PROPOSED ESIZAYO WIND ENERGY FACILITY EXPANSION PROJECT

Western Cape Province

VISUAL IMPACT ASSESSMENT

Produced for:

Biotherm Energy (Pty) Ltd

On behalf of:

WSP Group Africa (Pty) Ltd

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- April 2022 -

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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 Assessment (VIA).

He has been involved in the application of Geographical Information Systems (GIS) in Environmental Planning and Management since 1990. He has extensive practical knowledge in spatial analysis, environmental 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.

WSP Group Africa (Pty) Ltd appointed Lourens du Plessis as an independent specialist consultant to undertake the visual impact assessment for the Proposed Esizayo Wind Energy Facility (WEF) Expansion Project. He will not benefit from the outcome of the project decision-making.

1.2. Assumptions and Limitations

This assessment was undertaken during the planning stage of the project and is based on information available at that time. It is assumed that all information regarding the project details provided by the client is correct and relevant to the proposed project.

1.3. Level of Confidence

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

[1] Adapted from Oberholzer (2005).

- 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 study area and experience of this type of project by the practitioner:

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

These values are applied as follows:

Table 1: Level of confidence.

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

The level of confidence for this assessment is determined to be ***9*** *and indicates that the author's confidence in the accuracy of the findings is high:*

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

1.4. Methodology

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

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 an AW3D30 digital terrain model of the study area.

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

- **Determine 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 infrastructure.

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**

Undertake a site visit (July 2021) 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.

2. BACKGROUND AND PROPOSED INFRASTRUCTURE

BioTherm Energy (Pty) Ltd (BioTherm) is proposing the expansion of their authorised Esizayo Wind Energy Facility (WEF) in the Western Cape Province. The currently proposed Esizayo WEF will have a maximum generation capacity of 140MW (250MW in previous revisions of plan) and is one of three wind energy projects being proposed by BioTherm in the greater area. These projects include: Esizayo, Maralla West and Maralla East. The intention is to expand the generating capacity of the Esizayo WEF by an additional 200MW through the construction of an additional 23 wind turbines.

The Esizayo WEF site lies within the Moordenaars Karoo in the Western Cape, in the Karoo Hoogland and Lainsburg Local Municipalities. It is situated approximately 21km (at the closest) north of the N1 and 60km south of the town of Sutherland. It is bordered to the west by the R354 arterial road, which runs between Matjiesfontein and Sutherland (see **Figure 1**).

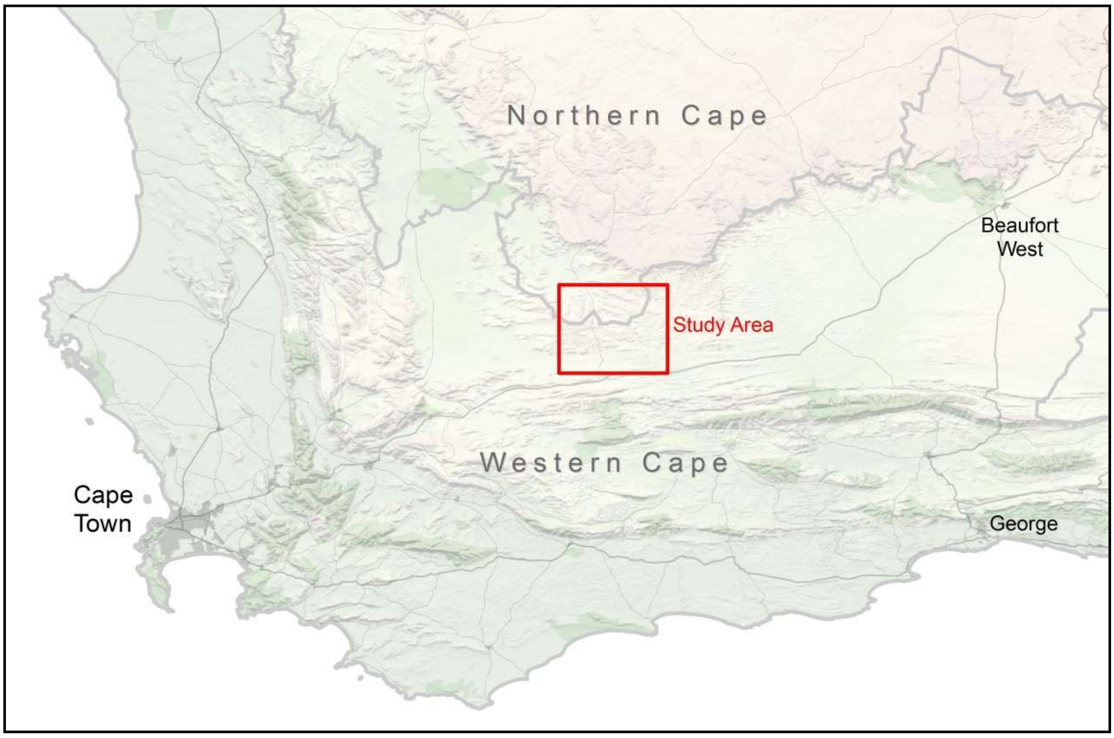

Figure 1: Regional locality of the proposed Esizayo WEF Expansion Project.

The proposed project components are reflected in the table below.

Table 2: Proposed project components.

Component	Description / Dimensions
Location of the site	Approximately 30km northeast of Laingsburg
Total area of the site	5, 850 ha
Size of buildable area i.e. project infrastructure footprint (only referred layout, inclusive of all associated infrastructure)	Up to 200ha (including turbines, roads and powerlines)

Area occupied by each turbine	Each turbine with a foundation of up to 25m in diameter and up to 4m in depth, compacted hard standing areas of up to 4.5 ha each
Farm Names	Portion 2 of Farm Aanstoot Farm 72 (C04300000000007200002) Portion 1 of Farm Leeuwenfontein 71 (C04300000000007100001) Remainder of Farm Leeuwenfontein 71 (C04300000000007100000)
Export capacity	Up to 200MW
Proposed technology	Wind turbines
Number of Turbines	Up to 23 wind turbines
Turbine Generating Capacity	Up to 10 MW
Hub height from ground level	Up to 150m
Rotor diameter	Up to 200m
Width of internal roads	Up to 9m, (turns will have radius of up to 55m)
Length of internal roads	30km
Power lines	33kV underground cables or overhead powerlines linking groups of wind turbines to onsite 33&132kV substation(s).

The farms listed in the table above are situated within the Gazetted Central Electricity Grid Infrastructure (EGI) Corridor, one of five corridors earmarked for electricity infrastructure development within South Africa. The project also falls within the Komsberg Renewable Energy Development Zone (REDZ), one of the eight areas that have been identified through an extensive process for the development of renewable energy installations.

The National Environmental Management Act (NEMA) and Environmental Impact Assessment (EIA) Regulations require that a Basic Assessment (BA) be undertaken for the proposed Esizayo WEF Expansion Project, since it includes listed activities in terms of these regulations.

The construction phase of the expanded WEF is dependent on the number of turbines ultimately erected and is estimated at one week per turbine. The construction phase is expected to be ~24 months. The lifespan of the facility is approximated at 20 to 25 years.

3. SCOPE OF WORK

This report is the Visual Impact Assessment (VIA) of the proposed Esizayo WEF Expansion Project as described above.

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

The study area for the visual assessment encompasses a geographical area of approximately 2,395km² (the extent of the full page maps displayed in this report) and includes a minimum 20km buffer zone from the proposed wind turbine structures.

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

- The visibility of the infrastructure to, and potential visual impact on, observers travelling along the R354 arterial road 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 on observers in close proximity to the facility.
- The visual absorption capacity of the natural vegetation (if applicable).
- Potential cumulative visual impacts (or consolidation of visual impacts), with specific reference to the location of the proposed infrastructure within the Komsberg REDZ, the Central Power Corridor and within close proximity to authorized WEF infrastructure.
- The potential visual impact of lighting of the facility in terms of light glare, light trespass and sky glow.
- Potential visual impacts associated with the construction phase.
- The potential visual impact of shadow flicker.
- The potential to mitigate visual impacts and inform the design process.

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

4. RELEVANT LEGISLATION AND GUIDELINES

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

- National Environmental Management Act 107 of 1998 (NEMA);
- The Environmental Impact Assessment Regulations, 2014 (as amended);
- Guideline on Generic Terms of Reference for EAPS and Project Schedules (DEADP, Provincial Government of the Western Cape, 2011); and
- Guideline for involving visual and aesthetic specialists in EIA processes: Edition 1.

5. THE AFFECTED ENVIRONMENT

The proposed Esizayo WEF Expansion Project lie within the Moordenaars (Murderer's) Karoo; a dry, barren and desolate region south of the Great Escarpment, approximately 22km (at the closest) north of Matjiesfontein. The

Esizayo WEF and the proposed expansion project are located within the Western Cape Province, adjacent to the border of the Northern Cape Province.

The Moordenaars Karoo does not include any major towns or settlements and is very remote. The project site is accessible via the R354 arterial road that traverses in between the N1 national road (near Matjiesfontein) and Sutherland.

Topography, hydrology and vegetation

The study area is situated on land that ranges in elevation from approximately 680m (in the south-east of the study area) to 1,520m at the top of the Brandkop hill (part of the future Brandvalley WEF) west of the Komsberg MTS (see **Map 1**). The proposed project infrastructure is located on a *plateau* with terrain morphological units identified as *strongly undulating plains and hills* and *tall hills*. The larger study area is characterised by *high mountains* (Klein-Roggeveldberge) to the north-west and a range of mountains to the south. These mountains form the escarpments of the *plateau* mentioned above. Mountains to the south include:

- Tafelkop
- Gruiskop
- Kranskop
- Spitskop
- Ramkop
- Droëberg
- Losper se Berg
- Langkloof se Berg
- Kranskop
- Bokberg

Hills and ridges to the west and north of the proposed development site include:

- Skaapberg
- Appelfontein se Rant
- Perdeplaas se berg
- Kliphoogte
- Langberg

It is expected that these topographical units would influence the viewshed pattern of the proposed Esizayo Expansion Project. Refer to **Map 2** for the Terrain Morphology of the study area.

There are no perennial rivers in the study area, with only a few weakly defined non-perennial or seasonal water courses appearing within this arid region (*Karoo Renosterveld Bioregion*). One of these is the Roggeveld River (traversing south of the project site), a tributary of the Buffels River that ultimately flows past Lainsburg. Additional rivers within the study area (shown on Map 2) include:

- Meintjiesplaas River
- Wilgehout River
- Groot River
- Tankwe River
- Wilgebos River

All of these rivers, with the exception of the Meintjiesplaas River, are situated below the *plateau* mentioned above.

