UMMBILA EMOYENI WIND ENERGY FACILITY

Mpumalanga Province

Environmental Impact Assessment Report

DFFE Reference No.: 14/12/16/3/3/2/2160

October 2022

savannah environmental

t +27 (0)11 656 3237 f +27 (0)86 684 0547

e info@savannahsa.com w www.savannahsa.com

Prepared for:

Emoyeni Renewable Energy Farm (Pty) Ltd
Unit 3, Denmar Square
45 Bell Crescent Road
Westlake
Cape Town
7945

Prepared by:

savannah environmental

t +27 (0)11 656 3237 f +27 (0)86 684 0547 e info@savannahsa.com w www.savannahsa.com
First Floor, Block 2, 5 Woodlands Drive Office Park, Cnr Woodlands Drive & Western Service Road, Woodmead, 2191

PROJECT DETAILS

DFFE Ref No.:	:	14/12/16/3/3/2/2160
Title	:	Environmental Impact Assessment Process: Scoping Report for the Ummbila Emoyeni Wind Energy Facility, Mpumalanga Province
Authors	:	Savannah Environmental (Pty) Ltd Jo-Anne Thomas
Client	:	Emoyeni Renewable Energy Farm (Pty) Ltd
Report Revision	:	Final for Authority review and decision-making
Date	:	October 2022

When used as a reference this report should be cited as: Savannah Environmental (2022) Environmental Impact Assessment Report for the Ummbila Emoyeni Wind Energy Facility, Mpumalanga Province.

PURPOSE OF THE EIA REPORT AND INVITATION TO COMMENT

Emoyeni Renewable Energy Farm (Pty) Ltd has appointed Savannah Environmental as the independent environmental consultant to undertake the Scoping and Environmental Impact Assessment (S&EIA) process for the Ummbila Emoyeni Wind Energy Facility, Mpumalanga Province. The EIA process is being undertaken in accordance with the requirements of the 2014 EIA Regulations promulgated in terms of the National Environmental Management Act (No. 107 of 1998) (NEMA).

This EIA Report consists of twelve chapters, as follows:

- **Chapter 1** provides background to the Ummbila Emoyeni Wind Energy Facility and the EIA process.
- **Chapter 2** provides a description of the wind farm and infrastructure associated with the facility.
- **Chapter 3** provides the site selection information and identified project alternatives.
- **Chapter 4** describes wind energy as a power generation option and provides insight to technologies for wind energy.
- **Chapter 5** outlines the strategic regulatory and legal context for energy planning in South Africa, and specifically for the proposed facility.
- **Chapter 6** describes the need and desirability of the Ummbila Emoyeni Wind Energy Facility within the project site.
- **Chapter 7** outlines the process which was followed during the EIA process.
- **Chapter 8** describes the existing biophysical and socio-economic environment affected by the proposed facility.
- **Chapter 9** provides a description and assessment of the potential impacts associated with the proposed wind farm and associated infrastructure.
- **Chapter 10** provides a description and assessment of the potential cumulative impacts associated with the proposed wind farm and associated infrastructure.
- **Chapter 11** presents the conclusions and recommendations based on the findings of the EIA for the Ummbila Emoyeni Wind Energy Facility.
- **Chapter 12** provides references used in the compilation of the EIA Report.

The EIA Report was made available for review from **Thursday, 08 September 2022 – Monday, 10 October 2022** on the Savannah Environmental website (https://savannahsa.com/public-documents/energy-generation/). All comments received have been included within a Comments and Responses Report included as Appendix C of this report. Changes made to this final report have been underlined for ease of reference.

EXECUTIVE SUMMARY

Emoyeni Renewable Energy Farm (Pty) Ltd is proposing the development of a commercial Wind Energy Facility and associated infrastructure on a site located ~6km south-east of Bethal and 1km east of Morgenzon, within the Mpumalanga Province. The project site is located across the Govan Mbeki, Lekwa, and Msukaligwa Local Municipalities within the Gert Sibande District (refer to **Figure 1.1**). The facility will have a contracted capacity of up to 900MW[1] and will be known as the Ummbila Emoyeni Wind Energy Facility. The project is planned as part of a larger cluster of renewable energy projects (to be known as the Ummbila Emoyeni Renewable Energy Farm), which include one 900MW wind energy facility, to be developed in several phases, and one 150MW solar energy facility The grid connection infrastructure for both facilities will include a 400/132kV Main Transmission Substation (MTS), to be located between the Camden and SOL Substations, which will be looped in and out of the existing Camden-Sol 400kV transmission line; on-site switching stations (132kV in capacity) at each renewable energy facility (Eskom Portion); 132kV power lines from the switching stations at each renewable energy facility to the new 400/132kV MTS; and a collector substation with 2 x 132kV bus bars and 4 x 132kV IPP feeder bays to the onsite IPP Substation.

Each renewable energy facility will be constructed as a separate stand-alone project and therefore, separate Scoping and Environmental Impact Assessment (S&EIA) processes will be undertaken for each of the renewable energy facilities. Similarly, the grid connection solution will be subjected to a separate S&EIA process.

From a regional perspective, the identified area within the Mpumalanga Province is considered favourable for the development of a commercial wind energy facility by virtue of prevailing climatic conditions, relief, the extent of the affected properties, the availability of a direct grid connection (i.e., a point of connection of the national grid) and the availability of land on which the development can take place. A technically feasible project site[2], with an extent of ~27 819ha has been identified by Emoyeni Renewable Energy Farm (Pty) Ltd as a technically suitable area for the development of the Ummbila Emoyeni Wind Energy Facility. The project site comprises numerous properties as listed in **Table 1** below.

Table 1: Detailed description of the Ummbila Emoyeni Wind Energy Facility project site

Province	**Mpumalanga Province**
District Municipality	Gert Sibande District Municipality
Local Municipality	Govan Mbeki, Lekwa, and Msukaligwa Local Municipalities
Ward Number (s)	Ward 15 of the Govan Mbeki Local Municipality Ward 12 of the Lekwa Local Municipality Wards 8 and 10 of the Msukaligwa Local Municipality
Nearest town(s)	Richmond (~35km south-west) and Victoria West (~80km south-east)
Affected Properties:	

Parent Farm Number	**Farm Portions**
Farm 261 – Naudesfontein	15 R/E, 21
Farm 264 – Geluksplaats	0, 1, 3, 4, 5, 6 R/E, 8 R/E, 9R/E, 10, 11, 12
Farm 268 – Brak Fontein Settlement	6,7,10,11,12

[1] The draft EIA Report referred to a capacity of 666MW. The change in capacity has been included in the Final EIA Report to accommodate changes in technology. The project footprint and turbine specifications remain unchanged from those presented within the draft EIA Report.

[2] The project site is the area with an extent of 27 819ha, within which the Ummbila Emoyeni Wind Energy Facility development footprint will be located.

Farm 420 – Rietfontein	8,9,10,11,12,15 R/E,16,18,19,22,32
Farm 421 - Sukkelaar	2, 2, 7, 9, 9 10, 10 11, 11 12, 12, 22 ,25 R/E, 34, 35, 36, 37, 37, 38, 39, 40, 42, 42
Farm 422 – Klipfontein	0, 2 R/E, 3 R/E, 4, 5, 6, 7, 8 R/E, 9, 10, 12, 13 R/E, 14 R/E, 16, 17, 18, 19, 20, 21, 22, 23
Farm 423 – Bekkerust	0 R/E, 1, 2 R/E, 4, 5 R/E, 6, 10, 11, 12, 13 14, 15, 17, 19 R/E, 20, 22, 23, 24,25
Farm 454 – Oshoek	4 R/E, 13, 18
Farm 455 – Ebenhaezer	0, 1, 2, 3
Farm 456 – Vaalbank	1, 2, 3, 4, 7, 8, 13, 15, 16, 17, 18, 19
Farm 457 – Roodekrans	0, 1, 4, 5, 7, 22, 23, 23
Farm 458 – Goedgedacht	0, 2, 3, 4, 4, 5, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 21, 21, 22, 23, 25, 26 R/E, 27, 28, 29, 31, 32, 33, 34, 35, 36, 37, 39, 41, 42, 43
Farm 467 – Twee Fontein	0 R/E, 1 R/E, 4 R/E, 5, 6, 7 R/E, 8, 10
Farm 469 – Klipkraal	5 R/E, 6, 7, 8
Farm 548 – Durabel	0
Farm 470 – Dorpsplaats	85
Farm 451 - Drinkwater	4, 22
Farm 452 - Brakfontein	5

The full extent of the project site has been considered within the EIA process with the aim of determining the suitability from an environmental and social perspective and identifying areas that should be avoided in development planning. Within this identified project site, a development area and a development footprint have been defined for assessment. The project site is larger than the area required for the development footprint of a 900MW Wind Energy Facility and therefore provides the opportunity for the optimal placement of infrastructure, ensuring avoidance of major identified environmental sensitivities or constraints identified through this EIA process.

The Ummbila Emoyeni Wind Energy Facility is proposed in response to the identified objectives of national and provincial government and local and district municipalities to develop renewable energy facilities for power generation purposes. It is the developer's intention to bid the Ummbila Emoyeni Wind Energy Facility under the Department of Mineral Resources and Energy's (DMRE's) Renewable Energy Independent Power Producer Procurement (REIPPP) Programme or possibly a similar private programme, with the aim of evacuating the generated power into the national grid. This will aid in the diversification and stabilisation of the country's electricity supply, in line with the objectives of the Integrated Resource Plan (IRP) published by the Department of Minerals Resources and Energy, with the Ummbila Emoyeni Wind Energy Facility set to inject up to 900MW of electricity into the national grid. Similarly, the location of the new generation in the Mpumalanga Province is important in the context of the Just Energy Transition (JET). The Ummbila Emoyeni Wind Energy Facility will provide valuable jobs and socio-economic benefits that are required in an area where coal fired generation will be phased out over the next 10 years (see graph below). This will be vitally important if the JET is to be successfully implemented and is a transition for everyone.

Infrastructure associated with the Ummbila Emoyeni Wind Energy Facility will include:

» Up to 111 wind turbines with a maximum hub height of up to 200m. The tip height of the turbines will be up to 300m.

- 33kV cabling to connect the wind turbines to the onsite collector substations, to be laid underground where practical.
- 3 x 33kV/132kV onsite collector substation (IPP Portion), each being 5ha.
- Battery Energy Storage System (BESS).
- Cabling between turbines, to be laid underground where practical.
- Construction compounds including site office (approximately 300m x 300m in total but split into 3ha each of 150m x 200m):
  - 3 x Batching plant of up to 4ha to 7ha.
  - 3 x O&M office of approximately 1.5ha each adjacent to each collector SS.
  - 3 x construction compound / laydown area, including site office of 3ha each (150m x 200m each).
- Laydown and crane hardstand areas (approximately 75m x 120m).
- Access roads of 12 -13m wide, with 12m at turning circles.

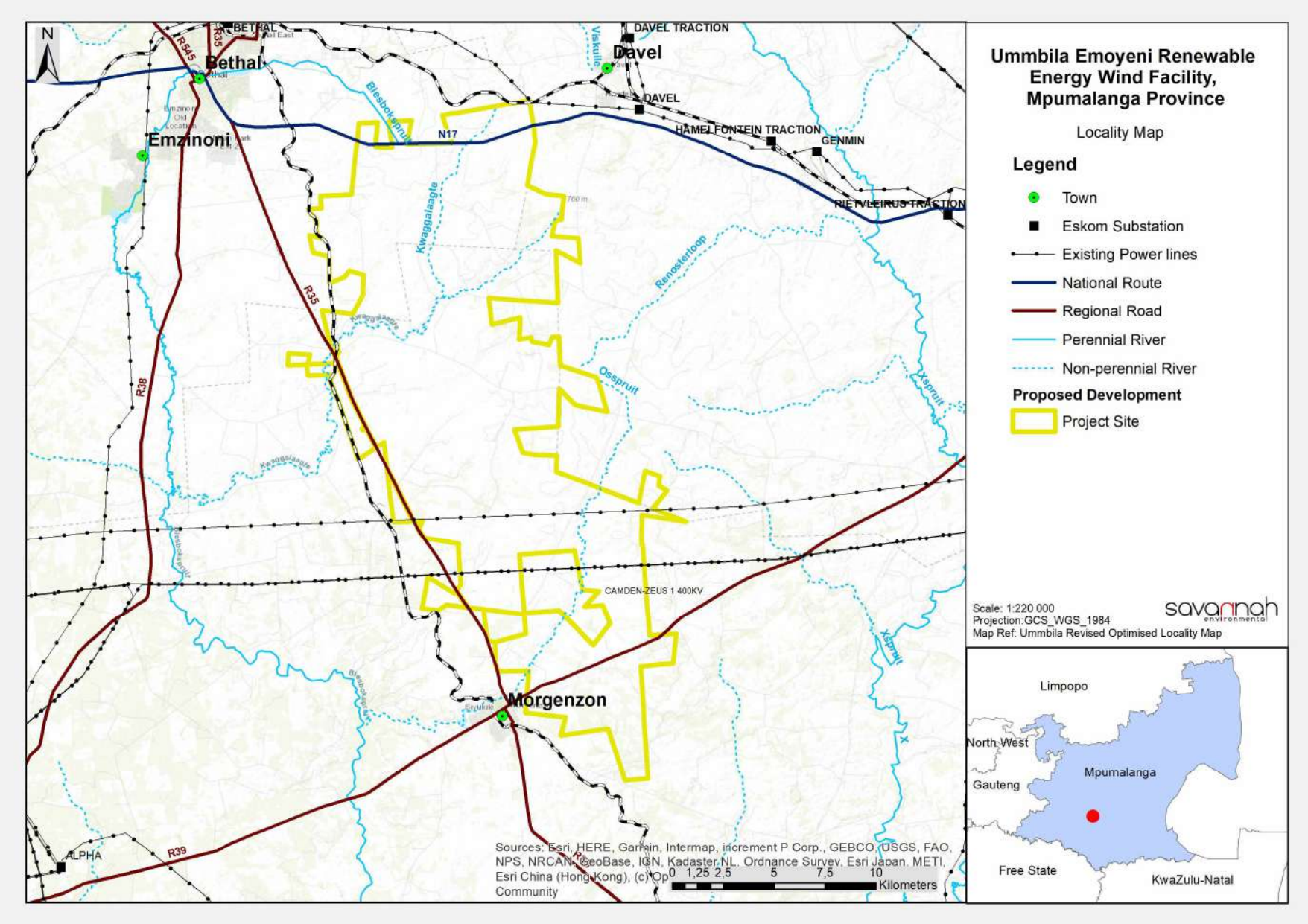


Figure 1: Locality map of the project site within which the Ummbila Emoyeni Wind Energy Facility is proposed to be developed

1. Environmental Permitting Requirements

The Ummbila Emoyeni Wind Energy facility and its associated infrastructure trigger the need for THE following environmental permit:

» **An Environmental Authorisation (EA)** from the National Department of Forestry, Fisheries, and the Environment (DFFE), in consultation with the Provincial Mpumalanga Department of Agriculture, Rural Development, Land and Environmental Affairs (DARDL&EA)), in accordance with the requirements of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) and Environmental Impact Assessment (EIA) Regulations (GNR 326), 2014, as amended.

Savannah Environmental has been appointed as the Independent Environmental Assessment Practitioner (EAP) in accordance with NEMA and Regulations 21 to 24 of the 2014 EIA Regulations (GNR 326) to undertake the required S&EIA in support of the application for Environmental Authorisation (EA) and the public participation process for the project, in order to identify and assess all potential environmental impacts associated with the proposed Wind Energy Facility and recommend appropriate mitigation measures in an Environmental Management Programme (EMPr).

An EIA is an effective planning and decision-making tool for the project developer as it allows for the identification and management of potential environmental impacts. It provides the opportunity for the developer to be fore warned of potential environmental issues and allows for the resolution of issues reported on in the Scoping and EIA Reports as well as a dialogue with Interested and Affected Parties (I&APs). Comprehensive, independent environmental specialist studies are required in accordance with the EIA Regulations to provide the competent authority with sufficient information in order to make an informed decision. The EIA process being undertaken for the proposed general waste disposal site comprises two phases – i.e., Scoping and Impact Assessment - and involves the identification and assessment of environmental impacts through specialist studies, as well as public participation. The process followed in these two phases is as follows:

» The **Scoping Phase** includes the identification and description of potential impacts associated with the proposed project through a desktop study and consultation with interested and affected parties and key stakeholders. This phase considers the broader project area in order to identify and delineate any environmental fatal flaws, no-go or sensitive areas, as well as project alternatives in order to determine which should be assessed in more detail in the EIA Phase. Following the public review period of the Scoping Report, this phase culminates in the submission of a final Scoping Report and Plan of Study for the EIA Phase to the competent authority for acceptance and approval to continue with the EIA Phase of the process.

» The **EIA Phase** involves a detailed assessment of potentially significant positive and negative impacts (direct, indirect, and cumulative) identified in the Scoping Phase. This phase considers a proposed development footprint and includes detailed specialist investigations (including field surveys), consideration of feasible alternatives and public consultation. Recommendations of practical and achievable mitigation and management measures are included in an Environmental Management Programme (EMPr) considering all phases of the project. Following the public review period of the EIA Report and EMPr, this phase culminates in the submission of a Final EIA Report and EMPr to the competent authority for review and decision-making.

2 Evaluation of the Ummbila Emoyeni Wind Energy Facility

The EIA Report, together with the specialist studies contained within **Appendices D-M** provide a detailed assessment of the potential impacts that may result from the development of the Ummbila Emoyeni Wind Energy Facility. No environmental fatal flaws or unacceptable impacts were identified in the detailed specialist studies conducted, provided that the recommended mitigation measures are implemented. These measures include, amongst others, the avoidance of sensitive features within the development footprint and the undertaking of the construction and operational bird and bat monitoring, as specified by the specialists.

The potential environmental impacts associated with the Ummbila Emoyeni Wind Energy Facility assessed through the EIA process include:

- Impacts on terrestrial ecology (flora and fauna).
- Impacts on freshwater ecology.
- Impacts on avifauna.
- Impacts on bats.
- Impacts on soils and agricultural potential.
- Impacts on heritage resources, including archaeology, palaeontology and the cultural landscape.
- Noise impacts due to the construction and operation of the wind farm.
- Visual impacts on the area imposed by the components of the facility.
- Positive and negative social impacts.
- Traffic impacts.

The development footprint, as assessed in the EIA Report is presented in **Figure 2**.

1.1. Impacts on Terrestrial Ecology (including flora and fauna)

From a botanical and ecological perspective, it was found that the study area is mostly comprised of either Moderate (7549 ha; 20.7%) or Low (14496 ha; 39.7%) sensitivity. This large extent of low sensitivity areas is fortunate and means that there are ample areas for the development to occur. Various "Very High" sensitivity areas also occur throughout the study area (comprising features such as wetlands, ephemeral rivers and streams, seepages, and other drainage lines). Furthermore, various CBA and ESA areas occur throughout the study area. Development is highly discouraged within the areas classified as CBA Irreplaceable Areas and development within CBA Optimal Areas should be avoided as far as possible.

A total of 198 plant species were found within the study area, which consisted of 158 native, 0 Red List, 6 protected, 0 Mpumalanga endemic, 39 alien, and 11 NEM:BA listed invasive species.

A total of 32 mammal species, 6 amphibians and 10 reptile species were recorded within the projects site. No amphibian or reptile SCC were recorded within the project site; however, 4 mammal SCC were recorded within the project site namely; Serval (Near Threatened), Brown hyena (Near Threatened); Vlei rat (Near Threatened), Cape clawless otter (Near Threatened) and South African hedgehog (Near Threatened). It was determined that the development will not detrimentally impact these populations/individual SCC.

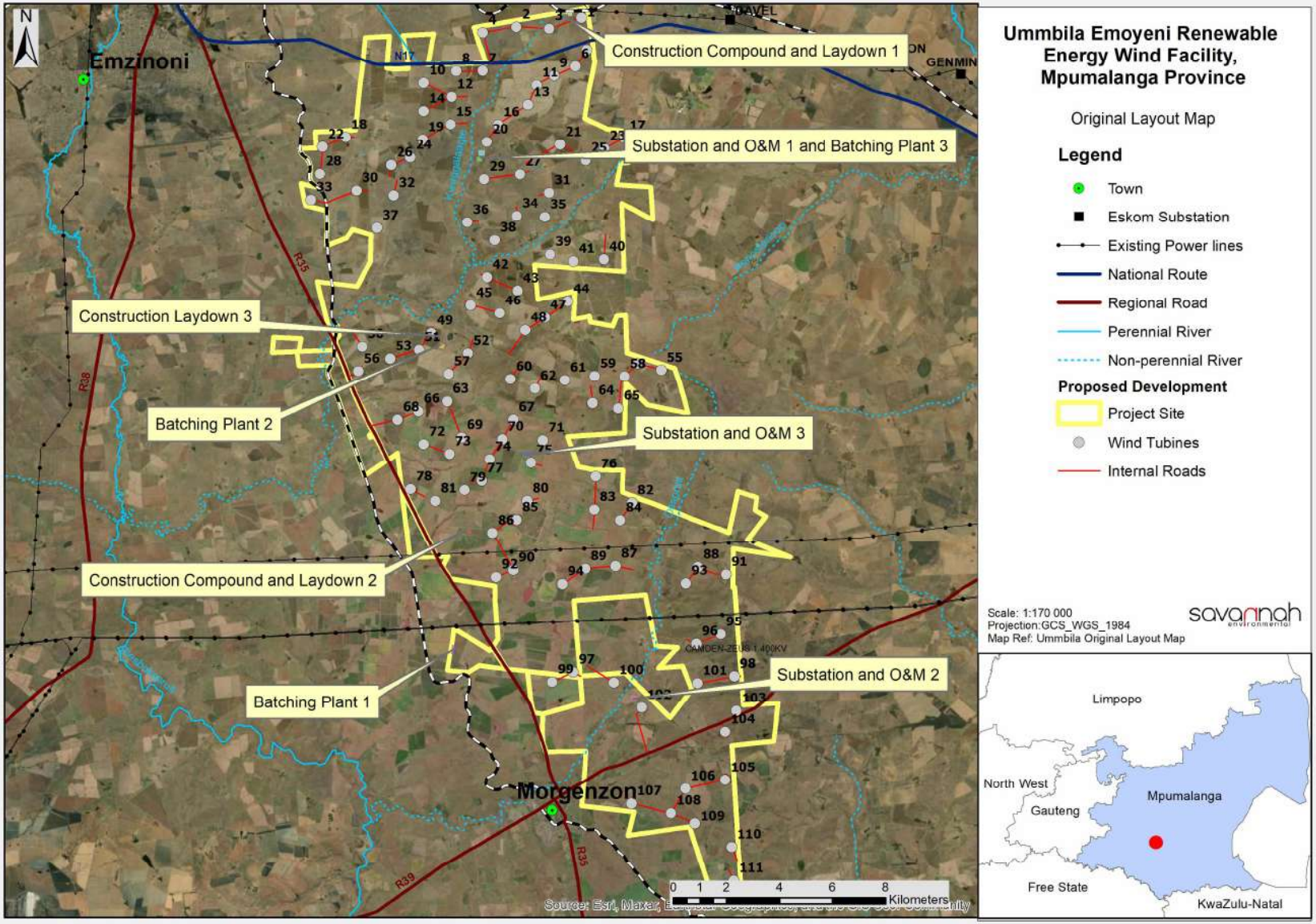


Figure 2: The indicative development footprint of the Ummbila Emoyeni Wind Energy Facility, as assessed within the EIA Report

During this assessment it was determined that the study area contains numerous habitat variations, and include Drainage, Fallow Land, Natural Clay, Natural Dolerite, Natural Loam Soil, Natural Rock Turf, Natural Sandstone, and Disturbed areas. Each of these areas (excluding disturbed areas) have certain unique species, with drainage areas having the highest number (i.e., many of its species are not shared with the other habitats). Development should therefore not proceed within drainage areas, which are all classified as "Very High" sensitivity. Natural rock turf and natural clay areas had the lowest number of species that occurred only in those types, and development should therefore aim to occur within these habitat types, since this would minimize the loss of unique biodiversity.

None of the proposed turbine localities occur within drainage areas ("Very High" sensitivity). However, internal access routes will cross drainage areas at sixteen locations. A total of fourteen (14) wind turbines are planned within the natural areas classified as CBA Optimal Areas ("Very High" sensitivity), five (5) wind turbines are planned within natural areas classified as CBA Irreplaceable Areas ("Very High" sensitivity). Furthermore, a total of twenty (20) turbines occur within natural areas, that fall outside of any CBAs (eight of these turbines fall within ESAs) and have subsequently been classified as "Medium" in terms of sensitivity (as determined by the authors of this report via desktop mapping and ground truthing).

A new optimised layout has been proposed (refer to Chapter 11), and according to this layout no wind turbines will be located within any CBA Irreplaceable Areas, with only six wind turbines planned within CBA Optimal Areas. Thus, according to this optimized layout, almost all of the sensitive areas will be avoided and the Ummbila WEF will not significantly impact sensitive areas or impact conservation targets set out by the province.

There are no impacts associated with the proposed wind energy facility that cannot be mitigated to a low level. Its local environmental impact can be reduced to an acceptable magnitude. Likewise, the contribution of the proposed wind energy facility to the cumulative impact in the area would be low and is acceptable. As such, there are no fatal flaws associated with the development and no terrestrial ecological considerations that should prevent it from proceeding. Therefore, it is the opinion of the specialists that the **development may be authorised** within the specified area, subject to the implementation of the recommended mitigation measures.

1.2. Impacts on Freshwater Ecology

All endorheic wetland features, wetland features that are not directly connected to the larger extensive wetland network or that have been fractured/isolated through agricultural practices are classified as High Sensitive. Even though these wetland features do not provide functions and services to the extent of the more connected and larger wetland features, these wetlands still provide some functions and services. Furthermore, most of these wetland features are fairly small and any direct impacts on these wetland habitats may have a significant impact on the drivers of these wetland features as well as the associated biodiversity. Another feature of these wetlands is the fact that, even though small in size, the are located within relatively small catchment areas, thus these wetlands' percentage coverage in relationship to their catchments are fairly significant, making these wetland features vulnerable to catchment disturbances.

The following buffer areas are recommended, and should be implemented for maintaining the freshwater resource features REC (Recommended Ecological Category) allowing the persistence of the current present ecological status as well as their functions and services.

- All small, endorheic seepages and depressions with a High Ecological Importance: 50m buffers from the outer edge of the freshwater resource features.
- All larger interconnected wetland features with Very Ecological Importance: 100m buffers from the outer edge of the freshwater resource features.
- All freshwater features with their buffer areas have been classified as either Very High- or High sensitive and should be regarded as "No-Go" areas apart from the following activities and infrastructure which may be allowed (although restricted to an absolute minimum footprint):
  - only activities relating to the route access and cabling:
    - the use/upgrade of existing roads and watercourse crossings are the preferred options;
    - Where no suitable existing roads and watercourse crossings exist, the construction of new access roads and watercourse crossings can be allowed, however this should be deemed as a last resort.
    - All underground cabling should be laid either within access roads or next to access roads (as close as possible).

With mitigation measures in place, impacts on the freshwater resource features' integrity and functioning can be potentially reduced to sufficiently low levels. This would be best achieved by incorporating the recommended management & mitigation measures into an Environmental Management Programme (EMPr) for the site, together with appropriate rehabilitation guidelines and ecological monitoring recommendations.

Based on the outcomes of this study it is the specialist's considered opinion that the **proposed project detailed in this report could be authorised from a freshwater resource perspective**.

Since there are watercourses present within the development area of the Ummbila Emoyeni Wind Energy Facility as identified in the Freshwater Impact Assessment (**Appendix E**), and since water may be abstracted from boreholes for use during the construction and operational phases, a water use authorisation for the project will be required from the DWS for water uses identified in Section 21(a), Section 21(c) and 21(i) of the National Water Act (Act 36 of 1998).

1.3. Impacts on Avifauna

Pre-construction bird monitoring was undertaken over a period of 12 months within the project area. The pre-construction bird monitoring included the identification of twelve vantage points, five drive transects, and 15 walk transects of 500m in length across the project site. A total of 102 species (5 805 birds) were recorded during the walk transects conducted across the full pre-construction bird monitoring period.

A total of 26 target species were recorded during vantage point monitoring over the pre-construction monitoring period. A total of 72 observations of 18 target species (comprising 235 birds) were recorded during 703.12km of drive transect observations.

The following sensitivities were identified from an avifaunal perspective:
- Wetlands - Very High Avifaunal Site Ecological Importance
- Natural Grasslands – High Avifaunal Site Ecological Importance
- Agricultural/cultivated fields – Very Low Avifaunal Site Ecological Importance

Very High sensitivity areas are no-go for the development of WTGs and blade tips are not to allowed to encroach on these areas. Linear infrastructure can traverse these areas, where necessary, following the implementation of appropriate mitigation measures. *WTG development is permitted within areas of high sensitivity* following the implementation of additional mitigation requirements, although development within these areas should be avoided, where possible. Development in medium sensitivity areas should also be avoided and reduced wherever practically possible.

Based on the avifaunal sensitivity of the project site, wind turbines (plus 100 m radius representing an assumed blade length) within the indicative layout assessed encroach on the revised areas of high avifaunal sensitivity. Note that the 100m is a conservative blade length (blade length and not radius is the important figure) but nonetheless, these will be considered to be relocated, should it be possible to achieve the target generating output of the development within fewer wind turbines, or additional mitigation implemented as recommended in the avifaunal assessment. These include WTGs 6, 9, 11, 13, 19, 24, 26, 28, 29, 30, 32, 34, 36, 49, 52, 59, 61, 64, 82, 83, 84, 96, 100, 101. Nevertheless, all wind turbines in the proposed layout avoid areas identified to be of Very High Avifaunal Sensitivity (wind turbine no-go) areas and the **wind turbine layout is therefore acceptable from an avifauna perspective**.

The Avifauna Impact Assessment identified that all impacts associated with the development of the Ummbila Emoyeni Wind Energy Facility will be of low, medium and high significance before mitigation, and can be mitigated to an acceptable level of impact (i.e., medium and low significance, depending on the impact being considered). The impacts rated to be of high significance pre-mitigation are not considered as fatal flaws, provided the prescribed mitigation measures are implemented. One of these mitigation measures includes avoiding areas to be of very high sensitivity (no-go). Secondly, the implementation of additional mitigation measures such as observer-based shut-down-on-demand in areas of elevated recorded passage rates will be highly effective at reducing the likelihood of collisions as large flocks of birds are easily detected.

Based on the screening study, reconnaissance study, and results of the pre-construction avifauna monitoring programme conducted for the Ummbila Emoyeni Wind Energy Facility, it is the avifaunal specialist's informed opinion that the proposed development will not have a significant negative impact on the viability or persistence of avifaunal populations (particularly avifaunal species of conservation concern) in the area following the implementation of mitigation measures. It is the specialist's opinion that the proposed development can be **approved from an avifaunal perspective** and that the indicative positions of all 111 wind turbines in the layout are acceptable.

1.4. Impacts on Bats

Pre-construction bat monitoring was undertaken over a period of 12 months for the project site in accordance with the best practice guidelines. The monitoring was designed to monitor bat activity across the area for the Ummbila Emoyeni Wind Energy Facility.

Key habitat features have been identified for bats within the project site. These habitat features present specific uses and opportunities for bats including roosts, foraging resources and commuting resources. Sensitive features within the project site at which bat foraging activity may be concentrated include farm buildings (and within

built up areas for some species) where they would forage for insects attracted to lighting, dams and wetland areas, within and along the edge of woodland/tree patches, and over cultivated areas (refer to **Table 2**).

Table 2: Features used to assign spatial risk categories in the project site for bats

Risk Level		
Low	**Medium**	**No-Go**
Heavily modified land	CBA Optimal	Farm Dams
Moderately modified land	ESA Landscape corridor	Wetlands
	ESA Local corridor	Trees
	Other Natural Areas	Buildings
		Rivers/Streams
		Wetlands
		CBA Irreplaceable Areas

To avoid collision impacts, no part of the wind turbines, including the blade tips, shall intrude into the no-go buffers. The turbine assessed has a rotor diameter of 170m and hub height of 150m. Thus, to ensure the turbine blades do not cross into the bat buffers, an additional distance of 42m must be added to the 200m no-go buffers. Six turbines in the proposed indicative layout assessed in the EIA are currently located within no-go areas: WTG10, WTG61, WTG82, WTG88, WTG100, and WTG101. These turbines must be relocated into low and medium sensitivity areas. In addition, several locations of the construction compounds, laydown areas, batching plants, and substations associated with the wind energy facility, specifically Substation and O&M 1 and Batching Plant 3, Construction Laydown Area 3 and a small portion of Batching Plant 2, Construction Compound 2, also need to be adjusted so that they are outside no-go Areas. The optimised layout presented in Section 11.3 of this EIA Report addresses this requirement.

Based on the bat activity recorded at the site proposed for the Ummbila Emoyeni Wind Energy Facility, the significance ratings for the majority of the impacts to bats posed by the development are predicted to be low and medium significance before mitigation. After mitigation, all impacts are predicted to be low. Based on the opportunity for reduction of the impacts through appropriate mitigation measures from a medium significance to a low, acceptable significance, no fatal flaws are expected to occur. The specialist indicates that with the implementation of the mitigation measures, the development of the Ummbila Emoyeni Wind Energy Facility will not result in unacceptable impacts to bats, and **can be authorised**.

1.5. Impacts on Soils and Agricultural Potential

Four main sensitive soil forms were identified within the project site, namely the Vaalbos, Avalon, Ermelo and Tukulu soil forms. The land capability sensitivity (DAFF, 2017) indicates a range of sensitivities expected throughout the project site, which predominantly covers "Moderately Low" to "Moderate" sensitivities. Smaller patches are characterised by sensitivities up to "Moderately High". Furthermore, various crop field boundaries were identified by means of the DFFE Screening Tool (2022), which are predominantly characterised by "High" sensitivities with one area being classified as "Very High" sensitivity.

The specialist has recommended that such high potential crop fields be avoided by relocating wind turbines and associated infrastructure (e.g., laydown areas, substations, etc.) from the areas characterised by "High" to "Very High" crop fields in order to ensure that these crop fields are preserved, where possible. In a case where

relocating the project infrastructure is not feasible, the developer should engage with the owners of the crop fields for an appropriate compensation. Approximately 22 turbines are located within sensitivity crop fields.

The Soils and Agricultural Potential Impact Assessment identified that all impacts associated with the development of the Ummbila Emoyeni Wind Energy Facility will be of medium significance before mitigation, and can be mitigated to an acceptable level of impact (i.e., low significance). The proposed development will have an overall low residual impact on the agricultural production ability of the land. It is the **specialist's opinion that the project be approved** subject to implementation of the recommended mitigation measures.

1.6. Impacts on Heritage Resources (archaeology, palaeontology and cultural landscape)

The proposed development will not have a substantial negative impact on the archaeological heritage resources identified within the proposed development area for the renewable energy facilities and associated infrastructure. No Stone Age or Iron age archaeology was identified during the field assessment. Some historical ruins and kraals of contextual historic significance, graded IIIC, were identified; however, none of these are likely to be impacted as per the layout provided and assessed.

A number of burial grounds and/or graves were identified during the field assessment (Grade IIIA) and some of these fall within areas likely to be impacted as per the proposed layout. A 50m no-go buffer has been recommended around these burial grounds. The burial ground recorded as Observation 008 is located away from any proposed infrastructure and is therefore unlikely to be impacted by the development. However, it is still recommended that a no-development area of 50m be implemented around this site to ensure that no impact takes place.

No palaeontological no-go areas have been identified within the project areas. With the exception of one fossil site of low scientific value, none of the recorded fossil sites overlap directly with, or lie close to (< 20 m) the proposed infrastructure and no modification of the layouts through micro-siting is proposed here on palaeontological grounds. One fossil site (UMB10) is located in close proximity to a proposed road and turbine; however, this site has low palaeontological significance and has been sufficiently recorded. No further mitigation is recommended for this site.

Impacts on archaeological and palaeontological heritage are expected to be of medium and high significance pre-mitigation and can be reduced to low significance post-mitigation.

The facility layout has been assessed to have a high impact on the cultural landscape pre-mitigation as some of the wind turbines fall within the no development 500m buffers along major routes such as the N17, R35 and R39 and the 200m no development buffers along secondary routes. Impacts to the cultural landscape can be reduced to be of low significance following the implementation of mitigation measures. These mitigations have been applied and no turbines are located north of the N17 or within road buffer.

Based on the outcomes of the Heritage Impact Assessment, it is **not anticipated that the proposed development of the wind energy facility and its associated infrastructure will negatively impact on significant heritage resources** on condition the recommended mitigation measures are adhered to.

1.7. Noise Impacts

Ambient (background) sound levels were measured over a period of up to seven nights from 9 to 15 March 2022 at five locations in the vicinity of the project site. Considering the results of the ambient sound levels and the developmental character of the area, ambient sound levels were elevated, especially at night. The acceptable zone sound level (noise rating level) during low and no-wind conditions would be typical of a rural (daytime) to suburban (night-time) noise district, e.g.: 45 dBA for the daytime period and 40 dBA for the nigh-time period.

Numerous noise-sensitive developments, receptors and communities were identified within the potential area of influence (within 2 000m from a wind turbine). Based on the results of the Noise Impact Assessment, adjustments in terms of the proposed layout are required as there are potential noise sensitive receptors are located within 1 000m of some of the wind turbines, namely, NSR47, NSR40 and NSR46. The specialist has recommended that should it be found that the structures at these noise sensitive receptors are used for residential purposes at the time of operation of the wind farm, the residents must be relocated, or the wind turbine located within 1 000m from these noise sensitive receptors must be moved further than 1 000m from these noise sensitive receptors.

Noise impacts will be of low significance for daytime construction activities, of medium significance for night-time construction activities (with mitigation proposed to reduce the significance to low), and of medium significance for day-time operation activities and high significance for night-time operation activities (with mitigation proposed to reduce the significance to low). Most of the higher significance ratings relate to the potential noise impact on NSR 40, 46 and 47.

Because the total projected noise levels will exceed the rural rating levels, with the projected noise level exceeding 42 dBA, active noise monitoring is recommended. Once-off noise measurements are recommended at the locations of NSRs located within the 42 dBA noise level contour before the wind energy facility is developed, to be repeated once within a year after the wind energy facility is fully operational.

It is **recommended that the proposed Ummbila Emoyeni Wind Energy Facility and associated infrastructure project be authorised**, provided that the applicant can reduce the noise levels to less than 45 dBA at all receptors (structures used for residential purposes) through the implementation of recommended mitigation measures. The proposed layout (i.e., turbine placement) is considered to be acceptable from a noise perspective with the implementation of appropriate mitigation measures to ensure that the total noise levels are less than 45 dBA at all structures used for residential purposes. The locations of facility substations, BESS and O&M hubs are acceptable.

1.8. Visual Impacts

The following sensitivities have been identified from a visual perspective:

- Highly sensitive areas include:
  - Areas immediately surrounding settlement and homesteads development of which is likely to significantly change the character of views for residents. A 1 000m buffer is proposed (and has been

applied in the indicative layout) which should be sufficient to ensure that development does not totally dominate views. It is possible that receptors (owners /residents) have no concern regarding the development of these areas, in which case the sensitivity rating will reduce.
  - Corridors beside the main roads that could be affected including the N17, the R35, and the R39. This is deemed sensitive because development in this corridor is likely to be highly obvious to people travelling along the roads the proposed 500m corridor should be sufficient to ensure that development does not totally dominate views.
- Medium sensitivity areas include:
  - Watercourses and a buffer of 250m either side of watercourses. These areas are proposed in order to protect these natural features within the proposed focus area.
- Low sensitivity areas include:
  - Valley side slopes the development of which is likely to make the project least obvious from surrounding areas. The fact that development may be focused on areas with relatively low sensitivity does not preclude the necessity for mitigation.

Considering the visual sensitivities overlain on the wind farm layout, the following can be noted:
- Three turbines are located within the high sensitivity area beside the N17.
- Two turbines are located within the high sensitivity area beside the R35.
- Two turbines are located in the high sensitivity area beside the R39.
- Approximately 95 turbines are located within the shadow flicker risk area.
- Fourteen turbines are located within or on the edge of the 1 000m homestead buffer.

A visibility analysis was undertaken for the project. Based on the results of the visibility analysis, the turbines, are likely to be visible within a 10km buffer, and are only likely to be visible over high sections of the landscape within the 30km buffer. Outside the 30km buffer, turbines are unlikely to be seen as being prominent. None of the proposed onsite substations are likely to be highly visible, although they may be intermittently visible to main roads, but are unlikely to be obvious.

The proposed project will generally result in landscape and visual impacts of low to high significance, depending on the distance from the facility. Subject to mitigation measures being undertaken, particularly the necessary shadow flicker study and the implementation of recommended mitigation measures within the final design, from a Landscape and Visual Impact perspective, it is the specialist's opinion that **there is no reason why the proposed project should not be authorised**.

1.9. Socio-Economic Impacts

Impacts are expected to occur with the development of the Ummbila Emoyeni Wind Energy Facility during the construction, operation and decommissioning phases. Both positive and negative impacts are identified and assessed.

Impacts during construction include:
- Impact on production.
- Impact on the Gross Domestic Product (GDP).
- Impact on employment creation.

- Skills development.
- Household income and standard living.
- Temporary increase in government revenue.
- Change in sense of place.
- Safety and security.
- Agricultural operations.
- Influx of people.
- Daily movement patterns.

Impacts during the operation phase include:
- Impact on production.
- Impact on the GDP.
- Employment creation.
- Household income and standard of living.
- Increase in government revenue.
- Rental revenue for landowners.
- Improvement in energy sector generation.
- Visual and sense of place impacts.
- Impacts on agricultural operations.

Positive impacts during both construction and operation are expected to be of medium and high significance pre-enhancement and can be increase to medium and high post-enhancement. Negative impacts during both construction and operation are expected to be of medium and low significance pre-mitigation and can be reduced to medium (different score) and low significance post-mitigation, depending on the type of impact.

The net positive impacts associated with the development and operation of the proposed project are expected to outweigh the net negative effects. The project is also envisaged to have a positive stimulus on the local economy and employment creation, leading to the economy's diversification and a small reduction in the unemployment rate. It is the specialist's opinion that the **project should therefore be considered for authorisation**.

1.10. Traffic Impacts

It is assumed that if components are imported to South Africa, it will be via the Port of Richards Bay in KwaZulu-Natal, or the ports of East London and Ngqura in the Eastern Cape. The Port of Richards Bay is located ~460km travel distance from the proposed site whilst the ports of East London and Ngqura are respectively located ~1 130km and 1 200km travel distance from the proposed site. The Port of Richards Bay is the preferred port of entry; however, the ports of East London and Ngqura can be used as alternatives, should the Port of Richards Bay not be available.

The proposed site is bounded by the N17 in the south, the R39 in the south and east and the R35 in the west. Access to the proposed site can be obtained from any of these three roads, depending on the traffic volumes of each road. The road carrying the least traffic will be considered as the best option. There is also an existing network of unnumbered gravel roads that might be suitable as a main access road to the proposed site.

The construction and decommissioning phases of a wind farm are the only significant traffic generators and therefore noise, dust and exhaust pollution will be higher during these phases. The duration of these phases is short term i.e., the impact of the Wind Farm on traffic on the surrounding road network is temporary. The access point to the proposed site has been assessed and was found to be acceptable from a transport perspective. The **development is supported** from a transport perspective provided that the recommendations and mitigation measures are adhered to.

1.11 Assessment of Cumulative Impacts

Cumulative impacts and benefits on various environmental and social receptors will occur to varying degrees with the development of several renewable energy facilities in South Africa. The degree of significance of these cumulative impacts is difficult to predict without detailed studies based on more comprehensive data/information on each of the receptors and the site-specific developments. The alignment of renewable energy developments with South Africa's National Energy Response Plan and the global drive to move away from the use of non-renewable energy resources and to reduce greenhouse gas emissions is undoubtedly positive. The economic benefits of renewable energy developments at a local, regional and national level have the potential to be significant.

The are several authorised renewable energy projects within a 30km radius of the proposed site, namely:
- Majuba Solar PV Facility.
- Tutuka Solar PV Facility.
- Forzando North Coal Mine Solar PV Facility.
- Hendrina Renewable Energy Complex.

In addition to the renewable energy facilities listed above, one new renewable energy facility (a solar energy facility) is proposed by Emoyeni Renewable Energy Farm (Pty) Ltd, within the footprint of the Ummbila Emoyeni Wind Energy Facility, namely:
- Ummbila Emoyeni Solar Energy Facility.

The Ummbila Emoyeni Renewable Energy Farm will also include grid connection infrastructure comprising a 400/132kV Main Transmission Substation (MTS), to be located between the Camden and SOL Substations, which will be looped in and out of the existing Camden-Sol 400kV transmission line; on-site switching stations (132kV in capacity) at each renewable energy facility (Eskom Portion); 132kV power lines from the switching stations at each renewable energy facility to the new 400/132kV MTS; and a collector substation with 2 x 132kV bus bars and 4 x 132kV IPP feeder bays to the onsite IPP Substation to evacuate the generated power to the national grid.

The majority of cumulative impacts associated with the Ummbila Emoyeni Wind Energy Facility will be of a low significance, medium and high significance, with impacts of a high significance associated with the impacts on bats and the socio-economic environment. A summary of the cumulative impacts is included in **Table 3** below.

Table 3: Summary of the cumulative impact significance for the Ummbila Emoyeni Wind Energy Facility

Specialist assessment	Overall significance of impact of the proposed project considered in isolation	Cumulative significance of impact of the project and other projects in the area
Terrestrial Ecology	Low	Low and Medium
Freshwater Ecology	Low	Low
Avifauna	Low	Medium
Bats	Medium	High
Soils and Agricultural Potential	Low	Low
Heritage (including archaeology, palaeontology and sense of place)	Medium	Medium
Noise	There is a very low risk of cumulative noises during the construction phase since there are no other wind energy facilities proposed within the area of potential influence. Similarly, because there are no other wind energy facilities within the area of influence, there are no risk of a cumulative noise impact.	
Visual	Low	Low and Medium
Socio-Economic	*Positive impacts:* Medium and High *Negative impacts:* Medium	*Positive impacts:* Medium and High *Negative impacts:* Medium
Traffic	Low	Medium (assuming all projects in the area are constructed at the same time)

Based on the specialist cumulative assessment and findings, the development of the Ummbila Emoyeni Wind Energy Facility and its contribution to the overall impact of all renewable energy projects to be developed within a 30km radius, it can be concluded that the Ummbila Emoyeni Wind Energy Facility cumulative impacts will be of low, medium and high significance, with impacts of a high significance mainly relating to impacts on bats and the positive impacts on the socio-economic environment. From a bats perspective, the wind energy facility may result in unacceptable loss to local bat populations, which can be reduced to an acceptable level with the implementation of recommended mitigation measures. Based on all other areas of study considered as part of this EIA report, the development of the Ummbila Emoyeni Wind Energy Facility will not result in unacceptable, high cumulative impacts and will not result in a whole-scale change of the environment.

3. Optimisation of the Facility Layout

The indicative facility layout/development footprint assessed within this EIA Report was designed by the project developer in order to respond to and avoid the sensitive environmental and social features located within the project site, which were identified by the specialists during the Scoping Phase of the EIA process. This approach ensured the application of the mitigation hierarchy (i.e., avoid, minimise, mitigate, and offset) to the proposed project, which ultimately ensures that the development is appropriate from an environmental perspective and is suitable for development within the project site.

Considering this proposed layout, the following specialists identified and confirmed specific turbines and associated infrastructure to be unacceptably placed within the project site (refer to **Table 4**).

Table 4: Turbines and associated infrastructure not considered to be acceptable in the positions as proposed in the facility layout/development footprint based on specialist findings

Specialist finding	Turbines/associated infrastructure affected
The bats specialist indicates that six (6) turbines and some of the infrastructure associated with the wind energy facility are located within the no-go buffer areas.	» WTG10, WTG61, WTG82, WTG88, WTG100, and WTG101 » Substation and O&M 1 and Batching Plant 3, Construction Laydown Area 3 and a small portion of Batching Plant 2, Construction Compound 2
The heritage specialist indicates that one turbine is located within the 50m no-go development buffer around burial grounds, and that there is a road that infringes into the 50m no-go development buffer around burial grounds.	WTG101 and road to WTG60
The noise specialist indicates that three (3) turbines are located within 500m and 1 000m (close to the 500m buffer) of noise sensitive receptors (NSR 40, 46 and 47) and would therefore result in significant noise impacts should these residences be occupied at the time of operation of the wind farm.	WTG76, WTG67 and WTG61

Based on the findings as documented in **Table 4**, a revision to the facility layout was undertaken and an optimised layout[3] provided which addressed the need to relocate the turbines and associated infrastructure, as listed in **Table 4**.

Further scrutiny of the optimised layout by specialists (refer to **Appendix D to M**) identified and confirmed that specific turbines and associated infrastructure were still unacceptably placed within the project site (refer to **Table 5** and **Figure 3**).

Table 5: Turbines and associated infrastructure not considered to be acceptable in the positions as proposed in the optimised layout based on specialist findings

Specialist finding	Turbines/associated infrastructure affected
The terrestrial ecology specialist indicates that some of the internal roads for the optimised layout fall within no-go areas from a terrestrial ecology perspective.	» A section of the road to WTG19 crosses a CBA1: Irreplaceable » A section of the road to WTG44 crosses a CBA1: Irreplaceable » A section of the road to WTG56 crosses a CBA1: Irreplaceable
The freshwater ecology specialist indicates that one (1) turbine from the optimised layout falls within no-go buffer around the one of the freshwater/drainage features.	WTG10
The bats specialist indicates that some of the infrastructure associated with the wind energy facility falls within bat no-go areas.	Substation and O&M 1 and Batching Plant 3, Construction Laydown Area 3 and a small portion of Batching Plant 2, Construction Compound 2
The noise specialist indicates that optimisation of the layout would change the noise levels as well as the receptors that are impacted	N/A

[3] It should be noted that the turbine numbering within the assessed and optimised layout differs.

Specialist finding	Turbines/associated infrastructure affected
and as such, the same mitigation measures applied to the assessed layout should be considered for the optimised layout.	

Based on the findings as documented in **Table 5**, the optimised layout was further refined and a layout which addresses the need to relocate the turbines and associated infrastructure, as listed in **Table 5** was designed (refer to **Figure 4**). The result is that the refined optimised facility layout has repositioned turbines and associated infrastructure outside of the sensitive areas and features regarded to be no-go for development, following the principle of the mitigation hierarchy where avoidance of impact is the preferred approach. In addition, the applicant undertook a shadow flicker study as recommended by the visual specialist study (refer to **Appendix T**). A number of houses will potentially be affected by shadow flicker and would require mitigation (such as relocation of receptors or implementation of a shadow flicker protection system) to be implemented during the final planning and micro-siting of the facility.

With the implementation of the refined optimised layout, the development footprint is considered to be suitable and appropriate from an environmental perspective for the wind farm, as it ensures the avoidance, reduction and/or mitigation of all identified detrimental or adverse impacts on sensitive features as far as possible. For the avoidance of doubt, all 111 WTG positions are now placed in acceptable locations from a sensitivity perspective in the refined optimised layout.

All specialists assessed the full extent of the project site as shown in the sensitivity map. This refined Optimised Facility Layout considers the required mitigation measures as stated by the specialists and represents a positive outcome in terms of impact avoidance, reduction and mitigation. As such, the impact of this refined Optimised Facility Layout is considered to be acceptable and the layout is preferred. Final micro-siting must however be undertaken prior to construction considering all mitigation measures recommended within this EIA Report and associated specialist studies.

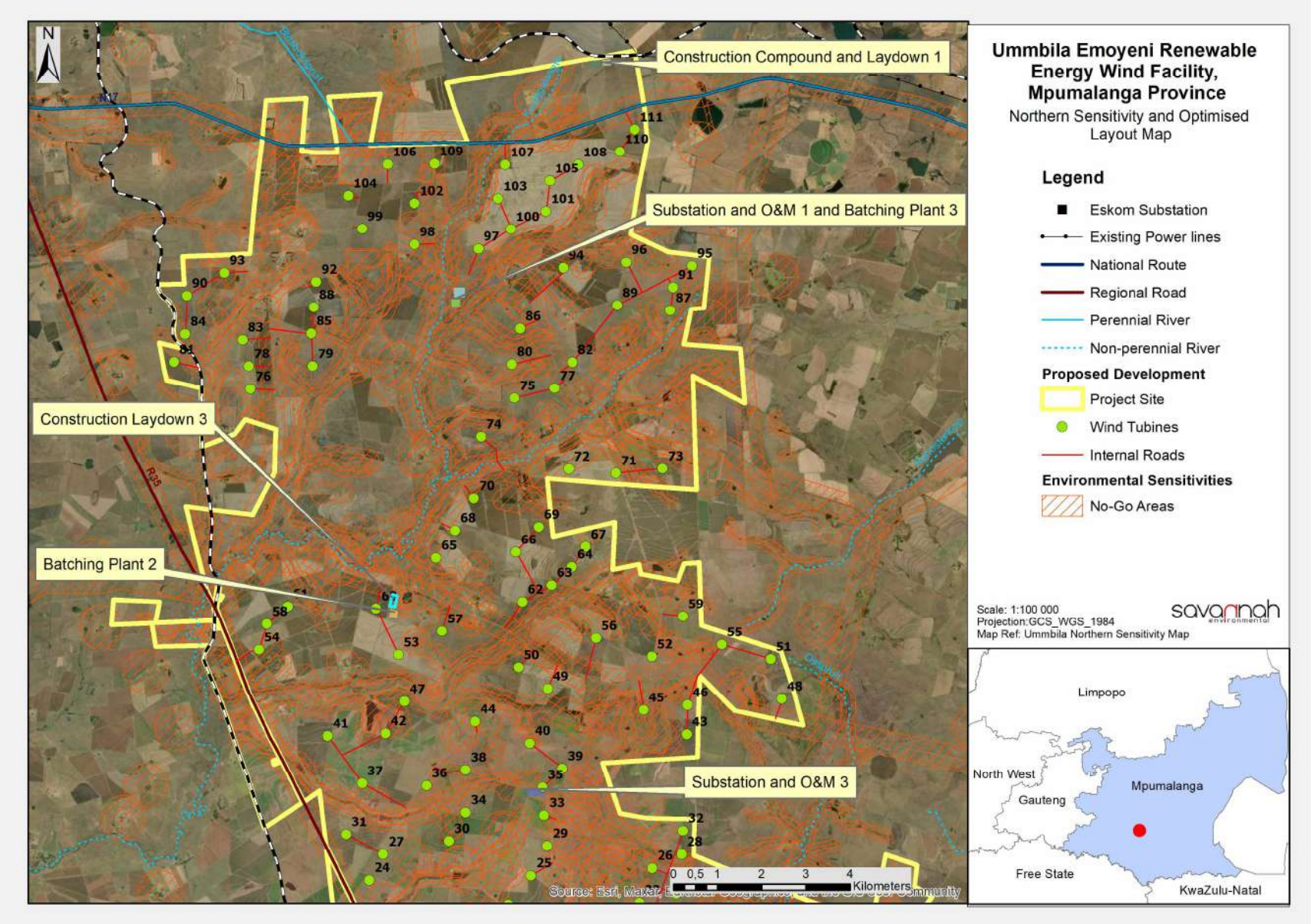


Figure 3a: Optimised layout for the Ummbila Emoyeni Wind Energy Facility, overlain with the identified environmental sensitivities (northern portion)

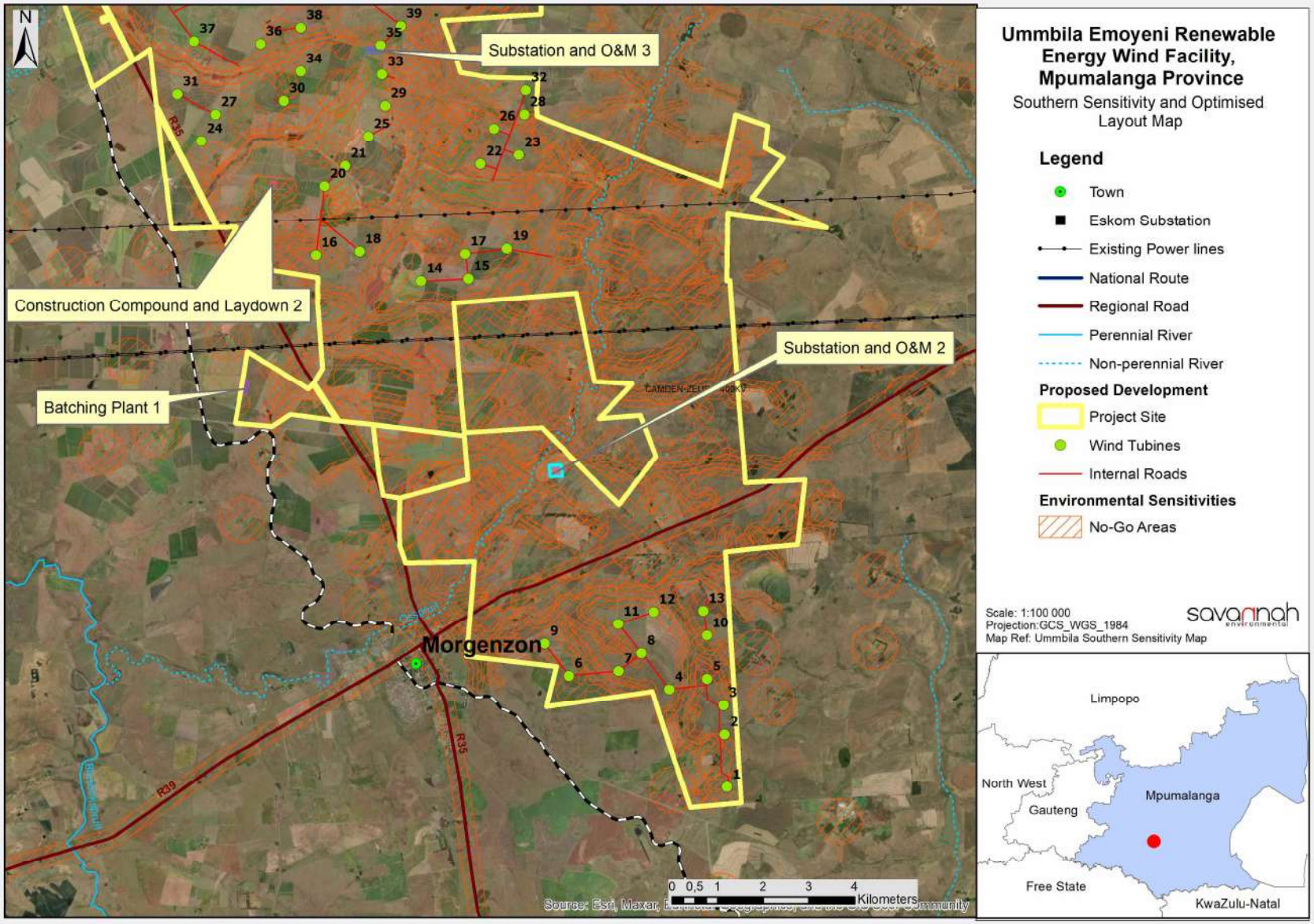


Figure 3b: Optimised layout for the Ummbila Emoyeni Wind Energy Facility, overlain with the identified environmental sensitivities (southern portion)

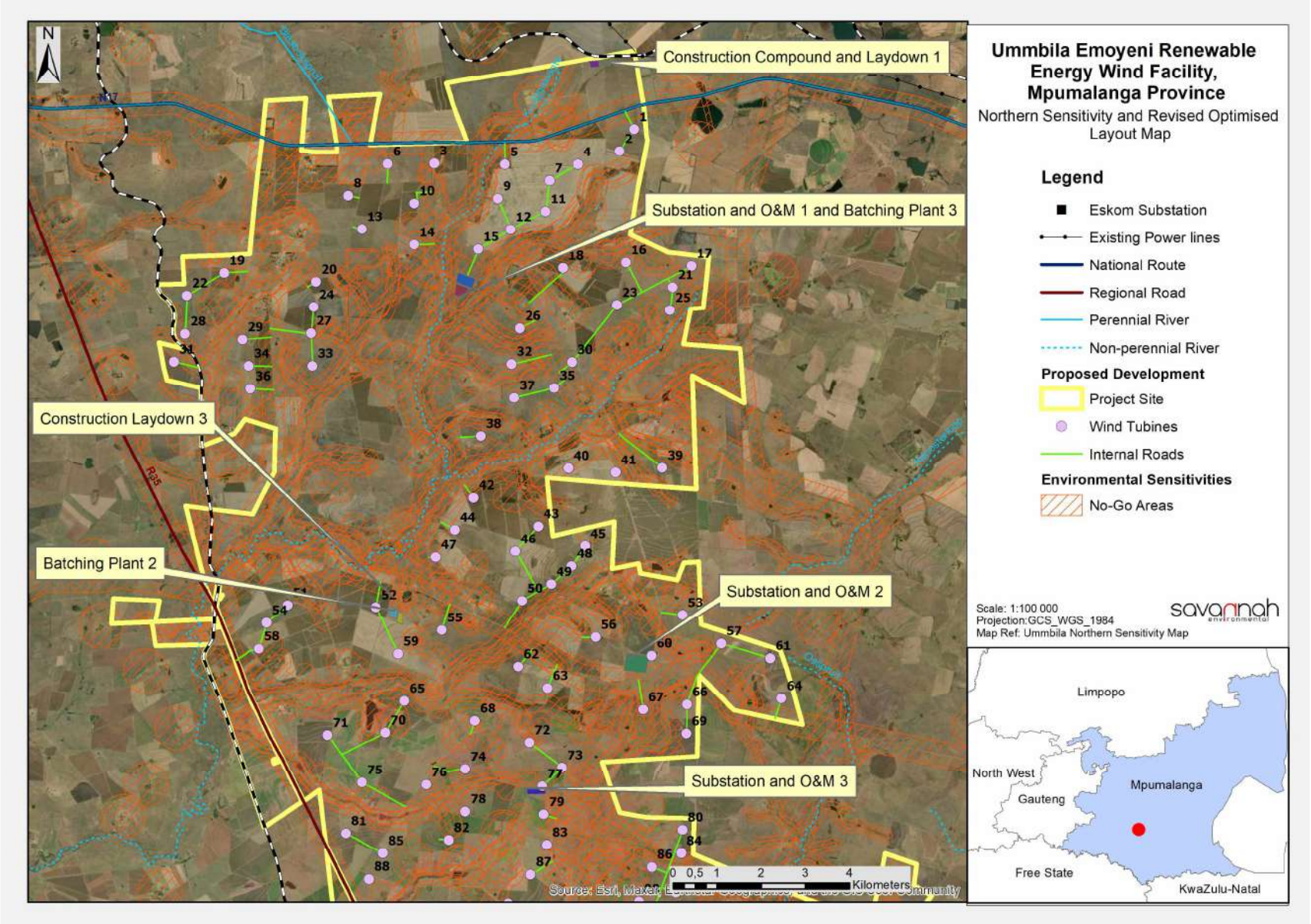


Figure 4a: Refined optimised layout for the Ummbila Emoyeni Wind Energy Facility considered to be acceptable for development (northern section)

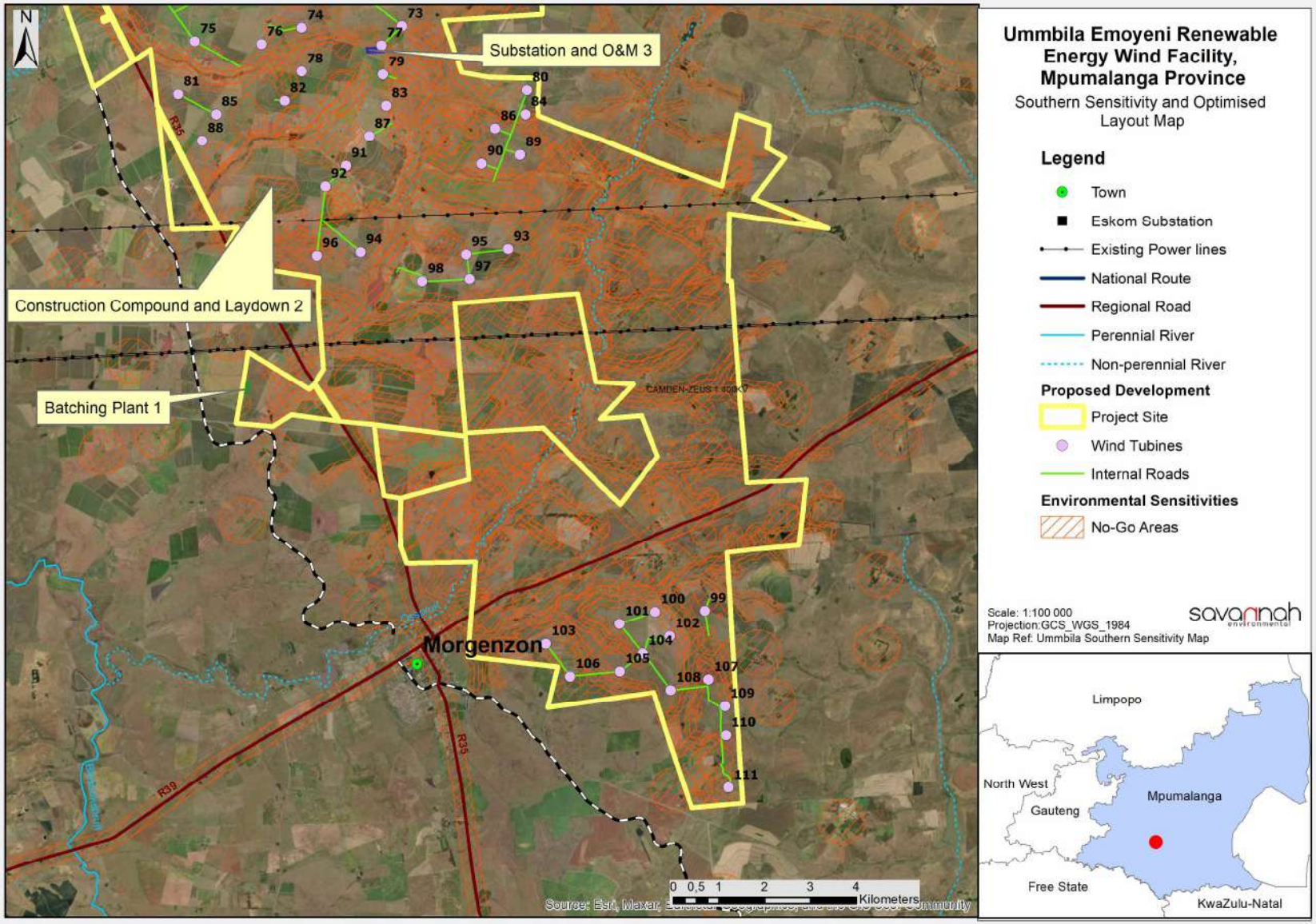


Figure 4b: Refined optimised layout for the Ummbila Emoyeni Wind Energy Facility considered to be acceptable for development (southern section)

4. Environmental Costs versus Benefits of the Ummbila Emoyeni Renewable Energy Facility

Environmental costs (including those to the natural environment, economic and social environment) can be anticipated at a local and site-specific level and are considered acceptable provided the mitigation measures as outlined in the EIA Report and the EMPr are implemented and adhered to. No fatal flaws have been identified. These environmental costs could include:

- *Loss of biodiversity, flora and fauna due to the clearing of land for the construction and utilisation of land for the wind farm* – The cost of loss of biodiversity has been minimised/avoided through avoiding placement of project components and infrastructure within the ecological features considered to be of very high sensitivity (no-go areas).
- *Impacts on freshwater resources* – the impacts on freshwater resources have been minimised through the avoidance of the sensitive features by project infrastructure. The internal access roads and MV Cabling will however need to cross some freshwater resource features, some of which will be on existing gravel roads.
- *Visual impacts associated with the wind farm/impacts to the sense of place* – The Ummbila Emoyeni Wind Energy Facility will be visible to receptors up to a distance of 10km from the site and mainly of a high significance. No mitigation of this impact is possible (i.e., the structures will be visible in the landscape), but general mitigation and management are required as best practise to minimise secondary visual impacts which may arise from mismanagement of the site. Other large scale industrial operations including mining operations and power stations are relatively obvious in the region. Whilst the proposed project will create a new large scale industrial operation and change the character of an area of rural landscape, this is not entirely out of character with the region.
- *Loss of land for agriculture* – The development will remove areas available for agricultural activities; however, based on the small development footprint of the wind farm and the fact that agricultural activities can continue on the properties together with the wind farm, this will be limited and not significant.
- *Impacts on birds and bats* – loss of birds and bats species due to collision with turbines. The impact has been minimised through the avoidance of areas of very high sensitivity (no-go areas) and is considered to be acceptable with implementation of mitigation measures.
- *Negative impact to the cultural landscape* – The Ummbila Emoyeni Wind Energy Facility is proposed within a landscape area with an overriding rural character within which there are large industrial nodes including mining operations and coal fired power stations. Whilst the proposed project will create a new large scale industrial node within the agricultural landscape, this is not entirely out of character with the broader region. However, it will be a significant local character change.
- *Loss of heritage and palaeontological resources* – Six burial grounds were identified within and close to the project site, around which a 50m no-go buffer has been recommended. With the exception of one fossil site of low scientific value, none of the recorded fossil sites overlaps directly with, or lies close to (< 20m) the proposed infrastructure.

