Appendix H.10

VISUAL ASSESSMENT

PROPOSED DEVELOPMENT OF THE DALMANUTHA WIND ENERGY FACILITY(ALTERNATIVE 1 AND 2) IN EMAKHAZENI LOCAL MUNICIPALITY, MPUMALANGA PROVINCE

VISUAL IMPACT ASSESSMENT

Produced for:

Dalmanutha Wind (Pty) Ltd

On behalf of:

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- MAY 2023 -

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DECLARATION

I, **Lourens du Plessis**, as an independent consultant who compiled this Visual Impact Assessment, 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.

____

Lourens du Plessis
Professional GISc Practitioner

1. STUDY APPROACH

1.1. Qualification and experience of the practitioner

Lourens du Plessis (t/a LOGIS) is a Professional Geographical Information Sciences (GISc) Practitioner registered with The South African Geomatics Council (SAGC), and specialises in Environmental GIS and Visual Impact Assessments (VIA).

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

He holds a BA degree in Geography and Anthropology from the University of Pretoria and worked at the GisLAB (Department of Landscape Architecture) from 1990 to 1997. He later became a member of the GisLAB and in 1997, when Q-Data Consulting acquired the GisLAB, worked for GIS Business Solutions for two years as project manager and senior consultant. In 1999 he joined MetroGIS (Pty) Ltd as director and equal partner until December 2015. From January 2016 he worked for SMEC South Africa (Pty) Ltd as a technical specialist until he went independent and began trading as LOGIS in April 2017.

Lourens has received various awards for his work over the past two decades, including EPPIC Awards for ENPAT, a Q-Data Consulting Performance Award and two ESRI (Environmental Systems Research Institute) awards for Most Analytical and Best Cartographic Maps, at Annual International ESRI User Conferences. He is a co-author of the ENPAT atlas and has had several of his maps published in various tourism, educational and environmental publications.

He is familiar with the "Guidelines for Involving Visual and Aesthetic Specialists in EIA Processes" (Provincial Government of the Western Cape: Department of Environmental Affairs and Development Planning) and utilises the principles and recommendations stated therein to successfully undertake visual impact assessments.

1.2. 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;
- Chief Directorate National (CDN) Geo-Spatial Information, varying dates. *1:50 000 Topographical Maps and Data.*
- DFFE, 2018/2020. *National Land-cover Database 2018/2020 (NLC2018/2020).*
- DFFE, 2022. *South African Protected Areas Database (SAPAD_OR_2022_Q2).*
- JAXA, 2021. Earth Observation Research Centre. *ALOS Global Digital Surface Model (AW3D30).*
- Google Earth Pro. *Up to date and recent satellite images.*
- Professional judgement based on experience gained from similar projects;
- Literature research on similar projects;
- Procedures for the Assessment and Minimum Criteria for Reporting on identified Environmental Themes in terms of Sections 24(5)(a) and (h) and 44 of NEMA

Quality of the above information bases are rated as Good.

1.3. Assumptions and limitations

To prepare this Report, LoGis utilised only the documents and information provided by WSP or any third parties directed to provide information and documents by WSP. LoGis 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. LoGis 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.

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 WSP 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 with the layout provided.

1.4. Legal framework

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

- **The National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA):** This report is in line with Appendix 6 of NEMA: Environmental Impact Assessment (EIA) Regulations (2014, as amended) which details the minimum requirements a specialist report must contain for an Environmental Impact Assessment.
- **Guideline for Involving Visual and Aesthetic Specialists in EIA Processes (DEADP, Provincial Government of the Western Cape, 2005):** This guideline was developed for use in the Western Cape, however in the absence of the development of any other guideline, this provides input for the preparation of visual specialist input into EIA processes. The guideline documents the requirements for visual impact assessment, typical issues that trigger the need for specialist visual input, the scope and extent of a visual assessment, information required, as well as the assessment ad reporting of visual impacts and management actions.
- **Screening Tool as per Regulation 16 (1)(v) of the Environmental Impact Assessment Regulations, 2014 as amended:** a Screening report was generated for this proposed project, whereby a visual impact assessment was identified as one of the specialist studies that would be required.

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:

[1] Adapted from Oberholzer (2005).

- **3**: A high level of information and knowledge is available of the project and the visual impact assessor is well experienced in this type of project and level of assessment.
- **2**: A moderate level of information and knowledge is available of the project and 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:

Table 1: Level of confidence

<table>
<tr><td></td><td colspan="4">Information on the project & experience of the practitioner</td></tr>
<tr><td rowspan="4">Information on the study area</td><td></td><td>3</td><td>2</td><td>1</td></tr>
<tr><td>3</td><td>9</td><td>6</td><td>3</td></tr>
<tr><td>2</td><td>6</td><td>4</td><td>2</td></tr>
<tr><td>1</td><td>3</td><td>2</td><td>1</td></tr>
</table>

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**

1.6. Methodology

The study was undertaken using Geographical Information Systems (GIS) software as a tool to generate viewshed analyses and to apply relevant spatial criteria to the proposed facility. A detailed Digital Terrain Model (DTM) for the study area was created from topographical data provided by the Japan Aerospace Exploration Agency (JAXA), Earth Observation Research Centre, in the form of the ALOS Global Digital Surface Model "ALOS World 3D - 30m" (AW3D30) elevation model.

Visual Impact Assessment (VIA)

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

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

The VIA will consider potential cumulative visual impacts, or alternatively the potential to concentrate visual exposure/impact within the region (if applicable).

The following VIA-specific tasks have been undertaken:

- **Determine potential visual exposure**

The visibility or visual exposure of any structure or activity is the point of departure for the visual impact assessment. It stands to reason that if (or where) the proposed facility and associated infrastructure were not visible, no impact would occur.

The viewshed analyses of the proposed facility and the related infrastructure are based on a 30m SRTM digital terrain model of the study area.

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

- **Determine visual distance/observer proximity to the facility**

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

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

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

- **Determine viewer incidence/viewer perception (sensitive visual receptors)**

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

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

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

- **Determine the visual absorption capacity (VAC) of the landscape**

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

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

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

- **Calculate the visual impact index**

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

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

- **Determine impact significance**

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

- **Propose mitigation measures**

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

- **Reporting and map display**

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

- **Site visit and photo simulations**

A site visit was undertaken on the 10 October 2022 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. It should be noted that, from a visual perspective, the different seasons do not influence the results of the impact assessment, and as such regardless of the timing of the site visit, the level of confidence for the assessment and findings is high.

Photographs from strategic viewpoints were taken in order to simulate realistic post construction views of the Wind Energy Facility (WEF). This aids in visualising the perceived visual impact of the proposed WEF and place it in spatial context.

2. PROJECT DESCRIPTION

The Dalmanutha Wind Energy Facility ("*Dalmanutha Wind*") is located approximately 7km southeast of the Belfast town within Emakhazeni Local Municipality, Mpumalanga Province. Site access is via the N4, which is approximately 220 meters from Dalmanutha Wind. Dalmanutha Wind will consist of two (2) alternatives:

Alternative 1: Dalmanutha Wind Facility

The proposed Dalmanutha WEF will be developed with a capacity of up to 300 megawatts (MW), and will comprise the following key components:

- Wind Turbines
  - Up to 70 turbines[2], each with a foundation of approximately 25m^2 in diameter (500m^2 area and requiring ~2 500m^3 concrete each) and approximately 3m depth;
  - Turbine hub height of up to 200m;
  - Rotor diameter up to 200m; and
  - Permanent hard standing area for each wind turbine (approximately 1ha).

- IPP portion onsite substation and battery energy storage system (BESS)

[2] An up to 77 turbine layout was considered during the scoping phase however as a result of the avifauna specialist input the turbine layout has been optimised to include up to 70 turbines. The optimised up to 70 turbine layout will be assessed in the EIA phase

- IPP portion onsite substation of up to 4ha. The substation will consist of a high voltage substation yard to allow for multiple up to 132kV feeder bays and transformers, control building, telecommunication infrastructure, access road, etc.; and
- The Battery Energy Storage System (BESS) storage capacity will be up to 300MW/1200 megawatt-hour (MWh) with up to four hours of storage. It is proposed that Lithium Battery Technologies, such as Lithium Iron Phosphate, Lithium Nickel Manganese Cobalt oxides or Vanadium Redox flow technologies will be considered as the preferred battery technology; however, the specific technology will only be determined following Engineering, Procurement, and Construction (EPC) procurement. The main components of the BESS include the batteries, power conversion system and transformer which will all be stored in various rows of containers.

- Operation and Maintenance Building Infrastructure

  - Operations and maintenance (O&M) building infrastructure will be required to support the functioning of the WEF and for services required by operations and maintenance staff. The O&M building infrastructure will be near the onsite substation and will include:
    - Operations building of approximately $200m^2$;
    - Workshop and stores area of approximately $150m^2$ each;
    - Stores area of approximately $150m^2$; and
    - Refuse area for temporary waste and septic/conservancy tanks with portable toilets to service ablution facilities.
  - Total combined area of the buildings will not exceed 5 000 m^2.

- Construction camp laydown

  - Temporary laydown or staging area -Typical area 220m x 100m = $22000m^2$.
  - Laydown area could increase to $30000m^2$ for concrete towers, should they be required.
  - Sewage: septic and/or conservancy tanks and portable toilets.
  - Temporary cement batching plant, wind tower factory & yard of approximately 7ha, comprising amongst others, a concrete storage area, batching plant, electrical infrastructure and substation, generators and fuel stores, gantries and loading facilities, offices, material stores (rebar, concrete, aggregate and associated materials), mess rooms, workshops, laydown and storage areas, sewage and toilet facilities, offices and boardrooms, labour mess and changerooms, mixers, moulds and casting areas, water and settling tanks, pumps, silos and hoppers, a laboratory, parking areas, internal and access roads - Gravel and sand will be stored in separate heaps whilst the cement will be contained in a silo. The maximum height of the silo will be 20m.

- Access roads

  - The Project site can be accessed easily via either the tarred R33 or the N4 national road which run along the northern and western boundaries of the site.
  - There is an existing road that goes through the land parcels to allow for direct access to the project development area.
  - Internal and access roads with a width of between 8m and 10m, which can be increased to approximately 12m on bends. The roads will be positioned within a 20m wide corridor to accommodate cable trenches, stormwater channels and bypass /circles of up to 20m during construction. Length of the internal roads will be approximately 60km.

- Associated infrastructure

- The medium voltage collector system will comprise of cables up to and including 33kV that run underground, except where a technical assessment suggest that overhead lines are required, within the facility connecting the turbines to the onsite substation.
- Over the fence 132 kV cable to connect the onsite IPP substation to the Common collector switching station.
- Fencing of up to 4m high around the construction camp and lighting.
- Lightning protection.
- Telecommunication infrastructure.
- Stormwater channels.
- Water pipelines.
- Offices.
- Operational control centre.
- Operation and Maintenance Area / Warehouse/workshop.
- Ablution facilities.
- A gatehouse.
- Control centre, offices, warehouses.
- Security building.
- A visitor's centre.
- Substation building.

Alternative 2: Dalmanutha Wind and Solar Facility

The proposed Dalmanutha Wind and Solar Energy Facility will be developed with a capacity of up to 300 megawatts (MW)[3], and will comprise the following key components:

- Wind Turbines
  - Up to 44 turbines, each with a foundation of approximately 25m^2 in diameter (500m^2 area and requiring ~2 500m^3 concrete each) and approximately 3m depth;
  - Turbine hub height of up to 200m;
  - Rotor diameter up to 200m; and
  - Permanent hard standing area for each wind turbine (approximately 1ha per turbine).

- Solar Fields
  - Solar PV array comprising PV modules (solar panels), which convert the solar radiation into direct current (DC);
  - PV panels will be up to a height of 6m (when the panel is horizontal) and will be mounted on fixed tilt, single axis tracking or dual axis tracking mounting structures. Monofacial or bifacial Solar PV Modules are both considered;
  - Footprint: ~160 ha; and
  - Inverters, transformers and other required associated electrical infrastructure and components.
- IPP portion onsite substation and battery energy storage system (BESS)
  - IPP portion onsite substation of up to 4ha. The substation will consist of a high voltage substation yard to allow for multiple up to 132kV feeder bays and transformers, control building, telecommunication infrastructure, access road, etc.; and
  - The Battery Energy Storage System (BESS) storage capacity will be up to 300MW/1200 megawatt-hour (MWh) with up to four hours of storage. It is proposed that Lithium Battery Technologies, such as Lithium Iron Phosphate, Lithium Nickel Manganese Cobalt oxides or Vanadium Redox flow technologies will be considered as the preferred battery technology; however, the specific technology will only be determined following Engineering, Procurement, and Construction (EPC) procurement. The main components of the BESS include the

[3] The MW split for the Wind and Solar Facilities will be dependent on the technology available at the time of construction and financial model.

batteries, power conversion system and transformer which will all be stored in various rows of containers.

- Operation and maintenance building infrastructure
  - Operations and maintenance (O&M) building infrastructure will be required to support the functioning of the WEF and SEF and for services required by operations and maintenance staff. The O&M building infrastructure will be near the onsite substation and will include:
  - Operations building of approximately 200m2;
  - Workshop and stores area of approximately 150m2 each;
  - Stores area of approximately 150m2; and
  - Refuse area for temporary waste and septic/conservancy tanks with portable toilets to service ablution facilities.
  - Total combined area of the buildings will not exceed 5 000m^2.

- Construction camp laydown
  - Temporary laydown or staging area -Typical area 220m x 100m = 22000m^2.
  - Laydown area could increase to 30000m^2 for concrete towers, should they be required.
  - Sewage: septic and/or conservancy tanks and portable toilets.
  - Temporary cement batching plant, wind tower factory & yard of approximately 7ha, comprising amongst others, a concrete storage area, batching plant, electrical infrastructure and substation, generators and fuel stores, gantries and loading facilities, offices, material stores (rebar, concrete, aggregate and associated materials), mess rooms, workshops, laydown and storage areas, sewage and toilet facilities, offices and boardrooms, labour mess and changerooms, mixers, moulds and casting areas, water and settling tanks, pumps, silos and hoppers, a laboratory, parking areas, internal and access roads - Gravel and sand will be stored in separate heaps whilst the cement will be contained in a silo. The maximum height of the silo will be 20m.

- Access roads
  - The Project site can be accessed easily via either the tarred R33 or the N4 national road which run along the northern and western boundaries of the site.
  - There is an existing road that goes through the land parcels to allow for direct access to the project development area.
  - Internal and access roads with a width of between 8m and 10m for the WEF, which can be increased to approximately 12m on bends. The roads will be positioned within a 20m wide corridor to accommodate cable trenches, stormwater channels and bypass /circles of up to 20m during construction. Length of the internal roads will be approximately 60km. For the SEF, internal gravel roads will be established between the arrays and will be up to 4m wide.

- Associated infrastructure
  - For the WEF, the medium voltage collector system will comprise of cables up to and including 33kV that run underground, except where a technical assessment suggest that overhead lines are required, within the facility connecting the turbines to the onsite substation. The SEF will comprise low and medium voltage cabling between components (above or below ground as needed).
  - Over the fence 132 kV cable to connect the onsite IPP substation to the Common collector switching station.

  - Fencing of up to 4m high around the construction camp and lighting.
  - Lightning protection.
  - Telecommunication infrastructure.
  - Stormwater channels.
  - Water pipelines.
  - Offices.

- Operational control centre.
- Operation and Maintenance Area / Warehouse/workshop.
- Ablution facilities.
- A gatehouse.
- Control centre, offices, warehouses.
- Security building.
- A visitor's centre.
- Substation building.

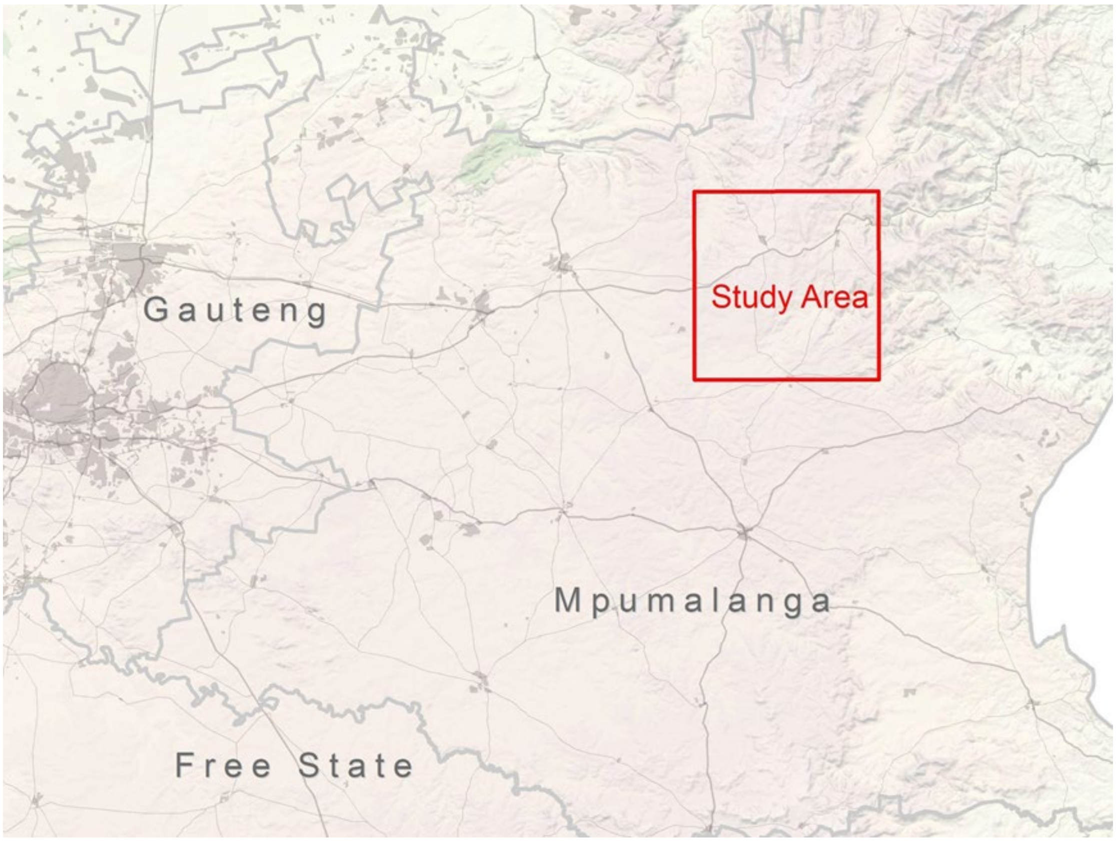


Figure 1: Regional locality of the proposed project area

The following affected properties are applicable to the Dalmanutha Wind Energy Facility:

Table 2: Affected farm portions

Farm No.	Portion No.	Farm name
378	1	Berg-en-Dal
378	9	Berg-en-Dal
384	7	Vogelstruispoort
385	6	Waaikraal
385	7	Waaikraal
385	8	Waaikraal
385	10	Waaikraal

385	12	Waaikraal
385	13	Waaikraal
385	24	Waaikraal
403	3	Leeuwkloof
403	4	Leeuwkloof
412	1	Welgevonden
404	1	Leeuwkloof
404	2	Leeuwkloof
405	3	Geluk
467	0	Camelia

A summary of the details and dimensions of the planned infrastructure associated with the Project is provided below:

Table 3: Technical details

Component	**Description / Dimensions**
Alternative 1	
Site extent	9 197 ha
Development footprint (permanent infrastructure area)	~400 ha (including all associated infrastructure)
Number of turbines	Up to 70
Turbine hub height	Up to 200m
Rotor diameter	Up to 200m
Turbine tip height	Up to 300m
Contracted capacity	Up to 300MW

Tower type	Steel or concrete towers can be utilised at the site. Alternatively, the towers can be of a hybrid nature, comprising concrete towers and top steel sections.
Turbine foundation	Approximately 25m diameter x 3m deep. These dimensions may be larger as required by the geotechnical conditions.
Alternative 2	
Site extent	9 147 ha
Development footprint (permanent infrastructure area)	~400 ha (including all associated infrastructure)
Number of turbines	Up to 44
Turbine hub height	Up to 200m
Rotor diameter	Up to 200m
Turbine tip height	Up to 300m
Contracted capacity	Up to 300MW
Tower type	Steel or concrete towers can be utilised at the site. Alternatively, the towers can be of a hybrid nature, comprising concrete towers and top steel sections.
Turbine foundation	Approximately 25m diameter x 3m deep. These dimensions may be larger as required by the geotechnical conditions.
Solar fields	Solar PV array with a footprint of 160 ha

3. SCOPE OF WORK

This report is the Visual Impact Assessment (VIA) of the proposed **Dalmanutha Wind** as described above.

