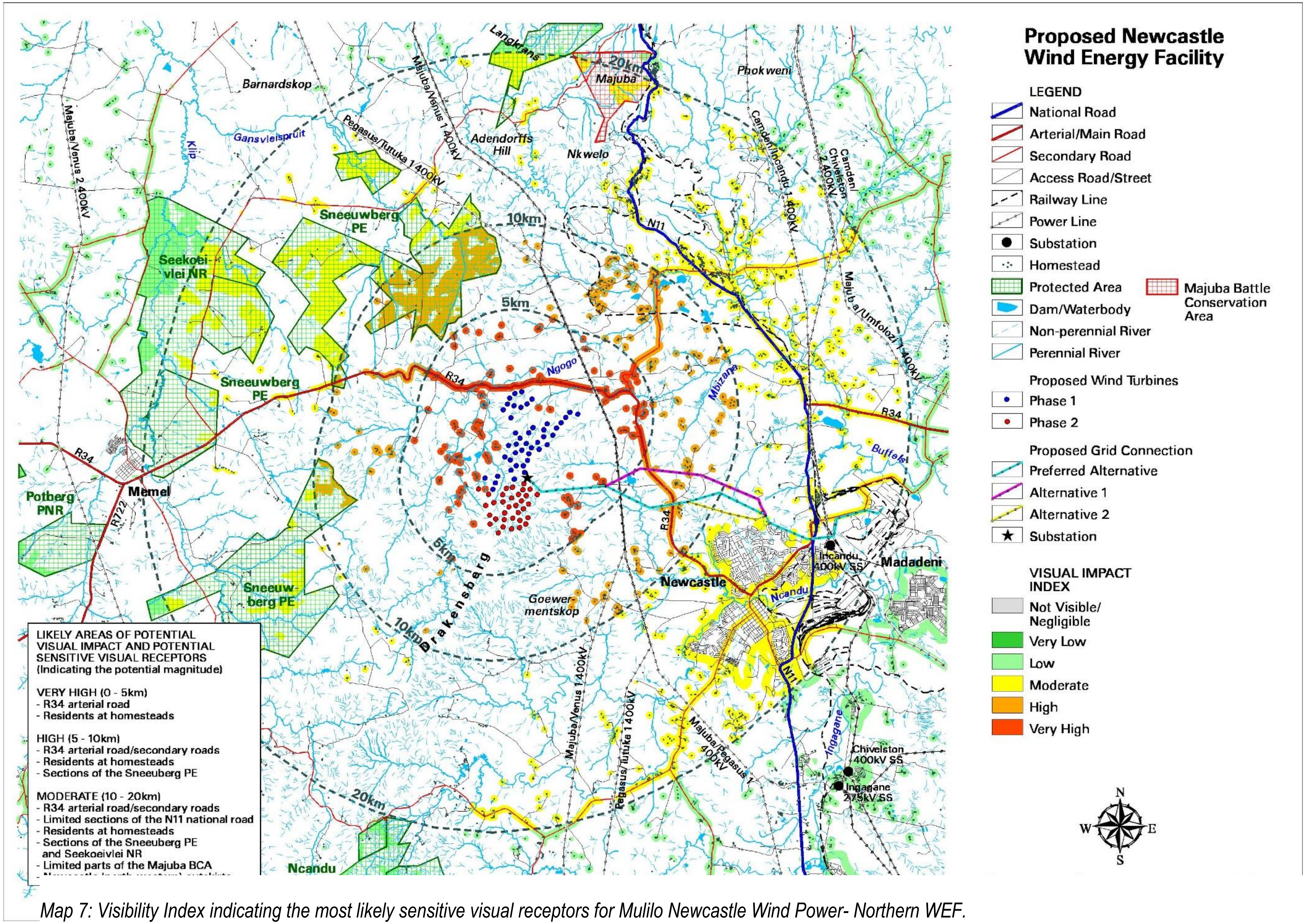
Map 4: Potential visual exposure (viewshed analysis) of the proposed Mulilo Newcastle Wind Power- Northern WEF.



Map 5: Potential cumulative visual exposure of the proposed Newcastle WEF Complex



Map 6: Visibility Index illustrating the frequency of exposure of the proposed Mulilo Newcastle Wind Power- Northern WEF layout



Map 7: Visibility Index indicating the most likely sensitive visual receptors for Mulilo Newcastle Wind Power- Northern WEF.