Benefits of the Ummbila Emoyeni Wind Energy Facility include the following:

- The project will result in important economic benefits at the local and regional scale through job creation, income and other associated downstream economic development, supporting the Just Energy Transition in the region. These will persist during the pre-construction, construction, operation and decommissioning phases of the project.

- The project provides an opportunity for a new land use on the affected properties which would result in additional financial benefits to the directly affected landowners through compensation. It is important to note that the construction and operation of a wind farm can occur in tandem with crop production.
- The project contributes towards the Provincial and Local goals for the development of renewable energy as outlined in the respective IDPs.
- The project serves to diversify the economy and electricity generation mix of South Africa through the addition of wind energy, in line with national policy regarding energy generation.
- The water requirement for a wind farm is negligible compared to the levels of water used by coal-based technologies. This generation technology is therefore supported in dry climatic areas.
- South Africa's per capita greenhouse gas emissions are amongst the highest in the world due to the reliance on fossil fuels. The Ummbila Emoyeni Wind Energy Facility will contribute to achieving goals for implementation of renewable energy and sustaining a 'green' economy within South Africa.

The benefits of the Ummbila Emoyeni Wind Energy Facility are expected to occur at a national, regional and local level. As the costs to the environment at a site-specific level have been largely limited through the appropriate placement of infrastructure on the project site within lower sensitive areas, the benefits of the project are expected to partially offset the localised environmental costs of the wind farm, provided that the mitigation measures, as recommended by the specialists are adhered to.

5. Overall Conclusion (Impact Statement)

The preferred activity was determined by the developer to be the development of a renewable energy facility on site using wind as the preferred technology, due to the availability of a strong wind resource, available grid capacity, benign topography, and good access. A technically viable development footprint was proposed by the developer considering environmental sensitivities identified in the scoping study and assessed as part of the EIA process. The assessment of the development footprint within the project site was undertaken by independent specialists and their findings have informed the results of this EIA Report.

From a review of the relevant policy and planning framework, it was concluded that the project is well aligned with the policy framework, and a clear need for the project is seen from a policy perspective at a local, provincial and National level.

The specialist findings from the EIA studies undertaken have indicated that there are no identified fatal flaws associated with the implementation of the development footprint within the project site subject to implementation of the recommended mitigation measures. The developer has designed a project development footprint in response to the identified sensitive environmental features and areas present within the project site. This approach is in line with the application of the mitigation hierarchy, where all the sensitive areas which could be impacted by the development have been avoided (i.e., tier 1 of the mitigation hierarchy). Feedback from the bat and heritage specialists has indicated some of the turbines and associated infrastructure need to be relocated to avoid areas of very high sensitivity. This recommendation has been adhered to by the developer which has designed an optimised layout (refer to **Figure 3**) which is in-line with these requirements to ensure environmental acceptability. Further scrutiny of the optimised layout identified and confirmed that specific turbines and associated infrastructure were still unacceptably placed within the project site. Based on the findings as documented in **Table 5**, the optimised layout was further refined and a layout which addresses the need to relocate the turbines and associated infrastructure, as listed in **Table 5** was designed (refer to **Figure 4**). The result is that the refined optimised facility layout has

repositioned turbines and associated infrastructure outside of the sensitive areas and features regarded to be no-go for development.

The impacts that are expected to remain after the avoidance of the sensitive areas by the refined optimised facility layout have been reduced to acceptable levels through the recommendation of specific mitigation measures by the specialists. The minimisation of the significance of the impacts is in line with tier 2 of the mitigation hierarchy.

Therefore, impacts can be mitigated to acceptable levels or enhanced through the implementation of the recommended mitigation or enhancement measures. This is however not relevant for the visual impact of the wind farm as the turbines will be visible regardless of the mitigation applied. This high significance rating is, however, not considered as a fatal flaw by the specialist.

As detailed in the cost-benefit analysis, the benefits of the Ummbila Emoyeni Wind Energy Facility are expected to occur at a national, regional and local level. As the costs to the environment at a site-specific level have been largely limited through the appropriate placement of infrastructure on the project site within lower sensitive areas through the avoidance of features and areas considered to be sensitive/no-go for development, the benefits of the project are expected to partially offset the localised environmental costs of the wind farm. From a social perspective, both positive and negative impacts are expected.

Through the assessment of the development footprint within the project site, it can be concluded that the development of the Ummbila Emoyeni Wind Energy Facility will not result in unacceptable environmental impacts (subject to the implementation of the recommended mitigation measures).

6. Overall Recommendation

Considering the findings of the independent specialist studies, the impacts identified, the development footprint proposed by the developer, the avoidance of the sensitive environmental features within the project site, as well as the potential to further minimise the impacts to acceptable levels through mitigation, it is the reasoned opinion of the EAP that the Ummbila Emoyeni Wind Energy Facility is acceptable within the landscape and can reasonably be authorised subject to implementation of the refined optimised facility layout and the mitigation and enhancement measures recommended by the specialists.

The Ummbila Emoyeni Wind Energy Facility with a contracted capacity of up to 900MW includes the following infrastructure (to be included within an authorisation issued for the project):

- Up to 111 wind turbines with a maximum hub height of up to 200m. The tip height of the turbines will be up to 300m.
- 33kV cabling to connect the wind turbines to the onsite collector substations, to be laid underground where practical.
- 3 x 33kV/132kV onsite collector substation (IPP Portion), each being 5ha.
- Battery Energy Storage System (BESS) (200MW/800MWh).
- Cabling between turbines, to be laid underground where practical.
- Construction compounds including site office (approximately 300m x 300m in total but split into 3ha each of 150m x 200m):
  - Batching plant of up to 4ha to 7ha.
  - 3 x O&M office of approximately 1.5ha each adjacent to each collector SS.

  - 3 x construction compound / laydown area, including site office of 3ha each (150m x 200m each).
- Laydown and crane hardstand areas (approximately 75m x 120m).
- Access roads of 12 -13m wide, with 12m at turning circles.

The following key conditions would be required to be included within an authorisation issued for the Ummbila Emoyeni Wind Energy Facility:

- All mitigation measures detailed within this EIA Report, as well as the specialist reports contained within **Appendices D to M** are to be implemented.
- The EMPrs (for the facility and onsite substation) as contained within **Appendix O** of this EIA Report should form part of the contract with the Contractors appointed to construct and maintain the wind farm in order to ensure compliance with environmental specifications and management measures. The implementation of this EMPr for all life cycle phases of the Ummbila Emoyeni Wind Energy Facility is considered key in achieving the appropriate environmental management standards as detailed for this project.
- Following the final design of the Ummbila Emoyeni Wind Energy Facility, a revised layout must be submitted to DFFE for review and approval prior to commencing with construction. Micro-siting must take all recommended mitigation measures into consideration. No development is permitted within the identified no-go areas as detailed in **Figure 4**.
- An Environmental Site Officer (ESO) must form part of the on-site team to ensure that the EMPr is implemented and enforced and an Environmental Control Officer (ECO) must be appointed to oversee the implementation activities and monitor compliance for the duration of the construction phase.
- Preconstruction walk-through of the final development footprint for protected species that would be affected and that can be translocated must be undertaken. The survey must also cover sensitive habitats and species that are required to be avoided. Permits from the relevant provincial authorities, will be required to relocate and/or disturb listed plant species.
- Observer-based Shut-down-on-demand or similar technology is to be implemented for all WTGs placed in identified sensitive areas as well as those WTGs that remain within 3 000m of VPs 1, 2, 3 and 10.
- Develop and implement a carcass search and bird activity monitoring programme in-line with the latest applicable guidelines. Regular reviews of operational phase monitoring data (activity and carcass) and results to be conducted by an avifaunal specialist. The above reviews should strive to identify sensitive locations including WTGs and areas of increased collisions that may require additional mitigation.
- Prevent birds from nesting in substation infrastructure through exclusion covers or spikes if required (determined on a case-by-case basis).
- Implement bat fatality monitoring throughout the operational phase and apply curtailment or deterrents if fatality thresholds are exceeded.
- If the structures located at NSR47 are used for residential purposes, the resident(s) must be relocated, or the WTG located within 1 000m from these NSR should be moved further than 1 000m from these NSR.
- Active noise monitoring (i.e., the measurement of noise levels at identified locations) is recommended throughout the operation phase at NSRs within 2000m of a wind turbine before the development of the wind energy facility, with the measurements repeated after the first year of operation. Should any of these locations not be used for residential purposes, measurements at these NSRs would not be required.
- Should a reasonable and valid noise complaint be registered, the developer must investigate the noise complaint as per the guidelines in sub-section 12.1 and 12.2 of the noise impact assessment. Once-off noise measurements must be conducted at the location of the person that registered a valid and reasonable noise complaint. The measurement location should consider the direct surroundings to

ensure that other sound sources cannot influence the reading. These measurement locations can be reduced accordingly if the NSR are relocated, or the dwelling are no longer used for residential purposes.

- In order to minimise noise impacts on NSRs used for residential purposes within 1 000m of WTGs at the time of implementation of the project:
  - the resident(s) could be relocated, or;
  - the WTG located within 1 000m from these NSR be moved further than 1 000m from these NSR; or
  - the applicant can select to use a quieter WTG (with a SPL less than 108.5 dBA as per the IEC 61400-14 certificate) within 1 500m from NSR 40 and 46.
- Implement recommendations of the shadow flicker study to inform the final design and appropriate mitigation.
- All other relevant environmental permits must be obtained prior to the construction of the facility.

A validity period of 10 years of the Environmental Authorisation is requested, should the project obtain approval from DFFE.

DEFINITIONS AND TERMINOLOGY

Alternatives: Alternatives are different means of meeting the general purpose and need of a proposed activity. Alternatives may include location or site alternatives, activity alternatives, process or technology alternatives, temporal alternatives or the 'do nothing' alternative.

Betz Limit: It is the flow of air over the blades and through the rotor area that makes a wind turbine function. The wind turbine extracts energy by slowing the wind down. The theoretical maximum amount of energy in the wind that can be collected by a wind turbine's rotor is approximately 59%. This value is known as the Betz Limit.

Commence: The start of any physical activity, including site preparation and any other activity on site furtherance of a listed activity or specified activity, but does not include any activity required for the purposes of an investigation or feasibility study as long as such investigation or feasibility study does not constitute a listed activity or specified activity.

Commercial Operation date: The date after which all testing and commissioning has been completed and is the initiation date to which the seller can start producing electricity for sale (i.e. when the project has been substantially completed).

Commissioning: Commissioning commences once construction is completed. Commissioning covers all activities including testing after all components of the wind turbine are installed.

Construction: Construction means the building, erection or establishment of a facility, structure or infrastructure that is necessary for the undertaking of a listed or specified activity. Construction begins with any activity which requires Environmental Authorisation.

Cumulative impacts: Impacts that result from the incremental impact of the proposed activity on a common resource when added to the impacts of other past, present or reasonably foreseeable future activities (e.g. discharges of nutrients and heated water to a river that combine to cause algal bloom and subsequent loss of dissolved oxygen that is greater than the additive impacts of each pollutant). Cumulative impacts can occur from the collective impacts of individual minor actions over a period and can include both direct and indirect impacts.

Cut-in speed: The minimum wind speed at which the wind turbine will generate usable power.

Cut-out speed: The wind speed at which shut down occurs.

Decommissioning: To take out of active service permanently or dismantle partly or wholly, or closure of a facility to the extent that it cannot be readily re-commissioned. This usually occurs at the end of the life of a facility.

Development area: The development area is that identified area (located within the project site) where the Ummbila Emoyeni Wind Energy Facility is planned to be located. The development area is still to be determined.

Development footprint: The development footprint is the defined area (located within the development area) where the wind turbines and other associated infrastructure for the Ummbila Emoyeni Wind Energy Facility is planned to be constructed. This is the actual footprint of the facility, and the area which would be disturbed.

Direct impacts: Impacts that are caused directly by the activity and generally occur at the same time and at the place of the activity (e.g. noise generated by blasting operations on the site of the activity). These impacts are usually associated with the construction, operation, or maintenance of an activity and are generally obvious and quantifiable.
Disturbing noise: A noise level that exceeds the ambient sound level measured continuously at the same measuring point by 7 dB or more.

'Do nothing' alternative: The 'do nothing' alternative is the option of not undertaking the proposed activity or any of its alternatives. The 'do nothing' alternative also provides the baseline against which the impacts of other alternatives should be compared.

Endangered species: Taxa in danger of extinction and whose survival is unlikely if the causal factors continue operating. Included here are taxa whose numbers of individuals have been reduced to a critical level or whose habitats have been so drastically reduced that they are deemed to be in immediate danger of extinction.

Emergency: An undesired/ unplanned event that results in a significant environmental impact and requires the notification of the relevant statutory body, such as a local authority.

Endemic: An "endemic" is a species that grows in a particular area (is endemic to that region) and has a restricted distribution. It is only found in a particular place. Whether something is endemic or not depends on the geographical boundaries of the area in question and the area can be defined at different scales.

Environment: the surroundings within which humans exist and that are made up of:

4. The land, water and atmosphere of the earth;
ii. Micro-organisms, plant and animal life;
iii. Any part or combination of (i) and (ii) and the interrelationships among and between them; and
iv. The physical, chemical, aesthetic and cultural properties and conditions of the foregoing that influence human health and well-being.

Environmental impact: An action or series of actions that have an effect on the environment.

Environmental impact assessment: Environmental Impact Assessment, as defined in the NEMA EIA Regulations and in relation to an application to which scoping must be applied, means the process of collecting, organising, analysing, interpreting and communicating information that is relevant to the consideration of that application.

Environmental management: Ensuring that environmental concerns are included in all stages of development, so that development is sustainable and does not exceed the carrying capacity of the environment.

Environmental management programme: An operational plan that organises and co-ordinates mitigation, rehabilitation and monitoring measures in order to guide the implementation of a proposal and its ongoing maintenance after implementation.

Generator: The generator is what converts the turning motion of a wind turbine's blades into electricity.

Heritage: That which is inherited and forms part of the National Estate (Historical places, objects, fossils as defined by the National Heritage Resources Act of 2000).

Indigenous: All biological organisms that occurred naturally within the study area prior to 1800.
Indirect impacts: Indirect or induced changes that may occur because of the activity (e.g. the reduction of water in a stream that supply water to a reservoir that supply water to the activity). These types of impacts include all the potential impacts that do not manifest immediately when the activity is undertaken or which occur at a different place because of the activity.

Interested and affected party: Individuals or groups concerned with or affected by an activity and its consequences. These include the authorities, local communities, investors, work force, consumers, environmental interest groups, and the public.

Method statement: A written submission to the ECO and the site manager (or engineer) by the EPC Contractor in collaboration with his/her EO.

Mitigation hierarchy: The mitigation hierarchy is a framework for managing risks and potential impacts related to biodiversity and ecosystem services. The mitigation hierarchy is used when planning and implementing development projects, to provide a logical and effective approach to protecting and conserving biodiversity and maintaining important ecosystem services. It is a tool to aid in the sustainable management of living, natural resources, which provides a mechanism for making explicit decisions that balance conservation needs with development priorities

Nacelle: The nacelle contains the generator, control equipment, gearbox and anemometer for monitoring the wind speed and direction.

No-go areas: Areas of environmental sensitivity that should not be impacted on or utilised during the development of a project as identified in any environmental reports.

Pollution: A change in the environment caused by substances (radio-active or other waves, noise, odours, dust or heat emitted from any activity, including the storage or treatment or waste or substances.

Pre-construction: The period prior to the commencement of construction, this may include activities which do not require Environmental Authorisation (e.g., geotechnical surveys).

Project site: The project site is the area with an extent of 27 819ha, within which the Ummbila Emoyeni Wind Energy Facility development footprint will be located.

Rare species: Taxa with small world populations that are not at present Endangered or Vulnerable but are at risk as some unexpected threat could easily cause a critical decline. These taxa are usually localised within restricted geographical areas or habitats or are thinly scattered over a more extensive range. This

category was termed Critically Rare by Hall and Veldhuis (1985) to distinguish it from the more generally used word "rare."

Red data species: Species listed in terms of the International Union for Conservation of Nature and Natural Resources (IUCN) Red List of Threatened Species, and/or in terms of the South African Red Data list. In terms of the South African Red Data list, species are classified as being extinct, endangered, vulnerable, rare, indeterminate, insufficiently known or not threatened (see other definitions within this glossary).

Rotor: The portion of the wind turbine that collects energy from the wind is called the rotor. The rotor converts the energy in the wind into rotational energy to turn the generator. The rotor has three blades that rotate at a constant speed of about 15 to 28 revolutions per minute (rpm).

Significant impact: An impact that by its magnitude, duration, intensity, or probability of occurrence may have a notable effect on one or more aspects of the environment.

Tower: The tower, which supports the rotor, is constructed from tubular steel. It is between 80m and 120m tall. The nacelle and the rotor are attached to the top of the tower. The tower on which a wind turbine is mounted is not just a support structure. It also raises the wind turbine so that its blades safely clear the ground and so it can reach the stronger winds at higher elevations. The tower must be strong enough to support the wind turbine and to sustain vibration, wind loading and the overall weather elements for the lifetime of the wind turbine.

Wind power: A measure of the energy available in the wind.

Wind rose: The term given to the diagrammatic representation of joint wind speed and direction distribution at a particular location. The length of time that the wind comes from a particular sector is shown by the length of the spoke, and the speed is shown by the thickness of the spoke.

Wind speed: The rate at which air flows past a point above the earth's surface.

TABLE OF CONTENTS

PROJECT DETAILS i
PURPOSE OF THE EIA REPORT AND INVITATION TO COMMENT ii
EXECUTIVE SUMMARY iii
DEFINITIONS AND TERMINOLOGY xxxi
TABLE OF CONTENTS xxxv
APPENDICES LIST xl
CHAPTER 1: INTRODUCTION 1
1.1. Requirement for an Environmental Impact Assessment Process 2
1.2. Legal Requirements as per the EIA Regulations, 2014 (as amended) for the undertaking of an Environmental Impact Assessment Report 4
1.3. Project Overview 5
1.4. Overview of the Environmental Impact Assessment (EIA) Process 8
1.5. Details of Environmental Assessment Practitioner and Expertise to conduct the S&EIA Process 10
CHAPTER 2: PROJECT DESCRIPTION 12
2.1 Legal Requirements as per the EIA Regulations, 2014 (as amended), for the undertaking of an Environmental Impact Assessment Report 12
2.2 Nature and Extent of the Ummbila Emoyeni Wind Energy Facility 12
2.2.1. Overview of the Project Site 13
2.2.2. Components of the Ummbila Emoyeni Wind Energy Facility 14
2.2.3 Project Development Phases Associated with the Ummbila Emoyeni Wind Energy Facility 17
CHAPTER 3: CONSIDERATION OF ALTERNATIVES 22
3.1 Legal Requirements as per the EIA Regulations, 2014 (as amended) for the undertaking of an Environmental Impact Assessment Report 22
3.2 Alternatives Considered during the S&EIA Process 22
3.2.1 Consideration of Fundamentally Different Alternatives 23
3.2.2 Consideration of Incrementally Different Alternatives 23
3.3 Project Alternatives under Consideration for the Ummbila Emoyeni Wind Energy Facility 23
3.3.1. Property or Location Alternatives 23
3.3.2. Design and Layout Alternatives 25
3.3.3. Activity Alternatives 26
3.3.4. Technology Alternatives 26
3.3.5. The 'Do-Nothing' Alternative 29
CHAPTER 4: WIND AS A POWER GENERATION TECHNOLOGY 30
4.1. Wind Resource as a Power Generation Technology 30
4.2. How do wind turbines function and what are the associated infrastructure? 31
4.3. Main Components of a Wind Turbine 33
4.4. Operating Characteristics of a Wind Turbine 35
4.5. Battery Energy Storage System (BESS) 36
CHAPTER 5: POLICY AND LEGISLATIVE CONTEXT 37
5.1 Legal Requirements as per the EIA Regulations, 2014 (as amended) for the undertaking of an Environmental Impact Assessment Report 37
5.2. Strategic Electricity Planning in South Africa 37
5.3. International Policy and Planning Context 39
5.4. National Policy and Planning Context 41

5.5. Provincial Policy and Planning Context 50
5.6. Local Policy and Planning Context 53
CHAPTER 6: NEED AND DESIRABILITY 55
6.1. Legal Requirements as per the EIA Regulations, 2014 (as amended), for the undertaking of an Environmental Impact Assessment Report 55
6.2. Need and Desirability from an International Perspective 55
6.3. Need and Desirability from a National Perspective 56
6.3.1. Benefits of Renewable Energy and the Need and Desirability in the South African Environment 61
6.4. Need and Desirability of the project from a Regional Perspective 64
6.5. Receptiveness of and desirability of the project site to develop the Ummbila Emoyeni Wind Energy Facility 66
CHAPTER 7: APPROACH TO UNDERTAKING THE EIA PROCESS 68
7.1 Legal Requirements as per the EIA Regulations, 2014 (as amended), for the undertaking of an Environmental Impact Assessment Report 68
7.2 Relevant legislative permitting requirements 69
7.2.1 National Environmental Management Act (No. 107 of 1998) (NEMA) 69
7.2.2 National Water Act (No. 36 of 1998) (NWA) 73
7.2.3 National Heritage Resources Act (No. 25 of 1999) (NHRA) 74
7.3 Overview of the Scoping Phase 75
7.4 Overview of the EIA Phase 87
7.4.1 Authority Consultation and Application for Environmental Authorisation in terms of the 2014 EIA Regulations (as amended) 87
7.4.2 Public Participation Process 88
7.5 Outcome of the DFFE Web-Based Screening Tool 91
7.6 Assessment of Issues Identified throughout the EIA Process 93
7.7 Assumptions and Limitation of the EIA Process 95
7.8 Legislation and Guidelines that have informed the preparing of this Scoping Report 96
7.8.1 Best Practice Guidelines Birds & Wind Energy (2015) 109
7.8.2 South African Best Practice Guidelines for Pre-Construction Monitoring of Bats at Wind Energy Facilities (2020) 109
7.8.3 South African Good Practice Guidelines for Operational Monitoring for Bats at Wind Energy Facilities (2019) 110
7.8.4 The IFC Environmental Health and Safety (EHS) Guidelines 110
7.8.5 IFC Environmental, Health and Safety Guidelines for Wind Energy (August 2015) 111
CHAPTER 8: DESCRIPTION OF THE AFFECTED ENVIRONMENT 113
8.1 Legal Requirements as per the EIA Regulations, 2014 (as amended), for the undertaking of an Environmental Impact Assessment 113
8.2. Regional Setting 114
8.3. Climatic Conditions 116
8.4. Biophysical Characteristics of the Project Site 116
8.4.1. Topographical profile 117
8.4.2. Geology, Soils and Agricultural Potential 118
8.4.3. Land Use 122
8.4.4. Ecological Profile of the Broader Study Area and the Project Site 122
8.5. Integrated Heritage including Archaeology, Palaeontology, and the Cultural Landscape 147
8.5.1. Archaeology 147
8.5.2. Palaeontology 151

8.5.3. Cultural Landscape 153
8.6. Visual Quality 154
8.6.1 Identified Visual Receptors 155
8.7. Ambient Noise Levels and Sensitive Noise Developments 155
8.8. Traffic Conditions 159
8.9. Socio-Economic Profile 161
8.9.1. Profile of the Broader Area 161
8.9.2. Profile of the Immediate Affected Area 163
CHAPTER 9: ASSESSMENT OF IMPACTS 165
9.1. Legal Requirements as per the EIA Regulations, 2014 (as amended), for the undertaking of an Environmental Impact Assessment Report 167
9.2. Quantification of Areas of Disturbance on the Site 168
9.3. Potential Impacts on Terrestrial Ecology (including flora and fauna) 169
9.3.1 Results of the Terrestrial Ecology Impact Assessment 169
9.3.2 Description of Impacts on Terrestrial Ecology 171
9.3.3 Impact tables summarising the significance of impacts on terrestrial ecology during construction, operation and decommissioning (with and without mitigation) 172
9.3.5 Overall Result 177
9.4. Potential Impacts on Freshwater Ecology 178
9.4.1 Results of the Freshwater Impact Assessment 178
9.4.2 Description of Impacts on Freshwater Ecology 181
9.4.3 Impact tables summarising the significance of impacts on freshwater ecology during construction, operation and decommissioning (with and without mitigation) 183
9.4.4 Overall Result 192
9.5. Potential Impacts on Avifauna 193
9.5.1 Results of the Avifauna Impact Assessment 193
9.5.2 Description of Avifaunal Impacts 197
9.5.3 Impact tables summarising the significance of impacts on avifauna during construction, operation and decommissioning (with and without mitigation) 197
9.5.4 Overall Result 203
9.6. Potential Impacts on Bats 203
9.6.1 Results of the Bat Impact Assessment 203
9.6.2 Description of Bat Impacts 208
9.6.3 Impact tables summarising the significance of impacts on bats during the construction, operation and decommissioning phases (with and without mitigation) 208
9.6.4 Overall Result 212
9.7. Assessment of Impacts on Soils Agricultural Potential 212
9.7.1 Results of the Soils and Agricultural Potential Assessment 212
9.7.2 Description of Impacts on Soils and Agricultural Potential 214
9.7.3 Impact tables summarising the significance of impacts on soils and agricultural potential during the construction, operation and decommissioning phases (with and without mitigation) 214
9.7.4 Overall Result 217
9.8. Assessment of Impacts on Heritage Resources (including archaeology, palaeontology and cultural landscape) 217
9.8.1 Results of the Heritage Impact Assessment 217
9.8.2 Description of the Heritage Impacts 221

9.8.3 Impact tables summarising the significance of impacts on heritage during construction, operation and decommissioning (with and without mitigation) 221
9.8.4 Overall Result 224
9.9. Assessment of Noise Impacts 225
9.9.1 Results of the Noise Impact Assessment 225
9.9.2 Description of Noise Impacts 230
9.9.3 Impact tables summarising the significance of impacts on noise during construction, operation and decommissioning (with and without mitigation) 232
9.9.4 Overall Result 238
9.10. Assessment of Visual Impacts 238
9.10.1 Results of the Visual Impact Assessment 239
9.10.2 Description of Visual Impacts 243
9.10.3 Impact table summarising the significance of visual impacts during construction, operation and decommissioning (with and without mitigation) 243
9.10.4 Overall Result 251
9.11. Assessment of Socio-Economic Impacts 251
9.11.1 Results of the Socio-Economic Impact Assessment 251
9.11.2 Description of Socio-Economic Impacts 252
9.11.3 Impact tables summarising the significance of socio-economic impacts during construction, operation and decommissioning (with and without mitigation measures) 252
9.11.4 Overall Result 264
9.12. Assessment of Impacts on Traffic 264
9.12.1 Results of the Traffic Impact Assessment 264
9.12.2 Description of Traffic Impacts 265
9.12.3 Impact tables summarising the significance of impacts on traffic during the construction and operation phases (with and without mitigation) 265
9.12.4 Overall Result 266
9.13. Risks Associated with Energy Storage 267
9.14. Assessment of the 'Do Nothing' Alternative 270
9.14.1 Conclusion 272
CHAPTER 10: ASSESSMENT OF POTENTIAL cumulative IMPACTS 274
10.1. Legal Requirements as per the EIA Regulations, 2014 (as amended), for the undertaking of an Environmental Impact Assessment Report 274
10.2 Approach taken to Assess Cumulative Impacts 274
10.3 Cumulative Impacts on Terrestrial Ecology (including flora and fauna) 278
10.4 Cumulative Impacts on Freshwater Ecology 280
10.5 Cumulative Impacts on Avifauna 282
10.6 Cumulative Impacts on Bats 283
10.7 Cumulative Impacts on Soils and Agricultural Potential 284
10.8 Cumulative Impacts on Heritage (cultural landscape) 285
10.9 Cumulative Noise Impacts 286
10.10 Cumulative Visual Impacts 286
10.11 Cumulative Socio-Economic Impacts 291
10.12 Cumulative Traffic Impacts 292
10.13 Conclusion regarding Cumulative Impacts 293
CHAPTER 11: CONCLUSIONS AND RECOMMENDATIONS 296

11.1. Legal Requirements as per the EIA Regulations, 2014 (as amended), for the undertaking of an Environmental Impact Assessment Report 297
11.2 Evaluation of the Ummbila Emoyeni Wind Energy Facility 298
11.2.1 Impacts on Terrestrial Ecology (including flora and fauna) 300
11.2.2 Impacts on Freshwater Ecology 301
11.2.3 Impacts on Avifauna 302
11.2.4 Impacts on Bats 303
11.2.5 Impacts on Soils and Agricultural Potential 304
11.2.6 Impacts on Heritage Resources (archaeology, palaeontology and cultural landscape) 304
11.2.7 Noise Impacts 305
11.2.8 Visual Impacts 306
11.2.9 Socio-Economic Impacts 306
11.2.10 Traffic Impacts 307
11.2.11 Assessment of Cumulative Impacts 308
11.3. Optimisation of the Facility Layout 311
11.4. Environmental Costs versus Benefits of the Ummbila Emoyeni Renewable Energy Facility 317
11.5. Overall Conclusion (Impact Statement) 318
11.6. Overall Recommendation 319
CHAPTER 12: References 322

APPENDICES LIST

Appendix A: EIA Project Consulting Team and Specialist CVs
Appendix B: Authority Consultation
Appendix C: Public Participation Process
Appendix C1: I&AP Database
Appendix C2: Site Notices and Newspaper Advertisements
Appendix C3: Background Information Document
Appendix C4: Organs of State Correspondence
Appendix C5: Stakeholder Correspondence
Appendix C6: Comments Received
Appendix C7: Minutes of Meetings
Appendix C8: Comments Received
Appendix C9: Comments and Responses Report
Appendix D: Terrestrial Ecology Impact Assessment
Appendix E: Freshwater Impact Assessment
Appendix F: Avifauna Impact Assessment
Appendix G: Bat Impact Assessment
Appendix H: Soils and Agricultural Impact Assessment
Appendix I: Heritage Impact Assessment
Appendix J: Noise Impact Assessment
Appendix K: Visual Impact Assessment
Appendix L: Socio-Economic Impact Assessment
Appendix M: Traffic Impact Assessment
Appendix N: Specialist Declarations
Appendix O: Environmental Management Programmes
Appendix O1: Facility Environmental Management Programme (Facility)
Appendix O2: Generic Substation Environmental Management Programme
Appendix P: Maps
Appendix Q: DFFE Screening Report
Appendix R: EAP Declaration of Independence and Affirmation
Appendix S: SG Codes for the Affected Properties
Appendix T: Shadow Flicker Study

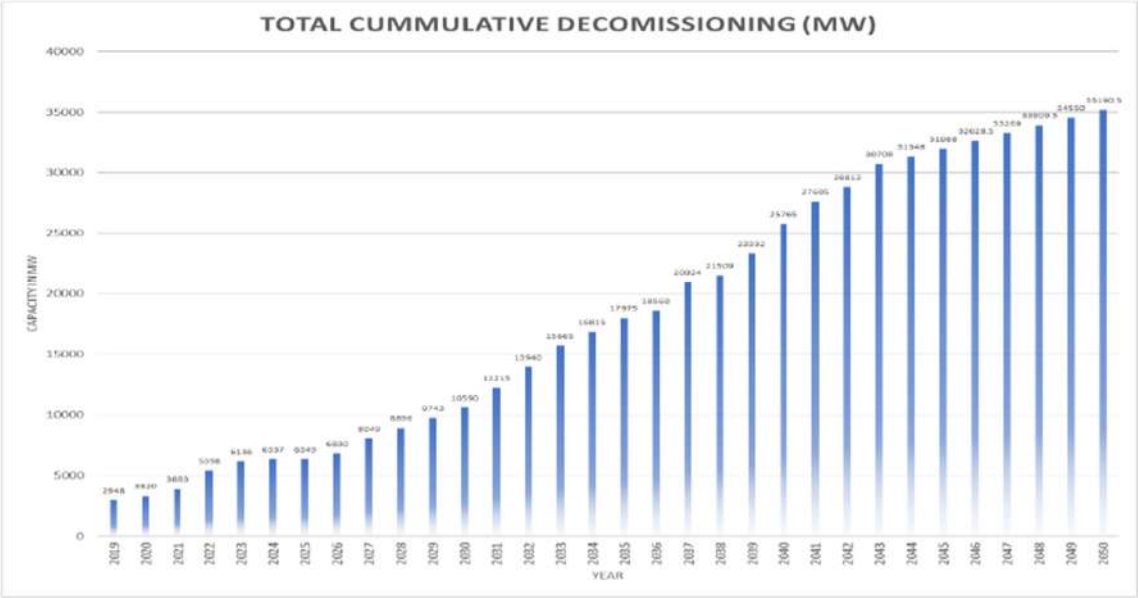
CHAPTER 1: INTRODUCTION

Emoyeni Renewable Energy Farm (Pty) Ltd is proposing the development of a commercial Wind Energy Facility and associated infrastructure on a site located ~6km south-east of Bethal and 1km east of Morgenzon, within the Mpumalanga Province. The project site is located across the Govan Mbeki, Lekwa, and Msukaligwa Local Municipalities within the Gert Sibande District (refer to **Figure 1.1**). The facility will have a contracted capacity of up to 900MW[4] and will be known as the Ummbila Emoyeni Wind Energy Facility. The project is planned as part of a larger cluster of renewable energy projects (to be known as the Ummbila Emoyeni Renewable Energy Farm), which include one 900MW wind energy facility, to be developed in several phases, and one 150MW solar energy facility The grid connection infrastructure for both facilities will include a 400/132kV Main Transmission Substation (MTS), to be located between the Camden and SOL Substations, which will be looped in and out of the existing Camden-Sol 400kV transmission line; on-site switching stations (132kV in capacity) at each renewable energy facility (Eskom Portion); 132kV power lines from the switching stations at each renewable energy facility to the new 400/132kV MTS; and a collector substation with 2 x 132kV bus bars and 4 x 132kV IPP feeder bays to the onsite IPP Substation.

Each renewable energy facility will be constructed as a separate stand-alone project and therefore, separate Scoping and Environmental Impact Assessment (S&EIA) processes will be undertaken for each of the renewable energy facilities. Similarly, the grid connection solution will be subjected to a separate S&EIA process.

The Ummbila Emoyeni Wind Energy Facility is proposed in response to the identified objectives of national and provincial government and local and district municipalities to develop renewable energy facilities for power generation purposes. It is the developer's intention to bid the Ummbila Emoyeni Wind Energy Facility under the Department of Mineral Resources and Energy's (DMRE's) Renewable Energy Independent Power Producer Procurement (REIPPP) Programme or possibly a similar private programme, with the aim of evacuating the generated power into the national grid. This will aid in the diversification and stabilisation of the country's electricity supply, in line with the objectives of the Integrated Resource Plan (IRP) published by the Department of Minerals Resources and Energy, with the Ummbila Emoyeni Wind Energy Facility set to inject up to 900MW of electricity into the national grid. Similarly, the location of the new generation in the Mpumalanga Province is important in the context of the Just Energy Transition (JET). The Ummbila Emoyeni Wind Energy Facility will provide valuable jobs and socio-economic benefits that are required in an area where coal fired generation will be phased out over the next 10 years (see graph below). This will be vitally important if the JET is to be successfully implemented and is a transition for everyone.

[4] The draft EIA Report referred to a capacity of 666MW. The change in capacity has been included in the Final EIA Report to accommodate changes in technology. The project footprint and turbine specifications remain unchanged from those presented within the draft EIA Report.



Source: 2019 Finalised Integrated Resource Plan ("IRP")

From a regional perspective, the identified area within the Mpumalanga Province is considered favourable for the development of a commercial wind energy facility by virtue of prevailing climatic conditions, relief, the extent of the affected properties, the availability of a direct grid connection (i.e., a point of connection of the national grid) and the availability of land on which the development can take place.

1.1. Requirement for an Environmental Impact Assessment Process

Section 24 of South Africa's National Environmental Management Act (No. 107 of 1998) (NEMA) pertains to Environmental Authorisations (EA), and requires that the potential consequences for, or impacts of, listed or specified activities on the environment be considered, investigated, assessed, and reported on to the Competent Authority CA. The 2014 Environmental Impact Assessment (EIA) Regulations, as amended (GNR 326), published under the NEMA prescribe the process to be followed when applying for EA, while the Listing Notices (Listing Notice 1 (GNR 327), Listing Notice 2 (GNR 325), and Listing Notice 3 (GNR 324)) contain those activities which may not commence without an EA from the Competent Authority.

As the project has the potential to impact on the environment, an EA is required from the National Department of Forestry, Fisheries and the Environment (DFFE) subject to the completion of a full S&EIA process, as prescribed in Regulations 21 and 24 of the 2014 EIA Regulations (GNR 326), as amended. The requirement for EA subject to the completion of a full S&EIA process is triggered by the inclusion of, amongst others, Activity 1 of Listing Notice 1 (GNR 325), namely:

"The development of facilities or infrastructure for the generation of electricity from a renewable resource where the electricity output is 20MW or more."

In terms of GNR 779 of 01 July 2016, the DFFE has been determined as the Competent Authority for all projects which relate to the IRP for Electricity 2010 – 2030, and any updates thereto. Through the decision-making process, the DFFE will be supported by the Mpumalanga Department of Agriculture, Rural Development, Land and Environmental Affairs (DARDL&EA) as the commenting authority.

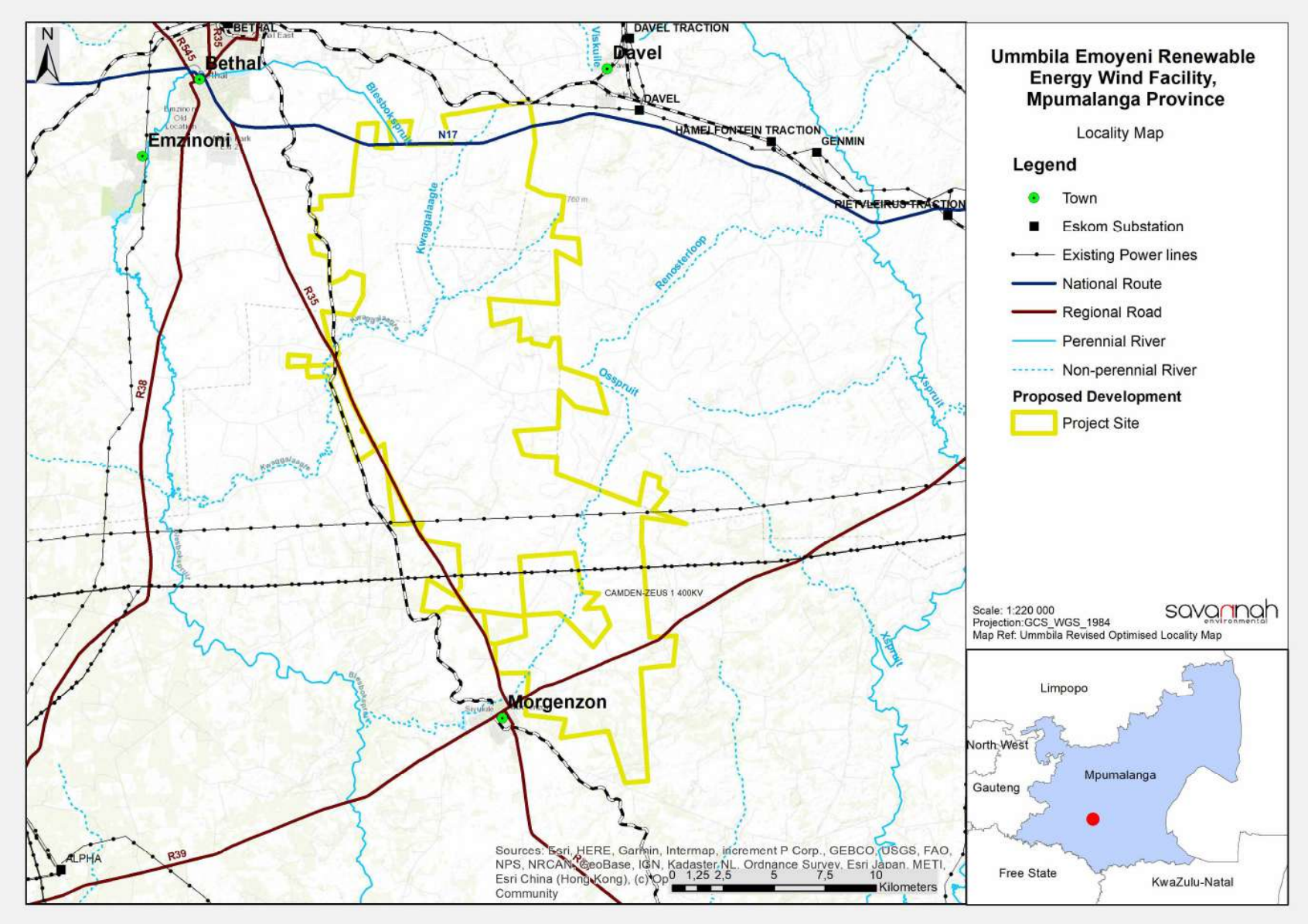


Figure 1.1: Locality map of the project site within which the Ummbila Emoyeni Wind Energy Facility is proposed to be developed (also refer to **Appendix P** for project maps)

1.2. Legal Requirements as per the EIA Regulations, 2014 (as amended) for the undertaking of an Environmental Impact Assessment Report

This EIA Report has been prepared in accordance with the requirements of the EIA Regulations published on 08 December 2014 (and amended on 07 April 2017) promulgated in terms of Chapter 5 of the National Environmental Management Act (Act No 107 of 1998). This chapter of the EIA Report includes the following information required in terms of Appendix 3: Scope of Assessment and Content of Environmental Impact Assessment Reports:

Requirement	Relevant Section
3(1)(a)the details of (i) the EAP who prepared the report and (ii) the expertise of the EAP; including a curriculum vitae.	The details of the EAP and the expertise of the EAP have been included in **section 1.5**. The Curriculum vitae of the Savannah Environmental team have been included as **Appendix A**.
3(1)(b) the location of the development footprint of the activity on the approved site as contemplated in the accepted scoping report, including (i) the 21-digit Surveyor General code of each cadastral land parcel; (ii) where available, the physical address and farm name and (iii) where the required information in items (i) and (ii) is not available, the coordinates of the boundary of the property or properties.	The location of the project site proposed for the development of the Ummbila Emoyeni Wind Energy Facility is included as **Figure 1.1**. The details of the affected properties, including the property names and numbers, as well as the SG-codes are included in **Table 1.1**.
3(1)I a plan which locates the proposed activity or activities applied for as well as the associated structures and infrastructure at an appropriate scale, or, if it is (i) a linear activity, a description, and coordinates of the corridor in which the proposed activity or activities is to be undertaken; or (ii) on land where the property has not been defined, the coordinates within which the activity is to be undertaken.	The locality of the project site is illustrated on a locality map included as **Figure 1.1**. The centre point co-ordinates of the project site are included in **Table 1.1**.

This EIA Report consists of twelve chapters, as follows:

- **Chapter 1** provides background to the Ummbila Emoyeni Wind Energy Facility and the EIA process.
- **Chapter 2** provides a description of the wind farm and infrastructure associated with the facility.
- **Chapter 3** provides the site selection information and identified project alternatives.
- **Chapter 4** describes wind energy as a power generation option and provides insight to technologies for wind energy.
- **Chapter 5** outlines the strategic regulatory and legal context for energy planning in South Africa, and specifically for the proposed facility.
- **Chapter 6** describes the need and desirability of the Ummbila Emoyeni Wind Energy Facility within the project site.
- **Chapter 7** outlines the process which was followed during the EIA process.
- **Chapter 8** describes the existing biophysical and socio-economic environment affected by the proposed facility.
- **Chapter 9** provides a description and assessment of the potential impacts associated with the proposed wind farm and associated infrastructure.
- **Chapter 10** provides a description and assessment of the potential cumulative impacts associated with the proposed wind farm and associated infrastructure.
- **Chapter 11** presents the conclusions and recommendations based on the findings of the EIA for the Ummbila Emoyeni Wind Energy Facility.
- **Chapter 12** provides references used in the compilation of the EIA Report.

1.3. Project Overview

A technically feasible project site[5], with an extent of ~27 819ha has been identified by Emoyeni Renewable Energy Farm (Pty) Ltd as a technically suitable area for the development of the Ummbila Emoyeni Wind Energy Facility. The project site comprises numerous properties as listed in **Table 1.1** below.

Table 1.1: Detailed description of the Ummbila Emoyeni Wind Energy Facility project site

Province	**Mpumalanga Province**
District Municipality	Gert Sibande District Municipality
Local Municipality	Govan Mbeki, Lekwa, and Msukaligwa Local Municipalities
Ward Number (s)	Ward 15 of the Govan Mbeki Local Municipality Ward 12 of the Lekwa Local Municipality Wards 8 and 10 of the Msukaligwa Local Municipality
Nearest town(s)	Richmond (~35km south-west) and Victoria West (~80km south-east)
Affected Properties[6]:	

Parent Farm Number	Farm Portions
Farm 261 – Naudesfontein	15 R/E, 21
Farm 264 – Geluksplaats	0, 1, 3, 4, 5, 6 R/E, 8 R/E, 9R/E, 10, 11, 12
Farm 268 – Brak Fontein Settlement	6,7,10,11,12
Farm 420 – Rietfontein	8,9,10,11,12,15 R/E,16,18,19,22,32
Farm 421 – Sukkelaar	2, 2, 7, 9, 9 10, 10 11, 11 12, 12, 22 ,25 R/E, 34, 35, 36, 37, 37, 38, 39, 40, 42, 42
Farm 422 – Klipfontein	0, 2 R/E, 3 R/E, 4, 5, 6, 7, 8 R/E, 9, 10, 12, 13 R/E, 14 R/E, 16, 17, 18, 19, 20, 21, 22, 23
Farm 423 – Bekkerust	0 R/E, 1, 2 R/E, 4, 5 R/E, 6, 10, 11, 12, 13 14, 15, 17, 19 R/E, 20, 22, 23, 24,25
Farm 454 – Oshoek	4 R/E, 13, 18
Farm 455 – Ebenhaezer	0, 1, 2, 3
Farm 456 – Vaalbank	1, 2, 3, 4, 7, 8, 13, 15, 16, 17, 18, 19
Farm 457 – Roodekrans	0, 1, 4, 5, 7, 22, 23, 23
Farm 458 – Goedgedacht	0, 2, 3, 4, 4, 5, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 21, 21, 22, 23, 25, 26 R/E, 27, 28, 29, 31, 32, 33, 34, 35, 36, 37, 39, 41, 42, 43
Farm 467 – Twee Fontein	0 R/E, 1 R/E, 4 R/E, 5, 6, 7 R/E, 8, 10
Farm 469 – Klipkraal	5 R/E, 6, 7, 8
Farm 548 – Durabel	0
Farm 470 – Dorpsplaats	85
Farm 451 – Drinkwater	4, 22
Farm 452 – Brakfontein	5

Current zoning	Agriculture
Site Coordinates (centre of project site)	26°36'25.92"S; 29°36'26.38"E
Corner coordinates of project site	

Latitude	Longitude
26°30'1"S	29°37'30"E
26°30'20"S	29°38'34"E

[5] The project site is the area with an extent of 27 819ha, within which the Ummbila Emoyeni Wind Energy Facility development footprint will be located.

[6] Refer to **Appendix S** for SG codes.

26°30'56"S	29°38'32"E
26°30'58"S	29°38'21"E
26°31'22"S	29°38'15"E
26°31'31"S	29°38'56"E
26°32'2"S	29°39'8"E
26°31'57"S	29°38'30"E
26°33'14"S	29°38'21"E
26°33'9"S	29°36'31"E
26°33'49"S	29°36'27"E
26°33'39"S	29°37'16"E
26°34'1"S	29°37'16"E
26°34'12"S	29°37'38"E
26°34'24"S	29°38'3"E
26°34'7"S	29°38'15"E
26°34'7"S	29°38'31"E
26°34'51"S	29°38'29"E
26°35'19"S	29°39'41"E
26°35'57"S	29°39'41"E
26°35'59"S	29°38'58"E
26°35'31"S	29°38'32"E
26°36'25"S	29°38'28"E
26°36'30"S	29°37'12"E
26°37'4"S	29°37'22"E
26°37'18"S	29°37'39"E
26°37'18"S	29°38'29"E
26°37'39"S	29°38'23"E
26°38'28"S	29°40'46"E
26°37'42"S	29°40'59"E
26°37'47"S	29°41'27"E
26°38'3"S	29°41'21"E
26°38'8"S	29°41'41"E
26°38'38"S	29°41'9"E
26°39'1"S	29°42'16"E
26°38'50"S	29°40'54"E
26°42'0"S	29°41'15"E
26°41'56"S	29°42'0"E
26°42'40"S	29°41'54"E
26°42'51"S	29°41'1"E
26°45'44"S	29°41'9"E
26°45'57"S	29°40'32"E
26°44'32"S	29°40'1"E
26°44'41"S	29°38'38"E
26°44'15"S	29°38'40"E
26°44'8"S	29°37'31"E
26°43'0"S	29°37'35"E
26°43'0"S	29°36'34"E
26°42'18"S	29°36'40"E
26°42'12"S	29°36'17"E
26°41'30"S	29°36'17"E
26°41'16"S	29°35'14"E
26°41'22"S	29°35'0"E

26°41'23"S	29°34'25"E
26°40'31"S	29°34'39"E
26°40'52"S	29°35'26"E
26°39'47"S	29°35'28"E
26°39'27"S	29°34'21"E
26°38'26"S	29°34'43"E
26°38'28"S	29°35'18"E
26°37'58"S	29°35'14"E
26°37'54"S	29°34'39"E
26°38'14"S	29°34'17"E
26°38'24"S	29°33'56"E
26°38'8"S	29°33'50"E
26°38'14"S	29°33'30"E
26°37'11"S	29°32'25"E
26°35'15"S	29°31'40"E
26°35'4"S	29°31'54"E
26°35'9"S	29°31'5"E
26°34'50"S	29°31'5"E
26°34'50"S	29°30'30"E
26°34'26"S	29°30'26"E
26°34'33"S	29°31'3"E
26°34'47"S	29°31'50"E
26°33'26"S	29°31'38"E
26°33'24"S	29°32'21"E
26°33'10"S	29°32'39"E
26°32'32"S	29°32'39"E
26°32'25"S	29°32'14"E
26°32'32"S	29°31'50"E
26°32'0"S	29°31'40"E
26°31'53"S	29°31'9"E
26°31'27"S	29°31'9"E
26°31'28"S	29°31'33"E
26°31'4"S	29°31'21"E
26°30'46"S	29°31'5"E
26°30'32"S	29°31'23"E
26°30'17"S	29°31'23"E
26°30'22"S	29°32'14"E
26°28'33"S	29°32'41"E
26°28'30"S	29°33'5"E
26°29'0"S	29°33'3"E
26°29'3"S	29°33'29"E
26°28'26"S	29°33'28"E
26°28'21"S	29°33'58"E
26°28'56"S	29°34'2"E
26°28'55"S	29°35'17"E
26°28'12"S	29°35'1"E
26°27'47"S	29°37'34"E
26°28'53"S	29°37'45"E
26°30'1"S	29°37'30"E

During the Scoping Phase, the full extent of the project site was considered by the specialist assessments, with the aim of determining the suitability from an environmental and social perspective and identifying areas that should be avoided in development planning. Based on the specialist assessments undertaken during the Scoping Phase, areas of environmental sensitivity were identified within the project site. In order to avoid these areas of potential sensitivity and to ensure that potential detrimental environmental impacts are minimised as far as possible, the developer identified a suitable development footprint[7] (390ha in extent) within the project site where the wind turbines and other associated infrastructure for the Ummbila Emoyeni Wind Energy Facility is planned to be constructed. Since the project site assessed during the Scoping Phase is larger than the area required for the development footprint, it provides the opportunity for the optimal placement of the infrastructure, ensuring avoidance of major identified environmental sensitivities.

Infrastructure associated with the Ummbila Emoyeni Wind Energy Facility will include:

- Up to 111 wind turbines with a maximum hub height of up to 200m. The tip height of the turbines will be up to 300m.
- 33kV cabling to connect the wind turbines to the onsite collector substations, to be laid underground where practical.
- 3 x 33kV/132kV onsite collector substation (IPP Portion), each being 5ha.
- Battery Energy Storage System (BESS).
- Cabling between turbines, to be laid underground where practical.
- Construction compounds including site office (approximately 300m x 300m in total but split into 3ha each of 150m x 200m):
  - Batching plant of up to 4ha to 7ha.
  - 3 x O&M office of approximately 1.5ha each adjacent to each collector SS.
  - 3 x construction compound / laydown area, including site office of 3ha each (150m x 200m each).
- Laydown and crane hardstand areas (approximately 75m x 120m).
- Access roads of 12 -13m wide, with 12m at turning circles.

The key infrastructure components proposed as part of the Ummbila Emoyeni Wind Energy Facility are described in greater detail in Chapter 2 of this EIA Report.

The overarching objective for the Ummbila Emoyeni Wind Energy Facility is to maximise energy production through optimal exposure to the available wind resource, while minimising infrastructure, operational and maintenance costs, as well as potential social and environmental impacts in accordance with the principles of sustainable development. Local level environmental and planning issues have been assessed through the EIA process with the aid of site-specific specialist studies in order to delineate areas of sensitivity within the project site. These site-specific specialist studies have assisted in informing and optimising the design of the wind farm.

1.4. Overview of the Environmental Impact Assessment (EIA) Process

An EIA is an effective planning and decision-making tool for the project developer as it allows for the identification and management of potential environmental impacts. It provides the opportunity for the

[7] The development footprint, which is ~390ha in extent, is the defined area (located within the project site) where the wind turbines and other associated infrastructure for the Ummbila Emoyeni Wind Energy Facility is planned to be constructed. This is the actual footprint of the facility, and the area which would be disturbed.

developer to be forewarned of potential environmental issues and allows for the resolution of the issues reported on in the Scoping and EIA reports as well as dialogue with interested and affected parties (I&APs).

The EIA process comprises of two (2) phases (i.e., Scoping and EIA) (refer to **Figure 1.2**) and involves the identification and assessment of potential environmental impacts through the undertaking of independent specialist studies, as well as public participation. The processes followed in these two phases is as follows:

- The **Scoping Phase** includes the identification of potential issues associated with the project through a desktop study (considering existing information), limited field work and consultation with interested and affected parties and key stakeholders. This phase considers the project site in order to identify and delineate any environmental fatal flaws, no-go and / or sensitive areas. Following a public review period of the Scoping report, this phase culminates in the submission of a final Scoping Report and Plan of Study for the EIA to the Competent Authority for consideration and acceptance. The Scoping Report was accepted, and the Plan of Study for the EIA Phase approved by the DFFE on 03 August 2022.

- The **EIA Phase** involves a detailed assessment of the potentially significant positive and negative impacts (direct, indirect, and cumulative) identified in the Scoping Phase. This phase considers a proposed development footprint within the project site and includes detailed specialist investigations as well as public consultation. Following a public review period of the EIA Report, this phase culminates in the submission of a final EIA Report and an Environmental Management Programme (EMPr), including recommendations of practical and achievable mitigation and management measures, to the Competent Authority for final review and decision-making.

Figure 1.2: Regulated timeframe of an EIA Process

1.5. Details of Environmental Assessment Practitioner and Expertise to conduct the S&EIA Process

In accordance with Regulation 12 of the 2014 EIA Regulations (GNR 326), Emoyeni Renewable Energy Farm (Pty) Ltd has appointed Savannah Environmental (Pty) Ltd as the independent Environmental Consultant responsible for managing the Application for EA and supporting S&EIA process; inclusive of comprehensive, independent specialist studies. The application for EA and S&EIA process will be managed in accordance with the requirements of NEMA, the 2014 EIA Regulations (GNR 326), and all other relevant applicable legislation.

Savannah Environmental is a specialist environmental consulting company providing a holistic environmental management service, including environmental assessment, and planning to ensure compliance and evaluate the risk of development, and the development and implementation of environmental management tools. Savannah Environmental benefits from the pooled resources, diverse skills and experience in the environmental field held by its team. Neither Savannah Environmental, the Environmental Assessment Practitioners (EAPs) employed by the company nor any of the specialists responsible for undertaking studies for this project are subsidiaries or are affiliated to the applicant.

Furthermore, Savannah Environmental does not have any interests in secondary developments that may arise out of the authorisation of the proposed facility.

The Savannah Environmental team have considerable experience in environmental impact assessment processes and environmental management and have been actively involved in undertaking environmental studies for a wide variety of projects throughout South Africa, including those associated with electricity generation from renewable energy sources.

» **Jo-Anne Thomas**, the principle EAP on this project, is a registered EAP with the Environmental Assessment Practitioners Association of South Africa (EAPASA – 2019/726) and a Professional Natural Scientist with the South African Council for Natural Scientific Professions (SACNASP). She provides technical input for projects in the environmental management field, specialising in Strategic Environmental Advice, Environmental Impact Assessment studies, environmental auditing and monitoring, environmental permitting, public participation, Environmental Management Plans and Programmes, environmental policy, strategy and guideline formulation, and integrated environmental management. Her key focus is on integration of the specialist environmental studies and findings into larger engineering-based projects, strategic assessment, and providing practical and achievable environmental management solutions and mitigation measures. Responsibilities for environmental studies include project management (including client and authority liaison and management of specialist teams); review and manipulation of data; identification and assessment of potential negative environmental impacts and benefits; review of specialist studies; and the identification of mitigation measures.

» **Nicolene Venter**, the principle public participation consultant for this project, is a Board Member of IAPSA (International Association for Public Participation South Africa). She holds a Higher Secretarial Diploma and has over 21 years of experience in public participation, stakeholder engagement, awareness creation processes and facilitation of various meetings (focus group, public meetings, workshops, etc.). She is responsible for project management of public participation processes for a wide range of environmental projects across South Africa and neighbouring countries.

In order to adequately identify and assess potential environmental impacts associated with the proposed Ummbila Emoyeni Wind Energy Facility, the following specialist sub-consultants have provided input into this EIA Report:

Specialist	Area of Expertise
Gerhard Botha of Nkurenkuru Ecology and Biodiversity (Pty) Ltd	Ecology and Surface Water
Owen Davies of Arcus Consulting	Avifauna
Jonathan Aronson of Camissa	Bats
Matthew Mamera and Andrew Husted of the Biodiversity Company	Soils and Agricultural Potential
Morné de Jager of Enviro-Acoustic Research	Noise
Jon Marshall of Environmental Planning & Design CC	Visual
Pierre van Jaarsveld of Urban-Econ Development Economist (Pty) Ltd	Socio- Economic
Jenna Lavin of CTS Heritage	Heritage (including Archaeology Palaeontology and Cultural Heritage)
Iris Wink of JG Afrika	Traffic

Appendix A includes the curricula vitae for the environmental assessment practitioners from Savannah Environmental and the specialist consultants.

CHAPTER 2: PROJECT DESCRIPTION

This chapter provides an overview of the Ummbila Emoyeni Wind Energy Facility and details the project scope which includes the planning/design, construction, operation, and decommissioning activities required for the development. It must be noted that the project description presented in this Chapter may change to some extent based on the outcomes and recommendations of detailed engineering and other technical studies, the findings and recommendations of the EIA and supporting specialist studies, and any licencing, permitting, and legislative requirements.

2.1 Legal Requirements as per the EIA Regulations, 2014 (as amended), for the undertaking of an Environmental Impact Assessment Report

This chapter of the EIA Report includes the following information required in terms of the EIA Regulations, 2014, as amended – Appendix 3: Scope of Assessment and Content of Environmental Impact Assessment Reports:

Requirement	Relevant Section
3(1)(b) the location of the development footprint of the activity on the approved site as contemplated in the accepted scoping report, including (i) the 21 digit Surveyor General code of each cadastral land parcel, (ii) where available the physical address and farm name and (iii) where the required information in items (i) and (ii) is not available, the coordinates of the boundary of the property or properties.	The location of the proposed project is detailed in Chapter 1, **Table 1.1**, as well as **section 2.2.1** below.
3(1)(d)(ii) a description of the scope of the proposed activity, including (ii) a description of the activities to be undertaken including associated structures and infrastructure related to the development.	A description of the activities to be undertaken with the development of project is included in **Table 2.1** and **Table 2.2**.

2.2 Nature and Extent of the Ummbila Emoyeni Wind Energy Facility

In responding to the growing electricity demand within South Africa, the need to promote renewable energy and sustainability within the Mpumalanga Province, as well as the country's targets for renewable energy, Emoyeni Renewable Energy Farm (Pty) Ltd is proposing the development of a commercial wind farm and associated infrastructure to add new capacity to the national electricity grid. The Ummbila Emoyeni Wind Energy Facility will comprise up to 111 wind turbines with a contracted capacity of up to 900MW. The optimum turbine for use at the project site is yet to be determined; however, it is considered that each turbine could have a generating capacity between 6 – 15MW[8], with a hub height of up to 200m. The final turbine capacity and model will be dependent on what is deemed suitable for the site in relation to, among other things, further studies of the wind regime, terrain, commercial considerations and potential environmental constraints.

[8] The 15MW capacity of the individual turbines is a predicted maximum per turbine and the final decision regarding the final turbine capacity will be based on the facility layout and technical and environmental considerations.

2.2.1. Overview of the Project Site

The project is to be developed on a site located approximately 6km south-east of Bethal and 1km east of Morgenzon. The project site is located across the Govan Mbeki, Lekwa, and Msukaligwa Local Municipalities within the Gert Sibande District in the Mpumalanga Province. The full extent of the project site (i.e., 27 819ha) was considered during the Scoping Phase of the EIA process, within which the Ummbilia Emoyeni Wind Energy Facility will be appropriately located from a technical and environmental sensitivity perspective. The project site consists of numerous properties as listed in **Table 2.1** below.

Table 2.1: Properties which the Ummbila Emoyeni Renewable Energy Farm project site will be located

Parent Farm Number	Farm Portions
Farm 261 – Naudesfontein	15 R/E, 21
Farm 264 – Geluksplaats	0, 1, 3, 4, 5, 6 R/E, 8 R/E, 9R/E, 10, 11, 12
Farm 268 – Brak Fontein Settlement	6,7,10,11,12
Farm 420 – Rietfontein	8,9,10,11,12,15 R/E,16,18,19,22,32
Farm 421 – Sukkelaar	2, 2, 7, 9, 9 10, 10 11, 11 12, 12, 22 ,25 R/E, 34, 35, 36, 37, 37, 38, 39, 40, 42, 42
Farm 422 – Klipfontein	0, 2 R/E, 3 R/E, 4, 5, 6, 7, 8 R/E, 9, 10, 12, 13 R/E, 14 R/E, 16, 17, 18, 19, 20, 21, 22, 23
Farm 423 – Bekkerust	0 R/E, 1, 2 R/E, 4, 5 R/E, 6, 10, 11, 12, 13 14, 15, 17, 19 R/E, 20, 22, 23, 24,25
Farm 454 – Oshoek	4 R/E, 13, 18
Farm 455 – Ebenhaezer	0, 1, 2, 3
Farm 456 – Vaalbank	1, 2, 3, 4, 7, 8, 13, 15, 16, 17, 18, 19
Farm 457 – Roodekrans	0, 1, 4, 5, 7, 22, 23, 23
Farm 458 – Goedgedacht	0, 2, 3, 4, 4, 5, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 21, 21, 22, 23, 25, 26 R/E, 27, 28, 29, 31, 32, 33, 34, 35, 36, 37, 39, 41, 42, 43
Farm 467 – Twee Fontein	0 R/E, 1 R/E, 4 R/E, 5, 6, 7 R/E, 8, 10
Farm 469 – Klipkraal	5 R/E, 6, 7, 8
Farm 548 – Durabel	0
Farm 470 – Dorpsplaats	85
Farm 451 – Drinkwater	4, 22
Farm 452 – Brakfontein	5

A development footprint of ~390ha has been identified within the project site and assessed for the construction of the facility and its associated infrastructure. The optimal position for each turbine and associated infrastructure was determined taking into consideration the environmental sensitivities identified through the Scoping Evaluation. The turbines have been appropriately placed to optimise the energy generating potential of the wind resource while also minimising impacts on environmental sensitivities.

Access to the project site is ample with the presence of existing roads mainly consisting of national and regional roads. The project site is situated directly adjacent to the N17, R35 and R39, which provide direct access to the project site (refer to **Figure 2.1**). Transport of blades / tower sections would be routed via the N2 highway from the Richards Bay deep-water port, via Ermelo.

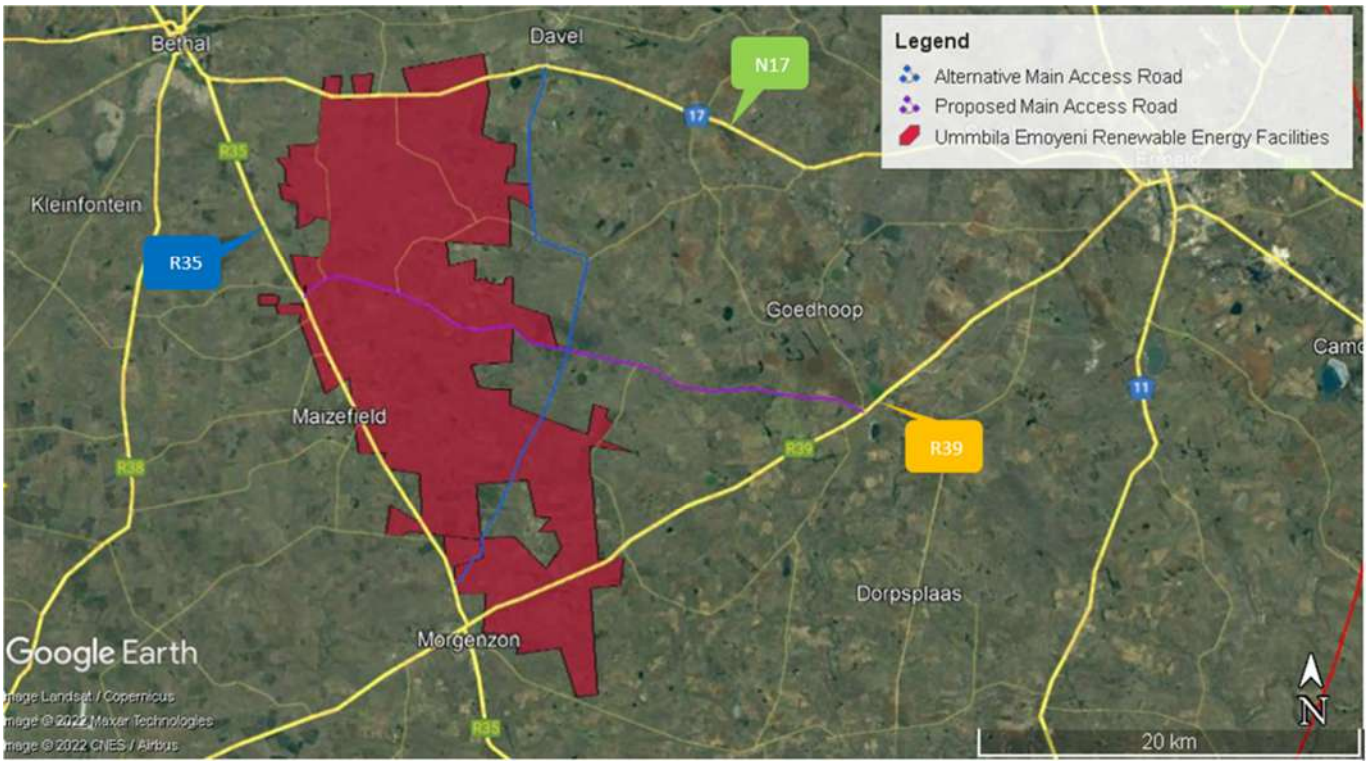


Figure 2.1: Proposed main access roads and alternatives to the project site

2.2.2. *Components of the Ummbila Emoyeni Wind Energy Facility*

The development footprint is proposed to accommodate the wind turbines and all associated infrastructure which is required for such a facility, and will include:

- Up to 111 wind turbines with a maximum hub height of up to 200m. The tip height of the turbines will be up to 300m.
- 33kV cabling to connect the wind turbines to the onsite collector substations, to be laid underground where practical.
- 3 x 33kV/132kV onsite collector substation (IPP Portion), each being 5ha.
- Battery Energy Storage System (BESS).
- Cabling between turbines, to be laid underground where practical.
- Construction compounds including site office (approximately 300m x 300m in total but split into 3ha each of 150m x 200m):
  - 3 x Batching plant of up to 4ha to 7ha.
  - 3 x O&M office of approximately 1.5ha each adjacent to each collector SS.
  - 3 x construction compound / laydown area, including site office of 3ha each (150m x 200m each).
- Laydown and crane hardstand areas (approximately 75m x 120m).
- Access roads of 12 -13m wide, with 12m at turning circles.