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

The study area for the visual assessment encompasses a geographical area of and includes a minimum 20km buffer zone from the proposed wind turbine structures.

Anticipated issues related to the potential visual impact of the proposed Dalmanutha Wind Alternatives 1 and 2 include the following:

- The visibility of the facility to, and potential visual impact on, observers travelling along the national, arterial or secondary roads within the study area.
- The visibility of the facility to, and visual impact on residents of homesteads within the study area.
- The potential visual impact of the facility on the visual character or sense of place of the region.
- The potential visual impact of the facility on tourist routes or tourist destinations (if present).
- The potential visual impact of the construction of ancillary infrastructure (i.e. substations) on observers in close proximity to the facility.
- The visual absorption capacity of the natural vegetation (if applicable).
- The potential cumulative visual impact of the proposed WEF and associated infrastructure in context of the other Dalmanutha West WEF proposed.
- The potential visual impact of lighting of the facility in terms of light glare, light trespass and sky glow.
- Potential visual impacts associated with the construction phase.
- The potential visual impact of shadow flicker.
- Potential visual impact of solar glint and glare as a visual distraction and possible air/road travel hazard.
- Potential visual impact of solar glint and glare on static ground-based receptors (residents of homesteads) in close proximity to the PV facility
- The potential to mitigate visual impacts and inform the design process.

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

4. THE AFFECTED ENVIRONMENT

The study area is situated within the within the Emakhazeni Local Municipality, in the Mpumalanga Province. The proposed site is located approximately 15 km south east of Belfast, 9 km south west of eNtokozweni and 28 km north of Carolina.

Figure 2: View of the site from the R33

The dominant terrain morphological units or terrain types that describe the study area are predominantly composed of *moderately undulating plains.* The site itself is situated on relatively flat land, with a slight rise in elevation towards the southern proposed wind turbine positions. Hilly terrain lies along the northeastern and southeastern portions of the study area, as well as towards the northwest of the site: The Elandsrivier is defined by the Dwaalheuwel, Baldhill and Mareskop *koppie* surrounds towards the northeast. The Komati River lies within a valley of up to 400m deep within the Krokodilkop surrounding the south-east, while the Nooitgedacht Dam (fed by the Witkloofspruit, releasing into the Vaalwaterspruit) lies within a gentle depression south of the study area alongside the Nakop. The Steelpoort River is delineated in a slight depression towards the northwest of the study area. Tributaries of the Komati River traverse through / surround certain portions of the study area. Refer to **Map 1** for a topographical map of the study area.

Figure 3: Topography showing undulating plains

Lamb and mutton farming dominate the land-use character in the western part of the study area, as well as dairy and maize. Timber is a leading industry in the district, therefore exotic plantations are located throughout the study area, but are more concentrated in areas towards the north, north-east and south-east of the site.

Figure 4: Sheep farming in the area

Industrial infrastructure is quite prominent throughout the study area. There is a large network of existing high voltage power lines that traverse the study area and connect to the numerous substations that dot the landscape. Additionally, mining/quarrying areas (coal and black granite are other leading industries in the study area), have been delineated towards the west, north-west, north-east and south of the proposed Dalmanutha WEF.

Figure 5: Existing Gumeni Substation in the east

Figure 6: Existing high voltage powerlines within the study area

Figure 7: Industrial infrastructure within the region

Railway line infrastructure is also present within the study area. The historic Pretoria-Maputo (Delagoa Bay) railway runs from east to west and connects Maptuo, Mozambique to Pretoria, South Africa via Komatipoort, Waterval Boven, Machadodorp and Witbank. Another line runs from north to south from Machadodorp to Carolina and lastly a line runs from Machadodorp via Belfast before heading north.

The region has a rural character, with scattered isolated homesteads occurring within the study area. In terms of the natural vegetation, the study area falls within the grassland biome, and more specifically the Mesic Highveld Grassland Bioregion. Steenkampsberg Montane Grassland has been delineated north of the study area, while Eastern Highveld Grassland (towards the southeast) and KaNgwane Montane Grassland (towards the southwest) have been further identified.

Figure 8: Example of the types of home/farmsteads

The towns of Belfast (north of the site, with a population of 200.7 people per km^2), Emgwenya or Waterval Boven and Machadodorp (north-east of the site, with Waterval Boven having 153.0 people per km^2 and Machadadorp having 152.1 people per km^2), and Carolina (south of the site, having 1,150 people per km^2) lie within the study area.[4] The town of Carolina, therefore, accounts for the highest population concentration within the region.

The study area receives approximately 773mm of rainfall per annum[5]. Most of the farming (in terms of surface area) is dryland agriculture, with sporadic patches of irrigated agriculture towards the northwest, west and south of the proposed facility.

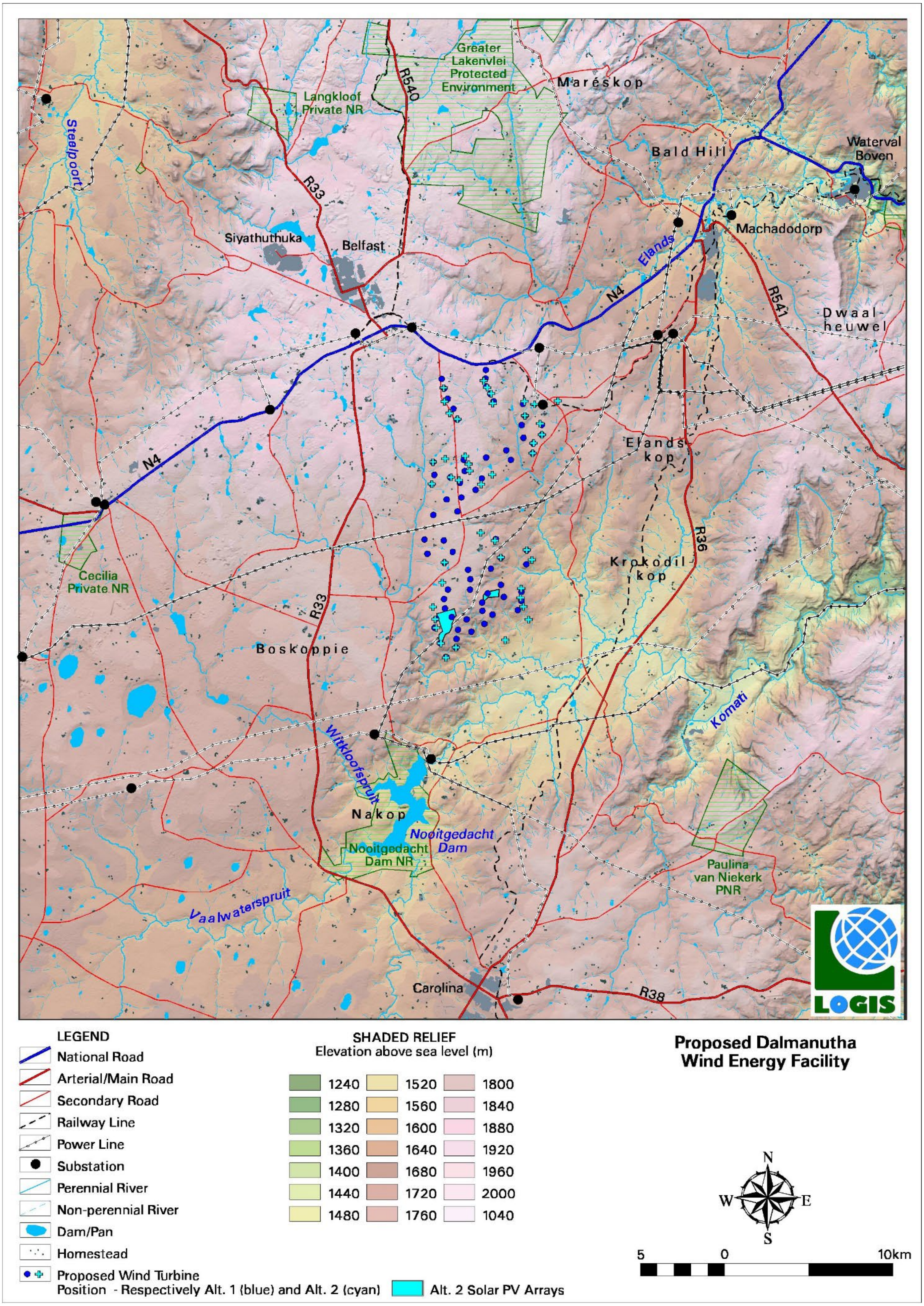
[4] Source: Statistics South Africa, 2011.
[5] Source:: https://weatherspark.com/

The region has a rural character, with scattered isolated homesteads occurring within the study area. Refer to **Map 2** for the land cover and broad land use patterns within the study area.

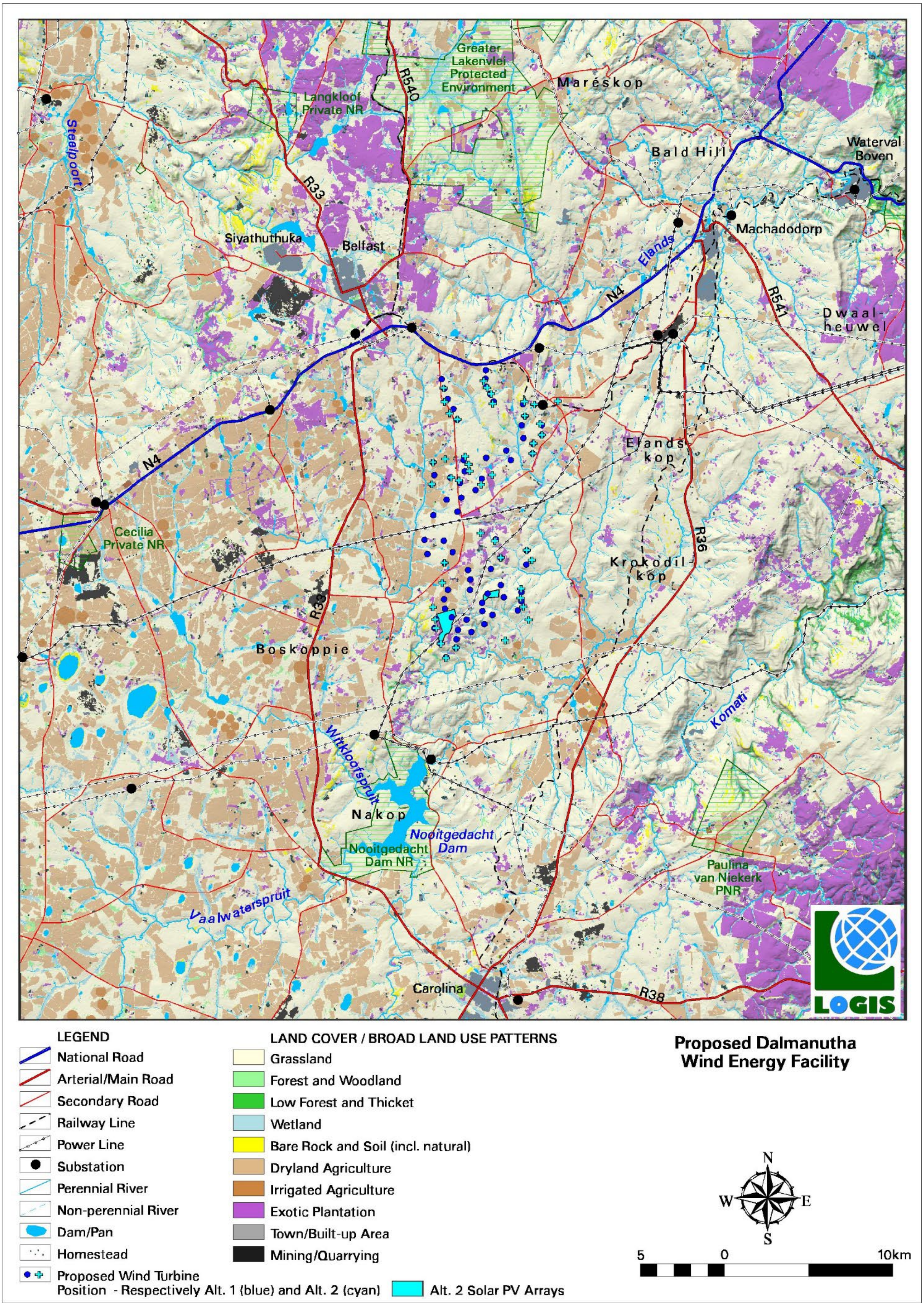
The following conservation areas have been identified:

- The Greater Lakenvlei Protected Environment and the Langkloof Private Nature Reserve (towards the north);
- the Pauline van Niekerk Private Nature Reserve towards the southeast;
- the Cecilia Private Nature Reserve lies towards the west of the proposed WEF; and
- the Nooitgedacht Dam Nature Reserve is located some 15 km to the south of the site.

Figure 9: Nooitgedacht Dam Nature Reserve



Map 1: Shaded relief map of the study area



5. RESULTS

Map 2: Land cover/ broad land use patterns

5.1. Potential visual exposure

Alternative 1: Dalmanutha Wind Facility

A visibility analysis was undertaken from each of the wind turbine positions (70 in total) at an offset of 300m (approximate tip-height) above ground level. The result of the visibility analysis is displayed on **Map 3**.

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

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

The core, uninterrupted area of visual exposure of the wind turbines is likely to be experienced by sensitive receptors within a 5km radius of the structures with a reduced frequency of exposure to the south and north along lower lying drainage lines and perennial rivers. Between 5-10 Km, the visual exposure is still highly concentrated with small pockets of visually screened areas found along Elandskop and Krokodilkop in the east. Frequency of exposure is reduced to the north west near Belfast, north and north east owing to the hilly topography, as well as in the south west along Boskoppie. It is expected that the wind turbine structures will be highly visible from homesteads within this zone, as well as from portions of the N4, R 33, R36 and various secondary roads traversing the project site.

Additional visual exposure on the undulating plains between 10 – 20km of the turbine structures is largely reduced and concentrated to the west, south west, south and north and north east. Visually screened areas are found to the north west and east. The frequency of visual exposure (number of turbines visible) is reduced somewhat to then north and it is expected that some wind turbines may only be partially visible i.e. mainly the blades. This is due to the hilly topography to thereby largely restricting the visual exposure to the plains beyond these mountains.

The frequency of visual exposure beyond 20km from the turbine structures is expected to subside and may be exposed though it is expected that most turbines will only be partially visible. Visibility of the turbine structures will be scattered throughout this area.

The homesteads and roads expected to be visually influenced are listed below. It should be noted that this section of the report focusses only on the potential visual exposure at varying distances and it does not yet refer to visual impact significance or any correlation thereto.