There are a limited number of farm dams within the study area which receives a mean annual rainfall of 290mm.

The vegetation cover in the study area is predominantly *Central Mountain Shale Renosterveld* on the more elevated mountainous terrain and *Koedoesberge-Moordenaars Karoo* in the lower-lying areas below the escarpments. The land cover types are low shrubland (Fynbos) for most of the study area, with bare sand and rock surfaces primarily associated with the mountainous terrain to the south. It should be noted that the vegetation cover in the region e.g. bare sand and rock surfaces can change according to the season and the amount of rainfall.

Refer to **Map 3** for the land cover map of the study area.

Land use and settlement patterns

The majority of the study area is sparsely populated with a population density of less than 1 person per km^2. The study area consists of a landscape that can be described as remote due to its considerable distance from any major metropolitan centres or populated areas. The scarcity of water and other natural resources has influenced settlement within this region, keeping numbers low, and distribution limited to the availability of water. Settlements, where they occur, are usually rural homesteads and farmsteads.

Very few homesteads and settlements are present within the study area. Some of these, in closer proximity to the proposed WEF, include[2]:

- Swartland
- Bon Espirance
- Leeufontein
- Saaiplaas
- Smithkraal
- Ou Mure
- Aanstoot
- Nuwerus
- Fortuin
- Araura
- Die Bron

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

The predominant land use in the area is stock farming (predominantly sheep, game or goat farming). Since rainfall is low and water is scarce, crop farming accounts for only a small portion of the land use and is largely confined to the more fertile valleys. Due to the low carrying capacity, farms are large and usually at least about 5km apart.

The R354 arterial road provides motorised access to the region from the N1 national road near Matjiesfontein, the quaint historical town closest to the site (approximately 22km by road to the project site). This road is a local tourism route ultimately leading to Sutherland, the home of the Southern African Large Telescope (SALT). This town and Matjiesfontein are considered to be local tourist attractions/destinations within the region. The Komsberg/Kareedoringkraal

[2] The names listed below 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.

secondary or district gravel road provides access to the Komsberg MTS from the R354 arterial road.

Besides the two towns mentioned above, there are no other identified tourist attractions of designated protected areas within the study area.[3]

In spite of the rural and natural character of the study area, there are a number existing overhead power lines in the study area. These include:

- Droërivier-Kappa (Komsberg) 1 400kV
- Droërivier-Kappa (Komsberg) 2 400kV
- Gamma-Kappa 1 765kV

These power lines all congregate at the Komsberg MTS.

There are also a number of future power lines that have been authorised and/or surveyed, but not yet constructed. Of relevance to this study are the surveyed Hidden Valley-Komsberg 1 and 2 power lines and the authorised Maralla WEF-Komsberg MTS and Esizayo WEF-Komsberg MTS. These power lines are indicated on the maps in this report.

Further to this, the proposed Esizayo WEF Expansion Project is located within the Komsberg Renewable Energy Development Zone (REDZ) and Central Strategic Transmission Corridor. Refer to **Figure 2** for the regional locality of the site in relation to the Komsberg REDZ. REDZ are described as:

"areas where large scale wind and solar PV energy facilities can be developed in terms of SIP 8 and in a manner that limits significant negative impacts on the environment, while yielding the highest possible socio-economic benefits to the country."

Source: https://redzs.csir.co.za

Figure 2 further indicates the status of Renewable Energy Environmental Applications (REEA) within the Komsberg REDZ (dated 2021 1st quarter).

Applications that have been approved (additional to the Esizayo WEF) in the region include:

- Rietkloof WEF
- Hidden Valley WEF (Karusa, Great Karoo & Soetwater)
- Brandvalley WEF
- Roggeveld WEF
- Gunstfontein WEF
- Komsberg WEF
- Maralla East and West WEFs
- Karreebosch WEF
- Sutherland WEF

Note: Some of these applications include more than one phase.

It is clear that the region will come under increasing development pressure, and visual intrusion from WEF infrastructure, should all (or most) of the proposed WEFs be constructed.

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[3] Sources: DEAT (ENPAT Northern and Western Cape), Gebhardt (2017), NBI (Vegetation Map of South Africa, Lesotho and Swaziland), NLC2018 (ARC/CSIR), REEA_OR_2021_Q1 and SAPAD2021 (DFFE).

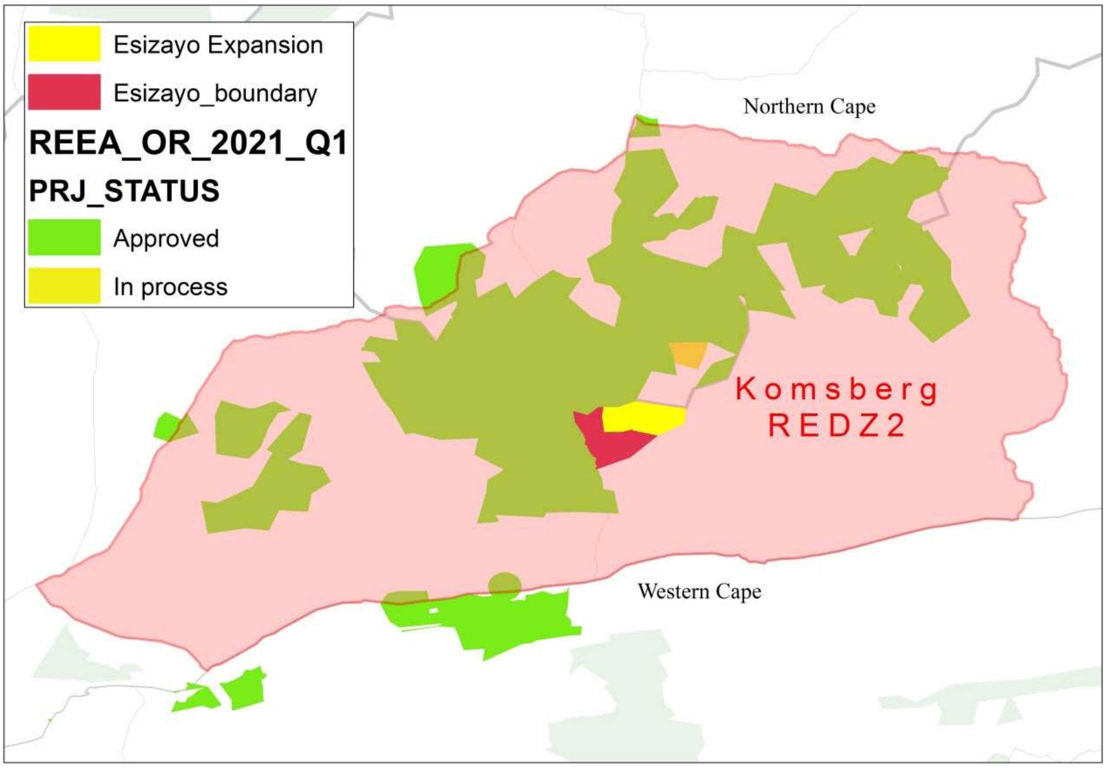


Figure 2: Regional locality of the Esizayo WEF Expansion Project in relation to the Komsberg Renewable Energy Development Zone (REDZ).

*Note: The data above (**Figure 2**) is provided by the Department: Forestry, Fisheries and the Environment (DFFE). The author accepts no responsibility for the accuracy thereof.*

Also refer to **Map 4** for the farms authorised for WEF developments within the study area, the authorised Esizayo WEF and the farms identified for the proposed Esizayo WEF expansion.

The photographs below aid in describing the general environment within the study area and surrounding the proposed project infrastructure.

Figure 3: View along the R354 arterial road looking north towards the Great Escarpment and Sutherland.

Figure 4: The R354 (local tourist route) within the study area.

Figure 5: Typical dry riverbed within the study area.

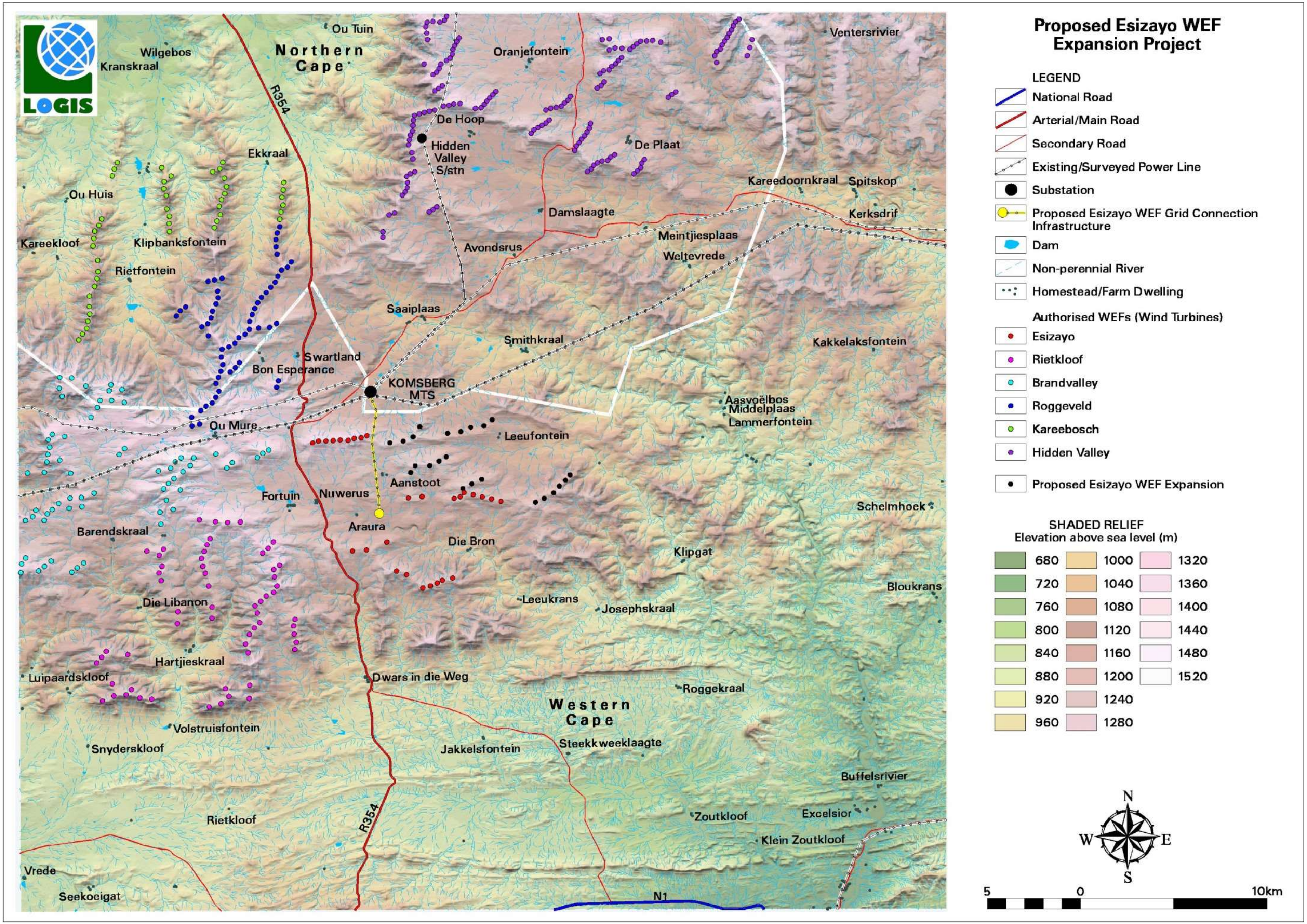
Figure 6: The Komsberg/Kareedoringkraal secondary road.

