PROPOSED HUGO WIND ENERGY FACILITY, WESTERN CAPE PROVINCE

VISUAL IMPACT ASSESSMENT

On behalf of:

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Produced by:

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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 Assumptions and limitations

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

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

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

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

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

This Visual Impact Assessment and all associated mapping has been undertaken according to the worst-case scenario.

1.3 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 but no specific assessment protocol has been prescribed.

1.4 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

The quality of this data is rated as good.

1.5 Level of confidence

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

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

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

These values are applied as follows:

Table 1: Level of confidence

	Information on the project & experience of the practitioner			
Information on the study area		**3**	**2**	**1**
	3	9	6	3
	2	6	4	2
	1	3	2	1

The level of confidence for this assessment is determined to be **9** and indicates that the author's confidence in the accuracy of the findings is 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 EIA Requirements for Specialist Reports

As there is no specialist protocol available for visual impact assessments, this report has been compiled in accordance with the requirements of Appendix 6 of the 2014 NEMA EIA Regulations, as amended. This stipulates and prescribes the content of the Specialist Reports. Table 2 below details these requirements and refers the reader to relevant pages where specific information can be found for ease of reference:

Table 2: EIA Specialist requirements

[1] Adapted from Oberholzer (2005).

EIA Regulations, 2014 Requirements, as amended	Page Reference
(a) Details of-	
(i) The specialist who prepared the report	Section 1.1
(ii) Expertise of that specialist to compile a specialist report including a CV	Section 1.1
(b) Declaration that the specialist is independent in a form as may be specified by the competent authority	Page iii
(c) An indication of the scope of, and purpose for which, the report was prepared	Section 3
(cA) an indication of the quality and age of base data used for the specialist report	Section 1.4
(cB) a description of the existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change	Section 4 and 5.2
(d) The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment	Section 1.7
(e) A description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used	Section 1.7
(f) Details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternative	Section 5.
(g) An identification of any areas to be avoided, including buffers	Appendix 1 SSV
(h) A map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers	Appendix 1 SSV
(i) A description of any assumptions made and any uncertainties or gaps in knowledge	Section 1.2
(j) A description of the findings and potential implications of such findings on the impact of the proposed activity or activities	Section 7 and 8
(k) Any mitigation measures for inclusion in the EMPr	Section 8.5
(l) Any conditions for inclusion in the EA	Section 10
(m)Any monitoring requirements for inclusion in the EMPr or EA	
(n) A reasoned opinion-	
(i) Whether the proposed activity or portions thereof should be authorized	Section 10
(iA) regarding the acceptability of the proposed activity	Section 10

EIA Regulations, 2014 Requirements, as amended	Page Reference
(ii) If the opinion is that the proposed activity or portions thereof should be authorized, any avoidance, management and mitigation measures that should be included in the EMPr and where applicable, the closure plan	Section 10
(o) A description of any consultation process that was undertaken during the course of preparing the specialist report	N/A
(p) A summary and copies of any comments received during any consultation process and where applicable all responses thereto	Section 5.4
(q) Any other information requested by the competent authority	N/A

1.7 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 NASA in the form of a 30m SRTM (Shuttle Radar Topography Mission) elevation model.

The Plan of Study for the Visual Impact Assessment (VIA) is stated below.

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 6th September 2023 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 proposed Hugo WEF will comprise up to 42 turbines with a maximum output capacity of up to 360 MW. The WEF will be located on the following land parcels: RE 147; RE/172; 0/173; RE/174; and 9/148. The final design which will be requested for approval in the EA, will be determined based on the outcome of the specialist studies undertaken for the EIA phase of the development. The proposed turbine footprint and associated facility infrastructure will cover an area of up to 7900 ha, depending on the final design.

It is proposed that an on-site substation with a capacity up 132 kV with an up to 33 kV overhead / underground powerline will be installed. It is unknown at this stage how long the connection to the grid will be, or what route the cabling will be installed.

A summary of the details and dimensions of the planned infrastructure associated with the project is provided in Table 3.

Table 3: Details or dimensions of typical infrastructure for the Hugo WEF

WEF Technical Details Components	Description / Dimensions - Hugo
Maximum Generation Capacity	up to 360MW
Type of technology	Onshore Wind
Number of Turbines	Up to 42
WTG Hub Height from ground level	up to 150m
Blade Length	up to 100m
Rotor Diameter	up to 200m
Structure height (Tip Height)	up to 250m

WEF Technical Details Components	Description / Dimensions - Hugo
Structure orientation	Wind regiment dependent
Operations and maintenance buildings (O&M building) with parking area	up to 1 HA
Site Access	Via the R318
Area occupied by inverter transformer stations/substations	up to 2.5 HA
Capacity of on-site substation	132/33kv
Battery Energy Storage System footprint	up to 5 HA
BESS type	Lithium-ion or Redox-flow technology, depending on the most feasible at the time of implementation
BESS Alternatives (site, technology, design and layout)	Same as above. See layout for design and position
Length of internal roads	TBD
Width of internal roads	Access roads to the site and between project components with a width of approximately 4.5 m and a servitude of 13.5 m.
Proximity to grid connection	TBD
Internal Cabling	Cabling between the turbines, to be laid underground where practical.
Height of fencing	TBD
Type of fencing	TBD
Water supply, volumes required	±26500m³ for the construction, commissioning and test phase (±26 months), the majority being consumed during year-one of the construction. ±90m³/annum for the life-of-WEF (20-25 years)
Waste Management, waste volumes, and how will it be managed	To be determined at a later stage- either through Municipal channels or private
Details on where material and equipment will be sourced for construction	To be determined upon construction and latest market availability
Employment opportunities during construction and operations (maintenance) Skilled, semi-skilled, unskilled employees	Low skilled: up to (± 55%) Semi-skilled: up to (± 30%) Skilled: up to (± 15%)

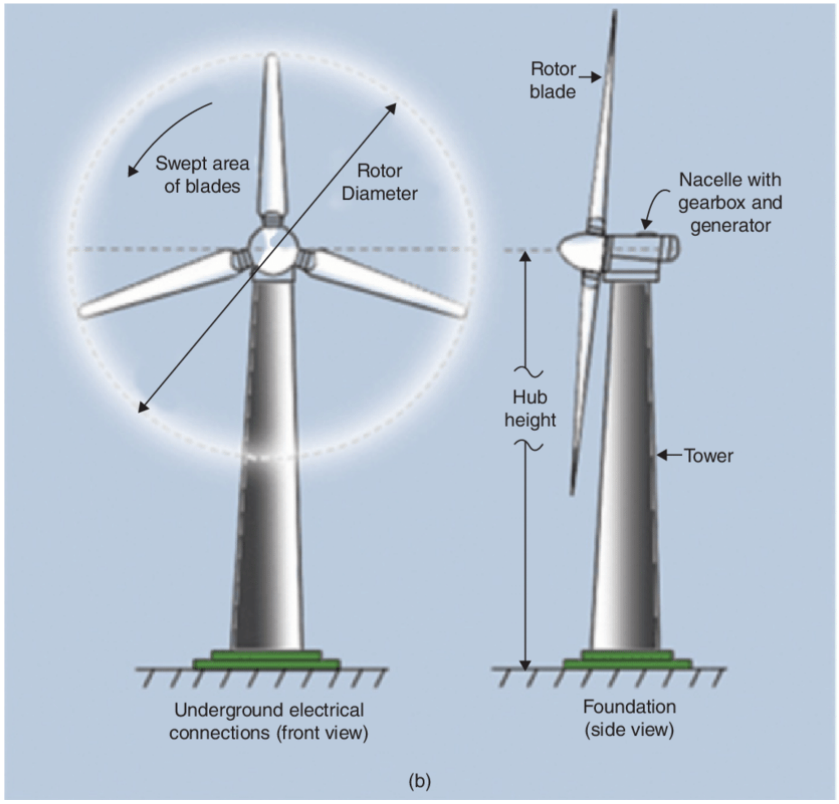


Figure 1: Illustration of the main components of a wind turbine[2]

3. SCOPE OF WORK

This report is the Visual Impact Assessment (VIA) of the proposed **Hugo Wind Energy Facility** 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 includes a minimum 20km buffer zone from the proposed wind turbine structures. Anticipated issues related to the potential visual impact of the proposed Wind Energy Facility (WEF) 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 WEFs in process and authorised within the study area, or potential consolidation of visual impacts.
- 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.

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

- The potential visual impact of shadow flicker.
- The potential to mitigate visual impacts and inform the design process.

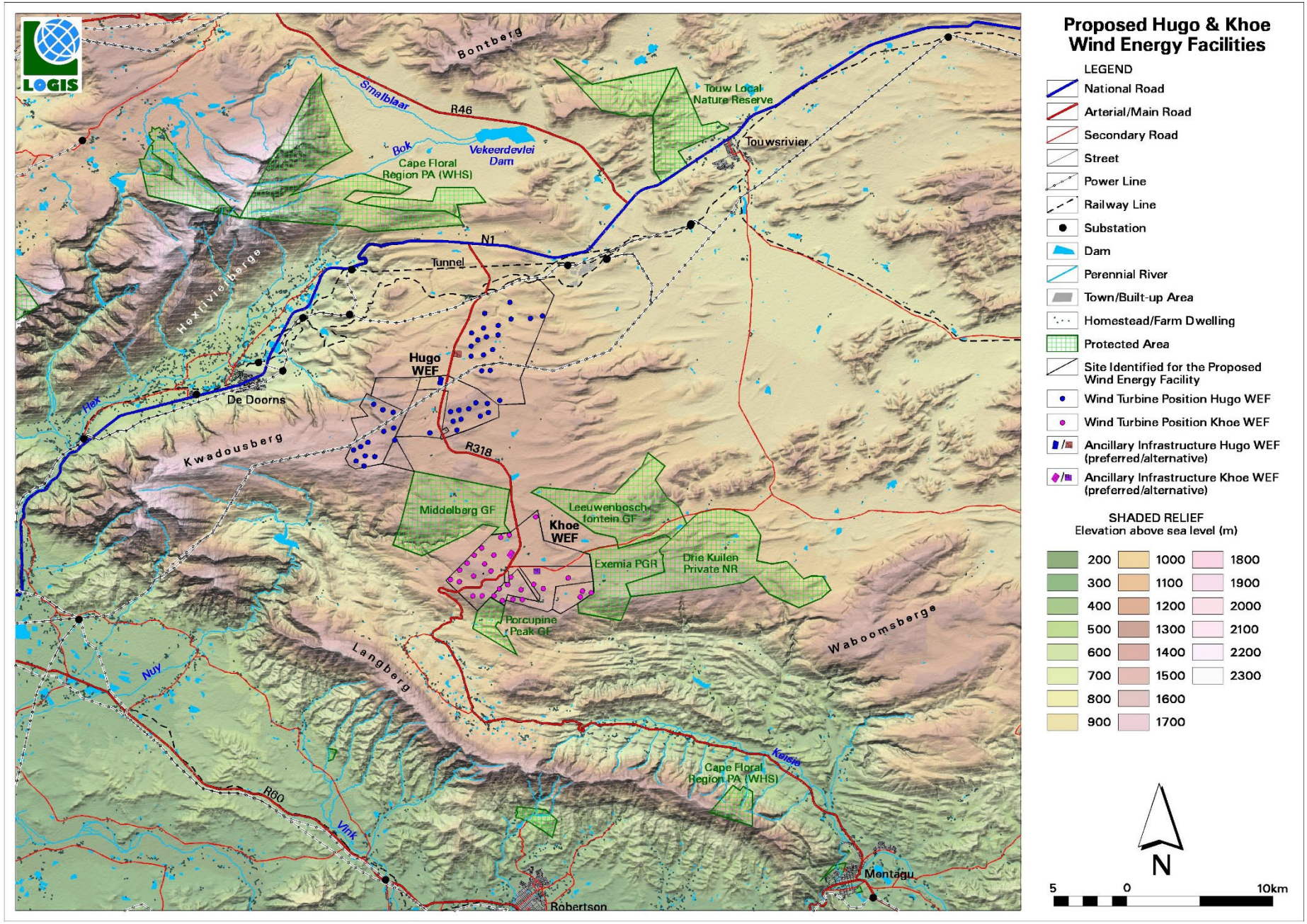
It is envisaged that the issues listed above may constitute a visual impact at a local and/or regional scale.

4. THE AFFECTED ENVIRONMENT

The proposed Hugo WEF and associated infrastructure is located approximately 16 km south west of the town of Touws Rivier and 30 km north east of Worcester within the Breede Valley Local Municipality and the Cape Winelands District Municipality within the Western Cape Province.

The study area occurs on land that ranges in elevation from approximately 200 metres above sea level (masl) in the south west at the base of the Langberg Mountain along drainage lines and in the west along the Hex River to 1800masl on the tops of mountain ranges such as Kwadousberg and Langberg. The site itself is located on land with an average elevation of 1500 masl. Numerous mountain ranges are located within the study area, namely the Hexrivierberge and Kwadousberg in the west, Langberg to the south, Waboomsberge to the south east and Bontberg to the north. Prominent water sources within the study area include the Nuy, Vink, Keisie, Hex Rivers. The Smalblaar and Bok rivers flow into the Verkeerdevlei Dam in the north. See **Map 1** for the shaded relief/topography map of the study area.

Figure 2: Undulating topography of the site



Map 1: Shaded relief map of the study area

Land cover consists primarily of low shrubland (fynbos) with scattered areas of bare rock and soil. The predominant land use is viticulture (vineyards) along the Hex River and areas to the south west and dryland and irrigated agriculture. Refer to **Map 2**.

Figure 3: Viticulture in the study area and farmstead

Figure 4: Low shrub land (fynbos) vegetation

The study area is fairly populated with 44 people per km^2 within the local municipality. The most populated areas within the study area are the towns of De Doorns to the west, Touws Rivier to the north east and further afield, Robertson to the south. Outside of these areas, there are isolated homesteads scattered around the study area.