A summary of the details and dimensions of the planned infrastructure associated with the project is provided in **Table 2.2.**

Table 2.2: Details or dimensions of typical infrastructure required for the 900MW Ummbila Emoyeni Wind Energy Facility

Infrastructure	Footprint and dimensions
Number of turbines	Up to 111 turbines
Hub Height	Up to 200m
Tip Height	Up to 300m
Rotor Diameter	Up to 200m
Contracted Capacity	Up to 900MW (individual turbines between 6MW and 15MW in capacity each)
Tower Type	Steel or concrete towers can be utilised at the site. Alternatively, the towers can be of a hybrid nature, comprising concrete towers with top steel sections.
Area occupied by the on-site collector substations (IPP Portion)	3 x on-site collector substations (IPP Portion) of 5ha each. This will consist of the Eskom switching station and IPP substation
Capacity of on-site collector substations (IPP Portion)	33kV/132kV
Cabling between the turbines	Cabling will be installed underground where feasible at a depth of up to 1.5m to connect the turbines to the on-site facility substation. Where not technically feasible to place cabling underground, this will be installed above-ground. The cabling will have a capacity of up to 33kV.
Laydown and Operations and Maintenance (O&M) hub	» 3 x Batching plant of up to 4ha to 7ha. » 3 x O&M office of approximately 1.5ha each adjacent to each collector SS. » 3 x construction compound / laydown area, including site office of 3ha each (150m x 200m each). » Laydown and crane hardstand areas (approximately 75m x 120m).
Access and internal roads	» Wherever possible, existing access roads will be utilised to access the project site and development footprint. » It is unlikely that access roads will need to be upgraded as part of the proposed development. » Internal roads of up to 12-13m in width will be required to access each turbine and the on-site substation. » Access roads will be12m at turning circles
Laydown and crane hardstand areas (at each turbine position)	~75m x 120m
Turbine foundation	Diameter of up to 40m per turbine
Battery Energy Storage System (BESS)	» Export Capacity of up to 800MWh » Total storage capacity 200MW » Storage capacity of up to 6-8 hours » The BESS will be housed in containers covering a total approximate footprint of up to 5ha. » Battery types to be considered: Solid State Batteries as the preferred (Lithium Ion) and Redox Flow Batteries as the alternative (Vanadium Redox).
Grid connection	The grid connection infrastructure will include a 400/132kV MTS, to be located between the Camden and SOL Substations, which will be looped in and out of the existing Camden-Sol 400kV transmission line; on-site switching stations (132kV in

Infrastructure	Footprint and dimensions
	capacity) at each renewable energy facility (Eskom Portion); 132kV power lines from the switching stations at each renewable energy facility to the new 400/132kV MTS; and a collector substation with 2 x 132kV bus bars and 4 x 132kV IPP feeder bays to the onsite IPP Substation. The grid connection infrastructure will be assessed as part of a separate S&EIA process in support of an application for EA.
Temporary infrastructure	Temporary infrastructure, including laydown areas, hardstand areas and a concrete batching plant, will be required during the construction phase. All temporary infrastructure will be rehabilitated following the completion of the construction phase, where it is not required for the operation phase.

Table 2.3 provides details regarding the requirements and the activities to be undertaken during the Ummbila Emoyeni Wind Energy Facility development phases (i.e., construction phase, operation phase and decommissioning phase). **Table 2.4** provides photographs of the construction phase of a wind energy facility similar to the Ummbila Emoyeni Wind Energy Facility.

2.2.3 *Project Development Phases Associated with the Ummbila Emoyeni Wind Energy Facility*

Table 2.3: Details of the Ummbila Emoyeni Wind Energy Facility project development phases (i.e., construction, operation, and decommissioning)

Construction Phase	
Requirements	» Project receives EA from the DFFE, preferred bidder allocation granted by DMRE, a generating license issued by NERSA, and a Power Purchase Agreement secured with Eskom. In addition to bidding into the REIPPPP, the developer is also considering options such as Private Power Purchase Agreements and Wheeling Agreements with Eskom to deliver the generated power to Private Offtakers. » Duration dependent on number of turbines, expected to be 24 months (for each phase) for the Ummbila Emoyeni Wind Energy Facility. » Create direct construction employment opportunities. Approximately 240 employment opportunities will be created. » No on-site labour camps. Employees to be accommodated in the nearby towns such as Bethal or Morgenzon and transported to and from site on a daily basis by bus. » Overnight on-site worker presence would be limited to security staff. » Waste removal and sanitation will be undertaken by a sub-contractor, where possible. Waste containers, including containers for hazardous waste, will be located at easily accessible locations /turbine positions on site when construction activities are undertaken. » Electricity required for construction activities will be generated by a generator. Where low voltage connections are possible, these will be considered. » Either borehole / municipal / dam or a combination of all 3 will be used to provide water. Should water availability at the time of construction be limited, water will be transported to site via water tanks. Water will be used for sanitation and potable water on site as well as construction works. It is also anticipated that water can be obtained from adjacent Seriti coal mines if required but this will be explored during the WULA process. This will have the added benefit of taking mine acid water and converting it into water that can be used during construction and operation.
Activities to be undertaken	
Conduct surveys prior to construction	» Including, but not limited to, a geotechnical survey, site survey and confirmation of the turbine micro-siting footprint, and survey of the on-site collector substation site to determine and confirm the locations of all associated infrastructure.
Establishment of access roads to the site	» Internal access roads within the site will be established at the commencement of construction. » Existing access roads will be utilised, where possible, to minimise impact. It is unlikely that access roads will need to be upgraded as part of the proposed development, although maintenance may be required to ensure roads are in adequate condition to enable transportation of project components to site. » Access roads to be established between the turbines for construction and/or maintenance activities within the development footprint. » Internal service road alignment will be approximately 4.5m wide. To be determined by the final micro-siting or positioning of the wind turbines.
Undertake site preparation	» Including the clearance of vegetation at the footprint of each turbine, establishment of the laydown areas, the establishment of internal access roads and excavations for foundations. » Stripping of topsoil to be stockpiled, backfilled, removed from site and/or spread on site. » To be undertaken in a systematic manner to reduce the risk of exposed ground being subjected erosion.

	» Include search and rescue of floral species of concern (where required) and the identification and excavation of any sites of cultural/heritage value (where required).
Establishment of laydown areas and batching plant on site	» A laydown area for the storage of wind turbine components, including the cranes required for tower/turbine assembly and civil engineering construction equipment. » The laydown will also accommodate building materials and equipment associated with the construction of buildings. » A crane hardstand at each turbine position where the main lifting crane will be erected and/or disassembled. Each hardstand to be ~75m x 120m in extent. » No new borrow pits will be required. Infilling or depositing materials will be sourced from licenced borrow pits within the surrounding areas. » A temporary concrete batching plant up to 7ha in extent to facilitate the concrete requirements for turbine foundations.
Construct foundation	» Concrete foundations to be constructed at each turbine location. » Excavations to be undertaken mechanically. » Concrete foundation will be constructed to support a mounting ring. » Depending on geological conditions, the use of alternative foundations may be considered (e.g., reinforced piles).
Transport of components and equipment to and within the site	» Turbine units to be transported include the tower segments, hub, nacelle, and three rotor blades. » Components to be transported to the site in sections on flatbed trucks by the turbine supplier. There are three viable options for the port of entry for imported components – the Port of Richard's Bay in KwaZulu-Natal, and the ports of East London and Ngqura in the Eastern Cape. The most feasible port of entry is deemed to be the Port of Richard's Bay in the KwaZulu- Natal Province. » Components considered as abnormal loads in terms of the Road Traffic Act (Act No 29 of 1989) due to dimensional limitations (abnormal length of the blades) and load limitations (i.e., the nacelle) will require a permit for the transportation of the abnormal loads on public roads. » Specialised construction and lifting equipment to be transported to site to erect the wind turbines. » Civil engineering construction equipment to be brought to the site for the civil works (e.g., excavators, trucks, graders, compaction equipment, cement trucks, site offices etc.). » Components for the establishment of the onsite collector substation (including transformers) and the associated infrastructures to be transported to site. » Transportation will take place via appropriate National and Provincial roads, and the dedicated access/haul road to the site.
Construction of the turbine	» A lifting crane will be utilised to lift the tower sections, nacelle, and rotor into place. » Approximately 1 week is required to erect a single turbine depending on climatic conditions. » Lifting cranes are required to move between the turbine sites.
Construction of the onsite collector substations and connection of wind turbines to the substation	» 3 x onsite collector substations (IPP Portion) to be constructed within the development footprint. ∗ The following simplified sequence is conducted for the construction of a substation: ∗ Step 1: Surveying of the development footprint, engaging with affected landowners, environmental specialist walkthroughs to inform permitting requirements. ∗ Step 2: Final design and micro-siting of the infrastructure based on geo-technical, topographical conditions and potential environmental sensitivities.

	∗ Step 3: Search-and-rescue activities, vegetation clearance and construction of access roads/tracks (where required), including installation of fencing. ∗ Step 4: Trenching and ground grid conduit installation. ∗ Step 5: Installation of concrete foundations. ∗ Step 6: Assembly and installation of steel structures and isolators. ∗ Step 7: Control building assembly. ∗ Step 8: Gravel placement and commissioning. ∗ Step 9: Rehabilitation of disturbed areas. ∗ Step 10: Continued maintenance. » Cabling will be installed underground, where feasible, between the turbines and the onsite collector substations at a depth of up to 1.5m to connect the turbines to the onsite collector substations. Where not technically feasible to place cabling underground, this will be installed above-ground. The cabling will have a capacity of up to 33kV.
Establishment of ancillary infrastructure	» Site offices and maintenance buildings, including workshop areas for maintenance and storage will be required. » Establishment will require the clearing of vegetation, levelling, and the excavation of foundations prior to construction.
Connect facility to the power grid	» The grid connection infrastructure will include a 400/132kV MTS, to be located between the Camden and SOL Substations, which will be looped in and out of the existing Camden-Sol 400kV transmission line; on-site switching stations (132kV in capacity) at each renewable energy facility (Eskom Portion); 132kV power lines from the switching stations at each renewable energy facility to the new 400/132kV MTS; and a collector substation with 2 x 132kV bus bars and 4 x 132kV IPP feeder bays to the onsite IPP Substation.
Undertake site rehabilitation	» Commence with rehabilitation efforts once construction completed in an area, and all construction equipment is removed. » On commissioning, access points to the site not required during the operation phase will be closed and prepared for rehabilitation.
Operation Phase	
Requirements	» Duration will be 20-30 years. » Requirements for security and maintenance of the project. » Employment opportunities relating mainly to operation activities and maintenance. Approximately 10 to 25 full-time employment opportunities will be available during the operation of the wind farm. » Waste containers, including containers for hazardous waste, will be located at easily accessible locations /turbine positions on site when construction activities are undertaken. Waste removal and sanitation will be undertaken by a suitably qualified contractor. » Either borehole / municipal / dam or a combination of all 3 will be used to provide water. Should water availability at the time of construction be limited, water will be transported to site via water tanks. Water will be used for sanitation and potable water on site as well as construction works.
Activities to be undertaken	
Operation and Maintenance	» Full time security, maintenance, and control room staff. » All turbines will be operational except under circumstances of mechanical breakdown, inclement weather conditions, or maintenance activities.

	» Wind turbines to be subject to periodic maintenance and inspection. » The BESS will be in place for the life of the facility and will be maintained as required throughout the operation period. » Disposal of waste products (e.g., oil) in accordance with relevant waste management legislation. » Areas which were disturbed during the construction phase to be utilised, should a laydown area be required during operation.
Decommissioning Phase	
Requirements	» Decommissioning of the Ummbila Emoyeni Wind Energy Facility infrastructure at the end of its economic life. » Potential for repowering of the facility, depending on the condition of the facility at the time. » Expected lifespan of approximately 20 – 30 years (with maintenance) before decommissioning is required. » Decommissioning activities to comply with the legislation relevant at the time. » Alternative options include resale of the WTGs or decommissioning and recycling of valuable materials (copper, steel, aluminium etc). Both scenarios would require removal (in part) of the remaining infrastructure, such as the substation, buildings, met mast, access roads, crane hardstand and electrical cables.
Activities to be undertaken	
Site preparation	» Confirming the integrity of site access to accommodate the required equipment and lifting cranes. » Preparation of the site (e.g., laydown areas and construction platform). » Mobilisation of construction equipment.
Disassemble and remove turbines	» Large crane required for the disassembling of the turbine and tower sections. » Components to be reused, recycled, or disposed of in accordance with regulatory requirements. » All parts of the turbine would be considered reusable or recyclable except for the blades. » Concrete will be removed to a depth as defined by an agricultural specialist and the area rehabilitated. » Cables will be excavated and removed, as may be required.
Components to be disposed of or recycled	» Foundation. » Tower. » Electrical facilities in tower base. » Rotor. » Generator. » Machine house. » Regarding the foundation body and sub-base of the tower, the concrete will undergo crushing and be used as combined base/wearing course. » Reinforcing steel will go through cleansing and milling to re-melt the components. » The BESS components will disposed of in line with the applicable legislation at the time of decommissioning of the facility.

It is expected that the areas of the project site affected by the wind farm infrastructure (development footprint) will revert back to their original land-use (i.e., agriculture) once the Ummbila Emoyeni Wind Energy Facility has reached the end of its economic life and all infrastructure has been decommissioned.

Table 2.4: Photographs of the construction phase of a wind farm similar to the Ummbila Emoyeni Wind Energy Facility (Source: www.alamy.com/stock-photo/wind-turbine-construction.html; www.medianet.com.au/releases/178350/; www.industrycrane.com/blog/wind-turbines-installation-process.html)





CHAPTER 3: CONSIDERATION OF ALTERNATIVES

This Chapter provides an overview of the various alternatives considered for the Ummbila Emoyeni Wind Energy Facility as part of the S&EIA Process.

3.1 Legal Requirements as per the EIA Regulations, 2014 (as amended) for the undertaking of an Environmental Impact Assessment Report

This chapter of the EIA Report includes the following information required in terms of Appendix 3: Scope of Assessment and Content of Environmental Impact Assessment Reports:

Requirement	Relevant Section
3(1)(g) a motivation for the preferred development footprint within the approved site as contemplated in the accepted scoping report.	The identification and motivation for the preferred project site, the development footprint within the project site, the proposed activity and the proposed technology is included in **sections 3.3.1, 3.3.3 and 3.3.4**.
3(1)(h)(i) details of the development footprint alternatives considered.	The details of all alternatives considered as part of the Ummbila Emoyeni Wind Energy Facility are included in **sections 3.3.1 – 3.3.5**.
3(1)(h)(ix) if no alternative development footprint for the activity were investigated, the motivation for not considering such.	The site selection process followed by the developer in order to identify the preferred project site and development footprint is described in **section 3.3.1**.
3(1)(h)(x) a concluding statement indicating the location of the preferred alternative development footprint within the approved site as contemplated in the accepted scoping report.	Where no alternatives have been considered, motivation has been included. This is included in **section 3.3**.

3.2 Alternatives Considered during the S&EIA Process

In accordance with the requirements of Appendix 3 of the 2014 EIA Regulations (GNR 326), reasonable and feasible alternatives, including but not limited to site and technology alternatives, as well as the "do-nothing" alternative should be considered.

The DFFE Guideline for determining alternatives states that the key criteria for consideration when identifying alternatives are that they should be "practicable", "feasible", "relevant", "reasonable" and "viable". Essentially there are two types of alternatives:

- Incrementally different (modifications) alternatives to the project.
- Fundamentally (totally) different alternatives to the project.

In this instance, 'the project' refers to Ummbila Wind Energy Facility, a wind energy facility with capacity of up to 900MW and associated infrastructure proposed to be developed by an Independent Power Producer (IPP) and intended to form part of the DMRE's REIPPP Programme, or other similar programmes or private off-take.

3.2.1 Consideration of Fundamentally Different Alternatives

Fundamentally different alternatives are usually assessed at a strategic level and, as a result, project specific EIAs are therefore limited in scope and ability to address fundamentally different alternatives. At a strategic level, electricity generating alternatives have been addressed as part of the DMRE's current Integrated Resource Plan for Electricity 2010 – 2030 (IRP)[9], and will continue to be addressed as part of future revisions. In this regard, the need for renewable energy power generation from wind energy facilities has been identified as part of the technology mix for power generation in the country for the next 20 years.

The fundamental energy generation alternatives were assessed and considered within the development of the IRP and the need for the development of renewable energy projects has been defined. Therefore, fundamentally different alternatives to the proposed project are not considered within this EIA process.

3.2.2 Consideration of Incrementally Different Alternatives

Incrementally different alternatives relate specifically to the project under investigation. "Alternatives", in relation to a proposed activity, means different ways of meeting the general purposes and requirements of the activity, which may include alternatives for:

- The properties on which, or location where the activity is proposed to be undertaken.
- The type of activity to be undertaken.
- The design or layout of the activity.
- The technology to be used in the activity.
- The operational aspects of the activity.

In addition, the option of not implementing the activity (i.e., the "do-nothing" alternative) must also be considered.

The sections below describe the incrementally different alternatives being considered as part of the Ummbila Emoyeni Wind Energy Facility. Where no alternative is being considered, a motivation has been provided as required by the EIA Regulations, 2014, as amended.

3.3 Project Alternatives under Consideration for the Ummbila Emoyeni Wind Energy Facility

3.3.1. Property or Location Alternatives

The development site identified for the Ummbila Wind Energy Facility is located ~6km south-east of Bethal and 1km east of Morgenzon. The preferred project site was identified through an investigation of prospective sites and properties in the area within the Mpumalanga Province. Several other renewable energy facilities are planned within the broader study area, supporting the suitability of the area for renewable energy projects.

The investigation involved the consideration of specific characteristics that play a role in the opportunities and limitations for the development of a wind farm. These are discussed in the sections below.

[9] The Integrated Resource Plan (IRP) is legislated policy which regulates power generation planning.

» **Wind resource**: Wind resource is the first main driver of site selection and project viability when considering the development of wind farms. The project site, which is located near the towns of Bethal and Morgenzon in the Mpumalanga Province has good wind resource potential. The wind resource for the development site has been monitored using onsite monitoring devices over approximately 18 months and has been proven to be competitive and equal to other projects in the country. Modelled wind speeds were validated using nearby weather station data at 10m above ground level and extrapolated to the hub height of up to 150m. The windlab technical team explored the wind resource around the country and highlighted this area as being a strong site from a resource perspective.

» **Land Availability:** In order to develop the Ummbila Emoyeni Wind Energy Facility with a contracted capacity of up to 900MW, sufficient space is required. The preferred project site was identified within the Mpumalanga Province and in the Bethal / Morgenzon area following the confirmation of a feasible wind resource from on-site wind measurements taken over an 18-month period. The properties included in the project site are privately-owned parcels available in the area for a development of this nature through agreement with the landowners and are deemed technically feasible by the project developer for such development to take place. The combination of the affected properties has an extent of ~27 819ha, which was considered by the developer as sufficient for the development of the Ummbila Emoyeni Wind Energy Facility. A development footprint of 390 ha (less than 2% of the total area of 27 000 ha considered) for the placement of infrastructure within the project site has been identified considering environmental constraints and sensitivities identified through the Scoping Evaluation and is assessed within this EIA Report.

» **Land Use, Geographical and Topographical Considerations**: The character of the greater area surrounding the project site can be described as natural grassland which is interspersed with areas of cultivation. Main crop types include sunflower seed production, sorghum, rye and potatoes. Settlement occurs in the form of isolated homesteads throughout the study area that are generally related to agricultural uses. There is a tourism related establishment (Silver Water Game Lodge) located within the north-eastern section of the proposed site. This facility appears to be focused around a dam. Settlement in the form of towns and villages is limited. The closest towns include Morgenzon, Bethal and Ermelo. Other disturbance visible is mining infrastructure, a railway track and power lines.

The proposed focus area is located across a series of valley and ridgelines that run in a general east to west direction. The valley lines all feed into the Bleboksprui which flows in a north to south direction approximately 8.5km to the west of the proposed site.

Based on the location of the project site within an area where supporting tranmission and distribution infrastructure is readily available to enable the evacuation of the generated power and the suitable and prefereble topography present, the site was identified as being technically preferred for the planned development.

» **Access to the National Electricity Grid** – A key factor in the siting of any generation project is a viable grid connection. The grid connection infrastructure for the facility will include a 400/132kV Main Transmission Substation (MTS), to be located between the Camden and SOL Substations, which will be looped in and out of the existing Camden-Sol 400kV transmission line; on-site switching stations (132kV in capacity) at each renewable energy facility (Eskom Portion); 132kV power lines from the switching stations at each renewable energy facility to the new 400/132kV MTS; and a collector substation with 2 x 132kV bus bars and 4 x 132kV IPP feeder bays to the onsite IPP Substation. This proposed grid connection has been confirmed with Eskom as a feasible option through a Cost Estimate Letter ("CEL"). The grid

connection solution will be subjected to a separate S&EIA process. The Project will require the construction of a new 400/132kV MTS Substation equipped with several 400/132kV 500MVA transformers, and space for future transformers and feeder bays. The cost to build these facilities will be covered by the Project and the facilities themselves will be constructed on a self-build basis, to be handed over to Eskom. The MTS Substation is anticipated to unlock substantial capacity along a major transmission route of the country, creating room for additional energy evacuation in future and making it easier for other projects to connect to the national grid. Thus, further capacity will be unlocked, and the socio-economic benefits derived from these projects will be gained (this would not be limited to a specific technology).

» **Site access**: Access to the project site is ample with the presence of existing roads mainly consisting of national and regional roads. The proposed site is bounded by the N17 to the north, the R39 to the east and south and the R35 to the west. It is assumed that if components are imported to South Africa, it will be via the Port of Richard's Bay, which is located in KwaZulu-Natal. The Port is located approximately 460km from the proposed site. Alternatively, components can be imported via the Port of East London, located approximately 1 130km from the proposed site, or from the Port of Ngqura, located approximately 1 200km from the proposed site, both being located in the province of the Eastern Cape.

Based on the above considerations, the Ummbila Emoyeni Wind Energy Facility project site was identified by the developer as being the most technically feasible and viable project site within the broader area for further investigation in support of an application for authorisation. As a result, no property/location alternatives are proposed as part of this S&EIA process.

3.3.2. Design and Layout Alternatives

The overall aim of the facility layout (i.e., development footprint) is to maximise electricity production through exposure to the wind resource, while minimising infrastructure, operation, and maintenance costs, and social and environmental impacts.

Following the confirmation of the Ummbila Emoyeni Wind Energy Facility preferred project site as being technically feasible for the development of a Wind Energy Facility, the developer commenced with the scoping assessment of the site to evaluate the main constraints and opportunities and determine whether or not there are any fatal flaws or significant no-go areas within the site that might compromise or limit the development of the Ummbila Emoyeni Wind Energy Facility and the potential to generate 900MW. The scoping process included specialist investigations of the project site based on desktop studies and where possible, field assessments.

The purpose of this phase of the project was to identify sensitive and no-go areas, as well as to determine appropriate buffers to be considered within the development of the project layout. The sensitivity spatial data as compiled by the specialist team during the Scoping Phase for the project site was provided to the applicant. This is a common approach in the development of renewable energy projects in order to inform the placement of infrastructure for further investigation in the EIA Phase.

Through integration of the specialist sensitivity data obtained, based on field-survey and desktop studies, as well as consideration of technical aspects, the developer designed the layout to avoid areas and features of high environmental sensitivity. Where avoidance was not possible, appropriate mitigation and management measures (in this instance the development of technical mitigation solutions as well as recommendations from the various environmental specialists) have been proposed for implementation

during the construction and operation of the proposed Wind Energy Facility. This has resulted in the consideration of a development footprint as part of the EIA process which is designated to be environmentally appropriate as far as possible.

An overall environmental sensitivity map has been provided in order to illustrate the sensitive environmental features located within the project site which needs to be considered and, in some instances completely avoided by the development footprint (refer to Chapter 11).

3.3.3. Activity Alternatives

Emoyeni Renewable Energy Farm (Pty) Ltd is a renewable energy project developer and as such is only considering renewable energy activities in accordance with the need for such development within the IRP (refer to Chapters 5 and 6 for more detail). Considering the available renewable energy resources within the area and the current significant restrictions placed on other natural resources such as water, it is considered that wind energy is the preferred option for the development of a renewable energy facility within the identified project site. Development of a solar energy facility is also being considered in a separate application process due to the viable solar resource in the area. No other activity alternatives are being considered within this S&EIA process.

3.3.4. Technology Alternatives

i) Renewable Energy Technology Alternatives

Using Windlab's inhouse patented technology, the company identified this site as being highly competitive from a wind resource perspective, and for this reason was developed further as a wind farm project. On the ground monitoring has validated the initial Windlab wind map, thus confirming that the site is a strong wind project site. Emoyeni Renewable Energy Farm (Pty) Ltd is therefore considering wind technology as a feasible option for implementation at the identified project site based on the outcome of the onsite wind monitoring and modelling (as detailed above) and has considered various wind turbine options based on the identified environmental constraining factors which have been determined through the Scoping Evaluation. The preferred option has been informed by efficiency as well as environmental impact and constraints (such as noise associated with the turbine and sensitive biophysical features). The wind turbines being proposed for the Ummbila Emoyeni Wind Energy Facility will be between 6 – 15MW in capacity, with a hub height of up to 200m and a tip height of up to 300m.

There is a limited range of alternative technologies (turbines) available for commercial-scale wind energy facilities. In addition, the technology is constantly evolving. **Table 3.1** summarises the types of variables associated with existing wind turbine technologies.

Table 3.1: Variables associated with existing wind turbine technologies.

Variables	Description
Type	The horizontal axis wind turbine completely dominates the commercial scale wind turbine market.
Size	Typical land-based utility scale wind turbines are currently in the 600 kW to 6MW range internationally.
Foundation	The foundation is usually poured reinforced concrete. Its size and shape are dictated by the size of the wind turbine and local geotechnical considerations. The foundation for the Ummbila Emoyeni Wind Energy Facility is estimated to be of a diameter of up to 40m per turbine.

Tower	Towers are typically constructed from steel and/or concrete and can be hybrid. The towers used for the Ummbila Emoyeni Wind Energy Facility will be up to 200m in height.
Rotor	3- Bladed rotor is standard.
Rotor Speed Control	Fixed or variable speed rotors.
Gears	Geared and gearless.
Generator	Standard high-speed generator (geared) or custom low-speed ring generator (gearless).
Other variables	Yaw gears, brakes, control systems, lubrication systems and all other turbine components are similar on modern wind turbines.

Ummbila Emoyeni Renewable Energy Farm (Pty) Ltd therefore confirms wind energy technology as the preferred technology alternative for the development of the project. No further technology alternatives are considered within this EIA Report.

ii) Battery Energy Storage System Technology Alternatives

Technology within a BESS frequently advances and as such the Applicant has not determined the specific technology that will be utilised at this stage. Two technology types however are envisaged, both of which have been assessed in this report to ensure that all impacts related to both types have been addressed:

- Lithium-Ion technology (e.g. Lithium Ferrophosphate (LFP), Nickel Manganese Cobalt Oxide (NMC) or similar technology and chemistries); and
- Redox-flow technology (e.g. vanadium flow battery, or similar technology and chemistries).

Both technologies include batteries housed within containers which are fully enclosed and self-contained. It is important to note that while both types are detailed and assessed in this report, no specific technology is proposed as that preferred for authorisation, as both are expected to have similar impacts due to their design and functions being closely related. Therefore, the assessment proposes both technologies for authorisation (i.e. a BESS of either Lithium-Ion or Redox-flow type), to allow the proponent to determine the precise technology when the project is implemented, on the understanding that further investigation into the specific technologies available at the time of being awarded preferred bidder status will allow for one of two to be selected and ultimately developed.

a) Lithium-Ion technology

A **lithium-ion (Li-ion) battery** is a rechargeable electrochemical battery operating on a wide array of chemistries where lithium ions are transferred between the electrodes during the charge and discharge reactions (Parsons, 2017).

A Li-ion cell is comprised of three main components; cathode and anodes electrodes, and an electrolyte that allows lithium ions to move from the negative electrode to the positive electrode during discharge and back when charging (**Figure 3.1**) (Parsons, 2017). While charging, lithium ions flow from the positive metal oxide electrode, to the negative graphite electrode which is reversed during discharge (i.e. ion flow is in the opposite direction).

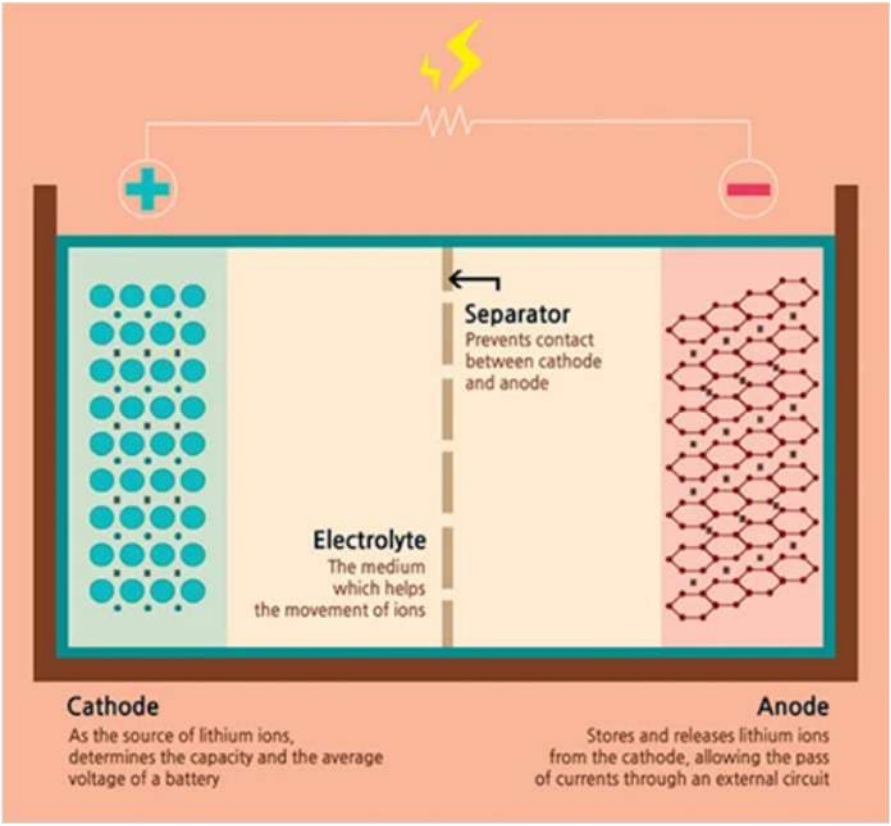


Figure 3.1: An example of a Li-ion cell and its component(Source: https://eepower.com/technical-articles/changing-the-world-with-lithium-ion-batteries/#)

Li-ion battery cells contain two reactive materials which are capable of electron transfer chemical reactions (commonly a lithium source cathode and a graphite anode). Lithium ion batteries utilise both lithium and a heavy metal (commonly cobalt or manganese) in the reactions required for energy storage, resulting in environmental impacts during the preconstruction phases of the technology (i.e. supply chain impacts). Lithium can however be recycled, adding the future potential use of this battery technology, however the recycling process is difficult and expensive.

The High round-trip efficiency (the fraction of energy put into the storage that can be retrieved), high power and energy density of this technology provide a significant advantage where a small footprint and available space are an issue. A significant disadvantage to Li-ion has been the high initial cost, as well as the limited cycle lives produced by earlier (historical) chemistries used in the battery (Parsons, 2017). Regardless, recent technological advances and large-scale manufacturing have reduced the price drastically and increased performance, with the result that Li-ion batteries are expected to be an important BESS through to 2030 in both small- and large-scale applications.

b) Flow Batteries

Flow batteries contain tanks filled with electrolyte, which flows through an electrochemical cell or reaction stack **(Figure 3.2)** (Parsons, 2017). They store and release energy through a reversible electrochemical reaction between two electrolytes (chemical reactants), which are separated by a membrane through which charging and discharging occurs. These batteries provide an energy output greater than or equal to lead acid batteries, and their storage capacity is dependent upon the size of the electrolyte tanks while the power output is dependent on the size of the reaction stack (Parsons, 2017).

Flow batteries are a technology of battery which requires mechanical systems (pumps, pipes, and tanks) and are therefore inherently more complex than a solid-state battery (for example, lithium-ion, lead or advanced lead acid batteries discussed above). The greatest advantage these batteries exhibit is their scalability and their longer duration discharge cycles which are more cost efficient when compared to solid-state batteries (Parsons, 2017). The most successful and widespread of these batteries use vanadium (discussed below) and zinc-bromine chemistries.

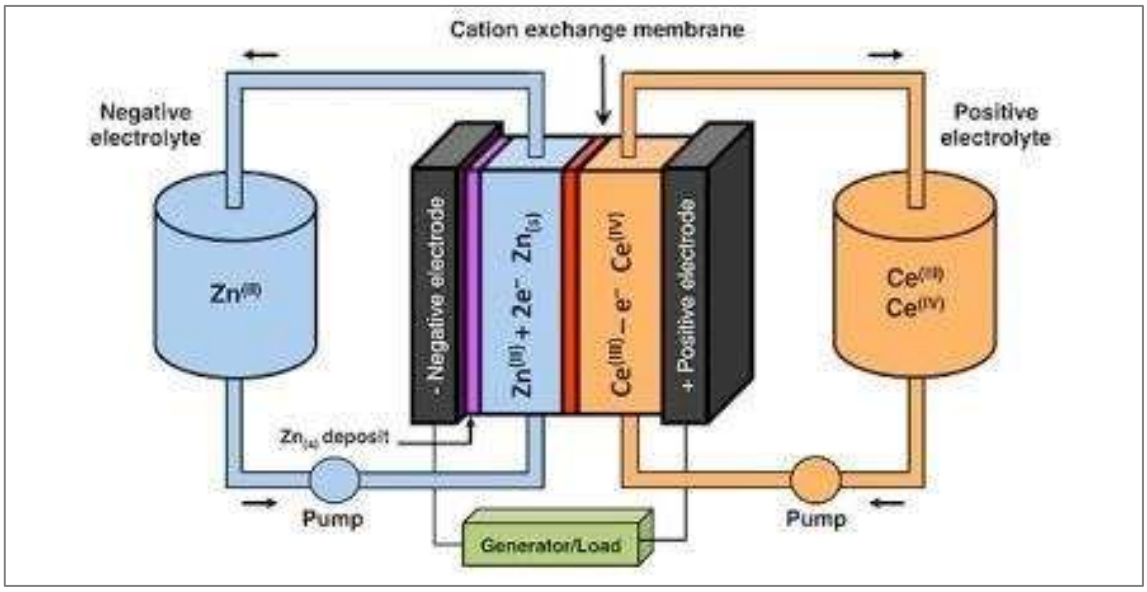


Figure 3.2: An example of a flow battery and its component
(Source:http://www.upsbatterycenter.com/blog/flow-batteries-bring-light-africa/#prettyPhoto)

Redox Flow Batteries (RFB) are a class of electrochemical energy storage technology which entail a chemical reduction and oxidation reaction that stores energy in liquid electrolyte solution flowing through a battery of electrochemical cells during charge and discharge. They are therefore a subset (or one variant) of flow batteries and essentially work by two separate containers of dissolved chemical components, separated by a membrane, which facilitate ion exchange (and thus the resulting flow of electric current) across the membrane when an electrical load is applied to the system. These batteries may act as a fuel cell, where spent electrolyte solution is exchanged once no longer effective, or rechargeable, where regeneration may be achieved by applying a source of electricity to the electrolyte). The energy capacity of this battery is a function of the volume of the electrolyte solution, allowing for a high degree of scalability.

3.3.5. The 'Do-Nothing' Alternative

The 'do-nothing' alternative is the option of not constructing and operating the Ummbila Emoyeni Wind Energy Facility. Should this alternative be selected, there would be no environmental impacts or benefits as a result of construction and operation activities associated with a wind energy facility. The 'do-nothing' alternative will therefore likely result in minimising the cumulative impact on land, although it is expected that pressure to develop the site for renewable energy purposes will be actively pursued due to the same factors which make the site a viable option for renewable energy development and the need for renewable energy generation in the country. The 'do-nothing' alternative has been assessed as part of the EIA Phase (refer to Chapters 9 and 11 of this EIA Report).

CHAPTER 4: WIND AS A POWER GENERATION TECHNOLOGY

Environmental pollution and the emission of CO_2 from the combustion of fossil fuels through the implementation of conventional power plants constitute a threat to the environment. The use of fossil fuels is reportedly responsible for ~70% of greenhouse gas emissions worldwide. The approach to addressing climate change needs to include a shift in the way that energy is generated and consumed. Worldwide, many solutions and approaches are being developed to reduce emissions. However, it is important to acknowledge that the most cost-effective solution in the short-term is not necessarily the least expensive long-term solution. This holds true not only for direct project costs, but also indirect project costs such as impacts on the environment. Renewable energy is considered a 'clean source of energy' with the potential to contribute greatly to a more ecologically, socially, and economically sustainable future. The challenge however is to ensure that wind energy projects are able to meet all economic, social and environmental sustainability criteria through the appropriate placement of these facilities.

Compared with other renewable energy sources such as solar and bio-energy, wind energy generates the highest energy yield while affecting the smallest physical land space. Wind technologies convert the energy of moving air masses at the earth's surface to mechanical power that can be used directly for mechanical needs (e.g., milling or water pumping) or converted to electric power in a generator (i.e., a wind turbine). The use of wind for electricity generation is essentially a non-consumptive use of a natural resource and produces an insignificant quantity of greenhouse gases in its life cycle. A wind farm also qualifies as a Clean Development Mechanism (CDM) project (i.e., a financial mechanism developed to encourage the development of low carbon generating technologies) as it meets all international requirements in this regard.

This chapter explores the use of wind energy as a means of power generation.

4.1. Wind Resource as a Power Generation Technology

Using the wind resource for energy generation has the attractive attribute in that the fuel is free. The economics of a wind energy project crucially depend on the wind resource at the project site. Detailed and reliable information about the speed, strength, direction, and frequency of the wind resource is vital when considering the installation of a wind farm, as the wind resource is a critical factor to the success of the installation.

- **Wind power** is the conversion of wind energy into a useful form, such as electricity, using wind turbines.
- **Wind speed** is the rate at which air flows past a point above the earth's surface. Average annual wind speed is a critical siting criterion, since this determines the cost of generating electricity. The doubling of the wind speed increases the wind power by a factor of 8, so even small changes in wind speed can produce large changes in the economic performance of a wind farm. Wind turbines can start generating electricity at wind speeds of between ~3 m/s to 4 m/s (this is also known as the cut-in wind speed), with wind speeds greater than 6 m/s currently required for a wind farm to be economically viable. Wind speed can be highly variable and is also affected by a number of factors, including surface roughness of the terrain. The effect of height variation/relief in the terrain is seen as a speeding-up/slowing-down effect of the wind due to the topography of the landscape. Elevation in the topography influences the flow of air, and results in turbulence within the air stream, which has to be considered in the placement of turbines.

» **Wind direction** at a site is important to understand as it influences the turbulence over the site, and therefore the potential energy output. However, wind turbines can extract energy from any wind direction as the nacelle automatically turns to face the blades into the predominant wind direction at any point in time.

A wind resource measurement campaign and analysis programme must be conducted for the site proposed for development, as only measured data will provide a robust prediction of the wind farm's expected energy production over its lifetime. This has been undertaken for the project site over an 18-month period through the on-site monitoring of the wind resource using onsite monitoring devices.

The placement of the individual turbines within a wind farm must consider the following technical factors:

» Predominant wind direction, wind strength and frequency.
» Topographical features or relief affecting the flow of the wind (e.g., causing shading effects and turbulence of air flow).
» Effects of adjacent turbines on wind flow and speed – specific spacing is required between turbines in order to reduce the effects of wake turbulence.

Wind turbines typically need to be spaced approximately 3 to 5 times the rotor diameter apart in order to minimise the induced wake effect that the turbines might have on each other (refer to **Figure 4.1**). A viable footprint for the establishment of the Ummbila Emoyeni Wind Energy Facility has been determined through the consideration of both technical and environmental criteria. The spacing requirements for wind turbines were considered in the micro-siting of the turbines on the site.

4.2. How do wind turbines function and what are the associated infrastructure?

Wind turbines are mounted on a tower at height to capture the most energy. The kinetic energy of wind is used to turn a wind turbine to generate electricity. At an increased height above ground, they can take advantage of the faster and less turbulent wind. Turbines catch the wind's energy with their propeller-like blades. Generally, a wind turbine consists of three rotor blades and a nacelle mounted at the top of a tapered steel or concrete tower. The mechanical power generated by the rotation of the blades is transmitted to the generator within the nacelle.

Turbines are able to operate at varying speeds. The amount of energy a turbine can harness depends on both the wind velocity and the length of the rotor blades. It is anticipated that the turbines utilised for the Ummbila Emoyeni Wind Energy Facility will have a hub height of up to 200m, and a tip height of up to 300m. The capacity of the wind farm will depend on the wind turbine selected by Emoyeni Renewable Energy Farm (Pty) Ltd (turbine capacity and model that will be deemed most suitable for the site). A maximum of 111 turbines are proposed for the project.

Other infrastructure associated with the facility includes internal access roads, onsite collector substations, Battery Energy Storage System (BESS), cabling to connect the wind turbines to the onsite collector substations, cabling between the turbines, laydown and crane hardstand areas, and construction compounds, including site office. The construction phase of the wind energy facility is dependent on the number of turbines erected and is estimated at a maximum of approximately 24 months. The lifespan of the facility (i.e., operation phase) is approximated at 20 to 30 years.

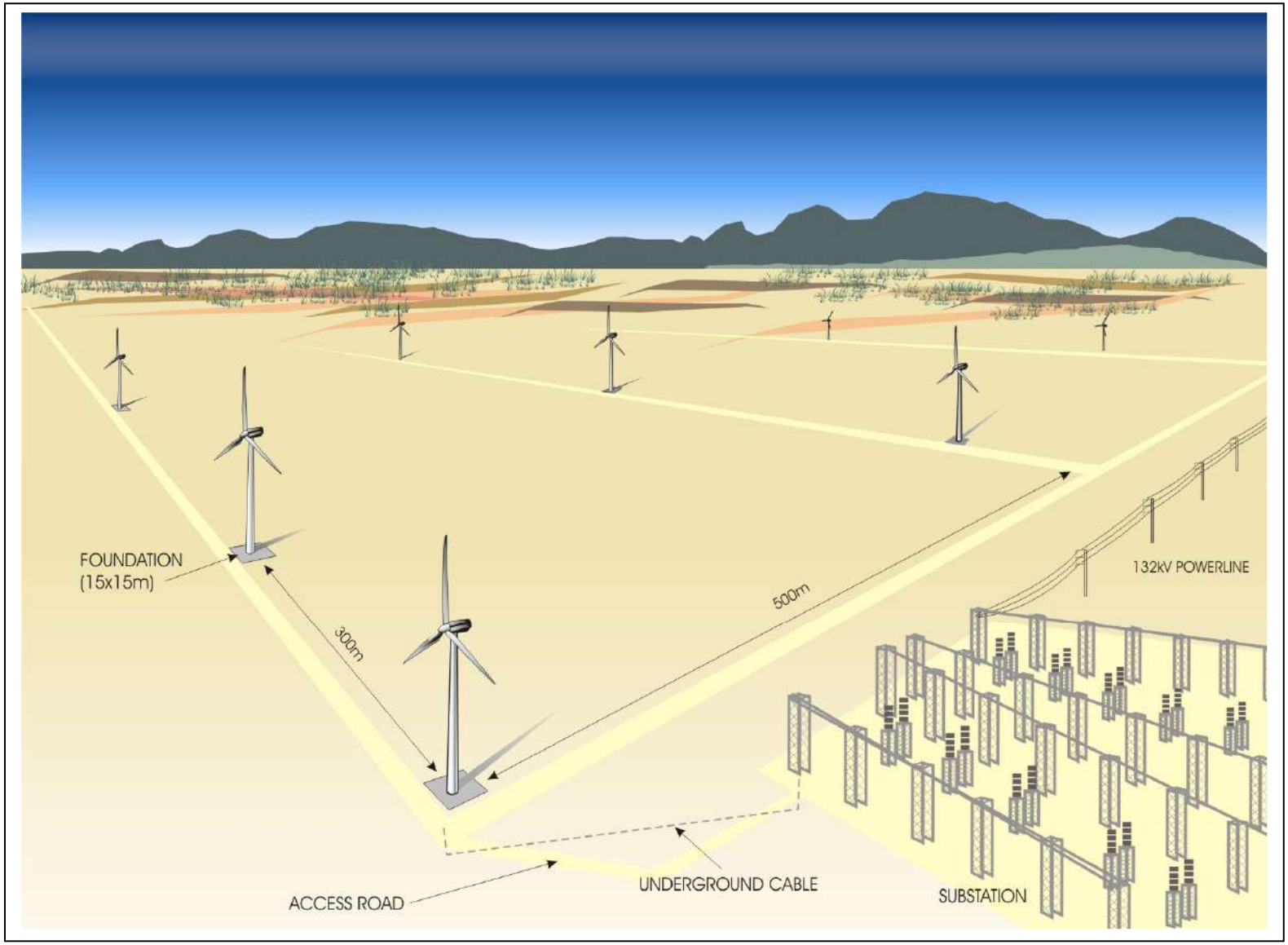


Figure 4.1: Artist's impression of a portion of a typical wind energy facility, illustrating the various components and associated infrastructure. Note that distances and measurements shown are indicative and for illustrative purposes only.

4.3. Main Components of a Wind Turbine

The turbine consists of the following major components (as shown in **Figure 4.2**):

- The foundation unit
- The tower
- The rotor
- The nacelle

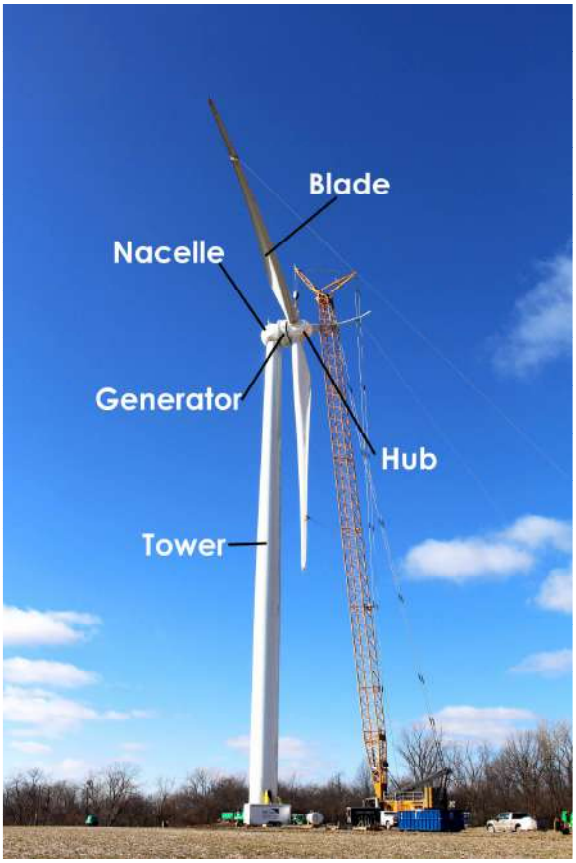


Figure 4.2: Illustration of the main components of a wind turbine (source: https://oneenergy.com/wind-energy-basics/energy-terminology/)

The foundation

The foundation is used to secure each wind turbine to the ground. These structures are commonly made of reinforced concrete and are designed to withstand the vertical loads (weight) and lateral loads (wind).

The tower

The tower is a hollow structure (steel or concrete or a combination of the two materials, known as hybrid) allowing access to the nacelle (up to 200m in height). The height of the tower is a key factor in determining the amount of electricity a turbine can generate as the wind speed varies with height. Towers are typically delivered to site in sections and then erected and joined together on site. Most towers are made of steel; however, some are made of reinforced post-stressed concrete.

The tower on which a wind turbine is mounted is not just a support structure. It also raises the wind turbine so that its blades safely clear the ground and so it can reach the stronger winds at higher elevations. The tower must be strong enough to support the wind turbine and to sustain vibration, wind loading and the overall weather elements for the lifetime of the wind turbine.

Figure 4.3: Example of a tower on which the rotor is mounted

The Rotor

The portion of the wind turbine that collects energy from the wind is called the rotor. The rotor comprises of three rotor blades. The rotor blades use the latest advances in aeronautical engineering materials science to maximise efficiency. The greater the number of turns of the rotor the more electricity is produced. The rotor converts the energy in the wind into rotational energy to turn the generator. The rotor has three blades that rotate at about 15 to 28 revolutions per minute (rpm). The speed of rotation of the blades is controlled by turning the blades to face into the wind ('yaw control') and changing the angle of the blades ('pitch control') to make the most use of the available wind.

The rotor blades function in a similar way to the wing of an aircraft, utilising the principles of lift. When air flows past the blade, a wind speed and pressure differential is created between the upper and lower blade surfaces. The pressure at the lower surface is greater and therefore acts to "lift" the blade. When blades are attached to a central axis, like a wind turbine rotor, the lift is translated into rotational motion. Lift-powered wind turbines are well suited for electricity generation.

The nacelle

The nacelle at the top of the tower accommodates the gears, the generator, anemometer for monitoring the wind speed and direction, cooling and electronic control devices, and yaw mechanism. Geared nacelles generally have a longer form/ structure than gearless turbines.

The generator is what converts the turning motion of a wind turbine's blades into electricity. Inside this component, coils of wire are rotated in a magnetic field to produce electricity. The generator's rating, or size, is partly dependent on the length of the wind turbine's blades because more energy is captured by longer blades.

Other infrastructure associated with the facility includes internal access roads, a power line, an on-site collector substation and operation and maintenance buildings. The construction phase of the wind farm is dependent on the number of turbines erected and is estimated at a maximum of approximately 30 months (including all infrastructure). The lifespan of the facility (i.e., operation phase) is approximated at 20 to 25 years.

4.4. Operating Characteristics of a Wind Turbine

A turbine is designed to operate continuously, unattended and with low maintenance for more than 20 years or >120 000 hours of operation. Once operating, a wind farm can be monitored and controlled remotely, with a mobile team for maintenance, when required.

The cut-in speed is the minimum wind speed at which the wind turbine will generate usable power and is usually between ~3 m/s and 4 m/s. This wind speed is typically between 10 and 15 km/hr (i.e., ~3 m/s and 4 m/s).

At very high wind speeds, typically over 90 km/hr (25 m/s), the wind turbine will cease power generation and shut down. The wind speed at which shut down occurs is called the cut-out speed. Having a cut-out speed is a safety feature which protects the wind turbine from damage. Normal wind turbine operation usually resumes when the wind drops back to a safe level.

It is the flow of air over the blades and through the rotor area that makes a wind turbine function. The wind turbine extracts energy by slowing the wind down. The theoretical maximum amount of energy in the wind that can be collected by a wind turbine's rotor is approximately 59%. This value is known as the Betz Limit. Therefore, if a blade were 100% efficient then it would extract 59% of the energy as this is the maximum (due to Betz law). In practice, the typical collection efficiency of a rotor is 35% to 45%. A complete wind energy system incurs losses through friction and modern systems end up converting between 20-25% of the energy in the air into electricity which equates to 34 - 42% of the maximum (due to Betz Law).

However, because the energy in the air is free, describing how efficiently the energy is converted is only useful for system improvement and monitoring purposes. A more useful measurement is the Capacity Factor, which is also represented as a percentage. The Capacity Factor percentage is calculated from the actual MWh output of electricity from the entire wind farm over 1 year divided by the nameplate maximum theoretical output for the same period. It therefore also takes wind resource, wind variability and system availability (downtime, maintenance and breakdowns) into account.

Wind turbines can be used as stand-alone applications, or they can be connected to a utility power grid. For utility-scale sources of wind energy, a large number of wind turbines are usually erected close together (suitably spaced so as to minimise wake losses and wake induced turbulence) and then connected to an on-site substation where all power is transformed to the correct voltage and then exported via a linkage to the utility power grid. This is termed a wind farm.

4.5. Battery Energy Storage System (BESS)

Increasing BESS capacity is required as the penetration of renewable energy increases in the grid as the BESS provides the ancillary services required for grid stability that variable generation such as wind cannot provide. The general purpose and utilisation of a Battery Energy Storage System (BESS) is to save and store excess electrical output as it is generated, allowing for a timed release when the capacity is required the most and the provision of ancillary services to ensure reliable operation of power networks during normal operation and contingency events. BESS systems therefore provide flexibility and reliability services for the efficient operation of the electric grid.

The BESS will store and integrate a greater amount of renewable energy from the wind energy facility into the electricity grid. This will assist with the objective to generate electricity by means of renewable energy to feed into the National Grid which will be procured under either the REIPPPP, other government run procurement programmes or for sale to private entities if required.

Figure 4.4 below illustrates a typical utility scale BESS system (a Lithium-Ion BESS).

Figure 4.4: Li-Ion BESS containerised modules located within the BESS enclosure footprint (Source: Tesla).

CHAPTER 5: POLICY AND LEGISLATIVE CONTEXT

This Chapter provides an overview of the policy and legislative context within which the development of a wind farm, such as the Ummbila Emoyeni Wind Energy Facility, is proposed. It identifies environmental legislation, policies, plans, guidelines, spatial tools, municipal development planning frameworks and instruments that are applicable to this activity and are to be considered in the assessment process which may be applicable to or have bearing on the proposed project.

5.1 Legal Requirements as per the EIA Regulations, 2014 (as amended) for the undertaking of an Environmental Impact Assessment Report

This chapter of the EIA Report includes the following information required in terms of the EIA Regulations, 2014 - Appendix 3: Scope of Assessment and Content of Environmental Impact Assessment Reports:

Requirement	Relevant Section
3(1)(e) a description of the policy and legislative context within which the development is proposed and how the proposed development complies with and responds to the legislation and policy context.	Chapter 5 as a whole provides an overview of the policy and legislative context which is considered to be associated with the development of the Ummbila Emoyeni Wind Energy Facility. The regulatory and planning context has been considered at national, provincial and local levels.

5.2. Strategic Electricity Planning in South Africa

The need to expand electricity generation capacity in South Africa is based on national policy and informed by on-going strategic planning undertaken by the DMRE. The hierarchy of policy and planning documentation that support the development of renewable energy projects such as the Ummbila Emoyeni Wind Energy Facility is illustrated in **Figure 5.1**. These policies are discussed in more detail in the following sections, along with the provincial and local policies or plans that have relevance to the development of the proposed project.

The South African energy industry is evolving rapidly, with regular changes to legislation and industry role-players. The regulatory hierarchy for an energy generation project of this nature consists of three tiers of authority who exercise control through both statutory and non-statutory instruments – that is National, Provincial and Local levels. As wind farm developments are a multi-sectoral issue (encompassing economic, spatial, biophysical, and cultural dimensions), various statutory bodies are likely to be involved in the approval process of a wind farm project and the related statutory environmental assessment process.

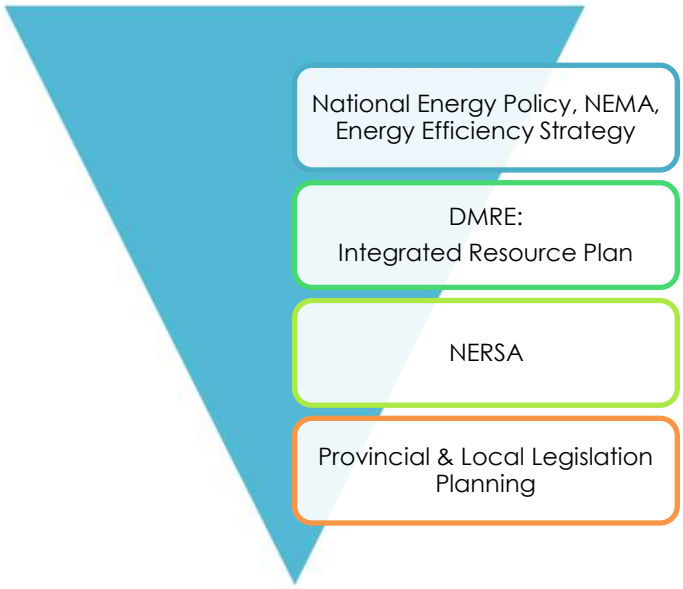


Figure 5.1: Hierarchy of electricity and planning documents

At **National Level**, the main regulatory agencies are:

- **Department of Mineral Resources and Energy (DMRE):** This Department is responsible for policy relating to all energy forms and for compiling and approving the Integrated Resource Plan (IRP) for electricity. Furthermore, the Department is also responsible for granting approvals for the use of land which is contrary to the objects of the Mineral and Petroleum Resource Development Act (Act No. 28 of 2002) (MPRDA) in terms of Section 53 of the Act. Therefore, in terms of the Act, approval from the Minister is required to ensure that the proposed activities do not sterilise mineral resources that may occur within the project site and development area.
- **National Energy Regulator of South Africa (NERSA):** NERSA is responsible for regulating all aspects of the electricity sector and will ultimately issue licenses for IPP projects to generate electricity.
- **Department of Forestry, Fisheries and the Environment (DFFE):** This Department is responsible for environmental policy and is the controlling authority in terms of NEMA and the EIA Regulations, 2014 (GN R326) as amended. DFFE is the Competent Authority for this project (as per GN R779 of 01 July 2016), and is charged with granting the EA for the project under consideration.
- **The South African Heritage Resources Agency (SAHRA):** SAHRA is a statutory organisation established under the National Heritage Resources Act (No. 25 of 1999) (NHRA), as the national administrative body responsible for the protection of South Africa's cultural heritage.
- **South African National Roads Agency Limited (SANRAL):** This Agency is responsible for the regulation and maintenance of all national road routes.
- **Department of Water and Sanitation (DWS):** This Department is responsible for effective and efficient water resource management to ensure sustainable economic and social development. This Department is also responsible for evaluating and issuing licenses pertaining to water use (i.e., Water Use License (WUL) and General Authorisation).
- **The Department of Agriculture, Rural Development and Land Reform (DARDLR):** This Department is the custodian of South Africa's agricultural resources and is primarily responsible for the formulation and implementation of policies governing the agriculture sector. Furthermore, the Department is also responsible for issuing permits for the disturbance or destruction of protected tree species listed under Section 15 (1) of the National Forest Act (No. 84 of 1998) (NFA).

At **Provincial Level**, the main regulatory agencies are:

- **Provincial Government of Mpumalanga – Mpumalanga Department of Agriculture, Rural Development, Land and Environmental Affairs (DARDL&EA):** This Department is the commenting authority for the EIA process for the project and is responsible for issuing of biodiversity and conservation-related permits.
- **Mpumalanga Department of Public Works, Roads and Transport:** This Department provides effective co-ordination of crime prevention initiatives, provincial police oversight, traffic management and road safety towards a more secure environment.
- **Mpumalanga Provincial Heritage Resource Authority (MPHRA):** This Department identifies, conserves and manages heritage resources throughout the Mpumalanga Province.

At the **Local Level,** the local and district municipal authorities are the principal regulatory authorities responsible for planning, land use and the environment. In the Mpumalanga Province, both the local and district municipalities play a role. The project site is located across the **Govan Mbeki, Lekwa, and Msukaligwa Local Municipalities** within the **Gert Sibande District**. In terms of the Municipal Systems Act (No. 32 of 2000), it is compulsory for all municipalities to go through an Integrated Development Planning (IDP) process to prepare a five-year strategic development plan for the area under their control.

5.3. International Policy and Planning Context

A brief review of the most relevant international policies relevant to the establishment of the Ummbila Emoyeni Wind Energy Facility are provided below in **Table 5.1**. The Ummbila Emoyeni Wind Energy Facility is considered to be aligned with the aims of these policies, even if contributions to achieving the goals therein are only minor.

Table 5.1: International policies relevant to the Ummbila Emoyeni Wind Energy Facility

Relevant policy	Relevance to the Ummbila Emoyeni Wind Energy Facility
United Nations Framework Convention on Climate Change (UNFCCC) and Conference of the Party (COP)	The Conference of the Parties (COP), established by Article 7 of the UNFCCC, is the supreme body and highest decision-making organ of the Convention. It reviews the implementation of the Convention and any related legal instruments and takes decisions to promote the effective implementation of the Convention. The Conference of the Parties (COP) 21 was held in Paris from 30 November to 12 December 2015. From this conference, an agreement to tackle global warming was reached between 195 countries. South Africa signed the Agreement in April 2016 and ratified the agreement on 01 November 2016. The Agreement was assented to by the National Council of Provinces on 27 October 2016, and the National Assembly on 1 November 2016. The Paris Agreement set out that every 5 years countries must set out increasingly ambitious climate action. This meant that, by 2020, countries needed to submit or update their plans for reducing emissions, known as nationally determined contributions (NDCs). The COP26 summit held on 2021 brought parties together to accelerate action towards the goals of the Paris Agreement and the UN Framework Convention on Climate Change. On 13 November 2021, COP26 concluded in Glasgow with all countries agreeing the

Relevant policy	Relevance to the Ummbila Emoyeni Wind Energy Facility
	Glasgow Climate Pact to keep 1.5˚C alive and finalise the outstanding elements of the Paris Agreement. South Africa's National Climate Change Response Policy (NCCRP) establishes South Africa's approach to addressing climate change, including adaptation and mitigation responses. The NCCRP formalises Government's vision for a transition to a low carbon economy, through the adoption of the 'Peak, Plateau and Decline' (PPD) GHG emissions trajectory whereby South Africa's emissions should peak between 2020 and 2025, plateau for approximately a decade, and then decline in absolute terms thereafter, and based on this the country has pledged to reduce emissions by 34% and 42% below Business As Usual (BAU) emissions in 2020 and 2025, respectively. The policy provides support for the Ummbila Emoyeni Wind Energy Facility which will contribute to managing climate change impacts, supporting the emergency response capacity, as well as assist in reducing GHG emissions in a sustainable manner.
The Equator Principles IV (October 2020)	The Equator Principles (EPs) IV constitute a financial industry benchmark used for determining, assessing, and managing project's environmental and social risks when financing projects. The EPs are primarily intended to provide a minimum standard for due diligence to support responsible risk decision-making. The EPs are applicable to large infrastructure projects (such as the Ummbila Emoyeni Wind Energy Facility) and apply globally to all industry sectors. Such an assessment should propose measures to minimise, mitigate, and offset adverse impacts in a manner relevant and appropriate to the nature and scale of the Ummbila Emoyeni Wind Energy Facility. In terms of the EPs, South Africa is a non-designated country, and as such the assessment process for projects located in South Africa evaluates compliance with the applicable IFC Performance Standards on Environmental and Social Sustainability, and Environmental Health and Safety (EHS) Guidelines. The Ummbila Emoyeni Wind Energy Facility is currently being assessed in accordance with the requirements of the 2014 EIA Regulations, as amended (GN R326), published in terms of Section 24(5) of the National Environmental Management Act (No. 107 of 1998) (NEMA), which is South Africa's national legislation providing for the authorisation of certain controlled activities. Through this assessment, all potential social and environmental risks are identified and assessed, and appropriate mitigation measures proposed.
International Finance Corporation (IFC) Performance Standards and Environmental and Social Sustainability (January 2012)	The International Finance Corporation's (IFC) Performance Standards (PSs) on Environmental and Social Sustainability were developed by the IFC and were last updated on 1 January 2012. Performance Standard 1 requires that a process of environmental and social assessment be conducted, and an Environmental and Social Management System (ESMS) appropriate to the nature and scale of the project, and commensurate with the level of its environmental

Relevant policy	Relevance to the Ummbila Emoyeni Wind Energy Facility
	and social risks and impacts, be established and maintained. The above-mentioned standard is the overarching standard to which all the other standards relate. Performance Standards 2 through to 8 establish specific requirements to avoid, reduce, mitigate, or compensate for impacts on people and the environment, and to improve conditions where appropriate. While all relevant social and environmental risks and potential impacts should be considered as part of the assessment, the standards 2 and 8 describe potential social and environmental impacts that require particular attention specifically within emerging markets. Where social or environmental impacts are anticipated, the developer is required to manage them through its ESMS consistent with Performance Standard 1. Given the nature of the Ummbila Emoyeni Wind Energy Facility, it is anticipated (at this stage of the process) that Performance Standards 1, 2, 3, 4, 6, and 8 may be applicable to the project.

5.4. National Policy and Planning Context

Further to the South African government's commitment in August 2011 to support the development of renewable energy capacity, the DMRE initiated the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) to procure renewable energy from the private sector in a series of bid rounds. According to the IPP Procurement Programme overview report (2021), as at March 2021, 6 422MW of renewable energy capacity from 112 independent power producers (IPPs) has been procured in seven bid rounds[10], with 5 078MW from 79 IPP projects operational and made available to the grid[11]. National policies have to be considered for the construction and operation of the Wind Energy Facility to ensure that the development is in line with the planning of the country.

A brief review of the most relevant national policies is provided below in **Table 5.2**. The development of Ummbila Emoyeni Wind Energy Facility is considered to align with the aims of these policies, even where contributions to achieving the goals therein are only minor.

Table 5.2: Relevant national legislation and policies for Ummbila Emoyeni Wind Energy Facility

Relevant legislation or policy	Relevance to Ummbila Emoyeni Wind Energy Facility
Constitution of the Republic of South Africa, 1996	Section 24 of the Constitution pertains specifically to the environment. It states that everyone has the right to an environment that is not harmful to their health or well-being, and to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that prevent pollution and ecological degradation, promote conservation and secure ecologically sustainable development, and use of natural resources while promoting justifiable economic and social development. The Constitution outlines the need to promote social and economic development. Section 24 of the Constitution therefore requires that development be conducted in

10 Bid windows1, 2 ,3 ,3.5 ,4 and small BW1(1S2) and small BW2(2S2). 2 583 MW of renewable energy capacity was awarded to IPPs in the REIPPPP bid window 5 in October 2021.