Figure 7: Existing power lines in the study area.

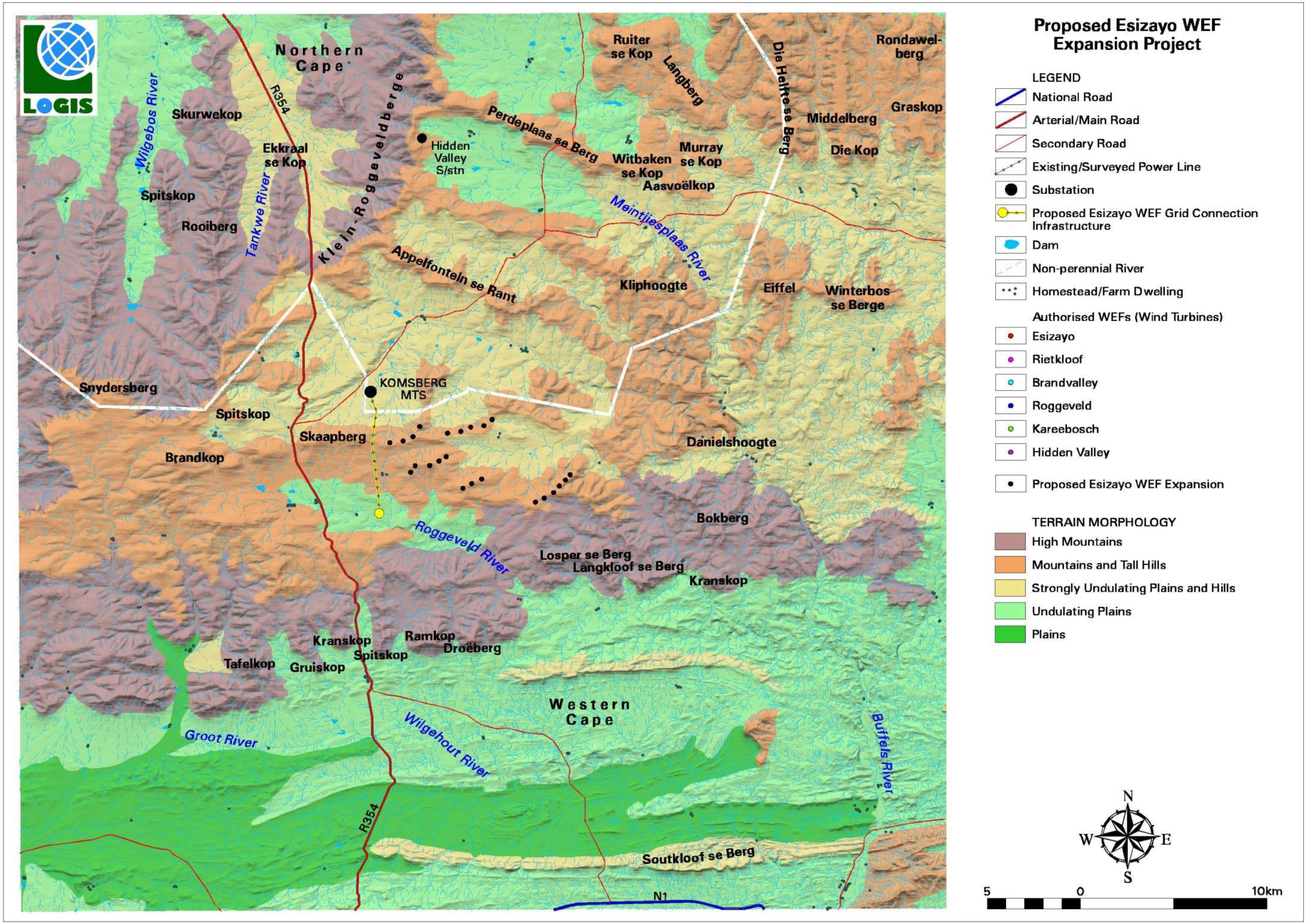
Figure 8: Low shrubland in the study area.

Figure 9: Wide open expanse of the study area.

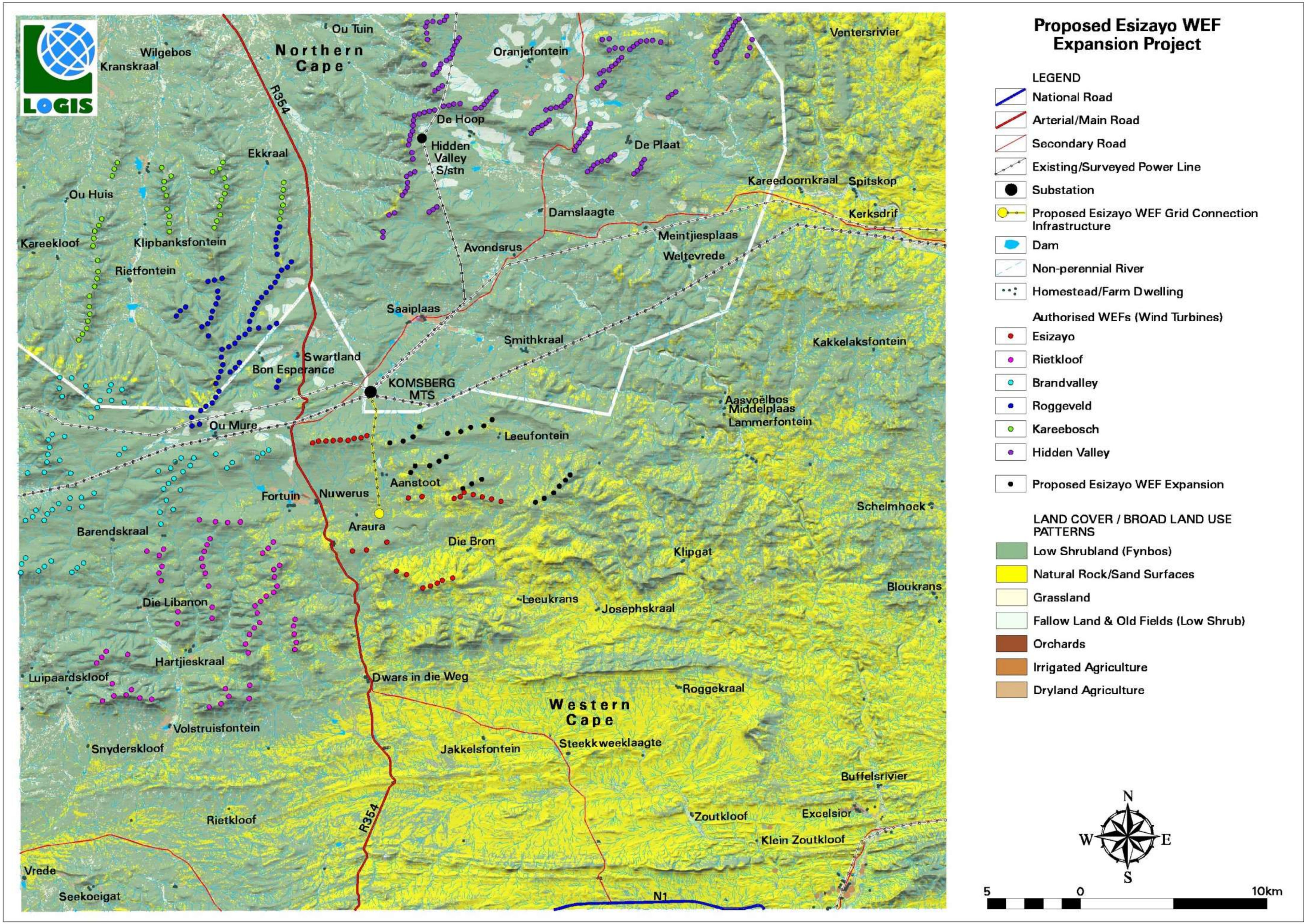
Figure 10: A typical Karoo farmstead/homestead.