7.6 VISUAL IMPACT INDEX

The combined results of visual exposure, viewer incidence / perception and visual distance of the proposed facility are displayed on

Map 6 and **Map 7.** Here the weighted impact and the likely areas of impact and potential sensitive visual receptors 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 5 km of the proposed facility. Sensitive visual receptors within this zone comprise mainly of the following users:
    - Residents of homesteads
    - Users of the R34 arterial road

  The above receptors are likely to experience **very high** visual impact.

- Visual impact is prominently **moderate** between 5 km and 10 km of the proposed facility. Sensitive visual receptors within this zone comprise mainly of the following users:
    - Users traveling along the R34 and other secondary roads, potential visibility is however scattered along the length of the roads and visual intrusion where possible will be brief
    - Residents of homesteads
    - Visitors to sections of Sneeuwberg Protected Environment

  These receptors are likely to experience a **high** visual impact.

- Visual impact is prominently **low** between 10 km and 20 km of the proposed facility. Sensitive visual receptors within this zone comprise mainly of the following users:
    - Users traveling along the R34 and other secondary roads, potential visibility is however scattered along the length of the road and visual intrusion where possible will be brief
    - Users travelling along limited sections of the N11 national road
    - Residents at homesteads including residents in the outskirts of the town of Newcastle
    - Visitors to sections of Sneeuwberg Protected Environment and Seekoeivlei Nature Reserve
    - Limited parts of the Majuba BCA

  These receptors are likely to experience a **moderate** visual impact.

- Beyond the 20 km of the proposed facility, the extent of potential visual impact is somewhat reduced, and the magnitude is predominantly **very low**.

7.7 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 Mulilo Newcastle Wind Power- Northern 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.

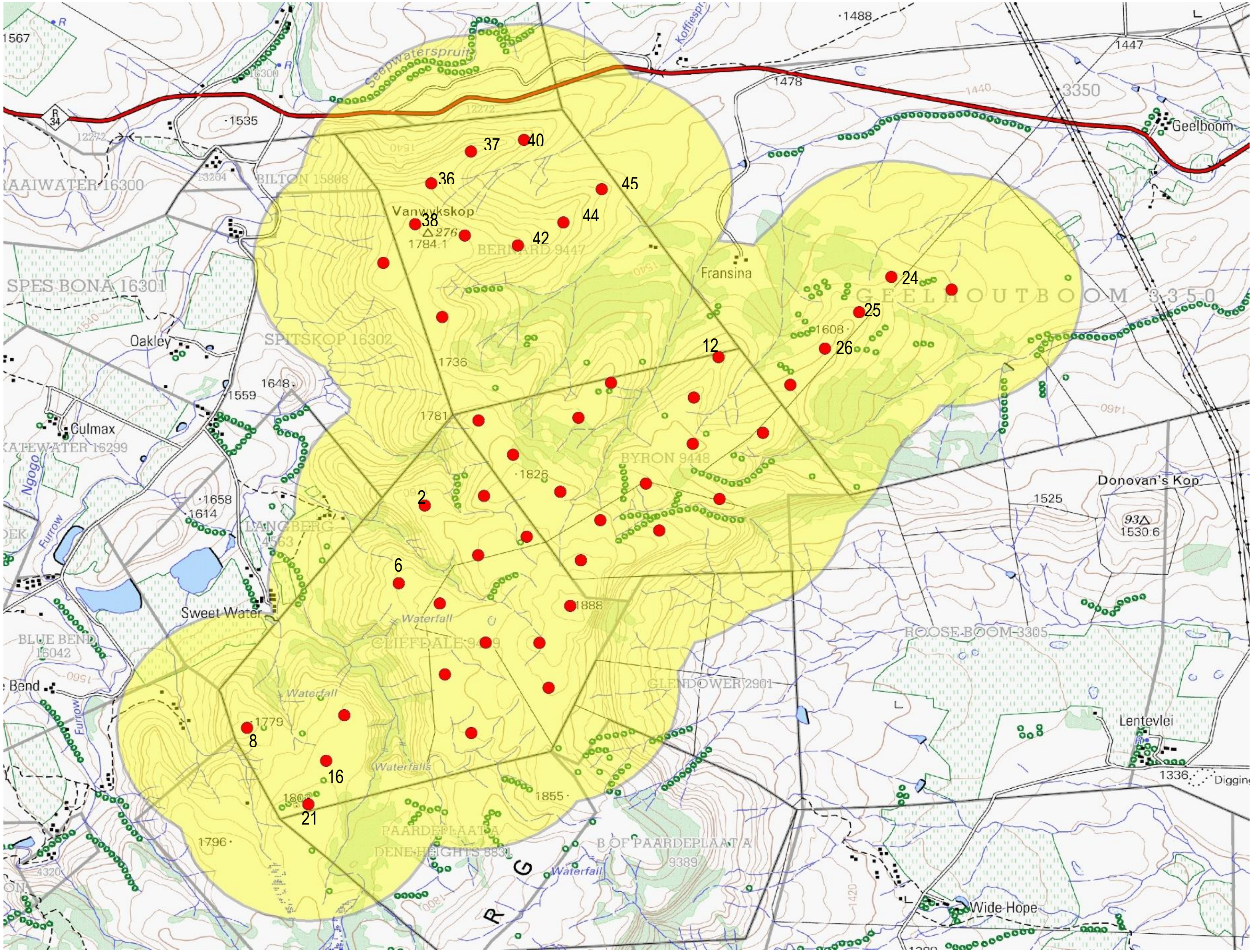
The impact of shadow flicker can be effectively mitigated by choosing the correct site and layout for the wind turbines, taking the orientation of the turbines relative to the nearby homesteads / roads and the latitude of the site into consideration. Tall structures and trees will also obstruct shadows 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 shadow flicker assessment for the proposed **Mulilo Newcastle Wind Power- Northern WEF** was undertaken on a likely 37 turbine layout using a 240m blade tip height (hub height of 140m and rotor diamter of 200m). As such, sensitive receptors are considered to be affected where shadows are predicted to occur within 1km of a turbine. Therefore, a 1km zone around each turbine has been identified as the zone within which there is a risk of shadow flicker occurring. These zones and turbines loacted near sensitive receptors have been labelled on **Map 8.**