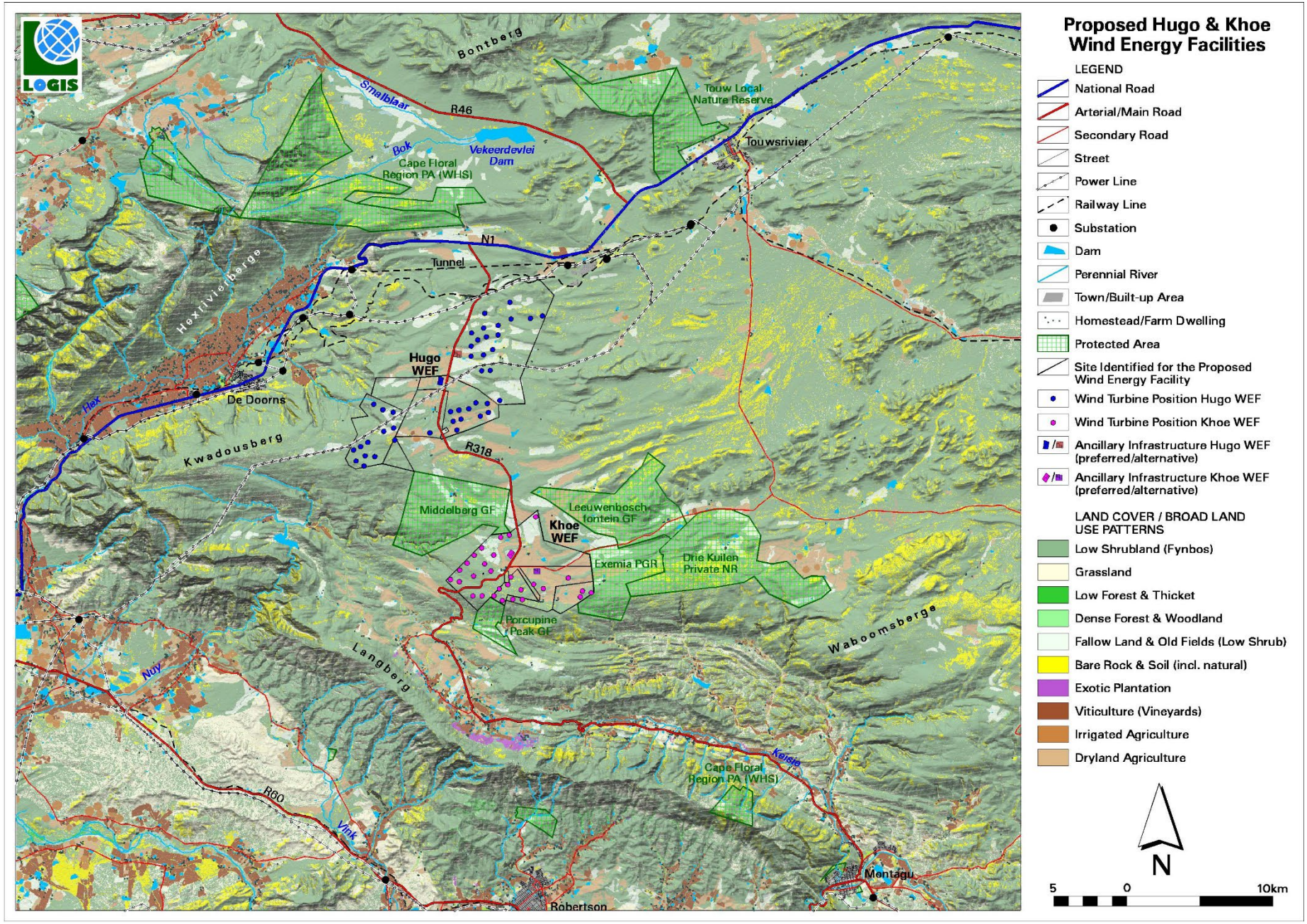
Figure 5: Example of homesteads found in the town of Touws Rivier

Access to the site is via the R318 which is off the N1 national road. The N1 is a main connector that runs from Cape Town, through Bloemfontein, Johannesburg and Polokwane to the border of Zimbabwe. The R318 travels through the Hugo WEF site and is a regional road that connects the N1 between De Doorns and Touws Rivier. The Rooihoogtepas is a scenic mountain pass located on the R318, just south of the proposed site. An old railway system that used to run from DeDoorn, via Touws Rivier to Beaufort West can be found to the north and east of the proposed site.

Figure 6: View of the site from the R318

Other industrial infrastructure within the study area includes limited existing high voltage powerlines located to the north of the site and traversing through the site. Numerous substations are located to the north of the proposed Hugo WEF site.

Figure 7: Existing power lines traversing the proposed Hugo site



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

There are three formally (3) protected areas within the study area, namely the Cape Floral Region Protected Area, Touw Local Nature Reserve and Drie Kuilen Private Nature Reserve. The Cape Floral Region is also a World Heritage Site as recognized by UNESCO. Drie Kuilen PNR offers a variety of activities such as game drives, hikes and overnight accommodation.

Numerous non-designated private natures reserves and guest farms are also located within the study area, namely Aquila Private Nature Reserve to the north, Middelberg guest farm, Leeuwenboschfontein guest farm, Porcupine Peak guest farm and Exemia Private Game Reserve can be found near the centre of the study area. All of these reserves and farms offer tourist accommodation facilities and activities.

It should be noted that while there are existing buildings on Exemia, the future intent for the property is to develop it into an ecotourism destination consisting of amongst others, a campsite, healing room, wedding venue and other accommodation offerings.

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

This study area is known as a tourist destination owing to its location within the Cape Winelands, the Cape Floral Region, and the town of Touws Rivier which is located on the Flowers Route. Five (5) tourist accommodation establishments are located approximately 5 km of the proposed WEF, namely, Middelberg Guest Farm, Ezelsjacht Guest Farm, Kamagu Safari Lodge, Matroosberg Stasie and Ratelbosch.

5. RESULTS

5.1 Potential visual exposure

A visibility analysis was undertaken from each of the wind turbine positions (42 in total) at an offset of 250m (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 and areas located behind areas of higher elevation (i.e. hill /mountains) 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 0 - 5km radius of the structures. The frequency of visual exposure (number of turbines visible) is expected to be high on the area surrounding the turbines and slightly reduced to the north east, south west and west of the proposed site. It is expected that the wind turbine structures will be highly visible from homesteads within this zone, the northern section of the Middelberg Guest Farm as well as, from the N1 National Road to the north and the R318 arterial road that bisects the site.

Visual exposure between 5-10 km is still fairly concentrated, though it does become slightly scattered owing to the topography. Visually screened areas can be found to the north and south west and are associated with the lower lying non-perennial rivers and screening effects of the hilly topography. The frequency of exposure is reduced to the south west and west of the proposed site.

In the longer distance (i.e. between 10 and 20km offset), the extent of potential visual exposure is somewhat reduced and scattered throughout this zone. Visually exposed areas tend to be concentrated to the north east, south east and west. The Langberg Mountain range visually screens the areas to the south, while the Bontberg screens areas to the north. The frequency of visual exposure (number of turbines visible) has become marginally reduced, though it is still high

to the east and north west. It is expected that some wind turbines may only be partially visible i.e. mainly the blades. This is as a result of the ridges and mountains to the north and south of the proposed site, thereby largely restricting the visual exposure to the plains beyond these topographical features.

The frequency of visual exposure beyond 20km from the turbine structures is once again expected to subside, as well as, the sections of wind turbines that may be exposed. Visibility of the turbine structures will be scattered throughout this area with small visually exposed areas to the north east, east and south west.

The homesteads and roads expected to be visually influenced are listed below. The identification of these homesteads or farm dwellings are based on their locations as per the SA 1: 50 000 topographical maps[3]. Should a homestead / residence / institution not be listed in terms of the SA 1: 50 000 topographical maps, then it is assumed that the impacts will be similar to the other identified residences within the same proximity radii. It should also 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:

- Kamagu Safari Lodge[4]
- Helpmekaar (Matroosberg Stasie)
- Uitsig
- Nadini
- Ratelbosch
- Vredelus
- Bloukom Huisie
- Soutrivier (Ezelsjacht Guest Farm)
- Middelberg Guest Farm (including the camping site, koshuis and Middelberg Self Catering)
- Various unknown homesteads
- Observers travelling along the N1 National Road and the R318 arterial/main road

Located within a 5 - 10km radius:

- Cape Floral Region Protected Areas
- Karoo1 Hotel Village and Africamps
- Kleinberg
- Kleinstraat (Kamuga Safari Lodge)
- Grootstraat
- Skulpiesklip
- Sandvlei (Guest Farm)
- Simonskloof Mountain Retreat
- Non Pareil & Impangele Mountain Lodge
- Various Unknown homesteads
- De Doorns and outlying
- Hex River Valley Dwellings
- Southern portion of the Middelberg Guest farm
- Western portion of the Leeuwenboschfontein Guest Farm
- Observers travelling along the N1 National Road and the R318 arterial/main road

Located within a 10 - 20km radius:

- Aquila PGR
- Outlying parts of Touwsrivier
- Touw Local Nature Reserve
- Vredefort
- Spes Bona
- Merweda

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

[4] Facilities listed in parenthesis indicate the location of this specific sensitive receptors on other proposed renewable energy facility development sites within the study area. This includes facilities that are already authorized and ones where authorization is still in process.

- Njalo Njalo Safari
- Excelsior
- Nauga
- Drie Kuilen Private NR (including The Top Viewpoint)
- Exemia Private Game Farm
- Oumuur
- Koo (incl. various dwellings, & Vrugtegeur & Langdam Guest Farms)
- Heinzberg
- Various Unknown homesteads
- Hex River Valley Dwellings
- Observers travelling along the N1 National Road, the R318 and R46 arterial/main roads and various secondary roads

Located beyond 20km:
- Rooikoppies
- De Bron
- Blinkwater
- Alfalfa, Thornlands, Welverdiend, etc.
- Sandhills, Klipheuwel, etc.

It must be noted that a small portion of the sensitive visual receptors of farm and homesteads located within the 0-5 km range as listed above, who could be affected visually by the proposed Hugo Wind Energy Facility are in fact located on properties involved with the proposed project. It is therefore assumed that these sensitive receptors are in fact aware of, and to a certain extent accepting, of the visual intrusion associated with WEFs in general as a result of their involvement.

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 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
- 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 mitigation measures. This is often problematic as most regulatory bodies do not have specific rules, regulations, or standards for completing a cumulative visual assessment, nor do they offer meaningful guidance regarding appropriate assessment methods. There are also not any authoritative thresholds or restrictions related to the capacity of certain landscapes to absorb the cumulative visual impacts of wind turbines.

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

The cumulative impact of the WEF development on the landscape and visual amenity is a product of:
- The distance between individual WEFs (or turbines);
- The distance over which the wind turbines are visible;
- The overall character of the landscape and its sensitivity to the structures;
- The siting and design of the WEFs themselves; and
- The way in which the landscape is experienced.

Additionally, 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.

The proposed Hugo WEF addressed in this report is one half of a larger wind energy cluster consisting of another proposed WEF to the south, known as Khoe wind energy facility. Viewshed analyses were undertaken from both proposed WEFs as part of this development only. Visibility analyses of the two (2) proposed WEFs were undertaken individually from each of the WEF's wind turbine positions at an offset off 250m above ground level (the approximate/estimated blade tip-height). The results of these viewshed analyses were overlain in order to determine areas where both WEFs may theoretically be visible.

Map 4 illustrates the anticipated cumulative visual impact of both Hugo and Khoe WEFs and specifically the anticipated frequency of visual exposure. Areas shaded in the following colours are likely to be exposed to the corresponding number of facilities as follows:

- Green – Hugo WEF only
- Yellow – Khoe WEF only
- Red – both Hugo and Khoe WEFs

The approximate 71 wind turbine positions are located approximately 8 km from each other. The areas of highest potential cumulative visual exposure are located in the area between the two WEFs, on the Khoe site itself, to the north east of Hugo WEF and in the south west along the Langberg escarpment. Terrain located within the valleys of the more mountainous landscapes or located within lower lying drainage lines are generally more shielded from the cumulative visual exposure of the wind turbine structures. The opposite effect occurs along the more elevated ridges and hills where the terrain may be exposed to more turbines.

The areas of higher cumulative visual exposure contain sensitive visual receptors in the form of residents of homesteads, tourist accommodation (Middelberg and Ezelsjacht guest farms), Exemia Private Game Reserve, Leeuwenboschfontein Guest farm and the formally Protected Drie Kuilen Nature Reserve and portions of the Cape Floral Regional Protected Area/World Heritage Site. Observers travelling along the arterial R318 and secondary roads traversing the study area will also be similarly exposed. It is expected that should all 71 wind turbines of the Hugo and Khoe WEF Cluster be constructed; the potential cumulative visual impacts may range from moderate (where observers are absent i.e. vacant natural land) to very high significance (where observers are present i.e. at homesteads, tourist accommodation and along roads).

Another approach for this assessment included all renewable energy projects within 35 km that have received an EA, as well as the known in process and proposed projects. The information was collected from the National DFFE Renewable Energy EIA Application (REEA) database, 2023 Quarter 4.

The REEA database is the most accurate and up-to-date data available to the project team. There may be some projects with "in-process" applications for which data is not yet publicly available. This is the data found to be available and efforts were made to determine recent amendments. The REEA database contains land parcels, and not the footprints. In most cases the actual development footprint of the nearby Renewable Energy developments could not be easily quantified or accessed spatially. Hence the land parcels considered, are larger than the land the facility will occupy. It is important to note that the existence of an approved EA does not directly equate to actual development of the project. For these reasons this data tends towards a worst-case scenario.