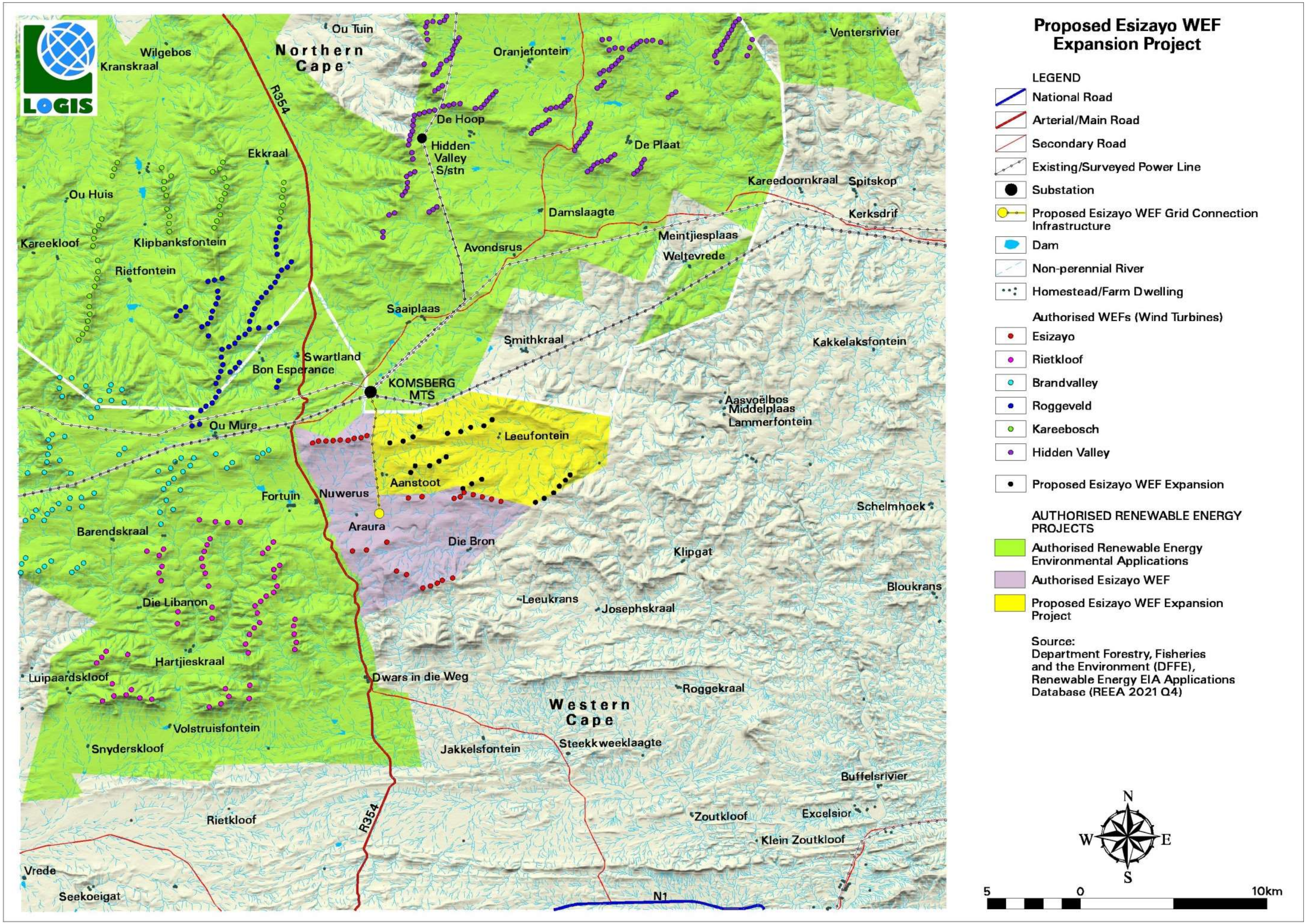
Map 1: Shaded relief map of the study area.



Map 2: Terrain morphology.



Map 3: Land cover and broad land use patterns.



Map 4: Approved/authorised Renewable Energy EIA Applications within the study area.

6. RESULTS

6.1. Potential visual exposure

A visibility analysis was undertaken from each of the wind turbine positions (23 in total) at an offset of 250m (approximate maximum blade-tip-height) above ground level. The result of the visibility analysis is displayed on **Map 5**.

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

The topography of the study area, as was expected, greatly influences the viewshed pattern of the proposed Esizayo WEF Expansion project. The core, uninterrupted area of visual exposure of the wind turbines is largely contained within a 5 - 10km radius of the wind turbine structures. This is due to the Appelfontein se Rant (ridge) to the north and north-east of the proposed development site. The Spitskop and Brandkop hills to the west, the Kranskop, Ramkop and Droëberg hills to the south, and the Losper se Berg, Langkloof se Berg, Kranskop and Bokberg hills to the south-east, similarly contains the visual exposure within a 5 - 10km radius.

Visual exposure within a 10 – 20km radius (to the north-east and east) is largely restricted to the south and west-facing slopes of the mountains and ridges of the Perdeplaas se Berg, Eiffel and Winterbos se Berge. Most of the valleys within this zone are shielded from the wind turbine structures and visual exposure below the Klein-Roggeveldberge escarpment is highly unlikely.

Visibility beyond 20km from the turbine structures will primarily be to the north-east along the south-west-facing slopes of the Langberg, Die Helfte se Berg, Die Kop and Graskop. Visibility to the south, towards the N1 national road, will be contained by the Soutkloof se Berg

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

Less than 5km from the wind turbines:

- Smithkraal
- Leeufontein
- Die Bron
- Araura
- Aanstoot
- Observers travelling along the R354 arterial road and the Komsberg to Kareedoringkraal secondary road

Located within a 5 - 10km radius:

- Saaiplaas
- Avondsrus
- Klipgat

- Josephskraal
- Leeukrans
- Nuwerus
- Fortuin
- Ou Mure
- Bon Esperance
- Swartland

Located within a 10 - 20km radius:

- De Hoop
- Kakkelaksfontein
- Schelmhoek
- Zoutkloof
- Jakkelsfontein

Located beyond 20km:

- Not applicable

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

6.2. 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 has to turn his or her head to see the various WEF's wind turbines; and
- Sequential, when the observer has to move to another viewpoint to see different developments, or different views of the same development (such as when travelling along a route).

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

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

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

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

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

For the purpose of this study, viewshed analyses were undertaken from the proposed Esizayo WEF Expansion Project and all the authorised WEFs within the study area, of which the wind turbine layouts were available at the time of drafting this report.

These include:

- Proposed Esizayo WEF Expansion Project (23 turbines)
- Authorised Esizayo WEF (28 turbines adjacent west and south)
- Rietkloof WEF (60 turbines 8km south-west)
- Hidden Valley WEF (Karusa, Great Karoo & Soetwater) (156 turbines 10km north)
- Roggeveld WEF (58 turbines 7km north-west)
- Karreebosch WEF (45 turbines 13km north-west)
- Brandvalley WEF (67 turbine 6.5km west)

Note: Distances indicated are between the closest wind turbine positions.

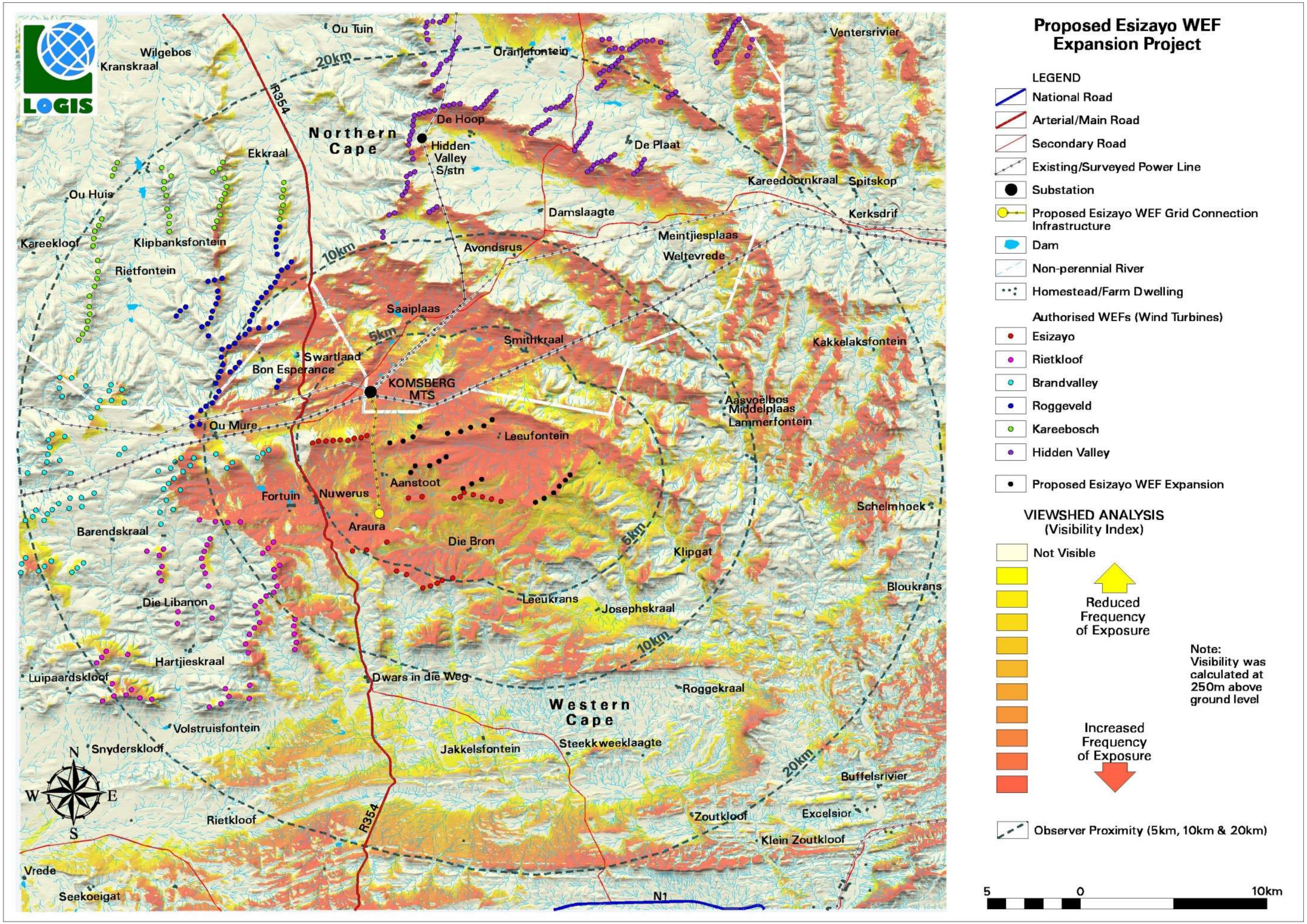
Visibility analyses of the formerly listed seven WEFs were undertaken individually from each of the WEF's wind turbine positions at an offset off 150m above ground level (the approximate/estimated hub-height). The results of these viewshed analyses were overlain in order to determine areas where all seven WEFs may theoretically be visible, areas where six may be visible, areas where five may be visible, etc. and ultimately areas where turbines from only a single WEF may be visible.

The cumulative viewshed analysis is displayed on **Map 6** and the number of WEFs visible is indicated in the legend, e.g. an area where wind turbines from just one WEF is visible are indicated in light blue, and an area where wind turbines from all seven WEFs may be visible are indicated in red.