11 https://www.cliffedekkerhofmeyr.com/en/news/publications/2019/Corporate/energy-alert-22-october-The-Integrated-Resource-Plan-2019-A-promising-future-roadmap-for-generation-capacity-in-South-Africa.html

Relevant legislation or policy	Relevance to Ummbila Emoyeni Wind Energy Facility
	such a manner that it does not infringe on an individual's environmental rights, health, or well-being. This is especially significant for previously disadvantaged individuals who are most at risk to environmental impacts. The undertaking of an EIA process for the proposed project in terms of the requirements of the EIA Regulations, 2014 (as amended) aims to minimise any impacts on the natural and social environment.
National Environmental Management Act (No. 107 of 1998) (NEMA)	The NEMA is South Africa's key piece of environmental legislation and sets the framework for environmental management in South Africa. The NEMA is founded on the principle that everyone has the right to an environment that is not harmful to their health or well-being as contained within the Bill of Rights. The national environmental management principles state that the social, economic, and environmental impacts of activities, including disadvantages and benefits, must be considered, assessed, and evaluated, and decisions must be appropriate in the light of such consideration and assessment. The need for responsible and informed decision-making by government on the acceptability of environmental impacts is therefore enshrined within the NEMA.
National Energy Act (No. 34 of 2008)	The purpose of the National Energy Act (No. 34 of 2008) is to ensure that diverse energy resources are available, in sustainable quantities and at affordable prices, to the South African economy in support of economic growth and poverty alleviation, while taking into account environmental management requirements and interactions amongst economic sectors, as well as matters relating to renewable energy. The National Energy Act also provides for energy planning, increased generation and consumption of renewable energies, contingency energy supply, holding of strategic energy feedstocks and carriers, adequate investment in, appropriate upkeep and access to energy infrastructure. The Act provides measures for the furnishing of certain data and information regarding energy demand, supply, and generation, and for establishing an institution to be responsible for promotion of efficient generation and consumption of energy and energy research. The Act provides the legal framework which supports the development of power generation facilities.
White Paper on the Energy Policy of the Republic of South Africa (1998)	The White Paper on Energy Policy places emphasis on the expansion of energy supply options to enhance South Africa's energy security. This can be achieved through increased use of renewable energy and encouraging new entries into the generation market. The policy states that the advantages of renewable energy include, minimal environmental impacts during operation in comparison with traditional supply technologies, generally lower running costs, and high labour intensities. Disadvantages include higher capital costs in some cases, lower energy densities, and lower levels of availability, depending on specific conditions, especially with sun and wind-based systems. Nonetheless, renewable resources generally operate from an unlimited resource base and, as such, can increasingly contribute towards a long-term sustainable energy future.
White Paper on the Renewable Energy Policy of the Republic of South Africa (2003)	The White Paper on Renewable Energy Policy supplements Government's predominant policy on energy as set out in the White Paper on the Energy Policy of the Republic of South Africa (DME, 1998). The policy recognises the potential of renewable energy and aims to create the necessary conditions for the development and commercial implementation of renewable energy technologies.

Relevant legislation or policy	Relevance to Ummbila Emoyeni Wind Energy Facility
	The White Paper on Renewable Energy sets out Government's vision, policy principles, strategic goals, and objectives for promoting and implementing renewable energy in South Africa. The country relies heavily on coal to meet its energy needs due to its abundant, and fairly accessible and affordable coal resources. However, massive renewable energy resources that can be sustainable alternatives to fossil fuels, have so far remained largely untapped. The development of additional renewable energy projects will promote the use of the abundant South African renewable energy resources and contribute to long-term energy security and diversification of the energy mix.
The Electricity Regulation Act (No. of 2006)	The Electricity Regulation Act of 2006 replaced the Electricity Act (No. 41 of 1987), as amended, with the exception of Section 5B, which provides funds for the energy regulator for the purpose of regulating the electricity industry. The Act establishes a national regulatory framework for the electricity supply industry and introduces the National Energy Regulator (NERSA) as the custodian and enforcer of the National Electricity Regulatory Framework. The Act also provides for licences and registration as the manner in which the generation, transmission, distribution, trading, and import and export of electricity are regulated.
National Development Plan 2030	The National Development Plan (NDP) 2030 is a plan prepared by the National Planning Commission in consultation with the South African public which is aimed at eliminating poverty and reducing inequality by 2030. In terms of the Energy Sector's role in empowering South Africa, the NDP envisages that, by 2030, South Africa will have an energy sector that promotes: » Economic growth and development through adequate investment in energy infrastructure. The sector should provide reliable and efficient energy service at competitive rates, while supporting economic growth through job creation. » Social equity through expanded access to energy at affordable tariffs and through targeted, sustainable subsidies for needy households. » Environmental sustainability through efforts to reduce pollution and mitigate the effects of climate change. In formulating its vision for the energy sector, the NDP took the IRP 2010 as its point of departure. Therefore, although electricity generation from coal is still seen as part of the energy mix within the NDP, the plan sets out steps that aim to ensure that, by 2030, South Africa's energy system will look very different to the current situation: coal will contribute proportionately less to primary-energy needs, while gas and renewable energy resources – especially wind, solar, and imported hydroelectricity – will play a much larger role. The NDP aims to provide a supportive environment for growth and development, while promoting a more labour-absorbing economy. The development of Ummbila Emoyeni Wind Energy Facility supports the NDP through the development of energy-generating infrastructure which will not lead to the generation of GHGs and will result in economic development and growth of the area surrounding the development area.
Integrated Energy Plan (IEP), November 2016	The purpose and objectives of the Integrated Energy Plan (IEP) are derived from the National Energy Act (No. 34 of 2008). The IEP takes into consideration the crucial role that energy plays in the entire economy of the country and is informed by the output

Relevant legislation or policy	Relevance to Ummbila Emoyeni Wind Energy Facility
	of analyses founded on a solid fact base. It is a multi-faceted, long-term energy framework which has multiple aims, some of which include: » To guide the development of energy policies and, where relevant, set the framework for regulations in the energy sector. » To guide the selection of appropriate technologies to meet energy demand (i.e., the types and sizes of new power plants and refineries to be built and the prices that should be charged for fuels). » To guide investment in and the development of energy infrastructure in South Africa. » To propose alternative energy strategies which are informed by testing the potential impacts of various factors such as proposed policies, introduction of new technologies, and effects of exogenous macro-economic factors. A draft version of the IEP was released for comment on 25 November 2016. The purpose of the IEP is to provide a roadmap of the future energy landscape for South Africa which guides future energy infrastructure investments and policy development. The development of the IEP is an ongoing continuous process. It is reviewed periodically to take into account changes in the macroeconomic environment, developments in new technologies and changes in national priorities and imperatives, amongst others. The 8 key objectives of the integrated energy planning process are as follows: » Objective 1: Ensure security of supply. » Objective 2: Minimise the cost of energy. » Objective 3: Promote the creation of jobs and localisation. » Objective 4: Minimise negative environmental impacts from the energy sector. » Objective 5: Promote the conservation of water. » Objective 6: Diversify supply sources and primary sources of energy. » Objective 7: Promote energy efficiency in the economy. » Objective 8: Increase access to modern energy.
Integrated Resource Plan for Electricity (IRP) 2010-2030	The Integrated Resource Plan (IRP) for Electricity 2010 – 2030 is a subset of the IEP and constitutes South Africa's National electricity plan. The primary objective of the IRP is to determine the long-term electricity demand and detail how this demand should be met in terms of generating capacity, type, timing, and cost. The IRP also serves as input to other planning functions, including amongst others, economic development and funding, and environmental and social policy formulation. The promulgated IRP 2010–2030 identified the preferred generation technology required to meet expected demand growth up to 2030. It incorporated government objectives such as affordable electricity, reduced greenhouse gas (GHG) emissions, reduced water consumption, diversified electricity generation sources, localisation and regional development. The need for a Just Transition to a sustainable, low carbon and equitable energy system is also recognised. Following the promulgation of the IRP 2010–2030, implementation followed in line with Ministerial Determinations issued under Section 34 of the Electricity Regulation (Act No. 4) of 2006. The Ministerial Determinations give effect to planned infrastructure by facilitating the procurement of the required electricity capacity.

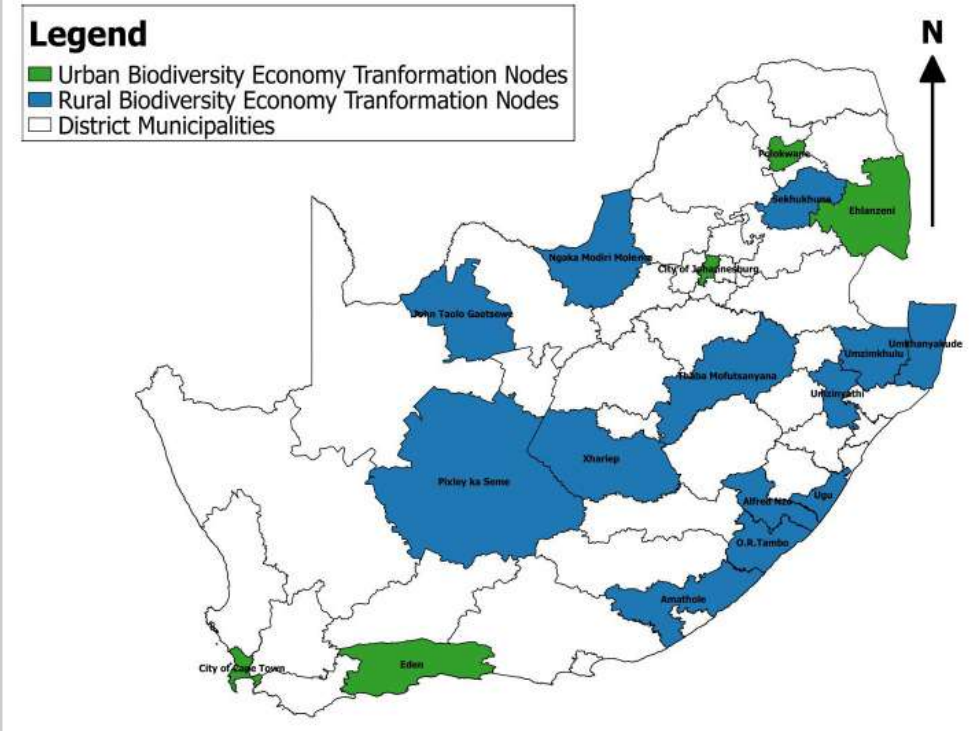
Relevant legislation or policy	Relevance to Ummbila Emoyeni Wind Energy Facility
	According to the IPP Procurement Programme overview report (2021), as at 31 March 2021, a total of 6 422MW has been procured under the REIPPP Programme from 112 IPPs in seven bid rounds, with 5 078MW being currently operational and made available to the grid. IPPs have commissioned 1005MW from two (2) Open Cycle Gas Turbines (OCGT) peaking plants. Under the Eskom Build Programme, 1 332MW has been procured from the Ingula Pumped Storage Project, 1 588MW and 800MW from the Medupi and Kusile power stations and 100MW from the Sere Wind Farm. Provision has been made for the following new capacity by 2030: » 1 500MW of coal » 2 500MW of hydro » 6 000MW of solar PV » 14 400MW of wind » 1 860MW of nuclear » 2 088MW of storage » 3 000MW of gas/diesel » 4 000MW from other distributed generation, co-generation, biomass and landfill technologies Based on the IRP 2019, 1 600MW per annum has been allocated for wind facilities from 2022 to 2030. This will bring the total installed capacity of wind facilities by 2030 to 17 742MW. Therefore, the development of the Ummbila Emoyeni Wind Energy Facility is supported by the IRP 2019.
New Growth Path (NGP) Framework, 23 November 2010	The purpose of the New Growth Path (NGP) Framework is to provide effective strategies towards accelerated job-creation through the development of an equitable economy and sustained growth. The target of the NGP is to create 5 million jobs by 2020; with economic growth and employment creation as the key indicators identified in the NGP. The framework seeks to identify key structural changes in the economy that can improve performance in terms of labour absorption and the composition and rate of growth. To achieve this, government will seek to, amongst other things, identify key areas for large-scale employment creation, as a result of changes in conditions in South Africa and globally, and to develop a policy package to facilitate employment creation in these areas.
National Climate Change Bill, 2018	On 08 June 2018, the Minister of Environmental Affairs published the National Climate Change Bill ("the Bill") for public comment. The Bill provides a framework for climate change regulation in South Africa aimed at governing South Africa's sustainable transition to a climate resilient, low carbon economy and society. The Bill provides a procedural outline that will be developed through the creation of frameworks and plans. Ummbila Emoyeni Wind Energy Facility is a renewable energy generation facility and would not result in the generation or release of emissions during its operation.
National Climate Change Response Policy, 2011	South Africa's National Climate Change Response Policy (NCCRP) establishes South Africa's approach to addressing climate change, including adaptation and mitigation responses. The NCCRP formalises Government's vision for a transition to a low carbon economy, through the adoption of the 'Peak, Plateau and Decline' (PPD)

Relevant legislation or policy	Relevance to Ummbila Emoyeni Wind Energy Facility
	GHG emissions trajectory whereby South Africa's emissions should peak between 2020 and 2025, plateau for approximately a decade, and then decline in absolute terms thereafter, and based on this, the country has pledged to reduce emissions by 34% and 42% below Business As Usual (BAU) emissions in 2020 and 2025, respectively. As an integral part of the policy, a set of near-term priority flagship programmes will be implemented to address the challenges of climate change, one of which includes the Renewable Energy Flagship Programme. This flagship programme includes a scaled-up renewable energy programme, based on the current programme specified in the IRP 2010, and using the evolving South African Renewables Initiative led by the Department of Public Enterprise and Department of Trade and Industry (DTI), as a driver for the deployment of renewable energy technologies. The programme will be informed by enhanced domestic manufacturing potential and the implementation of energy efficiency and renewable energy plans by local government. The development of the Ummbila Emoyeni Wind Energy Facility is aligned with the Renewable Energy Flagship Programme identified under South Africa's NCCRP and could therefore be argued to be aligned with the country's approach to addressing climate change.
National Climate Change Response Strategy for South Africa, 2004	The need for a national climate change policy for South Africa was identified as an urgent requirement during the preparations for the ratification of the UNFCCC in 1997. A process to develop such a policy was thus instituted under the auspices of the National Committee for Climate Change (NCCC), a non-statutory stakeholder body set up in 1994 to advise the Minister on climate change issues and chaired by the then Department of Environmental Affairs and Tourism (DEAT). It was determined that a national climate change response strategy will promote integration between the programmes of the various government departments involved to maximise the benefits to the country as a whole, while minimising negative impacts. Further, as climate change response actions can potentially act as a significant factor in boosting sustainable economic and social development, a national strategy specifically designed to bring this about is clearly in the national interest, supporting the major objectives of the government, including poverty alleviation and the creation of jobs. A number of principles and factors guided the conception of the strategy and are required to be implemented. These are: » Ensuring that the strategy is consistent with national priorities, including poverty alleviation, access to basic amenities including infrastructure development, job creation, rural development, foreign investment, human resource development and improved health, leading to sustainable economic growth. » Ensuring alignment with the need to consistently use locally available resources. » Ensuring compliance with international obligations. » Recognizing that climate change is a cross cutting issue that demands integration across the work programmes of other departments and stakeholders, and across many sectors of industry, business, and the community. » Focussing on those areas that promote sustainable development. » Promoting programmes that will build capacity, raise awareness, and improve education in climate change issues. » Encouraging programmes that will harness existing national technological competencies.

Relevant legislation or policy	Relevance to Ummbila Emoyeni Wind Energy Facility
	» Reviewing the strategy constantly in the light of national priorities and international trends. » Recognizing that South Africa's emissions will continue to increase as development is realised. The strategy was devised through an integrated approach and considers policies and programmes of other government departments and the fact that South Africa is a developing country. This will ensure that the principles of sustainable development are adequately served and do not conflict with existing development policies.
Just Transition Framework for South Africa (June 2022) - A Presidential Climate Commission Report	The Presidential Climate Commission (PCC) is a multi-stakeholder body established by the President of the Republic of South Africa to (1) advise on the country's climate change response and (2) support a just transition to a low-carbon climate-resilient economy and society. The PCC facilitates dialogue between social partners on these issues—defining the type of economy and society the country wants to achieve, and detailed pathways for how to get there. One of the first tasks of the PCC was to design a just transition framework for South Africa. In December 2020, President Cyril Ramaphosa created the PCC to oversee and facilitate a just transition to a low-emissions and climate-resilient economy. The just transition framework is the first building block towards this objective, bringing coordination and coherence to just transition planning in the country. The just transition framework sets out a shared vision for the just transition, principles to guide the transition, and policies and governance arrangements to give effect to the transition. The Just Transition Framework builds on research, policies, and consultations on the just transition in South Africa, as well as international best practice guidelines. The Just Transition Framework sets out a shared vision for the just transition, principles to guide the transition, and policies and governance arrangements to give effect to the transition from an economy that is predominantly reliant on fossil-fuel based energy, towards a low-emissions and climate-resilient economy. The framework is a planning tool for achieving a just transition in South Africa, setting out the actions that the government and its social partners will take to achieve a just transition, and the outcomes to be realised in the short, medium, and long term.
Strategic Integrated Projects (SIPs)	The Presidential Infrastructure Coordinating Committee (PICC) is integrating and phasing investment plans across 18 Strategic Infrastructure Projects (SIPs) which have five core functions: to unlock opportunity, transform the economic landscape, create new jobs, strengthen the delivery of basic services, and support the integration of African economies. A balanced approach is being fostered through greening of the economy, boosting energy security, promoting integrated municipal infrastructure investment, facilitating integrated urban development, accelerating skills development, investing in rural development, and enabling regional integration. SIP 8 and 9 of the energy SIPs supports the development of the wind energy facility: » SIP 8: Green energy in support of the South African economy: Support sustainable green energy initiatives on a national scale through a diverse range of clean energy options as envisaged in the Integrated Resource Plan (IRP 2010 – 2030) and supports bio-fuel production facilities. » SIP 9: Electricity generation to support socio-economic development: The proposed Ummbila Emoyeni Wind Energy Facility is a potential SIP 9 Project as

Relevant legislation or policy	Relevance to Ummbila Emoyeni Wind Energy Facility
	electricity will be generated and social and economic upliftment, development and growth will take place within the surrounding communities. It would become a SIP 9 project if selected as a Preferred Bidder project by the Department Mineral Resources and Energy. SIP 9 supports the acceleration of the construction of new electricity generation capacity in accordance with the IRP 2010 to meet the needs of the economy and address historical imbalances. The Ummbila Emoyeni Wind Energy Facility could be registered as a SIP project once it is under development. The project would then contribute to the above-mentioned SIPs.
National Biodiversity Economy Strategy (NBES) (March 2016)	The biodiversity economy of South Africa encompasses the businesses and economic activities that either directly depend on biodiversity for their core business or that contribute to conservation of biodiversity through their activities. The commercial wildlife and the bioprospecting industries of South Africa provide cornerstones for the biodiversity economy and are the focus of this strategy. Both the wildlife and bioprospecting sub-sectors of the biodiversity economy have already demonstrated the potential for significant future development and growth. In the study commissioned on the situational analysis of the biodiversity economy, the contribution of the biodiversity economy to the national economy can be measured in terms of Gross Domestic Product (GDP), with the wildlife and bioprospecting industries contributing approximately R3 billion to GDP in 2013. Growth in the wildlife and bioprospecting industries can make a significant impact on the national economy, while contributing to national imperatives such as job creation, rural development and conservation of our natural resources. The Wildlife Industry value chain is centred on game and wildlife farming/ranching activities that relate to the stocking, trading, breeding, and hunting of game, and all the services and goods required to support this value chain. The key drivers of this value chain include domestic hunters, international hunters and a growing retail market demand for wildlife products such as game meat and taxidermy products. This sector is therefore characterised by an interesting combination of agriculture, eco-tourism and conservation characteristics. Over the period 2008-2013, the total Wildlife Industry market grew by more than 14% per year. This growth comprised an average annual growth exceeding 6% in domestic hunting, a decrease in international hunting, and an exponential growth in live auction sales. It is considered likely that the consolidated Wildlife Industry has the potential to experience a weighted average annual growth rate of between 4 %-14 % per year up to 2030. In order for the wildlife and bioprospecting sub-sectors of the biodiversity economy to achieve its full potential, a strategic partnership between the state, private sector and communities is required. To this end, a National Biodiversity Economy Strategy (NBES) is required to guide the sustainable growth of the wildlife and bioprospecting industries and to provide a basis for addressing constraints to growth, ensuring sustainability, identifying clear stakeholder's responsibilities and monitoring progress of the Enabling Actions. The Vision of NBES is to optimise the total economic benefits of the wildlife and bioprospecting industries through its sustainable use, in line with the Vision of the

Relevant legislation or policy	Relevance to Ummbila Emoyeni Wind Energy Facility
	Department of Environmental Affairs. The purpose of NBES is to provide a 14-year national coordination, leadership and guidance to the development and growth of the biodiversity economy. NBES has set an industry growth goal stating that by 2030, the South African biodiversity economy will achieve an average annualised GDP growth rate of 10% per annum. This envisioned growth curve extends into the year 2030 and is aligned to the efforts of the country's National Development Plan, Vision 2030. The NBES seeks to contribute to the transformation of the biodiversity economy in South Africa through inclusive economic opportunities, reflected by a sector which is equitable - equitable access to resources, equitable and fair processes and procedures and equitable in distribution of resources (i.e. business, human, financial, indigenous species, land, water) in the market. To address these transformation NBES imperatives, NBES has the principles of: » Conservation of biodiversity and ecological infrastructure » Sustainable use of indigenous resources » Fair and equitable beneficiation » Socio-economic sustainability » Incentive driven compliance to regulation » Ethical practices » Improving quality and standards of products. The NBES provides the opportunity to redistribute South Africa's indigenous biological/ genetic resources in an equitable manner, across various income categories and settlement areas of the country. The NBES has prioritised nodes in the country for biodiversity economy transformation, referred to as BET nodes. NBES prioritises 18 BET nodes, 13 rural and 5 urban districts across the nine provinces of the country, with communities having been prioritised for development of small and medium size enterprises and community-based initiatives which sustainably use of indigenous biological and/or genetic resources. The Gert Sibande District Municipality within which the Ummbila Emoyeni Wind Energy Facility is proposed is not identified as a priority area.

Relevant legislation or policy	Relevance to Ummbila Emoyeni Wind Energy Facility
	

5.5. Provincial Policy and Planning Context

A brief review of the most relevant provincial policies is provided below in **Table 5.3**. The proposed development is considered to align with the aims of these policies, even if contributions to achieving the goals therein are only minor.

Table 5.3: Relevant provincial legislation and policies for Ummbila Emoyeni Wind Energy Facility

Relevant legislation or policy	Relevance to the Ummbila Emoyeni Wind Energy Facility
Mpumalanga Vision, 2030 (2013 – 2030)	The Mpumalanga Vision 2030 Strategic Implementation Framework (2013 - 2030) was established as a direct implementation response to the National Development Plan Vision, 2030. The framework describes the province's approach to realising the objectives of the NDP in the provincial context and seeks to achieve the MPG's Provincial Strategic Objectives (PSO's). Mpumalanga Vision, 2030 provides a provincial expression of the key priorities, objectives and targets that enumerated in the NDP and expressed within the policy. It seeks to present and affirm the province's approach towards realising the national vision and development plan. The implementation framework builds on and informs past and existing sectorial and related planning interventions within the province. The Vision 2030 Implementation Framework provides a basis for prioritisation during medium-term and annual planning cycles. The focus of the Mpumalanga Vision 2030 is to provide a summary overview on the facilitation of decision-making and the prioritisation of rolling back poverty, and inequality by raising living standards to an acceptable minimum, which entails a combination of interventions directed at increasing employment, improving the quality of education, productive growth, a social wage and good quality public services. In line with the principles of the NDP, the Vision 2030 highlights socio-economic outcomes such as employment and economic growth as priorities. The Mpumalanga

Relevant legislation or policy	Relevance to the Ummbila Emoyeni Wind Energy Facility
	Vision 2030 document formulated a spatial rationale for the province, which is based on nine key drivers, of which key drivers 1 to 6 are focused towards promoting economic development and job creation; key drivers 7 and 8 are focused on human development; and key driver 9 is focused on the conservation and sustainable management of the natural environment. Of relevance to the Ummbila Emoyeni Wind Energy Facility are key drivers 1 to 6 as the development of the facility will promote economic development and job creation.
Mpumalanga Economic Growth and Development Path (2011)	The Mpumalanga Economic Growth and Development Path (MEGDP) is informed by the National Economic Growth Path. According to the MEGDP, the Mpumalanga Province is committed to increasing local economic development and job creation in the agricultural, industrial, manufacturing, green economy, tourism, and mining sectors. The focal point of the Economic Growth and Development Path is the creation of appropriate labour absorbing jobs which will have a positive direct, indirect, and induced effects on the Provincial economy and the living standards of its people. The primary objective of the MEGDP is to grow the economy of the province; balance growth and development in order to creates jobs, reduce poverty and inequality, and improve the socio-economic conditions of the province. The Mpumalanga economic growth and development path also discusses climate change and the green economy as one of the focus areas where government will a prioritise effort to support employment creation. The Industrial Development Corporation (IDC) estimates that 296 000 jobs can be created over a ten-year period through investment in green energy alone. R11.7 billion will be invested in green energy. Government is developing an Integrated Resource Plan for energy that will have clear commitments on the level of green energy and renewable energy. A commitment must be made on procurement that favours the local industry. A higher level of skills will also be needed. Small business policies and regulation of the building industry will need to be considered. The proposed development falls directly in line with the Mpumalanga provincial growth path with regards to employment creation in the renewable energy industry, the benefits it will bring to the local community as well as contributing towards diversifying the local economy towards a greener economy.
Mpumalanga Spatial Development Framework (2013)	The Mpumalanga Spatial Development Vision for the future functional spatial development patterns is based on the integration of sustainable natura resources, economic development and job creation and human development to provide: *a sustainable urban and rural spatial development pattern focussed on a modern ecologically sustainable economy, supported by a suitably skilled labour force and providing for quality of living*. Strategic requirements which need to be addressed include the following: » Harnessing the opportunities provided by urbanisation forces to achieve effective rural development. » Adopting a flexible approach which suits the province and enables sustainable development rather than inhibits growth and development. » Creating world class infrastructure, services and amenities to attract investment. » Integrated infrastructure development planning responding to long term forecasted requirements.

Relevant legislation or policy	Relevance to the Ummbila Emoyeni Wind Energy Facility
	» Pro-active planning which integrates aspiring economic activities into the mainstream economies and urban fabric. » Safeguarding existing resources and creating opportunities for renewable energy development. » Consensus on where to develop and not develop the province. » Connecting the spatial frameworks to catalytic programmes of the Mpumalanga Implementation Framework and Plan. » Creating opportunities for increased international, national, provincial and municipal connectivity, linked by strategic transportation routes in the province. » Achieving improved quality of life in our settlements through formalisation, provision of planned amenities and consolidation of land uses. » Gearing up of spatial planning capacity, skills, systems, and procedures to achieve the vision. The development of Ummbila Emoyeni Wind Energy Facility supports the Mpumalanga Spatial Development Framework as it is a renewable energy development and will as such assist the province towards achieving its goal of creating opportunities for renewable energy development.
Mpumalanga Biodiversity Sector Plan (2014)	The Mpumalanga Biodiversity Sector Plan (MBSP) is a guideline which is part of a wider set of national biodiversity planning tools and initiatives that are designed for national legislation and policy. It also guides as a spatial tool to inform permissible land uses that support biodiversity and ecological processes. The MBSP contains various classes of environmental features of conservation value, such as protected areas, irreplaceable areas etc. Mapping of critical biodiversity areas is also provided in this document. According to the map of terrestrial critical biodiversity areas contained in the MBSP, the Mpumalanga Province comprises five areas, namely, protected areas, critical biodiversity areas (optimal and irreplaceable), ecological support areas, other natural areas, and moderately or heavily modified areas. According to the Mpumalanga Biodiversity Sector Plan, the project area overlaps with CBA1: Optimal (Terrestrial) and CBA1: Irreplaceable (Freshwater) areas.
Mpumalanga Draft Green Economy Sector Plan, 2016	The Plan aims to provide an integrated approach towards developing the green economy in Mpumalanga by 2030 in line with the Vision 2030. Specific objectives include: » Developing a sector plan based on the province's strengths in natural resources endowments » Expanding on the economic, green and environmental initiatives that are already underway in the province in order to facilitate quick wins » Support the DEDT's drive in sustainable economic development – Develop an action plan for implementation
Mpumalanga Tourism and Parks Agency Strategic Plan, 2011	» The strategic plan emphasises that Mpumalanga possesses significant potential to capture large numbers of international and domestic tourists. In particular, the Kruger National Park, several other reserves, natural and cultural and historical heritage are attractions that are in demand by all tourist groups. » The plan states that the environmental sector often puts much emphasis on biodiversity conservation without necessarily linking it with eco-tourism. The plan states that much naivety has been observed about what ecotourism can do. The plan calls for improved implementation of policy that will see biodiversity promotion being embraced by the broader tourism industry and the need for

Relevant legislation or policy	Relevance to the Ummbila Emoyeni Wind Energy Facility
	improved awareness from players within the sector to reduce the adverse environmental impacts of tourism.

5.6. Local Policy and Planning Context

The local tiers of government relevant to the Ummbila Emoyeni Wind Energy Facility are the Govan Mbeki, Lekwa, and Msukaligwa Local Municipalities all of which fall within the Gert Sibande District. Instruments and/or policies at both the district and local level contain objectives which align with the development of Ummbila Emoyeni Wind Energy Facility. These include, economic growth, job creation, community upliftment and poverty alleviation.

Table 5.4: Relevant local legislation and policies for Ummbila Emoyeni Wind Energy Facility

Relevant policy	Relevance to Ummbila Emoyeni Wind Energy Facility
Gert Sibande District Municipality IDP 2021	» The Gert Sibande District IDP acknowledges green economy development as a primary objective as per the MEGDP. The IDP further states that investment in research for new technologies will be prioritised. » The IDP identifies the need in enhancing green economy to improve service delivery in all its seven local municipalities. » Interventions to facilitate growth and job creation in the manufacturing sector includes: ∗ Supporting the development of clean forms of energy like wind and hydro power generations opportunities » The IDP indicated the following issues/strategic objectives in terms of electricity supply: ∗ Eradication of the remaining backlogs ∗ Create capacity to accommodate new developments
Govan Mbeki Local Municipality, LED 2014	» The LED indicates side linkage opportunities such as new energy sources (preferably renewable energy such as solar and wind) » Also mentioned in the LED is rural economic sector development with renewable energy as an opportunity. » Renewable energy is listed as and economic sector that the local municipality should focus on.
Govan Mbeki Local Municipality, IDP 2021	» One of the strategic goals identified by the IDP is renewable energy and energy efficiency. » The IDP states that the phasing in of renewable energy options, which include concentrated solar power, wind and natural gas, will reduce dependence on coal resources. » THE IDP indicated that the local municipality support the transition to a low-carbon economy by speeding up and expanding renewable energy implementation.
Lekwa Local Municipality, IDP 2021	» The IDP indicated that the electricity and energy department should develop and adopt by laws that promote renewable energy and energy efficiency. » Green Economy initiatives to mitigate the negative impact of climate change & create new green job opportunities is seen as a priority area within the local municipality.
Msukaligwa Local Municipality, IDP 2020/2021	» The IDP states that considering the challenges at Eskom, Government is taking the following measures to rapidly and significantly increase generation capacity outside of Eskom: ∗ Enabling the development of additional grid capacity from renewable energy, natural gas, hydropower, battery storage and coal.

Relevant policy	Relevance to Ummbila Emoyeni Wind Energy Facility
	* Government will negotiate supplementary power purchase agreements to acquire additional capacity from existing wind and solar plants. * Initiate the procurement of emergency power from projects that can deliver electricity into the grid within three to 12 months from approval.

CHAPTER 6: NEED AND DESIRABILITY

Appendix 3 of the 2014 EIA Regulations (GNR 326) requires that an EIA Report includes a motivation for the need and desirability of the proposed development, including the need and desirability of the activity in the context of the preferred location. The need and desirability of the development needs to consider whether it is the right time and the right place for locating the type of land-use/activity being proposed. The need and desirability of a proposed development is, therefore, associated with the wise use of land, and should be able to respond to questions such as, but not limited to, what the most sustainable use of the land may be.

This Chapter provides an overview of the need and desirability, and perceived benefits of the project specifically.

6.1. Legal Requirements as per the EIA Regulations, 2014 (as amended), for the undertaking of an Environmental Impact Assessment Report

This chapter includes the following information required in terms of Appendix 3: Scoping of Assessment and Content of Environmental Impact Assessment Reports:

Requirement	Relevant Section
3(1)(f) a motivation for the need and desirability for the proposed development including the need and desirability of the activity in the context of the preferred development footprint within the approved site as contemplated in the accepted scoping report.	The need and desirability for the development of the Ummbila Emoyeni Wind Energy Facility is included and discussed as a whole within this chapter. The need and desirability for the development of the wind farm has been considered from an international, national, regional, and site-specific perspective.

6.2. Need and Desirability from an International Perspective

The need and desirability of the Ummbila Emoyeni Wind Energy Facility, from an international perspective, can be described through the project's alignment with internationally recognised and adopted agreements, protocols, and conventions. South Africa is a signatory to a number of international treaties and initiatives, including the United Nation's Development Programme's (UNDP's) Sustainable Development Goals (SDGs). The SDGs address global socio-economic challenges such as poverty, hunger, health, education, climate change, gender equality, water, sanitation, energy, urbanisation, environment, and social justice. The SDGs consist of 17 global goals set by the United Nations. The 17 SDGs are characterised by 169 targets, and 304 indicators.

Goal 7 of the SDGs relates to "Affordable and Clean Energy", with the aim of the goal being to ensure access to affordable, reliable, sustainable, and modern energy for all. The following targets and indicators have been set for Goal 7:

Targets	Indicators
7.1 By 2030, ensure universal access to affordable, reliable and modern energy services.	7.1.1 Proportion of population with access to electricity. 7.1.2 Proportion of population with primary reliance on clean fuels and technology.

Targets		Indicators	
7.2	By 2030, increase substantially the share of renewable energy in the global energy mix.	7.2.1	Renewable energy share in the total final energy consumption.
7.3	By 2030, double the global rate of improvement in energy efficiency.	7.3.1	Energy intensity measured in terms of primary energy and GDP.
7.A	By 2030, enhance international cooperation to facilitate access to clean energy research and technology, including renewable energy, energy efficiency and advanced and cleaner fossil-fuel technology, and promote investment in energy infrastructure and clean energy technology.	7.A.1	Mobilised amount of United States dollars per year starting in 2020 accountable towards the $100 billion commitment.
7.B	By 2030, expand infrastructure and upgrade technology for supplying modern and sustainable energy services for all in developing countries, in particular least developed countries, small island developing States, and land-locked developing countries, in accordance with their respective programmes of support.	7.B.1	Investments in energy efficiency as a percentage of GDP and the amount of foreign direct investment in financial transfer for infrastructure and technology to sustainable development services.

The development of the Ummbila Emoyeni Wind Energy Facility would contribute positively towards Goal 7 (and specifically 7.2.1) of the SDGs through the following means:

- By generating up to 900MW (contracted capacity) of affordable and clean energy.
  - A study published by the CSIR on 14 October 2016 ("Cost of new power generators in South Africa Comparative analysis based on recent Independent Power Producer (IPP) announcements", Dr Tobias Bischof-Niemz and Ruan Fourie) which took into consideration the results of the cost prices bid successfully under the Department of Mineral Resources and Energy's Renewable Energy (RE) IPP and Coal Baseload IPP Procurement Programmes, found that solar PV and wind were 40% cheaper than new baseload coal (i.e. R0.62/kWh for PV and wind vs R1.03 for coal).
  - Wind power technology is one of the cleanest electricity generation technologies, as it does not result in the release of emissions during its operation.
- By contributing towards South Africa's total generation capacity, specifically through the utilisation of renewable energy resources.

The Kyoto Protocol (1997) is also relevant to the need for the development of the Ummbila Emoyeni Wind Energy Facility from an international perspective. The protocol calls for the reduction of South Africa's greenhouse gas emissions through actively cutting down on using fossil fuels, or by utilising more renewable resources. The development of the Ummbila Emoyeni Wind Energy Facility will add capacity to the renewable energy sector of the country and strengthen the commitment and action plan to achieve the requirements, as set out in the protocol, through the generation of energy without the emission of greenhouse gases.

6.3. Need and Desirability from a National Perspective

The transition away from fossil fuel to a more sustainable, low carbon energy system has come to be known as the Just Energy Transition. It is particularly relevant in South Africa and particularly the Mpumalanga Province as Eskom relies on coal fired plants for 90% of its capacity. As the world moves towards sustainable energy sources, and existing coal plants reach the end of their planned life, it is increasingly difficult for Eskom to finance new coal and obtain the required environmental consent. The objective is for a transition to occur

that allows equitable participation and inclusive growth for all in the future energy sector whilst protecting those effected. The roadmap as to how this will occur should be led by Government but in the absence of meaningful leadership there exists an opportunity to move into areas such as Mpumalanga as the need for employment opportunities and new forms of power generation will drive investment.

Eskom's fleet of coal-fired power stations is on average over 40 years old, and its performance is deteriorating, which has resulted in constant power cuts across the country over the last years. The project site has been purposefully chosen in the Mpumalanga Province, the location of the majority of the coal-fired power plants in the country. The majority of these plants are planned to be decommissioned between the present day and 2030 as the country transitions from a carbon powered economy to a renewable energy based one. This Transition is evidenced in the 2019 updated IRP that shows significant uptake of wind and Solar PV procurement alongside the decommissioning of coal generators that are reaching the end of their lifespan (11 000 MW to be decommissioned between 2019 and 2030). This Transition is known as the Just Energy Transition and the core will be the Mpumalanga Province. This provides scope for 1) large projects that will look to substitute with coal generation into the existing grid network and 2) The need for projects to fill the socio-economic void left by decommissioned coal.

The National Development Plan (NDP) envisages that, by 2030, South Africa will have an energy sector that provides reliable and efficient energy service at competitive rates; that is socially equitable through expanded access to energy at affordable tariffs; and that is environmentally sustainable through reduced emissions and pollution. Historically, coal has provided the primary fuel resource for baseload electricity generation in South Africa. Consequently, Eskom, who is the main electricity generating company in the country, generates approximately 85% of the country's electricity from coal resources (Stats SA, 2016), resulting in a large carbon footprint. Taking into consideration the need to ensure adequate supply of electricity and meet international obligations in terms of addressing climate change, Government has identified the need to diversify the energy mix within the country.

The Ummbila Emoyeni Wind Energy Facility is proposed in specific response to a National Government initiative, the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP), or a similar programme. The REIPPPPP was initiated in order to give effect to the requirements of the IRP with regards to renewable energy targets. As a result, the need and desirability of the Ummbila Emoyeni Wind Energy Facility from a national perspective can largely be linked from the project's alignment with national government policies, plans, and programmes which have relevance to energy planning and production (as discussed in detail in **Chapter 5**). The following key plans have been developed by National Government to consider South Africa's current energy production, projected future demands, and provides the necessary framework within which energy generation projects can be developed:

- Integrated Energy Plan (IEP)
- Integrated Resource Plan (IRP)

The above-mentioned energy plans have been extensively researched and are updated on an on-going basis to take into consideration changing scenarios, new information, developments in new technologies, and to reflect updated demands and requirements for energy production within the South African context. These plans form the basis of South Africa's energy generation sector and dictate national priorities for energy production.

The IEP is intended to provide a roadmap of South Africa's future energy landscape and guide future energy infrastructure investments and policy development. The Plan considered the three pillars of sustainable development, and list the following as the eight key energy planning objectives:

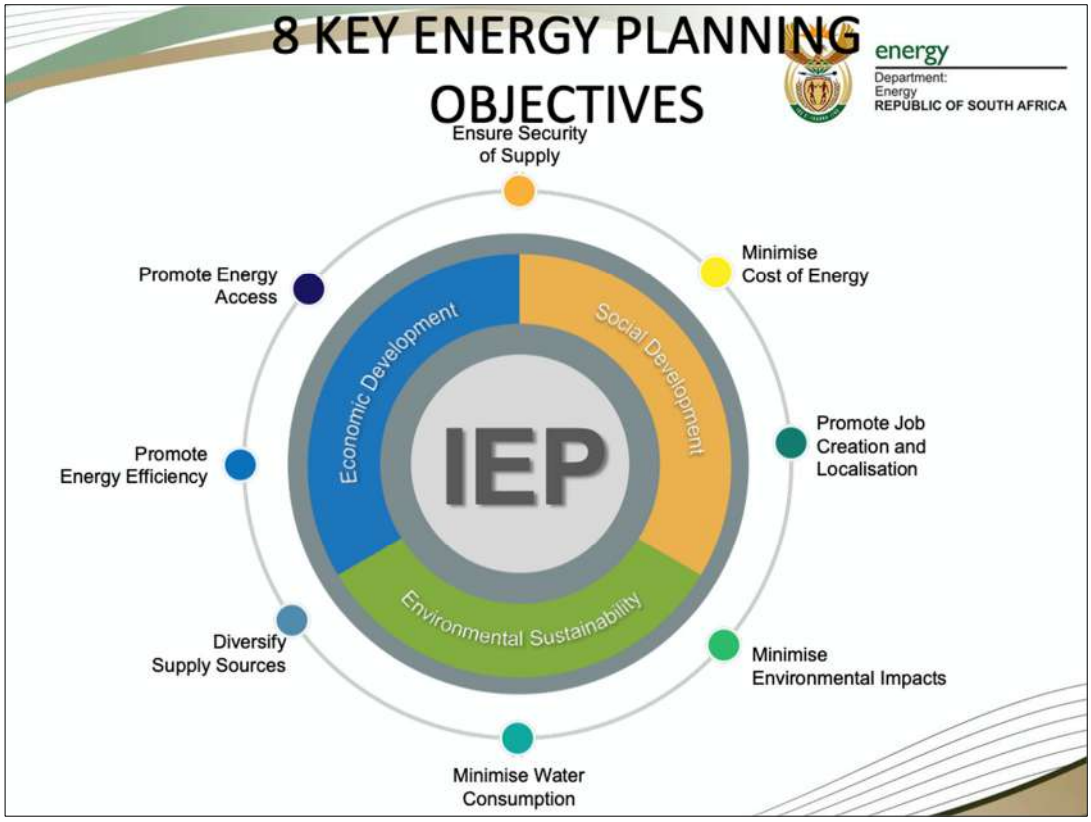


Figure 6.1: Eight key energy objectives as listed in the IEP, 2016 (extract from DOE presentation, December 2016)

In terms of electricity generation, the IEP states that South Africa should continue to pursue a diversified energy mix which reduces reliance on a single or a few primary energy sources, and includes the following statement regarding wind energy's contribution to the diversified energy mix:

» *Wind energy should continue to play a role in the generation of electricity. Allocations to ensure the development of wind energy projects aligned with the IRP should continue to be pursued.*

The IRP for Electricity 2010 – 2030 (gazetted in 2019) is a subset of the IEP and constitutes South Africa's current gazetted energy plan. The purpose of the plan is to ensure sustainable electricity development which takes into consideration technical, economic, and social constraints, and identifies investments in the electricity sector which are required to meet the country's forecasted electricity demands at minimum costs. This plan provides for the development of 17 743MW of capacity from large scale wind energy facilities by 2030, with an annual contribution of 1600MW from 2022.

A number of IPP Procurement Programmes have been initiated to secure electricity generated from a range of resources from the private sector (i.e., from Independent Power Producers, or IPPs). Under these Programmes, IPPs are invited to submit proposals for the finance, construction, operation, and maintenance of electricity generation facilities for the purpose of entering into an Implementation Agreement with the DMRE and a Power Purchase Agreement (PPA) with Eskom as the buyer. Provision has been made for new additional capacities in the IRP 2019 (refer to **Figure 6.2**).

	Coal	Cost (Decommissioning)	Nuclear	Hydro	Storage	PV	Wind	CSP	GAS/ Diesel	Other (Distributed Generation, Cogeri, Biomass, Landfill
Current	31715		1860	2100	2912	1474	1980	300	3830	499
2019	2155	-2372	-	-	-	-	244	300	-	Allocation to the intent of the short term capacity and energy gap
2020	1433	-557	-	-	-	114	300	-	-	
2021	1433	-1403	-	-	-	300	818	-	-	
2022	755	-344	-	-	513	400 1000	1600	-	-	
2023	750	-555	-	-	-	1000	1600	-	-	500
2024	1 000	-	1660	-	-	-	1600	-	1000	500
2025	7 000	-	-	-	-	1000	1600	-	-	500
2026	-	-1734	-	-	-	-	1600	-	-	500
2027	750	-547	-	-	-	-	1600	-	2000	500
2028	-	-475	-	-	-	1000	1600	-	-	500
2029	-	-1654	-	-	1575	1000	1600	-	-	500
2030	-	-1656	-	1500	-	1000	1600	-	-	500
Total Installed Capacity by 2030 (MW)	33164		1660	4600	5000	8288	17742	600	6380	-
% Total Installed Capacity (% of MW)	43		2.36	5.84	6.35	10.52	22.53	0.76	8.1	-
% Annual Energy Contribution (% of MWh)	58.3		4.5	0.3	1.2	6.3	17.8	0.6	1.3	-

Figure 6.2: A snapshot of the updated Energy Mix as per the IRP 2019

Renewable resources are valuable in contributing towards electricity generation and diversifying South Africa's electricity mix, while contributing towards South Africa's response to Climate Change. Under the REIPPPP, the DMRE intends to secure 14 725MW of electricity from renewable energy generation facilities utilising either onshore wind, concentrated solar thermal, solar photovoltaic (PV), biomass, biogas, landfill gas, or hydro across a number of bidding windows, while simultaneously contributing towards socio-economic development. A total of 1 980MW[12] of wind generated electricity has been awarded to preferred bidders across four (4) rounds of bidding to date. Round 5 of the REIPPPP resulted in the award of 2.5GW of capacity, 1 608 MW of which will be based on onshore wind. Bid window 6, the deadline for which is on 22 September 2022, includes a further allocation of 3 400MW of electricity from wind. Preferred bidders identified under any IPP Procurement Programme, including the REIPPPP, are required to satisfy a number of economic development requirements, including amongst others, job creation, local content, skills development, enterprise and supplier development, and socio-economic development. In addition to electricity generation and supply, IPP Procurement Programmes also contribute positively towards socio-economic development of a region, over and above job creation.

In addition to the policy considerations detailed above, Government has prioritised post COVID-19 turnaround plans in terms of renewable energies within the Just Energy Transition (JET), coupled with key

[12]https://www.cliffedekkerhofmeyr.com/en/news/publications/2019/Corporate/energy-alert-22-october-The-Integrated-Resource-Plan-2019-A-promising-future-roadmap-for-generation-capacity-in-South-Africa.html

development objectives of the various spheres of government. These policies share the same ideals, such as:

» The utilisation, application and investment in renewable energy resources in South Africa is considered to be an essential means of reducing the carbon footprint of the country,
» Diversifying the national economy,
» Reducing poverty, and
» Providing critical additional energy to that of Eskom.

Government has compiled an Economic Reconstruction and Recovery Plan which was presented to Parliament in October 2020. According to this plan, the economic survey will rely on a massive investment in infrastructure, including energy, telecommunications, ports and rail. The core elements of the Economic Reconstruction and Recovery Plan are as follows:

1. Priority interventions for economic recovery: the plan sets out eight priority interventions that will ignite South Africa's recovery and reconstruction effort. These are the flagship initiatives that all of society will rally around to build a new economy (**Figure 6.3**).
2. Enabling conditions for growth: these are growth-enhancing reforms and other preconditions for an inclusive, competitive and growing economy.
3. Macroeconomic framework: economic reconstruction and recovery requires careful mobilisation of resources to ensure fiscal sustainability.
4. Institutional arrangements: the plan focuses on execution, and is supported by enhanced institutional arrangements to ensure implementation and accountability.

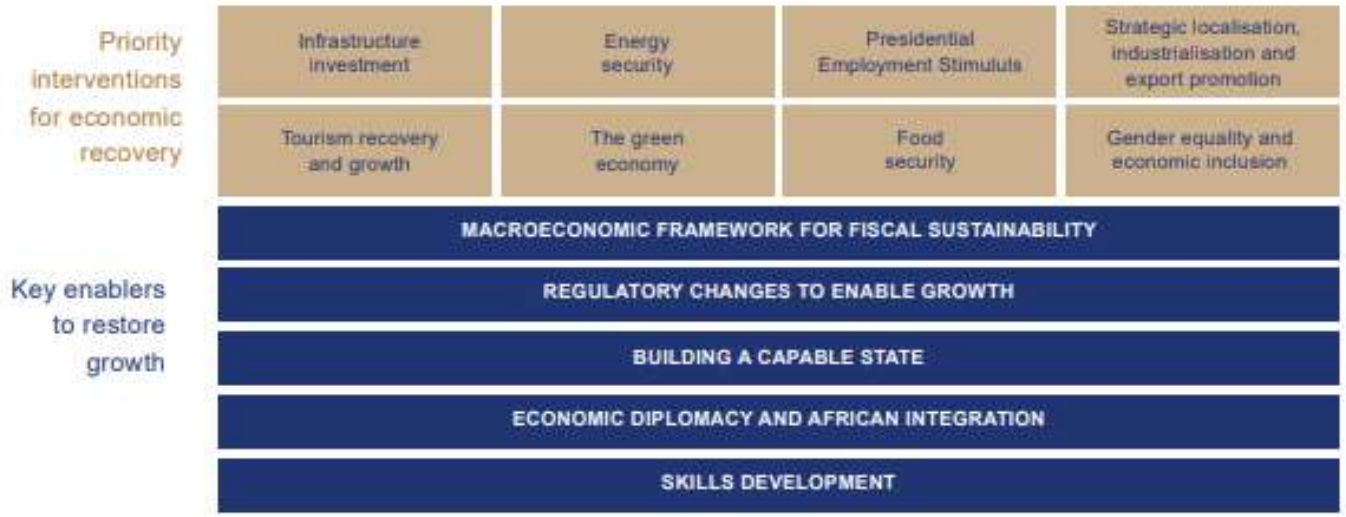


Figure 6.3: Core elements of the Economic Reconstruction and Recovery Plan (source: Building a new economy - Highlights of the Reconstruction and Recovery Plan, Presidency of the Republic of South Africa)

The plan recognises energy security as the most important prerequisite for the recovery agenda and states that renewed investment in a diversified energy mix can be achieved within a short time horizon, while alleviating a crippling energy crisis and facilitating a necessary transition to a less carbon-intensive economy. One of the key commitments of the plan is therefore to implement the IRP 2019 without delay to provide a substantial increase in the contribution of renewable energy sources by 2030, alongside other sources including battery storage, gas and clean coal. The transition to green energy is recognised as contributing

towards the realisation of the low-carbon, climate-resilient and inclusive economy envisaged by the National Development Plan. The development of the Ummbila Emoyeni Wind Energy Facility is identified as a mechanism for securing additional power generation capacity for input to the national grid, reducing the reliance for electricity on Eskom.

The South African government has identified the green economy as one of 12 job drivers that could help contribute to creating 5 million additional jobs by 2020. The New Growth Path, in which the sectoral jobs targets are disaggregated, envisages that as many as 300 000 new direct jobs could be created in the areas of natural resource management and renewable energy construction (Department of Energy, 2019). Even though the project will not form part of the REIPPP programme, the Applicant will implement similar social and economic development strategies, including amongst others, job creation, local content, skills development, enterprise and supplier development, and socio-economic development. In addition to electricity generation and supply the project will therefore also contribute positively towards socio-economic development of a region, over and above job creation.

The need for new power generation from wind energy facilities has been identified and assessed by government at a national scale considering the national energy requirements as well as international commitments under the Paris Agreement; therefore, provision has been made for the inclusion of new wind power generation capacity in South Africa's energy mix. The implementation of the Ummbila Emoyeni Wind Energy Facility has the potential to contribute positively towards the identified need, while simultaneously contributing to job creation and socio-economic development, identified as a need for the country within the National Development Plan (NDP).

Ummbila Emoyeni Wind Energy Facility will make use of renewable energy technology and would contribute positively towards reducing South Africa's GHG emissions and ensure compliance with all applicable legislation and permitting requirements. In addition, by making use of wind technology, Ummbila Emoyeni Wind Energy Facility would have reduced water requirements when compared with some other generation technologies in alignment with one of the vision 2030 themes of the then-Department of Water and Sanitation's National Water Resource Strategy 2 (2013) (i.e., transitioning to a low carbon economy through stimulating renewable energy and retrofitting buildings).

6.3.1. Benefits of Renewable Energy and the Need and Desirability in the South African Environment

The generation of electricity from renewable energy resources offers a range of potential socio-economic and environmental benefits for South Africa. These benefits include:

Socio-economic upliftment of local communities: The Ummbila Emoyeni Wind Energy Facility has the potential to create much needed employment for unskilled locals during the construction phase. Training opportunities will also be afforded to qualified local people who can be upskilled to undertake certain roles during the construction and operation phases. Some of the challenges facing the Local and District municipalities, as detailed in the IDPs include High rates of unemployment, high levels of poverty, and low levels of development despite the strategic local in terms of the national transport corridors. The Local and District municipalities are therefore in need to economic development, sustainable employment opportunities and growth in personal income levels. A study undertaken by the DMRE, National Treasury and the Development Bank of Southern Africa (DBSA) in June 2017 found that employment opportunities created during the construction phase of renewable energy projects implemented to date had created 40% more jobs for South African citizens than anticipated. The study also found that significantly more people from

local communities were employed during construction than was initially planned, confirming the potential benefits for local communities associated with the implementation of renewable energy projects.

Since inception of the REIPPPP in 2011, approximately 59 071 job years for South African citizens have been created. Ummbila Emoyeni Wind Energy Facility also has the potential to make a positive contribution towards the identified community needs. In terms of the economic development requirements of the REIPPPP, the project will commit benefits to the local community in the form of job creation, localisation, and community ownership. In accordance with the DMRE's bidding requirements of the REIPPPP, a percentage of the revenue generated per annum during operation will be made available to local communities through a social beneficiation scheme. Therefore, the potential for creation of employment and business opportunities, and the opportunity for skills development for local communities is significant. Secondary social benefits can be expected in terms of additional spend in nearby towns due to the increased demand for goods and services. These socio-economic benefits would include an increase in the standard of living for local residents within the area as well as overall financial and economic upliftment.

Increased new generation capacity: The country is in desperate need of new generation capacity. Current projections show that by 2030, new capacity of at least 50-60 GW renewable capacity will need to be added, even if there is no incremental demand from economic growth. The quantum of new capacity required doubles (~120GW) by 2030 when a 5% increase in demand growth is assumed. Given that renewables can often be deployed in a short timeframe and in a decentralised manner close to consumers, they offer the opportunity for improving grid strength and supply quality in the short-term, while reducing expensive distribution losses. According to CSIR's power sector statistics, South Africa experienced loadshedding for 650 hours in the first half of 2021 (15% of the time) wherein 963GWh of estimated energy was shed (mostly stage 2 load shedding). This is 76% of the total loadshedding experienced during 2020. It is important to note that although extensive load shedding continued during the first half of 2021, record relative variable renewable energy contributions were recorded, without which, load shedding would have been greater. It is thus imperative that new capacity is added as soon as possible.

Resource saving: It is estimated that the achievement of the targets in the Renewable Energy White Paper will result in water savings of approximately 16.5 million kilolitres per annum. As an already water-stressed nation, it is critical that South Africa engages in a variety of water conservation measures, particularly due to the detrimental effects of climate change on water availability. Renewable energy also translates into revenue savings, as fuel for renewable energy facilities is free, while compared to the continual purchase of fuel for conventional power stations.

According to the IPP Procurement Programme overview report dated 31 March 2021, water savings of 71.7 million kilolitres has been realised by the programme from inception to the date of this publication, of which 4.2 million kilolitres is in the 2021 reporting quarter included in this report.

Exploitation of significant renewable energy resource: At present, valuable renewable resources, including biomass by-products, solar irradiation and wind power remain largely unexploited. The use of these energy flows will strengthen energy security through the development of a diverse energy portfolio in South Africa.

According to the IPP Procurement Programme overview report, as of 31 March 2021, the REIPPPP had made the following significant impacts in terms of energy supply:

» 6 422MW of electricity had been procured from 112 Renewable Energy Independent Power Producers (IPPs) in seven bid rounds[13].
» 5 078 MW of electricity generation capacity from 79 IPP projects has been connected to the national grid.
» 59 761GWh of energy has been generated by renewable energy sources procured under the REIPPPP since the first project became operational in November 2013. Renewable energy IPPs have proved to be very reliable. Of the 79 projects that have started operations, 67 projects have been operational for longer than a year. The electrical energy generated over the past 12-month period for the 67 projects is 11 679GWh, which is 94% of their annual energy contribution projections of 12 481GWh over a 12-month delivery period. Twenty-six (26) of the 67 projects (39%) have individually exceeded their projections.

In August 2021, Bid Window 5, which had aimed to sign up 2 600MW of power, including 1 600MW of wind and 1 000MW of solar was open. It attracted 102 bids, offering capacity of 9 644MW. 25 Preferred Bidders were selected to provide a total of 2 583MW from wind and solar developments.

Economics: As a result of the excellent resource and competitive procurement processes, both wind power and solar PV power are now proven in South Africa as cheaper forms of energy generation than coal power. They offer excellent value for money to the economy and citizens of South Africa while benefitting society as a whole through the development of clean energy.

The following has been achieved by the IPP programme (March 2021) in terms of investment and economics:
» Investment (equity and debt) to the value of R209.7 billion was attracted in seven bid rounds.
» Socio-economic development contributions of R1.5 billion to date, of which R103.5 million was spent in this 2021 reporting quarter.
» Enterprise development contributions of R463.5 million to date, of which R34.8 million was spent in this 2021 reporting quarter.

Pollution reduction: The release of by-products through the burning of fossil fuels for electricity generation has a particularly hazardous impact on human health and contributes to ecosystem degradation. The use of solar irradiation or wind for power generation is a non-consumptive use of a natural resource which produces zero emissions during its operation.

The overview of the Independent Power Producers Procurement Report (March 2021) indicates that a carbon emission reduction of 60.7 Mton CO_2 has been realised by the IPP programme from inception to date, of which 3.6 Mton is in the 2021 reporting quarter.

Climate friendly development: The uptake of renewable energy offers the opportunity to address energy needs in an environmentally responsible manner and thereby allows South Africa to contribute towards mitigating climate change through the reduction of GHG emissions. South Africa is estimated to currently be responsible for approximately 1% of global GHG emissions (and circa half of those for which Africa is responsible) and is ranked 12th worldwide in terms of per capita carbon dioxide emissions as of 2021. Since its inception, the REIPPPP has achieved carbon emission reductions[14] of 60.7 Mton of CO_2. The development

[13] Bid windows1, 2 ,3 ,3.5 ,4 and small BW1(1S2) and small BW2(2S2). 2 583 MW of renewable energy capacity was awarded to IPPs in the REIPPPP bid window 5 in October 2021.
[14] Carbon emission reduction is calculated based on a displacement of power, from largely coal-based to more environmentally friendly electrical energy generation, using a gross Eskom equivalent emissions factor of 1.015 tons CO_2/MWh.

of Ummbila Emoyeni Wind Energy Facility, and the associated electricity generated as a result of the facility, will result in considerable savings on tons of CO_2 emissions.

Support for international agreements: The effective deployment of renewable energy provides a tangible means for South Africa to demonstrate its commitment to its international agreements under the Kyoto Protocol and the Paris Agreement, and for cementing its status as a leading player within the international community.

Employment creation: The development, procurement, installation, maintenance and management of renewable energy facilities have significant potential for job creation and skills development in South Africa. The construction phase will create temporary employment opportunities and the operation phase will create limited full-time employment opportunities.

Acceptability to society: Renewable energy offers a number of tangible benefits to society, including reduced pollution concerns, improved human and ecosystem health and climate friendly development.

Support to a new industry sector: The development of renewable energy offers the opportunity to establish a new industry within the South African economy, which will create jobs and skill local communities which have potential for further renewable energy projects.

Protecting the natural foundations of life for future generations: Actions to reduce our disproportionate carbon footprint can play an important part in ensuring our role in preventing dangerous anthropogenic climate change, thereby securing the natural foundations of life for generations to come; this is the basis of sustainable development.

6.4. Need and Desirability of the project from a Regional Perspective

Coal production is geographically concentrated with 80 percent occurring in Mpumalanga and over 70 percent of South Africa's total value added from coal coming from just four towns— eMalahleni (Witbank), Steve Tshwete (Middelburg), Govan Mbeki and Msukaligwa (Ermelo) (Just Energy Framework, 2022). As this coal capacity is decommissioned as plants come to the end of their useful life (many of the coal fired generators in the Province are more than 50 years old), this capacity will need to be replaced and jobs created for those involved in the coal supply chain. This is what is known as the **Just Energy Transition (JET).**

According to the Just Transition Framework "*Around 1.1 million people live in these districts (Stats SA 2011). Besides the direct employment effects, the downsizing in coal will affect a range of businesses and informal sector work that support the mines' labour force. Moreover, the municipalities depend on Eskom and the mines to provide some infrastructure and services (Patel et al. 2020). With appropriate planning and support, some of the job losses in the coal value chain can be offset by further development of the domestic renewable energy manufacturing industry. The Draft South African Renewable Energy Masterplan (SAREM) outlines some of the potential benefits that can be realized by industrialising the renewable energy value chain, including targeted job creation in areas where former coal sector employees live (DMRE, dtic and DSI 2022). As the SAREM is aligned with the Integrated Resource Plan (IRP), any updates to the IRP that increase the renewable energy targets for 2030 or beyond would likely result in increases to the projected job and GDP growth potential of the plan.*"

The Ummbila Emoyeni Wind Energy Facility will have a vital role to play in this transition both in terms of energy generation and socio-economic upliftment. It is also increasingly difficult to finance and procure new coal

generation due to environmental concerns from lenders. Additionally, the lowest cost of new generation is wind and solar, taking emission mitigation requirements into consideration (cheaper than coal on a Levelised Cost of Energy (LCOE) basis). The argument for new wind generation in the coal belt province of Mpumalanga is therefore compelling.

The Mpumalanga Province has also been identified as an area where electricity generation from renewable resources (including wind energy) is highly feasible and a viable option. Provincial policies and plans include renewable energy development and economic upliftment from such developments as part of the strategic planning. The location of the study area and project site within the Mpumalanga Province is therefore considered to support the Province/Region's generation targets.

The overarching objective for the Ummbila Emoyeni Wind Energy Facility is to maximise electricity production through exposure to the wind resource, while minimising infrastructure, operational and maintenance costs, as well as social and environmental impacts. From a regional site selection perspective, this region is considered to be technically viable for wind energy development by virtue of its measured wind resource. The wind speed for the area derived from the Wind Atlas for South Africa (WASA) High Resolution Wind Resource Map is within the range of 6.5m.s^{-1} to 7.5m.s^{-1}, which is considered favourable for the development of a wind farm (refer to **Figure 6.4**). Local municipality policies and plans include energy development and upliftment of the area as a result of such development as part of their priorities. The development of the proposed project is therefore supported at a planning level.

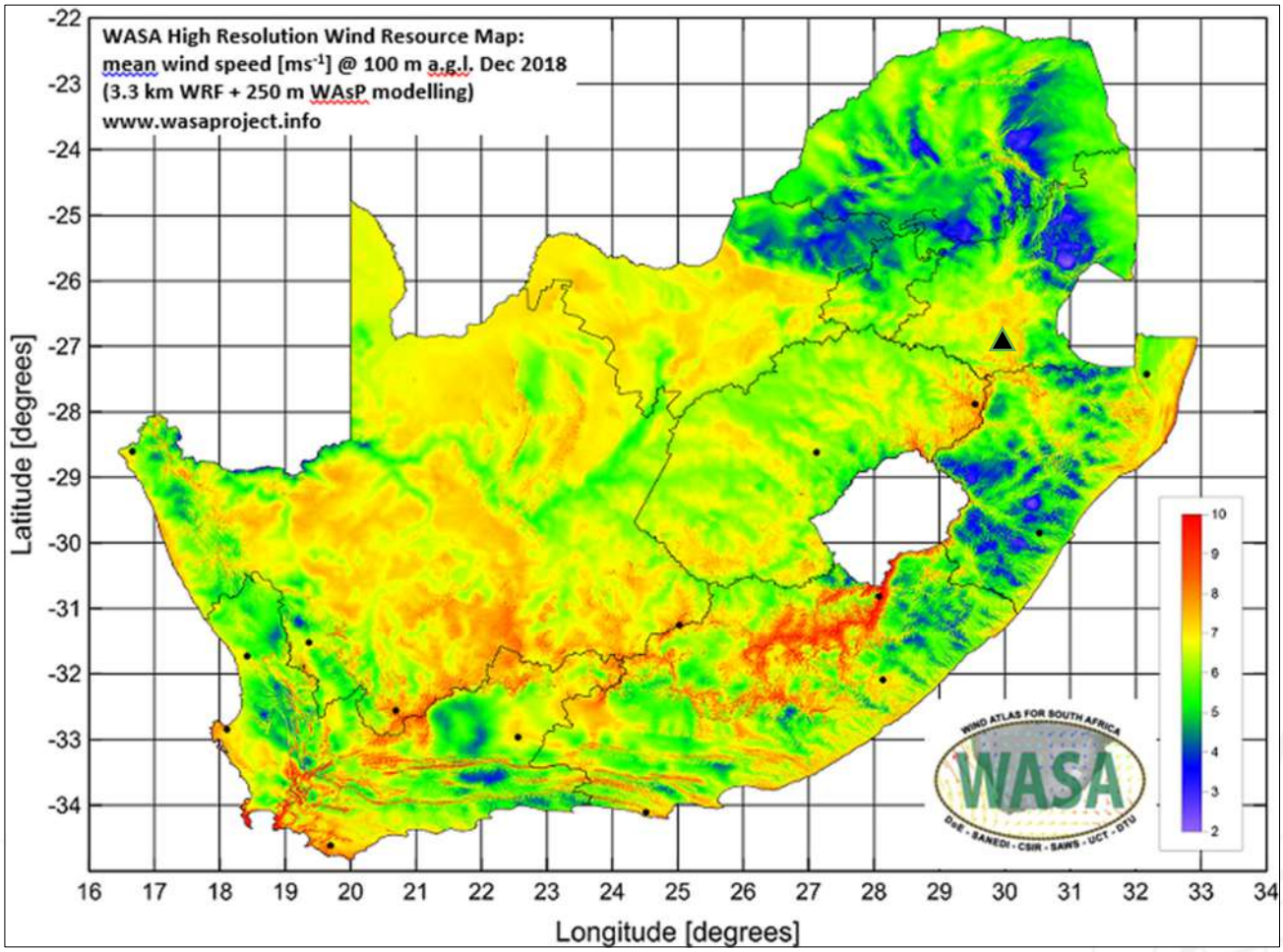


Figure 6.4: Wind resource map for South Africa, with the position of Ummbila Emoyeni Wind Energy Facility shown by the black triangle (Source: wasaproject.info)

6.5. Receptiveness of and desirability of the project site to develop the Ummbila Emoyeni Wind Energy Facility

The placement of a wind farm is strongly dependent on several factors including climatic conditions (wind speed), topography, the location of the site, availability of grid connection, the extent of the site and the need and desirability for the project. From a local level perspective, the project site and development area have specifically been identified by the proponent as being highly desirable from a technical perspective for the development of a wind farm due to the following site characteristics:

» **Wind resource**: Wind resource is the first main driver of site selection and project viability when considering the development of wind farms. The project site, which is located near the towns of Bethal and Morgenzon, in the Mpumalanga Province has good wind resource potential. The wind resource for the development site has been monitored using onsite monitoring devices over approximately 18 months and has been proven to be competitive and equal to other projects in the country. Modelled wind speeds were validated using nearby weather station data at 10m above ground level and extrapolated to the hub height of up to150m. The Windlab technical team explored the wind resource around the country and highlighted this area as being a strong site from a resource perspective. Note that the wind resource is strong at 150m above ground level. This is a different resource to that which is generally found in the Cape Provinces where the wind is often strongest at 80m – 120m. The advances in wind turbine technology and higher hub heights have allowed Windlab to successfully identify and model the wind at this higher height. Onsite measurement of the wind through two x 120m meteorological masts and a remote Triton SODAR acoustic monitoring device have validated the Windlab wind map. As an example, Figure 6.4 above is for wind measured at 80m.