Less than 5km from the wind turbines:

- Frisgewaagd [6]
- Clercqsvallei
- Welgevonden
- Frisgewaagd
- Drenthe
- Geluk
- Leeukloof
- Blyvooruitsig
- Vogelstruispoort
- Driekop
- Waaikraal
- De Rust
- Wemmershuis
- Bergendal
- Green Pastures

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

- Moreson
- Weltevreden
- Weltevreden
- Observers travelling along the N4 national road
- Observers travelling along the R33 arterial road
- Observers travelling along the Geluk/Dalmanutha secondary roads

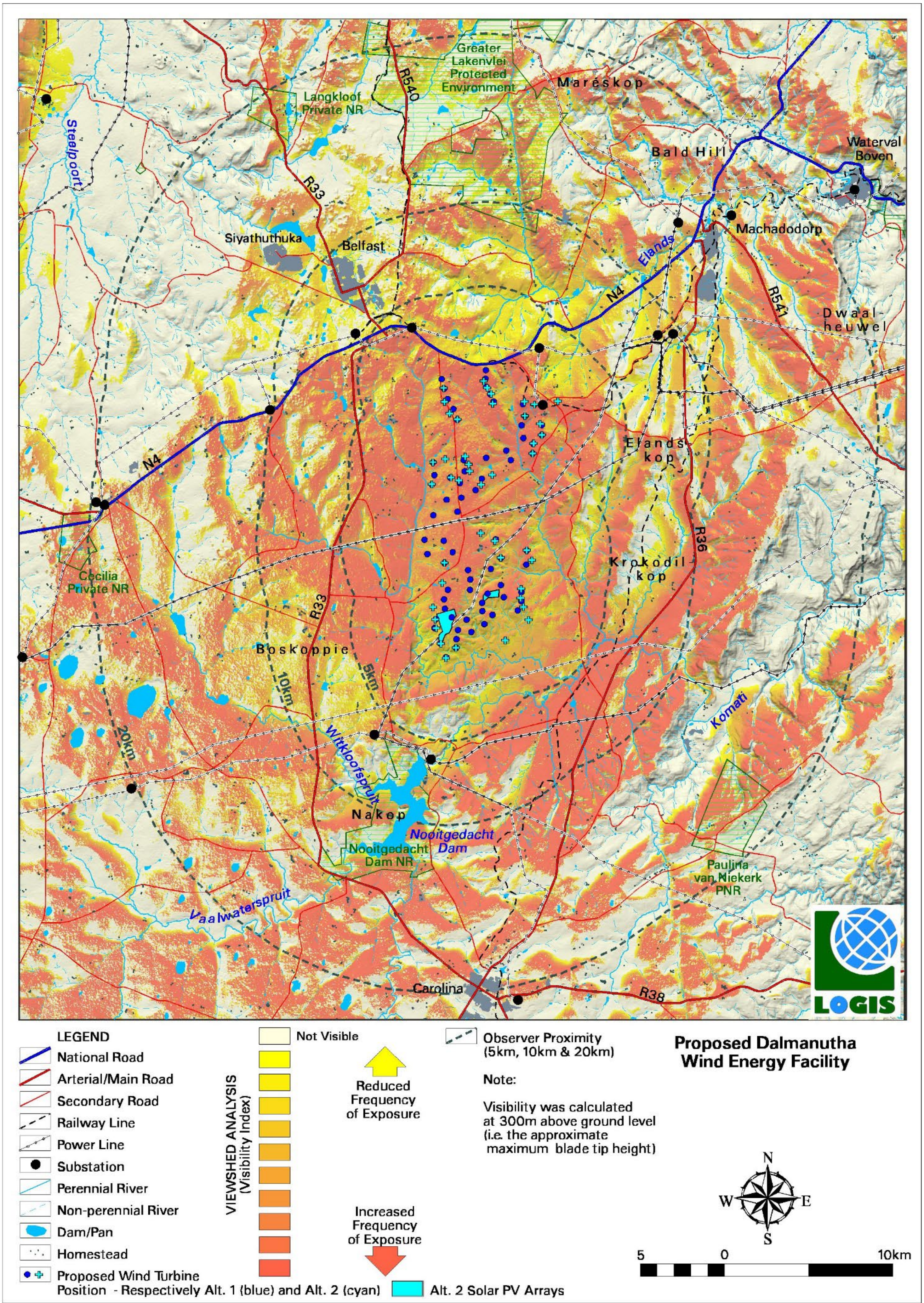
Located within a 5 - 10km radius:
- Hartebeespruit
- De Kroon
- Connievale
- Rietvlei
- Vlakfontein
- Brakspruit
- Mislukt
- Van Wyksvlei
- Eerstelingsfontein
- Blyvooruitzicht
- Zoekop
- Leeuwbank
- Zoekop
- Outer lying areas of Belfast
- Parts of the Nooitgedacht Dam and Lakenvlei Protected areas
- Observers travelling along the N4 National road
- Observers travelling along the R33 and R36 arterial roads
- Secondary roads

Located within a 10 - 20km radius:
- Du Elsarik
- Winchester
- Vaalkop
- Klipfontein
- Weltevrede
- Elgin
- Lakenvlei
- Elandfontein
- Groenvlei
- Rietvlei
- Zevenfontein
- Sewefontein
- Bloemfontein
- Suikerbosfontein
- Leeuwpoort
- Kwaggafontein
- Hawerfontein
- Berg-en-Dal
- Leliefontein
- Twyfelaar
- Goedehoop
- Blesbokspruit
- Grootpan
- Blesbokspruit
- Parts of the Cecilia, Nooitgedacht Dam, Lakenvlei Protected areas, Paulina van Niekerk PNR and Langkloof PNR
- Southern outlying parts of Siyathuthuka
- Observers travelling along the R33, R36, R541, R540 arterial roads
- Various secondary roads
- Observers travelling along portions of the N4 national road

Located beyond 20km:
- Klippan

- Uitvlug
- Vlakplaas
- Nooitgedacht
- Brahmanica Park
- Vaalbult
- Helpmekaar
- Leeupan
- Cecilia PNR
- Observers travelling along the R36, R38, R541 and R540 arterial roads

It is envisaged that the structures, where visible from short to medium distances (e.g. less than 10km), may constitute a high visual prominence, potentially resulting in moderate to high visual impacts.



Map 3: Viewshed analysis for Alternative 1: Dalmanutha Wind Facility

Alternative 2: Dalmanutha Wind and Solar Facility

A visibility analysis was undertaken from each of the wind turbine positions (44 in total) at an offset of 300m (approximate tip-height) above ground level, while the for the solar facility, the viewshed analysis was undertaken from a representative number of vantage points within the development footprint at an offset of 6m above ground level. The result of the visibility analysis is displayed on **Map 4**.

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

It must be noted that the visual exposure of the PV arrays falls entirely within the areas of exposure of the wind turbines.

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

The core, uninterrupted area of visual exposure of the wind turbines and PV arrays is likely to be experienced by sensitive receptors within a 5km radius of the structures with a reduced frequency of exposure to the south and north along lower lying drainage lines and perennial rivers. Between 5-10 Km, the visual exposure is still highly concentrated with small pockets of visually screened areas found along Elandskop and Krokodilkop in the east. Frequency of exposure is reduced to the north west, north and north east owing to the hilly topography, as well as in the south west along Boskoppie. It is expected that the wind turbine structures will be highly visible from homesteads within this zone, as well as from portions of the N4, R 33, R36 and various secondary roads traversing the project site.

Additional visual exposure on the undulating plains between 10 – 20km of the turbine structures is largely reduced and concentrated to the west, south west, south and north and north east. Visually screened areas are found to the north west and east. The frequency of visual exposure (number of turbines visible) is reduced somewhat to then north and it is expected that some wind turbines may only be partially visible i.e. mainly the blades. This is due to the hilly topography to thereby largely restricting the visual exposure to the plains beyond these mountains.

The frequency of visual exposure beyond 20km from the turbine structures is expected to subside and may be exposed though it is expected that most turbines will only be partially visible. Visibility of the turbine structures will be scattered throughout this area.

The homesteads and roads expected to be visually influenced are listed below. It should be noted that this section of the report focusses only on the potential visual exposure at varying distances and it does not yet refer to visual impact significance or any correlation thereto.

Less than 5km from the wind turbines:

- Frisgewaagd [7]
- Clercqsvallei
- Welgevonden
- Frisgewaagd
- Drenthe
- Geluk
- Leeukloof
- Blyvooruitsig
- Vogelstruispoort
- Driekop
- Waaikraal
- De Rust

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

- Wemmershuis
- Bergendal
- Green Pastures
- Moreson
- Weltevreden
- Weltevreden
- Observers travelling along the N4 national road
- Observers travelling along the R33 arterial road
- Observers travelling along the Geluk/Dalmanutha secondary roads

Located within a 5 - 10km radius:

- Hartebeespruit
- De Kroon
- Connievale
- Rietvlei
- Vlakfontein
- Brakspruit
- Mislukt
- Van Wyksvlei
- Eerstelingsfontein
- Blyvooruitzicht
- Zoekop
- Leeuwbank
- Zoekop
- Outer lying areas of Belfast
- Parts of the Nooitgedacht Dam and Lakenvlei Protected areas
- Observers travelling along the N4 National road
- Observers travelling along the R33 and R36 arterial roads
- Secondary roads

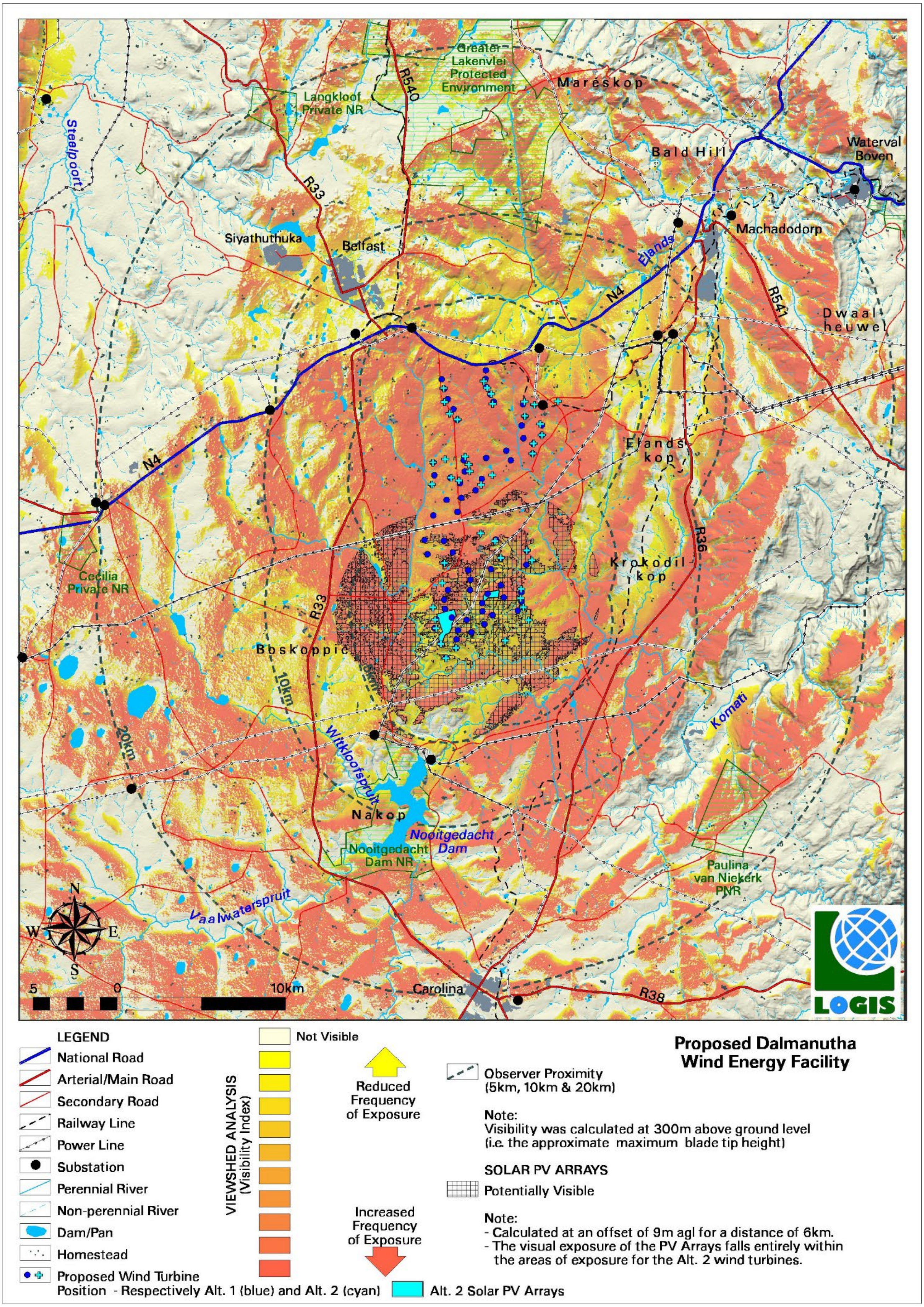
Located within a 10 - 20km radius:

- Du Elsarik
- Winchester
- Vaalkop
- Klipfontein
- Weltevrede
- Elgin
- Lakenvlei
- Elandfontein
- Groenvlei
- Rietvlei
- Zevenfontein
- Sewefontein
- Bloemfontein
- Suikerbosfontein
- Leeuwpoort
- Kwaggafontein
- Hawerfontein
- Berg-en-Dal
- Leliefontein
- Twyfelaar
- Goedehoop
- Blesbokspruit
- Grootpan
- Blesbokspruit
- Parts of the Cecilia, Nooitgedacht Dam, Lakenvlei Protected areas, Paulina van Niekerk PNR and Langkloof PNR
- Southern outlying parts of Siyathuthuka
- Observers travelling along the R33, R36, R541, R540 arterial roads
- Various secondary roads
- Observers travelling along portions of the N4 national road

Located beyond 20km:

- Klippan
- Uitvlug
- Vlakplaas
- Nooitgedacht
- Brahmanica Park
- Vaalbult
- Helpmekaar
- Leeupan
- Cecilia PNR
- Observers travelling along the R36, R38, R541 and R540 arterial roads

It is envisaged that the structures, where visible from short to medium distances (e.g. less than 10km), may constitute a high visual prominence, potentially resulting in moderate to high visual impacts.



Map 4: Viewshed analysis for Alternative 2: Dalmanutha Wind and Solar Facility

5.2. Cumulative visual assessment

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

Cumulative visual impacts may be:

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

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

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

The cumulative impact of the Dalmanutha Wind Facility on the landscape and visual amenity is a product of:

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

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

For the purpose of this study, viewshed analyses were undertaken from the two (2) proposed WEFs (i.e. Dalmanutha Wind and Dalmanutha West), as well as the Dalmanutha Solar Energy Facility which all form part of this development. Authorised Renewable Energy Facilities (REFs) within a 40km radius of the proposed Dalmanutha WEF and/or SEF, were indicated on the map but not included in the analyses as a result of their layouts not been available. Authorised REFs not included in this analysis but occurring in the study are as follows:

- Arnot Power Station PV Facility, located approximately 29.3km to the south west
- Haverfontein WEF, located approximately 6km to the south
- Machadodorp PV 1 Facility, located approximately 8.4km to the north east

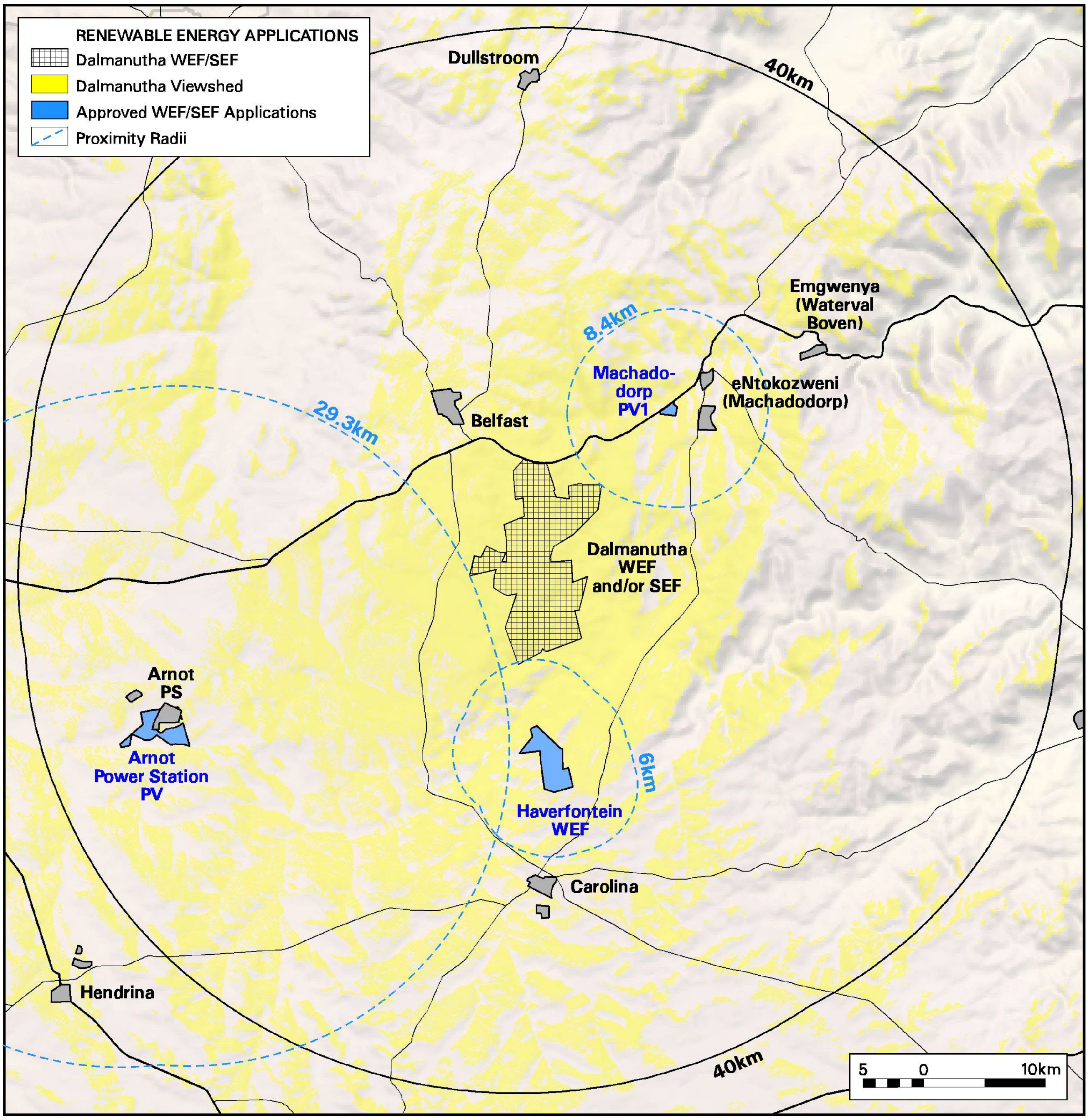
The cumulative viewshed analysis is displayed on **Map 5.**

Conclusion

The proposed Dalmanutha WEF is located on the eastern boundary of the Emalahleni Renewable Energy Development Zone (REDZ). Within this REDZ numerous Solar PV and wind energy projects have been proposed and/or already approved resulting in the area directly west of the Dalmauntha WEF having a high cumulative exposure. One such project located within the Emalahleni REDZ and within 40km of the proposed Dalmanutha WEF, is the Arnot Power Station PV Facility. It should be noted however, that the cumulative visual exposure (and potential cumulative visual impact) to the west of the proposed Dalmanutha WEF is not an unintended consequence of renewable energy facility developments within the region, but rather a concerted effort to concentrate renewable energy facilities within the Emalahleni REDZ. This is an effort to prevent the scattered proliferation of renewable energy generation infrastructure beyond the REDZ and throughout the greater region.

While the Dalmanutha WEF does not fall within the REDZ, the visual impact thereof will contribute to the overall cumulative visual impact of renewable energy projects within the greater region and the frequency of visual exposure to such infrastructure is expected to increase beyond the boundaries of the REDZ, especially considering the other already approved REFs (i.e. Haverfontein WEF and Machadodorp PV1) also located outside of the REDZ within 40km of the proposed Dalmanutha West WEF.

Owing to the location of the Emalahleni REDZ and the location of other already approved REFs outside the REDZ, the cumulative visual impact associated with the proposed Dalmanutha WEF is expected to be moderate to high. However still considered to be within acceptable limits.



Map 5: Cumulative viewshed analysis of the proposed and authorized renewable energy facilities within the study area

5.3. Visual distance / observer proximity to the WEF and/or PV facility

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

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

The proximity radii for the Dalmanutha Wind facility Alternative 1 and 2 were created in order to indicate the scale and viewing distance of the facility and to determine the prominence of the structures in relation to their environment. It should be noted that even though the proximity radii are indicated as (near) concentric circles from the wind turbines, the visual prominence of the structures will only apply where they are visible, as determined in the previous section (**Section 5.1**) of this report. For Alternative 2, it must be noted that the visual exposure of the PV arrays falls entirely within the areas of exposure of the wind turbines.

The proximity radii, based on the dimensions of the proposed development footprint are indicated on **Map 6 and 7**, and include the following:

- 0 - 5km. Short distance view where the WEF and/or PV 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 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.