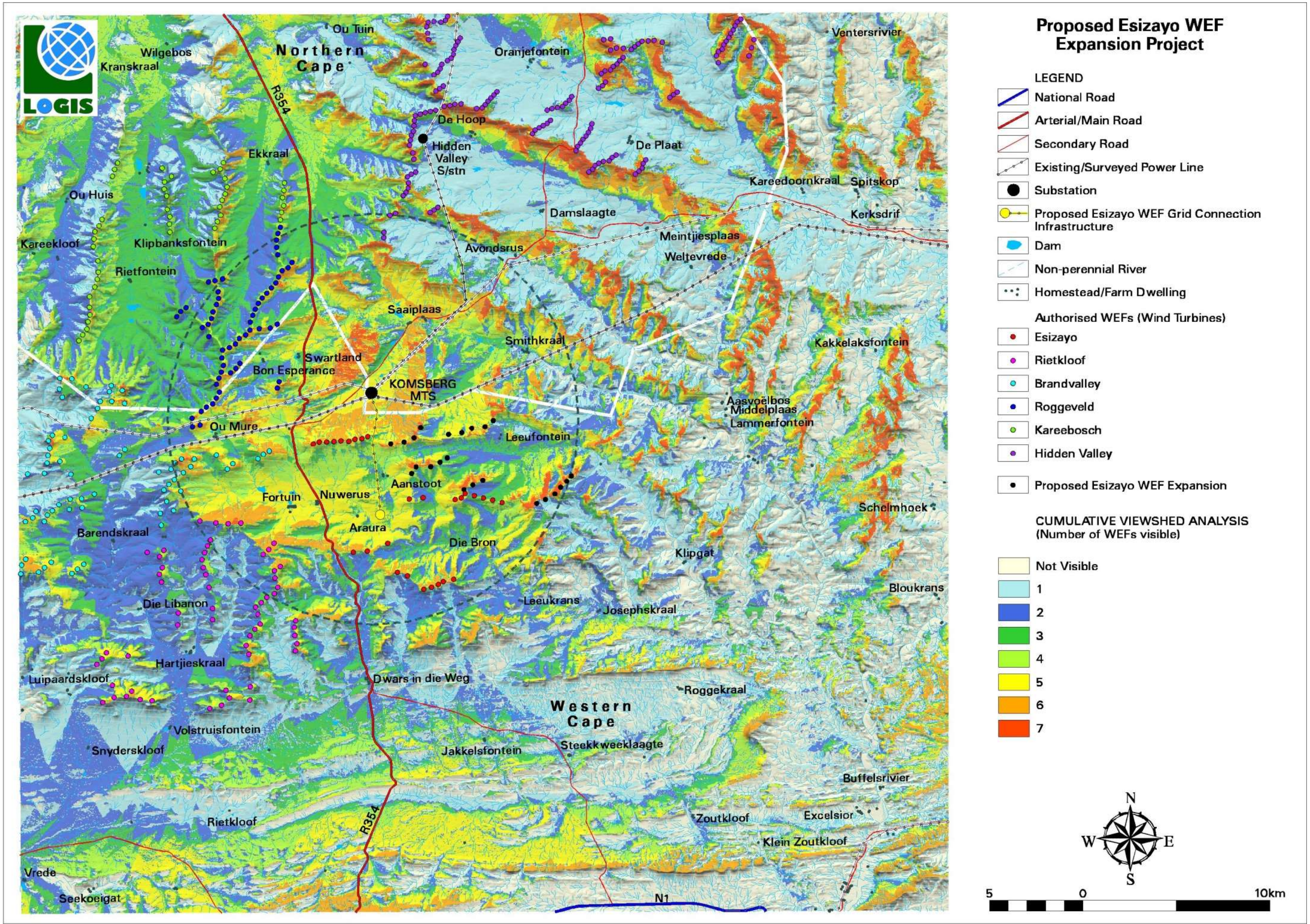
Results

The approximate 437 wind turbine positions within the study area are spread out across a very large surface area. The topography of the study area once again dictates the cumulative, or combined visual exposure of the wind turbine structures. Lower-lying ground and valleys are generally less exposed than elevated topographical units, i.e. mountains, hills and ridges. The highest frequency of visual exposure primarily occurs along the south and west-facing slopes of the parallel ridges (Appelfontein se Rant, Kliphoogte, Perdeplaas se Berg, Langberg, etc.) to the north-east of the study area. These elevated vantage points are prominently indicated on Map 6. The second combined viewshed pattern that emerges is the semi-circular concentration of areas of higher visual exposure surrounding the Komsberg MTS (indicated with a dashed circle on Map 6). This occurrence reinforces the fact that the WEFs are all concentrated within this area due to the Komsberg MTS acting as a grid connecting point, and is therefore not coincidental.

It should be borne in mind that the abovementioned viewshed pattern and cumulative visual exposure (and potential cumulative visual impact) is not an unintended consequence of WEF developments within the region, but rather a concerted effort to concentrate wind energy generation infrastructure within the Komsberg REDZ. This is an effort to prevent the scattered proliferation of wind energy generation infrastructure beyond the REDZ and throughout the greater region. In light of this, and the generally remote location of the REDZ with a limited number of affected sensitive visual receptors, the potential cumulative visual impact is considered to be within acceptable limits.



Map 5: Viewshed analysis of the proposed Esizayo WEF Expansion Project.



Map 6: Cumulative viewshed analysis of the authorised wind turbines within the study area.

6.3. 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 6.1**) of this report.

The proximity radii, based on the dimensions of the proposed development footprint are indicated on **Map 7**, 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 11: Schematic representation of a wind turbine from 1, 2, 5 and 10km under perfect viewing conditions.

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

6.4. Viewer incidence / viewer perception

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

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

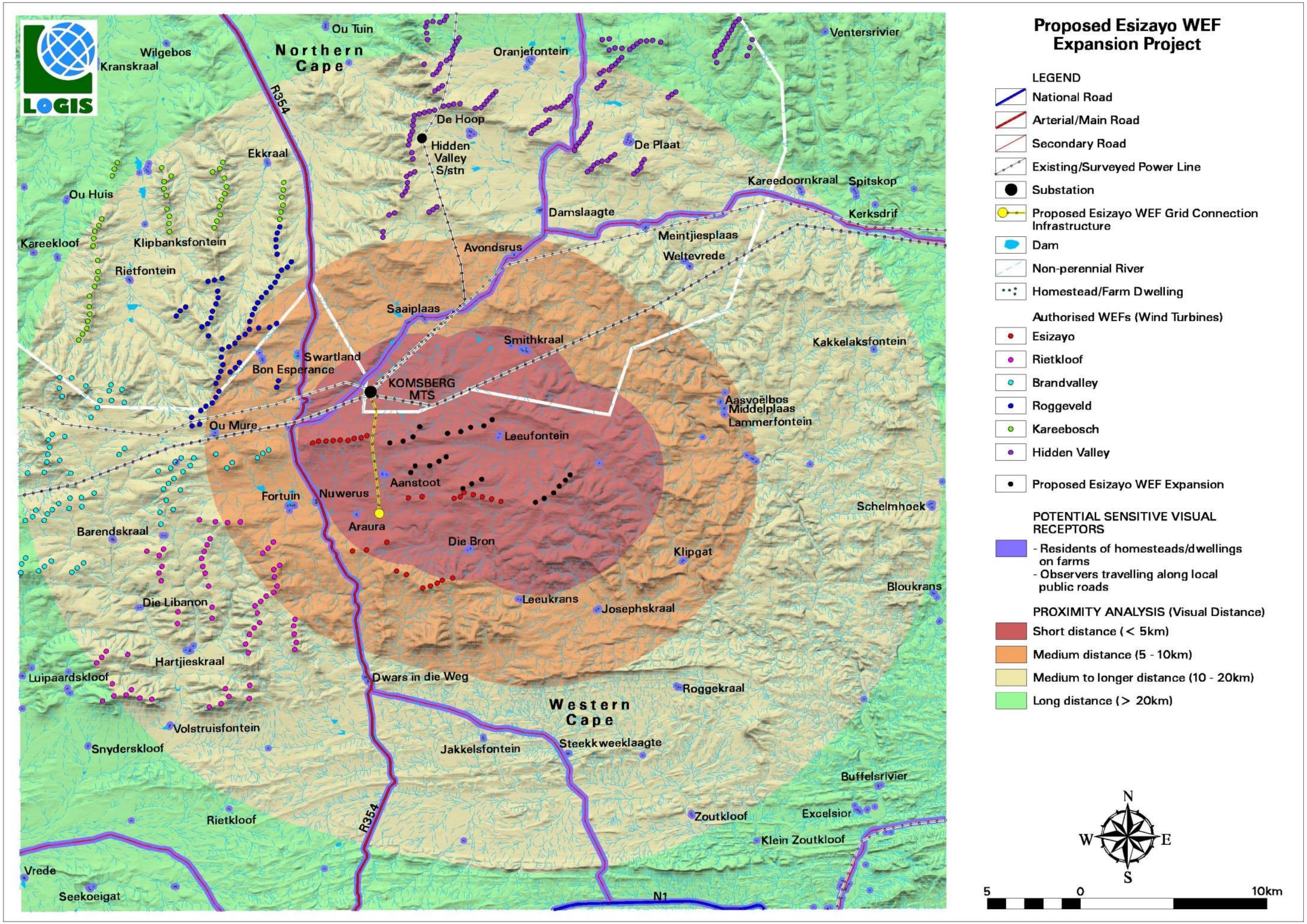
Viewer incidence is calculated to be the highest along the public roads within the study area. This includes the R354 arterial road and, to a lesser degree, the Komsberg/Kareedoringkraal secondary road. Travellers using these roads may be negatively impacted upon by visual exposure to the WEF.

Additional sensitive visual receptors are located at the farm residences (homesteads) throughout the study area. It is expected that the viewer’s perception, unless the observer is associated with (or supportive of) the WEF, would generally be negative.

Due to the remote location of the proposed Esizayo WEF Expansion Project, 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 6.1**. It is expected that these landowners may experience visual impacts ranging from moderate to high significance, depending on their proximity to the wind turbine structures, and their potential sensitivity (aversion) to wind turbine infrastructure.

Refer to **Map 7** for the location of the potential sensitive visual receptors discussed above.

The author is not aware of any specific objections raised against the construction and operation of the proposed Esizayo WEF Expansion Project.



Map 7: Proximity analysis and potential sensitive visual receptors.

6.5. Visual absorption capacity

The vegetation cover within the study area is predominantly *Central Mountain Shale Renosterveld* and *Koedoesberge-Moordenaars Karoo*. The land cover types are low shrubland (Fynbos) for most of the study area, with bare sand and rock surfaces in places.

Overall, the Visual Absorption Capacity (VAC) of the receiving environment is low by virtue of the limited height (or absence) of the vegetation and the overall low occurrence of buildings, structures and infrastructure. 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. Within this area the VAC of vegetation will not be taken into account, thus assuming a worst case scenario in the impact assessment.

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 infrastructure). 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 12: Low shrubland within the study area – low VAC.

6.6. Visual impact index

The combined results of the visual exposure, viewer incidence/perception and visual distance of the proposed Esizayo WEF Expansion Project are displayed on **Map 8**. 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/if sensitive receptors are present) and **moderate** within a 10 – 20km radius (where/if sensitive receptors are present). Receptors beyond 20km are expected to have a **low** potential visual impact.