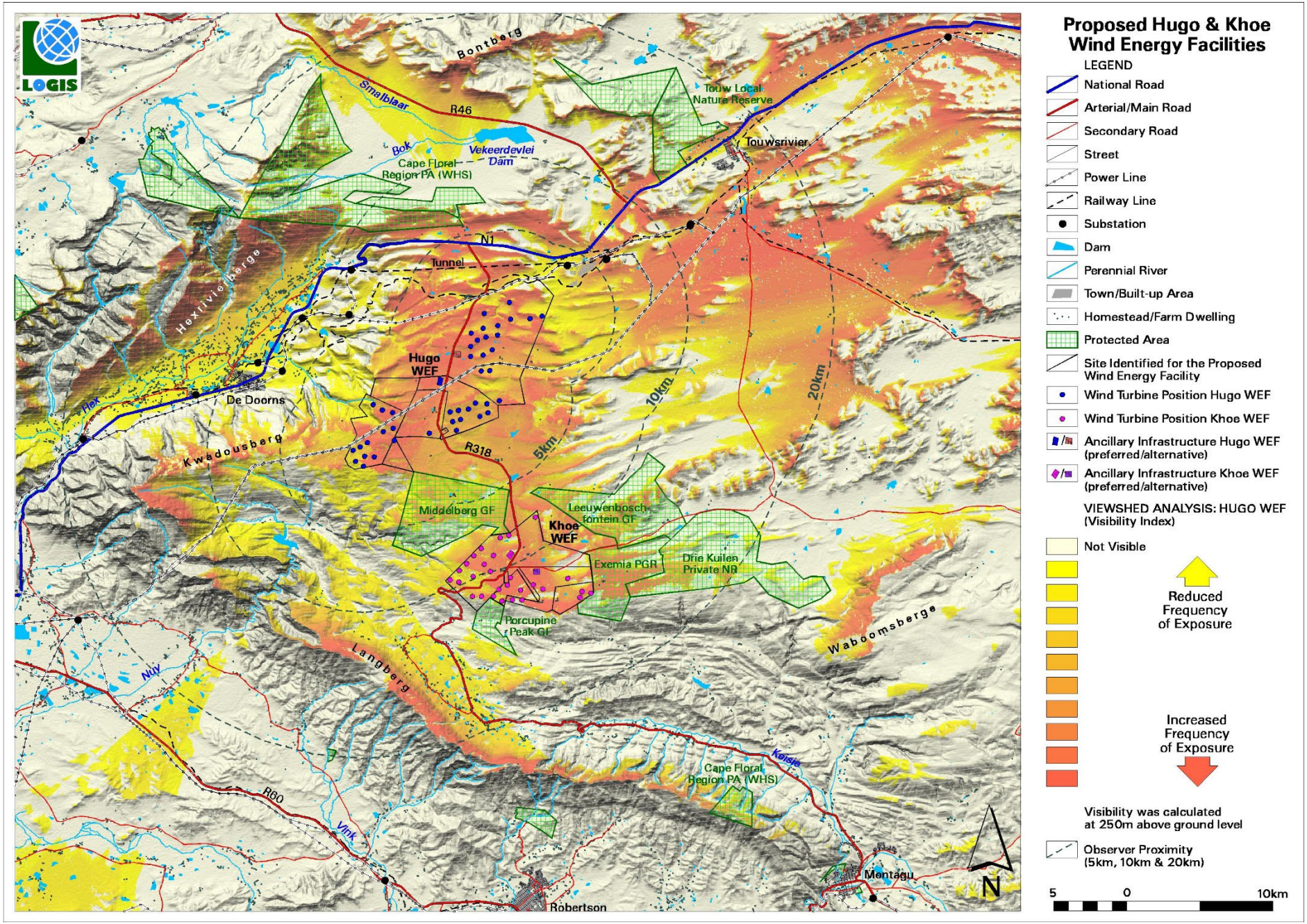
Map 5 details the approved (Environmentally Authorised) Renewable Energy Environmental Applications (REEA) within the study area (as of 2023 4th quarter) within a 35 km radius from the proposed Hugo and Khoe WEFS. No other wind energy facilities have been authorized within a 35 km radius; however, three (3) solar PV energy facilities have been approved, namely Sanral PV SEF to the north west and Touwsrivier and Montague Road Solar PV SEFs to the north east.

Results

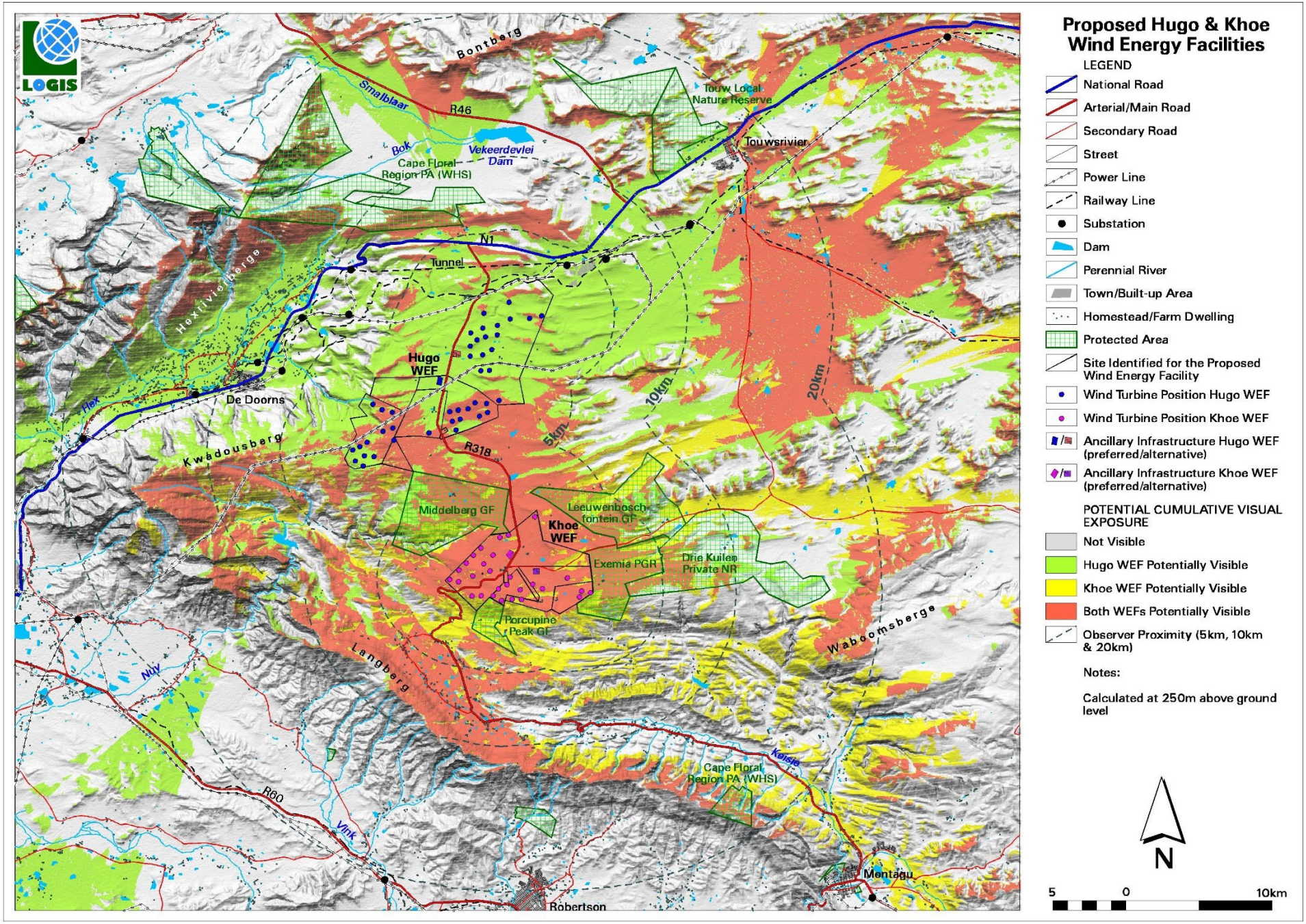
The study area is considered to have a high visual quality owing to the largely undeveloped, natural landscapes and remote location. The area is also not located within a REDZ, and as such very limited renewable energy facilities can be found within a 35 km radius. It must be noted that

should both facilities be constructed, visual receptors (particularly between both WEFs and to the north west and south west) will most likely experience them as one facility and will be exposed to wind turbines in multiple directions.

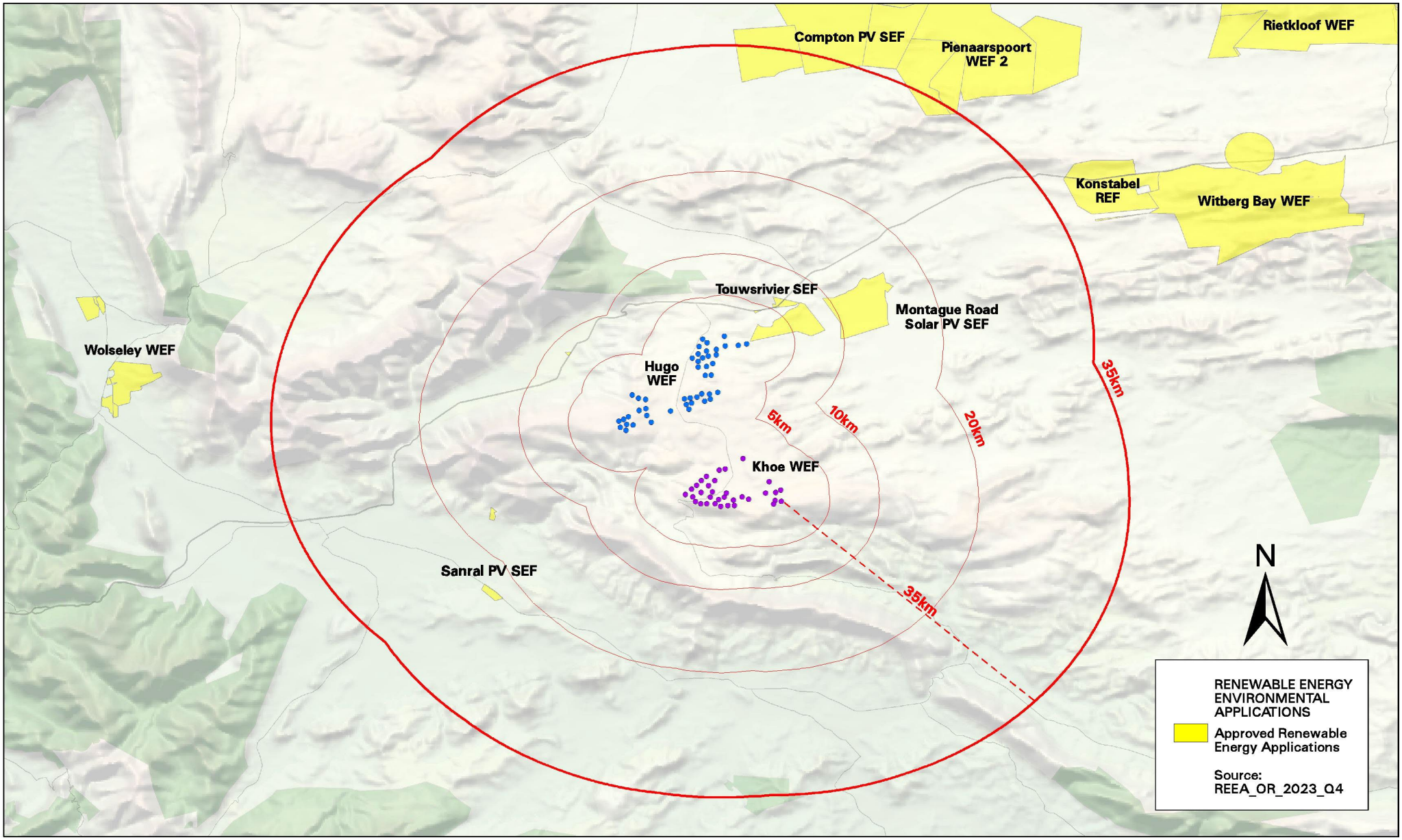
Based on the above, the cumulative visual impact of the proposed Hugo and Khoe WEFs is ultimately expected to be of **very high** negative significance and result in an unacceptable loss of visual resources within the region.



Map 3: Viewshed analysis of the proposed Hugo Wind Energy Facility, indicating the frequency of visual exposure



Map 4: Potential cumulative visual exposure of both the Hugo and Khoe wind energy facilities



Map 5: Other renewable energy facilities within a 35 km radius from the proposed Hugo and Khoe WEFs

5.3 Visual distance / observer proximity to the WEF

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 wind turbines were created in order to indicate the scale and viewing distance of the facility and to determine the prominence of the structures in relation to their environment. 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.

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

- 0 - 5km. Short distance view where the WEF 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 8: Schematic representation of a wind turbine from 1, 2, 5 and 10km under perfect viewing conditions.

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

5.4 Viewer incidence / viewer perception and sensitivity

The number of observers and their perception of a structure determines 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.

To aid in assessing the overall viewer sensitivity, visual receptors have been graded according to their sensitivity to changes in the landscape as per the table below:

Table 4: Visual receptor sensitivity

Visual receptor sensitivity	Description
Very High	Occupiers of residential properties within a very short to medium distance to the proposed development (0-10 km)
	Guest houses, lodges, other tourist accommodation within a very short to medium distance to the proposed development (0-10 km)
	Users/visitors to outdoor recreational facilities/ areas including protected areas, private nature reserves, and nature-based recreational activities- walking, cycling, hiking, horse-riding, swimming etc where their attention or interest is focussed on the landscape
High	Communities where views contribute to the landscape setting enjoyed by residents
	Visitors to identified heritage sites and cultural landscapes or other attractions where views of surroundings are an important contributor to the cultural experience
	Guest houses, lodges, other tourist accommodation within a medium to long distance to the proposed development (>10 km)
	Road users in motor vehicles along scenic routes where the primary focus is the landscape
Medium	Occupiers of residential properties within medium to long distance from the proposed development (>10 km)
	Outdoor recreation users where the focus is primarily on the activity and the landscape/views are secondary and not the focus i.e. sporting activities
	Road users in motor vehicles travelling through or past the affected landscape on provincial/secondary roads where views are transitory and fleeting.
Low	People at their place of work
	Road users in motor vehicles travelling through or past the affected landscape on major/national roads where views are fleeting
Negligible	No receptors present

Viewer incidence is calculated to be the highest along the public roads within the study area (N1, R318 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) and Guest farms throughout the study area. It is expected that the viewer's perception, unless the observer is associated with (or supportive of) the WEF, would generally be negative.

Numerous objections to the proposed Hugo WEF have been received by the EAP. Majority of the objecting stakeholders are owners/operators of guest farms/lodges within close proximity who are concerned with the visual impact on their businesses.

A summary of their concerns is detailed in the table below:

Table 5: Summary of comments received from stakeholders

Stakeholder	Comment/concern
Leeuwenboschfontein Observatory	Leeuwenboschfontein observatory is an astronomical observatory. Concerned with the light impact from the turbines at night
Langdam Guest Farm	Object to the development
Hein Havinga	Concerned with impact on his guest house
Various guest farm/lodges	Key concern is visual impact on the wilderness quality of the landscape, the Karoo sense of place and light pollution

Due to the generally remote location of the proposed Hugo Wind Energy Facility, there are a relatively limited 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 very high significance, depending on their proximity to the wind turbine structures and their potential sensitivity (as detailed in Table 4) to wind turbine infrastructure. Refer to **Map 6** for the location of the potential sensitive visual receptors discussed above.