This study found that three (3) turbines 36, 37, 38 and 40 located in the far north adjacent to the R34 are likely to have a shadow flicker impact on motorists using this portion of the R34. 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.

Twelve (12) turbines may have a shadow flicker impact on a few of home/farmsteads. Turbines 42, 44 and 45 in the north, turbines 12, 24, 25 and 26 in the north east may have an impact on two single homesteads within 1 Km of the turbine. However these homesteads are located within the farm portions earmarked for the proposed WEF development.

Turbines 2, 6, 8, 16 and 21 may have an impact on two single homesteads within 1 Km of the turbine. However, these affected homesteads are located outside of the farm portions earmarked for the propsoed WEF development.



Map 8: Potential sensitive receptors exposed to shadow flicker from the proposed Mulilo Newcastle Wind Power- Northern WEF

8. VISUAL IMPACT ASSESSMENT

8.1. 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 - How far the visual impact is going to extend 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: International
- (2) Low: National
- (3) Medium: Regional, within the region
- (4) High: Local, within the local neighbourhoods
- (5) Very high: Site specific, within the 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

8.2. PRIMARY IMPACTS

The primary visual impacts of the proposed Mulilo Newcastle Wind Power- Northern WEF are assessed as follows:

8.2.1. 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 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.

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

Table 4: Impact table summarising the significance of visual impact of construction on visual receptors in close proximity to the proposed infrastructure

Nature of Impact: Visual impact of construction on sensitive visual receptors in close proximity to the proposed facility		
	No mitigation	***Mitigation considered***
Extent	Local **(4)**	Local **(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.

8.2.2. POTENTIAL VISUAL IMPACT OF FACILITY OPERATIONS ON SENSITIVE VISUAL RECEPTORS IN CLOSE PROXIMITY TO THE PROPOSED DEVELOPMENT

The visual impacts of facility operations on sensitive visual receptors (i.e. residents of farm and homestead, as well as observers travelling along the R34) in close proximity to the proposed Mulilo Newcastle Wind Power- Northern WEF. (i.e. within 5km) is expected to be of **very high** significance. 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 5: Impact table summarising the significance of facility operations on sensitive visual receptors in close proximity (within 5km) to the proposed Mulilo Newcastle Wind Power- Northern WEF

Nature of Impact: Visual impact on sensitive receptors within 5km (residents of farm and homestead, as well as, observers travelling along the R34), in close proximity to the proposed facility		
	No mitigation	***Mitigation considered***
Extent	Regional **(3)**	Regional **(3)**
Duration	Long **(4)**	Long **(4)**
Magnitude	Very High **(10)**	Very High **(10)**
Probability	Definite **(5)**	Definite **(5)**
Significance	Very high **(85)**	Very high **(85)**
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: Operations: ➢ 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. Decommissioning: ➢ Remove infrastructure not required for the post-decommissioning use of the site. ➢ Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications. ➢ Monitor rehabilitated areas post-decommissioning and implement remedial actions.		
Cumulative impacts: The construction of the Mulilo Newcastle Wind Power- Northern WEF (37 turbines) together with the proposed Southern WEF (37 turbines), 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.		