» **Land Availability:** In order to develop the Ummbila Emoyeni Wind Energy Facility with a contracted capacity of up to 900MW, sufficient space is required. The preferred project site was identified within the Mpumalanga Province and in the Bethal / Morgenzon area following the confirmation of a feasible wind resource from on-site wind measurements taken over an 18-month period. The properties included in the project site are privately-owned parcels available in the area for a development of this nature through agreement with the landowners and are deemed technically feasible by the project developer for such development to take place. The combination of the affected properties has an extent of ~27 819ha, which was considered by the developer as sufficient for the development of the Ummbila Emoyeni Wind Energy Facility. A development footprint of 390ha within the project site for the placement of infrastructure has been identified considering environmental constraints and sensitivities identified within the project site through the Scoping Evaluation and is being assessed as part of this EIA Report.

» **Land Use, Geographical and Topographical Considerations**: The character of the greater area surrounding the project site can be described as natural grassland which is interspersed with areas of cultivation. Main crop types include sunflower seed production, sorghum, rye and potatoes. Settlement occurs in the form of isolated homesteads throughout the study area that are generally related to agricultural uses. There is a tourism related establishment (Silver Water Game Lodge) located within the north-eastern section of the proposed site. This facility appears to be focused around a dam. Settlement in the form of towns and villages is limited. The closest towns include Morgenzon, Bethal and Ermelo. Other disturbance visible is mining infrastructure, a railway track, power line servitudes and the future development of other renewable energy facilities which have received EAs from the DFFE. The proposed development is compatible with the surrounding land uses and does not present a conflicting land use.

The proposed focus area is located across a series of valley and ridgelines that run in a general east to west direction. The valley lines all feed into the Bleboksprui which flows in a north to south direction approximately 8.5km to the west of the proposed site. These characteristics are preferred for the construction and operation of a wind energy facility such as the Ummbila Emoyeni Wind Energy Facility.

» **Access to the National Electricity Grid** – A key factor in the siting of any generation project is a viable grid connection. The grid connection infrastructure for the facility will include a 400/132kV MTS, to be located between the Camden and SOL Substations, which will be looped in and out of the existing Camden-Sol 400kV transmission line; on-site switching stations (132kV in capacity) at each renewable energy facility (Eskom Portion); 132kV power lines from the switching stations at each renewable energy facility to the new 400/132kV MTS; and a collector substation with 2 x 132kV bus bars and 4 x 132kV IPP feeder bays to the onsite IPP Substation. This proposed grid connection has been confirmed with Eskom as a feasible option. The grid connection solution will be subjected to a separate S&EIA, and will be handed over to Eskom upon completion. The Project will require the construction of a new 400/132kV MTS Substation equipped with a 400/132kV 500MVA transformer, and space for future transformers and feeder bays. The cost to build these facilities will be covered by the Project and the facilities themselves will be constructed on a self-build basis, to be handed over to Eskom. The MTS is anticipated to unlock substantial capacity along a major transmission route of the country, creating room for additional energy evacuation in future and making it easier for other projects to connect to the national grid. Thus, further capacity will be unlocked, and the socio-economic benefits derived from these projects will be gained (this would not be limited to a specific technology).

» **Access Road Infrastructure and Site access:** Access to the project site is ample with the presence of existing roads mainly consisting of national and regional roads. The proposed site is bounded by the N17 to the north, the R39 to the east and south and the R35 to the west. It is assumed that if components are imported to South Africa, it will be via the Port of Richard's Bay, which is located in KwaZulu-Natal. The Port is located approximately 460km from the proposed site. Alternatively, components can be imported via the Port of East London, located approximately 1130km from the proposed site, or from the Port of Ngqura, approximately 1200km from the proposed site, both being located in the province of the Eastern Cape. As material and components would need to be transported to the project site during the construction phase, accessibility to the project site is a key factor in determining the viability of the Ummbila Emoyeni Wind Energy Facility, particularly taking transportation costs (direct and indirect) into consideration and the impact of this on the project economics and the ability to submit a competitive bid under the DMRE's REIPPP Programme or a similar programme.

Taking into consideration the wind resource, grid access, land availability, landowner support, access to road infrastructure, the current land use of the project site and development area, the development of the Ummbila Emoyeni Wind Energy Facility is considered to be desirable and will ultimately contribute to, and further develop the successful power generation activities already being undertaken within the Mpumalanga Province.

CHAPTER 7: APPROACH TO UNDERTAKING THE EIA PROCESS

In terms of the EIA Regulations of December 2014 (as amended) published in terms of the NEMA (Act No. 107 of 1998) as amended, the construction and operation of the Ummbila Emoyeni Wind Energy Facility is a listed activity requiring EA. The application for EA is required to be supported by a (EIA full S&EIA process based on the contracted capacity of the facility being 900MW and Activity 1 of Listing Notice 2 (GNR 325) being triggered.

An EIA process refers to the process undertaken in accordance with the requirements of the 2014 EIA Regulations (GNR 326), as amended, which involves the identification and assessment of direct, indirect, and cumulative environmental impacts associated with a proposed project or activity. The EIA process comprises two main phases: i.e., **Scoping** and **EIA Phase**, and is illustrated in **Figure 7.1**. Public participation forms an important component of the process and is undertaken throughout both phases.

Figure 7.1: The Phases of an Environmental Impact Assessment (EIA) Process

This EIA phase of the S&EIA process aimed at assessing potential issues associated with the proposed project identified through the Scoping Phase. This was achieved through an assessment of the proposed project involving detailed specialist studies, as well as a consultation process with the Interested and Affected Parties (I&APs), including the decision-making authority, directly impacted landowners/occupiers, adjacent landowners/occupiers, relevant organs of state departments, ward councillors and other key stakeholders. This chapter serves to outline the process followed during the S&EIA process to date.

7.1 Legal Requirements as per the EIA Regulations, 2014 (as amended), for the undertaking of an Environmental Impact Assessment Report

This chapter includes the following information required in terms of Appendix 3: Scope of Assessment and Content of Environmental Impact Assessment Reports:

Requirement	Relevant Section
3(1)(d)(i) a description of the scope of the proposed activity, including all listed and specified activities	All listed activities triggered and applied for are included in **Section 7.2** and **Table 7.1**.

Requirement	Relevant Section
triggered and being applied for; and (ii) a description of the associated structures and infrastructure related to the development.	
3(1)(h)(ii) details of the public participation process undertaken in terms of Regulation 41 of the Regulations, including copies of the supporting documents and inputs.	The public participation process followed throughout the S&EIA process for the Ummbila Emoyeni Wind Energy Facility is included in **Section 7.5.2** and copies of the supporting documents and inputs are included in **Appendix C**.
3(1)(h)(iii) a summary of the issues raised by interested and affected parties, and an indication of the manner in which the issues were incorporated, or the reasons for not including them.	The main issues raised through the undertaking of the public participation process, including consultation with I&APs, are included in the Comments and Responses Report in **Appendix C9**.
3(1)(h)(vi) the methodology used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks.	The methodology used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks are included in **Section 7.5.3**.
3(1)(p) a description of any assumptions, uncertainties, and gaps in knowledge which relate to the assessment and mitigation measures proposed.	The assumptions and limitations of the S&EIA process being undertaken for the Ummbila Emoyeni Wind Energy Facility is included in **Section 7.6**.

7.2 Relevant legislative permitting requirements

The legislative permitting requirements applicable to the Ummbila Emoyeni Wind Energy Facility, as identified and considered within this S&EIA process, are described in more detail under the respective sub-headings.

7.2.1 National Environmental Management Act (No. 107 of 1998) (NEMA)

The NEMA is South Africa's key piece of national environmental legislation that provides for the authorisation of certain controlled activities known as "listed activities". In terms of Section 24(1) of the NEMA, the potential impact on the environment associated with listed activities must be considered, investigated, assessed, and reported on to the Competent Authority (the decision-maker) charged by NEMA with granting of the relevant Environmental Authorisation (EA). Since the Ummbila Emoyeni Wind Energy Facility is a power generation project and therefore relates to the IRP for Electricity 2010 – 2030, the National Department of Forestry, Fisheries, and the Environment (DFFE) has been determined as the Competent Authority (CA) in terms of GNR 779 of 01 July 2016. The Mpumalanga Department of Agriculture, Rural Development, Land and Environmental Affairs (DARDL&EA) is the Commenting Authority on the project.

The need to comply with the requirements of the EIA Regulations published under NEMA ensures that developers are provided the opportunity to consider the potential environmental impacts of their activities early in the project development process, and also allows for an assessment to be made as to whether environmental impacts can be avoided, minimised or mitigated to acceptable levels. Comprehensive, independent environmental studies are required to be undertaken in accordance with the EIA Regulations to provide the Competent Authority with sufficient information in order for an informed decision to be taken regarding the application for EA.

The EIA process being conducted for the Ummbila Emoyeni Wind Energy Facility is undertaken in accordance with Section 24(5) of the NEMA, which defines the procedure to be followed in applying for EA, and requires that the potential consequences for, or impacts of, listed or specified activities on the

environment be considered, investigated, assessed, and reported on to the competent authority. Listed Activities are activities identified in terms of Section 24 of the NEMA which are likely to have a detrimental effect on the environment, and which may not commence without an EA from the competent authority subject to the completion of an environmental assessment process (either a Basic Assessment (BA) or full Scoping and EIA).

Table 7.1 details the listed activities in terms of the EIA Regulations, 2014 (as amended) that apply to the Ummbila Emoyeni Wind Energy Facility, and for which an application for Environmental Authorisation has been submitted to the DFFE. The table also includes a description of the specific project activities that relate to the applicable listed activities.

Table 7.1: Listed activities as per the EIA Regulations that are triggered by the Ummbila Emoyeni Wind Energy Facility

Notice Number	Activity Number	Description of listed activity
Listing Notice 1 (GNR 327) 08 December 2014 (as amended on 07 April 2017)	11(i)	The development of facilities or infrastructure for the transmission and distribution of electricity – (i) outside urban areas or industrial complexes with a capacity of more than 33 but less than 275kV. ***Internal electrical infrastructure required to connect the Ummbila Emoyeni Wind Energy Facility to the grid connection infrastructure will consist of 33kV cabling (buried or overhead), and 3 x 33/132kV onsite collector substations (IPP Portion).***
Listing Notice 1 (GNR 327) 08 December 2014 (as amended on 07 April 2017)	12(ii)(a)(c)	The development of – (ii) Infrastructure or structures with a physical footprint of 100 square metres or more Where such development occurs- (a) within a watercourse; or (c) within 32 metres of a watercourse. ***The construction and operation of the Ummbila Emoyeni Wind Energy Facility and associated infrastructure will occur within freshwater/ drainage features, as well as within 32m of these features. The infrastructure will have a physical footprint of more than 100 square metres.***
Listing Notice 1 (GNR 327) 08 December 2014 (as amended on 07 April 2017)	14	The development and related operation of facilities and infrastructure, for the storage, or for the storage and handling, of a dangerous good, where such storage occurs in containers with a combined capacity of 80 cubic metres or more but not exceeding 500 cubic metres. ***The development of the Ummbila Emoyeni Wind Energy Facility will require the construction and operation of facilities and infrastructure for the storage and handling of dangerous goods (combustible and flammable liquids, such as oils, lubricants, solvents) associated with the onsite collector substations, where such storage will occur inside containers with a combined capacity exceeding 80 cubic meters but not exceeding 500 cubic meters.***
Listing Notice 1 (GNR 327)	19(i)	The infilling or depositing of any material of more than 10 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 10 cubic metres from a

Notice Number	Activity Number	Description of listed activity
08 December 2014 (as amended on 07 April 2017)		(i) Watercourse. ***The site for the Ummbila Emoyeni Wind Energy Facility is associated with the presence of freshwater/drainage features. Therefore, during the construction phase, 10 cubic metres of rock will be removed from the watercourses for the development of the Ummbila Emoyeni Wind Energy Facility and associated infrastructure.***
Listing Notice 1 (GNR 327) 08 December 2014 (as amended on 07 April 2017)	24(ii)	The development of a road – (ii) with a reserve wider than 13.5m, or where no reserve exists where the road is wider than 8m. ***The construction of the Ummbila Emoyeni Wind Energy Facility will require the construction of new access roads of 12 -13m wide, with 12m at turning circles, in areas where no road reserve exists to provide access to the facility.***
Listing Notice 1 (GNR 327) 08 December 2014 (as amended on 07 April 2017)	28(ii)	Residential, mixed, retail, commercial, industrial, or institutional developments where such land was used for agriculture, game farming, equestrian purposes or afforestation on or after 01 April 1998 and where such development: (ii) will occur outside an urban area, where the total land to be developed is bigger than 1ha. ***The total area to be developed (i.e., the development footprint) for the Ummbila Emoyeni Wind Energy Facility is greater than 1ha and occurs outside an urban area in an area currently zoned for agriculture.***
Listing Notice 1 (GNR 327) 08 December 2014 (as amended on 07 April 2017)	56(ii)	The widening of a road by more than 6 metres, or the lengthening of a road by more than 1 kilometre (ii) where no reserve exists, where the existing road is wider than 8 metres. ***Existing farm roads within the project site may require widening, and access roads will be widened by more than 6 metres.***
Listing Notice 2 (GNR 325) 08 December 2014 (as amended on 07 April 2017)	1	The development of facilities or infrastructure for the generation of electricity from a renewable resource where the electricity output is 20MW or more. ***The project comprises a renewable energy generation facility, which will utilise wind power technology and will have a generation capacity of up to 900MW.***
Listing Notice 2 (GNR 325) 08 December 2014 (as amended on 07 April 2017)	15	The clearance of an area of 20ha or more of indigenous vegetation. ***The facility is located on agricultural land where the predominant land use is farming. The project will require the clearance of indigenous vegetation within an area in excess of 20ha for the development of infrastructure.***
Listing Notice 3 (GNR 325) 08 December 2014 (as amended on 07 April 2017)	4(f)(i)(ee)	The development of a road wider than 4 metres with a reserve less than 13.5 metres. f. Mpumalanga i. Outside urban areas: (ee) Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans.

Notice Number	Activity Number	Description of listed activity
		The development of the Ummbila Emoyeni Wind Energy Facility will require the development of access roads of 12 – 13m wide, with 12m at turning circles, in the Mpumalanga Province and outside urban areas. The project site is associated with the presence of a CBA1: Optimal (Terrestrial) and a CBA1: Irreplaceable (Freshwater).
Listing Notice 3 (GNR 325) 08 December 2014 (as amended on 07 April 2017)	10(f)(i)(cc)(ee)(hh)	The development and related operation of facilities or infrastructure for the storage, or storage and handling of a dangerous good where such storage occurs in containers with a combined capacity of 30 but not exceeding 80 cubic metres f. Mpumalanga i. Outside urban areas (cc) Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority (ee) Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans. (hh) Areas within a watercourse or wetland, or within 100 metres of a watercourse or wetland. ***The development of the Ummbila Emoyeni Wind Energy Facility will require the construction and operation of facilities for the storage and handling of a dangerous goods (combustible and flammable liquids, such as oils, lubricants, solvents) associated with the onsite collector substations, where such storage will include containers with a capacity of 80 cubic meters. The site is associated with the presence of freshwater/drainage features, a CBA1: Optimal (Terrestrial) and a CBA1: Irreplaceable (Freshwater) and is located within the Mpumalanga Province and outside urban areas. Further, parts of the site are located in areas which could be considered sensitive in terms of the Gert Sibande District Environmental Management Framework (EMF).***
Listing Notice 3 (GNR 325) 08 December 2014 (as amended on 07 April 2017)	12(f)(ii)	The clearance of an area of 300m^2 or more of indigenous vegetation within: b. Mpumalanga ii. Within critical biodiversity areas identified in bioregional plans. ***The Ummbila Emoyeni Wind Energy Facility development will require clearance in excess of 300m^2 within areas classified as CBA1: Optimal (Terrestrial) and CBA1: Irreplaceable (Freshwater) in the Mpumalanga Province.***
Listing Notice 3 (GNR 325) 08 December 2014 (as amended on 07 April 2017)	14(ii)(a)(c)(f)(i)(dd)(ff)	The development of— (ii) infrastructure or structures with a physical footprint of 10 square metres or more; where such development occurs— (a) within a watercourse; or (c) within 32 metres of a watercourse, measured from the edge of a watercourse. f. Mpumalanga

Notice Number	Activity Number	Description of listed activity
		ii. Outside urban areas: (dd) Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority (ff) Critical biodiversity areas or ecosystem service areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans. ***The development of Ummbila Emoyeni Wind Energy Facility will require the establishment of infrastructure with a physical footprint exceeding 10m². The site is associated with the presence of freshwater/drainage features, a CBA1: Optimal (Terrestrial) and a CBA1: Irreplaceable (Freshwater), and is located within the Mpumalanga Province, and outside urban areas. Further, parts of the site are located in areas which could be considered sensitive in terms of the Gert Sibande District Environmental Management Framework (EMF).***
Listing Notice 3 (GNR 325) 08 December 2014 (as amended on 07 April 2017)	18(f)(i)(ee)	The widening of a road by more than 4 metres, or the lengthening of a road by more than 1 kilometre. f. Mpumalanga i. Outside urban areas: (ee) Critical biodiversity areas or ecosystem service areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans. ***The development of the Ummbila Emoyeni Wind Energy Facility will require the widening of roads by more than 4m, outside urban areas, and within areas classified as CBA1: Optimal (Terrestrial) and CBA1: Irreplaceable (Freshwater) in the Mpumalanga Province.***

7.2.2 National Water Act (No. 36 of 1998) (NWA)

In accordance with the provisions of the National Water Act (No. 36 of 1998) (NWA), all water uses must be licensed with the Competent Authority (i.e., the Regional Department of Water and Sanitation (DWS) or the relevant Catchment Management Agency (CMA)). Water use is defined broadly, and includes taking and storing water, activities which reduce stream flow, waste discharges and disposals, controlled activities (activities which impact detrimentally on a water resource), altering a watercourse, removing water found underground for certain purposes, and recreation.

Table 7.2 contains Water Uses associated with the proposed project and identified in terms of the NWA which require licensing either in the form of a General Authorisation (GA), or in the form of a Water Use License (WUL). The table also includes a description of those project activities which relate to the applicable Water Uses.

Table 7.2: List of Water Uses published under Section 21 of NWA, as amended.

Notice No.	Activity No.	Description of Water Use
NWA (No. 36 of 1998)	Section 21 (a)	Taking water from a water resource. ***Groundwater from boreholes may be abstracted for use during the construction and operation phases for the project.***

Notice No.	Activity No.	Description of Water Use
NWA (No. 36 of 1998)	Section 21 (c)	Impeding or diverting the flow of water in a watercourse ***The site considered for the establishment of the Ummbila Emoyeni Wind Energy Facility is associated with the presence of freshwater/drainage features. Activities pertaining to the establishment of the wind farm might encroach on freshwater/drainage features which may lead to an impediment and diversion of the flow in the watercourses.***
NWA (No. 36 of 1998)	Section 21 (g)	Disposing of waste in a manner which may detrimentally impact on a water resource. ***The sewage generated during the operation phase may be collected and treated as per normal standards using a septic or conservancy tank. Sewage may also be stored in a conservancy tank and collected either by a honey-sucker truck or a service provider (contractor) for treatment at a licensed facility. This activity requires a license (GA if volumes are below 10 000m3) in terms of the NWA.***
NWA (No. 36 of 1998)	Section 21 (i)	Altering the bed, banks, course or characteristics of a watercourse. ***The site considered for the establishment of the Ummbila Emoyeni Wind Energy Facility is associated with the presence of freshwater/drainage features. Activities pertaining to the establishment of the wind farm might encroach on freshwater/drainage features which may lead to the altering of the characteristics of the watercourses.***

In the event that the flow of water in the freshwater/drainage features is affected and the bed, banks or course characteristics are altered, then a water use authorisation would be required. This will need to be in accordance with the requirements of the Regulations Regarding the Procedural Requirements for Water Use License Applications and Appeals (GNR 267), or a GA registered in accordance with the requirements of the Revision of General Authorisation. The process of applying for a WUL or GA registration will only be completed once a positive EA has been received and the project selected as Preferred Bidder under the REIPPPP or similar programme. This is in line with the requirements of the Department of Water and Sanitation (DWS).

7.2.3 National Heritage Resources Act (No. 25 of 1999) (NHRA)

The National Heritage Resources Act (No. 25 of 1999) (NHRA) provides an integrated system which allows for the management of national heritage resources, and to empower civil society to conserve heritage resources for future generations. Section 38 of NHRA provides a list of activities which potentially require the undertaking of a Heritage Impact Assessment.

<u>Section 38: Heritage Resources Management</u>

1). Subject to the provisions of subsections (7), (8) and (9), any person who intends to undertake a development categorised as –

a. the construction of a road, wall, power line, pipeline, canal or other similar form of linear development or barrier exceeding 300m in length;

b. the construction of a bridge or similar structure exceeding 50m in length;

c. any development or other activity which will change the character of a site –

i). exceeding 5 000m² in extent; or

ii). involving three or more existing erven or subdivisions thereof; or

iii). involving three or more erven or divisions thereof which have been consolidated within the past five years; or

iv). the costs of which will exceed a sum set in terms of regulations by SAHRA or a provincial heritage resources authority.

Must at the very earliest stages of initiating such a development, notify the responsible heritage resources authority and furnish it with details regarding the location, nature and extent of the proposed development.

In terms of Section 38(8), approval from the heritage authority is not required if an evaluation of the impact of such development on heritage resources is required in terms of any other legislation (such as NEMA), provided that the consenting authority ensures that the evaluation of impacts fulfils the requirements of the relevant heritage resources authority in terms of Section 38(3) and any comments and recommendations of the relevant resources authority with regard to such development have been taken into account prior to the granting of the consent. However, should heritage resources of significance be affected by the proposed development, a permit is required to be obtained prior to disturbing or destroying such resources as per the requirements of Section 48 of the NHRA, and the South African Heritage Resources Agency (SAHRA) Permit Regulations (GNR 668).

7.3 Overview of the Scoping Phase

The final Scoping Report submitted to the DFFE on **24 June 2022** and subsequently accepted on **03 August 2022** documented the evaluation of potential environmental impacts associated with the Ummbila Emoyeni Wind Energy Facility. The Scoping Phase was conducted in accordance with the requirements of the 2014 EIA Regulations (GNR 326), as amended, and therefore aimed to:

- Identify and evaluate potential environmental (biophysical and social) impacts and benefits of all phases of the proposed development (including design, construction, operation, and decommissioning) within the broader project site and development footprint through a review of existing baseline data, including specialist studies which were undertaken within the development footprint.
- Identify potentially sensitive environmental features and areas within the development footprint in order to inform the preliminary design process of the wind energy facility.
- Define the scope of studies to be undertaken during the EIA process.
- Provide the authorities with sufficient information in order to make a decision regarding the scope of issues to be addressed in the EIA Phase, as well as regarding the scope and extent of specialist studies that will be required to be undertaken.

Within this context, the objectives of the Scoping Phase were to, through a consultative process:

- Identify the policies and legislation relevant to the project.
- Motivate the need and desirability of the proposed project, including the need and desirability of the activity in the context of the preferred project location.
- Identify and confirm feasible alternatives for the project.
- Identify and describe potential impacts associated with the undertaking of the identified activities and proposed technology.

- Identify areas of high sensitivity to be avoided by the project infrastructure.
- Identify and list key issues associated with the project to be addressed during the EIA Phase through further detailed study and ground-truthing.
- Agree on the level of assessment, including the methodology to be applied, the expertise required, and the extent of further consultation to be undertaken in the EIA Phase of the process, with the aim of determining the extent of impacts associated with the activities through the life cycle of the project (i.e., construction, operation, and decommissioning).
- Identify suitable measures to avoid, manage or mitigate identified impacts and to determine the extent of the residual risks that need to be managed and monitored.

Key tasks undertaken within the Scoping Phase include:

- Consultation with relevant decision-making and regulating authorities (at National, Provincial and Local levels).
- Submission of the completed application for EA to the competent authority (i.e., the DFFE) in terms of Regulations 5 and 16 of the 2014 EIA Regulations (GNR 326), as amended.
- Undertaking a public participation process in accordance with Chapter 6 of GNR 326 and the Department of Environmental Affairs (2017) Public Participation guidelines in terms of the NEMA EIA Regulations (hereinafter referred to as "the Guidelines") in order to obtain comments on and identify issues and concerns associated with the proposed project.
- Undertaking of independent specialist studies in accordance with Appendix 6 of the EIA Regulations, 2014 (GNR 326), as amended, and the requirements of the Specialist Protocols published in Regulation GNR 320, issued on 20 March 2020 and GNR 1150 of 30 October 2020, where relevant, as well as other relevant guidelines.
- Preparation of a Scoping Report and Plan of Study for the EIA in accordance with the requirements of Appendix 2 of the 2014 EIA Regulations (GNR 326).
- Provision of a 30-day public and authority review period for the Scoping Report.
- Preparation of a Comments and Response (C&R) Report detailing all comments raised by I&APs and responses provided as part of the Scoping Phase.
- Submission of a Final Scoping Report, including a Plan of Study for the EIA, to the DFFE for review and acceptance on **24 June 2022**.

Table 7.3 provides a summary of the public participation process undertaken during the Scoping Phase.

Table 7.3: Summary of the public participation process undertaken during the Scoping Phase

Activity	Date
Announcement of the EIA process and the availability of the Scoping Report for a 30-day review and comment period, including details on how to access the Scoping Report via the online stakeholder engagement platform, in one local newspaper: » Ridge Times Newspaper (English advertisement)	10 May 2022
Distribution of the BID, process notification letters and stakeholder reply form announcing the EIA process and inviting I&APs to register on the project database. The BID and electronic reply form was also made available on the online stakeholder engagement platform.	12 May 2022

Activity	Date
Placement of site notices at the project site, including placement of further notices in the towns of Bethal and Morgenzon.	29 April 2022
Distribution of notification letters announcing the availability of the Scoping Report for a 30-day review and comment period. These letters were distributed to Organs of State, Government Departments, Ward Councillors, landowners within the surrounding area (including neighbouring landowners), registered I&APs and key stakeholder groups.	12 May 2022
30-day review and comment period of the Scoping Report.	Thursday, 12 May 2022 to Monday, 13 June 2022
Virtual meetings through the use of virtual platforms as determined through discussions with the relevant stakeholder group: » Landowners » Authorities and key stakeholders (including Organs of State, local municipality and official representatives of community-based organisations). » Where an I&AP does not have access to a computer and/or internet to participate in a virtual meeting telephonic discussions (including WhatsApp video call) will be set-up and minuted for inclusion. The preferred language of the I&AP has been considered when setting up these discussions. Direct in-person consultation will only take place in limited numbers and where sanitary conditions can be maintained at all times.	» A public meeting was held with key stakeholders on **Tuesday, 31 May 2022 at 17:00 – 18:00** via a virtual platform. » Focus group meetings were held with key stakeholders on **Wednesday, 15 May 2022 at 09:00 – 10:30, 11:00 – 12:30 and 14:00 – 15:00** via a virtual platform. » A discussion session with directly affected landowners was held on **Tuesday, 14 June 2022**.

Acceptance of the Scoping Report and approval of the Plan of Study for the EIA Phase was received on 03 August 2022, marking the start of the EIA Phase (refer to **Appendix B**). Additional Information requested by the DFFE in the acceptance of the Scoping Report and the location of the requested information in this EIA Report is detailed in **Table 7.4**.

Table 7.4: DFFE requirements and response/ reference to section in the EIA Report

DFFE Requirement for EIA	Response/Location in this EIA Report
(a) Listed Activities (i) The EIAr must provide an assessment of the impacts and mitigation measures for each of the listed activities applied for.	An assessment of impacts and recommended mitigation measures is included in this EIA Report (refer to **Chapter and 10**).
(ii) The listed activities represented in the EIAr and the application form must be the same and correct.	The listed activities applied for in the application form submitted to the DFFE on **24 June 2022** are the same as those included in this EIA Report.
(iii) The EIAr must assess the correct sub listed activity for each listed activity applied for.	The EIA Report assesses the correct sub listed activities for each listed activity applied for (refer to **Section 7.2.1, Table 7.1**).
(b) Public Participation (i) Please ensure that comments from all relevant stakeholders are submitted to the Department with the EIAr. This includes but is not limited to the Eskom, the provincial Department of Agriculture Rural Development, Land and Environmental Affairs, Mpumalanga Tourism and Parks Agency, Govan Mbeki Local Municipality, Lekwa Local Municipality and Msukaligwa Local Municipality, Gert Sibande District Municipality, the South African Heritage Resources Agency (SAHRA), The South African Civil Aviation Authority (SACAA), The Department of Transport, The Department of Water and Sanitation (DWS), The South African National Roads Agency Limited (SANRAL), The Endangered Wildlife Trust (EWT), The Endangered Wildlife Trust (EWT), Square Kilometre Array (SKA),The South African Astronomy Observation (SAAO) and the Department of Environment, Forestry and Fisheries: Directorate Biodiversity and Conservation.	All comments received to date have been included within the Comments and Responses Report (**Appendix C9**). Where comments have not been obtained, proof that attempts were made to obtain comments have been included in **Appendix C4** and **Appendix C5**. The database detailing registered I&APs is included as **Appendix C1** to the EIA Report.
(ii) Please ensure that all issues raised and comments received during the circulation of the draft SR and draft EIAr from registered I&APs and organs of state which have jurisdiction in respect of the proposed activity are adequately addressed in the final EIAr. Proof of correspondence with the various stakeholders must be included in the final EIAr. Should you be unable to obtain comments, proof should be submitted to the Department of the attempts that were made to obtain comments.	Comments received during the 30-day review and comment period of the draft Scoping Report have been captured and addressed in the Comments and Responses Report attached as **Appendix C9** to this EIA Report. Comments received during the 30-day review and comment period of the draft EIA Report will be captured and addressed in the Comments and Reponses Report (**Appendix C9**) to be submitted with the final EIA Report to the DFFE for decision-making. Proof of correspondence with the various stakeholders will be included in the final EIA Report in **Appendix C4** and **Appendix C5**. Where comments have not been obtained, proof that attempts were made to obtain comments will be included in **Appendix C4** and **Appendix C5**.

DFFE Requirement for EIA	Response/Location in this EIA Report
(iii) A Comments and Response trail report (C&R) must be submitted with the final EIAr. The C&R report must incorporate all comments for this development. The C&R report must be a separate document from the main report and the format must be in the table format as indicated in Appendix 1 of this comments letter. Please refrain from summarising comments made by I&APs. All comments from I&APs must be copied verbatim and responded to clearly. Please note that a response such as "noted" is not regarded as an adequate response to I&AP's comments.	All comments received during the Scoping Phase, and the 30-day review and comment period of the draft EIA Report, including those of the DFFE, will be included within the Comments and Responses Report (to be included as **Appendix C9** to the final EIA Report). All comments received from I&APs to date have been copied verbatim and responded to clearly (refer to **Appendix C9**). Comments received during the 30-day review and comment period of the draft EIA Report will also be copied verbatim and responded to clearly within the Comments and Reponses Report to be submitted with the final EIA Report.
(iv) Comments from I&APs must not be split and arranged into categories. Comments from each submission must be responded to individually.	Comments received from I&APs to date on the project have not been split and arranged in categories, and comments from each submission have been responded to individually (refer to **Appendix C9).**
(v) The Public Participation Process must be conducted in terms of Regulation 39, 40, 41, 42, 43 & 44 of the EIA Regulations, 2014, as amended.	The public participation process to date is being conducted in terms of Regulation 39, 40, 41, 42, 43 and 44 of the EIA Regulations 2014, as amended (GNR 326). Details of the public participation process undertaken to date are included in detail in **Chapter 7** of the EIA Report.
(vi) The EAP is requested to contact the Department to make the necessary arrangements to conduct a site inspection prior to the submission of the final EIAr.	Necessary arrangements to conduct will be made with the Department. As agreed with the case officer, this will be arranged following submission of the Final EIA Report and will be combined with that for the solar energy facility and the grid connection infrastructure.
(c) Alternatives (i) Please provide a description of each of the preferred alternative type and provide detailed motivation on why it is preferred.	An overview of the various alternatives (i.e., property/location alternatives, design and layout alternatives, activity alternatives, and technology alternatives) considered for the Ummbila Emoyeni Wind Energy Facility is included in Chapter 3 of the EIA Report. An assessment of the 'do-nothing' alternative is included in Chapter 9 of the EIA Report.
(d) Layout and Sensitivity Maps (i) The EIAr must provide the four corner coordinate points for the proposed development site (note that if the site has numerous bend points, at each bend point coordinates must be provided) as well as the start, middle and end point of all linear activities.	The EIA Report includes coordinate points of the proposed project site (refer to **Chapter 1, Table 1.1**)
(ii) The EIAr must provide the following: » Clear indication of the envisioned area for the proposed facility. » Clear description of all associated infrastructure. This description must include, but is not limited to the following: ∗ Internal roads infrastructure.	The facility layout is included in this EIA Report as **Figure 9.1, under Chapter 9**. A clear description of the infrastructure associated with the Ummbila Emoyeni Wind Energy Facility is included in **Chapter 2**.

DFFE Requirement for EIA	Response/Location in this EIA Report
* All supporting onsite infrastructure such as laydown area, guardhouse, and control room. * All necessary details regarding all possible locations and sizes of the proposed satellite substation and the main substation.	
(iii) A copy of the final preferred route layout map. All available biodiversity information must be used in the finalisation of the layout map. Existing infrastructure must be used as far as possible e.g. roads.	The facility layout is included in this EIA Report as **Figure 9.1**. Potential sensitive areas were identified through specialist desktop and in-field studies. The sensitivity shapefiles were shared with the project developer and were used to inform the design of the facility layout considered within this EIA Report. Existing roads will be used to access the project site as far as possible. Only the establishment of new internal roads to provide access to the wind turbines and other infrastructure associated with the facility is proposed.
(iv) The layout map must indicate the following: » Wind turbine positions and its associated infrasrtructure. » Permanent laydown area footprint. » Internal roads indicating width (construction period width and operation period width) and with numbered sections between the other site elements which they serve (to make commenting on sections possible). » Wetlands, drainage lines, rivers, stream and water crossing of roads and cables indicating the type of bridging structures that will be used. » The location of sensitive environmental features on site e.g. CBAs, heritage sites, wetlands, drainage lines etc. That will be affected by the facility and its associated infrastructure. » Substation(s) and/or transformer(s) sites including their entire footprint. » Location of access and service roads. » Connection routes (including pylon positions) to the distribution/transmission network. » All existing infrastructure on the site, especially railway lines and roads. » Buffer areas. » Buildings, including ccomodation. » All "no-go" areas.	The facility layout is included in this EIA Report as **Figure 9.1** and the revised Optimised Layout is included in **Figure 11.3**. The layout includes the positions of the wind turbines and other infrastructure associated with the facility. A map showing the layout overlain on the identified environmental sensitivities is included in this EIA Report as **Figure 11.3**.
(v) An environmental sensitivity map indicating environmental sensitive areas and features identified during the assessment process	A map showing the revised optimised layout overlain on the identified environmental sensitivities is included in this EIA Report as **Figure 11.3**.
(vi) map combining the final layout map superimposed (overlain) on the environmental sensitivity map.	A map showing the revised optimised layout overlain on the identified environmental sensitivities is included in this EIA Report as **Figure 11.3**.

DFFE Requirement for EIA	Response/Location in this EIA Report
(e) Cumulative Assessment (i) Should there be any other similar projects within a 30km radius of the proposed development site, the cumulative impact assessment for all identified and assessed impacts must be refined to indicate the following: » Identified cumulative impacts must be clearly defined, and where possible the size of the identified impact must be quantified and indicated, i.e., hectares of cumulatively transformed land. » Detailed process flow and proof must be provided, to indicate how the specialist's recommendations, mitigation measures and conclusions from the various similar developments in the area were taken into consideration in the assessment of cumulative impacts and when the conclusion and mitigation measures were drafted for this project. » The cumulative impacts significance rating must also inform the need and desirability of the proposed development. » A cumulative impact environmental statement on whether the proposed development must proceed.	Several renewable energy facilities within a 30km radius of the proposed development have been identified as detailed in **Chapter 10** of the EIA Report. An evaluation of potential cumulative impacts is included in **Chapter 10** of the EIA Report.
(f) Specialist assessments (i) The EAP must ensure that the terms of reference for all the identified specialist studies must include the following: » A detailed description of the study's methodology; indication of the locations and descriptions of the development footprint, and all other associated infrastructure that they have assessed and are recommending for authorisation. » Provide a detailed description of all limitations to the studies. All specialist studies must be conducted in the right season and providing that as a limitation will not be allowed. » Please note that the Department considers a 'no-go' area, as an area where no development of any infrastructure is allowed; therefore, no development of associated infrastructure including access roads is allowed in the 'no-go' areas. » Should the specialist definition of 'no-go' area differ from the Departments definition; this must be clearly indicated. The specialist must also indicate the 'no-go' area's buffer if applicable. » All specialist studies must be final, and provide detailed/practical mitigation measures for the preferred alternative and recommendations, and must not recommend further studies to be completed post EA.	» The identified specialist studies (**Appendix D to M**) include a detailed description of the methodology followed as well as an indication of the location and description of the development and all other associated infrastructure. » The specialist studies provide a detailed description of the limitations to the studies. » The Department's definition of 'no-go' area is noted and has been considered within this EIA Report. The 'no-go' areas identified by the specialists have been considered by the developer when designing the facility layout. » The specialist's definition of 'no-go' area is the same as that of the Department and various 'no-go' areas, including their associated buffer areas, have been recommended by the specialists and have been considered by the developer when designing the facility layout. » All specialist studies attached to this EIA Report (refer to **Appendix D – M** are final and provide detailed and practical mitigation measures and reommendations. » The mitigation and enhancement measures proposed by the specialists are included in **Chapters 9 and 10** of the EIA Report, as well as the project EMPrs which are attached as **Appendix O** to the EIA Report. » Several renewable energy facilities within a 30km radius of the proposed development have been identified as detailed in **Chapter 10** of the EIA Report. An

DFFE Requirement for EIA	Response/Location in this EIA Report
» Should a specialist recommend specific mitigation measures, these must be clearly indicated. » Regarding cumulative impacts: ∗ Clearly defined cumulative impacts and where possible the size of the identified impact must be quantified and indicated, i.e. hectares of cumulatively transformed land. ∗ A detailed process flow to indicate how the specialist's recommendations, mitigation measures and conclusions from the various similar developments in the area were taken into consideration in the assessment of cumulative impacts and when the conclusion and mitigation measures were drafted for this project. ∗ Identified cumulative impacts associated with the proposed development must be rated with the significance rating methodology used in the process. ∗ The significance rating must also inform the need and desirability of the proposed development. ∗ A cumulative impact environmental statement on whether the proposed development must proceed.	evaluation of potential cumulative impacts is included in **Chapter 10** of the EIA Report.
(ii) Should the appointed specialists specify contradicting recommendations, the EAP must clearly indicate the most reasonable recommendation and substantiate this with defendable reasons; and were necessary, include further expertise advice.	The appointed specialists do not specify contradicting recommendations.
(iii) Please include a table in the EIAr summarising the specialist studies required by the Screening Tool, a column indicating whether these studies were conducted or not, and a column with motivation for any studies not conducted.	**Table 7.6,** which is included under Section 7.5 of this EIA Report, details all the specialist studies required by the Screening Tool and a column indicating whether these studies were conducted or not.
(iv) It is further brought to your attention that Procedures for the Assessment and Minimum Criteria for Reporting on identified Environmental Themes in terms of Sections 24(5)(a) and (h) and 44 of the National Environmental Management Act, 1998, when applying for Environmental Authorisation, which were promulgated in Government Notice No. 320 of 20 March 2020 (i.e. "the Protocols"), and in Government Notice No. 1150 of 30 October 2020 (i.e. protocols for terrestrial plant and animal species), have come into effect. Should this study be required, the specialist assessments must be conducted in accordance with these protocols. Please note further that the Protocols require the specialists to be SACNASP registered.	The specialist studies have been conducted in accordance with Government Notice No. 320 of 20 March 2020 (i.e., "the protocols"), and Government Notice No. 1150 of 30 October 2020 (i.e., protocols for terrestrial plant and animal species). The report compilers/reviewers are registered with SACNASP.

DFFE Requirement for EIA	Response/Location in this EIA Report
(v) Please be reminded that section 2(3) of NEMA requires developments to be socially, environmentally, and economically sustainable, while section 2(4)(i) of NEMA requires the social, economic and environmental impacts of activities, including disadvantages and benefits, to be considered, assessed and evaluated.	Specialist studies that focus on the biophysical environment (terrestrial biodiversity, aquatic biodiversity, avifauna, bats) and the socio-economic environment have been undertaking as part of the S&EIA process for the proposed Ummbila Emoyeni Wind Energy Facility. This EIA Report considers and assesses the social, economic and environmental impacts of the proposed activity, including disadvantages and benefits, as documented within the specialist reports included as **Appendix D – M** to this EIA Report.
(vi) The following specialist assessments will form part of the EIAr: Specialist Study – Company Terrestrial Ecology (Fauna and Flora) – Gerhard Botha of Nkurenkuru Ecology and Biodiversity (Pty) Ltd Freshwater resources (including all waterbodies and wetlands) – Gerhard Botha of Nkurenkuru Ecology and Biodiversity (Pty) Ltd Bats – Jonathan Aronson of Camissa Avifauna – Owen Davies of Arcus Consulting Soils and Agricultural Potential – Ivan Baker/Andrew Husted of the Biodiversity Company Heritage (including Cultural Landscape, Archaeology and Palaeontology) – Jenna Lavin of CTS Heritage Visual – Jon Marshall of Environmental Planning & Design CC Noise – Morné de Jager of Enviro-Acoustic Research Traffic – Iris Wink of JG Afrika Socio-Economic – Pierre van Jaarsveld of Urban-Econ Development Economist (Pty) Ltd	All specialist assessments listed in the table form part of this EIA Report (refer to **Appendix D – M**).
(g) Environmental Management Programme (EMPr) (i) It is drawn to your attention that for substation infrastructure and overhead electricity transmission and distribution infrastructure, when such facilities trigger activity 11 or 47 of the Environmental Impact Assessment Regulations Listing Notice 1 of 2014, as amended, and any other listed and specified activities necessary for the realisation of such facilities, the generic Environmental Management Programme	The generic substation EMPr is included as **Appendix O2** to the EIA Report. Section C of the EMPr includes specific mitigation measures identified in the EIA Report and specialist reports.

DFFE Requirement for EIA	Response/Location in this EIA Report
(EMPr), contemplated in Regulations 19(4) must be used and submitted with the EIAr over and above the EMPr for the wind facility. Please ensure that any specific mitigation measures identified in the EIAr and specialist reports for the on-site substations are incorporated into the generic EMPr.	
(ii) Please ensure that the mitigation measures specified in the EIAr and specialist reports are also incorporated into the EMPr. In addition, ensure that the EMPr complies with the content of the EMPr in terms of Appendix 4 of the EIA Regulations, 2014, as amended.	The facility EMPr is included as **Appendix O1** to the EIA Report. The facility EMPr has been compiled in accordance with Appendix 4 of the EIA Regulations, 2014, as amended, an includes all mitigation measures specified in the EIA Report and specialist reports.
(iii) Please also include in the EMPr, a recommended frequency for the auditing of compliance with the conditions of the EA and EMPr, and for the submission of such compliance reports to the competent authority.	A monitoring programme for the construction phase is included under **Chapter 7, Section 7.4** of the facility EMPr attached as **Appendix O1** to the EIA Report. The monitoring programme includes details on the frequency of auditing of compliance with the conditions of the EA and EMPr and the frequency of submission of such compliance reports to the competent authority.
(iv) EMPr must include an environmental sensitivity map indicating environmental sensitive areas and features identified during the assessment process.	The environmental sensitivity map is attached as **Appendix A** to the facility EMPr which is included as **Appendix O1** to the EIA Report.
(v) A map combining the final layout map superimposed (overlain) on the environmental sensitivity map.	A map showing the layout overlain on environmental sensitivities is attached as **Appendix A** to the facility EMPr which is included as **Appendix O1** to the EIA Report.
(vi) EMPr must include measures to protect hydrological features such as streams, rivers, pans, wetlands, dams and their catchments, and other environmental sensitive areas from construction impacts including the direct or indirect spillage of pollutants.	Measures to protect hydrological features during construction are included under **Chapter 7, Objective** 7.
(vii) EMPr must include the following plans: » An alien invasive management plan to be implemented during construction and operation of the facility. The plan must include mitigation measures to reduce the invasion of alien species and ensure that the continuous monitoring and removal of alien species is undertaken. » A plant rescue and protection plan which allows for the maximum transplant of conservation important species from areas to be transformed. This plan must be compiled by a vegetation specialist familiar with the site and be implemented prior to commencement of the construction phase. » A post construction avifaunal monitoring plan to be implemented during the operational phase of the facility. This plan must be compiled by an avifaunal	» An alien invasive management plan is included as **Appendix C** to the facility EMPr. » A plant rescue and protection plan is included as **Appendix E** to the facility EMPr. » A post construction avifaunal monitoring plan to be implemented during the operational phase of the facility. This plan must be compiled by an avifaunal specialist familiar with the site and the plan must adhere to Birdlife's most recent avifaunal guideline. » The requirement to compie a post construction monitoring plan for implementation during the operational phase of the facility has been included as a mitigation measure in the facility EMPr (refer to **Chapter 6, Objective 2** of the facility EMPr). » A re-vegetation and habitat rehabilitation plan is included as **Appendix D** to the facility EMPr and will be implemented during the construciton and operational phases.

DFFE Requirement for EIA	Response/Location in this EIA Report
specialist familiar with the site and the plan must adhere to Birdlife's most recent avifaunal guideline. » A re-vegetation and habitat rehabilitation plan to be implemented during the construction and operation of the facility. Restoration must be undertaken as soon as possible after completion of construction activities to reduce the amount of habitat converted at any one time and to speed up the recovery to natural habitats. » An open space management plan to be implemented during the construction and operation of the facility. » A traffic management plan for the site access roads to ensure that no hazards would result from the increased truck traffic and that traffic flow would not be adversely impacted. This plan must include measures to minimize impacts on local commuters e.g. limiting construction vehicles travelling on public roadways during the morning and late afternoon commute time and avoid using roads through densely populated built-up areas so as not to disturb existing retail and commercial operations. » A transportation plan for the transport of components, main assembly cranes and other large pieces of equipment. » A storm water management plan to be implemented during the construction and operation of the facility. The plan must ensure compliance with applicable regulations and prevent off-site migration of contaminated storm water or increased soil erosion. The plan must include the construction of appropriate design measures that allow surface and subsurface movement of water along drainage lines so as not to impede natural surface and subsurface flows. Drainage measures must promote the dissipation of storm water run-off. » A fire management plan to be implemented during the construction and operation of the facility. » An erosion management plan for monitoring and rehabilitating erosion events associated with the facility. Appropriate erosion mitigation must form part of this plan to prevent and reduce the risk of any potential erosion. » An effective monitoring system to detect any leakage or spillage of all hazardous substances during their transportation, handling, use and storage. This must include precautionary measures to limit the possibility of oil and other toxic liquids from entering the soil or storm water systems.	» An open space management plan is included as **Appendix C** to the facility EMPr and will be implemented during the construction and operational phases. » A traffic management plan is included as **Appendix F** to the facility EMPr. » The requirement for a transportation plan is included in the facility EMPr under **Chapter 6, Objective 2**. » A stormwater management plan is included as **Appendix G** to the facility EMPr. » A fire management plan for implementation during the construction and operation of the facility is included as **Appendix I** to the facility EMPr. » An erosion management plan is included as **Appendix G** to the facility EMPr. » This comment is noted and has been included as a mitigation measure in the facility EMPr (refer to **Chapter 7, Objective 16 and Chapter 8, Objective** 7). » Measures to protect archaeological sites, artefcts and palaeontological fossils or graves during construction are included under **Chapter 7, Objective** 13 of the facility EMPr.

DFFE Requirement for EIA	Response/Location in this EIA Report
» Measures to protect archaeological sites, artefacts, paleontological fossils or graves from construction and operational impacts.	
(h) General (i) The EIAr must provide the technical details for the proposed facility in a table format as well as their description and/or dimensions.	The technical details of the proposed facility, in table format, are included under **Chapter 2** of the EIA Report (refer to **Table 2.2**).
(ii) Details of the future plans for the site and infrastructure after decommissioning in 20-30 years and the possibility of upgrading the proposed infrastructure to more advanced technologies must be indicated.	Details if the future plans for the site after decommissioning are included under **Chapter 2** of the EIA Report (refer to **Table 2.3**).
(iii) Should a Water Use License be required, proof of application for a license needs to be submitted.	The site considered for the establishment of the Ummbila Emoyeni Wind Energy Facility is associated with the presence of freshwater/drainage features. During the construction and operation phases, sewage may be collected and treated using septic or conservancy tanks, and water required for construction and operation may be sourced from boreholes. In the event that the flow of water in the freshwater/drainage features is affected and the bed, banks or course characteristics are altered, and should septic tanks be used, and water be abstracted from boreholes then a water use authorisation would be required. The process of applying for a WUL or GA registration will only be completed once a positive EA has been received and the project selected as Preferred Bidder under the REIPPPP or similar programme. This is in line with the requirements of DWS.
(iv) The EAP must provide landowner consent for all farm portions affected by the proposed project, whether the project component is linear or not, i.e., all farm portions where the access road, solar panels and associated infrastructure is to be located.	The landowner consents for the wind energy facility were included as an **Appendix 3** to the EA Application form submitted on **24 June 2022**.
(v) A construction and operational phase EMPr that includes mitigation and monitoring measures must be submitted with the final EIAr.	The EMPr for the wind energy facility is included as **Appendix O1** to the EIA Report. The generic substation EMPr is included as **Appendix O2** to the EIA Report. Both EMPrs include mitigation and monitoring measures for the construction and operational phases.
(vi) Please also ensure that the final EIAr includes the period for which the Environmental Authorisation is required and the date on which the activity will be concluded as per Appendix 3 of the NEMA EIA Regulations, 2014, as amended.	The EA is required for a period of 10 years as detailed under **Chapter 11**, **Section 11.6** of the EIA Report.

7.4 Overview of the EIA Phase

As per the EIA Regulations (GNR 326), the objectives of the EIA Phase are to, through a consultative process:

- Determine the policy and legislative context within which the activity is located and document how the proposed activity complies with and responds to the policy and legislative context.
- Describe the need and desirability of the proposed activity, including the need and desirability of the activity in the context of the development footprint on the approved site as contemplated in the accepted Scoping Report.
- Identify the location of the development footprint within the approved site as contemplated in the accepted Scoping Report based on an impact and risk assessment process inclusive of cumulative impacts and a ranking process focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects of the environment.
- Determine the:
  - Nature, significance, consequence, extent, duration and probability of the impacts occurring to inform identified preferred alternatives; and
  - Degree to which these impacts:
    - Can be reversed;
    - May cause irreplaceable loss of resources; and
    - Can be avoided, managed or mitigated.
- Identify the most ideal development footprint for the activity within the project site as contemplated in the accepted Scoping Report based on the lowest level of environmental sensitivity identified during the assessment.
- Identify, assess, and rank the impacts the activity will impose on the development footprint on the approved site as contemplated in the accepted Scoping Report through the life of the activity.
- Identify suitable measures to avoid, manage or mitigate identified impacts.
- Identify residual risks that need to be managed and monitored.

This EIA Report assesses potential positive and negative, direct, indirect, and cumulative impacts associated with all phases of the project life cycle including pre-construction, construction, operation and decommissioning. In this regard the EIA Report aims to provide the relevant authorities with sufficient information to make an informed decision regarding the proposed project.

The following subsections outline the activities within the EIA process that have been undertaken to date.

7.4.1 Authority Consultation and Application for Environmental Authorisation in terms of the 2014 EIA Regulations (as amended)

In terms of GNR 779 of 1 July 2016, the DFFE is the competent authority for all projects which relate to the IRP and any updates thereto. As the project is proposed within the Mpumalanga Province, the Mpumalanga DARDL&EA is the provincial commenting authority for the project. Consultation with these authorities, as well as other relevant Organs of State will continue throughout the Scoping Phase. To date, this consultation has included the following:

- Submission of the application for EA and the draft Scoping Report to the DFFE via the DFFE Novell Filr System on **13 May 2022**.
- Submission of the final Scoping Report on **24 June 2022**.

» Receipt of acceptance of the Scoping Report and approval of the Plan of Study for the EIA Phase on **03 August 2022**.

The following steps are to be undertaken as part of the EIA Phase of the process:

» Make the draft EIA Report available for a 30-day public review and comment period from **08 September 2022** to **10 October 2022**.
» Notification and consultation with stakeholders, I&APs and Organs of State that may have jurisdiction over the project, including provincial and local government departments, and State-Owned Enterprises.
» Incorporating comments received during the 30-day public review and comment period into the final EIA Report.
» Submission of the final EIA Report to DFFE for decision making.

The submissions, as listed above, were undertaken electronically, as required by the DFFE. A record of all authority correspondence undertaken during the Scoping Phase is included in **Appendix B**.

7.4.2 Public Participation Process

Public participation is an essential and regulatory requirement for an EIA process and is guided by Regulations 41 to 44 of the EIA Regulations 2014 (GNR 326), as amended. The purpose of public participation is clearly outlined in Regulation 40 of the EIA Regulations 2014 (GNR 326, as amended, and is being followed for this proposed project.

The sharing of information forms the basis of the public participation process and offers the opportunity for I&APs to become actively involved in the EIA Process from the outset. The public participation process is designed to provide sufficient and accessible information to I&APs in an objective manner. The public participation process affords I&APs opportunities to provide input into and receive information regarding the EIA process in the following ways:

During the **Scoping Phase**:
» Provide an opportunity to submit comments regarding the project.
» Assist in identifying reasonable and feasible alternatives, where required.
» Contribute relevant local information and knowledge to the environmental assessment.
» Allow registered I&APs to verify that their comments have been recorded, considered, and addressed, where applicable, in the environmental investigations.
» Foster trust and co-operation.
» Generate a sense of joint responsibility and ownership of the environment.
» Comment on the findings of the Scoping Phase results.
» Identify issues of concern and suggestions for enhanced benefits.

During the **EIA Phase**:
» Contribute relevant local information and knowledge to the environmental assessment.
» Verify that issues have been considered in the environmental investigations as far as possible as identified within the Scoping Phase.
» Comment on the findings of the environmental assessments.
» Attend a Focus Group Meeting to be conducted for the project.

During the **decision-making phase**:

» To advise I&APs of the outcome of the competent authority's decision, and how and by when the decision can be appealed.

The Public Participation process therefore aims to ensure that:

» Information containing all relevant facts in respect of the application is made available to potential stakeholders and I&APs for their review.
» The information presented during the public participation process is presented in such a manner, i.e., local language and technical issues, that it avoids the possible alienation of the public and prevents them from participating.
» Public participation is facilitated in such a manner that I&APs are provided with a reasonable opportunity to comment on the project.
» A variety of mechanisms are provided to I&APs to correspond and submit their comments i.e., fax, post, email, telephone, text message (SMS and WhatsApp).
» An adequate review period is provided for I&APs to comment on the findings of the Scoping and EIA Reports.

The following sections detail the tasks undertaken as part of the public participation process within the EIA Phase.

i. Advertisements and Notifications

The availability of the EIA Report for review and comment was announced to the Organs of State, potentially affected and adjacent landowners, tenants and occupiers, and the general public via the following:

» Notification letter distributed to all registered parties advising them of the availability of the EIA Report for review on comment on **08 September 2022.**
» An advertisement announcing the availability of and inviting comment on the EIA Report in the Ridge Times Newspaper (English advertisement) on **08 September 2022**. A copy of the newspaper advert as sent to the newspaper is included an **Appendix C2** of the EIA Report. The advert tear sheet is included in the final EIA Report as **Appendix C2**.
» The EIA Report is available for review and comment by I&APs for a 30-day period from **08 September 2022** to **10 October 2022**. The EIA Report is available on the Savannah Environmental website (https://savannahsa.com/public-documents/energy-generation/) and all registered I&APs have been notified of the availability on **08 September 2022**. I&APs will be encouraged to review the EIA Report and submit written comment. The EIA Report will be circulated to Organs of State via electronic transfer (Dropbox, WeTransfer, etc), or CD and/or hardcopy as per individual request. Evidence of distribution of the EIA Report is included in the final EIA Report as **Appendix C4** and **Appendix C5**.

ii. Public Involvement and Consultation

In order to accommodate the varying needs of stakeholders and I&APs within the surrounding area, as well as capture their views, comments, issues and concerns regarding the project, various opportunities will be provided to I&APs to note their comments and issues. I&APs have been consulted through the following means:

- Opportunity to review the EIA Report for a 30-day review and comment period from **08 September 2022** to **10 October 2022**.
- Comments received during this review period have been captured within a Comments and Responses Report (**Appendix C9**), which will be included within the final EIA Report.
- Focus group meetings: Virtual focus group meetings have been held with key government departments, stakeholders and landowners during the 30-day review and comment period of the EIA Report. The purpose of these focus group meetings was to provide an overview of the findings of the EIA studies in order to facilitate comments on the EIA process and EIA Report, as well as to record any issues or concerns raised by stakeholders regarding the project. A face-to-face public meeting with I&APs and an in-person focus group meeting with landowners has been held during the 30-day review and comment period of the EIA Report. The notes of these meetings are included in the final EIA Report as **Appendix C7**.
- Telephonic consultation sessions.
- Written, faxed or e-mail correspondence.

Table 7.4: Public involvement for the general waste disposal site during EIA Phase

Activity	Date
Advertising of the availability of the EIA Report for a 30-day review and comment period in the Ridge Times Newspaper (English advertisement).	08 September 2022
Distribution of notification letters announcing the availability of the EIA Report for a 30-day review and comment period. These letters were distributed to Organs of State, Government Departments, Ward Councillors, landowners within the surrounding area (including neighbouring landowners), registered I&APs and key stakeholder groups.	08 September 2022
30-day review and comment period of the EIA Report.	08 September 2022 to 10 October 2022
Virtual meetings through the use of virtual platforms as determined through discussions with the relevant stakeholder group: » Landowners » Authorities and key stakeholders (including Organs of State, local municipality and official representatives of community-based organisations). » Where an I&AP does not have access to a computer and/or internet to participate in a virtual meeting telephonic discussions (including WhatsApp video call) will be set-up and minuted for inclusion. The preferred language of the I&AP has been considered when setting up these discussions. Direct in-person consultation will only take place upon request or where deemed necessary.	Focus group meetings have been held during the EIA Phase as follows: » Landowner meeting at Oppi-Plaas near Morgenzon on 05 October 2022 Virtual Key Stakeholder Workshop held on 07 October 2022
On-going consultation (i.e., telephone liaison; e-mail communication) with all I&APs.	Throughout the EIA process

iii. Registered I&APs entitled to Comment on the EIA Report

43.(1) A registered I&AP is entitled to comment, in writing, on all reports or plans submitted to such party during the public participation process contemplated in these Regulations and to bring to the attention of the proponent or applicant any issues which that party believes may be of significance to the consideration of the application, provided that the interested and affected party discloses any direct business, financial, personal or other interest which that party may have in the approval or refusal of the application.

(2) In order to give effect to section 24O of the Act, any State department that administers a law relating to a matter affecting the environment must be requested, subject to regulation 7(2), to comment within 30 days.

44.(1) The applicant must ensure that the comments of interested and affected parties are recorded in reports and plans and that such written comments, including responses to such comments and records of meetings, are attached to the reports and plans that are submitted to the competent authority in terms of these Regulations.

(2) Where a person desires but is unable to access written comments as contemplated in subregulation (1) due to –

(a) A lack of skills to read or write;

(b) Disability; or

(c) Any other disadvantage;

Reasonable alternative methods of recording comments must be provided for.

I&APs registered on the database have been notified by means of a notification letter of the release of the EIA Report for a 30-day review and comment period, invited to provide comment on the EIA Report, and informed of the manner in which, and timeframe within which such comment must be made. The report was available in soft copies to I&APs. Hard copies of the report were available on request.

The EIA Report was available on the Savannah Environmental website (i.e., online stakeholder engagement platform) (https://savannahsa.com/public-documents/energy-generation/). A notification letter to all registered parties was distributed on **Thursday, 08 September 2022**. Where I&APs were not able to provide written comments (including SMS and WhatsApp), other means of consultation, such as telephonic discussions and face-to-face discussions have been used.

All comments raised as part of the discussions and written comments submitted during the 30-day review and comment period have been recorded and are included in **Appendix C7 and C8** of the EIA Report.

iv. Identification and Recording of Comments

Comments raised by I&APs to date have been included into a Comments and Responses (C&R) Report, which is included in **Appendix C9** of this EIA Report. The C&R Report includes detailed responses from members of the EIA project team and/or the project proponent to the issues and comments raised.

Notes of all the telephonic discussions, virtual meetings, and face-to-face meetings conducted during the 30-day review and comment period of the EIA Report are included in **Appendix C7** of the Final EIA Report.

7.5 Outcome of the DFFE Web-Based Screening Tool

In terms of GNR 960 (promulgated on 5 July 2019) and Regulation 16(1)(b)(v) of the 2014 EIA Regulations (as amended), the submission of a Screening Report generated from the national web based environmental screening tool is compulsory for the submission of applications in terms of Regulations 19 and 21 of the EIA Regulations.

The requirement for the submission of a Screening Report (included as **Appendix Q** of the Scoping Report) for the Ummbila Emoyeni Wind Energy Facility is applicable as it triggers Regulations 19 and 21 of the EIA Regulations, 2014, as amended. **Table 7.6** provides a summary of the specialist assessments identified in terms of the screening tool and responses to each assessment from the project team considering the project site under consideration.

Table 7.6: Sensitivity ratings from the DFFE's web-based online Screening Tool associated with the development of the Ummbila Emoyeni Wind Energy Facility

Environmental Theme/Specialist Assessment	Sensitivity Rating as per the Screening Tool (relating to the need for the study)	Project Team Response
Agriculture	High	A Soils and Agricultural Potential Impact Assessment is included in this EIA Report as **Appendix H**.
Animal Species	High	A Terrestrial Ecology Impact Assessment (including fauna) has been undertaken for the wind farm and is included as **Appendix D** of the EIA Report.
Bats	High	A Bat Impact Assessment has been undertaken for the wind farm and is included as **Appendix G** of the EIA Report. 12 months pre-construction monitoring as per the South African Bat Assessment Association Best Practice Guidelines for pre-construction monitoring of Bats at Wind Energy Facilities has been completed and has informed the assessment of impacts.
Landscape (Wind)	Very High	A Visual Impact Assessment has been undertaken for the wind farm and is included in this EIA Report as **Appendix K.**
Archaeological and Cultural Heritage	Low	A full Heritage Impact Assessment (including an assessment of archaeological heritage resources and the cultural landscape) has been undertaken for the wind farm and is included in this EIA Report as **Appendix I**.
Palaeontology	Very High	A full Heritage Impact Assessment (including an assessment of palaeontological heritage resources) has been undertaken for the wind farm and is included in this EIA Report as **Appendix I**.
Terrestrial Biodiversity	Very High	A Terrestrial Ecology Impact Assessment has been undertaken for the wind farm and is included as **Appendix D** of the EIA Report.
Aquatic Biodiversity	Very High	A Freshwater Impact Assessment has been undertaken for the wind farm and is included as **Appendix E** of the EIA Report.
Avian	Low	An Avifauna Impact Assessment has been undertaken for the wind farm and included as **Appendix F** of the EIA Report. 12-months pre-construction monitoring as per the BirdLife SA Best Practice Guidelines has been completed and and has informed the assessment of impacts.
Civil Aviation	High	The Civil Aviation Authority (CAA) and Air Traffic Navigation Services (ATNS) has been consulted in the scoping phase and will be consulted within the EIA phase of the process to obtain input and details of any requirements for further studies.
Defence	Low	The project site is not located within close proximity of any military base.
RFI (Wind)	Very High	The project site under consideration for the development of the Ummbila Emoyeni Wind Energy Facility is located within an area that is classified as having very high sensitivity for telecommunication given its location within 5km of a Sentech High Power Terrestrial Broadcasting Facility, within

Environmental Theme/Specialist Assessment	Sensitivity Rating as per the Screening Tool (relating to the need for the study)	Project Team Response
		1km of a telecommunication facility, and between 30 and 60km from a weather installation and within the radar's line of site. SENTECH and South African Weather Services will be consulted during the 30-day review and comment period of the EIA Report to provide written comment on the proposed development.
Noise	Very High	A Noise Impact Assessment has been undertaken for the wind farm and is included as **Appendix J** of the EIA Report.
Relative Flicker	Very High	A Visual Impact Assessment has been undertaken for the wind farm and is included in this EIA Report as **Appendix K.** The impact of shadow flicker associated with the development has been evaluated in the Visual Impact Assessment.
Plant Species	Medium	A Terrestrial Ecology Impact Assessment (including flora) has been undertaken for the Ummbila Emoyeni Wind Energy Facility and is included as **Appendix D** of the EIA Report.
Traffic Assessment	The screening report does not indicate a rating for this theme.	A Traffic Impact Assessment has been undertaken for the wind farm and is included as **Appendix M** of the EIA Report.
Socio-Economic Assessment	The screening report does not indicate a rating for this theme.	A Socio-Economic Impact Assessment has been undertaken and is included in the EIA Report as **Appendix L**.

7.6 Assessment of Issues Identified throughout the EIA Process

Based on the outcomes of the Scoping Phase evaluation of the project, the following studies were identified as requiring detailed assessment, The specialist consultants involved in the assessment of these impacts are indicated in **Table 7.7** below.

Table 7.7: Specialist studies undertaken as part of the EIA Phase

Specialist	Specialist Study	Appendix
Gerhard Botha of Nkurenkuru Ecology and Biodiversity (Pty) Ltd	Terrestrial Ecology Impact Assessment	Appendix D
	Freshwater Impact Assessment	Appendix E
Owen Davies of Arcus Consulting	Avifauna Impact Assessment	Appendix F
Jonathan Aronson of Camissa	Bat Impact Assessment	Appendix G
Matthew Mamera and Andrew Husted of the Biodiversity Company	Soils and Agricultural Potential Impact Assessment	Appendix H
Jenna Lavin of CTS Heritage	Heritage Impact Assessment (including Archaeology Palaeontology and Cultural Heritage)	Appendix I
Morné de Jager of Enviro-Acoustic Research	Noise Impact Assessment	Appendix J
Jon Marshall of Environmental Planning & Design CC	Visual Impact Assessment	Appendix K
Pierre van Jaarsveld of Urban-Econ Development Economist (Pty) Ltd	Socio- Economic Impact Assessment	Appendix L

Specialist	Specialist Study	Appendix
Iris Wink of JG Afrika	Traffic Impact Assessment	Appendix M

Specialist studies considered direct and indirect environmental impacts associated with the development of all components of the facility. Identified impacts are assessed in terms of the following criteria:

- The **nature**, a description of what causes the effect, what will be affected, and how it will be affected
- The **extent**, wherein it is indicated whether the impact will be local (limited to the immediate area or site of development), regional, national or international. A score of between 1 and 5 is assigned as appropriate (with a score of 1 being low and a score of 5 being high)
- The **duration**, wherein it is indicated whether:
  - The lifetime of the impact will be of a very short duration (0–1 years) – assigned a score of 1
  - The lifetime of the impact will be of a short duration (2-5 years) - assigned a score of 2
  - Medium-term (5–15 years) – assigned a score of 3
  - Long term (> 15 years) - assigned a score of 4
  - Permanent - assigned a score of 5
- The **magnitude**, quantified on a scale from 0-10, where a score is assigned:
  - 0 is small and will have no effect on the environment
  - 2 is minor and will not result in an impact on processes
  - 4 is low and will cause a slight impact on processes
  - 6 is moderate and will result in processes continuing but in a modified way
  - 8 is high (processes are altered to the extent that they temporarily cease)
  - 10 is very high and results in complete destruction of patterns and permanent cessation of processes
- The **probability of occurrence**, which describes the likelihood of the impact actually occurring. Probability is estimated on a scale, and a score assigned:
  - Assigned a score of 1–5, where 1 is very improbable (probably will not happen)
  - Assigned a score of 2 is improbable (some possibility, but low likelihood)
  - Assigned a score of 3 is probable (distinct possibility)
  - Assigned a score of 4 is highly probable (most likely)
  - Assigned a score of 5 is definite (impact will occur regardless of any prevention measures)
- The **significance**, which is determined through a synthesis of the characteristics described above (refer formula below) and can be assessed as low, medium or high
- The **status**, which is described as either positive, negative or neutral
- The degree to which the impact can be reversed
- The degree to which the impact may cause irreplaceable loss of resources
- The degree to which the impact can be mitigated

The **significance** is determined by combining the criteria in the following formula:
S = (E+D+M) P; where

S = Significance weighting
E = Extent
D = Duration
M = Magnitude
P = Probability

The **significance weightings** for each potential impact are as follows:

- **< 30 points:** Low (i.e. where this impact would not have a direct influence on the decision to develop in the area)
- **30-60 points:** Medium (i.e. where the impact could influence the decision to develop in the area unless it is effectively mitigated)
- **60 points:** High (i.e. where the impact must have an influence on the decision process to develop in the area)

Specialist studies also considered cumulative impacts associated with similar developments within the broader project site. The purpose of the cumulative assessment is to test if such impacts are relevant to the proposed project in the proposed location (i.e., whether the addition of the proposed project in the area will increase the impact). In this regard, specialist studies considered whether the construction of the proposed development will result in:

- Unacceptable risk
- Unacceptable loss
- Complete or whole-scale changes to the environment or sense of place
- Unacceptable increase in impact

A conclusion regarding whether the proposed development will result in any unacceptable loss or impact considering all the projects proposed in the area is included in the respective specialist reports.