5.5 Landscape Quality

The quality of a landscape is based on particular characteristics such as the scenic value, sense of place, uniqueness as well as, the extent to which its valued features have remained untransformed. These characteristics influence the way in which the landscape is experienced overall. A landscape with consistent, intact, well-defined and distinctive features is considered to be of higher quality, and in turn, higher sensitivity, than a landscape where the introduction of built infrastructure and transformation of the natural environment has diminished its character.

Sensitivity of the landscape character is intrinsically linked to its ability to absorb change.

Table 6: Landscape Character sensitivity

Landscape Character sensitivity	Description
Very High	The landscape character is such that its capacity to accommodate change is very low such as, formally protected landscapes inclusive of National Parks, Nature Reserves etc where the management objective is protection of the existing character. This also applied to non-designated landscapes of similar character and quality where the condition of the landscape is natural in state with little to no development or transformation.
High	The landscape character is such that it has limited/low capacity to accommodate change such as informal conservation areas not

	formally proclaimed i.e. Private Nature Reserves, Game Farms, areas identified in the Protected Area Expansion Strategy. The condition of the landscape is largely natural in state with little development or transformation.
Medium	The landscape character is such that there is some capacity for change. This includes the urban edge which consists of a mixture of land uses (residential, recreational facilities and farming) and rural country side. These landscapes may be recognized at a local (municipal) planning/policy level. The condition of the landscape is somewhat natural with a fair amount of built infrastructure and transformation.
Low	The character is such that it has capacity for change and where development would not result in a significant change or alternatively would have a positive impact. This includes the urban edge and rural countryside where these landscapes are not recognized at a local (municipal) planning/policy level. The condition of the landscape is largely transformed with a high level of built infrastructure.
Negligible	The character is such that its capacity to accommodate change is high and where development would make no significant change or would make a positive impact i.e. landscapes with little to no natural environment remaining i.e. urban areas, industrial and mining lands. The landscape often exhibits negative character and no longer holds any natural value.

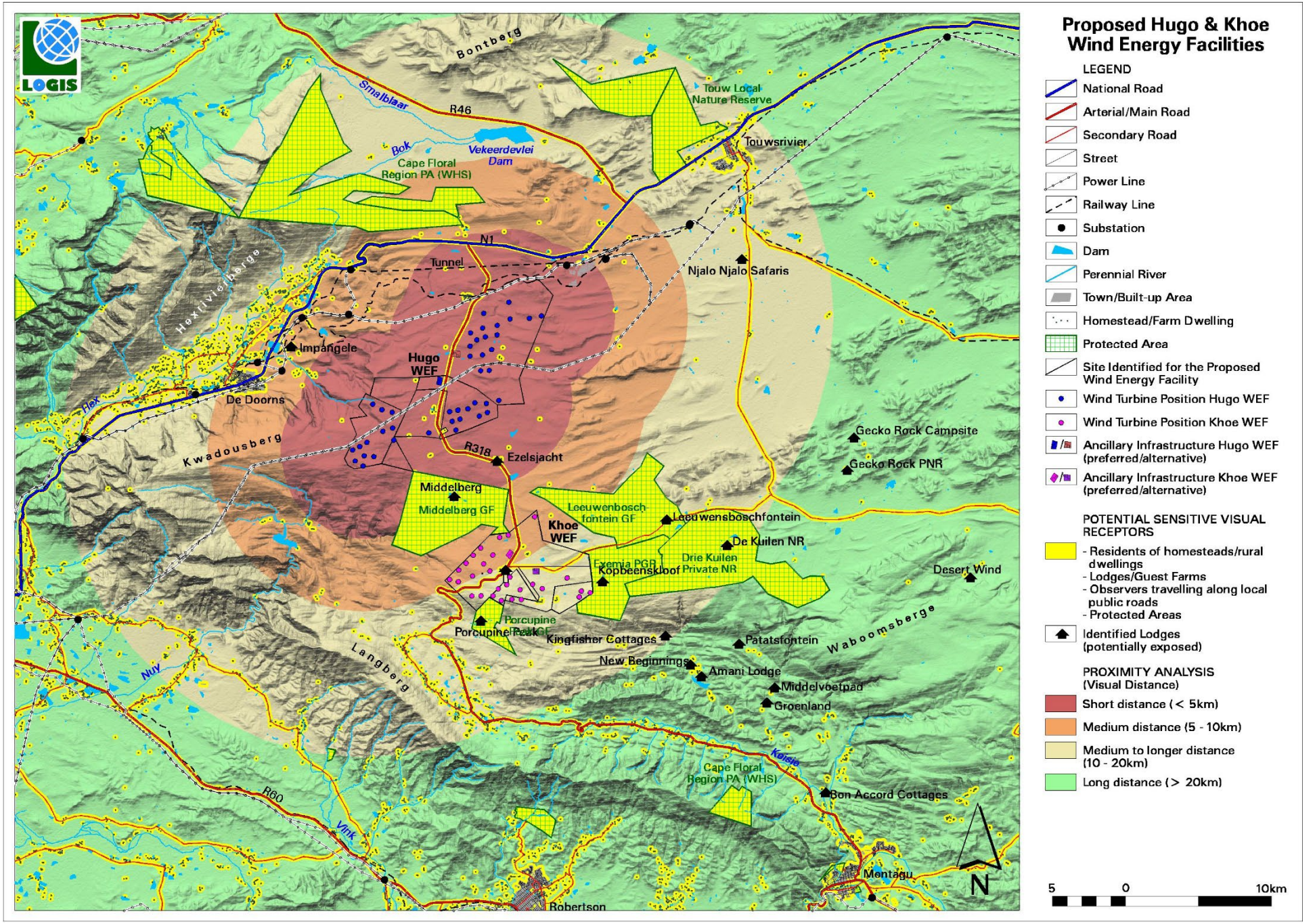
The study area is considered to have a high landscape quality based on the presence of both formal Protected areas and conservation areas, the limited presence of built infrastructure and the uniqueness of the landscape.

5.6 Visual absorption capacity

Land cover consists primarily of low shrubland (fynbos) with scattered areas of bare rock and soil (refer to **Figure 9**). Overall, the Visual Absorption Capacity (VAC) of the receiving environment is deemed low by virtue of the nature of the vegetation and the low occurrence of urban development. 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 9: Low shrubland and bare soil within the study area – low VAC.



Map 6: Proximity analysis and potential sensitive visual receptors

5.7 Visual impact index

The combined results of the visual exposure, viewer incidence/perception and visual distance of the proposed Hugo Wind Energy Facility are displayed on **Map 7**. 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 to; **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[5] located within a 20km radius of the proposed WEF are displayed on **Map 8**.

Magnitude of the potential visual impact

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

Residents of/visitors to:

- Kamagu Safari Lodge (site 2)
- Helpmekaar (Matroosberg Stasie) (site 3)
- Uitsig (site 5)
- Nadini (site 6)
- Unknown (site 7)
- Ratelbosch (site 8)
- Unknown (sites 9 and 10)
- Vredelus (site 11)
- Unknown (sites 12-13)
- Bloekom Huisie (site 14)
- Unknown (sites 15-17)
- Soutrivier (Ezelsjacht Guest Farm) (site 18)
- Middelberg Guest Farm (site 19)

Note: *a small portion of the sensitive visual receptors of farm and homesteads located within the 0-5 km range as listed above, who could be affected visually by the proposed Hugo Wind Energy Facility are in fact located on properties involved with the proposed project. It is therefore assumed that these sensitive receptors are in fact aware of, and to a certain extent accepting, of the visual intrusion associated with WEFs in general as a result of their involvement*

Observers travelling along the:

[5] The names indicated on the map and listed below 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. Should a homestead / residence / institution not be listed in terms of the SA 1: 50 000 topographical maps, then it is assumed that the impacts will be similar to the other identified residences within the same proximity radii.

- Observers travelling along the N1 National Road and the R318 arterial/main road (sites 1 and 4 respectively)

The WEF may have a visual impact of **high** magnitude on the following identified observers within a 5 – 10km radius:
Residents of/visitors to:

- Cape Floral Region Protected Areas (site 20)
- Karoo1 Hotel Village (site 21)
- Kleinberg (site 22)
- Kleinstraat (Kamuga Safari Lodge) (site 23)
- Grootstraat (site 24)
- Skulpiesklip (site 25)
- Leeuwenboschfontein Guest Farm (site 26)
- Unknown (site 27)
- Sandvlei (Guest Farm) (site 28)
- Unknown (site 29)
- Simonskloof Mountain Retreat (site 30)
- Unknown (site 31)
- Non Pareil & Impangele Mountain Lodge (site 32)
- Unknown (site 33)
- De Doorns and outlying (site 34)
- Hex River Valley Dwellings (site 35)

Observers travelling along the:

- Observers travelling along the N1 National Road and the R318 arterial/main road

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

Residents of/visitors to:

- Aquila PGR (site 36)
- Outlying parts of Touwsrivier (site 37)
- Touw Local Nature Reserve
- Vredefort (site 38)
- Spes Bona (site 39)
- Unknown (sites 40 and 41)
- Merweda (site 42)
- Njalo Njalo Safari (site 43)
- Excelsior (site 44)
- Nauga (site 45)
- Drie Kuilen Private NR (site 46)
- Unknown (site 46)
- Exemia Private Game reserve (site 47)
- Oumuur (site 48)
- Unknown (site 49)
- Koo (incl. various dwellings, & Vrugtegeur & Langdam Guest Farms) (site 50)
- Heinzberg (site 51)
- Unknown (sites 52 and 53)
- Hex River Valley Dwellings (site 54)

Observers travelling along the:

- Observers travelling along the N1 National Road, the R318 and R46 arterial/main roads and various secondary roads

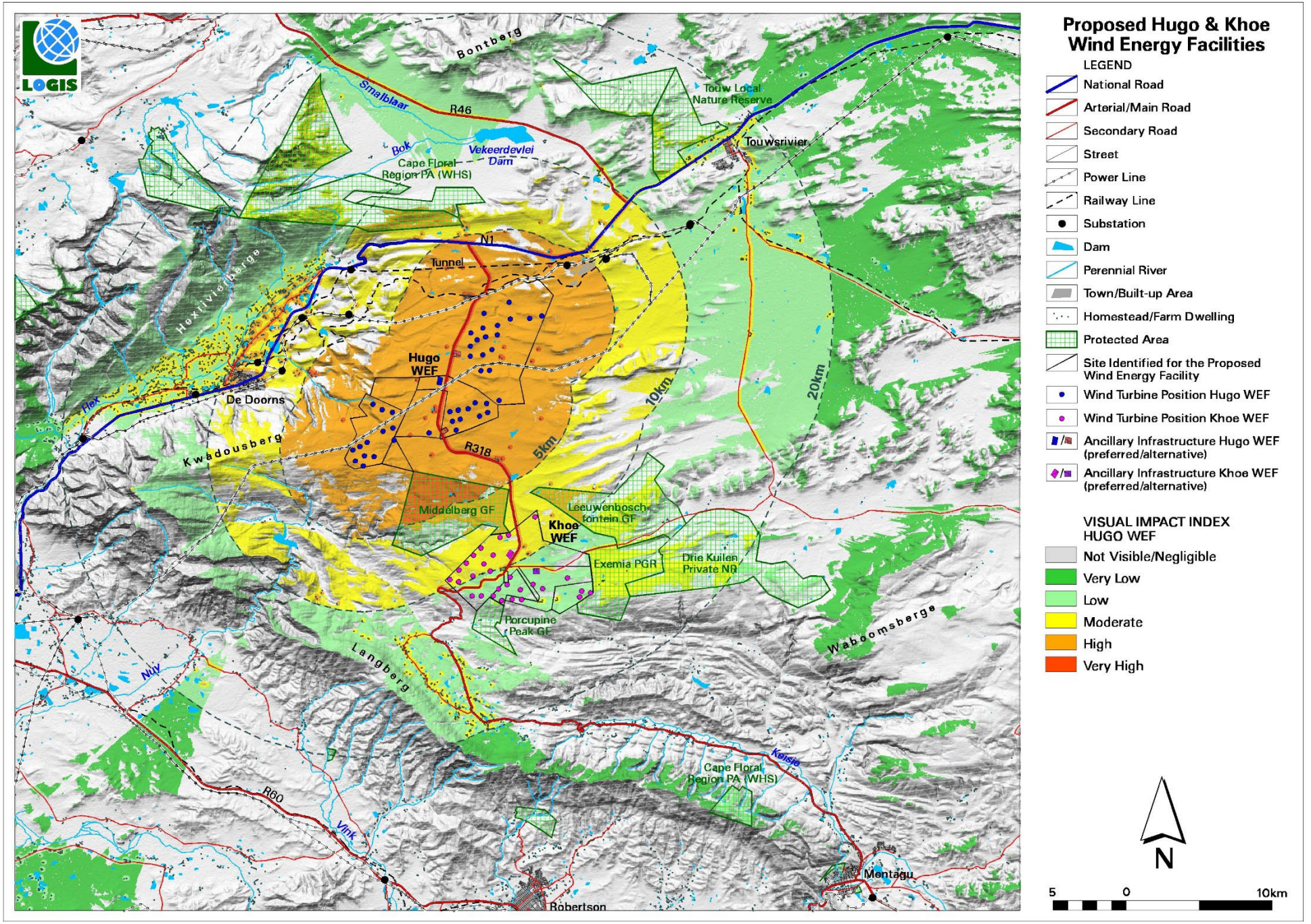
The WEF may have a visual impact of **low** magnitude impact on the following identified observers located beyond the 20km radius of the wind turbine structures:

Residents of/visitors to:

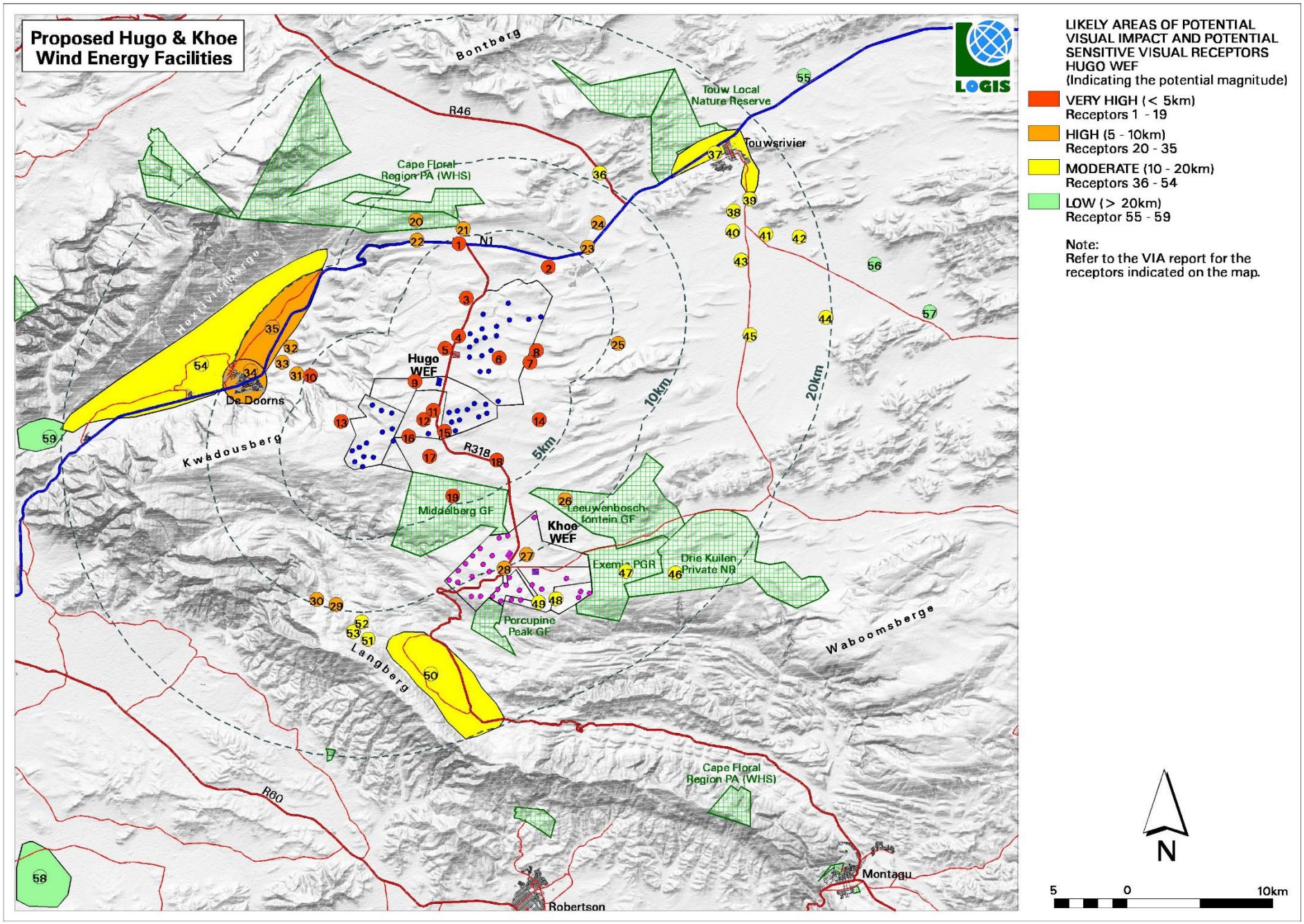
- Rooikoppies (site 55)
- De Bron (site 56)
- Blinkwater (site 57)
- Alfalfa, Thornlands, Welverdiend, etc. (site 58)

- Sandhills, Klipheuwel, etc. (site 59)

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.*



Map 7: Visual impact index



Map 8: Likely areas of potential visual impact and potential sensitive visual receptors

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 Hugo Wind Energy Facility 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.

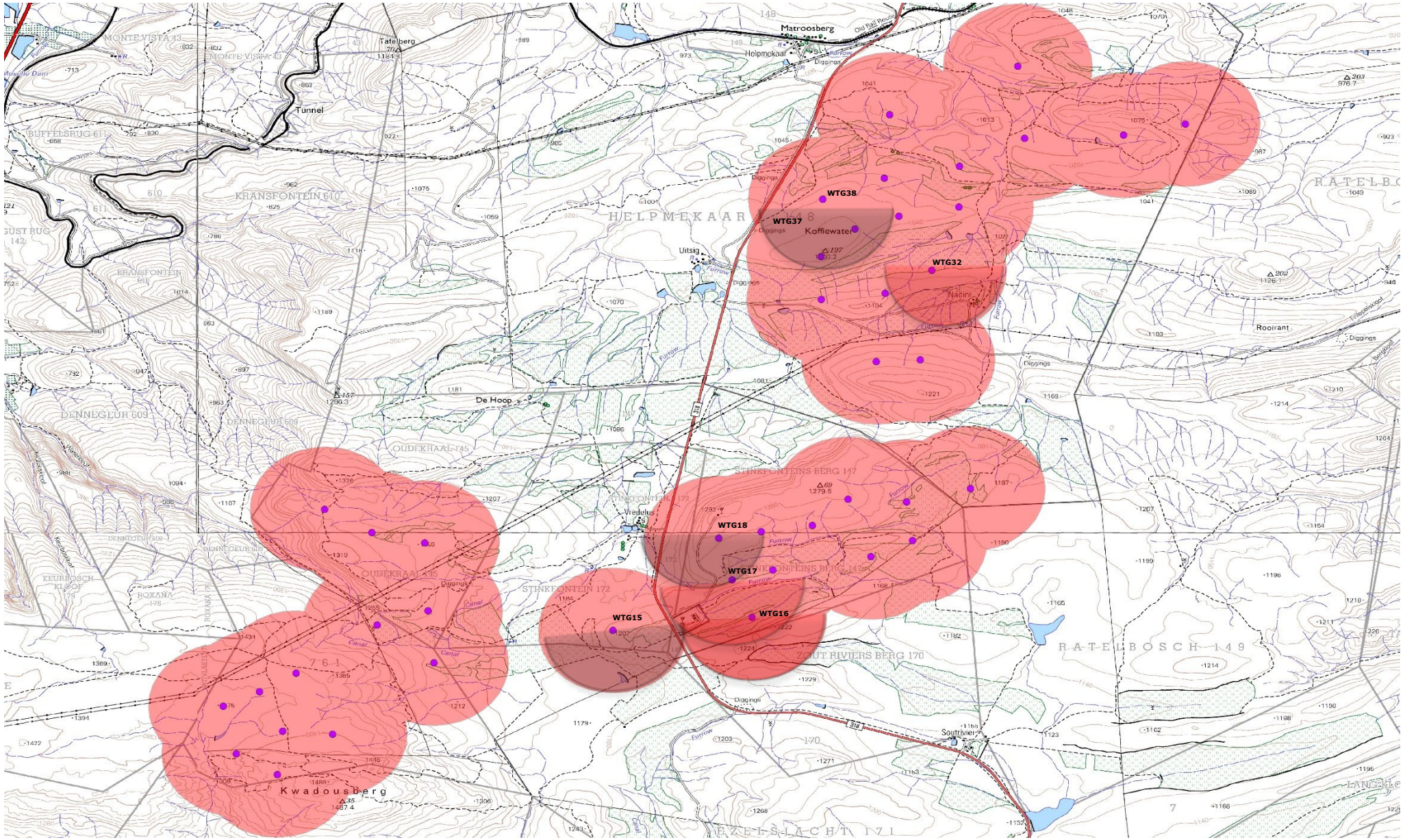
Shadow flicker may also be experienced by, and impact motorists, if a wind turbine is located in close proximity to an existing road. It is however expected that the shadow flicker experienced by motorists traveling along roads will be fleeting and not constitute a shadow flicker visual impact of concern.

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. It should also be noted that shadow flicker is only of concern on occupied residences, if any of the identified homesteads are derelict, deserted or not permanently occupied, the shadow flicker visual impact will be non-existent, and not constitute a shadow flicker visual impact of concern, until such a time as they are inhabited again.

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 Hgo Wind Energy Facility was undertaken on a likely 46 turbine layout using a 250m blade tip height (hub height of up to 150m and rotor diamter of 200m). As such, sensitive receptors are considered to be affected where shadows are predicted to occur within 1km of a turbine. As such, sensitive receptors who fall within this zone are likely to be impacted upon. Refer to **Map 9**.

This study found that three (3) turbines labelled WTG38, 15 and 18 (shaded in light grey) are likely to have a shadow flicker impact on motorists using the R318 arterial road. It is, however, expected that the number of motorists travelling on these roads will be limited and the level of exposure will be brief, thereby, not constituting a shadow flicker visual impact of concern for these receptors.

Four (4) turbines labelled WTG32, 18 and 17 and 16 (shaded in red), may have a shadow flicker impact on Nadini, Vredelus and an unknown homestead respectively. All of these homesteads appear to be located within the farm portions earmarked for the proposed WEF development and may pose a shadow flicker visual impact of concern.



Map 9: Potential sensitive receptors exposed to shadow flicker from the proposed Hugo Wind Energy 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 Hugo Wind Energy Facility 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 facilities will look like from all directions (i.e. it is not an artist's impression). Instead, the photo simulations indicate the anticipated visual alteration of the landscape from various sensitive visual receptors located at different distances from the facility should it be constructed. The simulations are based on the wind turbine dimensions and layout. The photograph positions are indicated on **Figure 10** below and should be referenced with the photo simulation being viewed in order to place the observer in spatial context of the proposed facility.

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

It is imperative that the natural vegetation be restored to its original (current) status for these simulated views to ultimately be realistic. The additional infrastructure (e.g. the proposed substation, access roads, etc.) associated with the facility are 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 Cluster.

A total of 10 photo simulations were prepared for the proposed Hugo WEF, inclusive of night time and cumulative views. The views were chosen to accurately represent the likely visual impact from a variety of viewpoints/receptors and directions around the proposed WEF site.

The photo simulations are displayed as "before", "after", 'night time' and "cumulative" views of the affected landscape.

From the simulations below, it can be noted that certain viewpoints are more sensitive to change than others. The landscape from the view points along the N1 are more readily able to accept the change owing to existing visual disturbances such as the N1 road itself, power line infrastructure and the hilly topography which provides screening to a certain extent. The remainder of the viewpoints located along the R318 and at various identified sensitive visual receptors (homesteads and tourist establishments) are more sensitive to change owing to the fact that the surrounding landscape is largely natural and undisturbed with very little to no built infrastructure.

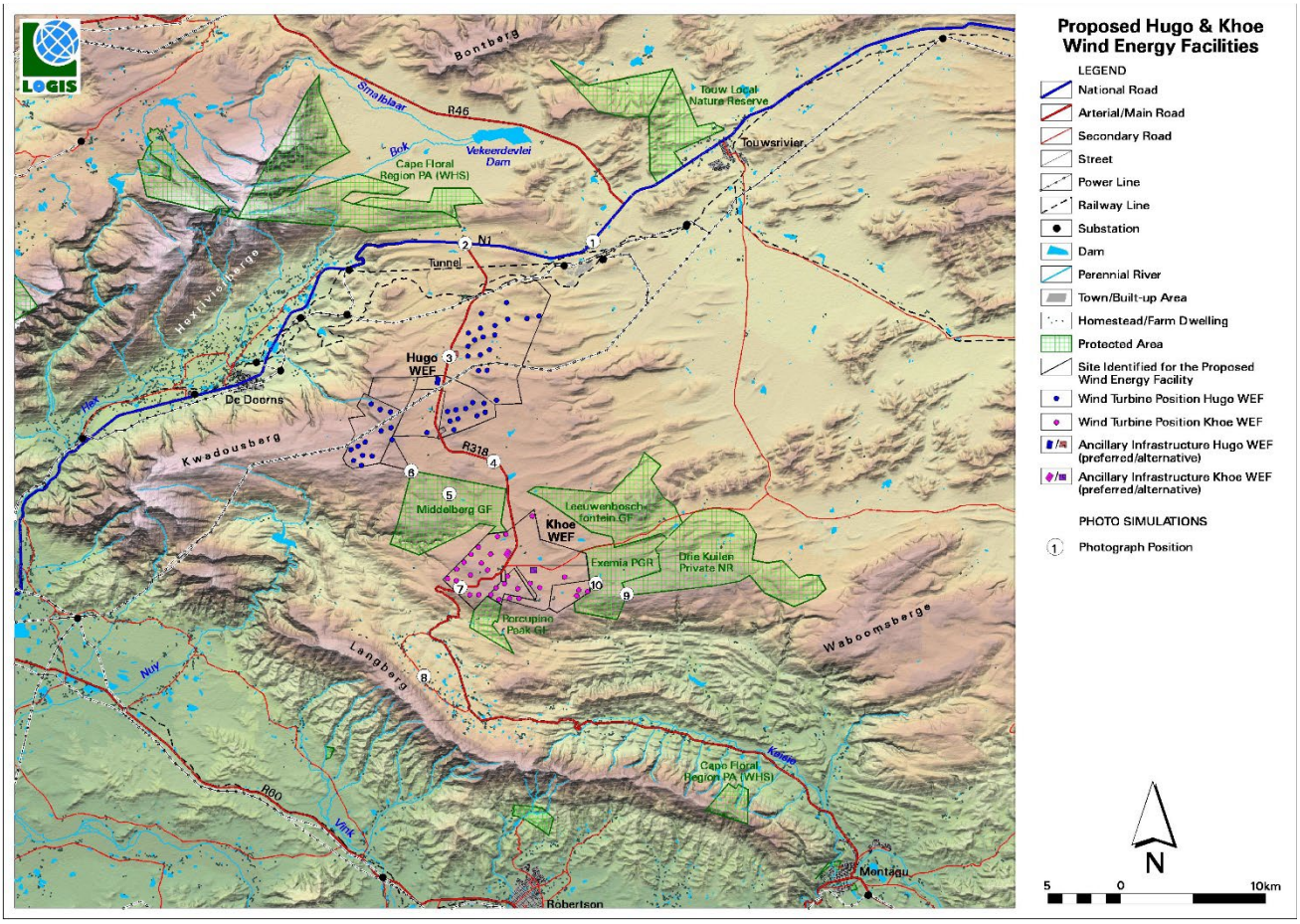


Figure 10: Photo simulation locations undertaken for the photo simulations of the Hugo WEF

7.1.Photo simulation 1

Figure 11: Photo simulation 1 – before. Viewpoint from the N1 taken in a south westerly direction.