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

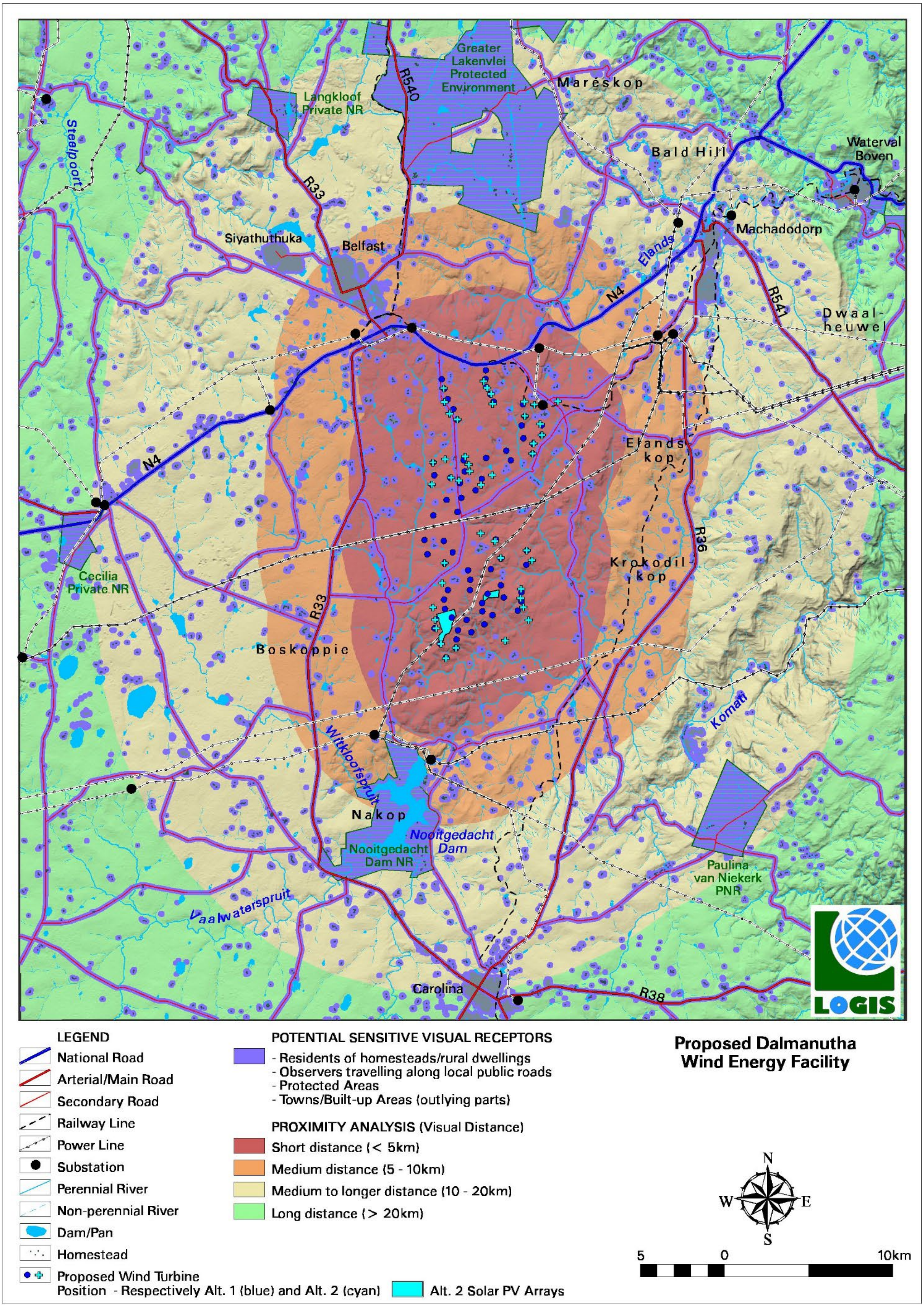
The visual distance theory and the observer's proximity to the facility are closely related, and especially relevant, when considered from areas with a high viewer incidence and a potentially negative visual perception of the proposed facility.

5.4. Viewer incidence / viewer perception

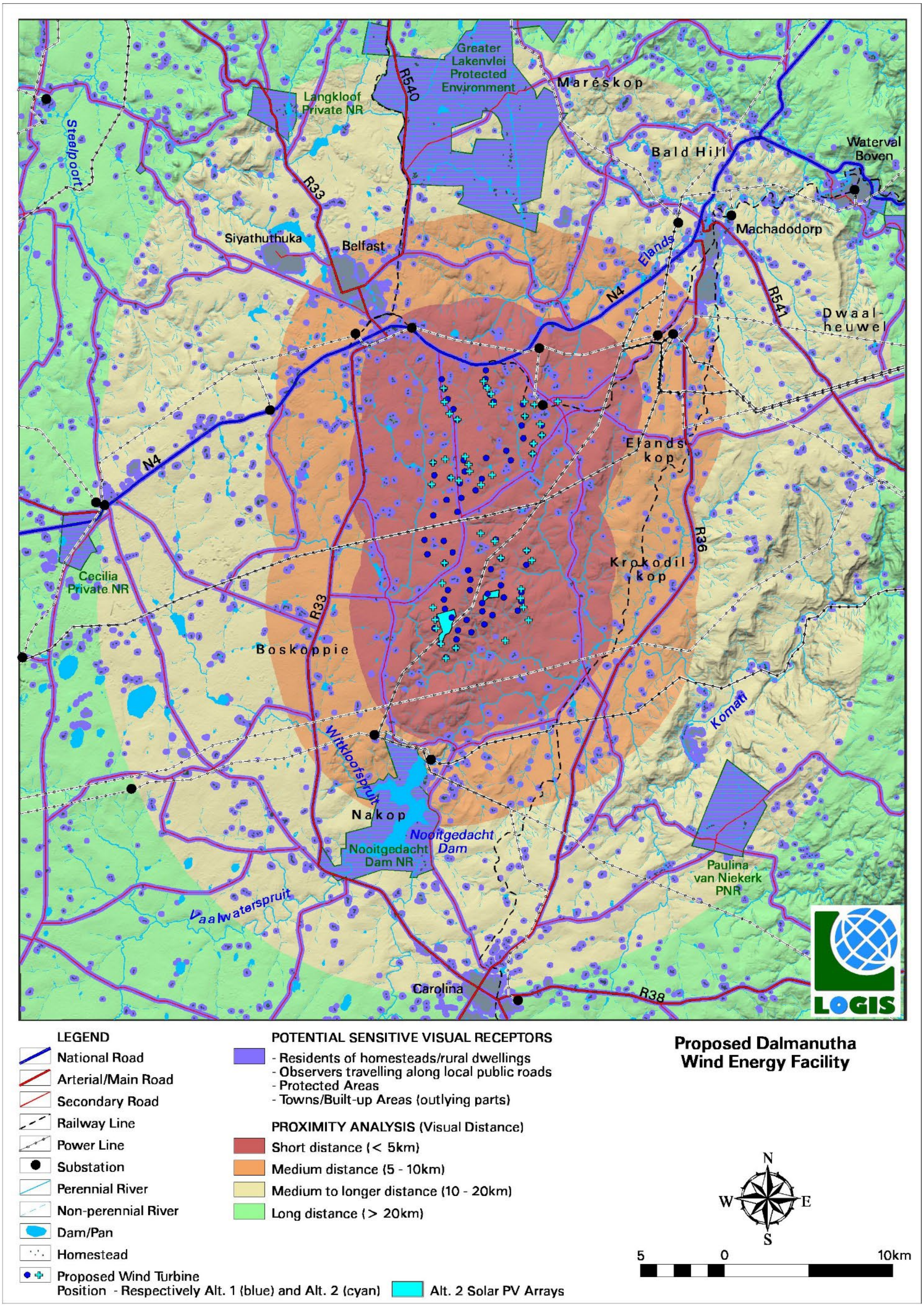
The number of observers and their perception of a structure determine the concept of visual impact. If there are no observers or if the visual perception of the structure is favourable to all the observers, there would be no visual impact. It is necessary to identify areas of high viewer incidence and to classify certain areas according to the observer's visual sensitivity towards the proposed WEF and its related infrastructure. It would be impossible not to generalise the viewer incidence and sensitivity to some degree, as there are many variables when trying to determine the perception of the observer; regularity of sighting, cultural background, state of mind, purpose of sighting, etc. which would create a myriad of options.

Viewer incidence is calculated to be the highest along the public roads within the study area (N4 and R33, R36 and various secondary roads). Travellers using these roads may be negatively impacted upon by visual exposure to the WEF. Additional sensitive visual receptors are located at the farm residences (homesteads) throughout the study area as well as various protected/conservation areas (e.g. Greater Lakenvlei PE, Nooitgedacht Dam NR). It is expected that the viewer's perception, unless the observer is associated with (or supportive of) the WEF, would generally be negative.

Despite the fairly remote location of the proposed Dalmanutha Wind, there are a fair number of potential sensitive visual receptors located within a 20km radius of the proposed facility. These potentially affected sensitive visual receptors are listed in **Section 5.1**. It is expected that these landowners may experience visual impacts ranging from moderate to high significance, depending on their proximity to the wind turbine structures, and their potential sensitivity (aversion) to wind turbine infrastructure. Refer to **Maps 6 and 7** for the location of the potential sensitive visual receptors discussed above.



Map 6: Proximity analysis and potential sensitive visual receptors for Alternative 1: Dalmanutha Wind facility



Map 7: Proximity analysis and potential sensitive visual receptors for Alternative 2: Dalmanutha Wind and Solar facility

5.5. Visual absorption capacity

Land cover is predominantly grassland and dryland agriculture which is defined as an area dominated by nearly continuous grasses often devoid of taller plants such as trees and shrubs (Refer to **Figure 11**).

Overall, the Visual Absorption Capacity (VAC) of the receiving environment is deemed low by virtue of the nature of the vegetation. In addition, the scale and form of the proposed structures mean that it is unlikely that the environment will visually absorb them in terms of texture, colour, form and light/shade characteristics.

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

Figure 11: Grassland devoid of large trees and shrubs

5.6. Visual impact index

The combined results of the visual exposure, viewer incidence/perception and visual distance of the proposed Dalmanutha Wind Facility are displayed on **Maps 8 and 9**. Here the weighted impact and the likely areas of impact have been indicated as a visual impact index. Values have been assigned for each potential visual impact per data category and merged in order to calculate the visual impact index.

The criteria (previously discussed in this report) which inform the visual impact index are:

- Visibility or visual exposure of the structures
- Observer proximity or visual distance from the structures
- The presence of sensitive visual receptors
- The perceived negative perception or objections to the structures (if applicable)
- The visual absorption capacity of the vegetation cover or built structures (if applicable)

An area with short distance visual exposure to the proposed infrastructure, a high viewer incidence and a potentially negative perception (i.e. a sensitive visual receptor) would therefore have a **higher** value (greater impact) on the index. This helps in focussing the attention to the critical areas of potential impact and determining the potential **magnitude** of the visual impact.

The index indicates that **potentially sensitive visual receptors** within a 5km radius of the WEF may experience a **very high** visual impact. The magnitude of visual impact on sensitive visual receptors subsequently subsides with distance; **high** within a 5 – 10km radius (where sensitive receptors are present) and **moderate** within a 10 – 20km radius (where sensitive receptors are present). Receptors beyond 20km are expected to have a **low** potential visual impact.

Likely areas of potential visual impact and potential sensitive visual receptors located within a 20km radius of the proposed WEF and/or PV are displayed on **Maps 10 and 11**.

Magnitude of the potential visual impact

Alternative 1: Dalmanutha Wind Facility

The WEF may have a visual impact of **very high** magnitude on the following observers (within a 5km radius):

Residents of/visitors to[8]:

1) Frisgewaagd
2) Clercqsvallei
3) Welgevonden
4) Frisgewaagd
5) Drenthe
6) Geluk
7) Leeukloof
8) Blyvooruitsig
9) Vogelstruispoort
10) Driekop
11) Waaikraal
12) De Rust
13) Wemmershuis
14) Bergendal
15) Green Pastures
16) Moreson
17) Weltevreden
18) Weltevreden

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

Observers travelling along the:

- Observers travelling along the N4 national road
- Observers travelling along the R33 arterial road
- Observers travelling along the Geluk/Dalmanutha secondary roads

The WEF may have a visual impact of **high** magnitude on the following observers (5 – 10km radius):

Residents of/visitors to:

19) Hartebeespruit
20) De Kroon
21) Connievale
22) Rietvlei
23) Vlakfontein
24) Brakspruit
25) Mislukt
26) Van Wyksvlei
27) Eerstelingsfontein
28) Blyvooruitzicht
29) Zoekop
30) Leeuwbank
31) Zoekop

As well as the outer lying areas of Belfast and parts of the Nooitgedacht Dam and Lakenvlei Protected areas.

Observers travelling along the:

- Observers travelling along the N4 National road
- Observers travelling along the R33 and R36 arterial roads
- Secondary roads

The WEF may have a visual impact of **moderate** magnitude impact on the following observers located between a 10 – 20km radius of the wind turbine structures:

Residents of/visitors to:

32) Du Elsarik
33) Winchester
34) Vaalkop
35) Klipfontein
36) Weltevrede
37) Elgin
38) Lakenvlei
39) Elandfontein
40) Groenvlei
41) Rietvlei
42) Zevenfontein
43) Sewefontein
44) Bloemfontein
45) Suikerbosfontein
46) Leeuwpoort
47) Kwaggafontein
48) Hawerfontein
49) Berg-en-Dal
50) Leliefontein
51) Twyfelaar
52) Goedehoop
53) Blesbokspruit

54) Grootpan
55) Blesbokspruit

- Parts of the Cecilia, Nooitgedacht Dam, Lakenvlei Protected areas, Paulina van Niekerk PNR and Langkloof PNR
- Southern outlying parts of Siyathuthuka

Observers travelling along the:

- Observers travelling along the R33, R36, R541, R540 arterial roads
- Various secondary roads
- Observers travelling along portions of the N4 national road

The WEF may have a visual impact of **low** magnitude impact on the following observers located beyond the 20km radius of the wind turbine structures:

Residents of/visitors to:

56) Klippan
57) Uitvlug
58) Vlakplaas
59) Nooitgedacht
60) Brahmanica Park
61) Vaalbult
62) Helpmekaar
63) Leeupan

- Cecilia PNR

Observers travelling along the:

- Observers travelling along the R36, R38, R541 and R540 arterial roads

Alternative 2: Dalmanutha Wind and Solar Facility

The WEF may have a visual impact of **very high** magnitude on the following observers (within a 5km radius):

Residents of/visitors to[9]:

1) Frisgewaagd
2) Clercqsvallei
3) Welgevonden
4) Frisgewaagd
5) Drenthe
6) Geluk
7) Leeukloof
8) Blyvooruitsig
9) Vogelstruispoort
10) Driekop
11) Waaikraal
12) De Rust
13) Wemmershuis
14) Bergendal
15) Green Pastures
16) Moreson
17) Weltevreden
18) Weltevreden

Observers travelling along the:

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

- Observers travelling along the N4 national road
- Observers travelling along the R33 arterial road
- Observers travelling along the Geluk/Dalmanutha secondary roads

The WEF may have a visual impact of **high** magnitude on the following observers (5 – 10km radius):

Residents of/visitors to:

19) Hartebeespruit
20) De Kroon
21) Connievale
22) Rietvlei
23) Vlakfontein
24) Brakspruit
25) Mislukt
26) Van Wyksvlei
27) Eerstelingsfontein
28) Blyvooruitzicht
29) Zoekop
30) Leeuwbank
31) Zoekop

As well as the outer lying areas of Belfast and parts of the Nooitgedacht Dam and Lakenvlei Protected areas.

Observers travelling along the:

- Observers travelling along the N4 National road
- Observers travelling along the R33 and R36 arterial roads
- Secondary roads

The WEF may have a visual impact of **moderate** magnitude impact on the following observers located between a 10 – 20km radius of the wind turbine structures:

Residents of/visitors to:

32) Du Elsarik
33) Winchester
34) Vaalkop
35) Klipfontein
36) Weltevrede
37) Elgin
38) Lakenvlei
39) Elandfontein
40) Groenvlei
41) Rietvlei
42) Zevenfontein
43) Sewefontein
44) Bloemfontein
45) Suikerbosfontein
46) Leeuwpoort
47) Kwaggafontein
48) Hawerfontein
49) Berg-en-Dal
50) Leliefontein
51) Twyfelaar
52) Goedehoop
53) Blesbokspruit
54) Grootpan
55) Blesbokspruit

- Parts of the Cecilia, Nooitgedacht Dam, Lakenvlei Protected areas, Paulina van Niekerk PNR and Langkloof PNR
- Southern outlying parts of Siyathuthuka

Observers travelling along the:

- Observers travelling along the R33, R36, R541, R540 arterial roads
- Various secondary roads
- Observers travelling along portions of the N4 national road

The WEF may have a visual impact of **low** magnitude impact on the following observers located beyond the 20km radius of the wind turbine structures:

Residents of/visitors to:

56) Klippan
57) Uitvlug
58) Vlakplaas
59) Nooitgedacht
60) Brahmanica Park
61) Vaalbult
62) Helpmekaar
63) Leeupan

- Cecilia PNR

Observers travelling along the:

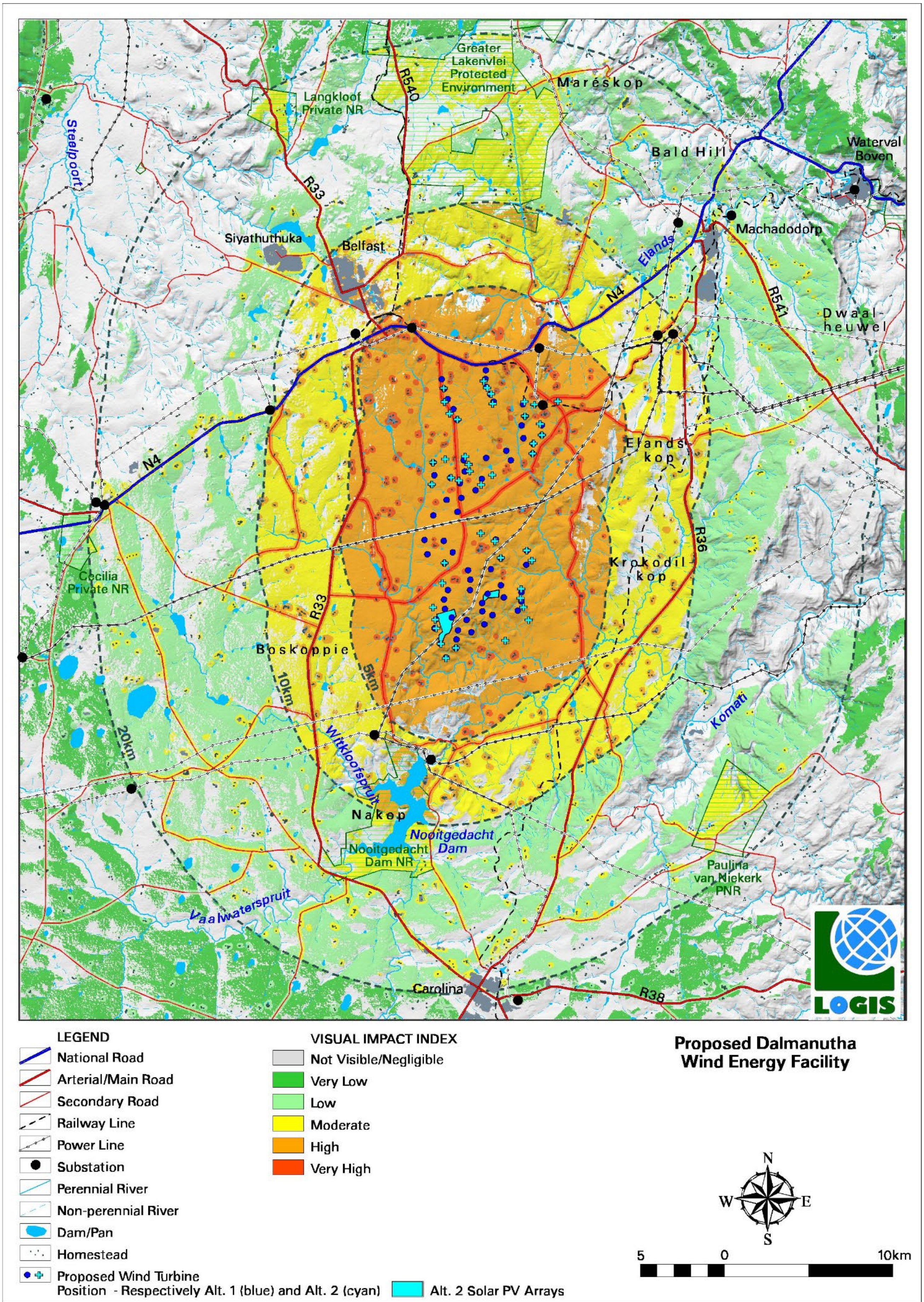
- Observers travelling along the R36, R38, R541 and R540 arterial roads

It must be noted that the visual impact of Alt 2 is very similar to that of Alt 1, with the exception that the frequency of visual exposure to the turbines will be less owing to the reduced number of proposed turbines.