As the project developer has the responsibility to avoid or minimise impacts and plan for their management (in terms of the requirements of NEMA and the 2014 EIA Regulations, as amended (GNR 326)), the mitigation of significant impacts is discussed. Assessment of impacts with mitigation is made in order to demonstrate the effectiveness of the proposed mitigation measures. A facility EMPr and a generic substation EMPr that include all the mitigation measures recommended by the specialists for the management of significant impacts are included as **Appendix O1 and O2** to this EIA Report. A generic overhead line EMPr is not required since the internal cables will be laid underground, and will have a capacity of up to 33kV and therefore do not trigger any listed activities in terms of the NEMA 2014 EIA Regulations, as amended.

7.7 Assumptions and Limitation of the EIA Process

The following assumptions and limitations are applicable to the EIA process for the Ummbila Emoyeni Wind Energy Facility:

- All information provided by the developer and I&APs to the environmental team was correct and valid at the time it was provided.
- The project site identified by the developer represents a technically suitable site for the establishment of a wind farm, which is based on the design undertaken by technical consultants for the project.
- The development footprint (the area that will be affected during the operation phase) will include the footprint for the wind farm and associated infrastructure (i.e., internal access roads, and grid connection infrastructure).
- Conclusions of the specialist studies undertaken, and this overall impact assessment assume that any potential impacts on the environment associated with the proposed development will be avoided, mitigated, or offset in accordance with the relevant recommendations made.

» This report and its investigations are project specific, and consequently the environmental team did not evaluate any other power generation alternatives.

Refer to the specialist studies contained in **Appendices D - M** for limitations specific to the independent specialist studies.

7.8 Legislation and Guidelines that have informed the preparing of this Scoping Report

The following legislation and guidelines have informed the scope and content of this Scoping Report:

» National Environmental Management Act (Act No. 107 of 1998).
» EIA Regulations of December 2014, published under Chapter 5 of NEMA (as amended).
» Department of Environmental Affairs (2017), Public Participation guidelines in terms of NEMA EIA Regulations.
» Department of Environmental Affairs (2017), Integrated Environmental Management Guideline: Guideline on Need and Desirability.
» Procedures for the assessment and minimum criteria for reporting on identified environmental themes in terms of sections 24(5)(a) and (h) and 44 of the National Environmental Management Act, 1998, when applying for environmental authorisation; and
» International guidelines – the Equator Principles, the IFC Performance Standards, the Sustainable Development Goals, World Bank Environmental and Social Framework, and the and World Bank Group Environmental, Health, and Safety Guidelines (EHS Guidelines).

Several other Acts, standards or guidelines have also informed the project process and the scope of issues addressed and assessed in this Scoping Report. A review of legislative requirements applicable to the proposed project as identified at this stage in the process is provided in **Table 7.8**.

Table 7.8: Relevant legislative permitting requirements applicable to the Ummbila Emoyeni Wind Energy Facility

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
National Legislation			
Constitution of the Republic of South Africa (No. 108 of 1996)	In terms of Section 24, the State has an obligation to give effect to the environmental right. The environmental right states that: "*Everyone has the right –* » *To an environment that is not harmful to their health or well-being, and* » *To have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that:* ∗ *Prevent pollution and ecological degradation,* ∗ *Promote conservation, and* ∗ *Secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development*."	Applicable to all authorities	There are no permitting requirements associated with this Act. The application of the Environmental Right however implies that environmental impacts associated with proposed developments are considered separately and cumulatively. It is also important to note that the "right to an environment clause" includes the notion that justifiable economic and social development should be promoted, through the use of natural resources and ecologically sustainable development.
National Environmental Management Act (No. 107 of 1998) (NEMA)	The 2014 EIA Regulations have been promulgated in terms of Chapter 5 of NEMA. Listed activities which may not commence without EA are identified within the Listing Notices (GNR 327, GNR 325 and GNR 324) which form part of these Regulations (GNR 326). In terms of Section 24(1) of NEMA, the potential impact on the environment associated with these listed activities must be assessed and reported on to the competent authority charged by NEMA with granting of the relevant environmental authorisation. Considering the capacity of the proposed Ummbila Emoyeni Wind Energy Facility (i.e., contracted capacity of 900MW) and the triggering of Activity 1 of Listing Notice 2	DFFE – Competent Authority Mpumalanga DARDL&EA – Commenting Authority	The listed activities triggered by the proposed project have been identified and are being assessed as part of the EIA process currently underway for the project. The EIA process will culminate in the submission of a Final EIA Report to the DFFE for decision-making.

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
	(GNR 325), a full Scoping and EIA process is required in support of the Application for EA.		
National Environmental Management Act (No 107 of 1998) (NEMA)	In terms of the "Duty of Care and Remediation of Environmental Damage" provision in Section 28(1) of NEMA every person who causes, has caused or may cause significant pollution or degradation of the environment must take reasonable measures to prevent such pollution or degradation from occurring, continuing or recurring, or, in so far as such harm to the environment is authorised by law or cannot reasonably be avoided or stopped, to minimise and rectify such pollution or degradation of the environment. In terms of NEMA, it is the legal duty of a project proponent to consider a project holistically, and to consider the cumulative effect of a variety of impacts.	DFFE Mpumalanga DARDL&EA	While no permitting or licensing requirements arise directly by virtue of the proposed project, this section finds application through the consideration of potential cumulative, direct, and indirect impacts. It will continue to apply throughout the life cycle of the project.
Environment Conservation Act (No. 73 of 1989) (ECA)	The Noise Control Regulations in terms of Section 25 of the ECA contain regulations applicable for the control of noise in the Provinces of Limpopo, North-West, Mpumalanga, Northern Cape, Eastern Cape, and KwaZulu-Natal Provinces. The Noise Control Regulations cover the powers of a local authority, general prohibitions, prohibitions of disturbing noise, prohibitions of noise nuisance, use of measuring instruments, exemptions, attachments, and penalties. In terms of the Noise Control Regulations, no person shall make, produce, or cause a disturbing noise, or allow it to be made, produced or caused by any person, machine, device or apparatus or any combination thereof (Regulation 04).	DFFE Mpumalanga DARDL&EA Govan Mbeki Local Municipality Lekwa Local Municipality Msukaliawa Local Municipality	Noise impacts are expected to be associated with the construction and operation phases of the project. A Noise Impact Assessment (**Appendix J**) has been undertaken for the Ummbila Emoyeni Wind Energy Facility which indicates that the significance of the potential noise impacts would be: » of a **low significance** for the daytime construction of the access roads; » of a **low significance** for the daytime construction traffic passing noise sensitive receptors; » of a **low significance** for the daytime construction activities (hard standing areas, excavation and concreting of

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
			foundations and the erection of the wind turbines and other infrastructure); » of a **medium significance** for the night-time construction activities. Mitigation is available to reduce the significance of the noise impact to **low**; » of a **medium significance** for daytime operational activities (noises from wind turbines) when considering the worst-case SPL, with mitigation available to reduce the significance of the daytime noise impact to **low**; » of a **high significance** for night-time operational activities (noises from wind turbines) when considering the worst-case SPL, with mitigation available to reduce the significance of the night-time noise impact to **low**; and » of a **high significance** for night-time operational activities (noises from wind turbines) when considering the reported SPL, with mitigation available to reduce the significance of the night-time noise impact to **low**. Most of the higher significance ratings relate to the potential noise impact on noise sensitive receptors in close proximity to the wind turbines. Because the total projected noise levels will exceed the rural rating levels, with the projected noise level exceeding 42 dBA, active noise monitoring is recommended during the operation phase.

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
			No permits are required in this regard in terms of this Act. Any applicable by-laws would however be required to be complied with.
National Water Act (No. 36 of 1998) (NWA)	A water use listed under Section 21 of the NWA must be licensed with the Regional DWS, unless it is listed in Schedule 1 of the NWA (i.e. is an existing lawful use), is permissible under a GA, or if a responsible authority waives the need for a licence. Water use is defined broadly, and includes consumptive and non-consumptive water uses, taking and storing water, activities which reduce stream flow, waste discharges and disposals, controlled activities (activities which impact detrimentally on a water resource), altering a watercourse, removing water found underground for certain purposes, and recreation. Consumptive water uses may include taking water from a water resource (Section 21(a)) and storing water (Section 21(b)). Non-consumptive water uses may include impeding or diverting of flow in a water course (Section 21(c)), and altering of bed, banks or characteristics of a watercourse (Section 21(i)).	Regional Department of Water and Sanitation	Freshwater/drainage features are present within the project site of the Ummbila Emoyeni Wind Energy Facility as identified in the Freshwater Impact Assessment (**Appendix E**). As a result, a water use authorisation for the project will be required from the DWS; however, the process will only be completed once a positive EA has been received and the project selected as Preferred Bidder by the DMRE's REIPPP Programme or a similar private off-taker programme. This is in line with the requirements from the DWS.
Minerals and Petroleum Resources Development Act (No. 28 of 2002) (MPRDA)	In accordance with the provisions of the MPRDA a mining permit is required in accordance with Section 27(6) of the Act where a mineral in question is to be mined, including the mining of materials from a borrow pit.	Department of Mineral Resources and Energy (DMRE)	Any person who wishes to apply for a mining permit in accordance with Section 27(6) must simultaneously apply for an EA in terms of NEMA. No borrow pits are expected to be required for the construction of the project, and as a result a mining permit or EA in this regard is not required to be obtained.

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
	Section 53 of the MPRDA states that any person who intends to use the surface of any land in any way which may be contrary to any object of the Act, or which is likely to impede any such object must apply to the Minister for approval in the prescribed manner.		In terms of Section 53 of the MPRDA, approval is required from the Minister of Mineral Resources and Energy to ensure that the proposed development does not sterilise a mineral resource that might occur on site.
National Environmental Management: Air Quality Act (No. 39 of 2004) (NEM:AQA)	The National Dust Control Regulations (GNR 827) published under Section 32 of NEM:AQA prescribe the general measures for the control of dust in all areas, and provide a standard for acceptable dustfall rates for residential and non-residential areas. In accordance with the Regulations (GNR 827) any person who conducts any activity in such a way as to give rise to dust in quantities and concentrations that may exceed the dustfall standard set out in Regulation 03 must, upon receipt of a notice from the air quality officer, implement a dustfall monitoring programme. Any person who has exceeded the dustfall standard set out in Regulation 03 must, within three months after submission of the dustfall monitoring report, develop and submit a dust management plan to the air quality officer for approval.	Mpumalanga DARDL&EA / Gert Sibande District Municipality	In the event that the project results in the generation of excessive levels of dust, the possibility could exist that a dustfall monitoring programme would be required for the project, in which case dustfall monitoring results from the dustfall monitoring programme would need to be included in a dust monitoring report, and a dust management plan would need to be developed.
National Heritage Resources Act (No. 25 of 1999) (NHRA)	Section 07 of the NHRA stipulates assessment criteria and categories of heritage resources according to their significance. Section 35 of the NHRA provides for the protection of all archaeological and palaeontological sites, and meteorites. Section 36 of the NHRA provides for the conservation and care of cemeteries and graves by SAHRA where this is not the responsibility of any other authority.	South African Heritage Resources Agency (SAHRA) Mpumalanga Provincial Heritage Resources Authority – provincial heritage authority	A full Heritage Impact Assessment has been undertaken as part of the EIA process (refer to **Appendix I** of the EIA Report). According to the Heritage Impact Assessment, even though the area is rich in history, no significant archaeological heritage resources were identified during the field assessment. No Stone Age or Iron Age heritage resources were identified during the survey. The few heritage resources that were identified

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
	Section 38 of the NHRA lists activities which require developers or any person who intends to undertake a listed activity to notify the responsible heritage resources authority and furnish it with details regarding the location, nature, and extent of the proposed development. Section 44 of the NHRA requires the compilation of a Conservation Management Plan as well as a permit from SAHRA for the presentation of archaeological sites as part of tourism attraction.		consist of the ruins of older farm structures and kraals. The field assessment identified six burial grounds or graves close to or within the proposed development footprints of turbines and roads. All graves are of high local significance as a result of their social and cultural value. Should a heritage resource be impacted upon, a permit may be required from SAHRA or the Mpumalanga Provincial Heritage Resources Authority in accordance with Section 48 of the NHRA, and the SAHRA Permit Regulations (GNR 668).
National Environmental Management: Biodiversity Act (No. 10 of 2004) (NEM:BA)	Section 53 of NEM:BA provides for the MEC / Minister to identify any process or activity in such a listed ecosystem as a threatening process. Three government notices have been published in terms of Section 56(1) of NEM:BA as follows: » Commencement of TOPS Regulations, 2007 (GNR 150). » Lists of critically endangered, vulnerable and protected species (GNR 151). » TOPS Regulations (GNR 152). It provides for listing threatened or protected ecosystems, in one of four categories: critically endangered (CR), endangered (EN), and vulnerable (VU) or protected. The first national list of threatened terrestrial ecosystems has been gazetted, together with supporting information on the listing process including the purpose and rationale for listing	DFFE Mpumalanga DARDL&EA	Under NEM:BA, a permit would be required for any activity that is of a nature that may negatively impact on the survival of a listed protected species. A Terrestrial Ecology Impact Assessment has been undertaken as part of the EIA process. Ground truthing confirmed 6 Species of Conservation Concern to be present within the study area (refer to Appendix D). These were exclusively protected species from a provincial perspective, and none of them are Red List species. No species listed under NEM:BA were identified. Should any species be affected by the project, a permit would be required to be obtained.

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
	ecosystems, the criteria used to identify listed ecosystems, the implications of listing ecosystems, and summary statistics and national maps of listed ecosystems (NEM:BA: National list of ecosystems that are threatened and in need of protection, (Government Gazette 37596, GNR 324), 29 April 2014).		
National Environmental Management: Biodiversity Act (No. 10 of 2004) (NEM:BA)	Chapter 5 of NEM:BA pertains to alien and invasive species, and states that a person may not carry out a restricted activity involving a specimen of an alien species without a permit issued in terms of Chapter 7 of NEM:BA, and that a permit may only be issued after a prescribed assessment of risks and potential impacts on biodiversity is carried out. Applicable, and exempted alien and invasive species are contained within the Alien and Invasive Species List (GNR 864).	DFFE Mpumalanga DARDL&EA	A Terrestrial Ecology Impact Assessment has been undertaken as part of the EIA process to identify the presence of any alien and invasive species present on site. A total of 40 alien plant species were found within the study area, 11 of which were NEM:BA listed invasive species (refer to Appendix D).
Conservation of Agricultural Resources Act (No. 43 of 1983) (CARA)	Section 05 of CARA provides for the prohibition of the spreading of weeds. Regulation 15 of GN R1048 published under CARA provides for the classification of categories of weeds and invader plants, and restrictions in terms of where these species may occur. Regulation 15E of GN R1048 published under CARA provides requirement and methods to implement control measures for different categories of alien and invasive plant species.	Department of Agriculture, Land Reform and Rural Development (DALRD)	CARA will find application throughout the life cycle of the project. In this regard, soil erosion prevention and soil conservation strategies need to be developed and implemented. In addition, a weed control and management plan must be implemented. In terms of Regulation 15E (GN R1048) where Category 1, 2 or 3 plants occur a land user is required to control such plants by means of one or more of the following methods: » Uprooting, felling, cutting or burning. » Treatment with a weed killer that is registered for use in connection with such plants in accordance with the directions for the use of such a weed killer.

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
			» Biological control carried out in accordance with the stipulations of the Agricultural Pests Act (No. 36 of 1983), the ECA and any other applicable legislation. » Any other method of treatment recognised by the executive officer that has as its object the control of plants concerned, subject to the provisions of sub-regulation 4. » A combination of one or more of the methods prescribed, save that biological control reserves and areas where biological control agents are effective shall not be disturbed by other control methods to the extent that the agents are destroyed or become ineffective.
National Forests Act (No. 84 of 1998) (NFA)	According to this Act, the Minister may declare a tree, group of trees, woodland or a species of trees as protected. Notice of the List of Protected Tree Species under the National Forests Act (No. 84 of 1998) was published in GNR 734. The prohibitions provide that "no person may cut, damage, disturb, destroy or remove any protected tree, or collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree, except under a licence granted by the Minister".	Department of Agriculture, Land Reform and Rural Development (DALRD)	A licence is required for the removal of protected trees. It is therefore necessary to conduct a survey that will determine the number and relevant details pertaining to protected tree species present in the development footprint for the submission of relevant permits to authorities prior to the disturbance of these individuals. A Terrestrial Ecology Impact Assessment has been undertaken as part of the EIA process to identify the presence of any protected trees present on site which will require a permit. No protected tree species were identified. Should any species be affected by the project, a permit would be required to be obtained.

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
National Veld and Forest Fire Act (No. 101 of 1998) (NVFFA)	Chapter 4 of the NVFFA places a duty on owners to prepare and maintain firebreaks, the procedure in this regard, and the role of adjoining owners and the fire protection association. Provision is also made for the making of firebreaks on the international boundary of the Republic of South Africa. The applicant must ensure that firebreaks are wide and long enough to have a reasonable chance of preventing a veldfire from spreading to or from neighbouring land, it does not cause soil erosion, and it is reasonably free of inflammable material capable of carrying a veldfire across it. Chapter 5 of the Act places a duty on all owners to acquire equipment and have available personnel to fight fires. Every owner on whose land a veldfire may start or burn or from whose land it may spread must have such equipment, protective clothing and trained personnel for extinguishing fires, and ensure that in his or her absence responsible persons are present on or near his or her land who, in the event of fire, will extinguish the fire or assist in doing so, and take all reasonable steps to alert the owners of adjoining land and the relevant fire protection association, if any.	DFFE	While no permitting or licensing requirements arise from this legislation, this Act will be applicable during the construction and operation of the Ummbila Emoyeni Wind Energy Facility, in terms of the preparation and maintenance of firebreaks, and the need to provide appropriate equipment and trained personnel for firefighting purposes.
Hazardous Substances Act (No. 15 of 1973) (HAS)	This Act regulates the control of substances that may cause injury, or ill health, or death due to their toxic, corrosive, irritant, strongly sensitising or inflammable nature or the generation of pressure thereby in certain instances and for the control of certain electronic products. To provide for the rating of such substances or products in relation to the degree of danger, to provide for the prohibition and control of the importation, manufacture, sale, use, operation, modification, disposal or dumping of such substances and products.	Department of Health (DoH)	It is necessary to identify and list all Group I, II, III, and IV hazardous substances that may be on site and in what operational context they are used, stored or handled. If applicable, a license would be required to be obtained from the DoH.

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
	» Group I and II: Any substance or mixture of a substance that might by reason of its toxic, corrosive etc., nature or because it generates pressure through decomposition, heat or other means, cause extreme risk of injury etc., can be declared as Group I or Group II substance » Group IV: any electronic product, and » Group V: any radioactive material. The use, conveyance, or storage of any hazardous substance (such as distillate fuel) is prohibited without an appropriate license being in force.		
National Environmental Management: Waste Act (No. 59 of 2008) (NEM:WA)	The Minister may by notice in the Gazette publish a list of waste management activities that have, or are likely to have, a detrimental effect on the environment. The Minister may amend the list by – » Adding other waste management activities to the list. » Removing waste management activities from the list. » Making other changes to the particulars on the list. In terms of the Regulations published in terms of NEM:WA (GNR 912), a BA or EIA is required to be undertaken for identified listed activities. Any person who stores waste must at least take steps, unless otherwise provided by this Act, to ensure that: » The containers in which any waste is stored, are intact and not corroded or in » Any other way rendered unlit for the safe storage of waste. » Adequate measures are taken to prevent accidental spillage or leaking.	DFFE – Hazardous Waste Mpumalanga DARDL&EA – General Waste	No waste listed activities are triggered by the Ummbila Emoyeni Wind Energy Facility, therefore, no Waste Management License is required to be obtained. General and hazardous waste handling, storage and disposal will be required during construction and operation. The National Norms and Standards for the Storage of Waste (GNR 926) published under Section 7(1)(c) of NEM:WA will need to be considered in this regard.

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
	» The waste cannot be blown away. » Nuisances such as odour, visual impacts and breeding of vectors do not arise, and » Pollution of the environment and harm to health are prevented.		
National Road Traffic Act (No. 93 of 1996) (NRTA)	The technical recommendations for highways (TRH 11): "Draft Guidelines for Granting of Exemption Permits for the Conveyance of Abnormal Loads and for other Events on Public Roads" outline the rules and conditions which apply to the transport of abnormal loads and vehicles on public roads and the detailed procedures to be followed in applying for exemption permits are described and discussed. Legal axle load limits and the restrictions imposed on abnormally heavy loads are discussed in relation to the damaging effect on road pavements, bridges, and culverts. The general conditions, limitations, and escort requirements for abnormally dimensioned loads and vehicles are also discussed and reference is made to speed restrictions, power/mass ratio, mass distribution, and general operating conditions for abnormal loads and vehicles. Provision is also made for the granting of permits for all other exemptions from the requirements of the National Road Traffic Act and the relevant Regulations.	South African National Roads Agency (SANRAL) – national roads Mpumalanga Department of Public Works, Roads and Transport	An abnormal load / vehicle permit may be required to transport the various components to site for construction. These include route clearances and permits required for vehicles carrying abnormally heavy or abnormally dimensioned loads and transport vehicles exceeding the dimensional limitations (length) of 22m. Depending on the trailer configuration and height when loaded, some of the on-site substation and BESS components may not meet specified dimensional limitations (height and width) which will require a permit.
Provincial Policies / Legislation			
The Mpumalanga Nature Conservation Act (Act 10 of 1998)	This Act makes provision with respect to nature conservation in the Mpumalanga province. It provides for, among other things, protection of wildlife, hunting, fisheries, protection of endangered fauna and flora as listed in the Convention on international Trade in Endangered Species of Wild Fauna	Mpumalanga DARDL&EA	A collection/destruction permit must be obtained from Mpumalanga DARDL&EA for the removal of any protected plant or animal species found on site.

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
	and Flora, the control of harmful animals, freshwater pollution, and enforcement.		Ground truthing confirmed 6 Species of Conservation Concern to be present within the study area (refer to Appendix D). These were exclusively protected species from a provincial perspective, and none of them are Red List species. Permits will be required to impact directly on these species.

7.8.1 Best Practice Guidelines Birds & Wind Energy (2015)

The Best Practice Guidelines for Birds and Wind Energy (2015) proposed by the Birds and Renewable Energy Specialist Group (BARESG) (convened by BirdLife South Africa and the Endangered Wildlife Trust) contain guidelines for assessing and monitoring the impact of wind energy facilities on birds in Southern Africa. These guidelines recognise the impact that wind energy facilities may have on birds, through for example, creating a barrier to movement, displacing sensitive species, affecting breeding success and/or altering habitat. The guidelines were developed to ensure that negative impacts on threatened, or potentially threatened bird species are identified and mitigated using structured, methodical and scientific methods.

The guidelines are aimed at Environmental Assessment Practitioners (EAPs), avifaunal specialists, developers and regulators and propose a tiered assessment process as listed below:

(i) Scoping – a brief site visit informs a desktop assessment of likely avifauna present, possible impacts, and the design of a site-specific survey and monitoring protocols.
(ii) Pre-construction monitoring and impact assessment – a full assessment of the significance of likely impacts and available mitigation options, based on the results of systematic and quantified monitoring over at least 4 seasons.
(iii) Construction phase monitoring – not always necessary but can assist in determining whether the proposed mitigation measures are implemented and are effective and identify triggers of any observed changes.
(iv) Post-construction monitoring – repetition of the pre-construction monitoring, plus the collection of mortality data, to develop a complete before and after picture of impacts and refine mitigation measures.
(v) If warranted, more detailed and intensive research on affected threatened or potentially threatened species.

The following species-specific guidelines are also of relevance to consider during the pre-construction monitoring phase:

» Verreaux's Eagle and Wind Farms: Guidelines for impact assessment, monitoring, and mitigation (March 2017)
» Cape Vulture and Wind Farms: Guidelines for impact assessment, monitoring and mitigation (July 2018)

For the Ummbila Emoyeni Wind Energy Facility, the scoping assessment and the 12-months pre-construction bird monitoring as required by the guidelines have been completed at the project site. The results from the monitoring have informed both the development footprint as well as the Avifauna Impact Assessment report included as **Appendix F** to this EIA Report.

7.8.2 South African Best Practice Guidelines for Pre-Construction Monitoring of Bats at Wind Energy Facilities (2020)

The South African Best Practice Guidelines for Pre-Construction Monitoring of Bats at Wind Energy Facilities prepared by Inkululeko Wildlife Services (Pty) Ltd, Bats without Borders and Arcus Consultancy Services South Africa (Pty) Ltd seek to provide technical guidance for consultants charged with carrying out impact assessments for proposed Wind Energy Facilities, to ensure that pre-construction monitoring surveys produce the required level of detail and answers for authorities evaluating applications for Wind Energy Facility

developments. These guidelines outline basic requirements of best practice and highlight specific considerations relating to the pre-construction monitoring of proposed Wind Energy Facility sites for bats.

The results from pre-construction bat monitoring are required to inform the final layout, the BA or Scoping and EIA assessments and to provide adequate information to the competent authority for them to make an informed decision.

Bat activity is monitored using active and passive bat monitoring techniques. Active monitoring is carried out on site visits by the means of driven transects. A bat detector mounted on a vehicle is used, and transect routes are chosen based on road accessibility. Sampling effort and prevalent weather conditions are considered for each transect.

For the Ummbila Emoyeni Wind Energy Facility, a passive bat monitoring technique was utilised. Twelve (12) months of pre-construction bat monitoring has been completed and the passive bat activity data gathered has informed both the development footprint as well as the Bat Impact Assessment report which is included as **Appendix G** to this EIA Report.

7.8.3 South African Good Practice Guidelines for Operational Monitoring for Bats at Wind Energy Facilities (2019)

The South African Good Practice Guidelines for Operational Monitoring for Bats at Wind Energy Facilities are used as a guideline in developing protocols for operational monitoring of bat activity and fatalities at operating Wind Energy Facilities in South Africa. The objective of these guidelines is to provide practitioners with a standard protocol to monitor and estimate bat mortality, facilitating comparison between fatality rates across different Wind Energy Facilities.

According to these guidelines, the first two years of a Wind Energy Facility's operation are the most important period in which to collect post-construction information as this is when any change in bat activity and mortalities are likely to occur. Where more severe impacts have been identified or predicted, an extended period of data collection might be required to assess the effectiveness of any mitigation proposed. Examples of operational bat monitoring protocols include acoustic monitoring and carcass searches.

For the Ummbila Emoyeni Wind Energy Facility, the bat specialist has recommended that during operation, bat fatality monitoring must be undertaken to search for bat carcasses beneath wind turbines to measure the observed impact of the wind energy facility on bats for a minimum of two years. These guidelines will be used to develop the protocols for operational monitoring of bat activity and fatalities at the Ummbila Emoyeni Wind Energy Facility.

7.8.4 The IFC Environmental Health and Safety (EHS) Guidelines

The IFC EHS Guidelines are technical reference documents with general and industry specific examples of Good International Industry Practice (GIIP). The following IFC EHS Guidelines have relevance to the proposed project:

- IFC EHS General Guidelines
- IFC EHS Guidelines for Electric Power Transmission and Distribution

The General EHS Guidelines are designed to be used together with the relevant Industry Sector EHS Guidelines. The application of the General EHS Guidelines should be tailored to the hazards and risks associated with a project and should take into consideration site-specific variables which may be applicable, such as host country context, assimilative capacity of the environment, and other project factors. In instances where host country regulations differ from the standards presented in the EHS Guidelines, whichever is the more stringent of the two in this regard should be applied.

The General EHS Guidelines include consideration of the following:

- Environmental:
  - Air Emissions and Ambient Air Quality
  - Energy Conservation
  - Wastewater and Ambient Water Quality
  - Water Conservation
  - Hazardous Materials Management
  - Waste Management
  - Noise
  - Contaminated Land
- Occupational Health and Safety:
  - General Facility Design and Operation
  - Communication and Training
  - Physical Hazards
  - Chemical Hazards
  - Biological Hazards
  - Radiological Hazards
  - Personal Protective Equipment (PPE)
  - Special Hazard Environments
  - Monitoring
- Community Health and Safety:
  - Water Quality and Availability
  - Structural Safety of Project Infrastructure
  - Life and Fire Safety (L&FS)
  - Traffic Safety
  - Transport of Hazardous Materials
  - Disease Prevention
  - Emergency Preparedness and Response
- Construction and Decommissioning:
  - Environment
  - Occupational Health & Safety
  - Community Health & Safety

7.8.5 IFC Environmental, Health and Safety Guidelines for Wind Energy (August 2015)

The EHS Guidelines for wind energy include information relevant to environmental, health, and safety aspects of onshore and offshore wind energy facilities. It should be applied to wind energy facilities from the earliest feasibility assessments, as well as the environmental impact assessment, and continue to be applied throughout the construction and operation phases.
The guidelines list issues associated with wind energy facilities which need to be considered. These include:

- Environmental impacts associated with the construction, operation, and decommissioning of wind energy facilities activities may include, among others, impacts on the physical environment (such as noise or visual impact) and biodiversity (affecting birds and bats, for instance).
- Due to the typically remote location of wind energy facilities, the transport of equipment and materials during construction and decommissioning may present logistical challenges (e.g., transportation of long, rigid structures such as blades, and heavy tower sections).
- Environmental issues specific to the construction, operation, and decommissioning of wind energy projects and facilities include the following:
  - Landscape, Seascape, and Visual impacts
  - Noise
  - Biodiversity
  - Shadow Flicker
  - Water Quality

CHAPTER 8: DESCRIPTION OF THE AFFECTED ENVIRONMENT

This section of the EIA Report provides a description of the local environment. This information is provided in order to assist the reader in understanding the possible effects of the proposed project on the environment within which it is proposed to be developed. Aspects of the biophysical, social, and economic environment that could be directly or indirectly affected by, or could affect, the proposed development have been described. This information has been sourced from both existing information available for the area as well as collected field data undertaken by specialist consultants and aims to provide the context within which this S&EIA process is being conducted.

8.1 Legal Requirements as per the EIA Regulations, 2014 (as amended), for the undertaking of an Environmental Impact Assessment

This chapter includes the following information required in terms of the EIA Regulations, 2014 - Appendix 3: Scope of Assessment and Content of Environmental Impact Assessment Reports:

Requirement	Relevant Section
3(1)(h)(iv) the environmental attributes associated with the development footprint alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects.	The environmental attributes associated with the development of the Ummbila Emoyeni Wind Energy Facility are included as a whole within this chapter. The environmental attributes that are assessed within this chapter include the following: » The regional setting of the broader study area and the project site indicates the geographical aspects associated with the Ummbila Emoyeni Wind Energy Facility. This is included in **Section 8.2**. » The climatic conditions present within the broader study area have been included in **Section 8.3**. » The biophysical characteristics of the project site and the surrounding areas are included in **Section 8.4**. The characteristics considered are topography and terrain, geology, soils and agricultural potential and the ecological profile which includes the vegetation patterns, listed plant species, critical biodiversity areas and broad-scale processes, freshwater resources, terrestrial fauna, bats, and avifauna. » The heritage and cultural aspects (including archaeology and palaeontology) have been included in **Section 8.5**. » The visual quality of the surrounding area and the project site has been considered in **Section 8.6**. » The ambient noise levels and quality of the surrounding area and the project site has been considered in **Section 8.7**. » The traffic conditions within the broader study area and the project site have been considered in **Section 8.8**. » The socio-economic characteristics associated with the broader study area and the project site have been included in **Section 8.9**.

A more detailed description of each aspect of the affected environment is included within the specialist reports contained within **Appendices D – M**.

8.2. Regional Setting

The Ummbila Emoyeni Wind Energy Facility is located ~6km south-east of Bethal and 1km east of Morgenzon, across the Govan Mbeki, Lekwa, and Msukaligwa Local Municipalities within the Gert Sibande District in the Mpumalanga Province.

The Mpumalanga Province, within which the project site is located, is the second-smallest province in South Africa and is located in the north-eastern part of the country, bordering Swaziland and Mozambique (Mpumalanga Spatial Development Framework, 2018). The Mpumalanga Province covers an area of 76 495km^2 and has a population of 4 335 964, making it one of the most populous provinces in South Africa (Mpumalanga Spatial Development Framework, 2018). Mpumalanga is known for its mining, manufacturing, forestry, and service sectors. The Maputo Corridor, which links Mpumalanga with Gauteng and Maputo in Mozambique, harbours extensive potential in terms of economic development and growth for the region (Mpumalanga Spatial Development Framework, 2018). The Mpumalanga Province comprises three district municipalities, namely, Ehlanzeni, Gert Sibande and Nkangala (refer **to Figure 8.1**) – which contain seventeen local municipalities collectively, with the project site being located within the Gert Sibande District Municipality.

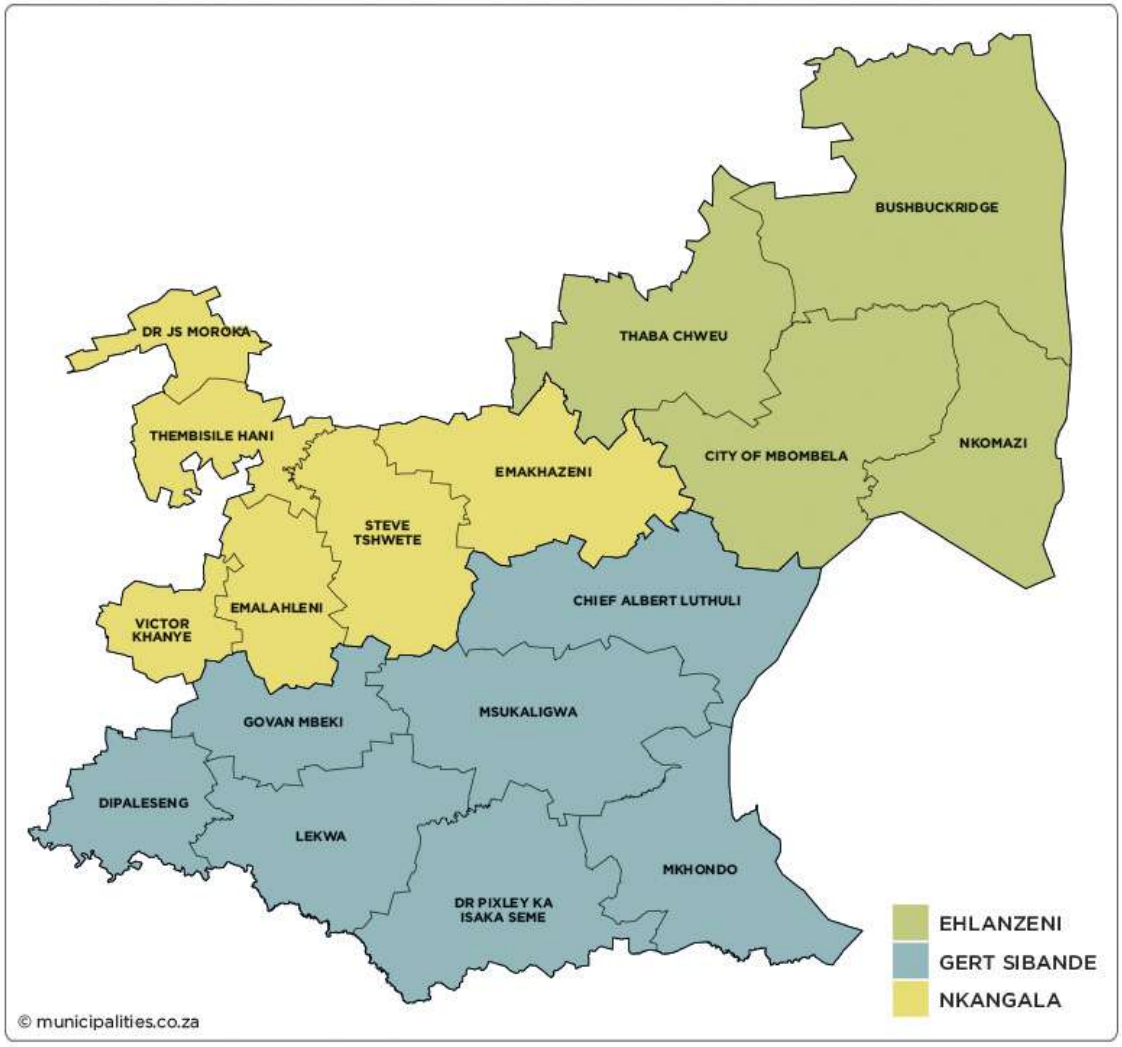


Figure 8.1: District municipalities of the Mpumalanga Province (Source: Municipalities of South Africa)

The Gert Sibande District Municipality is a Category C municipality[15] bordered by the Ehlanzeni and Nkangala District Municipalities to the north, KwaZulu-Natal and the Free State to the south, Swaziland to the east, and Gauteng to the west. It is the largest of the three districts in the Mpumalanga Province, making up almost half of its geographical area. The Gert Sibande District Municipality comprises seven local municipalities, namely, Govan Mbeki, Chief Albert Luthuli, Msukaligwa, Dipaleseng, Mkhondo, Lekwa and Dr Pixley ka Isaka Seme (refer to **Figure 8.2**). According to Stats SA (2016 Community Survey), Gert Sibande's population increased from 1 043 194 in 2011 to 1 135 409 people in 2016. This makes the district the smallest district in terms of population amongst the three districts in the province. The economy of the Gert Sibande District Municipality is driven by manufacturing, agriculture, transport, trade, community services, construction, electricity, finance and mining.

Figure 8.2: Local municipalities of the Gert Sibande District Municipality (Source: Municipalities of South Africa

The Govan Mbeki Local Municipality has the largest underground coal mining complex in the world, which makes it an important strategic area within the national context. It covers an aerial extent of 2 955km^2 and is bordered by the Nkangala District in the north, Dipaleseng and Lekwa in the south, Msukaligwa in the east, and the Gauteng Province in the west. It is one of the smallest of seven municipalities that make up the district, accounting for 9% of its geographical area. Secunda is the seat of the municipality, as well as the seat of the district municipality. According to Stats SA (2011), the population in Govan Mbeki Local Municipality's sits at 340 091. Primary economic sectors in the municipality include mining, manufacturing, trade, and construction.

The Lekwa Local Municipality is a Category B municipality[16] situated within the Gert Sibande District in the Mpumalanga Province. It is one of seven municipalities in the district. It was established on 05 December 2000 after the amalgamation of three former Transitional Local Councils, namely, Standerton, Sakhile and

[15] A municipality that has municipal executive and legislative authority in an area that includes more than one municipality.
[16] A municipality that shares municipal executive and legislative authority in its area with a category C municipality within whose area it falls.

Morgenzon. It is located in the south-west of the district, with immediate entrances to the KwaZulu-Natal, Gauteng and Free State Provinces. Newcastle, Heidelberg and Vrede are respective immediate entrances. Standerton serves as an urban node, whilst Morgenzon, which is 45km north-east of Standerton, serves as a satellite node.

The Lekwa Municipality lies on the large open plains of the Highveld region, which is characterised by tall grass, and it is traversed by the Vaal River, which flows in a western direction. The municipality is named after the Vaal River, which is commonly known as Lekwa (the Sesotho name for the Vaal River). Agriculture, forestry and fishing constitute about 30% of the Lekwa Local Municipality's economy.

The Msukaligwa Local Municipality is a Category B municipality situated within the Gert Sibande District in the Mpumalanga Province. It is bordered in the north by the Nkangala District and Chief Albert Luthuli, in the south by Lekwa and Dr Pixley Ka Isaka Seme, in the east by Mkhondo, and in the west by Govan Mbeki. It is the largest of the seven municipalities that make up the district, accounting for 19% of its geographical area. Ermelo is the seat of the municipality. The main economic sectors in the Msukaligwa Local Municipality are finance (23.8%), community services (20.9%), transport (17.5%), trade (14.4%), and mining (12.2%).

8.3. Climatic Conditions

The region within which the project site is located is characterised by summer rainfall and experiences a mean annual precipitation of up to 662mm. The region is also characterised by high and low extreme temperatures during the summer and winter, respectively, with frost occurring frequently (refer to **Figure 8.3**).

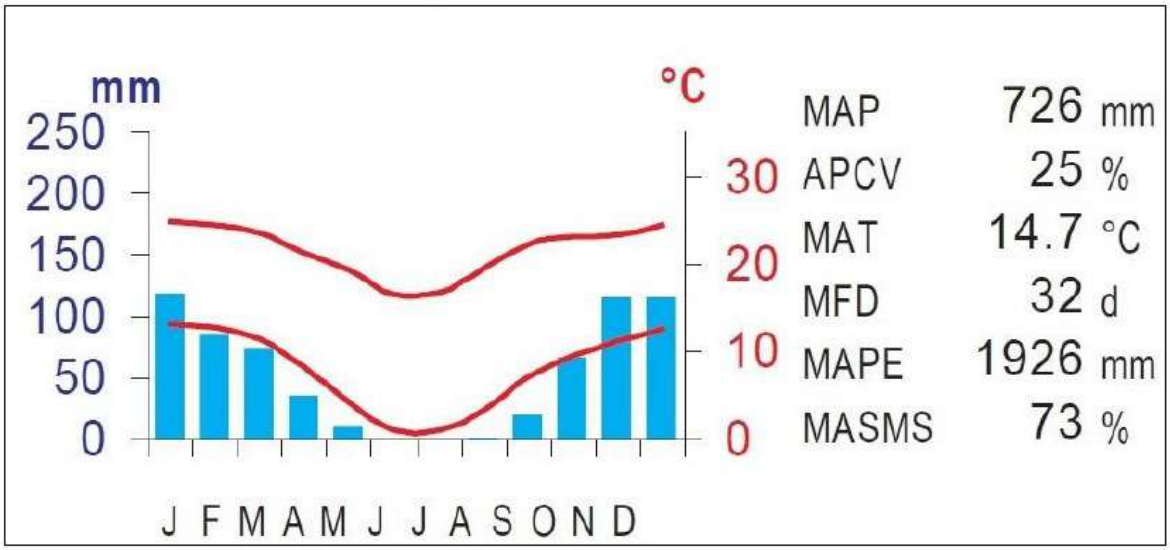


Figure 8.3: Climatic graph for the broader region within which the proposed project site is located

8.4. Biophysical Characteristics of the Project Site

The following section provides an overview and description of the biophysical characteristics of the study area and has been informed by specialist studies (**Appendix D - M**) undertaken for this Scoping Report.

8.4.1. Topographical profile

The project site occurs on land that ranges in elevation from approximately 1 581m to 1 778m. The general landform of the project site is undulating and is comprised of a series of similar size rounded ridgelines that extend approximately 20 – 30m above broad valley lines. The valley lines all feed into the Blebokspruit, which flows in a north to south direction, approximately 8.5km to the west of the proposed site. The Blesbokspruit flows into the Vaal River approximately 15km to the south-west of the site.

The slope percentage of the project site has been calculated and is illustrated in **Figure 8.4**. Most of the project site is characterised by a slope percentage between 0 and 4%, with some smaller patches within the project site characterised by a slope percentage ranging from 4 to 81%. This illustration indicates a non-uniform topography in scattered areas. The majority of the site is however characterised by a gentle slope.

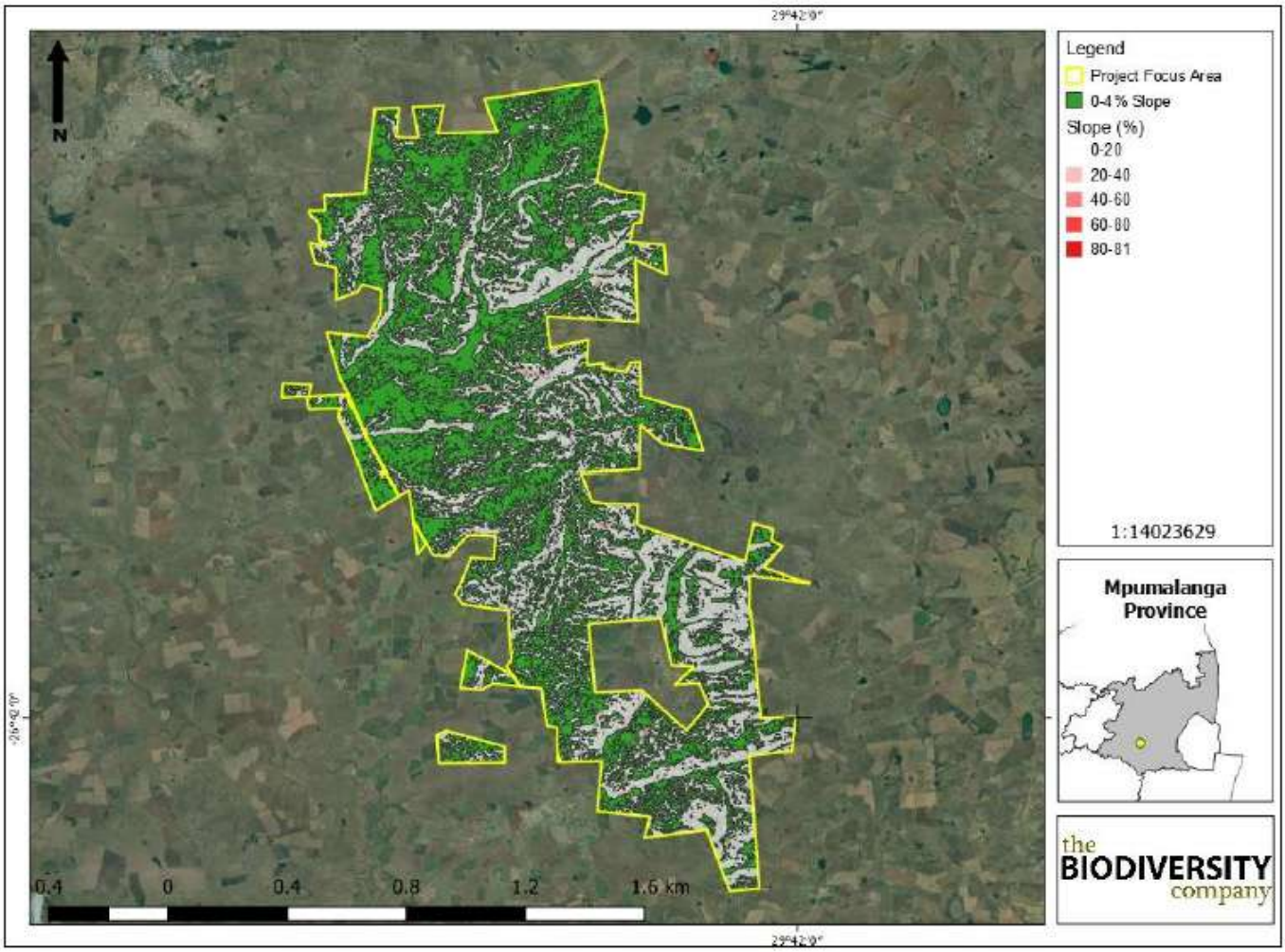


Figure 8.4: Slope percentage calculated for the project site within which the Ummbila Emoyeni Wind Energy Facility is proposed

8.4.2. Geology, Soils and Agricultural Potential

Geological Setting

The geology of the project site is characterised by the Madzaringwe Formation shale, mudstone and sandstone from the Karoo Supergroup or the Karoo Suite dolerites which feature prominently in this area. To the west, the rocks of the Ventersdorp, old Transvaal and Witwatersrand Supergroups are significant with the south being characterised by the Volksrust Formation from the Karoo Supergroup. The geology of the project site for the Ummbila Emoyeni Wind Energy Facility site is indicated in **Figure 8.5** below.

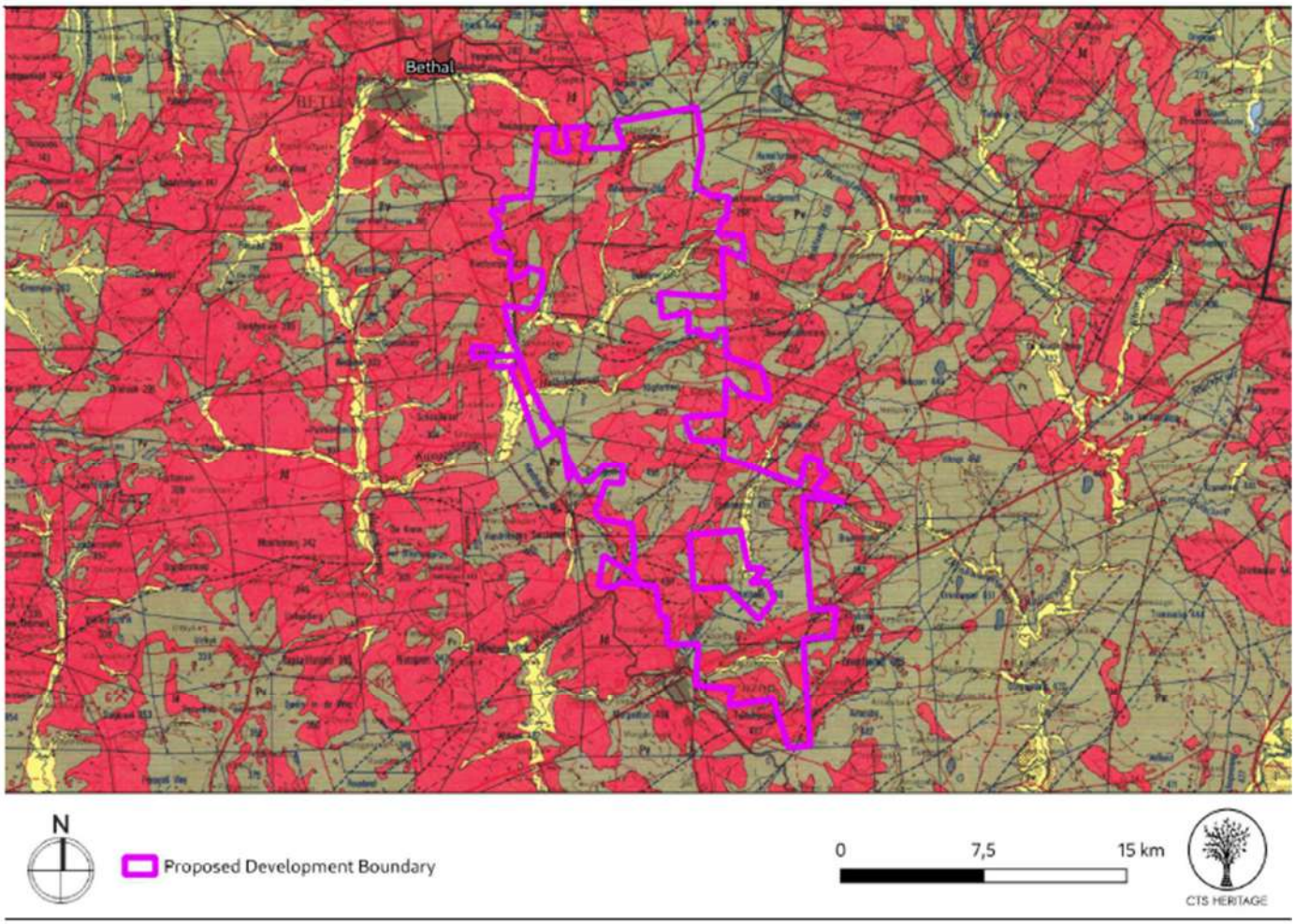


Figure 8.5: Extract from the CGS 2628 East Rand Map indicating the geological setting of the project site

Land Type, Soil Forms, Agricultural Potential and Land Capability

<u>Land Type</u>

According to the land type database, the project site is characterised by the Dc 3, Ea 20, Ea 21 and the Ea 22 land types (refer to **Figure 8.6**). The Dc land type is characterised by Prismacutanic and/or pedocutanic diagnostic horizons, with the addition of one or more of the following: Vertic, melanic and red structured diagnostic horizons. The Ea land type consists of one or more of the following soils: Vertic, Melanic, and red structured diagnostic horizons, of which these soils are all undifferentiated.

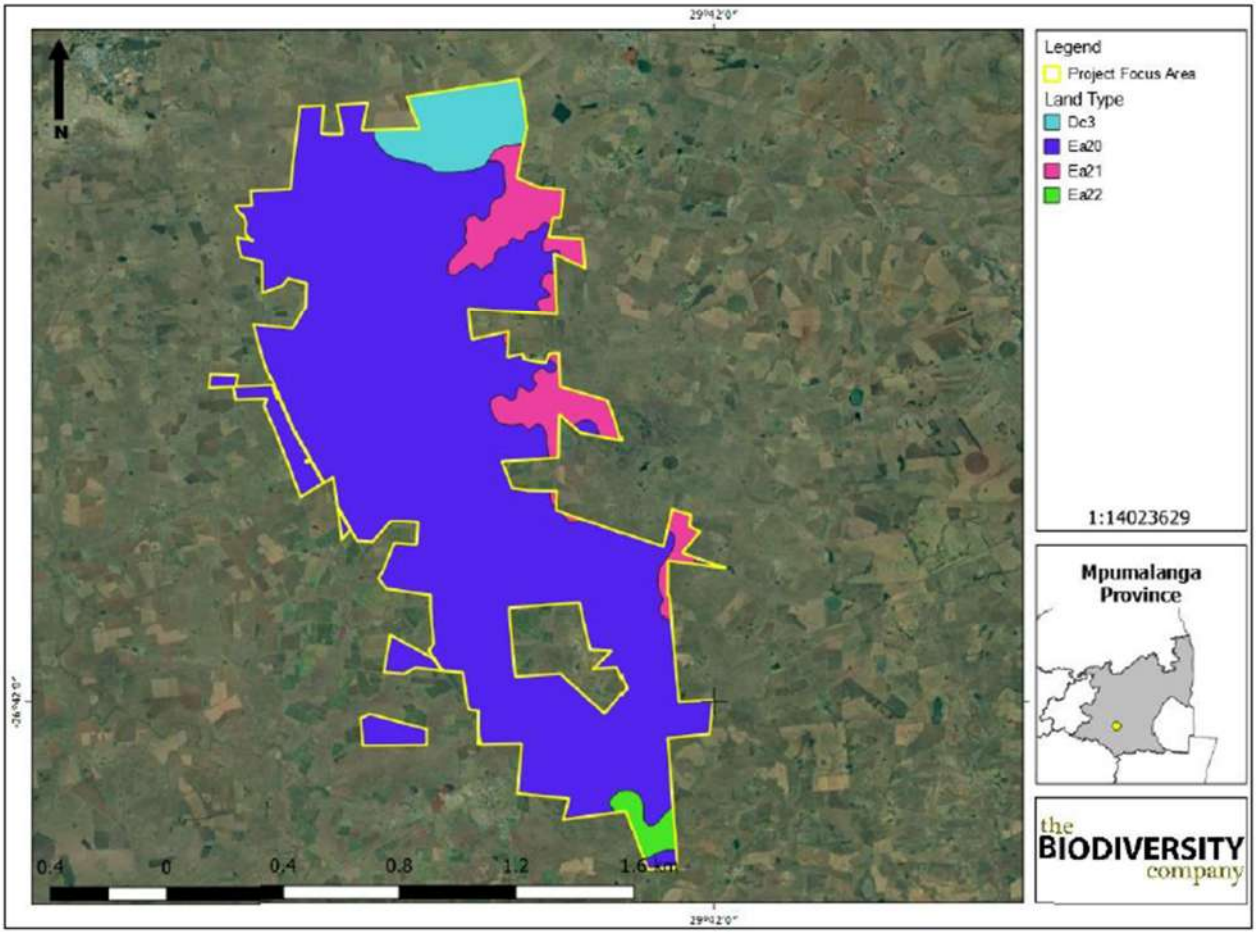


Figure 8.6: Land types present within the project site for the Ummbila Emoyeni Wind Energy Facility

Soil Forms

Soil profiles were studied up to a depth of 1.2m to identify specific diagnostic horizons which are vital in the soil classification process as well as determining the agricultural potential and land capability. The most sensitive soil forms have been considered. Five diagnostic horizons were identified within the project site, namely, orthic topsoil, lithic horizon, hard rock horizon, red apedal horizon, and red structured horizon.

During the stie survey undertaken as part of the soil assessment, various soil forms were identified. The soil forms are described in **Table 8.1** according to depth, clay percentage, indications of surface crusting, signs of wetness and percentage rock.

Table 8.1: Summary of soils identified within the project site

	Topsoil					Subsoil A				Subsoil B			
	Depth (mm)	Clay (%)	Signs of wetness	Rock %	Surface crusting	Depth (mm)	Clay (%)	Signs of wetness	Rock %	Depth (mm)	Clay (%)	Signs of wetness	Rock %
Vaalbos 1221(15)	0-300	0-15	None	0	None	300-400	15-30	None	10	400-500	15-30		30
Avalon 1220(15)	0-300	0-15	None	0	None	300-700	15-35	None	0	700-1200 (+)	>35	Plinthic conditions	

	Topsoil					Subsoil A				Subsoil B			
	Depth (mm)	**Clay (%)**	**Signs of wetness**	**Rock %**	**Surface crusting**	**Depth (mm)**	**Clay (%)**	**Signs of wetness**	**Rock %**	**Depth (mm)**	**Clay (%)**	**Signs of wetness**	**Rock %**
Ermelo 1220(15)	0-300	0-15	None	0	None	300-1 200 (+)	0-15	None	0	N/A			
Tukulu 1120 (15)	0-300	0-15	None	0	None	300-800	0-15	None	0	800-1200	>35	Present	

Land Capability

Land capability is determined by the physical features of the landscape, including the soils present. Land capability is defined by the most intensive long-term use of land under rain-fed conditions. Land capability is divided into eight classes, and these may be divided into three capability groups. **Table 8.2** shows how the land classes and groups are arranged in order of decreasing capability and ranges of use. The risk of use increases from class I to class VIII.

Table 8.2: Land capability class and intensity of use

Land Capability Class	Increased Intensity of Use									Land Capability Groups
I	W	F	LG	MG	IG	LC	MC	IC	VIC	**Arable Land**
II	W	F	LG	MG	IG	LC	MC	IC		
III	W	F	LG	MG	IG	LC	MC			
IV	W	F	LG	MG	IG	LC				
V	W	F	LG	MG						**Grazing Land**
VI	W	F	LG	MG						
VII	W	F	LG							
VIII	W									**Wildlife**
W - Wildlife		**MG - Moderate Grazing**			**MC - Moderate Cultivation**					
F- Forestry		**IG - Intensive Grazing**			**IC - Intensive Cultivation**					
LG - Light Grazing		**LC - Light Cultivation**			**VIC - Very Intensive Cultivation**					

The land capability of the most sensitive soils within the project site falls within classes 3, 4 and 5 (refer to **Table 8.3**).

Table 8.3: Land capability for the soils within the project site

Land Capability Class	Definition of Class	Conservation Need	Use-Suitability	Land Capability Group	Sensitivity
3	Moderate limitations. Some erosion hazard	Special conservation practice and tillage methods	Rotation crops and ley (50%)	Arable	High
4	Severe limitations. Low arable potential.	Intensive conservation practice	Long term leys (75%)	Arable	Moderate
5	Water course and land with wetness limitations	Protection and control of water table	Improved pastures, suitable for wildlife	Grazing	Low

Agricultural/Land Potential

Agricultural/land potential is determined by combining the land capability results and the climatic capability of the region as shown in **Table 8.4**. Climatic capability is determined by means of the Mean Annual Precipitation (MAP) and annual Class A pan. Descriptions of the different land potential classes are provided in **Table 8.5**.

Table 8.4: The combination table for land potential classification

Land capability class	Climate capability class							
	C1	C2	C3	C4	C5	C6	C7	C8
I	L1	L1	L2	L2	L3	L3	L4	L4
II	L1	L2	L2	L3	L3	L4	L4	L5
III	L2	L2	L3	L3	L4	L4	L5	L6
IV	L2	L3	L3	L4	L4	L5	L5	L6
V	Vlei	Vlei	Vlei	Vlei	Vlei	Vlei	Vlei	Vlei
VI	L4	L4	L5	L5	L5	L6	L6	L7
VII	L5	L5	L6	L6	L7	L7	L7	L8
VIII	L6	L6	L7	L7	L8	L8	L8	L8

Table 8.5: Description of the land potential classes

Land potential	Description of land potential class
L1	Very high potential: No limitations. Appropriate contour protection must be implemented and inspected.
L2	High potential: Very infrequent and/or minor limitations due to soil, slope, temperatures or rainfall. Appropriate contour protection must be implemented and inspected.
L3	Good potential: Infrequent and/or moderate limitations due to soil, slope, temperatures or rainfall. Appropriate contour protection must be implemented and inspected.
L4	Moderate potential: Moderately regular and/or severe to moderate limitations due to soil, slope, temperatures or rainfall. Appropriate permission is required before ploughing virgin land.

Land potential	Description of land potential class
L5	Restricted potential: Regular and/or severe to moderate limitations due to soil, slope, temperatures or rainfall.
L6	Very restricted potential: Regular and/or severe limitations due to soil, slope, temperatures or rainfall. Non-arable
L7	Low potential: Severe limitations due to soil, slope, temperatures or rainfall. Non-arable
L8	Very low potential: Very severe limitations due to soil, slope, temperatures or rainfall. Non-arable

From the three land capability classes (i.e., 3, 4 and 5), two land potential levels have been determined. Land capability III and IV have been reduced to a land potential level L5 due to climatic limitations. The land capability V has been allocated a land potential "Vlei" considering its hydromorphic characteristics.

8.4.3. Land Use

The predominant land use within the project site is farming. The study area consists of a mosaic of buildings/structures, active farmland ("agriculture"), fallow land (abandoned farmlands which consist of secondary vegetation; "fallow"), natural grasslands, and freshwater resource features or drainage areas (which is comprised of small streams, wetlands, shallow pans and depressions, and artificial dams).
Farming practices comprise a mixture of cultivation (mainly maize with some soya bean cultivation), livestock farming (predominantly cattle on natural to near-natural grasslands and planted pastures), and to a lesser extent game farming.

In spite of the rural and natural character of the area within which the project site is proposed, there are major high voltage overhead power lines that traverse the project site, namely, the Camden Sol 2 400kV power line, and the Camden Tutuka 400kV power line.

8.4.4. Ecological Profile of the Broader Study Area and the Project Site

i. Broad-Scale Vegetation Patterns

The national vegetation map for the project site is depicted in **Figure 8.7**. The entire study area is mapped as Soweto Highveld Grassland (Gm 8), but other vegetation types occur nearby, namely Amersfoort Highveld Clay Grassland (Gm 13), Eastern Highveld Grassland (Gm 12).

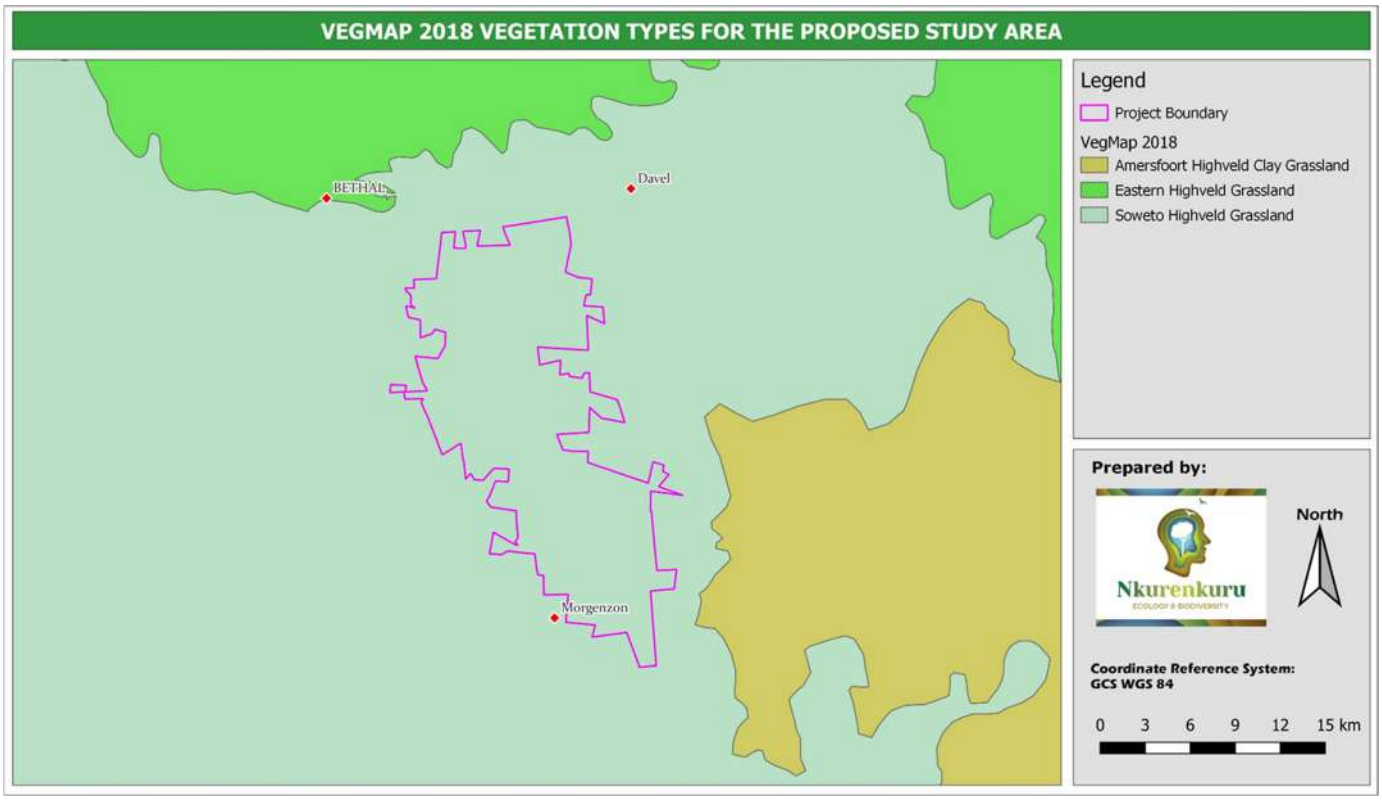


Figure 8.7: Map illustrating the different vegetation types, according to VegMap 2018, for the study area, as well as the general region.

Soweto Highveld Grassland (Gm 8)

This vegetation type is distributed mainly in Mpumalanga and Gauteng, with small outliers in the Free State and North West Provinces. It has an altitudinal range of 1420 – 1760 m. It is distributed in a broad band roughly delimited by the N17 road between Ermelo and Johannesburg in the north, Perdekop in the southeast, and the Vaal River in the south. The vegetation type extends further westwards along the southern edge of the Johannesburg Dome with parts of Soweto, and as far as Randfontein. In southern Gauteng it includes parts of Vanderbijlpark and Vereeniging, as well as Sasolburg in the northern Free State.