Figure 12: Photo simulation 1 – after. The closest wind turbine in the Hugo Wind Facility is 6.4km from this point.

Figure 13: Photo simulation 1- night time

7.2. Photo simulation 2

Figure 14: Photo simulation 2 – before. Viewpoint taken from the N1 looking towards the R318 in a south/ south east direction

Figure 15: Photo simulation 2 – after. The closest wind turbine in the Hugo Wind Facility is 4.8km from this point.

Figure 16: Photo simulation 2- night time

7.3. Photo simulation 3a

Figure 17: Photo simulation 3a – before. Viewpoint from a secondary road off the R318 looking from east to south.

Figure 18: Photo simulation 3a – after. The closest turbine from this point is 3.5 km.

Figure 19: Photo simulation 3a- night time

7.4.Photo simulation 3b

Figure 20: Photo simulation 3b- before. Extended panoramic view taken from the R318 panning from north to east

Figure 21: Photo simulation 3b- after. The closest wind turbine of the Hugo Wind Facility is 1.3km from this point.

Figure 22: Photo simulation 3b- night time

7.5.Photo simulation 4

Figure 23: Photo simulation 4- before. Extended panoramic view taken from the R318 panning from west to north. Ezelsjacht Guest farm is depicted in the east

Figure 24: Photo simulation 4- after. The closest wind turbine from this point is 3.5 km

Figure 25: Photo simulation 4- night time view

7.6. Photo simulation 5

Figure 26: Photo simulation 5- before. View taken from the Main Lodge location at Middelberg Guest Farm looking north west to north east

Figure 27: Photo simulation 5- after. The closest wind turbine from this position is 4.3 km.

Figure 28: Photo simulation 5- night time view

7.7. Photo simulation 6

Figure 29: Photo simulation 6- before. View taken from the campsite at Middelberg Guest farm in a west to north direction.

Figure 30: Photo simulation 6- after. The closest turbine is located 2.5 km from this point

Figure 31: Photo simulation 6- night time view

7.8. Photo simulation 7

Figure 32: Photo simulation 7- before. View taken from the R318 looking north west towards the proposed Hugo WEF

Figure 33: Photo simulation 7- after. The closest turbine is located 10.8 km from this point

Figure 34: Photo simulation 7- night time view

Figure 35: Photo simulation 7- cumulative after. View taken from the R318 looking north west and includes both the proposed Hugo WEF in the background and the proposed Khoe WEF in the foreground. The closest turbine is 0.5 km from this point and is associated with the Khoe WEF

Figure 36: Photo simulation 7- cumulative night time view

7.9. Photo simulation 8

Figure 37: Photo simulation 8- before. View taken from a secondary road outside of Langdam Guest Farm looking north to east

Figure 38: Photo simulation 8- after. The closest turbine is 15 km from this point

Figure 39: Photo simulation 8- night time view

Figure 40: Photo simulation 8- cumulative view after. View taken from a secondary road outside of Langdam Guest Farm looking north to east and includes both the proposed Hugo WEF to the left and the proposed Khoe WEF in centre. The closest turbine is 6.4 km from this point and is associated with the Khoe WEF

Figure 41: Photo simulation 8- cumulative night time view

7.10. Photo simulation 9

Figure 42: Photo simulation 9- before. View taken from the view point at Drie Kuilen Private Nature Reserve looking north west

Figure 43: Photo simulation 9- after. The closest turbine is located 16 km from this point

Figure 44: Photo simulation 9- night time view

Figure 45: Photo simulation 9- cumulative view after. View taken from the view point at Drie Kuilen Private Nature Reserve looking north west and includes both the proposed Hugo WEF in the background and the proposed Khoe WEF in the foreground. The closest turbine is 2.7 km from this point and is associated with the Khoe WEF

Figure 46: Photo simulation 9- cumulative night time view

7.11. Photo simulation 10

Figure 47: Photo simulation 10- before. View taken from the western boundary of Exemia Private Nature Reserve which is earmarked for the placement of the main lodge looking north west.

Figure 48: Photo simulation 10- after. The closest turbine is 14.5 km from this point.

Figure 49: Photo simulation 10- night time view

Figure 50: Photo simulation 10- cumulative view after. View taken the western boundary of Exemia Private Nature Reserve which is earmarked for the placement of the main lodge looking north west and includes both the proposed Hugo WEF in the background and the proposed Khoe WEF in the foreground. The closest turbine is 0.9 km from this point and is associated with the Khoe WEF

Figure 51: Photo simulation 10- cumulative night time view

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 - How far the visual impact is going to extend and to what extent it will have the highest impact. In the case of this type of development the extent of the visual impact is most likely to have a higher impact on receptors closer to the development and decrease as the distance increases.

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

Duration - The timeframe in both the construction and operational phase 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. Where more than one value is applicable, the higher of these will be used as a worst-case scenario.

- (2) Negligible
- (4) Low
- (6) Moderate
- (8) High
- (10) Very High

Receptor Sensitivity – the sensitivity of visual receptors based on location, susceptibility and value etc to change (of the landscape).

- (2) Negligible
- (4) Low
- (6) Moderate
- (8) High
- (10) Very High

Landscape Character – the quality of the landscape in terms of its particular characteristics

- (2) Negligible
- (4) Low
- (6) Moderate
- (8) High
- (10) Very High

Probability - The likelihood of the impact 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, extent, Receptor sensitivity and Landscape character.

$$\text{Significance} = \frac{(\text{Extent} + \text{Magnitude} + \text{Duration} + \text{Receptor Sensitivity} + \text{Landscape Character}) \text{ x Probability}}{2}$$

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

- Positive
- Negative
- Neutral

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

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

8.2 Direct Impact Assessment

The direct visual impacts of the proposed Hugo Wind Energy Facility are assessed as follows:

8.2.1. Construction Phase

During the construction period it is expected that any visual impact of concern on sensitive visual receptors within the study area will be temporary and limited to a short-term period (2-5 years). The below direct construction visual impacts of the proposed Hugo Wind Energy Facility are assessed as follows:

8.2.1.1. Potential visual impact of construction activities on identified sensitive visual receptors (residents and visitors) within 0 – 5km 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 landowners in the area within 5km from the proposed site. Additionally, dust as a result of the construction activities and construction equipment (i.e. cranes), temporary laydown areas, construction camps, etc. may also be visible at the site, resulting in a visual impact occurring during construction. Sensitive receptors in this zone consist of residents of various homesteads such as Uitsig as well as tourist accommodation offerings (Middelberg, Ezelszacht etc) (refer to Section 5.7 for a full list).

Construction activities may potentially result in a **moderate** temporary visual impact, both pre and post mitigation.

Table 7: Visual impact of construction on residents of homesteads and visitors to tourist accommodation within 5 km to the proposed WEF.

Nature of Impact: Visual impact of construction activities on residents of homesteads and visitors to tourist accommodation within 5 km to the proposed WEF.		
	Without mitigation	***With mitigation***
Extent	Very Short distance **(4)**	Very Short distance **(4)**
Duration	Short term **(2)**	Short term **(2)**
Magnitude	Very high **(10)**	High **(8)**
Receptor sensitivity	Very High **(10)**	Very High **(10)**
Landscape Character	High **(8)**	High **(8)**
Probability	Highly Probable **(4)**	Probable **(3)**
Significance	Moderate **(60)**	Moderate **(48)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible (1)	Reversible (1)
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation: <u>Planning:</u> ➢ Retain and maintain natural vegetation in all areas outside of the development footprint, but within the project site. <u>Construction:</u> ➢ 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.		

8.2.1.2. Potential visual impact of construction activities on identified sensitive visual receptors (observers travelling along roads) within 0 – 5km of 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 in the area within 5km from the proposed site. Additionally, dust as a result of the construction activities and construction equipment (i.e. cranes), temporary laydown areas, construction camps, etc. may also be visible at the site, resulting in a visual impact occurring during construction. Sensitive receptors in this zone consist of observers travelling along the R318 which cuts through the site and the N1 located to the north.

Construction activities may potentially result in a **moderate** temporary visual impact, both pre and post mitigation.

Table 8: Visual impact of construction activities on observers travelling along roads located within 5 km of the proposed WEF

Nature of Impact: Visual impact of construction activities on observers travelling along roads within 5 km of the proposed WEF.		
	Without mitigation	***With mitigation***
Extent	Very Short distance **(4)**	Very Short distance **(4)**
Duration	Short term **(2)**	Short term **(2)**
Magnitude	Very high **(10)**	High **(8)**
Receptor sensitivity	Moderate **(6)**	Moderate **(6)**
Landscape Character	High **(8)**	High **(8)**
Probability	Highly Probable **(4)**	Probable **(3)**
Significance	Moderate **(60)**	Moderate **(42)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible (1)	Reversible (1)
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation: 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 Phase

During the operational phase of the proposed Hugo Wind Energy Facility, it is generally accepted that the wind turbine structures associated with the proposed facility will constitute the largest visual impact of concern on sensitive visual receptors within the study area, as a result of their sheer scale in relation to other proposed infrastructure that may be located on the site. The below direct operational visual impacts of the proposed Hugo Wind Energy Facility are assessed as follows:

8.2.2.1. Potential visual impact on sensitive visual receptors (residents and visitors) located within a 5km radius of the wind turbine structures

The operation of the Hugo Wind Energy Facility is expected to have a **very high** visual impact (significance rating = 90) on observers/visitors residing at homesteads and tourist accommodation facilities within a 5km radius of the wind turbine structures. Refer to Section 5.7 for a full list.

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.

Of note is that the impact dealt with in the table below only addressed the potential visual impact associated with the visual intrusion of wind turbines structures themselves. The impacts associated with any other potential visual impacts as a result of the proposed development, such as ancillary infrastructure, sense of place or lighting impacts are dealt with separately in below sections of this report.

Table 9: Visual impact on observers (residents and visitors) within 5 km of the proposed wind turbine structures

Nature of Impact: Visual impact on residents of homesteads and visitors to tourist accommodation within 5 km to the proposed WEF.		
	Without mitigation	***With mitigation***
Extent	Very Short distance **(4)**	Very Short distance **(4)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Very high **(10)**	Very high **(10)**
Receptor sensitivity	Very High **(10)**	Very High **(10)**
Landscape Character	High **(8)**	High **(8)**
Probability	Definite **(5)**	Definite **(5)**
Significance	Very High **(90)**	Very High **(90)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible (1)	Reversible (1)
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
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 facility as a whole. Decommissioning: ➢ Remove infrastructure not required for the post-decommissioning use. ➢ Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications.		
Residual impacts: The visual impact will be removed after decommissioning, provided the WEF infrastructure is removed and the area rehabilitated. Failing this, the visual impact will remain.		

8.2.2.2. Potential visual impact on sensitive visual receptors (observers travelling along roads) located within a 5km radius of the wind turbine structures

During the entire operational lifespan of the Hugo Wind Energy Facility, it is expected that daily commuters and possible tourists travelling along the various roads within 5km of the wind turbine structures may be negatively impacted upon by the visual exposure to the proposed infrastructure, however brief. It is assumed that the observers travelling along these roads will view the visual intrusion of the turbines in a negative light when compared with the rural and scenic quality of the surrounding landscape.

The operation of the Hugo Wind Energy Facility is expected to have a **high** visual impact (significance rating = 80) on observers traveling along the roads within a 5km radius of the wind turbine structures. This includes observers travelling along the R318 and N1.

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 10: Visual impact on observers travelling along roads within 5 km of the proposed wind turbine structures

Nature of Impact: Visual impact on observers travelling along the roads within 5 km to the proposed WEF.		
	Without mitigation	***With mitigation***
Extent	Very Short distance **(4)**	Very Short distance **(4)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Very high **(10)**	Very high **(10)**
Receptor sensitivity	Moderate **(6)**	Moderate **(6)**
Landscape Character	High **(8)**	High **(8)**
Probability	Definite **(5)**	Definite **(5)**
Significance	High **(80)**	High **(80)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible (1)	Reversible (1)
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
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 facility as a whole. Decommissioning: ➢ Remove infrastructure not required for the post-decommissioning use. ➢ Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications.		
Residual impacts: The visual impact will be removed after decommissioning, provided the WEF infrastructure is removed and the area rehabilitated. Failing this, the visual impact will remain.		

8.2.2.3. Potential visual impact on sensitive visual receptors (residents of homesteads/ tourist accommodation) within a 5 – 10km radius of the proposed WEF

The Hugo Wind Energy Facility could have a **very high** visual impact (significance rating = 82) on residents of (or visitors to) homesteads and tourist accommodation within a 5 - 10km radius of the wind turbine structures.

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

Table 11: Visual impact of the proposed wind turbine structures on residents of homesteads/tourist accommodation within 5 – 10km of the proposed WEF

Nature of Impact: Visual impact on residents of homesteads and visitors to tourist accommodation within 5-10 km to the proposed WEF.		
	Without mitigation	***With mitigation***
Extent	Short distance **(3)**	Short distance **(3)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	High **(8)**	High **(8)**
Receptor sensitivity	Very High **(10)**	Very High **(10)**
Landscape Character	High **(8)**	High **(8)**
Probability	Definite **(5)**	Definite **(5)**
Significance	Very High **(82)**	Very High **(82)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible (1)	Reversible (1)
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Generic best practise mitigation/management measures: <u>Planning:</u> ➢ Retain/re-establish and maintain natural vegetation in all areas outside of the development footprint/servitude, but within the project site. <u>Operations:</u> ➢ Maintain the general appearance of the facility as a whole. <u>Decommissioning:</u> ➢ Remove infrastructure not required for the post-decommissioning use. ➢ Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications.		
Residual impacts: The visual impact will be removed after decommissioning, provided the WEF infrastructure is removed and the area rehabilitated. Failing this, the visual impact will remain.		

8.2.2.4. Potential visual impact on sensitive visual receptors (observers travelling along roads) located within a 5-10 km radius of the wind turbine structures

The Hugo Wind Energy Facility could have a **high** visual impact (significance rating = 72) on observers travelling along the R318 and N1 within a 5 - 10km radius of the wind turbine structures.