Likely areas of potential visual impact and potential sensitive visual receptors located within a 20km radius of the proposed WEF 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 observers (within a 5km radius):

Residents of/visitors to:

- Smithkraal
- Leeufontein (Esizayo WEF Expansion Project)
- Die Bron (Authorised Esizayo WEF)
- Araura (Authorised Esizayo WEF)
- Aanstoot (Esizayo WEF Expansion Project)

Note:

The location of Leeufontein, Aanstoot, Die Bron and Araura on the farms earmarked for the Expansion Project or the authorised Esizayo WEF reduces the probability of this impact occurring i.e. it is assumed that the landowners are supportive of the WEF developments on the affected properties.

Observers travelling along the:

- R354 arterial road and the Komsberg/Kareedoringkraal secondary road traversing respectively west and north-west of the proposed WEF

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

Residents of/visitors to:

- Saaiplaas
- Avondsrus
- Klipgat
- Josephskraal
- Leeukrans
- Nuwerus
- Fortuin
- Ou Mure
- Bon Esperance
- Swartland

Note:

The location of these residences (with the exception of Leeukrans, Josephskraal and Klipgat) on farms earmarked for various WEF developments reduces the probability of this impact occurring i.e. it is assumed that the landowners are supportive of the WEF developments on the affected properties.

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

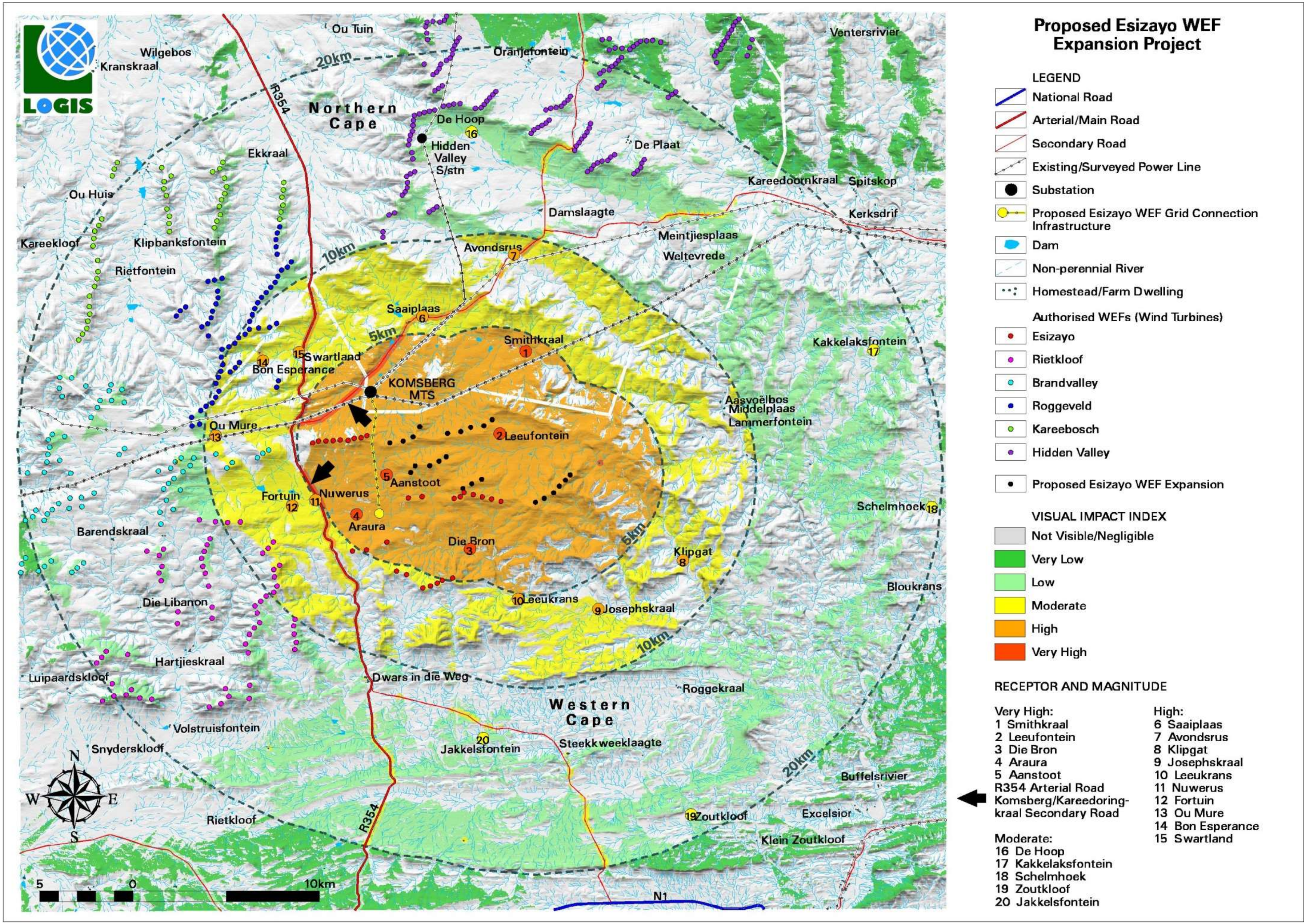
Residents of/visitors to:

- De Hoop
- Kakkelaksfontein
- Schelmhoek
- Zoutkloof
- Jakkelsfontein

Note:

The location of De Hoop on one of the farms earmarked for the Hidden Valley WEF reduces the probability of this impact occurring i.e. it is assumed that the landowner is supportive of the WEF developments on the affected properties.

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 8: Visual impact index and potentially affected sensitive visual receptors.

7. VISUAL IMPACT ASSESSMENT

7.1. 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:** SCOPE OF WORK) related to the visual impact.

The assessment of impacts and mitigation evaluates the likely extent and significance of the potential impacts on identified receptors and resources against defined assessment criteria, to develop and describe measures that will be taken to avoid, minimise or compensate for any adverse environmental impacts, to enhance positive impacts, and to report the significance of residual impacts that occur following mitigation.

The key objectives of the risk assessment methodology are to identify any additional potential environmental issues and associated impacts likely to arise from the proposed project, and to propose a significance ranking. Issues / aspects will be reviewed and ranked against a series of significance criteria to identify and record interactions between activities and aspects, and resources and receptors to provide a detailed discussion of impacts. The assessment considers direct[4], indirect[5], secondary[6] as well as cumulative[7] impacts.

A standard risk assessment methodology is used for the ranking of the identified environmental impacts pre-and post-mitigation (i.e. residual impact). The significance of environmental aspects is determined and ranked by considering the criteria[8] presented in **Table 2**.

Table 3: Impact assessment criteria and scoring system.

CRITERIA	SCORE 1	SCORE 2	SCORE 3	SCORE 4	SCORE 5
Impact Magnitude (M) The degree of alteration of the affected environmental receptor[9]	Very low: No impact on processes	Low: Slight impact on processes	Medium: Processes continue but in a modified way	High: Processes temporarily cease	Very High: Permanent cessation of processes
Impact Extent (E) The geographical extent of the impact on a given environmental receptor[10]	Long distance	Medium to longer distance	Short distance	Very short distance	N.A. Site only

[4] Impacts that arise directly from activities that form an integral part of the Project.
[5] Impacts that arise indirectly from activities not explicitly forming part of the Project.
[6] Secondary or induced impacts caused by a change in the Project environment.
[7] Cumulative impacts are those impacts arising from the combination of multiple impacts from existing projects, the Project and/or future projects.
[8] The definitions given are for guidance only, and not all the definitions will apply to all the environmental receptors and resources being assessed. Impact significance was assessed with and without mitigation measures in place.
[9] This value is read from the visual impact index. Where more than one value is applicable, the higher of these will be used as a worst case scenario.
[10] Long distance = > 20km. Medium to longer distance = 10 – 20km. Short distance = 5 – 10km. Very short distance = < 5km (refer to Section 6.3. Visual distance/observer proximity to the WEF).

CRITERIA	SCORE 1	SCORE 2	SCORE 3	SCORE 4	SCORE 5
Impact Reversibility (R) The ability of the environmental receptor to rehabilitate or restore after the activity has caused environmental change	Reversible: Recovery without rehabilitation		Recoverable: Recovery with rehabilitation		Irreversible: Not possible despite action
Impact Duration (D) The length of permanence of the impact on the environmental receptor	Immediate: On impact	Short term: 0-5 years	Medium term: 5-15 years	Long term: Project life	Permanent: Indefinite
Probability of Occurrence (P) The likelihood of an impact occurring in the absence of pertinent environmental management measures or mitigation	Improbable	Low Probability	Probable	High Probability	Definite
Significance (S) is determined by combining the above criteria in the following formula:	$[S = (E + D + R + M) \times P]$ $Significance = (Extent + Duration + Reversibility + Magnitude) \times Probability$				

IMPACT SIGNIFICANCE RATING					
Total Score	**4 -15**	**16 – 30**	**31 - 60**	**61 to 80**	**81 – 100**
Environmental Significance Rating (Negative (-))	**Very Low**	**Low**	**Moderate**	**High**	**Very High**
Environmental Significance Rating (Positive (+))	**Very Low**	**Low**	**Moderate**	**High**	**Very High**

7.2. Visual impact assessment

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

7.2.1. Construction impacts

7.2.1.1. Potential visual impact of construction activities on sensitive visual receptors in close proximity to the proposed WEF and ancillary infrastructure

During construction, there may be a noticeable increase in heavy vehicles utilising the roads to the development site that may cause, at the very least, a visual nuisance to other road users and landowners in the area.

Construction activities may potentially result in a **moderate** (significance rating = 39) temporary visual impact both before and after mitigation.

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

Potential Impact Visual impact of construction activities on sensitive visual receptors in close proximity to the proposed WEF infrastructure.	**Magnitude**	**Extent**	**Reversibility**	**Duration**	**Probability**	**Significance**		**Character**	**Confidence**
Without Mitigation	4	4	3	2	3	**39**	**Moderate**	(-)	High
With Mitigation	3	3	3	2	3	**36**	**Moderate**	(-)	High
Mitigation and Management Measures	Planning: • Retain and maintain natural vegetation immediately adjacent to the development footprint/servitude. Construction: • Ensure that vegetation is not unnecessarily removed during the construction phase. • Plan the placement of lay-down areas and temporary construction equipment camps in order to minimise vegetation clearing (i.e. in already disturbed areas) wherever possible. • Restrict the activities and movement of construction workers and vehicles to the immediate construction area 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.								