8.2.3. POTENTIAL VISUAL IMPACT OF FACILITY OPERATIONS ON SENSITIVE VISUAL RECEPTORS WITHIN THE REGION

The visual impact of facility operations on sensitive visual receptors (i.e. users of the R34 and other secondary roads, residents of farm and homesteads and visitors to sections of the Sneeuwberg Protected Environment) within the region (i.e. beyond the 5km offset) 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 this impact assessment.

Table 6: Impact table summarising the significance of visual impacts of the facility operations on sensitive visual receptors within the region (beyond the 5km offset)

Nature of Impact: Visual impact on the users of the R34 and other secondary roads, residents of farm and homesteads and visitors to sections of the Sneeuwberg Protected Environment on the periphery of the 5km offset and within the region beyond		
	No mitigation	***Mitigation considered***
Extent	Regional **(3)**	Regional **(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. 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 Mulilo Newcastle Wind Power- Northern WEF (37 turbines) together with the proposed Southern WEF (37 turbines), 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.

8.2.4. 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 than 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 impact 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 27: Example of aircraft warning lights fitted to the turbines as prescribed by the CAA[3]

There has been 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.

Lastly 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.

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

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 7: 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	Local **(3)**	Local **(3)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	High **(8)**	High **(8)**
Probability	Definite **(5)**	Probable **(3)**
Significance	High **(75)**	Moderate **(45)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible **(1)**	Reversible **(1)**
Irreplaceable loss of resources?	No	No
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 construction of the Mulilo Newcastle Wind Power- Northern WEF (37 turbines) together with the proposed Southern WEF (37 turbines) 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.		

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

A few homesteads and a small portion of the R34 are located within the 1 Km buffer, however it is expected that the shadow flicker experienced by motorist traveling along roads will be fleeting and not constitute a shadow flicker visual impact of concern. Additionally, 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. In this regard, any homesteds located to the north would lower the probability of this impact occuring. The significance of shadow flicker is therefore anticipated to be **High**.

Table 8: 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	Local **(4)**	Local **(4)**
Duration	Long **(4)**	Long **(4)**
Magnitude	Moderate **(6)**	Moderate **(6)**
Probability	Definite **(5)**	Definite **(5)**
Significance	High **(70)**	High **(70)**
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		

8.2.6. ANCILLARY INFRASTRUCTURE

On-site ancillary infrastructure associated with the Mulilo Newcastle Wind Power- Northern WEF includes a 33/132kV collector substation, 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 9: Impact table summarising the visual impact of the ancillary infrastructure

Nature of Impact: Visual impact of ancillary infrastructure on sensitive receptors in close proximity to the proposed development		
	No mitigation	***Mitigation considered***
Extent	Local **(4)**	Local **(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		

8.3. SECONDARY IMPACTS

8.3.1. 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 undeveloped and natural in character. The visual quality of the region is generally high and large tracts of intact vegetation characterise most of the visual environment, as well as, the scenic mountains and ridges. 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 10: 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	Regional **(3)**	Regional **(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: 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 of the Mulilo Newcastle Wind Power- Northern WEF (37 turbines) together with the proposed Southern WEF (37 turbines), 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.		

8.3.2. POTENTIAL VISUAL IMPACT OF FACILITY OPERATIONS ON PROTECTED/ CONSERVATION AREAS WITHIN THE REGION.

The greater region is generally seen as having a high scenic value and tourism value potential to a certain extent owing to the presence of a number of protected areas (Sneeuwberg Protected Environment, Seekoeivlei Nature Reserve, Potberg Private Nature Reserve and Ncandu Nature Reserve). The landscape is characterised by undulating hills with a high visual quality and strong sense of place. This study area is not known as a tourist destination, but Newcastle is an alternate route for travellers from Gauteng to Durban. Additionally, Newcastle is part of the KZN Battlefields Route where the Majuba Mountain has historical significance.