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

Table 12: Visual impact of the proposed wind turbine structures on observers travelling along roads within 5 – 10km of the proposed WEF

Nature of Impact: Visual impact on observers travelling along roads within 5-10 km to the proposed WEF.		
	Without mitigation	***With mitigation***
Extent	Short distance **(3)**	Short distance **(3)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	High **(8)**	High **(8)**
Receptor sensitivity	Moderate **(6)**	Moderate **(6)**
Landscape Character	High **(8)**	High **(8)**
Probability	Definite **(5)**	Definite **(5)**
Significance	High **(72)**	High **(72)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible (1)	Reversible (1)
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
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 facility as a whole. Decommissioning: ➢ Remove infrastructure not required for the post-decommissioning use. ➢ Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications.		
Residual impacts: The visual impact will be removed after decommissioning, provided the WEF infrastructure is removed and the area rehabilitated. Failing this, the visual impact will remain.		

8.2.2.5. Potential visual impact on formally protected areas within 5-10 km radius of the proposed wind turbines

The Hugo Wind Energy Facility could have a **very high** visual impact (significance rating = 87) on visitors/ tourists to the Cape Floral Region, a formally protected area and World Heritage Site located within a 5 - 10km radius of the wind turbine structures.

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

Table 13: Visual impact of the proposed wind turbine structures on visitors to formally protected areas within 5 – 10km of the proposed WEF

Nature of Impact: Visual impact on visitors to formally protected areas within 5-10 km to the proposed WEF.		
	Without mitigation	***With mitigation***
Extent	Short distance **(3)**	Short distance **(3)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	High **(8)**	High **(8)**
Receptor sensitivity	Very High **(10)**	Very High **(10)**
Landscape Character	Very High **(10)**	Very High **(10)**
Probability	Definite **(5)**	Definite **(5)**
Significance	Very High **(87)**	Very High **(87)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible (1)	Reversible (1)
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
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 facility as a whole. Decommissioning: ➢ Remove infrastructure not required for the post-decommissioning use. ➢ Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications.		
Residual impacts: The visual impact will be removed after decommissioning, provided the WEF infrastructure is removed and the area rehabilitated. Failing this, the visual impact will remain.		

8.2.2.6. Potential visual impact on sensitive visual receptors (residents of and visitors to homesteads) within 10 – 20km radius of the proposed wind turbine structures

The Hugo Wind Energy Facility could have a **moderate** visual impact (significance rating = 56) on residents of (or visitors to) homesteads/tourist accommodation within a 10 - 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 14: Visual impact of the proposed wind turbine structures on residents of homesteads located within a 10 – 20km radius

Nature of Impact: Visual impact on residents of homesteads and visitors to tourist accommodation within 10-20 km to the proposed WEF.		
	Without mitigation	***With mitigation***
Extent	Medium distance **(2)**	Medium distance **(2)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Moderate **(6)**	Moderate **(6)**
Receptor sensitivity	High **(8)**	High **(8)**
Landscape Character	High **(8)**	High **(8)**
Probability	Highly Probable **(4)**	Highly Probable **(4)**
Significance	Moderate **(56)**	Moderate **(56)**
Status (positive or negative)	Negative	Negative

Reversibility	Reversible (1)	Reversible (1)
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
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 facility as a whole. Decommissioning: ➢ Remove infrastructure not required for the post-decommissioning use. ➢ Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications.		
Residual impacts: The visual impact will be removed after decommissioning, provided the WEF infrastructure is removed and the area rehabilitated. Failing this, the visual impact will remain.		

8.2.2.7. Potential visual impact on sensitive visual receptors (observers travelling along roads) located within a 10-20 km radius of the wind turbine structures

The Hugo Wind Energy Facility could have a **moderate** visual impact (significance rating = 39) on observers travelling along roads within a 10 - 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 15: Visual impact of the proposed wind turbine structures on observers travelling along roads located within a 10 – 20km radius

Nature of Impact: Visual impact on observers travelling along roads within 10-20 km to the proposed WEF.		
	Without mitigation	***With mitigation***
Extent	Medium distance **(2)**	Medium distance **(2)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Moderate **(6)**	Moderate **(6)**
Receptor sensitivity	Moderate **(6)**	Moderate **(6)**
Landscape Character	High **(8)**	High **(8)**
Probability	Probable **(3)**	Probable **(3)**
Significance	Moderate **(39)**	Moderate **(39)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible (1)	Reversible (1)
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
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 facility as a whole. Decommissioning: ➢ Remove infrastructure not required for the post-decommissioning use. ➢ Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications.		
Residual impacts: The visual impact will be removed after decommissioning, provided the WEF infrastructure is removed and the area rehabilitated. Failing this, the visual impact will remain.		

8.2.2.8. Potential visual impact on formally protected areas and private nature reserves within 10-20 km from the proposed wind turbines

The Hugo Wind Energy Facility could have a **moderate** visual impact (significance rating = 60) on visitors/ tourists to the Drie Kuilen Private Nature Reserve (formally protected area) and the Exemia PNR (non designated), located within a 10 - 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 16: Visual impact of the proposed wind turbine structures on visitors to formally protected areas and private nature reserves within 10 – 20km of the proposed WEF

Nature of Impact: Visual impact on visitors to formally protected areas and private nature reserves within 10-20 km to the proposed WEF.		
	Without mitigation	***With mitigation***
Extent	Medium distance **(2)**	Medium distance **(2)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Moderate **(6)**	Moderate **(6)**
Receptor sensitivity	Very High **(10)**	Very High **(10)**
Landscape Character	High **(8)**	High **(8)**
Probability	Highly Probable **(4)**	Highly Probable **(4)**
Significance	Moderate **(60)**	Moderate **(60)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible (1)	Reversible (1)
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
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 facility as a whole. Decommissioning: ➢ Remove infrastructure not required for the post-decommissioning use. ➢ Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications.		
Residual impacts: The visual impact will be removed after decommissioning, provided the WEF infrastructure is removed and the area rehabilitated. Failing this, the visual impact will remain.		

8.2.2.9. 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 1km buffer along the edge of the outer most turbines were identified as the zone within which there is a risk of shadow flicker occurring.

This study found that three (3) turbines labelled WTG38, 15 and 18 (shaded in light grey) are likely to have a shadow flicker impact on motorists using the R318 arterial road. It is, however, expected that the number of motorists travelling on these roads will be limited and the level of exposure will be brief, thereby, not constituting a shadow flicker visual impact of concern for these receptors.

Four (4) turbines labelled WTG32, 18 and 17 and 16 (shaded in red), may have a shadow flicker impact on Nadini, Vredelus and an unknown homestead respectively. All of these homesteads appear to be located within the farm portions earmarked for the proposed WEF development and may pose a shadow flicker visual impact of concern.

The significance of shadow flicker is therefore anticipated to be **moderate,** when this structure is in use.

Table 17: 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.		
	Without mitigation	***With mitigation***
Extent	Very Short distance **(4)**	Very Short distance **(4)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Moderate **(6)**	Moderate **(6)**
Receptor sensitivity	Very High **(10)**	Very High **(10)**
Landscape Character	High **(8)**	High **(8)**
Probability	Probable **(3)**	Probable **(3)**
Significance	Moderate **(48)**	Moderate **(48)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible (1)	Reversible (1)
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
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: ➢ Consider planting of screening vegetation at the affected homestead to limit the effect of shadow flicker, should it be required. Decommissioning: ➢ Remove infrastructure not required for the post-decommissioning use. ➢ Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications.		
Residual impacts: The visual impact will be removed after decommissioning, provided the WEF infrastructure is removed and the area rehabilitated. Failing this, the visual impact will remain.		

8.2.2.10. 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, especially those located in closer proximity to the wind turbine structures especially within 0-5km and potentially up to 20km.

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 53** below.[6]

Figure 52: 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)

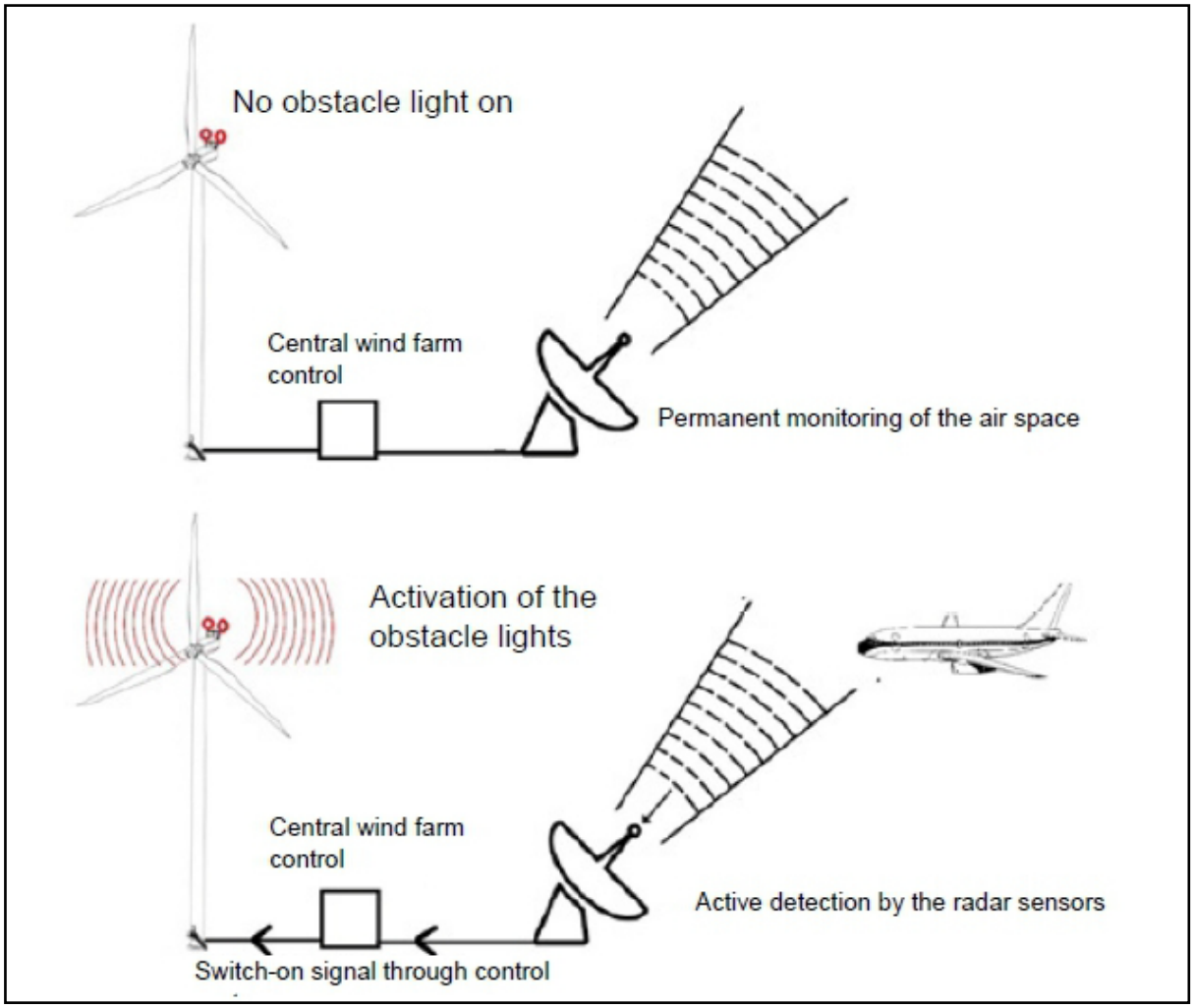


Figure 53: Diagram of the functional principle of the needs-based night lights.

[6] Source: Nordex Energy GmbH, 2019

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 on residents of homesteads and visitors to tourist accommodation is likely to be of **very high** significance (rating = 82), and may be mitigated to **high** (rating = 64) especially within 0-5km and potentially up to 10km radius of the wind turbine structures. Similarly, lighting impacts on observers travelling along roads is anticipated to be of **high** significance (rating= 72) which may be mitigated to **moderate** (rating = 54).

Table 18: Impact table summarising the significance of visual impact of lighting at night on residents/ visitors to homesteads and tourist accommodation in close to medium proximity (within 0-5km and potentially up to 10km) to the proposed WEF

Nature of Impact: Visual impact of lighting at night on residents and visitors to homesteads and tourist accommodation within 10 km from the proposed WEF		
	Without mitigation	***With mitigation***
Extent	Short to medium distance **(3)**	Very Short distance **(3)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	High **(8)**	Moderate **(6)**
Receptor sensitivity	Very High **(10)**	Very High **(10)**
Landscape Character	High **(8)**	High **(8)**
Probability	Definite **(5)**	Highly Probable **(4)**
Significance	Very High **(82)**	High **(64)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible (1)	Reversible (1)
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Generic best practise mitigation/management measures: Planning & operation: ➢ Implement needs-based night lighting if considered acceptable by the CAA. ➢ Limit aircraft warning lights to the turbines on the perimeter according to CAA requirements, thereby reducing the overall impact. ➢ 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. Decommissioning: ➢ Remove infrastructure not required for the post-decommissioning use. ➢ Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications.		
Residual impacts: The visual impact will be removed after decommissioning, provided the WEF infrastructure is removed and the area rehabilitated. Failing this, the visual impact will remain.		

Table 19: Impact table summarising the significance of visual impact of lighting at night on observers travelling along roads in close to medium proximity (within 0-5km and potentially up to 10km) to the proposed WEF

Nature of Impact: Visual impact of lighting at night on observers travelling along roads within 10 km from the proposed WEF

	Without mitigation	***With mitigation***
Extent	Short to medium distance **(3)**	Very Short distance **(3)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	High **(8)**	Moderate **(6)**
Receptor sensitivity	Moderate **(6)**	Moderate **(6)**
Landscape Character	High **(8)**	High **(8)**
Probability	Definite **(5)**	Highly Probable **(4)**
Significance	High **(72)**	Moderate **(54)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible (1)	Reversible (1)
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	

Generic best practise mitigation/management measures:

Planning & operation:

- Implement needs-based night lighting if considered acceptable by the CAA.
- Limit aircraft warning lights to the turbines on the perimeter according to CAA requirements, thereby reducing the overall impact.
- 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.

Decommissioning:

- Remove infrastructure not required for the post-decommissioning use.
- Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications.

Residual impacts:

The visual impact will be removed after decommissioning, provided the WEF infrastructure is removed and the area rehabilitated. Failing this, the visual impact will remain.

8.2.2.11. Ancillary infrastructure

On-site ancillary infrastructure associated with the WEF includes a 132kV substation and collector substation, Battery Energy Storage System (BESS), underground cabling between the wind turbines, internal access roads, gate house, Operation and Maintenance buildings. No dedicated viewshed analyses have been generated for the ancillary infrastructure, as the range of visual exposure will fall within (and be overshadowed by) that of the turbines.