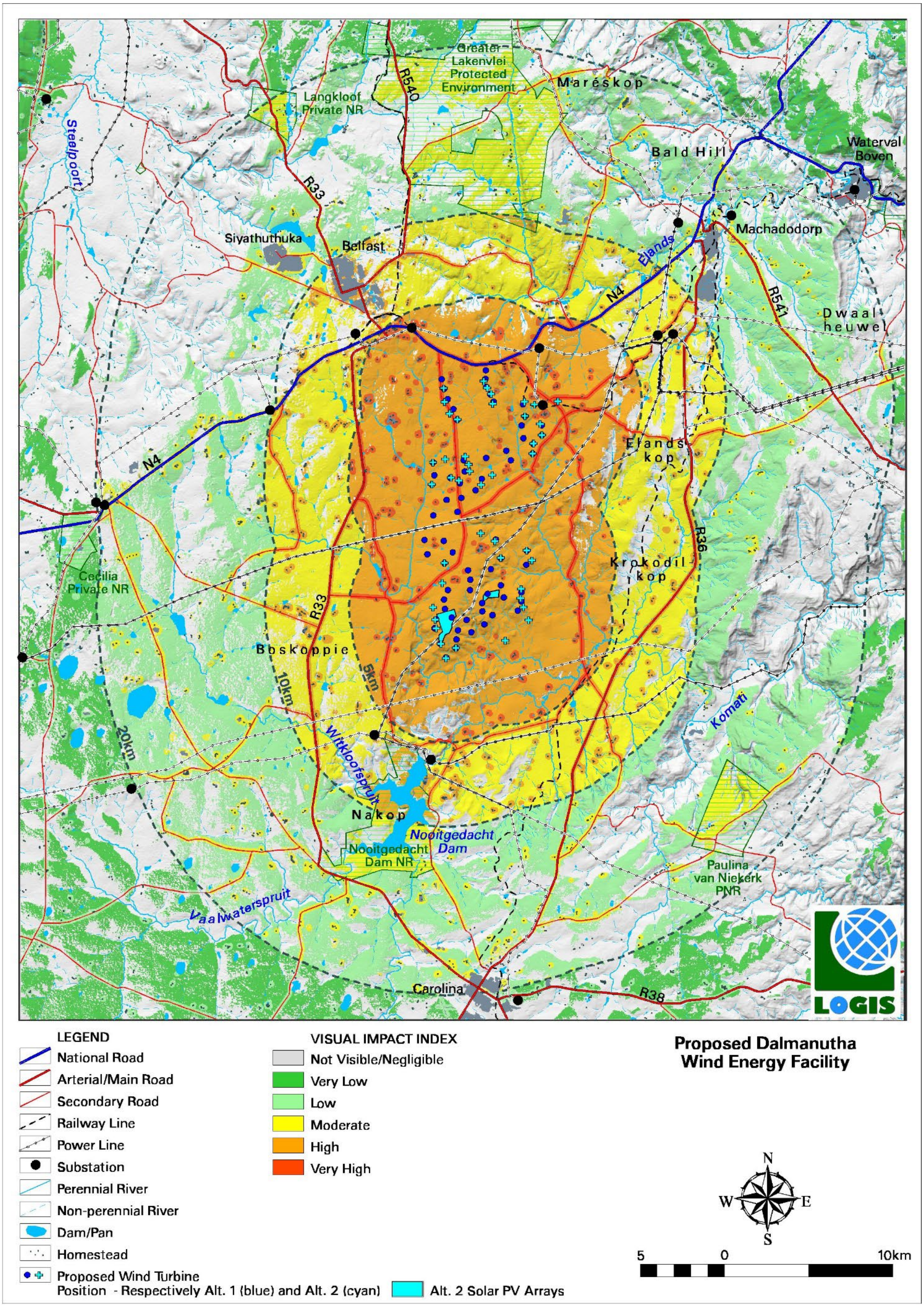
Note:

Where any of the above-mentioned homesteads are derelict or deserted, the visual impact will be non-existent, until such time as it is inhabited again.

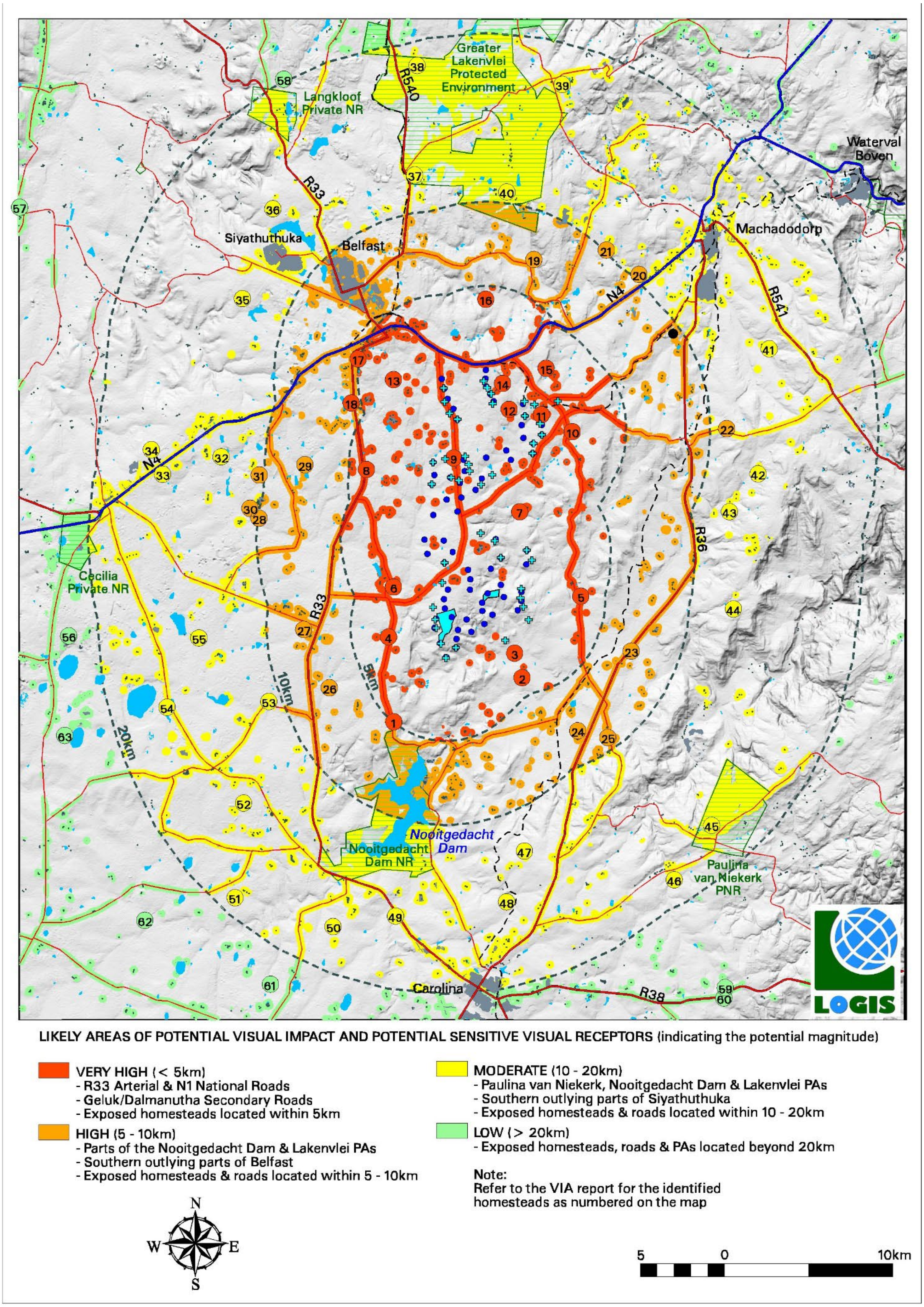
Additionally, some, not all, of the sensitive visual receptors of farm- and homesteads listed above who could be affected visually by the proposed Dalmanutha Wind are in fact located on properties involved in either this project or the proposed Dalmanutha West WEF and EGI developments adjacent to the proposed WEF.



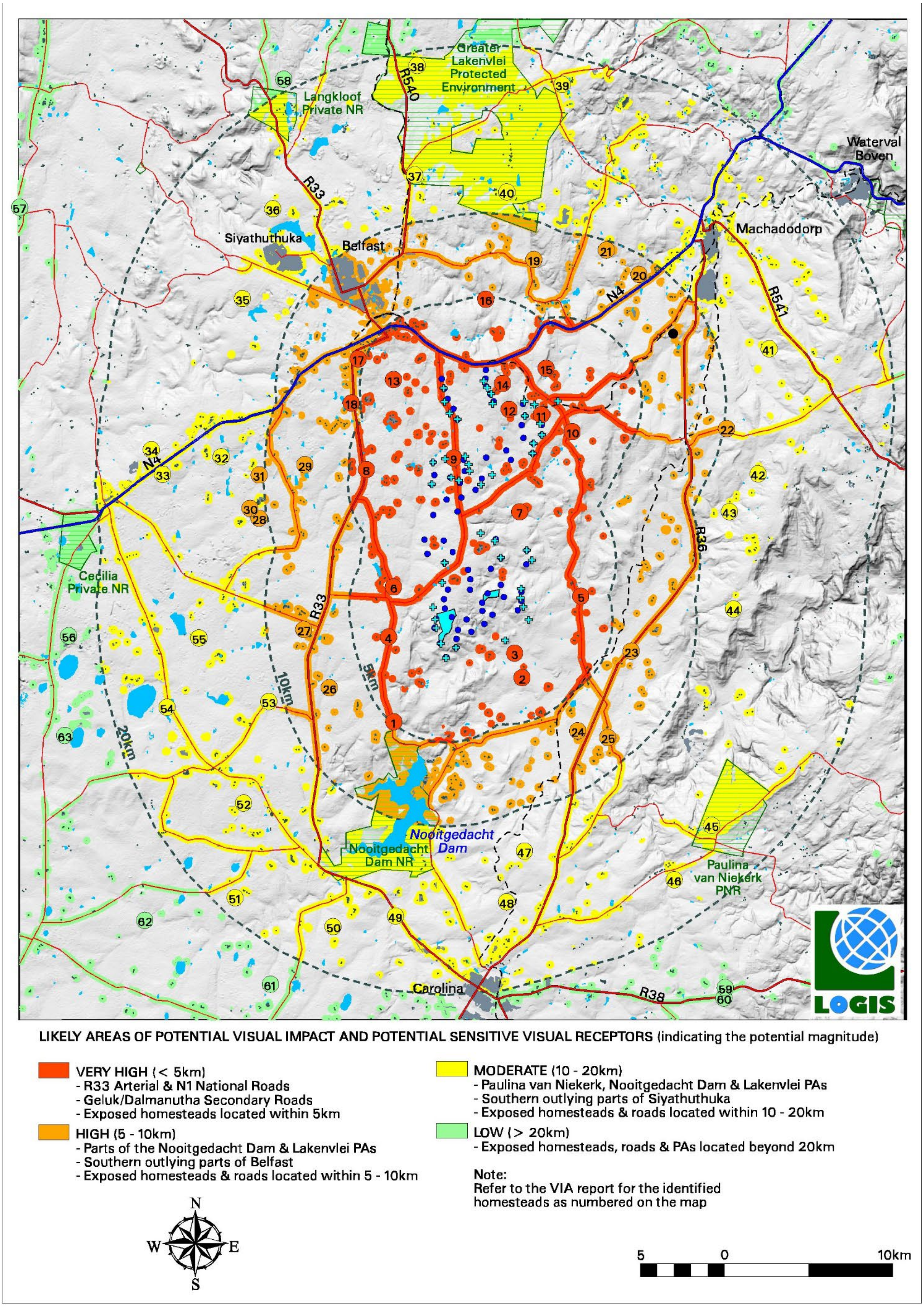
Map 8: Visual impact index for Alternative 1: Dalmanutha Wind facility



Map 9: Visual impact index for Alternative 2: Dalmanutha Wind and Solar facility



Map 10: Likely areas of potential visual impact and sensitive visual receptors for Alternative 1: Dalmanutha Wind facility



Map 11: Likely areas of potential visual impact and sensitive visual receptors for Alternative 2: Wind and Solar Facility

6. 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 Dalmanutha Wind 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 **Dalmanutha Wind** was undertaken on a likely 70 turbine layout for Alternative 1 and 44 turbine layout for Alternative 2 using a 300m blade tip height. As such, sensitive receptors are considered to be affected where shadows are predicted to occur within 1.2km 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 12 and 13.**

Alternative 1: Dalmanutha Wind Facility

This study found that twelve (12) turbines labelled 3-5, 17-18 and 24 – 25 and 28, 32 and 33 (shaded in yellow)**,** located adjacent to various secondary roads within the development site are likely to have a shadow flicker impact on motorists using these roads. It is, however, expected that the number of motorists travelling on these roads will be very limited and the level of exposure will be brief, thereby, not constituting a shadow flicker visual impact of concern for these receptors.

Thirteen (13) turbines labelled 1, 2, 7, 8, 10, 11, 12, 19, 27, 35, 38, 44 and 45 (shaded in red), scattered throughout the development site may have a shadow flicker impact on the villages / settlements including the following:

- Bergendal

- De Rust
- Waaikraal
- Vogelstruispoort
- Geluk
- Leeukloof

However majority, but not all, of these homesteads are located within the farm portions earmarked for the proposed WEF development. It is therefore assumed that these homes are in fact aware of and to a certain extent accepting of the shadow flicker associated with these turbines. It is recommended that further consultation is undertaken as part of the EIA consultation process with these specific sensitive receptors in order to establish their understanding and concerns regarding this possible impact. Should it be found during the consultation process that the residents of these homesteads are concerned with the impact associated with shadow flicker, it is then recommended that the positioning of the offending turbines be revised or removed.

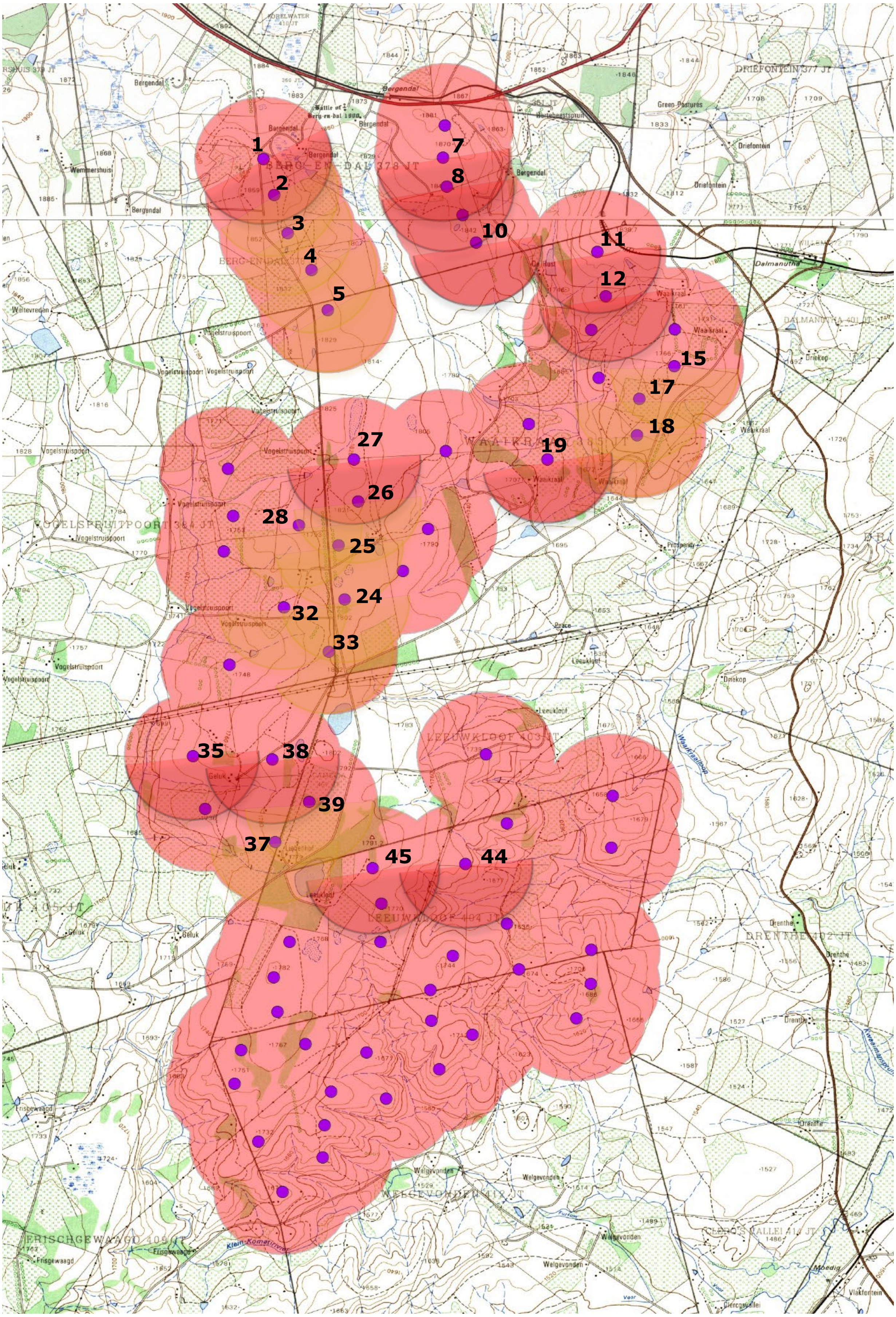
Alternative 2: Dalmanutha Wind and Solar Facility

This study found that ten (10) turbines labelled 1-4, 14-16 and 20, 24 and 25 (shaded in yellow)**,** located adjacent to various secondary roads within the development site are likely to have a shadow flicker impact on motorists using these roads. It is, however, expected that the number of motorists travelling on these roads will be very limited and the level of exposure will be brief, thereby, not constituting a shadow flicker visual impact of concern for these receptors.