The anticipated visual impact of the proposed Mulilo Newcastle Wind Power- Northern WEF on protected/conservation areas within the region is therefore expected to be of **moderate** 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 the facility operations on protected/conservation areas within the region

Nature of Impact: Visual impact of the proposed development on protected/conservation areas within the region.		
	No mitigation	***Mitigation considered***
Extent	Regional **(3)**	Regional **(3)**
Duration	Long **(4)**	Long **(4)**
Magnitude	Moderate **(6)**	Moderate **(6)**
Probability	Highly Probable **(4)**	Highly Probable **(4)**
Significance	Moderate **(52)**	Moderate **(52)**
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 of the Mulilo Newcastle Wind Power- Northern WEF (37 turbines) together with the proposed Southern WEF (37 turbines), 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.		

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

The construction of the Mulilo Newcastle Wind Power- Northern WEF may increase the cumulative visual impact of industrial type infrastructure within the region.

The table below illustrates the assessment of the anticipated cumulative visual impact of infrastructure on sensitive visual receptors within the region. Visual impacts are likely to be of **high** significance.

Table 12: Impact table summarising the significance of the cumulative visual impact of the proposed Newcastle WEF Complex on sensitive visual receptors within the region

Nature of Impact: The potential cumulative visual impact of the proposed Newcastle WEF Complex on sensitive visual receptors within the region		
	Expected visual impacts of the Mulilo Newcastle Wind Power- Northern WEF when considered in isolation	***Cumulative visual impact of Northern and Southern WEFs***
Extent	Regional **(3)**	Regional **(3)**
Duration	Long **(4)**	Long **(4)**
Magnitude	High **(8)**	High **(8)**
Probability	Highly Probable **(4)**	Definite **(5)**
Significance	Moderate **(60)**	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.		

8.4. 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.

9. SUMMARY OF VISUAL IMPACTS ASSESSED

In light of the results and findings of the Visual Impact Assessment undertaken for the Mulilo Newcastle Wind Power-Northern 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 within 5km (residents of farm and homestead, as well as observers travelling along the R34), in close proximity to the proposed facility is likely to be of **very high** significance. No mitigation is possible for a facility of this scale.
- The possible visual impact of facility operations on the users of the R34 and other secondary roads, residents of farm and homesteads and visitors to sections of the Sneeuwberg Protected Environment on the periphery of the 5km offset and within the region beyond is likely to be of **high** significance. No mitigation is possible within this environment and 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 **high** 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 anticipated visual impact of facility operations on protected/ conservation areas within the region is likely to be of **moderate** significance. No mitigation is possible for a facility of this scale.
- The potential cumulative visual impact of the proposed Newcastle WEF Complex on sensitive visual receptors within the region is likely to be of **high** significance.

10. CONCLUSION AND RECOMMENDATIONS

The visual assessment, including the photographic montages of the proposed Mulilo Newcastle Wind Power- Northern WEF, indicates that the construction and operation of the proposed WEF will have a very 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 the residents of numerous rural homesteads and observers travelling along the R34 regional road. This is largely due to the relatively close distance between the observers and the wind turbines, as well as, the elevated location of the turbines.

Overall, the significance of the visual impacts is predominately **high,** as a result of the generally undeveloped and natural character of the landscape. A significance of **very high** is expected on sensitive receptors in close proximity (within 5km) of the proposed facility. Some impacts are expected of **moderate** significance (visual impacts of construction activities, lighting at nights, protected/conservation areas). 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, residents of rural farm homesteads, residents of the town of Newcastle and visitors to protected areas within the region.

With regards to the shadow flicker likely to be experienced by homesteads that are located nearby, it is recommended, as per the IFC Performance Standards, that further consultation is undertaken as part of the EIA consultation process with these specific sensitive receptors of the identified homesteads, in order to establish their understanding and concerns regarding this possible impact. Should it be found during the consultation process that these specific receptors are concerned with the impact associated with shadow flicker, it is then recommended that the positioning of these specific turbines be revised or removed.

Conventional mitigation (e.g. 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 100m) and the receiving environment. However, a number of best practice mitigation measures have been proposed (Section 8.4) 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 Mulilo Newcastle Wind Power- Northern WEF, using visibility analyses, proximity analyses, photo simulations 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, 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 Mulilo Newcastle Wind Power- Northern 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 8) 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 Mulilo Newcastle Wind Power- Northern 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.

11. REFERENCES

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