The anticipated visual impact resulting from this infrastructure is likely to be of **moderate** significance post mitigation. It should be noted that the preferred alternative for the substation would have a lower significance rating owing to the greater distance from the R318 and the closest homestead.

Table 20: Visual impact of the ancillary infrastructure on residents of nearby homesteads

Nature of Impact: Visual impact of the ancillary infrastructure on observers in close proximity to the structures.		
	Without mitigation	***With mitigation***
Extent	Very Short distance **(4)**	Very Short distance **(4)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	High **(8)**	Moderate **(6)**
Receptor sensitivity	Very high **(10)**	Very high **(10)**
Landscape Character	High **(8)**	High **(8)**
Probability	Highly probable **(4)**	Probable **(3)**
Significance	High **(68)**	Moderate **(48)**

Status (positive or negative)	Negative	Negative
Reversibility	Reversible (1)	Reversible (1)
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
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. Decommissioning: ➢ Remove infrastructure not required for the post-decommissioning use. ➢ Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications.		
Residual impacts: The visual impact will be removed after decommissioning, provided the WEF infrastructure is removed and the area rehabilitated. Failing this, the visual impact will remain.		

Table 21: Visual impact of the ancillary infrastructure on observers travelling along the R318

Nature of Impact: Visual impact of the ancillary infrastructure on observers in close proximity to the structures.		
	Without mitigation	***With mitigation***
Extent	Very Short distance **(4)**	Very Short distance **(4)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	High **(8)**	Moderate **(6)**
Receptor sensitivity	Moderate **(6)**	Moderate **(6)**
Landscape Character	High **(8)**	High **(8)**
Probability	Definite **(5)**	Highly Probable **(4)**
Significance	High **(75)**	Moderate **(56)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible (1)	Reversible (1)
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
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. Decommissioning: ➢ Remove infrastructure not required for the post-decommissioning use. ➢ Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications.		
Residual impacts: The visual impact will be removed after decommissioning, provided the WEF infrastructure is removed and the area rehabilitated. Failing this, the visual impact will remain.		

8.3 Indirect Impact Assessment

The indirect visual impacts of the proposed Hugo Wind Energy Facility are assessed as follows:

8.3.1. Operational Phase

8.3.1.1. 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.

The greater environment has a rural, undeveloped character and a natural appearance. These generally undeveloped landscapes are considered to have a high visual quality. The landscape sensitivity (as discussed in Section 5.5) is considered to be high whereby it has limited to low capacity to accommodate/absorb any change, which in this case would be the proposed wind turbines.

The 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 **very high** 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 22: The potential impact on the sense of place of the region

Nature of Impact: The potential impact on the sense of place of the region.		
	Without mitigation	***With Mitigation***
Extent	Long distance **(1)**	Long distance **(1)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Very High **(10)**	Very High **(10)**
Receptor sensitivity	Very high **(10)**	Very high **(10)**
Landscape Character	High **(8)**	High **(8)**
Probability	Definite **(5)**	Definite **(5)**
Significance	Very High **(82)**	Very High **(82)**
Status (positive, neutral or negative)	Negative	Negative
Reversibility	Reversible (1)	Reversible (1)
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	No, only best practise measures can be implemented	
Generic best practise mitigation/management measures: Planning: ➢ Retain/re-establish and maintain natural vegetation in all areas outside of the development footprint/servitude, but within the project site. Operations: ➢ Maintain the general appearance of the facility as a whole. Decommissioning: ➢ Remove infrastructure not required for the post-decommissioning use. ➢ Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications.		
Residual impacts: The visual impact will be removed after decommissioning, provided the WEF infrastructure is removed and the area rehabilitated. Failing this, the visual impact will remain.		

8.4 Cumulative Impact Assessment

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

The study area is not located within a REDZ, and as such very limited renewable energy facilities can be found within a 35 km radius. No other wind energy facilities have been authorized within

a 35 km radius; however, three (3) solar PV energy facilities have been approved, namely Sanral PV SEF to the north west and Touwsrivier and Montague Road Solar PV SEFs to the north east. The proposed Hugo WEF addressed in this report is one half of a larger wind energy cluster consisting of another proposed WEF to the south, namely Khoe wind energy facility.

The cumulative visual impact of the proposed Hugo Wind Energy Facility, together with the proposed Khoe WEF (refer to **Section 5.2**) is expected to be **very high**, depending on the observer's sensitivity to wind turbine structures.

Owing to the sensitivity of the landscape, the high visual quality and the potential visual impacts on sensitive visual receptors, the cumulative visual impact is not considered to be within acceptable limits.

Table 23: The potential cumulative visual impact of wind farms on the visual quality of the landscape

Nature of Impact: The potential cumulative visual impact of wind farms on the visual quality of the landscape.		
	Overall impact of the proposed project considered in isolation	***Cumulative impact of the Hugo and Khoe WEFs***
Extent	Medium distance **(2)**	Medium distance **(2)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	High **(8)**	Very high **(10)**
Receptor sensitivity	Very high **(10)**	Very high **(10)**
Landscape Character	High **(8)**	High **(8)**
Probability	Highly probable **(4)**	Definite **(5)**
Significance	High **(64)**	Very High **(85)**
Status (positive, neutral or negative)	Negative	Negative
Reversibility	Reversible (1)	Reversible (1)
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	No	
Mitigation measures: N.A.		
Residual impacts: The visual impact will be removed after decommissioning, provided the WEF infrastructure is removed and the area rehabilitated. Failing this, the visual impact will remain.		

8.5 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:

- 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 (indirect) 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.

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 Hugo Wind Energy Facility 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 table is a summary of impacts remaining:

Table 24: Summary of impact significance

Significance Ratings Summary		
	Pre-mitigation impact rating	**Post mitigation impact rating**
Direct Impacts		
Construction Phase		
Potential temporary visual impact of construction on residents of towns and homesteads located within 5km of the proposed WEF	Moderate	Moderate
Potential temporary visual impact of construction on observers travelling along roads within 5km to the proposed WEF	Moderate	Moderate
Operational Phase		
Potential visual impact on observers/visitors residing at homesteads and tourist accommodation facilities within 5km of the proposed WEF	Very High	Very High
Potential visual impact on observers traveling along the roads within a 5km radius of the proposed WEF	High	High
Potential visual impact on residents of (or visitors to) homesteads and tourist accommodation within 5 - 10km radius of the proposed WEF	Very High	Very High
Potential visual impact on observers travelling along the R318 and N1 within a 5 - 10km radius of the proposed WEF	High	High

Potential visual impact on visitors/ tourists to the Cape Floral Region, a formally protected area and World Heritage Site located within a 5 - 10km radius of the proposed WEF	Very High	Very High
Potential visual impact on residents of (or visitors to) homesteads/tourist accommodation within 10 - 20km radius of the proposed WEF	Moderate	Moderate
Potential visual impact on observers travelling along roads within a 10 - 20km radius of the proposed WEF	Moderate	Moderate
Potential visual impact on formally protected areas and private nature reserves within 10-20 km from the proposed WEF	Moderate	Moderate
Potential shadow flicker impact on residents of homesteads located within 1 km from the proposed WEF	Moderate	Moderate
Potential visual impact of operational, safety and security lighting of the facility on residents of homesteads and visitors to tourist accommodation at night	Very High	High
Potential visual impact of operational, safety and security lighting of the facility on observers travelling along roads at night	High	Moderate
Potential visual impact of ancillary infrastructure	High	Moderate
Indirect Impacts		
Operational Phase		
Potential visual impact of the proposed infrastructure on the sense of place of the region	Very High	Very High
Cumulative Impacts		
The potential cumulative visual impact of the proposed PV Facility and OHL on the visual quality of the landscape	*In isolation High*	*Cumulative Very High*

The anticipated visual impacts listed above (i.e. post mitigation impacts) range from **very high** to **moderate** significance. Anticipated visual impacts on sensitive visual receptors in close proximity to the proposed facility remain very 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, the potential visual impacts associated with the proposed **Hugo Wind Energy Facility**. 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.

Having said the above, there are likely to be supporters of the Hugo Wind Energy Facility (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 and not as vocal in their support for the wind farm as potential detractors thereof. Many objections to the proposed Hugo WEF have been received by both the EAP and author of this report, whereby many stakeholders are concerned with the potential visual impact of the proposed WEF on their places of residence, guest farms/reserves and the overall sense of place of the region.

Based on the assessment undertaken in this report, it is expected that the construction and operation of the proposed Hugo Wind Energy Facility and its associated infrastructure, will have an overall **very high to high visual impact on the study area**, especially within (but not restricted to) a 0 – 10km radius (and potentially up to a 20km radius) of the proposed facility. Tourists both travelling through the region and visiting tourist facilities, as well as, residents of homesteads will likely experience visual impacts where the wind turbine structures are visible.

The study area is not located within a REDZ, and as such very limited renewable energy facilities can be found within a 35 km radius. No other wind energy facilities have been authorized within a 35 km radius; however, three (3) solar PV energy facilities have been approved, namely Sanral PV SEF to the north west and Touwsrivier and Montague Road Solar PV SEFs to the north east.

The proposed Hugo WEF addressed in this report is just one half of a larger wind energy cluster consisting of another proposed WEF to the south, known as the Khoe wind energy facility.

The cumulative visual impact of the proposed Hugo Wind Energy Facility, together with the proposed Khoe WEF is expected to be **very high with no mitigation possible and therefore is not found 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 8.5**). The proposed mitigation measures will primarily be effective in terms of mitigating lighting and construction phase visual impacts only.

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.

The DFFE screening tool generated for Hugo WEF indicated that the site has a very high sensitivity for shadow flicker owing to the fact that the site is located near temporarily/permanently inhabited residence. Based on the assessment, it can be found that the shadow flicker sensitivity for the proposed Hugo Wind Facility is **moderate**.

Similarly, the DFFE screening tool generated for Hugo WEF indicated that the site has a very high sensitivity for landscape owing to the fact that the site is located on top of mountains and high ridges, slope of more than 1:4, Mountain catchment area, within 3 km of a nature reserve/protected area and within 250 m of a river. From the site sensitivity verification process, it was concluded that the sensitivity of the visual receiving environment is **high**[7] due to:

- Town dwellings located within 4-6km from the proposed site
- No turbines are located on slopes of more than 1:4
- Turbines located on mountains and tall hills (high sensitivity)
- Turbines located within the 500 m road buffer of the R318
- World Heritage Site located just over 5km away
- Not located within a Renewable Energy Development Zone (REDZ)
- Low VAC of the receiving environment
- Limited built infrastructure

Refer to **Appendix 1** for the full site sensitivity verification report.

Overall, the significance of the visual impacts associated with the proposed **Hugo Wind Energy Facility is expected to be very high to high** as a result of the generally undeveloped character of the landscape and its inability to absorb changes of this magnitude. Additionally, the facility would be visible within an area that contains certain sensitive visual receptors who already 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 rural homesteads and tourists passing through or holidaying in the region.

Night time impacts have also been assessed whereby it was determined that the significance of lighting (particularly aircraft warning lighting mounted on the turbines) on the nightscape would be high post mitigation. As discussed, the greater environment is largely natural in character with limited built infrastructure. Unblemished night skies are a key attribute to the study areas sense of place and night time visual character. Light sources in the area are limited to isolated farm and

[7] The matrix and sensitivity rating dealt with in this section of the report only confirms and verifies the sensitivity of the receiving environment in comparison to the outcomes of the DFFE Screening Tool. It does not, however, determine the overall visual impact of the proposed development on the sensitive receptors likely to be exposed to the proposed facility.

homesteads and fleeting light from passing cars travelling along the R318 and other secondary roads. Therefore, the introduction of new light sources into a relatively dark night sky, will have an impact on the visual quality of the study area at night.

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. However, it must be noted that as per the *Guideline for the Management of Development on Mountains, Hills and Ridges of the Western Cape (April 2002),* development on the crest of a mountain, hill or ridge will be strongly discouraged. Turbines labelled WTG 18, 19, 21 and 23 were noted (as per the Site sensitivity verification report) to be located on mountains and tall hills identified as having a high sensitivity.

Furthermore, with regards to point 3 above, it has been established through the course of this assessment that many objections to the proposed Hugo WEF have been received by stakeholders within the region, as communicated by the EAP and social impact specialist. It should be noted that certain stakeholders also indicated that they ok with the WEF in principle (personal communication with the social specialist). Therefore, with the information available to the specialist at the time of writing this report, it cannot be empirically determined that the statistical majority of objecting stakeholders were exceeded. If evidence to the contrary surfaces during the progression of the development application, the specialist reserves the right to revise the statement below.

In spite of the predominantly very high to 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.

The proposed Hugo Wind Energy Facility will only be supported from a visual perspective if the conditions listed below are implemented, the layout adjusted accordingly and all best practice mitigation measures, as provided in this report are implemented and adhered to:

- Turbines labelled WTG 18, 19, 21, 23, 27 and 28 in the east be relocated outside of areas marked as mountains and tall hills (high sensitivity)
- Turbines labelled WTG 1, 2, 3, 9, 10, 11 and 12 in the west be reconsidered and located outside of areas marked as mountains and tall hills (high sensitivity)
- While no turbines are located within the stipulated 500 m buffer from the R318, it should be noted that the Breede Valley local municipality and the Langeberg spatial development framework considers the R318 to be a scenic route. Therefore the implementation of a 1 km buffer along this route is considered to be preferrable by the visual specialist

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 25: Management programme – Planning.

OBJECTIVE: The mitigation and possible negation of visual impacts associated with the planning of the Proposed Hugo Wind Energy Facility.

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 26: Management programme – Construction.

OBJECTIVE: The mitigation and possible negation of visual impacts associated with the construction of the Proposed Hugo Wind Energy Facility.

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 27: Management programme – Operation.

OBJECTIVE: The mitigation and possible negation of visual impacts associated with the operation of the Proposed Hugo Wind Energy Facility.

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 28: Management programme – Decommissioning.

OBJECTIVE: The mitigation and possible negation of visual impacts associated with the decommissioning of the Proposed Hugo Wind Energy Facility.

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.		

12.REFERENCES / DATA SOURCES

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13.APPENDIX 1: SITE SENSIVITY VERIFICATION REPORT