7.2.2. Operational impacts

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

The operation of the Esizayo WEF Expansion Project is expected to have a **high** visual impact (significance rating = 64) on observers/visitors residing at homesteads within a 5km radius of the wind turbine structures. This includes:

- Smithkraal

The following WEF properties are provisionally included, due to their assumed support for WEF developments. The homestead's names are listed below.

- Leeufontein
- Die Bron
- Araura
- Aanstoot

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

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

Potential Impact	**Magnitude**	**Extent**	**Reversibility**	**Duration**	**Probability**	**Significance**		**Character**	**Confidence**
Visual impact on observers (residents at homesteads and visitors/tourists) in close proximity (i.e. within 5km) to the wind turbine structures									
Without Mitigation	5	4	3	4	4	**64**	**High**	(-)	High
With Mitigation	5	4	3	4	4	**64**	**High**	(-)	High
Mitigation and Management Measures	***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.								

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

The operation of the Esizayo WEF Expansion Project is expected to have a **high** visual impact (significance rating = 64) on observers traveling along the roads within a 5km radius of the wind turbine structures. This includes observers travelling along the:

- Observers travelling along the R354 arterial road and the Komsberg to Kareedoringkraal secondary road

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

Table 6: Visual impact on observers travelling along roads in close proximity to the proposed wind turbine structures.

Potential Impact	**Magnitude**	**Extent**	**Reversibility**	**Duration**	**Probability**	**Significance**		**Character**	**Confidence**
Visual impact on observers travelling along the roads in close proximity (i.e. within 5km) to the wind turbine structures									
Without Mitigation	5	4	3	4	4	**64**	**High**	(-)	High
With Mitigation	5	4	3	4	4	**64**	**High**	(-)	High
Mitigation and Management Measures	***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.								

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

The Esizayo WEF Expansion Project could have a **moderate** visual impact (significance rating = 56) on residents of (or visitors to) homesteads within a 5 - 10km radius of the wind turbine structures.

Residents of/visitors to:

- Josephskraal
- Leeukrans
- Klipgat

The following properties are provisionally included, due to their location on farms earmarked for various WEF developments and their assumed support for WEF developments within the region.

- Saaiplaas
- Avondsrus

- Nuwerus
- Fortuin
- Ou Mure
- Bon Esperance
- Swartland

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

Table 7: Visual impact of the proposed wind turbine structures within the region (5 – 10km).

Potential Impact	**Magnitude**	**Extent**	**Reversibility**	**Duration**	**Probability**	**Significance**		**Character**	**Confidence**
Visual impact on observers travelling along the roads and residents at homesteads within a 5 – 10km radius of the wind turbine structures									
Without Mitigation	4	3	3	4	4	**56**	**Moderate**	(-)	High
With Mitigation	4	3	3	4	4	**56**	**Moderate**	(-)	High
Mitigation and Management Measures	***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.								

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

The Expansion Project could have a **moderate** visual impact (significance rating = 48) on residents of (or visitors to) homesteads within a 10 - 20km radius of the wind turbine structures.

Residents of/visitors to:

- Kakkelaksfontein
- Schelmhoek
- Zoutkloof
- Jakkelsfontein

The following property (located within the Hidden valley WEF) is provisionally included, due to its assumed support for WEF developments. The homestead's name is listed below.

- De Hoop

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

Table 8: Visual impact of the proposed wind turbine structures within the region (10 – 20km).

Potential Impact	**Magnitude**	**Extent**	**Reversibility**	**Duration**	**Probability**	**Significance**		**Character**	**Confidence**
Visual impact on observers travelling along the roads and residents at homesteads within a 10 – 20km radius of the wind turbine structures									
Without Mitigation	3	2	3	4	4	**48**	**Moderate**	(-)	High
With Mitigation	3	2	3	4	4	**48**	**Moderate**	(-)	High
Mitigation and Management Measures	***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.								

7.2.2.5. Shadow flicker

Shadow flicker only occurs when the sky is clear, and when the turbine rotor blades are between the sun and the receptor (i.e. when the sun is low). De Gryse in Scenic Landscape Architecture (2006) found that "*most shadow impact is associated with 3-4 times the height of the object*". Based on this research, an 1,000m buffer along the edge of the outer most turbines is identified as the zone within which there is a risk of shadow flicker occurring.

There are no places of residence within the 1,000m buffer. The significance of shadow flicker is therefore anticipated to be **low** to **negligible**.

Table 9: Visual impact of shadow flicker on sensitive visual receptors in close proximity to the proposed WEF.

Potential Impact	**Magnitude**	**Extent**	**Reversibility**	**Duration**	**Probability**	**Significance**		**Character**	**Confidence**
Visual impact of shadow flicker on sensitive visual receptors in close proximity to the proposed WEF									
Without Mitigation	2	4	3	4	2	**26**	**Low**	(-)	High
With Mitigation	2	4	3	4	2	**26**	**Low**	(-)	High
Mitigation and Management	N.A. due to the low probability of occurrence								

7.2.2.6. Lighting impacts

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 close proximity.

Another source of glare light, albeit not as intense as flood lighting, is the aircraft warning lights mounted on top of the hub of the wind turbines. These lights are less aggravating due to the toned-down red colour, but have the potential to be visible from a great distance. 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.

Figure 13: 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.)

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 switchon signal to the central wind farm control to activate the obstacle lights. See diagram in **Figure 14** below.[11]

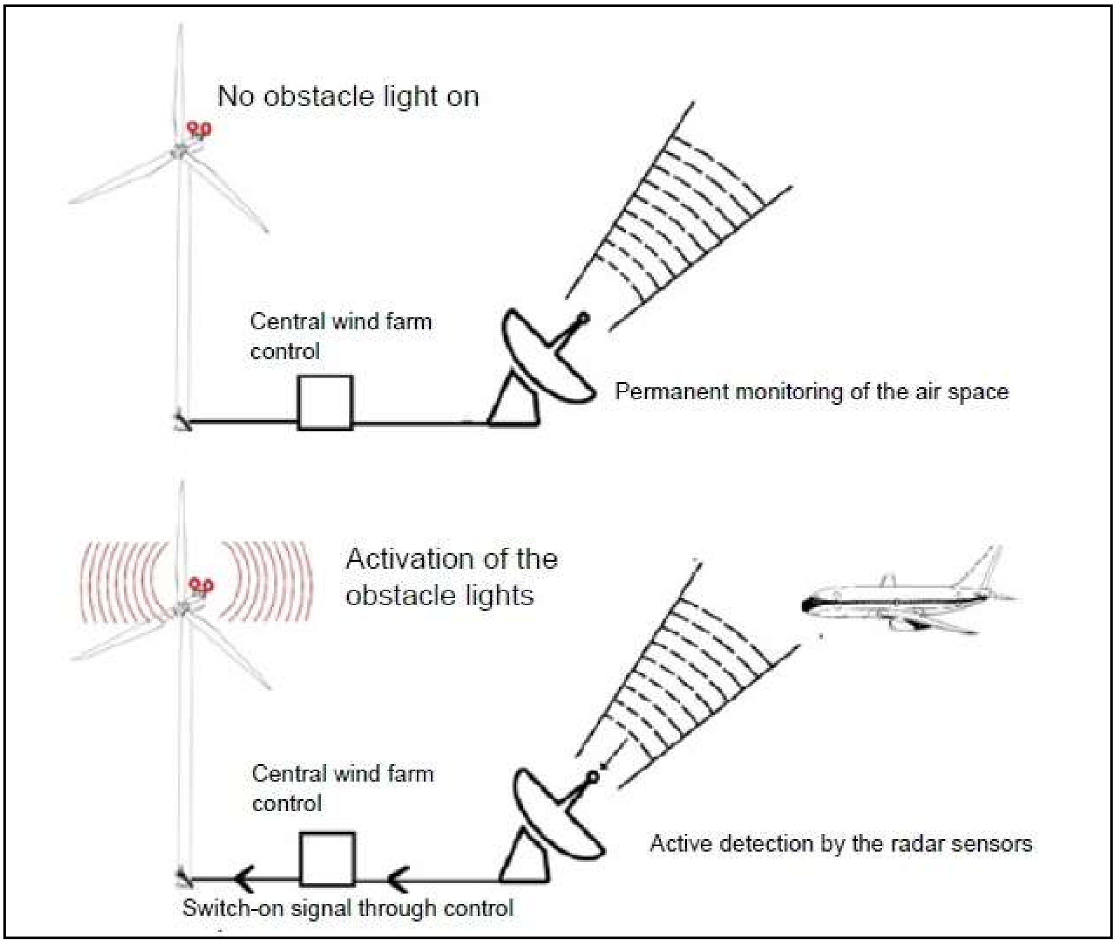


Figure 14: Diagram of the functional principle of the needs-based night lights.

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

This anticipated lighting impact is likely to be of **high** significance (rating = 64), and may be mitigated to **moderate** (rating = 42) especially within a 5 to 10km radius of the wind turbine structures.

Table 10: Impact table summarising the significance of visual impact of lighting at night on visual receptors in close to medium proximity (< 5km and potentially up to 10km) to the proposed WEF.

Potential Impact	**Magnitude**	**Extent**	**Reversibility**	**Duration**	**Probability**	**Significance**		**Character**	**Confidence**
Visual impact of lighting at night on sensitive visual receptors									
Without Mitigation	5	4	3	4	4	**64**	**High**	(-)	High
With Mitigation	3	4	3	4	3	**42**	**Moderate**	(-)	High
Mitigation and Management	Planning & operation:								

[11] Source: Nordex Energy GmbH, 2019

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
Visual impact of lighting at night on sensitive visual receptors									
Measures	• 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.								

7.2.2.7. Ancillary infrastructure

On-site ancillary infrastructure associated with the WEF includes a 33/132kV substation and collector substation, underground 33kV cabling between the wind turbines, internal access roads, workshop and office and staff accommodation. No dedicated viewshed analyses have been generated for the ancillary infrastructure, as the range of visual exposure will fall within (and be overshadowed by) that of the turbines.

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

Table 11: Visual impact of the ancillary infrastructure.

Potential Impact	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
Visual impact of the ancillary infrastructure on observers in close proximity to the structures.									
Without Mitigation	2	4	3	4	2	**26**	**Low**	(-)	High
With Mitigation	2	4	3	4	2	**26**	**Low**	(-)	High
Mitigation and Management Measures	***Generic best practise mitigation / management measures:*** Planning: • Retain/re-establish and maintain natural								

Potential Impact Visual impact of the ancillary infrastructure on observers in close proximity to the structures.	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
	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.								