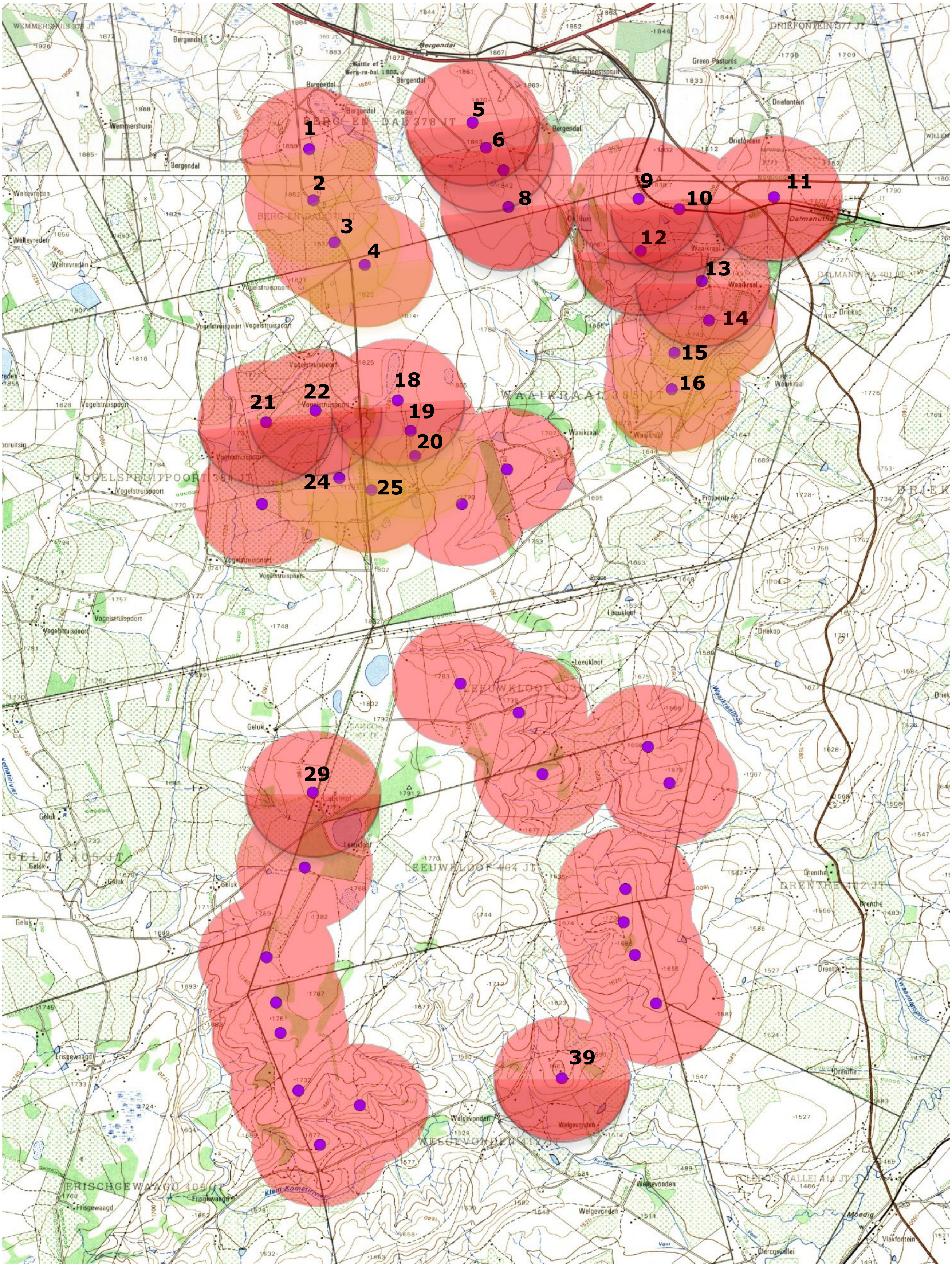
Thirteen (13) turbines labelled 5, 6, 8, 9-13, 18, 21 ,22, 29 and 39 (shaded in red), scattered throughout the development site may have a shadow flicker impact on the villages / settlements including the following:

- Bergendal
- De Rust
- Waaikraal
- Dalmanutha
- Vogelstruispoort
- Liebenhof
- Welgevonden

However majority, but not all, of these homesteads are located within the farm portions earmarked for the proposed WEF development. It is therefore assumed that these homes are in fact aware of and to a certain extent accepting of the shadow flicker associated with these turbines. It is recommended that further consultation is undertaken as part of the EIA consultation process with these specific sensitive receptors in order to establish their understanding and concerns regarding this possible impact. Should it be found during the consultation process that the residents of these homesteads are concerned with the impact associated with shadow flicker, it is then recommended that the positioning of the offending turbines be revised or removed.



Map 12: potential sensitive receptors exposed to shadow flicker for Alternative 1: Dalmanutha Wind facility



Map 13: Potential sensitive visual receptors exposed to shadow flicker for Alternative 2: Wind and Solar facility

7. PHOTO SIMULATIONS

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

The photo simulations indicate the anticipated visual alteration of the landscape from various sensitive visual receptors located at different distances from the facility. The simulations are based on the wind turbine dimensions and layout.

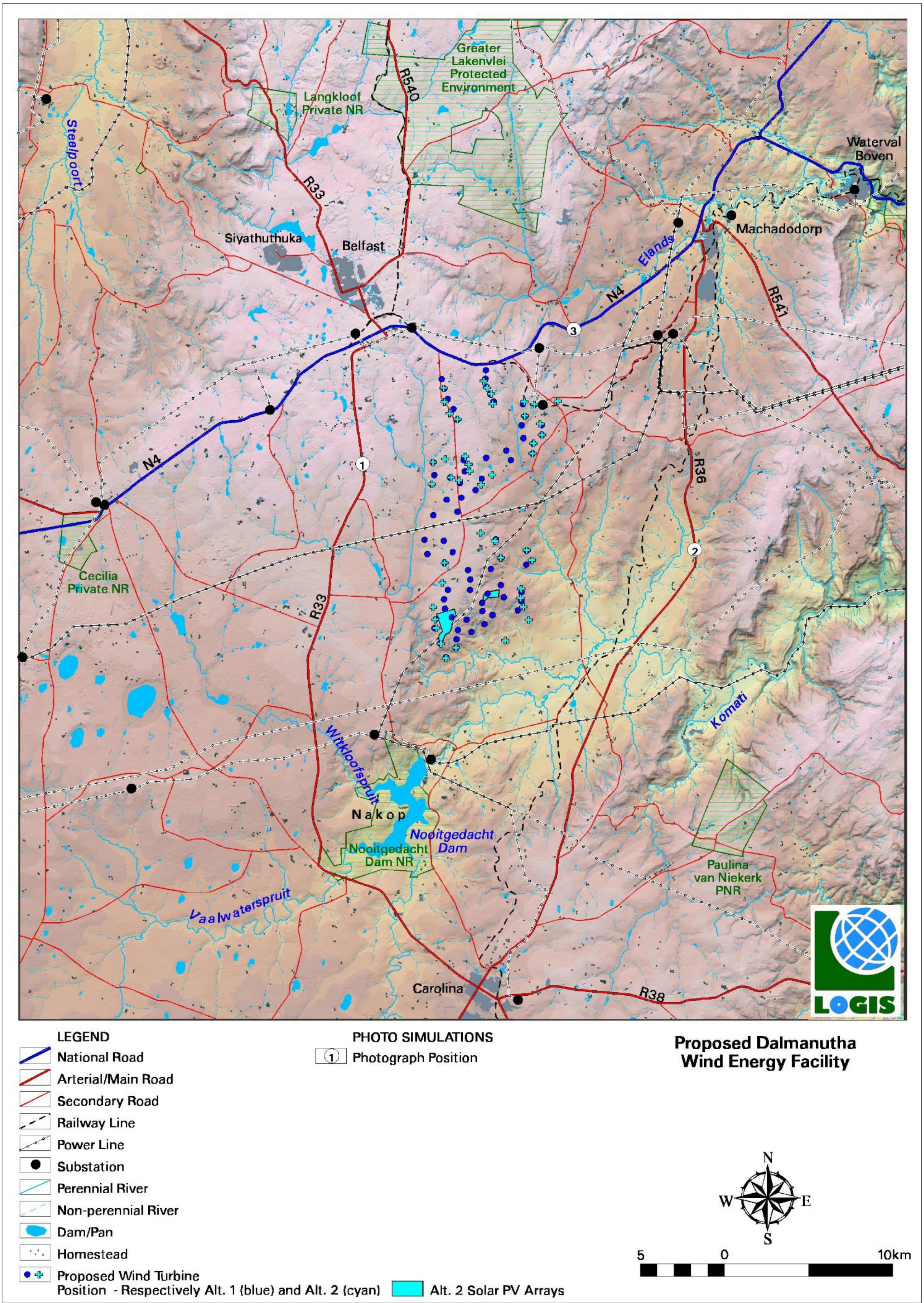
The photograph positions are indicated on **Map 14** below and should be referenced with the photo simulation being viewed in order to place the observer in spatial context.

The simulated views show the placement of the wind turbines during the long-term operation phase of the facility's lifespan. It is assumed that the necessary post-construction phase rehabilitation and mitigation measures, as proposed by the various specialists in the environmental impact assessment report, has been undertaken.

It is imperative that the natural vegetation be restored to its original (current) status for these simulated views to ultimately be realistic. The additional infrastructure (e.g. the proposed substation, access roads, etc.) associated with the facility is not included in the photo simulations.

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

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



Map 14: Locations where the photo simulations were taken

Figure 12: Photo simulation 1 – before. Viewpoint from the R33 looking east towards the proposed Dalmanutha WEF facilities.

Figure 13: Photo simulation 1 – after. Viewpoint from the R33 looking east towards the proposed Dalmanutha WEF facilities

Figure 14: Photo simulation 2 – before. Viewpoint from the R36 looking west towards the proposed Dalmanutha WEF facilities

Figure 15: Photo simulation 2 – after.

Figure 16: Photo simulation 3- before. View from the N4 looking south

Figure 17: Photo simulation 3- after

8. VISUAL IMPACT ASSESSMENT

8.1. Impact rating methodology

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

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

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

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

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

- (1) Very short: 0-1 years
- (2) Short: 2-5 years
- (3) Medium: 5-15 years
- (4) Long: >15 years
- (5) Permanent

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

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

Probability - The likelihood of the impact actually occurring.

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

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

- ***(0-12) Negligible:***
  Where the impact would have no direct influence on the decision to develop in the area. The impact would be of a very low order. In the case of negative impacts, almost no mitigation and or remedial activity would be needed, and any minor steps, which might be needed, would be easy, cheap, and simple.
- ***(13-30) Low:***
  Where the impact would have a very limited direct influence on the decision to develop in the area. The impact would be of a low order and with little real effect. In the case of negative impacts, mitigation and / or remedial activity would be either easily achieved or little would be required, or both.
- ***(31-60) Moderate:***
  Where the impact could influence the decision to develop in the area. The impact would be real but not substantial. In the case of negative impacts, mitigation and / or remedial activity would be both feasible and fairly easily possible.

- ***(61-80) High:***
  Where the impact must have an influence on the decision to develop in the area. The impacts are of a substantial order. In the case of negative impacts, mitigation and / or remedial activity would be feasible but difficult, expensive, time-consuming or some combination of these.
- ***(81-100) Very High:***
  Where the impact will definitely have an influence on the decision to develop in the area. The impacts are of the highest order possible. In the case of negative impacts, there would be no possible mitigation and / or remedial activity possible.

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

Status – The perception of Interested and Affected Parties towards the proposed development.
- Positive
- Negative
- Neutral

Reversibility – The possibility of visual recovery of the impact following the decommissioning of the proposed development
- (1) Reversible
- (3) Recoverable
- (5) Irreversible

This methodology complies to the International Finance Corporation (IFC) Performance Standards on Environmental and Social Sustainability, 2012 and Environmental, Health, and Safety Guidelines for Wind Energy, 2015.

8.2. Visual impact assessment

The primary visual impacts of the proposed WEF are assessed as follows in the table below.

It must be noted that the visual exposure of the PV arrays for Alternative 2 falls entirely within the areas of exposure of the wind turbines as will therefore be assessed as such.

8.2.1. Construction Impacts

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

During the construction period, there will be an increase in heavy vehicles utilising the roads to the construction sites that may cause, at the very least, a visual nuisance to other road users and landowners in the area in close proximity (within 5km). Within the region, dust as a result of construction activities may also be visible, as such it will result in a visual impact occurring during construction. Sensitive receptors in this zone consist of observers travelling along the R398, various secondary and internal farm roads, as well as residents of various homesteads.

Construction activities may potentially result in a **high** (significance rating = 80) temporary visual impact, that may be mitigated to **moderate** (significance rating = 56) for both Alternative 1 and 2.

Homesteads located on farm portions earmarked for the Dalmanutha Wind project reduces the probability of this impact occurring on these specific receptors (i.e. it is assumed that these landowners are supportive of WEF developments and their associated visual impacts).

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

Table 4: Visual impact of construction on sensitive visual receptors in close proximity to the proposed WEF.

Nature of Impact: Visual impact of construction activities on sensitive visual receptors in close proximity to the proposed Developments				
	Alternative 1: Dalmanutha Wind Facility		Alternative 2: Dalmanutha Wind and Solar Facility	
	Without mitigation	***With mitigation***	***Without mitigation***	***With mitigation***
Extent	Neighbourhood **(4)**	Neighbourhood **(4)**	Neighbourhood **(4)**	Neighbourhood **(4)**

Duration	Short term **(2)**	Short term **(2)**	Short term **(2)**	Short term **(2)**
Magnitude	Very high **(10)**	High **(8)**	Very high **(10)**	High **(8)**
Probability	Definite **(5)**	Highly probable **(4)**	Definite **(5)**	Highly probable **(4)**
Significance	High **(80)**	Moderate **(56)**	High **(80)**	Moderate **(56)**
Status (positive or negative)	Negative	Negative	Negative	Negative
Reversibility	Reversible (1)	Reversible (1)	Reversible (1)	Reversible (1)
Irreplaceable loss of resources?	No			
Can impacts be mitigated?	Yes	Yes	Yes	Yes
Mitigation: Planning: ➢ Retain and maintain natural vegetation in all areas outside of the development footprint, but within the project site. Construction: ➢ Ensure that vegetation is not unnecessarily removed during the construction period. ➢ Plan the placement of laydown areas and temporary construction equipment camps in order to minimise vegetation clearing (i.e. in already disturbed areas) where 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 of 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.				
Residual impacts: None, provided that rehabilitation works are carried out as required.				

8.2.2. Operational Impacts

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

The operation of the proposed WEF is expected to have a **very high** visual impact (significance rating = 90) on observers/visitors residing at homesteads and travelling along the N4, R33 and other secondary roads within a 5km radius of the wind turbine structures.

Homesteads located on farm portions earmarked for the Dalmanutha Wind project reduces the probability of this impact occurring on these specific receptors (i.e. it is assumed that these landowners are supportive of WEF developments and their associated visual impacts).

A mitigating factor within this scenario is that observers traveling along these roads will only be exposed to the visual intrusion for a short period of time. This reduces the probability of this impact occurring.

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

Table 5: Visual impact on observers (residents and visitors) in close proximity to the proposed wind turbine structures/PV

Nature of Impact: Visual impact on observers (residents at homesteads and visitors/tourists) in close proximity (i.e. within 5km) to the wind turbine structures				
	Alternative 1: Dalmanutha Wind Facility		Alternative 2: Dalmanutha Wind and Solar Facility	
	Without mitigation	***With mitigation***	***Without mitigation***	***With mitigation***
Extent	Neighbourhood **(4)**	Neighbourhood **(4)**	Neighbourhood **(4)**	Neighbourhood **(4)**
Duration	Long term **(4)**	Long term **(4)**	Long term **(4)**	Long term **(4)**
Magnitude	Very high **(10)**	Very high **(10)**	Very high **(10)**	Very high **(10)**
Probability	Definite **(5)**	Definite **(5)**	Definite **(5)**	Definite **(5)**
Significance	Very High **(90)**	Very High **(90)**	Very High **(90)**	Very High **(90)**
Status (positive or negative)	Negative	Negative	Negative	Negative
Reversibility	Reversible (1)	Reversible (1)	Reversible (1)	Reversible (1)
Irreplaceable loss of resources?	No			
Can impacts be mitigated?	No	No	No	No
Mitigation / Management: Operations: ➢ Retain / re-establish and maintain natural vegetation in all areas outside of the development footprint. ➢ Maintain the general neat and tidy appearance of the facility as a whole. ➢ Monitor rehabilitated areas, and implement remedial action as and when required. ➢ Investigate the potential to screen affected receptor sites (if applicable and located within 1km of the facility) with planted vegetation cover (Alt 2)				

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.
Residual impacts: None, provided that rehabilitation works are carried out as required.

8.2.2.2. Potential visual impact on sensitive visual receptors within the local area (5 – 10km radius)

The proposed WEF could have a **high** visual impact (significance rating = 75) on residents of (or visitors to) homesteads and observers travelling along the roads within a 5 - 10km radius of the wind turbine structures.

Homesteads located on farm portions earmarked for the Dalmanutha Wind project reduces the probability of this impact occurring on these specific receptors (i.e. it is assumed that these landowners are supportive of WEF developments and their associated visual impacts).