The vegetation type is characterised by gentle to moderate undulating landscapes on the Highveld plateau, and supports short to medium-high, dense, tufted grassland, which is dominated by Themeda triandra together with a variety of other grasses, such as *Elionurus muticus, Eragrostis racemosa, Heteropogon contortus,* and *Tristachya leucothrix*. In undisturbed areas, scattered small wetlands, narrow stream alluvia, pans, and occasional ridges or rocky outcrops occur as a mosaic within the grassland.

Shale, sandstone, or mudstone of the Madzaringwe Formation (Karoo Supergroup) or the intrusive Karoo Suite dolerites are characteristic of this vegetation type. The Volksrust Formation (Karoo Supergroup) is found in the south, while rocks of the older Transvaal, Ventersdorp, and Witwatersrand Supergroups are significant in the west. The soils are deep and reddish on flat plains, and are typically of the Ea, Ba, and Bb land types.

The vegetation type receives summer rainfall with a MAP of about 662 mm. It has a cool temperate climate with high extremes between maximum summer and minimum winter temperatures, with a frequent occurrence of frost and large thermic diurnal differences, especially in autumn and spring.

The unit is classified as Endangered with a target of protection of 24%. Only a few patches are statutorily conserved in the Waldrift, Krugersdorp, Leeuwkuil, Suikerbosrand, and Rolfe's Pan Nature Reserves, or privately conserved in the Johanna Jacobs, Tweefontein, Gert Jacobs, Nikolaas, and Avalon Nature Reserves, as well as the Heidelberg Natural Heritage Site. Almost half of the area already transformed by cultivation, urban sprawl, mining, and road infrastructure. Some areas have been flooded by dams, notably the Grootdraai, Leeukuil, Trichardtsfontein, Vaal, and Willem Brummer dams. Erosion is generally very low; only about 93%.

Table 8.6: Key species associated with Soweto Highveld Grassland (Gm 8)

IMPORTANT SPECIES	
Growth Form (d = Dominant)	**Key Species**
Graminoids	*Andropogon appendiculatus (d), Brachiaria serrata (d), Cymbopogon pospischilii (d), Cynodon dactylon (d), Elionurus muticus (d), Eragrostis capensis (d), E. chloromelas (d), E. curvula (d), E. plana (d), E. planiculmis (d), E. racemosa (d), Heteropogon contortus (d), Hyparrhenia hirta (d), Setaria nigrirostris (d), S. sphacelata (d), Themeda triandra (d), Tristachya leucothrix (d), Andropogon schirensis, Aristida adscensionis, A. bipartita, A. congesta, A. junciformis subsp. galpinii, Cymbopogon caesius, Digitaria diagonalis, Diheteropogon amplectens, Eragrostis micrantha, E. superba, Harpochloa falx, Microchloa caffra, Paspalum dilatatum.*
Herbs	*Hermannia depressa (d), Acalypha angustata, Berkheya setifera, Dicoma anomala, Euryops gilfillanii, Geigeria aspera var. aspera, Graderia subintegra, Haplocarpha scaposa, Helichrysum miconiifolium, H. nudifolium var. nudifolium, H. rugosum, Hibiscus pusillus, Justicia anagalloides, Lippia scaberrima, Rhynchosia effusa, Schistostephium crataegifolium, Seago densiflora, Senecio coronatus, Vernonia oligocephala, Wahlenbergia undulata.*
Geophytic Herbs	*Haemanthus humilis subsp. hirsutus, H. montanus.*
Herbaceous Climber	*Rhynchosia totta.*
Low Shrubs	*Anthospermum hispidulum, A. rigidum subsp. pumilum, Berkheya annectens, Felicia muricata, Ziziphus zeyheriana.*

Eastern Highveld Grassland (Gm 8)

This vegetation type is distributed throughout Mpumalanga and Gauteng Provinces, and occurs as plains between Belfast in the east, and the eastern side of Johannesburg in the west, and extends southwards to Bethal, Ermelo, and west of Piet Retief. The vegetation type has an altitudinal range of 1520 – 1780 m, but some parts are as low as 1300 m.

The vegetation type consists of slight to moderate undulating plains, and includes low hills and pan depressions. The vegetation is short, dense grassland dominated by grasses of the genera *Aristida, Digitaria, Eragrostis, Themeda, Tristachya*. Small, scattered rocky outcrops have wiry, sour grasses and some woody species, such as *Acacia caffra, Celtis africana, Diospyros lycioides* subsp. *lycioides, Parinari capensis, Protea caffra, P. welwitschii,* and *Searsia magalismontanum*.

Red to yellow sandy soils of the Ba and Bb land types dominate on shales and sandstones of the Madzaringwe Formation (Karoo Supergroup), and two dominant land types are found, namely Bb (65%) and Ba (30%).

The vegetation type has a strong seasonal summer rainfall, with very dry winters. The MAP ranges from 650 – 900 mm, with an average of 726 mm. Rainfall is relatively uniform across most of this vegetation type, but increases significantly in the extreme southeast, which is evidenced from the MAP coefficient of variation of 25% across most of the unit, which drops to 21% in the east and southeast. Frost incidence ranges from 13 – 42 days, but is higher at higher elevations.

The unit is classified as Endangered with a target of protection of 24%. Only a very small fraction is conserved in statutory reserves such as Nooitgedacht Dam and Jericho Darn Nature Reserves, or in private reserves such as Holkranse, Kransbank, and Morgenstond. About 44% has been transformed primarily by cultivation, plantations, mines, urbanisation, and by building of dams. Cultivation may have had a more extensive impact, as indicated by landcover data. No serious alien invasions are reported, but *Acacia mearnsii* can become dominant in disturbed sites. Erosion is very low.

Table 8.7: Key species associated with Eastern Highveld Grassland (Gm 12)

DOMINANT SPECIES	
Growth Form (d = Dominant)	**Key Species**
Graminoids	*Aristida aequiglumis (d), A. congesta (d), A. junciformis subsp. galpinii (d), Brachiaria serrata (d), Cynodon dactylon (d), Digitaria monodactyla (d), D. tricholaenoides (d), Elionurus muticus (d), Eragrostis chloromelas (d), E. curvula (d), E. plana (d), E. racemosa (d), E. sclerantha (d), Heteropogon contortus (d), Loudetia simplex (d), Microchloa caffra (d), Monocymbium ceresiiforme (d), Setaria sphacelata (d), Sporobolus africanus (d), S. pectinatus (d), Themeda triandra (d), Trachypogon spicatus (d), Tristachya leucothrix (d), T. rehmannii (d), Alloteropsis semialata subsp. eckloniana, Andropogon appendiculatus, A. schirensis, Bewsia biflora, Ctenium concinnum, Diheteropogon amplectens, Eragrostis capensis, E. gummiflua, E. patentissima, Harpochloa fax, Panicum natalense, Rendlia altera, Schizachyrium sanguineum, Setaria nigrirostris, Urelytrum agropyroides.*
Herbs	*Berkheya setifera (d), Haplocarpha scaposa (d), Justicia anagalloides (d), Pelargonium luridum (d), Acalypha angustata, Chamaecrista mimosoides, Dicoma anomala, Eryops gilfillanii, E. transvaalensis subsp. setilobus, Helichrysum aureonitens, H. caespititium, H. callicomum, H. oreophilum, H. rugulosum, Ipomoea crassipes, Pentanisia prunelloides subsp. latifolia, Seago densiflora, Senecio coronatus, Vernonia oligocephala, Wahlenbergia undulata.*
Geophytic Herbs	*Gladiolus crassifolius, Haemanthus humilis subsp. hirsutus, Hypoxis rigidula var. pilosissima, Ledebouria ovatifolia.*
Succulent Herb	*Aloe ecklonis.*
Low Shrubs	*Anthospermum rigidum subsp. pumilum, Stoebe plumosa.*

Amersfoort Highveld Clay Grassland (Gm 13)

This vegetation type is distributed throughout Mpumalanga and Kwa-Zulu Natal Provinces, extending in a north-south band from south of Ermelo, down through Amersfoort to the Memel area in south. The vegetation type has an altitudinal range of 1580 – 1860 m.

The vegetation type is comprised of undulating grassland plains, with small scattered patches of dolerite outcrops in some areas. The vegetation is comprised of a short, closed grassland cover, largely dominated by a dense *Themeda triandra* sward, often severely grazed to form a short lawn.

The unit is characterised by vertic clay soils derived from dolerite that is intrusive in the Karoo sediments of the Madzaringwe Formation in the north and the Volksrust Formation and the Adelaide Subgroup in the south. The Dominant land type is Ca, while the Ea land type is of subordinate importance.

The unit receives rainfall mainly in early summer, which ranges from 620 mm in the west to 830 mm in the east, and it has a MAP of 694 mm. Temperatures are higher in the west than the east, and the vegetation type has a MAT of 14°C. Winters are cold and summers are mild, and frost incidence is very high.

The unit is classified as Vulnerable with a target of protection of 27%. None of the vegetation type is protected. About 25% of the vegetation type is transformed, mostly by cultivation (22%). The area is not suited to afforestation. Silver and black wattle (*Acacia*), and *Salix babylonica* invade drainage areas. Erosion potential is very low (57%) and low (40%).

Overgrazing leads to invasion of Stoebe vulgaris. Parts of this unit were once cultivated and now lie fallow and have been left to revegetate with pioneer species. These transformed areas are not picked up by satellite for transformation coverage and the percentage of grasslands still in a natural state may be underestimated.

Table 8.8: Key species associated with Amersfoort Highveld Clay Grassland (Gm 13)

DOMINANT SPECIES	
Growth Form (d = Dominant)	**Key Species**
Graminoids	*Andropogon appendiculatus (d), Brachiaria serrata (d), Digitaria monodactyla (d), D. tricholaenoides (d), Elionurus muticus (d), Eragrostis capensis (d), E. chloromelas (d), E. plana (d), E. racemosa (d), Harpochloa falx (d), Heteropogon contortus (d), Microchloa caffra (d), Panicum natalense (d), Setaria nigrirostris (d), S. sphacelata (d), Themeda triandra (d), Trichoneura grandiglumis (d), Tristachya leucothrix (d), Abildgaardia ovata, Andropogon schirensis, Aristida bipartita, A. congesta, A. junciformis subsp. galpinii, A. stipitata subsp. graciliflora, Bulbostylis contexta, Chloris virgata, Cymbopogon caesius, C. pospischilii, Cynodon dactylon, Digitaria diagonalis, D. ternata, Diheteropogon amplectens, Eragrostis curvula, Koeleria capensis, Panicum coloratum, Setaria incrassata.*
Herbs	*Berkheya setifera (d), Vernonia natalensis, V. oligocephala (d), Acalypha peduncularis, A. wilmsii, Berkheya insignis, B. pinnatifida, Crabbea acaulis, Cynoglossum hispidum, Dicoma anomala, Haplocarpha scaposa, Helichrysum caespititium, H. rugulosum, Hermannia coccocarpa, H. depressa, H. transvaalensis, Ipomoea crassipes, I. oblongata, Jamesbrittenia silenoides, Pelargonium luridum, Pentanisia prunelloides subsp. latifolia, Peucedanum magalismontanum,*

DOMINANT SPECIES	
Growth Form (d = Dominant)	**Key Species**
	Pseudognaphalium luteoalbum, Rhynchosia effusa, Salvia repens, Schistostephium crataegifolium, Sonchus nanus, Wahlenbergia undulata.
Herbaceous Climber	*Rhynchosia totta.*
Geophytic Herbs	*Boophone disticha, Eucomis autumnalis subsp. clavata, Hypoxis villosa var. obliqua, Zantedeschia albomaculata subsp. macrocarpa.*
Tall Shrubs	*Diospyros austroafricana, D. lycioides subsp. guerkei.*
Low Shrubs	*Anthospermum rigidum subsp. pumilum (d), Helichrysum melanacme (d), Chaetacanthus costatus, Euphorbia striata var. cuspidata, Gnidia burchellii, G. capitata, Polygala uncinata, Searsia discolor.*
Succulent Shrub	*Euphorbia clavarioides var. truncata.*

ii. Fine-Scale Vegetation Patterns

Ground truthing indicated the following fine-scale vegetation patterns within the study area:

- ***Drainage areas,*** such as wetlands, temporary seepages, and ephemeral rivers, among others, comprised an approximate total of 9% (± 2 442 ha out of 28 856 ha) of the study area. Since much of these areas are seasonally waterlogged, they are characterised by heavy, black clay soils without many rocks. Some areas have exposed underlying sandstone banks. The type did not have any native trees, except for scattered individuals of Salix babylonica along larger river channels. The shrub layer was approximately 50 cm in height, with the forb layer being 50 cm and the graminoid layer 90 cm.
- ***Fallow land***, areas that were historically used for agriculture, but have subsequently been left to restore passively. It comprised an approximate total of 8% (± 2 190 ha out of 28 856 ha) of the study area. Fallow land condition depend on variety of factors, such as the history, intensity, and type of agricultural activities, as well as the time since cessation of activities, among other things. Therefore, although fallow lands are usually degraded and consist of secondary vegetation, they often revegetate to form important zones that support various types of biodiversity. Fallow lands can often be considered as Ecological Support Areas (ESA). These areas serve as habitats for SoCC, as well as other keystone or ecologically important species. Although it would take considerable time for fallow lands to restore to previous natural conditions (this might even have to involve some measure of active restoration), such areas often passively restore to a state that closely replicates that of the original, pristine conditions, even if only functionally. Such areas can function as buffer zones and/or corridors, adjacent to natural grasslands and drainage areas, that can be utilized by animal species, and could also function as reservoirs for certain native plant species. Numerous native species, shared with other natural types, were found in the fallow lands of the study area.
- ***Natural areas***, which comprised the largest part of the study area with an approximate total of 45% (± 12 814 ha out of 28 856 ha). A couple of variations were found within the broader scope of these natural areas, including areas of natural clay, dolerite, loam soil, shallow rock turf, and sandstone, all of which are grassland variations. By far the most abundant of these areas were natural clayey grassland. The other areas often integrate seamlessly with such clayey grasslands, and as such are difficult to map with accuracy on a fine scale.
- ***Disturbed areas*** are those that experience, or have recently experienced, considerable anthropogenic disturbance (apart from the fallow lands discussed abpove, which have generally been abandoned for

quite some time). These areas include, but are not limited to, manmade dams, kraals, ruins/murals, roadsides, housing areas, etc. Although these areas are small in size compared to the other types, they often serve as reservoirs for weedy species. They can also serve as corridors through which alien species spread, which is especially true for roadsides. Additionally, alien species are often specifically planted in these areas, and can even include NEM:BA listed species. The disturbed areas in the study area were characterised by a wide range of vegetation cover, topography, aspect, and soil types.

A total of 198 plant species were found within the study area, which consisted of 158 native, 0 Red List, 6 protected, 0 Mpumalanga endemic, 39 alien, and 11 NEM:BA listed invasive species. Furthermore, a total of 61 species were recorded within the study area that were not recorded within POSA, 6 of which were SoCC (*Boophone disticha*, *Crinum bulbispermum, Haemanthus humilis* subsp. *hirsutus, Aloe ecklonis, Gladiolus ecklonii,* and *Gladiolus woodii*), as well as 24 alien species. A summary of species according to the various classifications is given by Table 14 of the ecology specialist report (**Appendix D**).

ii. Ecosystem Threat Status of the Broad-Scale Vegetation Types

On the basis of a scientific approach used at national level by the South African National Biodiversity Institute (SANBI), vegetation types can be categorised according to their conservation status which is, in turn, assessed according to the degree of transformation relative to the expected extent of each vegetation type. The status of a habitat or vegetation type is based on how much of its original area still remains intact relative to various thresholds. On a national scale, the thresholds are as depicted in **Table 8.9** below, as determined by best available scientific approaches. The level at which an ecosystem becomes Critically Endangered differs from one ecosystem to another and varies from 16% to 36%.

Table 8.9: Conservation status of different vegetation types occurring within the project site and broader study area

Vegetation Type	Target (%)	Transformed (%)	Conserved (Statutorily & other reserves)	Conservation Status	
				National Vegetation Map (SANBI, 2018)	National Ecosystem List (NEMA:BA. 2011)
Soweto Highveld Grassland	24%	47.3%	0.2%	Vulnerable	Vulnerable
Amersfoort Highveld Clay Grassland	27%	24.5%	0%	Least Threatened	Not Listed
Eastern Highveld Grassland	24%	44%	0.3%	Vulnerable	Vulnerable

Determining ecosystem status (Driver *et al.*, 2005). *BT = biodiversity target (the minimum conservation requirement).

Habitat remaining (%)		
80–100	least threatened	LT
60–80	vulnerable	VU
*BT–60	endangered	EN
0–*BT	critically endangered	CR

According to scientific literature (Driver *et al*., 2005; Mucina *et al*., 2006), and as shown in **Table 8.9**, Soweto Highveld Grassland and Eastern Highveld Grassland are both listed as Vulnerable, and Amersfoort Highveld Clay Grassland is listed as Least Threatened.

The National List of Ecosystems that are Threatened and in need of protection (GN1002 of 2011), published under the National Environmental Management: Biodiversity Act (Act No. 10, 2004), lists national vegetation types that are afforded protection on the basis of rates of transformation. The thresholds for listing in this legislation are higher than in the scientific literature, which means there are fewer ecosystems listed in the National Ecosystem List versus in scientific literature.

According to the National Ecosystem List, Soweto Highveld Grassland and Eastern Highveld Grassland are listed as Vulnerable and Amersfoort Highveld Clay Grassland is not listed in the National List of Ecosystems that are Threatened and in need of protection (GN1002 of 2011).

iii. Listed Plant Species and Plants Protected in terms of the National Environmental Management: Biodiversity Act and the Mpumalanga Nature Conservation Act

A species list was obtained from the SANBI database (POSA) for the study area and surrounding environment. According to this list a total of 102 plant Species of Conservation Concern occur within the area. This included 19 Red List and 88 protected species. Together with this, the online screening report revealed the occurrence of additional Species of Conservation Concern, namely *Miraglossum davyi, Aspidoglossum xanthosphaerum,* and *Pachycarpus suaveolens*, as well as three sensitive species (1252, 691, 851; these species will not be made public in order to protect them from illegal activities).

Ground truthing confirmed 6 Species of Conservation Concern to be present within the study area (**Table 8.10**). These were exclusively protected species, and none of them are Red List species. All of these species were present in the list obtained online (POSA) during the desktop phase.

Table 8.10: Plant Species of Conservation Concern recorded within the study area. "MNCA" = Mpumalanga Nature Conservation Act

Family	Species	Conservation Status	
		IUCN Red List	MNCA Schedule
Asphodelaceae	*Aloe ecklonis*	LC	11
Amaryllidaceae	*Boophone disticha*	LC	11
Amaryllidaceae	*Crinum bulbispermum*	LC	11
Iridaceae	*Gladiolus ecklonii*	LC	11
Iridaceae	*Gladiolus woodii*	LC	11
Amaryllidaceae	*Haemanthus humilis* subsp. *hirsutus*	LC	11

iv. Trees Protected in Terms of the National Forests Act

No trees protected under the National Forests Act (No. 84 of 1998) were recorded within the project site.

v. Alien Plant Species

A total of 40 alien plant species were found within the study area, 11 of which were NEM:BA listed invasive species (refer to Appendix D). All of the land types that were inspected contained alien species; however, the number of alien species varied across the types, and these alien species were never dominant to any degree. In other words, none of the types were dominated by alien species. Only some of the recently abandoned agricultural lands were dominated by *Cosmos bipinnatus*. However, these areas are likely very recently abandoned, and do not resemble the description of fallow land.

vi. Critical Biodiversity Areas

The Mpumalanga Biodiversity Conservation Plan (MBCP) is a plan developed conjointly by the Mpumalanga Tourism and Parks Agency (MPTA) and Department of Agriculture and land Administration (DALA) to guide conservation and land-use decisions in the province in order to support sustainable development.

Terrestrial Critical Biodiversity Areas (CBA) have been identified for the entire Mpumalanga Province and are published by SANBI (http://bgis.sanbi.org/). This biodiversity assessment identifies CBAs representing biodiversity priority areas that should be maintained in a natural to near-natural state. CBA maps show the most efficient selection and classification of land portions to be safeguarded so that ecosystem functioning is maintained and national biodiversity objectives are met.

According to **Figure 8.8**, the majority of the project site is located within a CBA: Optimal area (41%), whilst 36% of the project site have been modified to some extent, either through cultivation, ploughing (historical and current) or through infrastructure. Only 6% of the project site is regarded as Irreplaceable CBA. Furthermore, four percent of the project area is regarded as potential important corridor areas. These areas are either associated with ridge/hill systems or are areas that are closely associated with extensive freshwater features.

vii. National Protected Areas Expansion Strategy, Protected Areas, and Conservation Areas

Land-based protected area expansion targets include large, intact, and unfragmented areas of high importance for biodiversity representation and ecological persistence, which are suitable for the creation or expansion of large, protected areas. Such areas were identified through a systematic biodiversity planning process undertaken as part of the development of the National Protected Area Expansion Strategy, 2008 (NPAES). They present the best opportunities for meeting the ecosystem-specific protected area targets set in the NPAES and were designed with a strong emphasis on climate change resilience and requirements for protecting terrestrial and freshwater ecosystems (FEPA: Freshwater Ecosystem Priority Areas). These areas should not be seen as future boundaries of protected areas, since in many cases only a portion of a particular focus area would be required to meet the protected area targets set in NPAES. They are also not a replacement for fine-scale planning, which may identify a range of different priority sites based on local requirements, constraints, and opportunities.

The site is not located within any NPAES focus areas or any Formal-/Informal Protected Areas. The nearest NPAES focus area is located approximately 41.6km north-west from the nearest focus area (Moist Escarpment Grassland focus area), while the nearest Formal Protected Area is located approximately 88km south of the site (Seekoeivlei Nature Reserve), and the nearest Informal Protected Area approximately 16km to the east of the site (Rietvlei Private Nature Reserve).

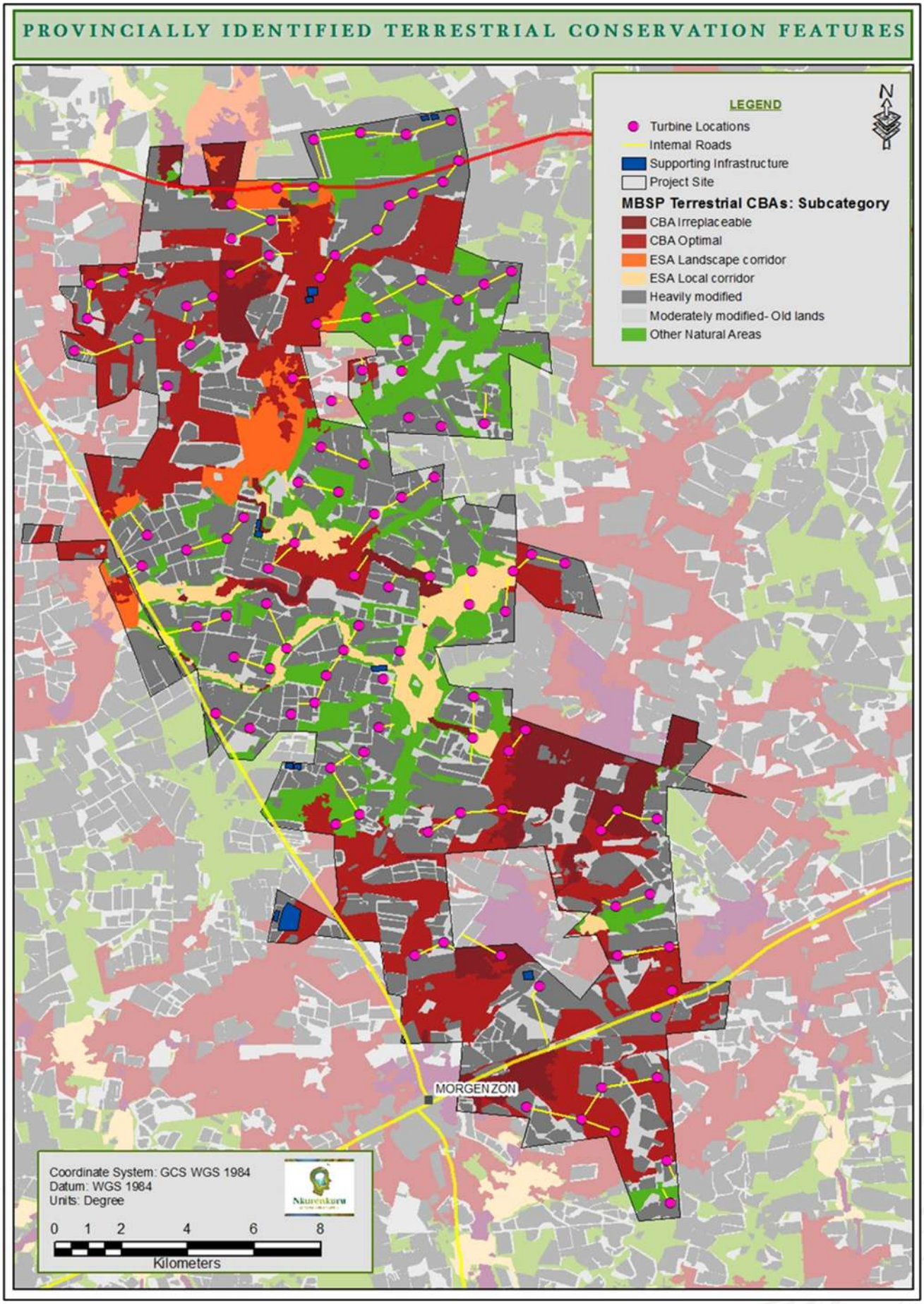


Figure 8.8: Provincially identified terrestrial conservation priority areas found within the greater surroundings of project site

viii. Habitats on Site

A map of the study area, based on observable land features via Google Earth Satellite Imagery, revealed that it consists primarily of five main functional land types, namely: buildings/structures, active farmlands, fallow land (abandoned farmlands), natural grassland areas, and drainage areas (which is comprised of wetlands, small streams, shallow pans and depressions, and natural or artificial dams, among other things) (refer to **Figure 8.9** and **Table 8.11**).

Almost half of the study area consists of natural grasslands (44.5%), while agriculture (38.7%) comprises much of the rest. Natural grasslands have a high sensitivity rating, since the vegetation type indicated for the study area, as per VegMap 2018, is Soweto Highveld Grassland, which is considered to be Endangered.

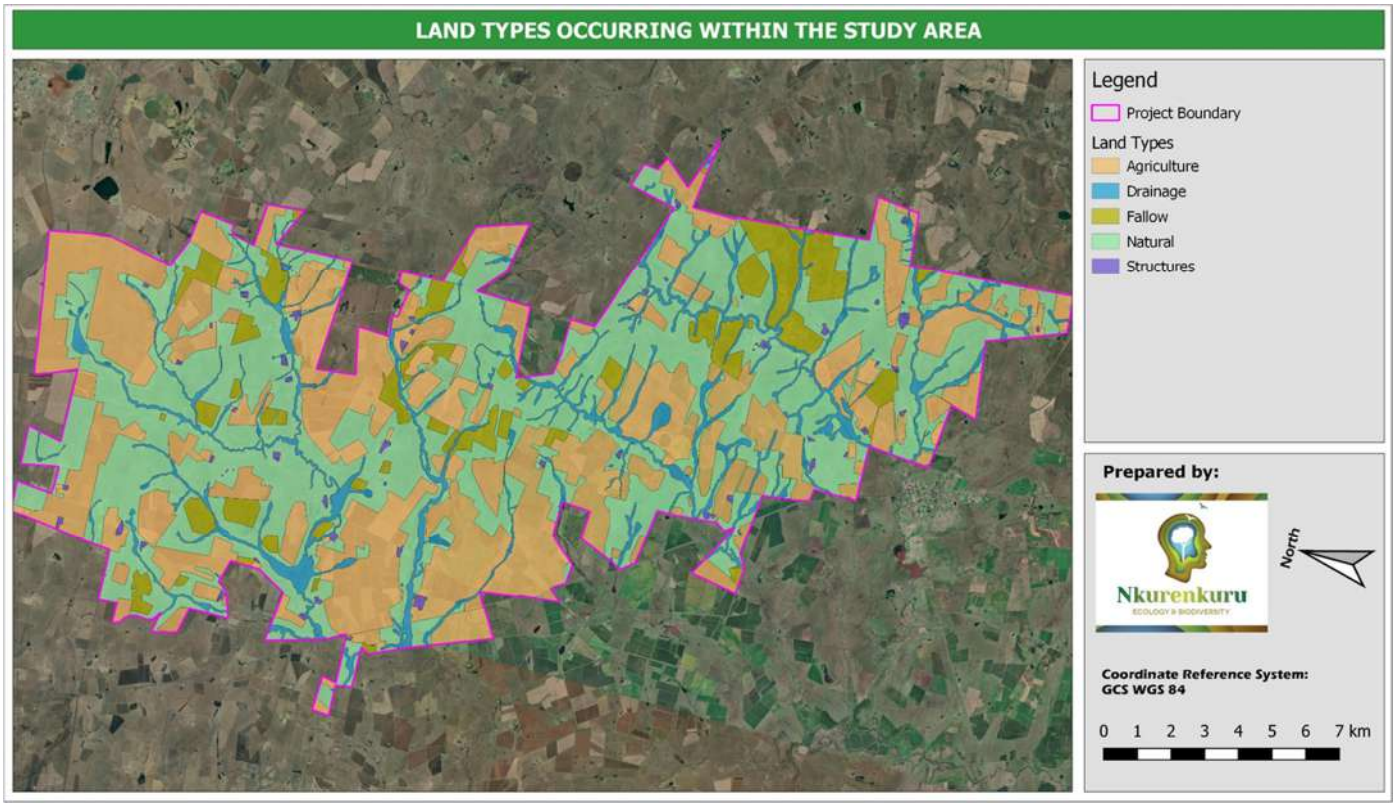


Figure 8.9: Desktop mapping of the land cover/habitat types occurring within the study area. Note that the map has been rotated sideways to optimize space (see the direction of the north arrow)

Table 8.11: Total approximate area sizes for land types occurring within the study area, as mapped based on currently available Google Earth Satellite Imagery

Land Type	Sensitivity	Total Area (ha)	Total Area (%)
Agriculture	Low	11 170	38.7
Drainage	Very High	2 442	8.5
Fallow Land	Medium	2 194	7.6
Natural Areas	High	12 841	44.5
Structures	Low	209	0.7
	Grand Total	**28 856**	100.0

ix. Strategic Water Source Areas and National Freshwater Ecosystem Priority Areas

The project site is located outside of any Strategic Water Source Areas (SWSA) for groundwater, but is located within a SWSA for surface water; namely, the Upper Vaal SWSA.

A review of the National Freshwater Ecosystems Priority Areas (NFEPA) coverage for the project site (refer to **Figure 8.10**) revealed that one FEPA1 priority sub-quaternary catchment covers about 25% of the project site. The river associated with this sub-quaternary catchment is the Osspruit River (FEPA1 Priority River,) which is a fairly short (34km) perennial watercourse, flowing in a largely south-western direction, feeding into the Blesbokspruit River. According to the Department of Water and Sanitation's 1999 Present Ecological State for mainstream rivers, this watercourse was classified as Moderately Modified (Class C).

Furthermore, five upstream sub-quaternary catchments are located within the project site (covering the remaining 75% of the project site). Most of these sub-quaternary catchments are fairly small to moderate in size, apart from the sub-quaternary catchment covering most of the central portion of the project site. Three of these sub-quaternary catchments are drained by the Kwaggaslaagte River and its associated tributaries, whilst the other two sub-quaternary catchments are drained by the Blesbokspruit River. The Present Ecological State (DWS, 1999) of the Kwaggaslaagte River and its associated tributaries are classified as Moderately Modified (Class C).

A review of the NFEPA coverage for the study area (refer to **Figure 8.10**) revealed that a large amount of wetland features occur within the project site (332 wetland features). Of these wetland features, most (188 features) are classified as Non-FEPA, artificial wetland features, and represent the numerous dams/reservoirs (mainly instream), that characterize the project site. Most of these artificial dam features are fairly small in size (average size of dam features; 0.85 ha). Of the 144 natural wetlands, only 20 wetlands have been listed as FEPA priority wetland features (Nel, et al., 2011). A summary of the natural wetlands occurring within the project site, as mapped within the NFEPA spatial coverage map, is provided in **Table 8.12** below.

Table 8.12: Summary of NFEPA Wetlands mapped within the project site.

Hydrogeomorphic Unit	Number of Wetlands	Average Size (ha)	Largest Feature (ha)	FEPA Priority Wetlands (amount)	Average Size of FEPA Priority Wetlands (ha)	Largest FEPA Priority Wetland (ha)	WETLAND CONDITION				
							AB: Natural or Good	C: Moderately Modified	Heavily to Critically Modified		
									Z1[17]	Z2[18]	Z3[19]
Channelled valley-bottom	59	3.4	167	9	0.8	6	11	17	5		26
Unchannelled valley-bottom	14	0.2	0.5	9	0.1	0.3	11	2	1		
Depression	8	2.7	15	1	N/A	1.2	4	3	1		
Flat	8	0.2	1	0	N/A	N/A	2	2			4
Seep	53	5.3	197	1	N/A	61	11	2	1		39

[17] Wetlands that overlap with a 1:50,000 "artificial" inland waterbody from the Department of Land Affairs: Chief Directorate of Surveys and Mapping (2005-2007).
[18] Majority of the wetland unit is classified as "artificial" in the wetland delineation GIS layer.
[19] Percentage natural land cover <25%.

Hydrogeomorphic Unit	Number of Wetlands	Average Size (ha)	Largest Feature (ha)	FEPA Priority Wetlands (amount)	Average Size of FEPA Priority Wetlands (ha)	Largest FEPA Priority Wetland (ha)	WETLAND CONDITION				
							AB: Natural or Good	C: Moderately Modified	Heavily to Critically Modified		
									Z1[17]	Z2[18]	Z3[19]
Valleyhead Seep	2	0.1	0.2	0	N/A	N/A	1				1
TOTAL	**144**	**3.6**	**167**	**20**	**3.6**	**61**	**40**	**26**	**8**	**0**	**70**

The above table indicates that almost half (48.6%) of all the wetland features have been significantly modified (less than 25% of natural land cover remain). Approximately 27.8% of all wetlands found within the project area can be regarded is largely natural or in a good condition. Of these forty intact wetlands, twenty are regarded as FEPA priority wetlands. Most of these FEPA priority wetlands are fairly small in size (>4 ha), apart from single seepage wetland that is fairly significant in terms of size (61 ha) (refer to **Figure 8.11**). The bulk of the wetlands that occur within the project site is closely associated with the watercourse/river features (channelled valley bottom wetlands, unchanneled valley bottom wetlands and most of the seepages) (refer to refer to **Figure 8.10**).

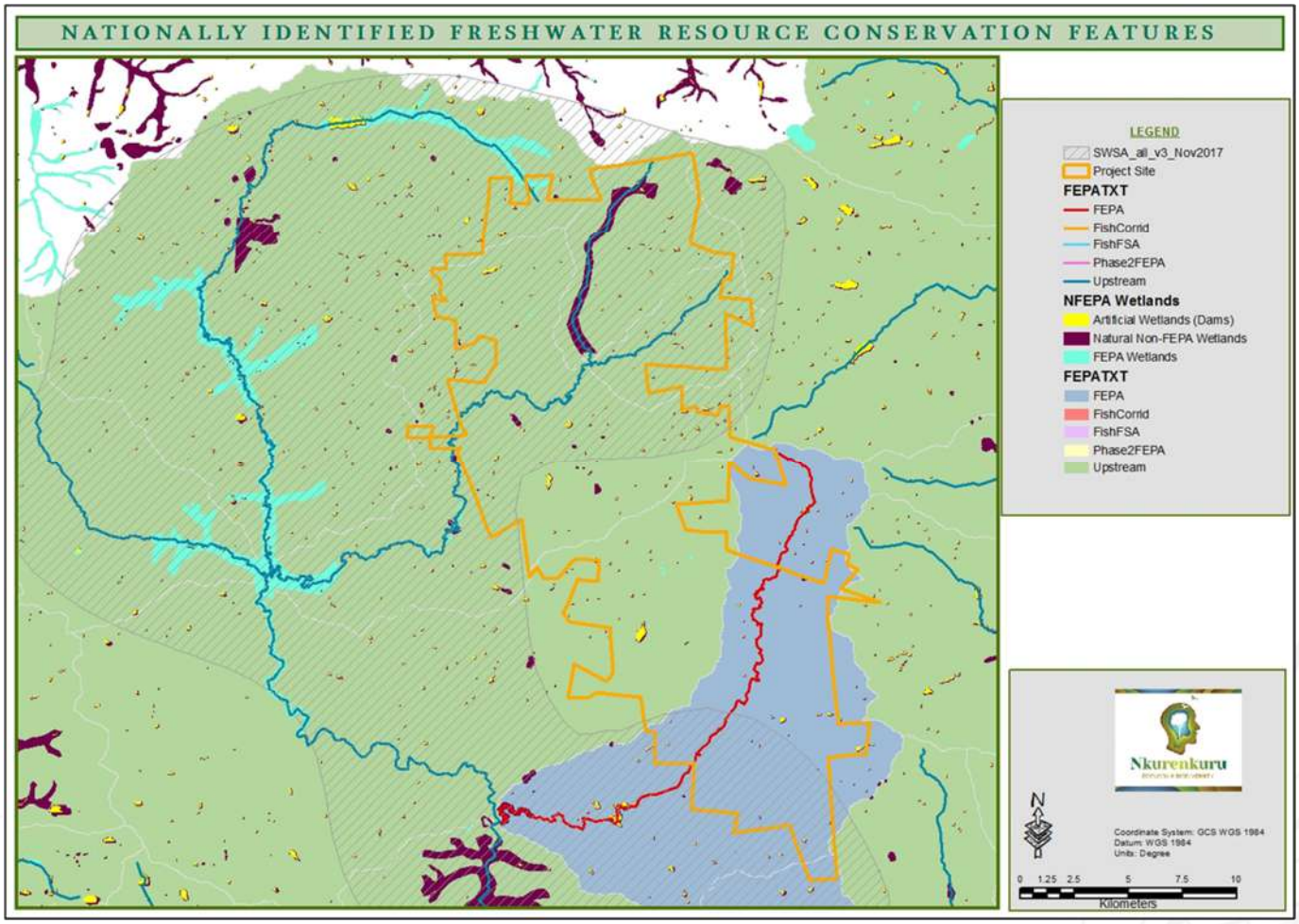


Figure 8.10: Nationally identified aquatic resource conservation priority areas found within the greater surroundings of the proposed project site

x. Freshwater/Drainage Features

Freshwater/drainage features cover approximately 2 949ha (7.5%) of the project site and are mainly characterised by channelled valley-bottom wetlands, followed by seepage wetlands (**Figure 8.11**). Where the larger watercourses flow across flatter, broader plains, floodplains are typically present. No large depression wetlands are present within the project site, with most of the depression wetlands being small and endorheic.

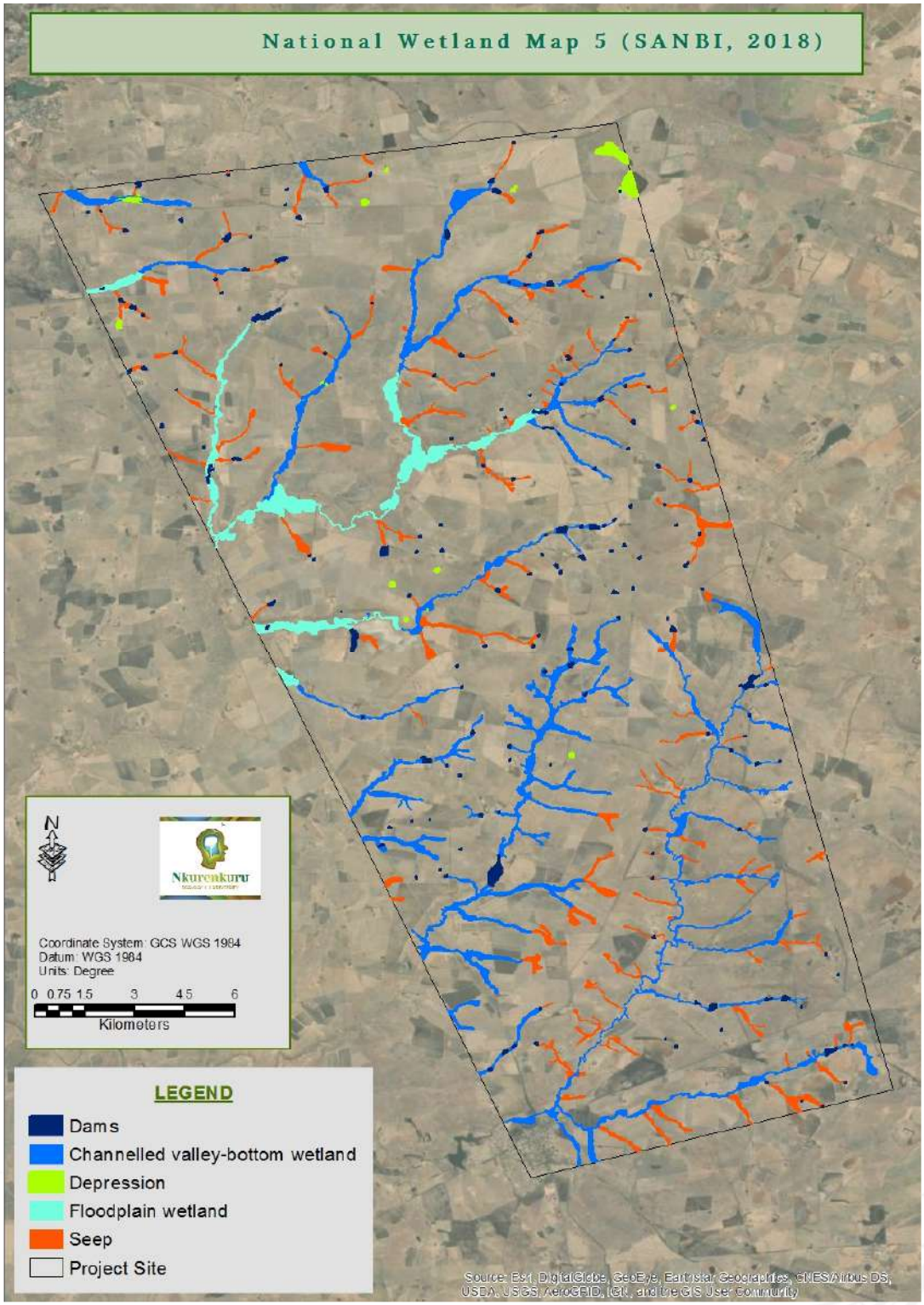


Figure 8.11: Regional drainage setting

During the field work undertaken for the EIA process, 318 freshwater resource features were identified (Table 8) and delineated within the 500m regulated area and include:

- Sixty (60) channelled valley-bottom wetlands
- Thirty-five (35) uncahnnelled valley-bottom wetlands,
- Two hundred and nine (209) seepage wetlands;
- Seven (7) depression Wetlands; and
- Seven (7) floodplain wetlands

The dominant drainage/wetland features within the project site are the floodplain wetlands, within which almost all of the other wetland features apart from a few endorheic wetland features (7 depression wetlands and 7 seepages), drain into directly. All of the freshwater resource features on and around the site are intermittent or ephemeral, being inundated only for brief periods each year, with periods of drought that are unpredictable in duration.

Artificial wetland features (impoundments/dams) are also a noteworthy hydrological feature within the project site with one-hundred and twenty dam features present within the project site. Most of these dam features are instream impoundments (especially common within the channelled valley-bottom wetlands) and are typically fairly small farm dams which is fairly easily breached or allow some seepage.

xi. Terrestrial Fauna Communities within the Study Area

Mammals

The International Union for Conservation of Nature (IUCN) Red List Spatial Data lists eighty-five (85) mammal species that could be expected to occur within the vicinity of the project site. This is regarded as a moderately-low species diversity. Of these species, sixteen are medium to large conservation dependant species, or species that had a historical range that included the project area, but with natural populations since becoming locally "extinct" in these areas. These species are now generally restricted to protected areas such as game reserves, game farms and protected areas, with most of these species being re-introduced in these areas.

Of the sixty-nine (69) remaining mammals, two (2) are introduced/exotic mammals (House Mouse – *Mus musculus* and Brown Rat – *Rattus norvegicus*). The remaining sixty-seven (67) mammals are regarded as indigenous species that contain or may contain natural populations within the area. Of these naturally occurring mammals, thirty-five (35) species been previously recorded within the larger survey area (Quarter Degree Grids: 2629DA, 2629CB, 2629AD, 2629BC) according to the Animal Demographic Unit (ADU) database, indicating a significant undersupplying within the area.

Of the remaining sixty-seven (67) small- to medium sized mammal species, that have a natural distribution range that include the project site and have a likelihood of occurring within the project site, fourteen (14) are listed as being of conservation concern on a regional or global basis (refer to **Table 8.13**).

Table 8.13: List of mammal species of conservation concern that may occur in the project area as well as their global and regional conservation statuses

Species	Common Name	Conservation Status			Likelihood of Occurrence
		Red Data	IUCN	TOPS	
Redunca fulvorufula	Mountain Reedbuck	NT	LC		Moderate
Panthera pardus	Leopard	NT	NT	Protected	High
Poecilogale albinucha	African Striped Weasel	EN	LC		High
Crocidura mariquensis	Swamp Musk Shrew	LC	VU	VU	Low
Dasymys incomtus	African Marsh Rat	NT	LC		Moderate
Otomys auratus	Southern African Vlei Rat	NT	LC		Moderate
Aonyx capensis	Cape Clawless Otter	NT	LC		Low
Parahyaena brunnea	Brown Hyaena	NT	LC		High
Leptailurus serval	Serval	NT	NT	Protected	High
Ambysomus septentrionalis	Highveld Golden Mole	NT	NT	Protected	Moderate
Crocidura maquassiensis	Maquassie Musk Shrew	NT	NT	Protected	High
Mystromys albicaudatus	White-tailed Mouse	NT	NT		Moderate
Hydrictis maculicollis	Spotted -necked Otter	VU	LC		Moderate
Chrysochloris villosus	Rough-haired Golden Mole	VU	LC		Moderate

Of the identified mammal species that may occur in the project area, twelve (12) are either nationally within TOPS (Threatened and Protected Species Issued in terms of Section 56(1) of the National Environmental Management: Biodiversity Act, 2004) or provincially within Schedule 1 and 2 of the Mpumalanga Nature Conservation Act, No. 10 of 1998 (refer to **Table 8.14**).

Table 8.14: List of Protected mammal species (according to national provincial regulations) that have a distribution that include the project site

Species	Common Name	TOPS (NEM:BA)	CITES	MPNCA Schedule 1	MPNCA Schedule 4	Likelihood of Occurrence
Aonyx capensis	Cape Clawless Otter	Protected	II	2		High
Hydrictis maculicollis	Spotted -necked Otter	Protected	II	2		Moderate
Mellovora capensis	Honey Badger	Protected		2		High
Parahyaena brunnea	Brown Hyaena	Protected		2		Moderate
Orycteropus afer	Aardvark	Protected		2		High
Proteles cristatus	Aardwolf		II	2		High
Redunca fulvorufula	Mountain Reedbuck			2		High
Raphicerus campestris	Steenbok			2		High
Atelerix frontalis	Southern African Hedgehog			2		High
Panthera pardus	Leopard	VU	I		4	Low
Leptailurus serval	Serval	Protected	II			High
Vulpes chama	Cape Fox	Protected				Moderate

Reptiles

The IUCN Red List Spatial Data lists sixty-six (66) reptile species that could be expected to occur within the vicinity of the project site. This is comparatively moderate-low suggesting that reptile diversity at the site is likely to be fairly moderate. Of the sixty-six (66) reptile species, twenty-four (24) have been previously recorded within the larger survey area (Quarter Degree Grids: 2629DA, 2629CB, 2629AD, 2629BC) according

to the Animal Demographic Unit (ADU) database, indicating under sampling within the region. Species that has been frequently observed within these QDGs are:

- Speckled Rock Skink – *Trachylepis punctatissima* (No. of Records: 15)
- Eastern Thread Snake – *Leptotyphlops scutifrons conjunctus* (No. of Records: 14)
- Bibron's Blind Snake – *Afrotyphlops bibronii* (No. of Records: 10)
- Distant's Ground Agama – *Agama aculeata distanti* (No. of Records: 7)
- Black-headed Centipede-eater – *Aparallactus capensis* (No. of Records: 7)
- Rhombic Egg-eater – *Dasypeltis scabra* (No. of Records: 7)

Of the sixty-six (66) reptile species that have a natural distribution range that includes the project site and have a likelihood of occurring within the project site, only one is listed as being of conservation concern on a regional or global basis, namely, Coppery Grass Lizard – *Chamaesaura aenea* (Near Threatened and Endemic). This species has a moderate likely hood of occurrence

All of the reptilian species apart from the water leguaan (*Varanus niloticus*), rock leguaan (*Varanus exanthematicus*) as well as all species of snakes (*Order Serpentes*) are regarded as Schedule 2 Protected Species in terms of the Mpumalanga Province Nature Conservation Act No 10 of 1998. Apart from the above mentioned provincially protected species, no TOPS species are likely to occur within the project site.

Amphibians

The IUCN Red List Spatial Data lists nineteen (19) amphibian species that occur within the region. Of these nineteen (19) amphibian species, thirteen (13)species have been previously recorded within the larger survey area (Quarter Degree Grids: 2629DA, 2629CB, 2629AD, 2629BC) according to the Animal Demographic Unit (ADU) database The most frequently recorded species area:

- Rattling Frog – *Semnodactylus wealii* (No. of Records: 10)
- Cape River Frog – *Amietia fuscigula* (No. of Records: 8)
- Common Caco – *Cacosternum boettgeri* (No. of Records: 8)
- Natal Sand Frog – *Tomopterna natalensis* (No. of Records: 7)
- Raucous Toad – *Sclerophrys capensis* (No. of Records: 7)

Of the nineteen (19) amphibian species that have a natural distribution range that include the project site, none are listed as being of conservation concern on a regional or global basis. Only one species protected under the Mpumalanga Province Nature Conservation Act No 10 of 1998 has a distribution range that includes the project site, namely African Bull Frog (*Pyxicephalus adspersus*). This species has a Moderate likelihood of occurrence.

xii. Bats

Bat Species and Important Bat Habitats

Based on current taxonomic information and bat occurrence data, twenty-four (24) species could occur within the project site (refer to **Table 8.15**). The majority have a low likelihood of occurrence and acoustic monitoring has confirmed the presence in the project site of six species. This includes four species classified as high risk from wind energy development: Natal Long-fingered bat, Cape Serotine, Little Free-tailed bat, and Egyptian Free-tailed bat.

Table 8.15: Bat Species Potentially Occurring within the project site

Common Name *Species Name*	Key Habitat Requirements*	Prob. of Occurrence	Conservation Status		WEF Risk[δ]
			IUCN[†]	RSA[‡]	
Natal Long-fingered bat *Miniopterus natalensis*	Temperate or subtropical species. Primarily in savannas and grasslands. Roosts in caves, mines, and road culverts. Clutter-edge forager.	**Confirmed (1,828 passes)**	LC/U	LC	High
Cape Serotine *Laephotis capensis*	Arid semi-desert, montane grassland, forests, savanna and shrubland. Roosts in vegetation and human-made structures. Clutter-edge forager.	**Confirmed (65,374 passes)**	LC/S	LC	High
Mauritian tomb bat *Taphozous mauritianus*	Savanna woodland preferring open habitat. Roosts on rock faces, the outer bark of trees or on the outer walls of buildings under the eaves of roofs. Forages in urban areas and over cultivation. Open-air forager.	High	LC/U	LC	High
Little Free-tailed bat *Chaerephon pumilus*	Semi-arid savannah, forested regions, woodland habitats. Roosts in narrow cracks in rock and trees but also in buildings. Open-air forager. Forages in urban areas and over cultivation.	**Confirmed (1,188 passes)**	LC/U	LC	High
Midas Free-tailed bat *Mops midas*	Hot low-lying savanna and woodland. Roosts in narrow cracks in rock and trees but also in buildings. Open-air forager.	Low	LC/D	LC	High
Egyptian Free-tailed bat *Tadarida aegyptiaca*	Desert, semi-arid scrub, savanna, grassland, and agricultural land. Roosts in rocky crevices, caves, vegetation, and human-made structures. Open-air forager.	**Confirmed (18,184 passes)**	LC/U	LC	High
Wahlberg's Epauletted fruit bat *Epomophorus wahlbergi*	Roost in dense foliage of large, leafy trees. Associated with forest and forest-edge habitats but will forage in urban environments.	Low	LC/S	LC	High
African Straw-coloured fruit bat *Eidolon helvum*	Non-breeding migrant in the PAOI.	Low	NT/D	LC	High
Egyptian Rousette *Rousettus aegyptiacus*	Distribution influenced by availability of suitable caves roosts.	Low	LC/S	LC	High
Temminck's Myotis *Myotis tricolor*	Montane forests, rainforests, coastal forests, savannah woodlands, arid thicket, and fynbos. Roosts communally in caves (and mines) and closely associated with mountainous terrain. Migratory. Clutter-edge forager.	Low	LC/U	LC	Medium-High
Welwitsch's Myotis *Myotis welwitschii*	Mainly open woodland and savannah but also high-altitude grassland, tropical dry forest, montane tropical moist forest, savannah and shrublands. Clutter-edge forager.	Low	LC/U	LC	Medium-High
Yellow-bellied house bat *Scotophilus dinganii*	Occurs throughout the Savannah Biome but avoids open habitats such as	**Confirmed**	LC/U	LC	Medium-High

Common Name *Species Name*	Key Habitat Requirements*	Prob. of Occurrence	Conservation Status		WEF Risk[δ]
			IUCN[†]	RSA[‡]	
	grasslands and Karoo scrub. Roosts in hollow trees and buildings. Clutter-edge forager.	**(321 passes)**			
Green House bat *Scotophilus viridis*	Savannah woodland species: restricted to low-lying, hot savannahs and avoids open habitats such as grasslands. Roosts in hollow trees and buildings. Clutter-edge forager.	Low	LC/U	LC	Medium-High
Dusky Pipistrelle *Pipistrellus hesperidus*	Woody habitats, such as riparian vegetation and forest patches. Recorded roosting in narrow cracks in rocks and under the loose bark of dead trees. Clutter-edge forager.	Low	LC/U	LC	Medium-High
Rusty Pipistrelle *Pipistrellus rusticus*	Savannah woodland and associated with open water bodies. Roosts in trees and old buildings. Clutter-edge forager.	Low	LC/U	LC	Medium-High
Long-tailed Serotine *Eptesicus hottentotus*	Montane grasslands, marshland and well-wooded riverbanks, mountainous terrain near water. Roosts in caves, mines, and rocky crevices. Clutter-edge forager.	**Confirmed (357 passes)**	LC/U	LC	Medium
Egyptian Slit-faced bat *Nycteris thebaica*	Savannah, desert, arid rocky areas, and riparian strips. Gregarious and roosts in caves but also in mine adits, Aardvark holes, rock crevices, road culverts, roofs, and hollow trees. Clutter forager.	Medium	LC/U	LC	Low
Geoffroy's Horseshoe bat *Rhinolophus clivosus*	Savannah woodland, shrubland, dry, riparian forest, open grasslands, and semi-desert. Roosts in caves, rock crevices, disused mines, hollow baobabs, and buildings. Clutter forager.	Medium	LC/U	LC	Low
Bushveld Horseshoe bat *Rhinolophus simulator*	Occurs in caves within areas of moist savannah, adjacent to rivers and savannah woodland, montane habitats, and coastal mosaics. Commonly associated with riparian forest and along wooded drainage lines. Roosts in caves and mines. Clutter forager.	Medium	LC/D	LC	Low
Blasius's Horseshoe bat *Rhinolophus blasii*	Savannah woodlands and are dependent on the availability of daylight roosting sites such as caves, mines, or boulder piles. Clutter forager.	Low	LC/D	NT	Low
Darling's Horseshoe bat *Rhinolophus darlingi*	Mesic woodland savannahs. Roosts in caves, boulder piles, mines, culverts, large hollow trees and disused buildings. Clutter forager.	Low	LC/U	LC	Low
Sundevall's Leaf-nosed bat *Hipposideros caffer*	Savannah, bushveld and/or coastal forests, near to rivers and other water sources. Roosts in caves, sinkholes, rock	Low	LC/D	LC	Low

Common Name *Species Name*	Key Habitat Requirements*	Prob. of Occurrence	Conservation Status		WEF Risk[δ]
			IUCN[†]	RSA[!]	
	fissures, hollow trees, mines, and culverts. Clutter forager.				
Percival's Short-eared Trident bat *Cloeotis percivali*	Savannah and woodland areas. Roosts in caves and mine tunnels. Clutter forager.	Low	LC/U	EN	Low
Botswana Long-eared bat *Laephotis botswanae*	Dry and moist savannah, grassland, and heathland habitats. Often found in the vicinity of rivers or in association with rocky outcrops. No information on roosting sites.	Low	LC/U	LC	Low

*Child et al. (2016), *Monadjem et al. (2020); [!] Child et al. (2016); †IUCN (2021); [δ] MacEwan et al. (2020b)

Bat roosting sites in the project site are relatively limited and unlikely to support large congregations of bats, with no underground sites (e.g., caves, mines, sinkholes) present. The closest known major bat roost is approximately 75km north of the project site. Although occasional ridges and rocky outcrops are features of the landscape, none are present in the project site. Bats are likely to roost in buildings associated with farmsteads within and bordering the project site, especially Cape Serotine and Egyptian Free-tailed Bat. The building inspections on site did not reveal any roosting bats but evidence (e.g., fur-oil-stained exit/entry points) suggests that bats are using these features. Trees growing at these farmsteads and elsewhere on site where they form clumps could also provide roosting spaces for bats.

Sensitive features within the project site at which bat foraging activity may be concentrated include farm buildings (and within built up areas for some species) where they would forage for insects attracted to lighting, dams and wetland areas, within and along the edge of woodland/tree patches, and over cultivated areas.

Summary of the Pre-Construction Bat Monitoring

Pre-construction bat monitoring was undertaken over a period of 12 months for the project site. Bat activity was sampled at eight locations. During the pre-construction bat monitoring, a total of 156 931[20] bat passes were recorded across 371 sample nights, 83% of which were attributed to Cape serotine. Thirteen (13) percent of total activity was attributed to Egyptian free-tailed bat. The remaining four species confirmed in the area accounted for 5 % of all activity.

Bat activity varied seasonally, with lowest activity in winter and activity increasing through spring and peaking in summer, although this varied by species. Both Egyptian free-tailed bat and Cape serotine showed bi-modal peaks in activity, with low activity in winter (refer to **Figure 8.13**).

[20] This excludes an additional 25,353 bat passes that were unable to be assigned to any particular species by the Wildlife Acoustics library "Bats of South Africa Version 5.4.0", and were thus classified as No ID. These calls were excluded from all analyses but are reported on here to highlight that they may include call fragments from species not confirmed for the site, and hence, the species list for the AoI may not be complete.

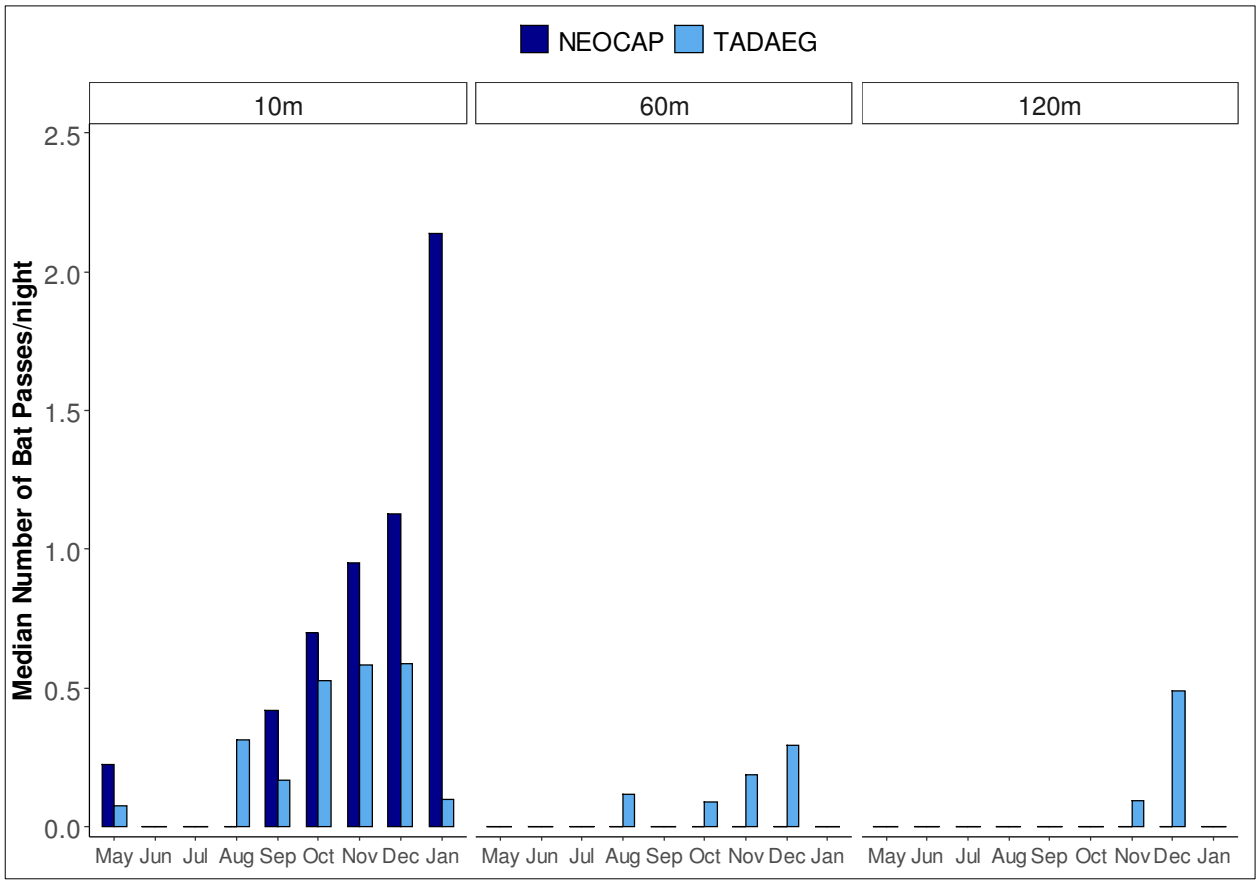


Figure 8.13: Bar chart showing bat passes/night by month for Cape serotine and Egyptian free-tailed bat

xiii. Avifauna

Important Bird and Biodiversity Areas (IBA)

The Amersfoort-Bethal-Carolina (SA018) Important Bird and Biodiversity Area (IBA) is a large IBA bounded by the roads connecting Bethal, Carolina, Ermelo and Amersfoort. The proposed project site is largely located within this IBA. The key species within this IBA is the globally Endangered Botha's Lark. Other globally threatened species include Blue Crane, Southern Bald Ibis, Black Harrier, Blue Korhaan, Black-winged Pratincole, Secretarybird, Martial Eagle and Denham's Bustard. Regionally, threatened species include African Grass Owl, White-bellied Korhaan and Lanner Falcon. Range- and biome-restricted species include Kurrichane Thrush and Buff-streaked Chat. The Chrissie Pans (SA019) IBA is a grouping of lakes and pans situated approximately 45km north-east of the proposed project site. This IBA supports a large population of threatened birds, both wetland and grassland, such as Southern Bald Ibis, Wattled and Blue Crane, Lesser Flamingo and Chestnut-banded Plover.

Avifauna Habitats

A large portion of the proposed project site has been transformed through agricultural practices such as ploughed maize fields as well as cattle and small stock grazing, which occurs throughout. Available avifaunal habitats also include watercourses and drainage lines which cross the site with several wetlands and man-made farm dams under various degrees of existing impact and transformation from farming practices (refer to **Figure 8.14**). Unploughed grassland areas have been considered to be in a natural or near-natural state of function for avifauna even if utilised for low density grazing.

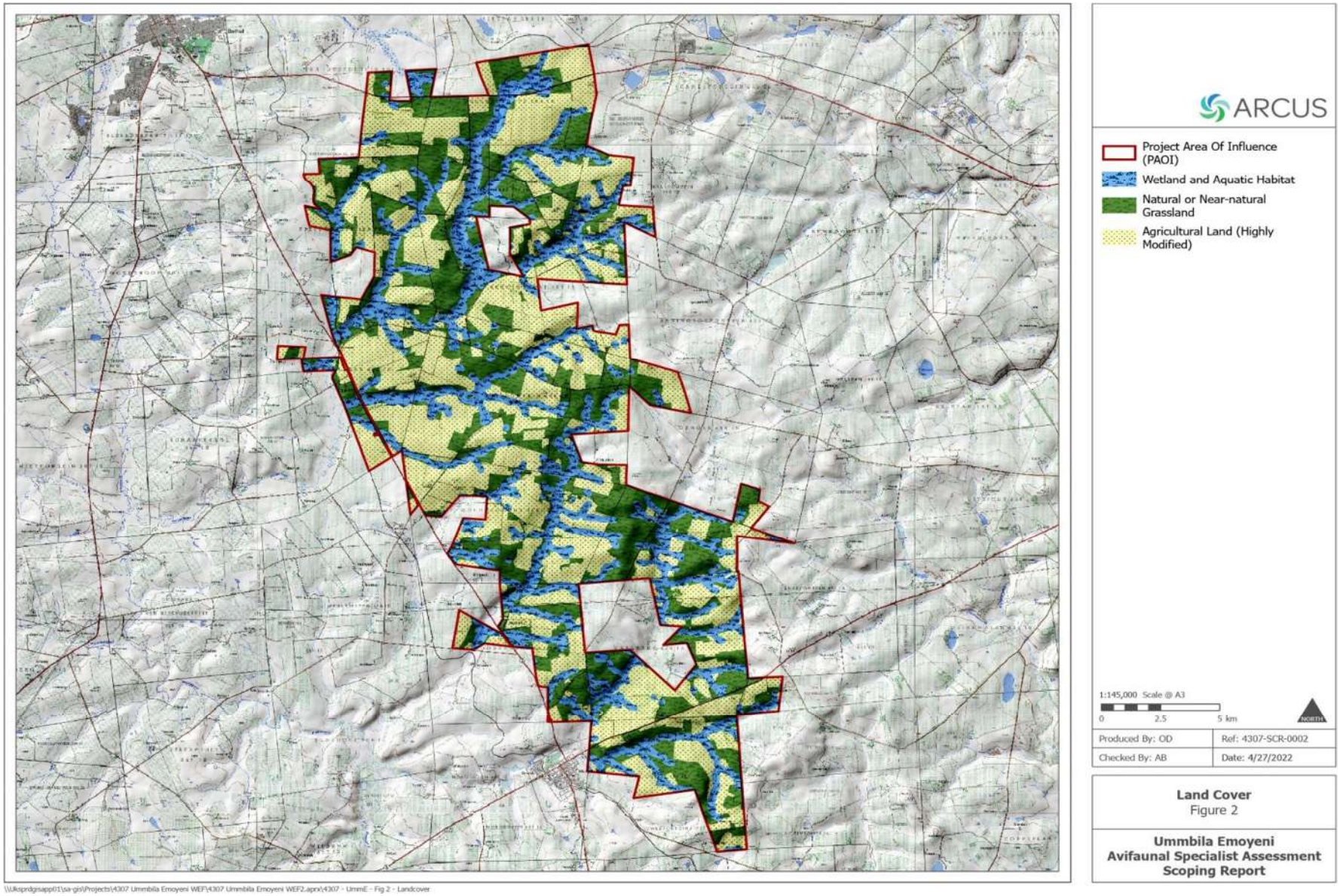


Figure 8.14: Avifauna habitats identified within the project site for the Ummbila Emoyeni Wind Energy Facility

Summary of the Pre-Construction Bird Monitoring

Pre-construction bird monitoring was undertaken over a period of 12 months within the project area. The pre-construction bird monitoring included the identification of twelve vantage points across the site as well as two vantage points at a suitable control site (**Figure 8.15**). Vantage points were selected to maximize the viewshed coverage across the site and available habitat types. Five drive transects were located across the site and 15 walk transects of 500m in length were identified to cover different vegetation and habitat types across the site. Transects were conducted twice each per survey.