7.3. Visual impact assessment: secondary impacts

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

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

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

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 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 **low** 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 12: The potential impact on the sense of place of the region.

Potential Impact The potential impact on the sense of place of the region	Magnitude	Extent	Reversibility	Duration	Probability	Significance		Character	Confidence
Without Mitigation	2	1	3	4	2	**20**	**Low**	(-)	High
With Mitigation	2	1	3	4	2	**20**	**Low**	(-)	High
Mitigation and Management Measures	***Generic best practise mitigation / management measures:*** Planning:								

<table>
<tr><td>Potential Impact</td><td rowspan="2">Magnitude</td><td rowspan="2">Extent</td><td rowspan="2">Reversibility</td><td rowspan="2">Duration</td><td rowspan="2">Probability</td><td rowspan="2">Significance</td><td rowspan="2">Character</td><td rowspan="2">Confidence</td></tr>
<tr><td>The potential impact on the sense of place of the region</td></tr>
<tr><td></td><td colspan="8">• 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.</td></tr>
</table>

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

The cumulative visual impact of the proposed Esizayo WEF Expansion Project and an additional six authorised WEFs (refer to **Section 6.2.**) will primarily be restricted to an approximate 11km radius from the Komsberg MTS.

The cumulative visual impact is expected to be **high**, depending on the observer's sensitivity to wind turbine structures. In spite of this, the cumulative visual impact is still considered to be within acceptable limits, due to the generally remote location of the Komsberg REDZ and the relatively limited number of affected sensitive visual receptors.

Table 13: The potential cumulative visual impact of wind farms on the visual quality of the landscape.

<table>
<tr><td colspan="3">Nature of Impact:
The potential cumulative visual impact of wind farms on the visual quality of the landscape</td></tr>
<tr><td></td><td>Overall impact of the proposed project considered in isolation (with mitigation)</td><td>Cumulative impact of the project and other projects within the area (with mitigation)</td></tr>
<tr><td>Extent</td><td>Very Short Distance (4)</td><td>Very Short Distance (4)</td></tr>
<tr><td>Duration</td><td>Long term (4)</td><td>Long term (4)</td></tr>
<tr><td>Magnitude</td><td>Very High (5)</td><td>Very High (5)</td></tr>
<tr><td>Probability</td><td>Highly Probable (4)</td><td>Highly Probable (4)</td></tr>
<tr><td>Significance</td><td>High (64)</td><td>High (64)</td></tr>
<tr><td>Status (positive, neutral or negative)</td><td>Negative</td><td>Negative</td></tr>
<tr><td>Reversibility</td><td>Reversible (3)</td><td>Reversible (3)</td></tr>
<tr><td>Irreplaceable loss of resources?</td><td>No</td><td>No</td></tr>
<tr><td>Can impacts be mitigated?</td><td colspan="2">No, only best practise measures can be implemented</td></tr>
<tr><td>Generic best practise mitigation/management measures:</td><td colspan="2"><u>Planning:</u>
• Retain/re-establish and maintain natural vegetation immediately adjacent to the development footprint/servitude.
<u>Operations:</u>
• Maintain the general appearance of the servitude as a</td></tr>
</table>

	whole. Decommissioning: • Remove infrastructure not required for the post-decommissioning use. • Rehabilitate all affected areas. Consult an ecologist regarding rehabilitation specifications.
Residual impacts:	The visual impact will be removed after decommissioning, provided the grid infrastructure is removed. Failing this, the visual impact will remain.

7.4. The potential to mitigate visual impacts

The primary visual impact, namely the appearance of the 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**, and where deemed feasible.

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

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

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

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

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

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

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

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

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

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

  Where sensitive visual receptors (as identified in **Section 6.6.**) 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.

8. CONCLUSION AND RECOMMENDATIONS

The visual impact assessment (VIA) practitioner takes great care to ensure that all the spatial analyses and mapping are as accurate as possible. The intention is to quantify, using visibility analyses, proximity analyses and the identification of sensitive receptors, the potential visual impacts associated with the proposed Esizayo WEF Expansion Project. 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 predominantly be negative towards the development of a WEF in the region.

There are likely to be supporters of the Esizayo WEF Expansion Project (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 (should any be identified). To the knowledge of the author, no objections were raised.

However, it is expected that the construction and operation of the proposed Esizayo WEF Expansion Project and its associated infrastructure, will have a high visual impact on the study area, especially within a 5km (and potentially up to 10km) radius of the proposed facility. The visual impact will differ amongst places, depending on the distance from the facility. Tourists travelling through the region and residents of homesteads will likely experience visual impacts where the wind turbine structures are visible.

The combined visual impact or cumulative impact of up to seven wind energy facilities (i.e. the proposed Esizayo WEF Expansion Project and six authorised WEFs) is expected to increase the area of potential visual impact within the region. The intensity of visual impact (number of turbines visible) to exposed receptors, especially those located within a 5km (and potentially up to 10km) radius of the proposed Esizayo WEF, is expected to increase when considered in conjunction with the other proposed or authorised WEFs. The fact that these WEFs are located within the remote Komsberg REDZ offsets the significance of this impact to some degree. This is due mainly to the fact that the population density of the region is very low and mostly (in terms of surface area) devoid of sensitive visual receptors.

Overall, the significance of the visual impacts associated with the proposed Esizayo WEF Expansion Project is expected to be high as a result of the generally undeveloped character of the landscape. The facility would be visible within an area that contains certain sensitive visual receptors who could consider visual exposure to this type of infrastructure to be intrusive. Such visual receptors include people travelling along the arterial and secondary roads, residents of rural homesteads and tourists passing through or holidaying in the region.

Conventional mitigation (e.g. such as screening of the structures) of the potential visual impacts is highly unlikely to succeed due to the nature of the development and the receiving environment. A number of mitigation measures have been proposed (**Section 7.4.**). The proposed mitigation measures will primarily be effective in terms of mitigating lighting and construction phase visual impacts.

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

9. IMPACT STATEMENT

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

The following is a summary of impacts remaining:

- Construction activities may potentially result in a **moderate** temporary visual impact both before and after mitigation.

- The operation of the Esizayo WEF Expansion Project is expected to have a **high** visual impact on observers/visitors residing at homesteads within a 5km radius of the wind turbine structures. No mitigation of this impact is possible.

- The operation of the Esizayo WEF Expansion Project is expected to have a **high** visual impact on observers traveling along the public roads within a 5km radius of the wind turbine structures. No mitigation of this impact is possible.

- The operation of the Esizayo WEF Expansion Project could have a **moderate** visual impact on sensitive visual receptors within the region (5

- 10km radius of the wind turbine structures). No mitigation of this impact is possible.

- The Esizayo WEF Expansion Project could have a **moderate** visual impact on residents of (or visitors to) homesteads within a 10 - 20km radius of the wind turbine structures.

- There are no places of residence within a 1,000m buffer from the wind turbine structures. The significance of shadow flicker is therefore anticipated to be **low** to **negligible**.

- The anticipated night-time lighting impact is likely to be of **high** significance and may be mitigated to **moderate**, provided that *needs-based aircraft warning lights* (if permitted by the CAA and deemed feasible), is installed.

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

- 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 **low** significance.

- The cumulative visual impact of the proposed Esizayo WEF Expansion Project and six authorised WEFs is expected to be of **high** significance. In spite of this, the cumulative visual impact is still considered to be within acceptable limits, due to the generally remote location of the Komsberg REDZ and the limited number of affected sensitive visual receptors.

The anticipated visual impacts listed above (i.e. post mitigation impacts) range from **high** to **low** significance. Anticipated visual impacts on sensitive visual receptors in close proximity to the proposed facility remain high and are not possible to mitigate. Even though it is possible that the potential visual impacts may exceed acceptable levels within the context of the receiving environment, the proposed WEF development is not considered to be fatally flawed.

A fatal flaw occurs when:

- There is non-compliance with Acts, Ordinances, By-laws and adopted policies relating to visual pollution, scenic routes, special areas or proclaimed heritage sites.

- Non-compliance with conditions of existing Records of Decision.

- Impacts that may be evaluated to be of high significance and that are considered by the **majority** of stakeholders and decision-makers to be unacceptable.[12]

In terms of the proposed wind turbine layout, the project proponent needs to adhere to all relevant National, Provincial and Local Government regulations and ordinances, including all prescribed health and safety guidelines. If these are not adhered to, the layout may be deemed non-compliant, and may need to be revised in order to ensure compliance. The author is not aware of any non-compliance and the layout is deemed acceptable within this (legal) context.

[12] Source: Oberholzer, B. 2005

10. 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 overleaf.

Table 14: Management programme – Planning.

<table>
<tr><td colspan="3">OBJECTIVE: The mitigation and possible negation of visual impacts associated with the planning of the Proposed Esizayo Expansion Project.</td></tr>
<tr><td>Project Component/s</td><td colspan="2">The WEF and ancillary infrastructure (i.e. turbines, access roads, substations and workshop).</td></tr>
<tr><td>Potential Impact</td><td colspan="2">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.</td></tr>
<tr><td>Activity/Risk Source</td><td colspan="2">The viewing of the above mentioned by observers on or near the site (i.e. within 5km and potentially up to 10km of the site) as well as within the region.</td></tr>
<tr><td>Mitigation: Target/Objective</td><td colspan="2">Optimal planning of infrastructure to minimise visual impact.</td></tr>
<tr><td>Mitigation: Action/control</td><td>Responsibility</td><td>Timeframe</td></tr>
<tr><td>Retain and maintain natural and / or cultivated vegetation in all areas outside of the development footprint, but within the project site.</td><td>Project proponent/ design consultant/ Engineering, Procurement and Construction (EPC) contractor</td><td>Early in the planning phase.</td></tr>
<tr><td>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.</td><td>Project proponent/ design consultant/ EPC contractor</td><td>Early in the planning phase.</td></tr>
<tr><td>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.</td><td>Project proponent/ design consultant/ EPC contractor</td><td>Early in the planning phase.</td></tr>
<tr><td>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, and 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</td><td>Project proponent/ design consultant/ EPC contractor</td><td>Early in the planning phase.</td></tr>
</table>

lighting, so allowing the site to remain in 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 15: Management programme – Construction.

OBJECTIVE: The mitigation and possible negation of visual impacts associated with the construction of the Proposed Esizayo Expansion Project.		
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 16: Management programme – Operation.

OBJECTIVE: The mitigation and possible negation of visual impacts associated with the operation of the Proposed Esizayo Expansion Project.		
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 17: Management programme – Decommissioning.

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

Monitoring	Monitoring of rehabilitated areas quarterly for at least a year following decommissioning.

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