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

Table 6: Visual impact of the proposed wind turbine structures within the local area (5 – 10km)

Nature of Impact: Visual impact on observers travelling along the roads and residents at homesteads within a 5 – 10km radius of the wind turbine structures				
	Alternative 1: Dalmanutha Wind Facility		Alternative 2: Dalmanutha Wind and Solar Facility	
	Without mitigation	***With mitigation***	***Without mitigation***	***With mitigation***
Extent	Local **(3)**	Local **(3)**	Local **(3)**	Local **(3)**
Duration	Long term **(4)**	Long term **(4)**	Long term **(4)**	Long term **(4)**
Magnitude	High **(8)**	High **(8)**	High **(8)**	High **(8)**
Probability	Definite **(5)**	Definite **(5)**	Definite **(5)**	Definite **(5)**
Significance	High **(75)**	High **(75)**	High **(75)**	High **(75)**
Status (positive or negative)	Negative	Negative	Negative	Negative
Reversibility	Reversible (1)	Reversible (1)	Reversible (1)	Reversible (1)

Irreplaceable loss of resources?	No			
Can impacts be mitigated?	No	No	No	No
Mitigation / Management: Operations: ➢ Retain / re-establish and maintain natural vegetation in all areas outside of the development footprint. ➢ Maintain the general neat and tidy appearance of the facility as a whole. ➢ Monitor rehabilitated areas, and implement remedial action as and when required. ➢ Investigate the potential to screen affected receptor sites (if applicable and located within 1km of the facility) with planted vegetation cover (Alt 2) 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.				
Residual impacts: None, provided that rehabilitation works are carried out as required.				

8.2.2.3. Potential visual impact on sensitive visual receptors within the district (10 – 20km radius)

The proposed WEF could have a **moderate** visual impact (significance rating = 48) on residents of (or visitors to) homesteads and observers travelling along the roads within a 10 - 20km radius of the wind turbine structures.

Homesteads located on farm portions earmarked for the Dalmanutha Wind project reduces the probability of this impact occurring on these specific receptors (i.e. it is assumed that these landowners are supportive of WEF developments and their associated visual impacts).

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

Table 7: Visual impact of the proposed wind turbine structures within the district (10 – 20km)

Nature of Impact: Visual impact on observers travelling along the roads and residents at homesteads within a 10 – 20km radius of the wind turbine structures				
	Alternative 1: Dalmanutha Wind Facility		Alternative 2: Dalmanutha Wind and Solar Facility	
	Without mitigation	***With mitigation***	***Without mitigation***	***With mitigation***
Extent	District **(2)**	District **(2)**	District **(2)**	District **(2)**

Duration	Long term **(4)**	Long term **(4)**	Long term **(4)**	Long term **(4)**
Magnitude	Moderate **(6)**	Moderate **(6)**	Moderate **(6)**	Moderate **(6)**
Probability	Highly Probable **(4)**	Highly Probable **(4)**	Highly Probable **(4)**	Highly Probable **(4)**
Significance	Moderate **(48)**	Moderate **(48)**	Moderate **(48)**	Moderate **(48)**
Status (positive or negative)	Negative	Negative	Negative	Negative
Reversibility	Reversible (1)	Reversible (1)	Reversible (1)	Reversible (1)
Irreplaceable loss of resources?	No			
Can impacts be mitigated?	No	No	No	No
Mitigation / Management: Operations: ➢ Retain / re-establish and maintain natural vegetation in all areas outside of the development footprint. ➢ Maintain the general neat and tidy appearance of the facility as a whole. ➢ Monitor rehabilitated areas, and implement remedial action as and when required. ➢ Investigate the potential to screen affected receptor sites (if applicable and located within 1km of the facility) with planted vegetation cover (Alt 2) 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.				
Residual impacts: None, provided that rehabilitation works are carried out as required.				

8.2.2.4. Potential visual impact on sensitive visual receptors within the region (beyond 20 Km radius)

The proposed WEF could have a **low** visual impact (significance rating = 27) on residents of (or visitors to) homesteads, observers travelling along the roads and visitors to the Cecilia Private NR beyond the 20km radius of the wind turbine structures.

Homesteads located on farm portions earmarked for the Dalmanutha Wind project reduces the probability of this impact occurring on these specific receptors (i.e. it is assumed that these landowners are supportive of WEF developments and their associated visual impacts).

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

Table 8: Visual impact of the proposed wind turbine structures within the region (beyond the 20 Km radius)

Nature of Impact: Visual impact on observers travelling along the roads, residents at homesteads and protected areas beyond the 20km radius of the wind turbine structures				
	Alternative 1: Dalmanutha Wind Facility		Alternative 2: Dalmanutha Wind and Solar Facility	
	Without mitigation	***With mitigation***	***Without mitigation***	***With mitigation***
Extent	Region **(1)**	Region **(1)**	Region **(1)**	Region **(1)**
Duration	Long term **(4)**	Long term **(4)**	Long term **(4)**	Long term **(4)**
Magnitude	Low **(4)**	Low **(4)**	Low **(4)**	Low **(4)**
Probability	Probable **(3)**	Probable **(3)**	Probable **(3)**	Probable **(3)**
Significance	Low **(27)**	Low **(27)**	Low **(27)**	Low **(27)**
Status (positive or negative)	Negative	Negative	Negative	Negative
Reversibility	Reversible (1)	Reversible (1)	Reversible (1)	Reversible (1)
Irreplaceable loss of resources?	No			
Can impacts be mitigated?	No	No	No	No

Mitigation / Management:

Operations:

- Retain / re-establish and maintain natural vegetation in all areas outside of the development footprint.
- Maintain the general neat and tidy appearance of the facility as a whole.
- Monitor rehabilitated areas, and implement remedial action as and when required.
- Investigate the potential to screen affected receptor sites (if applicable and located within 1km of the facility) with planted vegetation cover (Alt 2)

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.

Residual impacts:

None, provided that rehabilitation works are carried out as required.

8.2.2.5. Potential visual impact on Protected Areas within the district

The proposed WEF could have a **moderate** visual impact (significance rating = 56) on visitors to portions of the Greater Lakenvlei Protected Environment, the Cecilia Private NR, Paulina van Niekerk PNR, Langkloof PNR and the Nooitgedacht Dam NR between 5- 20km radius of the wind turbine structures.

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

Table 9: Visual impact of the wind turbine structures on Protected Areas within the district

Nature of Impact: Visual impact on visitors to protected areas within a 5 – 20km radius of the wind turbine structures				
	Alternative 1: Dalmanutha Wind Facility		Alternative 2: Dalmanutha Wind and Solar Facility	
	Without mitigation	***With mitigation***	***Without mitigation***	***With mitigation***
Extent	District **(2)**	District **(2)**	District **(2)**	District **(2)**
Duration	Long term **(4)**	Long term **(4)**	Long term **(4)**	Long term **(4)**
Magnitude	High **(8)**	High **(8)**	High **(8)**	High **(8)**
Probability	Highly Probable **(4)**	Highly Probable **(4)**	Highly Probable **(4)**	Highly Probable **(4)**
Significance	Moderate **(56)**	Moderate **(56)**	Moderate **(56)**	Moderate **(56)**
Status (positive or negative)	Negative	Negative	Negative	Negative
Reversibility	Reversible (1)	Reversible (1)	Reversible (1)	Reversible (1)
Irreplaceable loss of resources?	No			
Can impacts be mitigated?	No	No	No	No
Mitigation / Management: Operations: ➢ Retain / re-establish and maintain natural vegetation in all areas outside of the development footprint. ➢ Maintain the general neat and tidy appearance of the facility as a whole. ➢ Monitor rehabilitated areas, and implement remedial action as and when required.				

➢ Investigate the potential to screen affected receptor sites (if applicable and located within 1km of the facility) with planted vegetation cover (Alt 2) 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.
Residual impacts: None, provided that rehabilitation works are carried out as required.

8.2.2.6. Shadow flicker

Shadow flicker only occurs when the sky is clear, and when the turbine rotor blades are between the sun and the receptor (i.e. when the sun is low). De Gryse in Scenic Landscape Architecture (2006) found that "*most shadow impact is associated with 3-4 times the height of the object*". Based on this research, an 1.2km buffer along the edge of the outer most turbines were identified as the zone within which there is a risk of shadow flicker occurring.

A number of homesteads are located within the 1.2km buffer of turbines for both Alt 1 and 2. Of note is that most of the homesteads are located on properties involved in this development, thereby reducing the probability of this impact occurring. It is expected that motorists travelling along roads within the 1km zone of a turbine could potentially experience shadow flicker, however the shadow flicker experienced by these motorists will be fleeting and not constitute a shadow flicker visual impact of concern.

The significance of shadow flicker is therefore anticipated to be **high** before mitigation and **moderate** post mitigation.

Table 10: Visual impact of shadow flicker on sensitive visual receptors in close proximity to the proposed WEF

Nature of Impact: Visual impact of shadow flicker on sensitive visual receptors in close proximity to the proposed WEF.				
	Alternative 1: Dalmanutha Wind Facility		Alternative 2: Dalmanutha Wind and Solar Facility	
	Without mitigation	***With mitigation***	***Without mitigation***	***With mitigation***
Extent	Neighbourhood **(4)**	Neighbourhood **(4)**	Neighbourhood **(4)**	Neighbourhood **(4)**
Duration	Long term **(4)**	Long term **(4)**	Long term **(4)**	Long term **(4)**
Magnitude	High **(8)**	Moderate **(6)**	High **(8)**	Moderate **(6)**
Probability	Highly Probable **(4)**	Probable **(3)**	Highly Probable **(4)**	Probable **(3)**
Significance	High **(64)**	Moderate **(42)**	High **(64)**	Moderate **(42)**

Status (positive or negative)	Negative	Negative	Negative	Negative
Reversibility	Reversible (1)	Reversible (1)	Reversible (1)	Reversible (1)
Irreplaceable loss of resources?	No			
Can impacts be mitigated?	No	No	No	No
Mitigation / Management: Planning & operation: ➢ Adjust wind turbine locations to reduce the number of receptors likely to experience shadow flicker. ➢ Consult with participating landowners or identified receptors who may experience shadow flicker impacts to identify feasible and reasonable management and mitigation measures, should they be required. ➢ Installation of screening structures and/ or planting of trees to block shadows cast by the turbines on the identified affected receptors. ➢ Investigate the use of turbine control strategies which shut down the offending turbines when shadow flicker is likely to occur on identified receptors.				
Residual impacts: None, provided that rehabilitation works are carried out as required.				

8.2.2.7. Solar glint and glare impacts

Potential visual impact of solar glint and glare as a visual distraction and possible air/road travel hazard

This impact is only applicable to Alternative 2: Dalmanutha Wind and Solar facility.

Glint and glare occurs when the sun reflects off surfaces with specular (mirror-like) properties. Examples of these include glass windows, water bodies and potentially some solar energy generation technologies (e.g. parabolic troughs and CSP heliostats). Glint is generally of shorter duration and is described as "a momentary flash of bright light", whilst glare is the reflection of bright light for a longer duration.

The visual impact of glint and glare relates to the potential it has to negatively affect sensitive visual receptors in relative close proximity to the source (e.g. users of the secondary road), or aviation safety risk for pilots (especially where the source interferes with the approach angle to the runway). The Federal Aviation Administration (FAA) of the United States of America have researched glare as a hazard for aviation pilots on final approach and may prescribe specific glint and glare studies for solar energy facilities in close proximity to aerodromes (airports, airfields, military airbases, etc.). It is generally possible to mitigate the potential glint and glare impacts through the design and careful placement of the infrastructure.

PV panels are designed to generate electricity by absorbing the rays of the sun and are therefore constructed of dark-coloured materials, and are covered by anti-reflective coatings. Indications are that as little as 2% of the incoming sunlight is reflected from the surface of modern PV panels especially where the incidence angle (angle of incoming light) is smaller i.e. the panel is facing the sun directly. This is particularly true for tracker arrays that are designed to track the sun and keep the incidence angle as low as possible.[10]

There are no major roads within a 1km radius of the proposed PV facility. A secondary road is located within 1km of the proposed PV Facility. This approximate distance is recommended as a threshold within which the visual impact of glint and glare (if there is visual line of sight from the road) may influence road users.[11] The potential visual impact related to solar glint and glare as a road travel hazard is therefore expected to be of **low** significance. No mitigation of this impact is required since the solar reflection is predicted towards a local/secondary road.

Table 11: visual impact of glint and glare to users of secondary roads

Nature of Impact: The visual impact of solar glint and glare as a visual distraction and possible road travel hazard				
	Alternative 1: Dalmanutha Wind Facility		Alternative 2: Dalmanutha Wind and Solar Facility	
	Without mitigation	***With mitigation***	***Without mitigation***	***With mitigation***
Extent	N/A	N/A	Neighbourhood **(4)**	N/A
Duration	N/A	N/A	Long term **(4)**	N/A
Magnitude	N/A	N/A	Low **(4)**	N/A
Probability	N/A	N/A	Improbable **(2)**	N/A
Significance	N/A	N/A	Low **(24)**	N/A
Status (positive or negative)	N/A	N/A	Negative	N/A
Reversibility	N/A	N/A	Reversible (1)	N/A
Irreplaceable loss of resources?	No			
Can impacts be mitigated?	No	No	No	No
Mitigation / Management: ➢				
Residual impacts:				

[10] Sources: Blue Oak Energy, FAA and Meister Consultants Group.

[11] December 2020, Solar Photovoltaic Glint and Glare Guidance Third Edition.

None, provided that rehabilitation works are carried out as required.

Potential visual impact of solar glint and glare on static ground-based receptors (residents of homesteads) in close proximity to the PV facility

This impact is only applicable to Alternative 2: Dalmanutha Wind and Solar facility.

There are no affected residences within a 1km radius of the proposed PV facility. The potential visual impact related to solar glint and glare on static ground-based receptors (residents of homesteads) is therefore expected to be of **low** significance, both before and after mitigation.

Mitigation of this impact is possible and both specific measures as well as general "best practice" measures are recommended in order to reduce/mitigate the potential visual impact. The table below illustrates this impact assessment.

Table 12: Visual impact of glint and glare on residents of homesteads

Nature of Impact: The visual impact of solar glint and glare on residents of homesteads in closer proximity to the PV facility				
	Alternative 1: Dalmanutha Wind Facility		Alternative 2: Dalmanutha Wind and Solar Facility	
	Without mitigation	***With mitigation***	***Without mitigation***	***With mitigation***
Extent	N/A	N/A	Neighbourhood **(4)**	Neighbourhood **(4)**
Duration	N/A	N/A	Long term **(4)**	Long term **(4)**
Magnitude	N/A	N/A	Low **(4)**	Low **(4)**
Probability	N/A	N/A	Improbable **(2)**	Improbable **(2)**
Significance	N/A	N/A	Low **(24)**	Low **(24)**
Status (positive or negative)	N/A	N/A	Negative	Negative
Reversibility	N/A	N/A	Reversible (1)	Reversible (1)
Irreplaceable loss of resources?	No			
Can impacts be mitigated?	No	No	No	No
Mitigation / Management: Planning & operation:				

➢ Use anti-reflective panels and dull polishing on structures, where possible and industry standard. ➢ If specific sensitive visual receptors are identified during operation, investigate screening at the receptor site, where possible.
Residual impacts: None, provided that rehabilitation works are carried out as required.

8.2.2.8. Potential visual impact of operational, safety and security lighting of the facility at night

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

Another source of glare light, albeit not as intense as flood lighting, is the aircraft warning lights mounted on top of the hub of the wind turbines. These lights are less aggravating due to the toned-down red colour, but have the potential to be visible from a great distance. This is especially true due to the strobing effect of the lights, a function specifically designed to attract the observer's attention. The Civil Aviation Authority (CAA) prescribes these warning lights and the potential to mitigate their visual impacts have traditionally been very low other than to restrict the number of lights to turbines that delineate the outer perimeter of the facility.

Some ground-breaking new technology in the development of strobing lights that only activate when an aircraft is detected nearby 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 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. See diagram in **Figure 18** below.[12]

[12] Source: Nordex Energy GmbH, 2019

Figure 18: Aircraft warning lights fitted to the wind turbine hubs (Source:http://www.pinchercreekecho.com/2015/04/29/md-of-pincher-creek-takes-on-wind-turbine-lights)

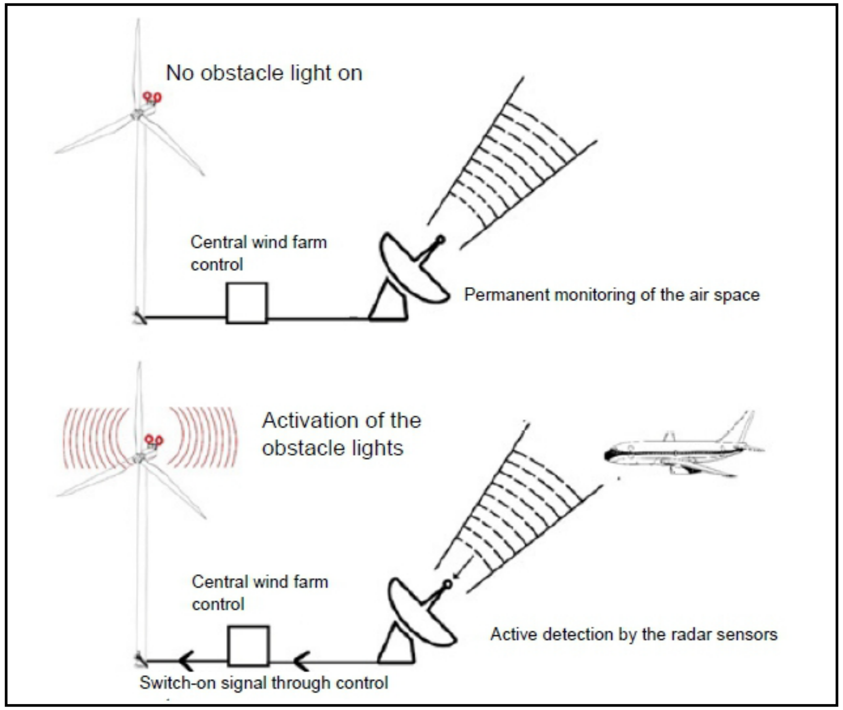


Figure 19: Diagram of the functional principle of the needs-based night lights.

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

This anticipated lighting impact is likely to be of **high** significance (rating = 75), and may be mitigated to **moderate** (rating = 52) especially within a 5 to 10km radius of the wind turbine structures.

Table 13: Impact table summarising the significance of visual impact of lighting at night on visual receptors in close to medium proximity (5-10km) to the proposed WEF

Nature of Impact: Visual impact of lighting at night on sensitive visual receptors.

	Alternative 1: Dalmanutha Wind Facility		Alternative 2: Dalmanutha Wind and Solar Facility	
	Without mitigation	***With mitigation***	***Without mitigation***	***With mitigation***
Extent	Region **(1)**	Region **(1)**	Region **(1)**	Region **(1)**
Duration	Long term **(4)**	Long term **(4)**	Long term **(4)**	Long term **(4)**
Magnitude	Very high **(10)**	High **(8)**	Very high **(10)**	High **(8)**
Probability	Definite **(5)**	Highly Probable **(4)**	Definite **(5)**	Highly Probable **(4)**
Significance	High **(75)**	Moderate **(52)**	High **(75)**	Moderate **(52)**
Status (positive or negative)	Negative	Negative	Negative	Negative
Reversibility	Reversible (1)	Reversible (1)	Reversible (1)	Reversible (1)
Irreplaceable loss of resources?	No			
Can impacts be mitigated?	No	No	No	No

Mitigation / Management:

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.

Residual impacts:

None, provided that rehabilitation works are carried out as required.

8.2.3. Ancillary infrastructure

On-site ancillary infrastructure associated with the WEF includes a substation, Battery Energy Storage System (BESS), underground cabling between the wind turbines, internal access roads, gate house, Operation and Maintenance buildings (including a control centre, offices, warehouses, workshop, canteen, visitors centre, staff lockers, etc.). 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 **low** significance both before and after mitigation.

Table 14: Visual impact of the ancillary infrastructure

Nature of Impact: Visual impact of the ancillary infrastructure on observers in close proximity to the structures.				
	Alternative 1: Dalmanutha Wind Facility		Alternative 2: Dalmanutha Wind and Solar Facility	
	Without mitigation	***With mitigation***	***Without mitigation***	***With mitigation***
Extent	Neighbourhood **(4)**	Neighbourhood **(4)**	Neighbourhood **(4)**	Neighbourhood **(4)**
Duration	Long term **(4)**	Long term **(4)**	Long term **(4)**	Long term **(4)**
Magnitude	Moderate **(6)**	Low **(4)**	Moderate **(6)**	Low **(4)**
Probability	Improbable **(2)**	Improbable **(2)**	Improbable **(2)**	Improbable **(2)**
Significance	Low **(28)**	Low **(24)**	Low **(28)**	Low **(24)**
Status (positive or negative)	Negative	Negative	Negative	Negative
Reversibility	Reversible (1)	Reversible (1)	Reversible (1)	Reversible (1)
Irreplaceable loss of resources?	No			
Can impacts be mitigated?	No	No	No	No
Generic best practise mitigation/management measures: Planning: ➢ Retain/re-establish and maintain natural vegetation in all areas outside of the development footprint/servitude, but within the project site. Operations: ➢ Maintain the general appearance of the infrastructure.				
Residual impacts: None, provided that rehabilitation works are carried out as required.				

8.3. Visual impact assessment: secondary impacts

8.3.1. The potential impact on the sense of place of the region

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

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

WhileiIndustrial infrastructure is quite prominent throughout the study area in the form of large network of existing high voltage power lines, numerous substations and mining/quarrying areas, the landscape character of the greater study area and site itself is still fairly natural in character owing to the presence of a number of protected areas.

The anticipated significance of the visual impacts on the sense of place within the region (i.e. beyond a 20km radius of the development and within the greater region) is expected to be of **Moderate** significance.

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

Table 15: The potential impact on the sense of place of the region

Nature of Impact: The potential impact on the sense of place of the region.				
	Alternative 1: Dalmanutha Wind Facility		Alternative 2: Dalmanutha Wind and Solar Facility	
	Without mitigation	***With mitigation***	***Without mitigation***	***With mitigation***
Extent	Region **(1)**	Region **(1)**	Region **(1)**	Region **(1)**
Duration	Long term **(4)**	Long term **(4)**	Long term **(4)**	Long term **(4)**
Magnitude	High **(8)**	High **(8)**	High **(8)**	High **(8)**
Probability	Highly Probable **(4)**	Highly Probable **(4)**	Highly Probable **(4)**	Highly Probable **(4)**
Significance	Moderate **(52)**	Moderate **(52)**	Moderate **(52)**	Moderate **(52)**
Status (positive or negative)	Negative	Negative	Negative	Negative

Reversibility	Reversible (1)	Reversible (1)	Reversible (1)	Reversible (1)
Irreplaceable loss of resources?	No			
Can impacts be mitigated?	No	No	No	No
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 neat and tidy 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.				
Residual impacts: None, provided that rehabilitation works are carried out as required.				

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

The cumulative visual impact of the proposed Dalmanutha WEF, the other associated WEF in the Cluster and grid connection will primarily occur on the plains. It is also important to note that the proposed WEF is located directly adjacent to the Emalaheni REDZ.

The cumulative visual impact is expected to be **moderate**, depending on the observer's sensitivity to wind turbine structures.

Table 16: The potential cumulative visual impact of wind farms on the visual quality of the landscape

Nature of Impact: The potential impact on the sense of place of the region.		
	Alternative 1: Dalmanutha Wind Facility	Alternative 2: Dalmanutha Wind and Solar Facility

	Overall impact of the proposed project considered in isolation	***Cumulative impact of the project and other projects in the area***	***Overall impact of the proposed project considered in isolation***	***Cumulative impact of the project and other projects in the area***
Extent	Region **(1)**	Region **(1)**	Region **(1)**	Region **(1)**
Duration	Long term **(4)**	Long term **(4)**	Long term **(4)**	Long term **(4)**
Magnitude	High **(8)**	High **(8)**	High **(8)**	High **(8)**
Probability	Probable **(3)**	Highly Probable **(4)**	Probable **(3)**	Highly Probable **(4)**
Significance	Moderate **(39)**	Moderate **(52)**	Moderate **(39)**	Moderate **(52)**
Status (positive or negative)	Negative	Negative	Negative	Negative
Reversibility	Reversible (1)	Reversible (1)	Reversible (1)	Reversible (1)
Irreplaceable loss of resources?	No			
Can impacts be mitigated?	No	No	No	No
Mitigation / Management: N/A				
Residual impacts: None, provided that rehabilitation works are carried out as required.				

8.4. The potential to mitigate visual impacts

The primary visual impact, namely the appearance of the WEF (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 mitigation is, however possible for the WEFs for both Alternative 1 and 2:

- It is recommended that vegetation cover (i.e. either natural or cultivated) be maintained in all areas outside of the actual development footprint (but still within the project site), both during construction and operation of the proposed WEF. This will minimise visual impact as a result of cleared areas and areas denuded of vegetation.

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

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

- Install aircraft warning lights that only activate when the presence of an aircraft is detected, if permitted by the CAA, where deemed feasible.

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

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

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

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

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

- During operation, the maintenance of the turbines and ancillary structures and infrastructure must be undertaken to ensure that the facility does not degrade, therefore aggravating the visual impact.

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

- Once the facility has exhausted its life span, the main facility and all associated infrastructure not required for the post rehabilitation use of the site must be removed and all disturbed areas appropriately rehabilitated. An ecologist must be consulted to give input into rehabilitation specifications.

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

- Secondary impacts anticipated as a result of the proposed WEF (i.e. visual character and sense of place) are not possible to mitigate. There is also no mitigation to ameliorate the negative visual impacts on roads frequented by tourists and which provides access to tourist destinations within the region.

For the PV facility that forms part of Alternative 2, the following is applicable:

- Glint and glare impact mitigation measures include the following:

    - Use anti-reflective panels and dull polishing on structures, where possible and industry standard.
    - Adjust tilt angles of the panels if glint and glare issues become evident, where possible.
    - If specific sensitive visual receptors are identified during operation, investigate screening at the receptor site, where possible.

- During operation, the maintenance of the PV arrays and ancillary structures and infrastructure will ensure that the facility does not degrade, therefore avoiding aggravating the visual impact.
- Where sensitive visual receptors (if present), are likely to be affected it is recommended that the developer enter into negotiations with the property owners regarding the potential screening of visual impacts at the receptor site. This may entail the planting of vegetation, trees or the construction of screens. Ultimately, visual screening is most effective when placed at the receptor itself.

Where sensitive visual receptors (as identified in **Section 5.6**) are likely to be affected and where valid objections (as determined by the visual specialist) are raised by these receptors during the application process, it is recommended that the developer investigate the receptor's willingness (and the viability) of screening of visual impacts at the receptor site prior to construction commencing. This may entail the planting of natural vegetation, natural trees or the construction of screens in the pre-dominant direction of impact likely to be experienced by the principal receptor at the site. Ultimately, visual screening is most effective when placed at the receptor itself and should be considered in this context only.

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

9. IMPACT STATEMENT

The findings of the Visual Impact Assessment undertaken for the proposed Dalamnutha WEF is that the visual environment surrounding the site, especially within a 5-10km radius (and potentially up to 20km), will be visually impacted upon for the anticipated operational lifespan of the facility (i.e. 20 - 25 years).

The following is a summary of impacts remaining:

Impact	**Pre mitigation significance**	**Post mitigation significance**	**Pre mitigation significance**	**Post mitigation significance**
Construction Phase				
	Alternative 1		**Alternative 2**	
Potential visual impact of construction activities on sensitive visual receptors in close proximity to the proposed WEF.	High	Moderate	High	Moderate
Operational Phase				
Potential visual impact on sensitive visual receptors located within a 5km radius of the wind turbine structures	Very High	Very High	Very High	Very High
Potential visual impact on sensitive visual receptors within the local area (5 – 10km radius)	High	High	High	High
Potential visual impact on sensitive visual receptors within the district (10 – 20km radius)	Moderate	Moderate	Moderate	Moderate
Potential visual impact on sensitive visual receptors within the region (beyond 20 Km radius)	Low	Low	Low	Low

Potential visual impact on Protected Areas within the district	Moderate	Moderate	Moderate	Moderate
Shadow Flicker	High	Moderate	High	Moderate
Potential visual impact of solar glint and glare as a visual distraction and possible air/road travel hazard	N/A	N/A	Low	Low
Potential visual impact of solar glint and glare on static ground-based receptors (residents of homesteads) in close proximity to the PV facility	N/A	N/A	Low	Low
Potential visual impact of operational, safety and security lighting of the facility at night	High	Moderate	High	Moderate
Ancillary infrastructure	Low	Low	Low	Low
The potential impact on the sense of place of the region	Moderate	Moderate	Moderate	Moderate
Cumulative visual impact	Moderate	Moderate	Moderate	Moderate

The anticipated visual impacts listed above (i.e. post mitigation impacts) range from **high** to **low** significance for both Alternative 1 and 2. Anticipated visual impacts on sensitive visual receptors in close proximity to the proposed facility remain high and are not possible to mitigate.

10.CONCLUSION AND RECOMMENDATIONS

The visual impact assessment (VIA) practitioner takes great care to ensure that all the spatial analyses and mapping is as accurate as possible. The intention is to quantify, using visibility analyses, proximity analyses, photo simulations and the identification of sensitive receptors and the potential visual impacts associated with the proposed **Dalmanutha WEF**. These processes are deemed to be transparent and scientifically defensible when interrogated.

However, visual impact is ultimately a subjective concept. The *subjects* in this case are the residents of, and visitors to the region. The author has attempted to accurately capture the location of these *subjects* (i.e. sensitive visual receptors and areas of likely visual impact) to the best of his ability, drawing on years of experience as a VIA practitioner. The VIA further adopts a risk averse approach in so far as to assume 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.

There are likely to be supporters of the Dalmanutha WEF (as renewable energy generation is a global priority) amongst the population of the larger region, but they are normally expected to be indifferent to the construction of the WEF/PV and not as vocal in their support for the wind farm/PV arrays as potential detractors thereof (should any be identified).

However, it is expected that the construction and operation of the proposed Dalmanutha WEF and its associated infrastructure, will have a **high visual impact on the study area**, especially within (but not restricted to) a 5-10km radius of the proposed facility. The visual impact will differ amongst places, depending on the distance from the facility. Tourists travelling through the region and residents of homesteads will likely experience visual impacts where the wind turbine structures are visible.

The proposed Dalmanutha WEF is located on the eastern boundary of the Emalahleni Renewable Energy Development Zone (REDZ). Within this REDZ numerous Solar PV and wind energy projects have been proposed and/or already approved resulting in the area directly west of the Dalmauntha West WEF having a high cumulative exposure.

While the Dalmanutha WEF does not fall within the REDZ, the visual impact thereof will contribute to the overall cumulative visual impact of renewable energy projects within the greater region and the frequency of visual exposure to such infrastructure is expected to increase beyond the boundaries of the REDZ, especially considering the other already approved REFs (i.e. Haverfontein WEF and Machadodorp PV1) also located outside of the REDZ within 40km of the proposed Dalmanutha WEF.

Owing to the location of the Emalahleni REDZ and the location of other already approved REFs outside the REDZ the cumulative visual impact associated with the proposed Dalmanutha WEF is expected to moderate to high. However still considered to be within acceptable limits.

Conventional mitigation (e.g. such as screening of the structures) of the potential visual impacts is highly unlikely to succeed due to the nature of the development and the receiving environment. A number of mitigation measures have been proposed (**Section 8.4**). The proposed mitigation measures will primarily be effective in terms of mitigating lighting and construction phase visual impacts.

Note: Regardless of whether or not mitigation measures will reduce the significance of the anticipated visual impacts, they are considered to be good practice and should all be implemented and maintained throughout the construction, operation and decommissioning phases of the proposed facility, should it be authorised.

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.

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 objections have been reported from stakeholders or decision-makers within the region, 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. While keeping in mind that there are also likely to be supporters of the Dalmanutha 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.

Overall, the significance of the visual impacts associated with the proposed **Dalmanutha WEF for both Alternative 1 and 2 is expected to be moderate to high** as a result of the generally undeveloped character of the landscape. Post mitigation significance for receptors within 5 km of the facility is anticipated to be **very high**. The facility would be visible within an area that contains certain sensitive visual receptors who could consider visual exposure to this type of infrastructure to be intrusive. Such visual receptors include people travelling along the national, arterial and secondary roads, as well as, residents of homesteads and tourists to the numerous protected/conservation areas.

Two (2) Alternatives have been proposed for the Dalmanutha WEF. Based on the above analyses, taking into consideration the number of sensitive visual receptors within close proximity, the different types of technology and number of turbines and existing infrastructure already in the study area, the visual impact is expected to be the same for each Alternative. Owing to this the author has no preferred alternative, however, it must be noted that the frequency of exposure to the turbines for Alternative 2 will be slightly reduced owing to the reduced number of wind turbines proposed. It must be noted that none of the Project Alternatives are considered fatally flawed from a visual perspective.

In spite of a few high residual ratings (as assessed in **Section 8.2**) 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 Dalmanutha 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.

It should be noted that the results/deductions in this report are based solely from a visual perspective in relation to potential visual impacts and sensitive visual receptors and exclude any potential issues/comments/fatal flaws identified by other specialist studies.

11. MANAGEMENT PROGRAMME

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

Table 17: Management programme – Planning.

OBJECTIVE: The mitigation and possible negation of visual impacts associated with the planning of the Proposed Dalmanutha WEF.		
Project Component/s	The WEF and ancillary infrastructure (i.e. turbines, access roads, substations and workshop).	
Potential Impact	Primary visual impact of the facility due to the presence of the turbines and associated infrastructure as well as the visual impact of lighting at night.	
Activity/Risk Source	The viewing of the above mentioned by observers on or near the site (i.e. within 5-10km of the site) as well as within the region.	
Mitigation: Target/Objective	Optimal planning of infrastructure to minimise visual impact.	
Mitigation: Action/control	**Responsibility**	**Timeframe**
Retain and maintain natural and / or cultivated vegetation in all areas outside of the development footprint, but within the project site.	Project proponent/ design consultant/ Engineering, Procurement and Construction (EPC) contractor	Early in the planning phase.
Make use of existing roads wherever possible and plan the layout and construction of roads and infrastructure with due cognisance of the topography to limit cut and fill requirements.	Project proponent/ design consultant/ EPC contractor	Early in the planning phase.
Plan all roads, ancillary buildings and ancillary infrastructure in such a way that clearing of vegetation is minimised. Consolidate infrastructure and make use of already disturbed sites rather than undisturbed areas.	Project proponent/ design consultant/ EPC contractor	Early in the planning phase.
Consult a lighting engineer in the design and planning of lighting to ensure the correct specification and placement of lighting and light fixtures for the WEF and the ancillary infrastructure. The following is recommended: o Install aircraft warning lights that only activate when an aircraft is detected (CAA regulations/conditions permitting, where deemed feasible). o Limit aircraft warning lights for the proposed WEF to the turbines on the perimeter, thereby reducing the overall requirement (CAA regulations/conditions permitting). o Shield the sources of light by physical barriers (walls, vegetation, or the structure itself); o Limit mounting heights of fixtures, or use foot-lights or bollard lights; o Make use of minimum lumen or wattage in fixtures; o Making use of down-lighters or shielded fixtures; o Make use of Low-Pressure Sodium lighting or other low impact lighting. o Make use of motion detectors on security lighting, so allowing the site to remain in	Project proponent/ design consultant/ EPC contractor	Early in the planning phase.

darkness until lighting is required for security or maintenance purposes.		

Performance Indicator	Minimal exposure (limited or no complaints from I&APs) of ancillary infrastructure and lighting at night to observers on or near the site (i.e. within 5-10km) and within the region.
Monitoring	Not applicable.

Table 18: Management programme – Construction.

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

Table 19: Management programme – Operation.

OBJECTIVE: The mitigation and possible negation of visual impacts associated with the operation of the Proposed Dalmanutha WEF.		
Project Component/s	The WEF and ancillary infrastructure (i.e. turbines, access roads, substations and workshop).	
Potential Impact	Visual impact of facility degradation (including operational wind turbines) and vegetation rehabilitation failure.	
Activity/Risk Source	The viewing of the above mentioned by observers on or near the site.	
Mitigation: Target/Objective	Well maintained and neat facility.	
Mitigation: Action/control	**Responsibility**	**Timeframe**
Maintain the general appearance of the facility as a whole, including the turbines, servitudes and the ancillary buildings.	Project proponent/ operator	Throughout the operation phase.
Maintain roads and servitudes to forego erosion and to suppress dust.	Project proponent/ operator	Throughout the operation phase.
Monitor rehabilitated areas, and implement remedial action as and when required.	Project proponent/ operator	Throughout the operation phase.
Performance Indicator	Well maintained and neat facility with intact vegetation on and in the vicinity of the facility.	
Monitoring	Monitoring of the entire site on an ongoing basis (by operator).	

Table 20: Management programme – Decommissioning.

OBJECTIVE: The mitigation and possible negation of visual impacts associated with the decommissioning of the Proposed Dalmanutha WEF.		
Project Component/s	The WEF and ancillary infrastructure (i.e. turbines, access roads, substations and workshop).	
Potential Impact	Visual impact of residual visual scarring and vegetation rehabilitation failure.	
Activity/Risk Source	The viewing of the above mentioned by observers on or near the site.	
Mitigation: Target/Objective	Only the infrastructure required for post decommissioning use of the site retained and rehabilitated vegetation in all disturbed areas.	
Mitigation: Action/control	**Responsibility**	**Timeframe**
Remove infrastructure not required for the post-decommissioning use of the site. This may include the turbines, substations, ancillary buildings, masts etc.	Project proponent/ operator	During the decommissioning phase.
Rehabilitate access roads and servitudes not required for the post-decommissioning use of the site. If necessary, an ecologist should be consulted to give input into rehabilitation specifications.	Project proponent/ operator	During the decommissioning phase.
Monitor rehabilitated areas quarterly for at least a year following decommissioning, and implement remedial action as and when required.	Project proponent/ operator	Post decommissioning.
Performance Indicator	Vegetation cover on and in the vicinity of the site is intact (i.e. full cover as per natural vegetation within the environment) with no evidence of degradation or erosion.	
Monitoring	Monitoring of rehabilitated areas quarterly for at least a year following decommissioning.	

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