A total of 26 target species were recorded during vantage point monitoring over the pre-construction monitoring period, during which time 405 flight paths were recorded, comprising 1 502 birds. The majority of flight paths were recorded during the summer monitoring period (213 flights comprising 1007 birds). A total of 93 flights (286 birds), 49 flights (107 birds) and 50 flights (102 birds) were recorded during winter, spring and autumn surveys respectively. This translated into average passage rates ranging from 7.35 birds/hour at VP2, to 0.46 birds/hour at VP5. The maximum passage rate recorded was 24.67 birds/hour at VP2 during summer (**Table 8.16**). The elevated passage rates recorded were due to large flocks of White Stork, Southern Bald Ibis, Black-winged Pratincole and Amur Falcon recorded during the summer months. The highest average passage rate per species was recorded for Southern Bald Ibis at VP1 (3.98 birds/hour) and VP2 (3.52 birds/hour, **Table 8.16**).

A total of 72 observations of 18 target species (comprising 235 birds) were recorded during 703.12km of drive transect observations, with Southern Bald Ibis representing the highest number of records, frequently encountered along DT1 (refer to **Table 8.17**) particularly in the north of the preferred site foraging in a mixture of modified and natural habitat.

A number of Greater Flamingo were observed along DT3 in a larger farm dam with open water. Blue Korhaan records were associated with areas of natural or near-natural vegetation and Secretarybird were recorded on multiple occasions towards the centre of the preferred site. Secretarybird were observed perched in a treeline and while no nest structure was located, this area has been buffered as it appears to be relatively central to the incidental and transect records made for this species in that area.

A total of 102 species (5 805 birds) were recorded during the walk transects conducted across the full pre-construction bird monitoring period. Red-billed Quelea accounted for 711 of these records as they are known to travel in large flocks and utilise agricultural resources. Notably, no Botha's Lark, Rudd's Lark or Yellow-breasted Pipit were recorded in the preferred site.

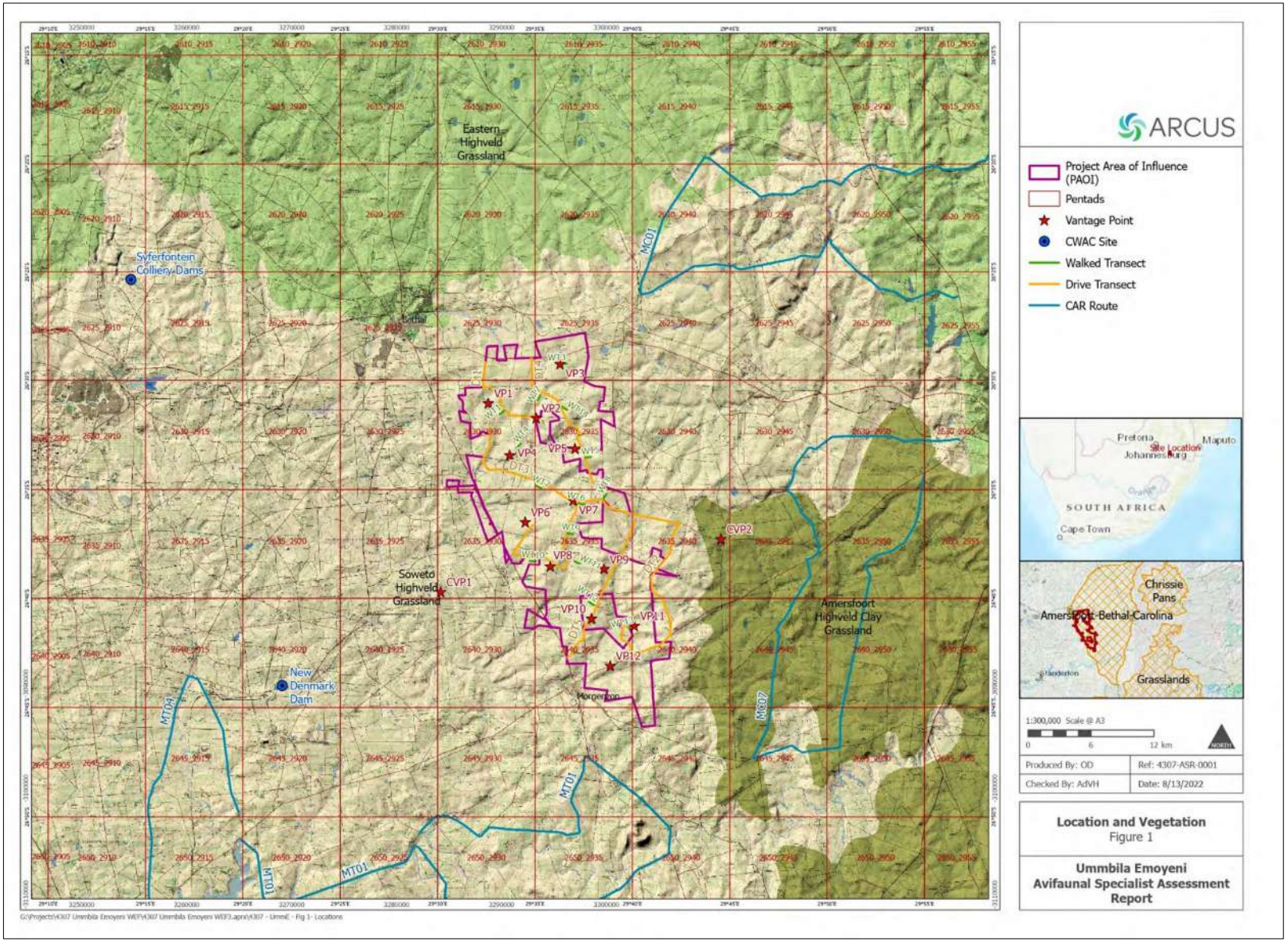


Figure 8.15: Walked and drive transects and vantage point

Table 8.16: Average Passage Rate (birds/hour) recorded per Species during the full Pre-Application Avifaunal Monitoring Period

Species	Vantage Point													
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**CVP 1**	**CVP 2**
African Harrier-hawk	-	-	-	0.02	-	-	-	0.02	-	-	0.02	0.02	-	-
Amur Falcon	0.02	**1.90**	0.04	0.25	-	-	0.04	-	0.46	0.38	0.04	0.19	0.06	-
Black Sparrowhawk	0.02	0.06	-	0.06	-	-	0.04	-	-	-	-	0.02	-	-
Black-chested Snake-eagle	-	-	-	-	-	-	-	-	0.04	-	0.02	-	-	-
Black-winged Kite	0.08	0.48	0.13	0.08	0.29	0.27	0.15	0.21	0.40	0.13	0.21	0.27	0.27	0.18
Black-winged Pratincole	-	-	**2.27**	-	0.02	-	0.13	-	0.02	-	-	-	-	-
Blue Crane	0.21	0.13	0.06	-	-	-	-	-	0.15	0.04	-	0.04	-	-
Blue Korhaan	-	0.02	-	-	-	-	0.04	-	0.04	-	-	-	-	0.08
Cape Vulture	-	-	-	-	-	-	0.02	-	-	-	-	-	-	-
Common Buzzard	0.02	0.08	0.02	-	0.13	-	0.04	0.13	0.06	0.02	0.02	0.10	0.08	0.05
Greater Kestrel	-	-	0.13	-	-	-	-	-	0.21	-	-	-	0.02	-
Grey-crowned Crane	-	-	0.04	-	-	-	-	-	-	-	-	-	-	-
Grey-winged Francolin	-	0.02	-	-	-	-	-	-	-	-	-	-	-	-
Lanner Falcon	-	-	0.04	0.10	-	0.04	0.02	-	0.17	0.02	-	-	-	-
Marsh Owl	-	0.02	0.10	-	-	0.02	-	-	-	-	-	-	0.02	-
Martial Eagle	-	-	-	0.02	-	-	0.02	0.02	-	-	-	-	-	-
Montagu's Harrier	0.04	-	0.04	0.06	-	-	-	-	0.04	-	-	-	-	-
Northern Black Korhaan	-	0.06	0.04	0.38	-	0.13	0.13	-	-	0.04	-	-	0.08	-
Pallid Harrier	0.04	0.02	-	0.02	-	-	0.02	-	-	-	-	-	-	-
Peregrine Falcon	0.02	-	-	-	-	-	-	-	-	-	-	-	-	-
Rock Kestrel	-	0.02	0.10	-	-	-	-	-	0.04	-	-	-	-	-
Secretarybird	-	0.15	-	0.06	-	0.02	0.02	-	0.02	0.02	0.10	0.04	0.08	0.05
Southern Bald Ibis	**3.98**	**3.52**	0.65	-	-	0.13	-	-	-	**2.83**	1.06	-	0.02	-
Spotted Eagle-owl	0.02	-	-	-	-	-	-	-	-	-	-	-	-	-
White Stork	**1.04**	0.88	**2.85**	0.29	-	-	-	0.08	0.08	-	-	-	-	-
Yellow-billed Kite	0.02	-	-	0.02	0.02	-	-	0.02	-	-	-	-	-	-
Total	**5.52**	**7.35**	**6.52**	1.38	0.46	0.60	0.67	0.48	1.73	**3.48**	1.48	0.69	0.65	0.36

Table 8.17: Species and Number of Individuals Recorded During Drive Transects, Each Conducted Twice Per Survey Across the Full Pre-Application Avifaunal Monitoring Period

Species	DT 1	DT 2	DT 3	DT 4	DT 5	Total
African Fish Eagle	1					**1**
African Spoonbill	2					**2**
Amur Falcon			3	2		**5**
Black Sparrowhawk	2					**2**
Black-winged Kite	1	10	11	6		**28**
Blue Crane				2		**2**
Blue Korhaan	8		2			**10**
Common Buzzard			5	3		**8**
Greater Flamingo	4		30			**34**
Greater Kestrel		1				**1**
Grey-winged Francolin	13					**13**
Lanner Falcon				2	1	**3**
Marsh Owl		2		1		**3**
Montagu's Harrier				1		**1**
Rock Kestrel			1	1		**2**
Secretarybird		3	1	1		**5**
Southern Bald Ibis	92				21	**113**
White Stork				2		**2**
Total	**123**	**16**	**53**	**21**	**22**	**235**

8.5. Integrated Heritage including Archaeology, Palaeontology, and the Cultural Landscape

8.5.1. Archaeology

Fifteen (15) archaeological heritage resources were identified within the study area during the survey of the project site for the wind energy facility. **Table 8.18** provides the description and coordinates of the archaeological heritage finds. **Figure 8.16** provides a locality map of the archaeological heritage resources identified within the project site.

Table 8.18: Archaeological heritage resources identified during the field assessment of the project site

ID	Site Name	Description	Co-ordinates		Grading	Mitigation
1	Ummbila Emoyeni 001	10? GRAVES Not all the cairns are intact	-26.50822222	29.57985	IIIA	No direct impact anticipated. Part of historic cluster
2	Ummbila Emoyeni 002	STONE STRUCTURE Part of the historical identity of the area, including stone structures and foundations.	-26.51131389	29.57884167	IIIC	No direct impact anticipated. Part of historic cluster
3	Ummbila Emoyeni 003	STONE FOUNDATION Part of the historical identity of the area, including stone structures and foundations.	-26.51185278	29.57861111	NCW	Likely to be impacted by the Solar PV Layout
4	Ummbila Emoyeni 004	AREA WITH OLD STONE HOUSE STONE CIRCLES STONE KRAAL	-26.74378611	29.69147222	IIIC	Not impacted by the current development layout

ID	Site Name	Description	Co-ordinates		Grading	Mitigation
		Part of the historical identity of the area, including stone structures and foundations.				
5	Ummbila Emoyeni 005	41 GRAVES Fieldstone cairns, with a few cement headstones. Headstones are marked, challenging to discern dates. Graves are situated right next to a cornfield, with a wire fence dissecting what may be more graves	-26.7268	29.68093056	IIIA	No direct impact anticipated. However, possibility of more burials in the area
6	Ummbila Emoyeni 006	15 GRAVES Fieldstone cairns. No inscriptions that could be read. Graves are situated on top of the koppie, within the wind turbine footprint.	-26.69272778	29.67026111	IIIA	Turbine must be relocated more than 300m east of its present location
7	Ummbila Emoyeni 007	OLD STRUCTURES Part of the historical identity of the area, including stone structures and foundations.	-26.51163056	29.64264722	NCW	Not impacted by the current development layout
8	Ummbila Emoyeni 008	POSSIBLE GRAVE One stone cairn	-26.50435	29.59498889	IIIA	No direct impact anticipated
9	Ummbila Emoyeni 009	HISTORIC YARD MIDDEN Part of the historical identity of the area, including stone structures and foundations.	-26.50869722	29.58020833	IIIC	No direct impact anticipated. Part of historic cluster
10	Ummbila Emoyeni 010	HISTORICAL HOUSE AND YARD Part of the historical identity of the area, including stone structures and foundations.	-26.50905278	29.58053611	IIIC	No direct impact anticipated. Part of historic cluster
11	Ummbila Emoyeni 011	LARGE STONE KRAAL Part of the historical identity of the area, including stone structures and foundations.	-26.51104444	29.58501667	IIIC	No direct impact anticipated. Part of historic cluster
12	Ummbila Emoyeni 012	5 GRAVES Metal cross, fieldstone cairns. Graves are along	-26.54944722	29.56575833	IIIA	No direct impact anticipated

ID	Site Name	Description	Co-ordinates		Grading	Mitigation
		the proposed powerline route				
13	Ummbila Emoyeni 013	80 GRAVES Fieldstone cairns and headstones, painted cement frames and headstones, cement and concrete slabs and headstones. Some of the graves have inscriptions; dates indicated as the 1940s and 1950s. Approximately 80 graves within a rectangular packed stone border Graves are along the proposed powerline route	-26.58522222	29.60138611	IIIA	Road/grid must be realigned to ensure a minimum of a 50m no development buffer is implemented around the site
14	Ummbila Emoyeni 014	HISTORICAL PUMP	-26.58596389	29.60083611	NCW	No direct impact anticipated
15	Ummbila Emoyeni 015	SITE SURFACE SCATTERS METAL Surface scatters of glass, large metal objects, farm implements and a cast-iron pot. Could be associated with the graveyard at WP 013 GR	-26.58672222	29.59949444	IIIC	No direct impact anticipated

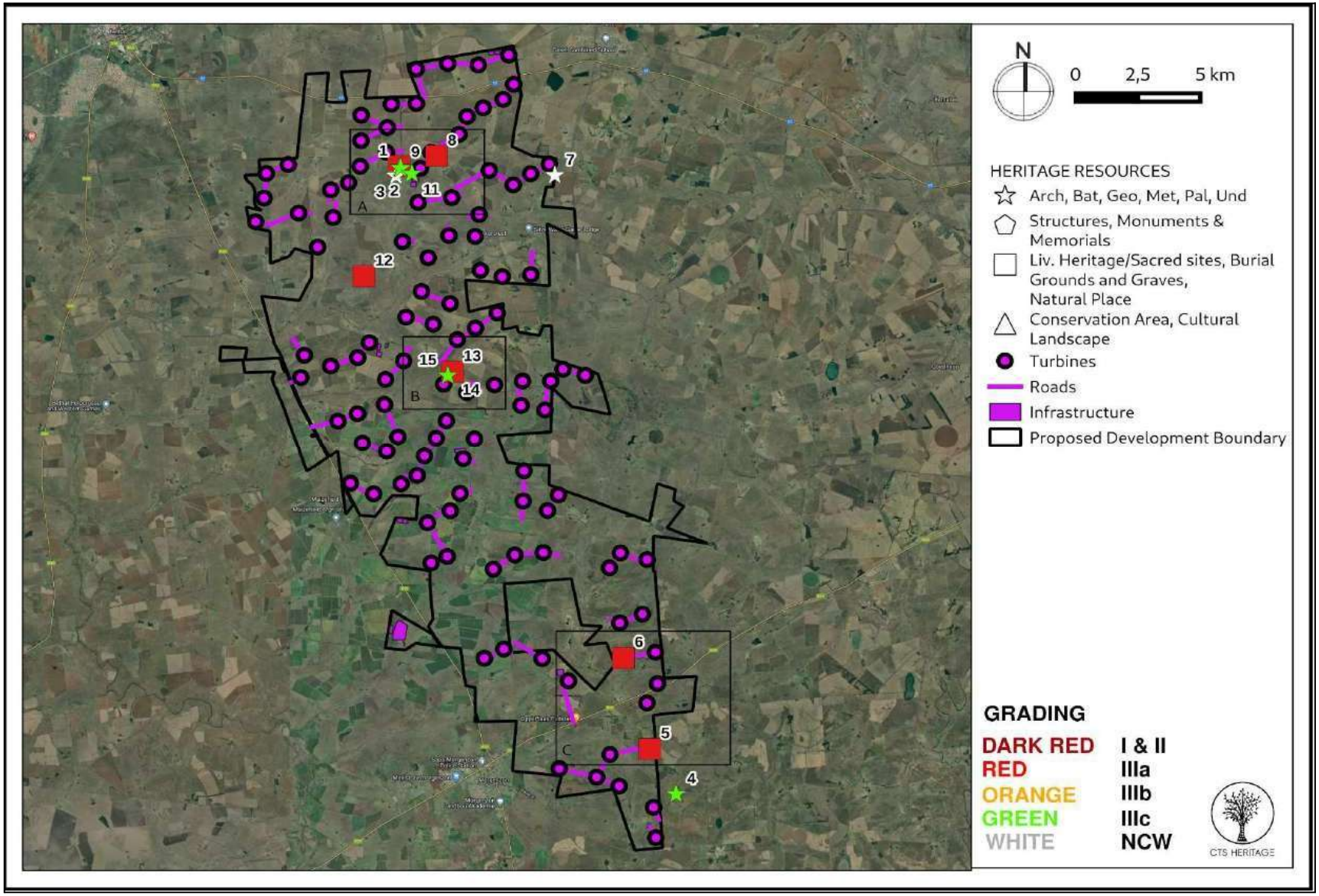


Figure 8.16: Map of archaeological heritage resources identified within the project

8.5.2. Palaeontology

According to the SAHRIS Palaeosensitivity Map (refer to **Figure 8.17**), the area proposed for development is underlain by sediments of zero, moderate and very high palaeontological sensitivity. The palaeontologically sensitive geology of the area is ascribed to the Vryheid Formation of the Ecca Group of sediments. The nature of the excavations associated with Renewable Energy facilities tends to be deep and as such, given the very high palaeontological sensitivity of the sediments that underlay the project site, the likelihood of impacting intact Vryheid Formation sediments is high.

Figure 8.17: Palaeosensitivity map indicating fossil sensitivity underlying the project site

Four (4) palaeontological heritage resources were identified during the survey of the project site. **Table 8.19** provides a description of the palaeontological finds and **Figure 8.18** provides a locality map of the palaeontological heritage resources identified within the project site.

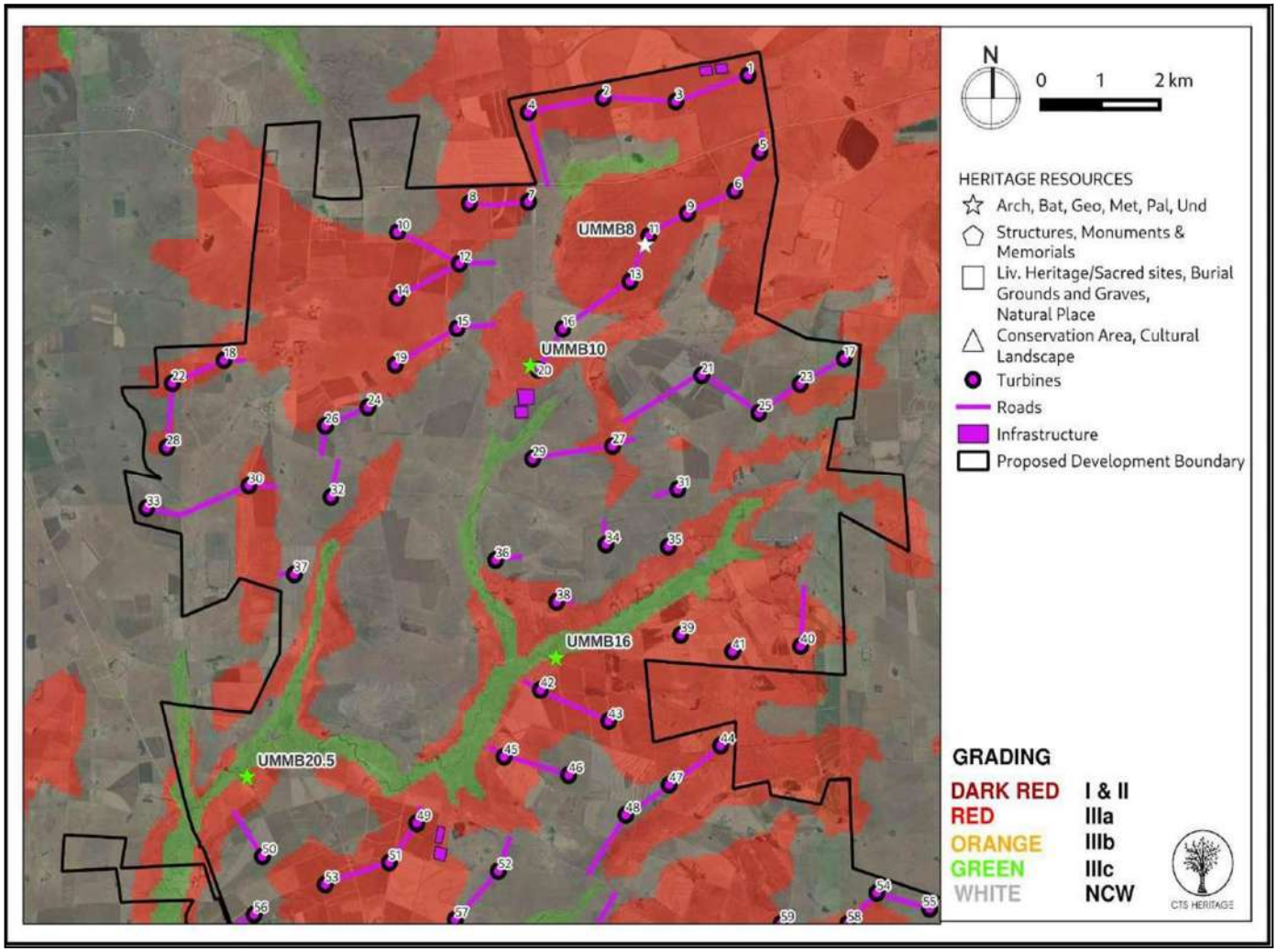


Figure 8.18: Map of palaeontological heritage resources within the proposed project site

Table 8.19: Palaeontological observations made during the field assessment of the project site

ID	Coordinates		Comments	Grade
UMMB8	26.491010° S	29.606630° E	Weathered shale and sandstone exposed during ploughing of very shallow soils on the Vryheid Formation in the northern part of the study area. Excavation for turbine foundations will expose shale and sandstone with a high chance of fossil finds.	NCW
UMMB10	26.508400° S	29.587170° E	Weathered shale and sandstone exposed during ploughing of very shallow soils on the Vryheid Formation in the northern part of the study area. Excavation for turbine foundations will expose shale and sandstone with a high chance of fossil finds.	IIIC
UMMB16	26.550580° S	29.591510°E	Trace fossils, as reported on by Mason and Christie (1985) are abundantly present in the siltstone and shale of the Vryheid Formation.	IIIC
UMMB20.5	26.567758° S	29.539098° E	Soft sediment deformation or possible trace fossil (feeding trail?) in sandstone of the Vryheid Formation.	IIIC

8.5.3. Cultural Landscape

The concept of cultural landscape gives spatial and temporal expression to the processes and products of the interaction between people and the environment. It may thus be conceived as a particular configuration of topography, geology, vegetation, land use and settlement pattern and associations which establishes some coherence of natural and cultural processes.

Possible receptors within the landscape which could be sensitive to landscape change have been identified and include the towns of Bethal and Morgenzon; the Silver Water and Rievlei Nature Reserves; local farmsteads and homesteads; and the N17, R35, R38, R39 and unsurfaced local roads.

The N17 that runs through the northern section of the development area marks the primary approach from Ermelo (established in the 1870's) to Bethal (established in the 1880's) and as such, the area proposed for development provides a significant gateway between these two historic towns. As with most National Routes, the alignment of the N17 follows the old regional route of the R29 which itself is likely based on historic routes between these significant towns. The way that the local farmsteads and roads interact with each other and elements of the landscape such as topography and river courses etc. all act as contributing elements to the cultural landscape. These elements are mapped in **Figure 8.19. and 8.20** below.

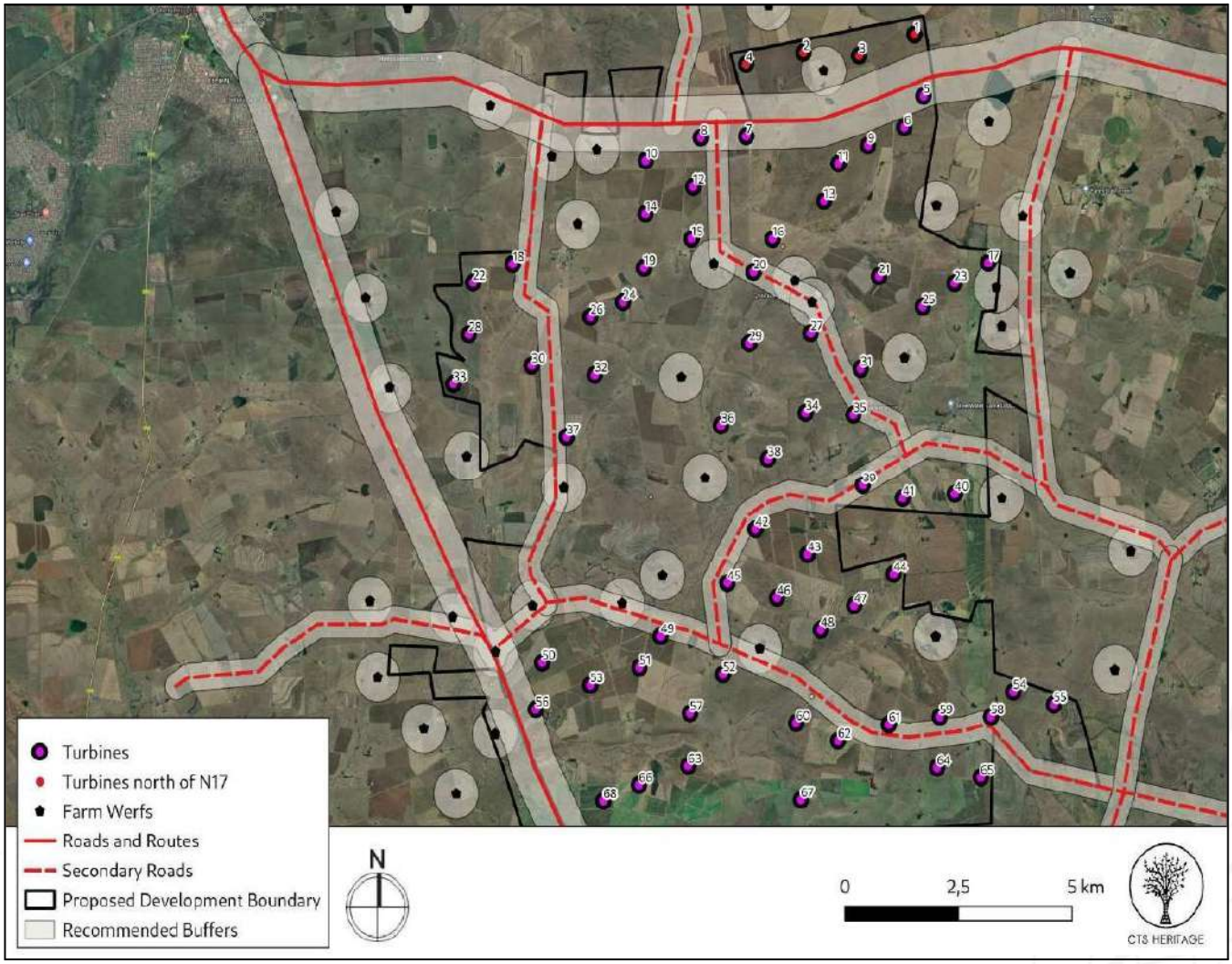


Figure 8.19: Cultural landscape features identified within the northern section of the project site

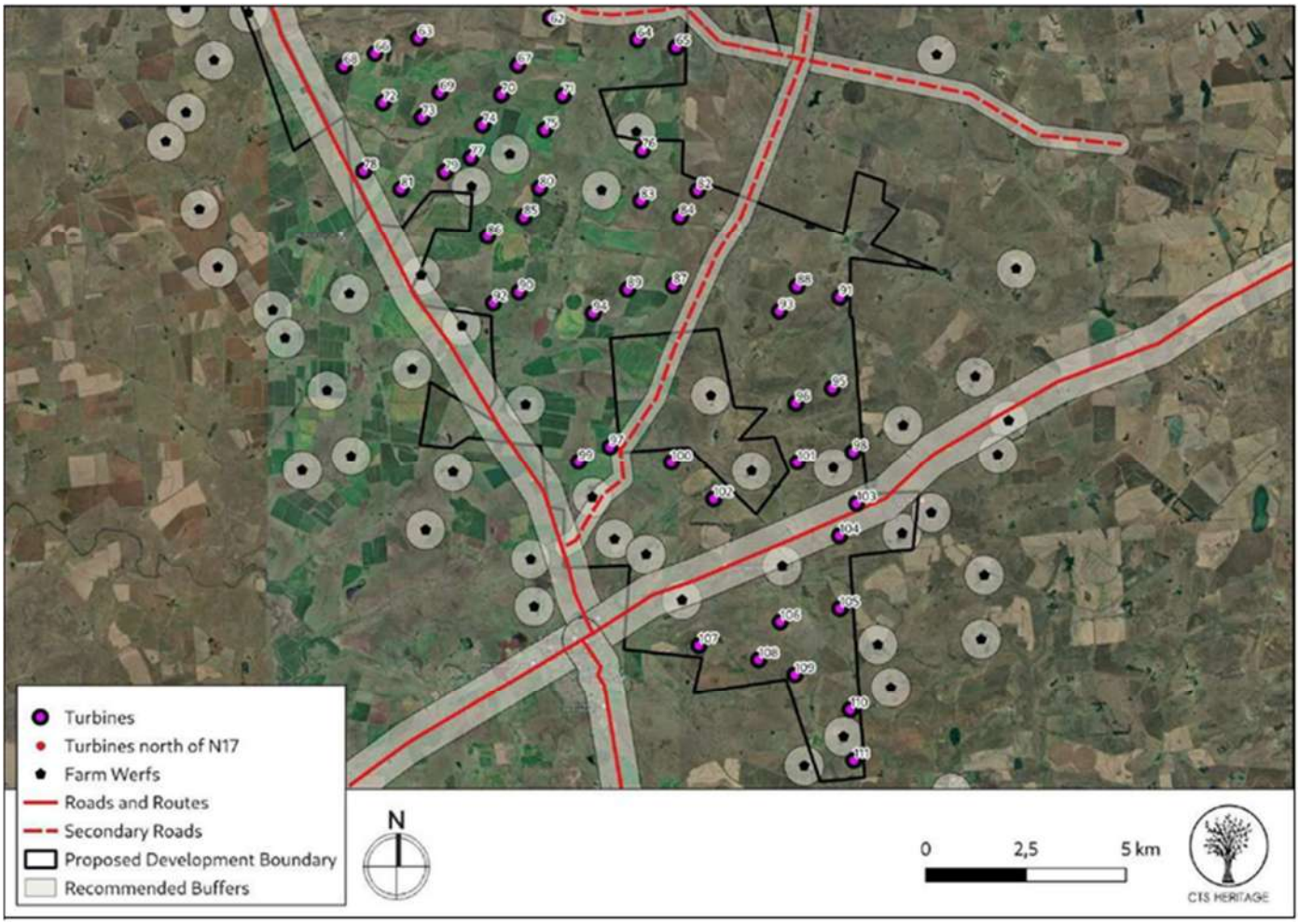


Figure 8.20: Cultural landscape features identified within the southern section of the project site

8.6. Visual Quality

The landscape of the project site and broader area is characterised by three general character types, namely, rural landscape areas, urban landscape aeras and industrial landscape areas. The general landform of the project site is undulating and comprises a series of similar size rounded ridgelines that extend approximately 20-30m above broad valley lines.

The landcover within the project site and broader area comprises four main categories, namely natural grassland, arable agriculture, settlements in the form of isolated homesteads, and settlements in the form of towns and villages. Local roads in the area include the N17, R35, R38 and R39, which are busy national/regional distributors that are likely to carry a full range of traffic types, including tourism-related traffic.

Electrical infrastructure is relatively common in the area including low voltage and medium voltage lines in close proximity to roads. Other land cover includes heavy industry, including mining operations and electricity generation. However, these uses are generally located some distance from the proposed focus area. These industrial uses are generally large, isolated, individual industrial operations within the surrounding rural landscape. Major high voltage overhead power lines cross the proposed project site, namely, the Camden Sol 2 400kV power line and the Camden Tutuka 400kV power line.

8.6.1 Identified Visual Receptors

This section is intended to highlight possible receptors within the landscape which due to use could be sensitive to landscape change.

» Area receptors may include:
  * The towns of Bethal, Ermelo and Morgenzon.
  * The Silver Water Reserve.
  * The Protected Areas of the Rietvlei Nature Reserve, the Ahlers Nature Reserve, the Majuba Nature Reserve and the Langcarel Nature Reserve.

» Point receptors may include (**Figure 8.21):**
  * There are a number of Local Farmsteads and Homesteads located both within the focus area and the surrounding landscape.

» Line receptors may include (**Figure 8.21**):
  * The N17, the R35, the R38 and the R39 as well as the unsurfaced local roads that that run through the study area. All of these are used mainly by local people with little tourism / recreational importance.

Figure 8.21: Local farmsteads and roads within the project site and broader area

8.7. Ambient Noise Levels and Sensitive Noise Developments

Existing Ambient Sound Levels

Ambient (background) sound levels were measured over a period of seven nights from 9 to 16 March 2022 in accordance with the South African National Standard SANS 10103:2008 "***The measurement and rating of environmental noise with respect to land use, health, annoyance and to speech communication***" considering the protocols defined in GG 43110. The protocol defined the SANS guidelines to be used and time periods (in which measurements must be collected), with the guidelines specifying the acceptable techniques for sound measurements, including the type of equipment (Class 1), minimum duration of measurement, microphone positions and height above ground level, calibration procedures and instrument checks and supplementary weather measurements and observations.

Ambient sound levels were measured at five locations in the vicinity of the project site. The sound levels were measured using a class-1 Sound Level Meters (SLMs) with the measurement localities presented in **Figure 8.22**. The SLMs would measure "average" sound levels over 10-minute periods, save the data and start with a new 10-minute measurement until the instruments were stopped.

Based on the ambient sound levels measured:

» Approximately 3 000 10-minute measurements were collected during the day, with the highest sound level measured being 94.9 dBA (at measurement location SULTSL03), with the lowest sound level being 28.0 dBA (at measurement location SULTSL02).
» Approximately 1 500 10-minute measurements were collected during the night-time period, with the highest sound level measured being 76.5 dBA (at measurement location SULTSL04), with the lowest sound level being 22.0 dBA (at measurement location SULTSL04).
» Considering the average of the 10-minute equivalent sound levels at the five measurement locations, daytime fast-weighted sound levels are 44.0 dBA with night-time fast-weighted sound levels being 40.2 dBA.

Considering the results of the ambient sound levels and the developmental character of the area, ambient sound levels were elevated, especially at night. The acceptable zone sound level (noise rating level) during low and no-wind conditions would be typical of a rural (daytime) to suburban (night-time) noise district, e.g.:

» 45 dBA for the daytime period.
» 40 dBA for the night-time period.

Noise-Sensitive Receptors

Potential noise-sensitive developments, receptors and communities were identified using tools such as Google Earth up to a distance of 2 000m (recommendation SANS 10328:2003) from wind turbine locations. These receptors are highlighted in **Figure 8.23**. Also indicated on this figure are generalized 500, 1 000 and 2 000m buffer zones. Generally, noises from wind turbines:

» Could be significant within 500m, with receptors staying within 500m from operational wind turbines subject to noises at a potentially sufficient level to be considered disturbing.
» Are normally limited to a distance of approximately 1 000m from operational wind turbines. Night-time ambient sound levels could be elevated and the potential noise impact measurable.
» Likely to be audible up to a distance of 2 000m at night. Noises from the wind turbines are of a low concern at distances greater than 2 000m, although the sound of the wind turbines may be audible at greater distances during certain metrological phenomena (sound levels are generally very low at distances greater than 2 000m).

Potential Noise Sources

Increased noise levels are directly linked with the various activities associated with the construction of the proposed Ummbila Emoyeni Wind Energy Facility and related infrastructure, as well as the operation phase of the activity.

During the construction, activities such as the use of construction equipment, the use of a concrete batching plant and borrow pits (if required), blasting and construction traffic will result in increased noise levels. For the operation phase, increased noise levels will result from routine servicing (access road and traffic light) and unscheduled maintenance. The primary source of noise during the operation phase will come from the rotation of the wind turbines.

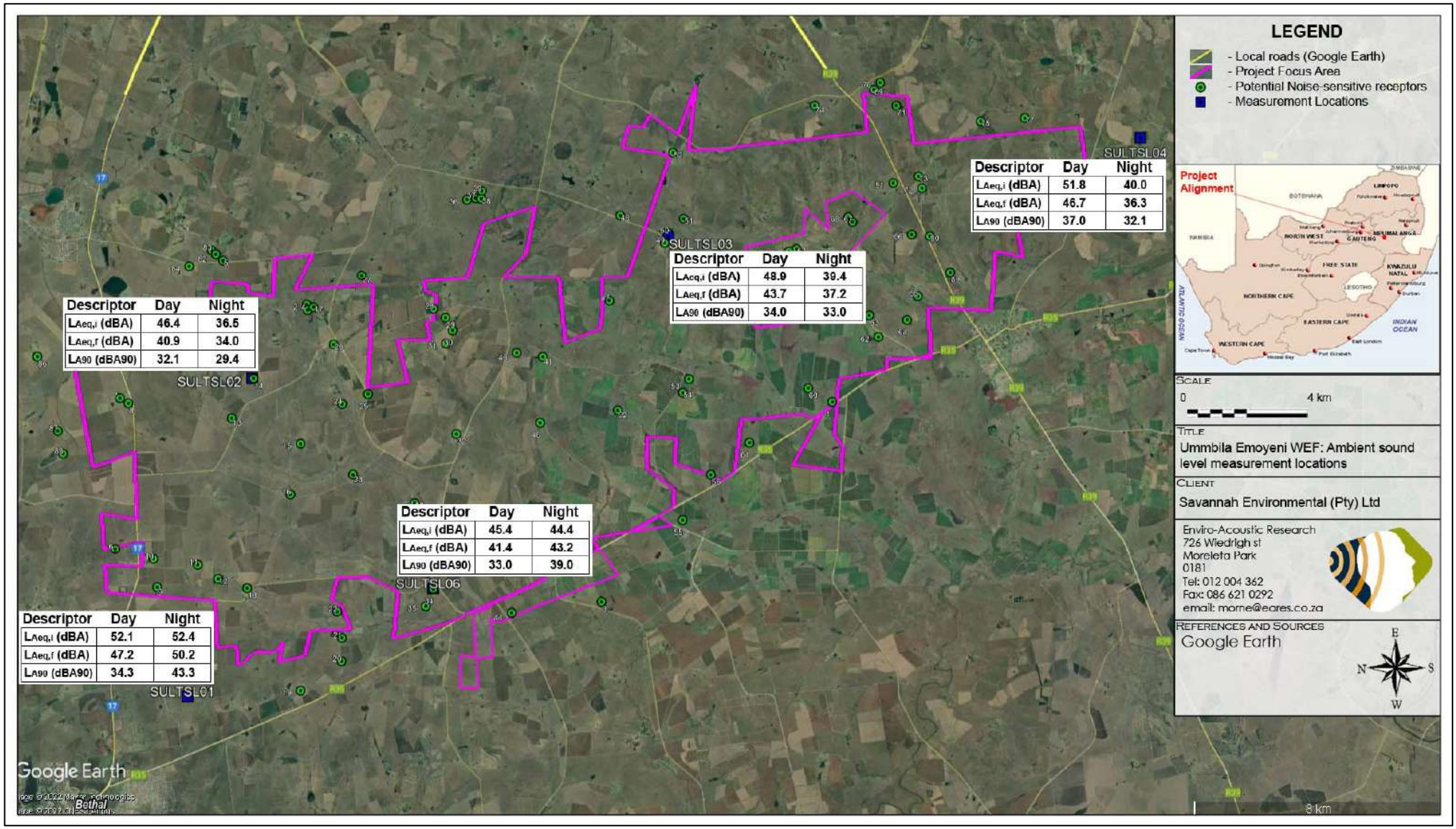


Figure 8.22: Localities where ambient sound levels were measured

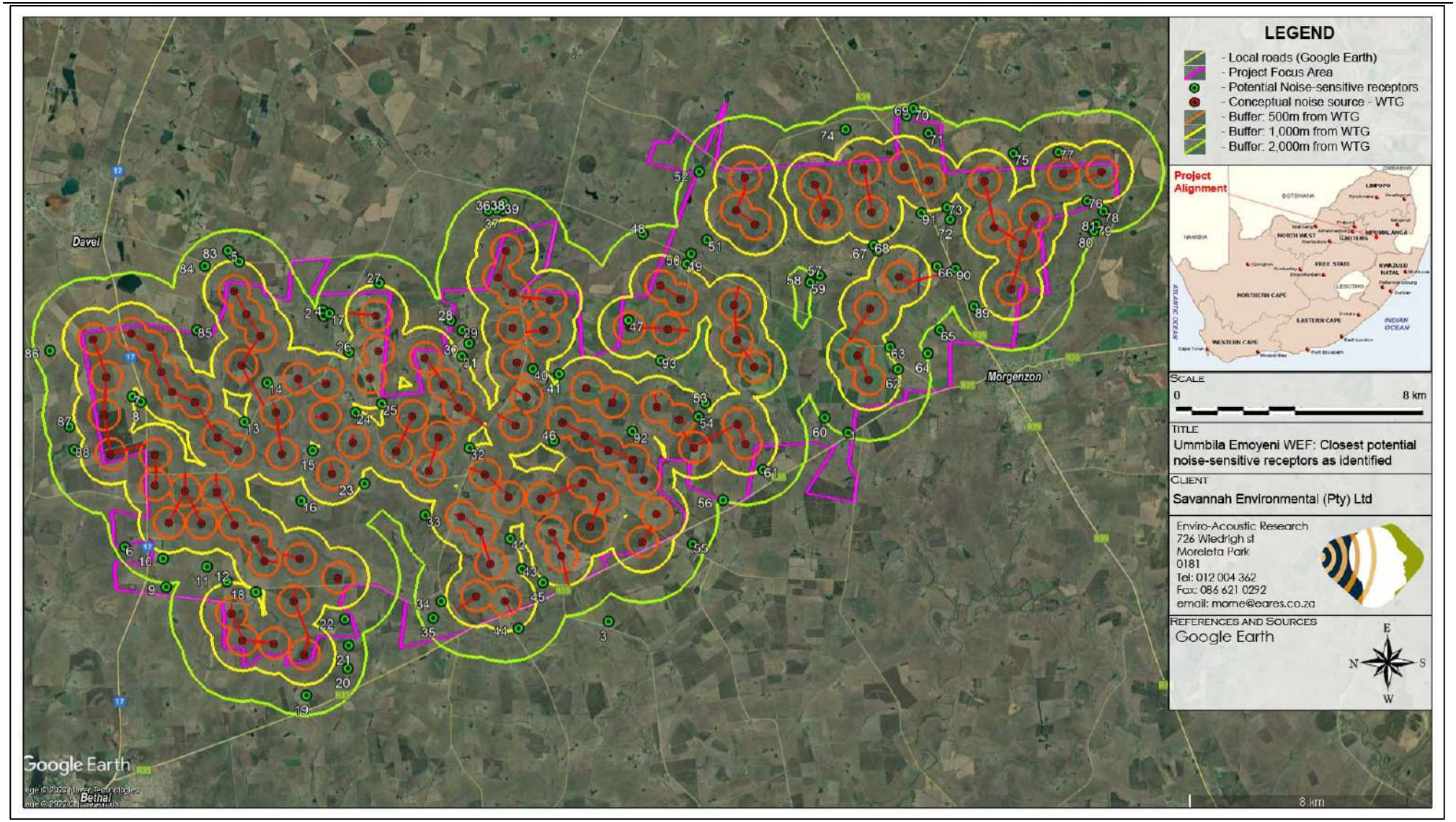


Figure 8.23: Noise-sensitive receptors close to the Ummbila Emoyeni Wind Energy Facility

8.8. Traffic Conditions

It is assumed that if components are imported to South Africa, it will be via the Port of Richard's Bay in KwaZulu-Natal, which is located approximately 460km from the proposed site, the Port of East London, which is located approximately 1 130km from the proposed site, or the Port of Ngqura, which is located approximately 1 200km from the proposed site, The preferred route from the Port of Richard's Bay is shown in yellow in **Figure 8.24**. The route follows the N2 north, passing through Pongola and Piet Retief before turning off on to the N17 in Ermelo that leads to an unnumbered gravel road towards the proposed site.

The alternative route from the Port of East London, shown in green in **Figure 8.24**, will follow the N6 north-west to Bloemfontein before taking the N1 north-east to Johannesburg. Vehicles will head east on the N12 and N17, passing through Bethal before turning off onto an unnumbered gravel road that leads to the proposed site.

The Port of Ngqura can also be considered as an alternative and the route is shown in blue in **Figure 8.25**. The route is approximately 1200km long and follows the N10 north up to Cradock before taking the R390 further north, passing through the town of Steynsburg and turning onto the N1 at Gariep. The route will continue north-east along the N1, through Bloemfontein, up to Johannesburg. Vehicles will head east on the N12 and N17, passing through Bethal before turning off onto an unnumbered gravel road that leads to the proposed site.

It should be noted that, although shorter routes exist, travel on national routes is proposed as the condition of some of the roads on the shorter routes are poor and not deemed suitable for hauling with heavy vehicles. There are also a number of toll plazas located on the national routes, but alternative roads can be considered in order to bypass these toll roads. This can however only be done at a later stage when more information is available regarding the type of heavy/abnormal vehicles, number of trips, etc.

The proposed site is bounded by the N17 in the north, the R39 in the south and the east and the R35 in the west, as shown in **Figure 8.25**. Access to the proposed site can be obtained from any of these three roads, depending on the traffic volumes of each road. The road carrying the least traffic will be considered as the best option. However, the N17 is a toll route and should be avoided as main access if other alternatives exist along either the R39 or the R35.

There is also an existing network of unnumbered gravel roads that might be suitable as a main access road to the proposed site as shown in pink and blue in **Figure 8.26**. Once the site layout and project capacity has been reduced as a result of the environmental constraints identified during the Scoping Phase of the EIA process, the options for a main access road and assess points can be further investigated.

The proposed main access road should link to the site access road, and possible access points are shown in **Figure 8.26**. Other alternative site access roads and points can be investigated at a later stage once the project area has been more clearly defined. All options should however conform to the requirements of access spacing and sufficient shoulder sight distances at these locations.

Figure 8.24: Preferred and alternative routes to the proposed site

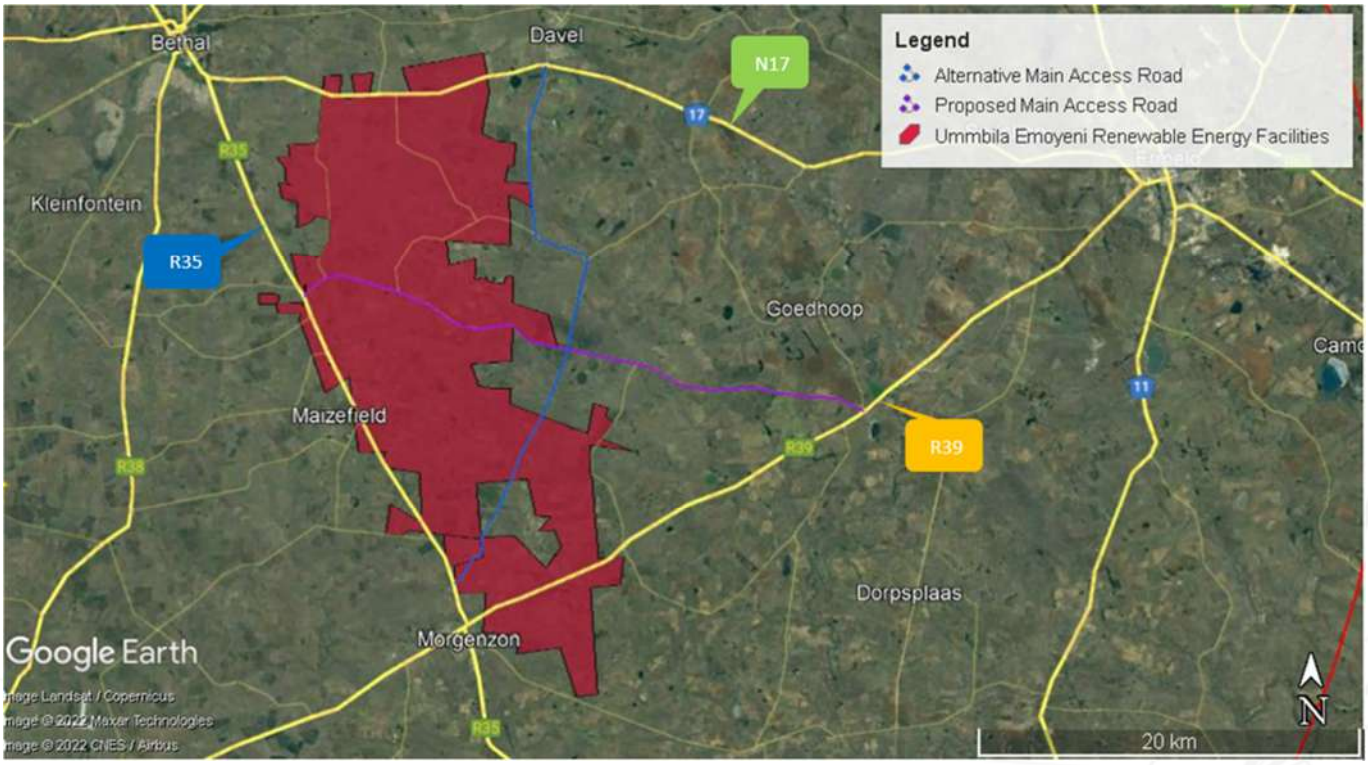


Figure 8.25: Proposed main access roads and alternatives to the project site

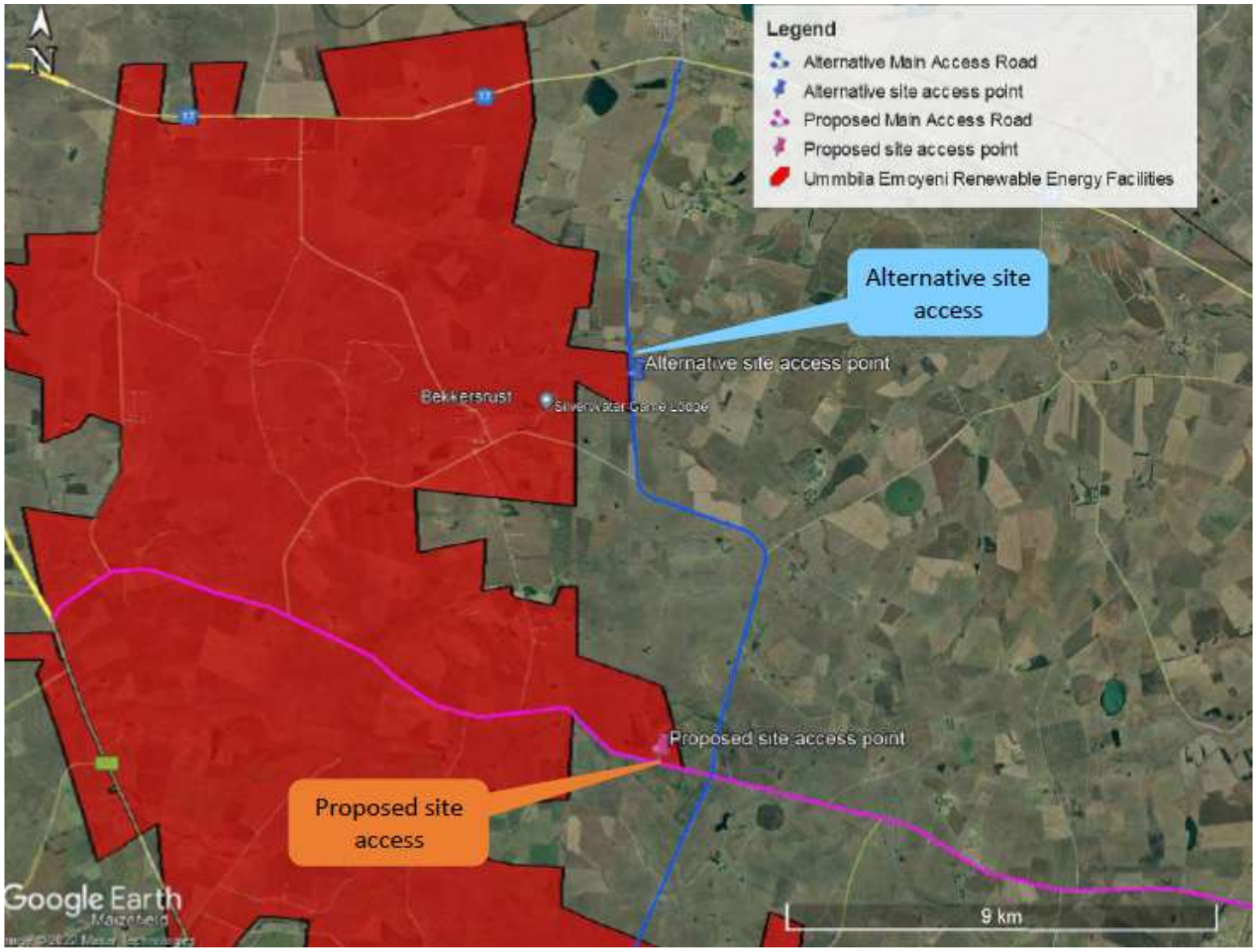


Figure 8.26: Proposed site access points

8.9. Socio-Economic Profile

8.9.1. Profile of the Broader Area

The project site is located within Ward 15 of the Govan Mbeki Local Municipality, Ward 12 of the Lekwa Local Municipality and Wards 8 and 10 of the Msukaligwa Local Municipality, which form part of the Gert Sibande District Municipality.

Population, Income and Employment Profile

The Govan Mbeki Local Municipality accounts for 28% of the population, and 30% of the households in the Gert Sibande District Municipality and Lekwa Local Municipality accounts for 12% of the population as well as households in the district. The Msukaligwa LM accounts for 14% of the population and 15% of the Households in the district.

Population growth between 2010 and 2020 was 1,9% (Lekwa), 2,2% (Govan Mbeki) and 2,0% (Msukaligwa) year-on-year for the local municipalities which compared favourably or similar to the district municipality (1,9%) and Mpumalanga (1,6%) over the same period. The high population growth in Govan Mbeki and Msukaligwa indicates that the municipality offers several opportunities, attracting people towards the area, this can also be motivated by the high population density (121 km^2) in comparison to the other areas as well as the higher average monthly household income, which is the highest (R16 755.00) of all the areas in review.

The average household income for the Gert Sibande District Municipality in 2022 is estimated to be R10 851.00. The proposed UEREF will also attract additional population to the study area as several employment opportunities will be created through the development, this will ensure a sustainable population growth.

Table 8.20: Overview of the primary study area's population structure (Source: Quantec Standardised Regional (2022))

Indicator	Mpumalanga	Gert Sibande District Municipality	Lekwa Local Municipality	Govan Mbeki Local Municipality	Msukaligwa Local Municipality
Area (km^2)	76 495	31 840	4 585	2 954	6 015
Population	4 821 139	1 290 117	148 706	356 532	186 123
Number of Households	1 291 462	338 534	39 993	102 847	50 850
Population density (km^2)	63	41	32	121	31
Average household size	3,8	3,7	3,6	3,6	3,8
Annual population growth (2010-2020)	1,6%	1,9%	1,9%	2,2%	2,0%
Average monthly household income	**R10 504**	**R10 851**	**R10 797**	**R16 755**	**R10 952**

Table 8.20 indicates the number of people employed and not economically active, the percentage of the population unemployed as well as the labour force participation rate for areas in review. The relatively lower unemployment rate and higher labour force participation relative to the district averages further suggests that both the local municipalities are subject to inward migration due to the employment opportunities available within the local municipalities.

Table 8.20: Employment profile of the study area (Source: Quantec Standardised Regional (2022))

Indicator	Mpumalanga	Gert Sibande District Municipality	Lekwa Local Municipality	Govan Mbeki Local Municipality	Msukaligwa Local Municipality
Employed	1 112 708	302 264	42 973	108 682	48 694
Unemployment Rate	31,7%	31,0%	26,5%	28,5%	28,2%
Not Economically Active	1 420 762	379 585	40 093	89 777	52 845
Labour force participation rate	36,5%	37,0%	43,6%	44,9%	40%

Economic Profile

The following subsection outlines the economic profile at a national as well as a provincial, district municipal and local municipal level.

Nationally, South Africa's Gross Domestic Product (GDP) recorded its fourth consecutive quarter growth, expanding with 1,2% in the second quarter of 2021 (April-June), this followed the increase of 1% in the first quarter (January-March). However, despite the gains made over the last four quarters, the economy is 1,4% smaller than what it was before the COVID-19 pandemic (StatsSA, 2021).

The GVA (Gross Value Added) of the Lekwa Local Municipality was R 19 million in 2020 (constant prices), which collectively accounts for just over 10% of the district economy's GVA, and 3% of the Mpumalanga's. The Govan Mbeki Local Municipality had a GVA of R 103 million in 2020, which accounts for 53% of the district's economy, and 17% of the province. The proposed Ummbila Emoyeni Wind Energy Facility will contribute further to the economy and ensure sustainability.

The growth in the local municipalities over the last few years was largely due to the strong performance of the agriculture, trade, finance business services sectors. Manufacturing indicated a contraction in the last 10-years in the district and local municipalities, but remains a large contributor in the economy. Many of these are linked to and service the large mining and manufacturing-based sectors that is present in the town of Secunda. Electricity is an average size industry in the municipalities, any new development would likely greatly increase the contribution of the utilities and construction sectors to the GVA.

Over the last ten years, the Compound Average Growth Rate (CAGR) of Lekwa Municipality contracted with 0,32%, whereas Govan Mbeki Local Municipality contracted with 0,16% and Msukaligwa LM increase with 0,99%. The sectors responsible for the contraction of the overall GVA a growth over the 10-year period in Lekwa Local Municipality was mining, manufacturing, utilities and construction. The mining, manufacturing and construction sectors were responsible for the overall contraction of the Govan Mbeki Local Municipality. It is a good indication that the utilities sector indicates a growth of 1,14% in the Govan Mbeki Local Municipality, the proposed Ummbila Emoyeni Wind Energy Facility will further increase this sector's performance. The increase in GVA for Msukaligwa LM is due to the strong performance in the electricity, gas and water sector, with a 3,62% growth as well as in the agriculture and hunting sector, which increase with 3,64%.

The trade sector employs the most with a 24,5% and 21,7% and 18,1% contribution in 2020 in the Lekwa and Govan Mbeki and Msukaligwa Local Municipality, respectively. The utilities sector employs the least to employment in both municipalities, the proposed Ummbila Emoyeni Wind Energy Facility will increase the number of employees in this sector. The local agricultural sector includes limited subsistence (informal) farming, unlike other areas in Mpumalanga, where this practice is more dominant. The presence of this subsistence agricultural activity means that the number of households that are dependent on agricultural activities for income could be slightly greater.

In general, agricultural activities are relatively labour intensive, thus a small decline in the size of the sector would generally lead to greater job losses than for example in manufacturing or utilities, which tend to be more capital intensive in nature. The agricultural sector is also frequently one of the largest employers in rural areas and it is for these two reasons that the sector is generally prioritised in development strategies.

8.9.2. Profile of the Immediate Affected Area

The project site is covered by natural grassland which is interspersed with areas of cultivation. Main crop types cultivated in the study area are include sunflower seed, sorghum, rye and potatoes. The project site is characterised by isolated homesteads that are generally related to agricultural uses. There is a tourism related establishment (Silver Water Game Lode) located within the north-eastern section of the proposed site, which appears to be focussed around a dam.

Settlement in the form of towns and villages is limited within the broader project site. The closest settlements include Morgenzon, which is a small town on the R39 less than 1km to the wets of the proposed project site; Bethal, which is also a small town located on the N17 and approximately 6.2km north-west of the proposed

project site; and Ermelo, which is located approximately 32km to the east of the proposed projects site. Ermelo is the district centre of the Gert Sibande District Municipality.

Local roads in the area include the N17, R35, R38 and R39, which are busy national / regional distributors that are likely to carry a full range of traffic types, including tourism related traffic. Electrical infrastructure is relatively common in the area, including low voltage and medium voltage lines in close proximity to roads. Other land cover within the broader project site includes heavy industry, including mining operations and electricity generation. However, these uses are generally located some distance from the proposed project site. These industrial uses are generally large, isolated, individual industrial operations within the surrounding rural landscape.

CHAPTER 9: ASSESSMENT OF IMPACTS

This chapter serves to assess the significance of the positive and negative environmental impacts (direct and indirect) expected to be associated with the development of the Ummbila Emoyeni Wind Energy Facility and associated infrastructure. This assessment has considered the construction of a wind farm with a contracted capacity of up to 900MW, within a development footprint[21] of approximately 390ha. The development footprint includes the following infrastructure:

- Up to 111 wind turbines with a maximum hub height of up to 200m. The tip height of the turbines will be up to 300m.
- 33kV cabling to connect the wind turbines to the onsite collector substations, to be laid underground where practical.
- 3 x 33kV/132kV onsite collector substation (IPP Portion), each being 5ha.
- Battery Energy Storage System (BESS).
- Cabling between turbines, to be laid underground where practical.
- Construction compounds including site office (approximately 300m x 300m in total but split into 3ha each of 150m x 200m):
  - Batching plant of up to 4ha to 7ha.
  - 3 x O&M office of approximately 1.5ha each adjacent to each collector SS.
  - 3 x construction compound / laydown area, including site office of 3ha each (150m x 200m each).
- Laydown and crane hardstand areas (approximately 75m x 120m).
- Access roads of 12 -13m wide, with 12m at turning circles.

The project is planned to be implemented in several phases depending on the off-take that is confirmed with various buyers of the power. The first build phase will likely be between 150MW and 450MW with the remainder of the project following in close sequence in manageable construction phases. Construction is therefore likely to be one process as this makes the most sense from an overheads and economies of scale perspective, the make-up of which will be determined based on the requirements at the time.

The full extent of the project site (~27 819ha) was considered through the Scoping Phase of the EIA process by the independent specialists and the EAP. On-site sensitivities were identified through the review of existing information, desktop evaluations and detailed field surveys. The identification of a development footprint for the wind farm within the project site was undertaken by the developer through consideration of the sensitive environmental features and areas, and application of a mitigation hierarchy which aimed at avoidance as the first level of mitigation. The specialist assessments undertaken as part of this EIA process have considered the development footprint (refer to **Figure 9.1**) which was provided by the developer.

21 The development footprint of the Ummbila Emoyeni Wind Energy Facility will be located within the ~27 819ha project site and will be a much smaller area within which the wind turbines and associated infrastructure will be constructed and operated in. The development footprint has been subject to detailed design by the developer through the consideration of sensitive environmental features identified by independent specialists, during the Scoping Phase of the EIA process, which need to be avoided by the wind farm.

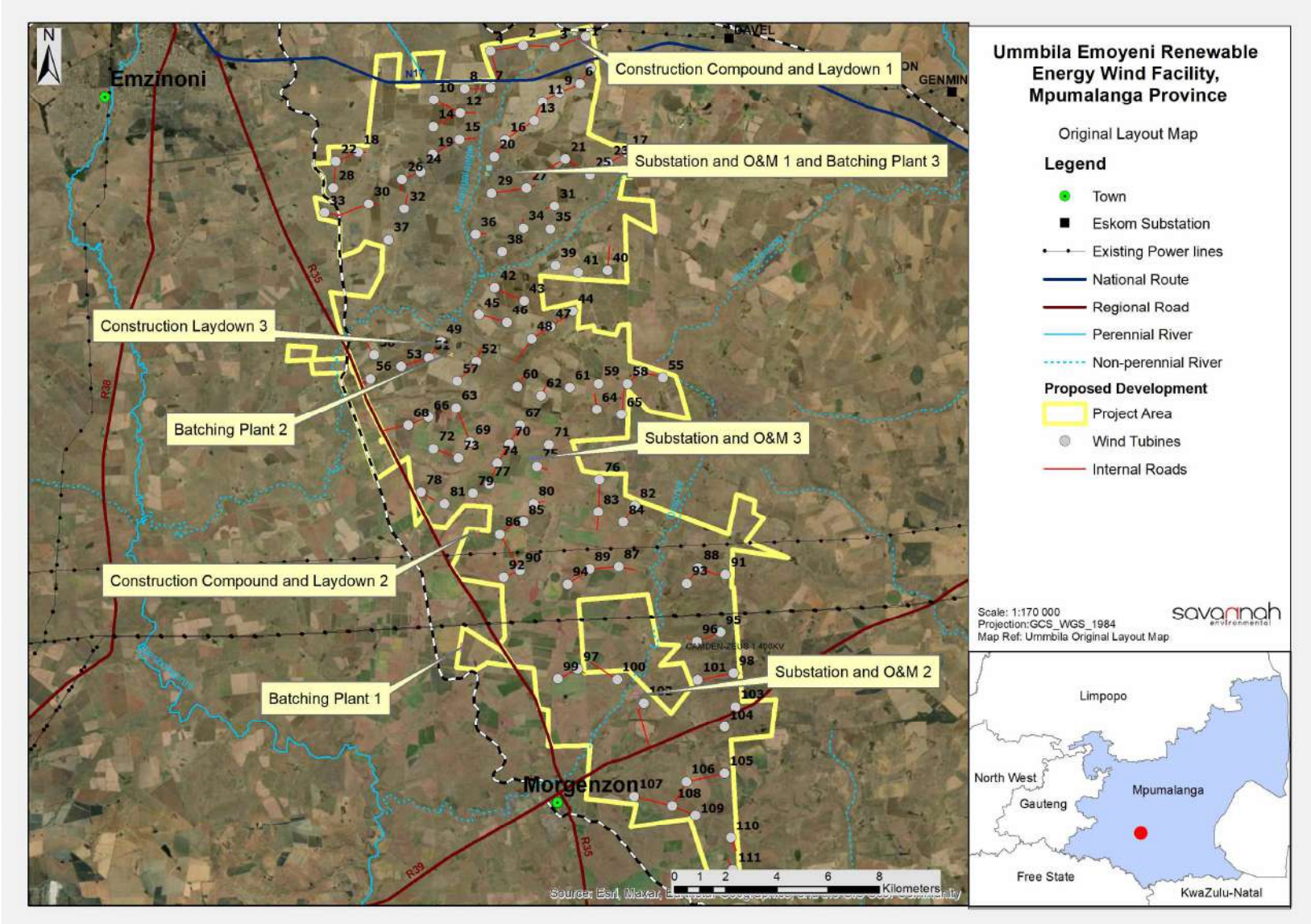


Figure 9.1: Map showing the project site within which the development footprint for the Ummbila Emoyeni Wind Energy Facility and associated infrastructure has been placed and assessed as part of this EIA process (also refer to **Appendix P**).

The sections which follow provide a summary of the specialist input for each field of study in terms of the impacts which are expected to occur, the significance of the impacts, the opportunity for mitigation of the impacts to an acceptable level and the appropriate mitigation measures recommended for the reduction of the impact significance. Note that impacts associated with decommissioning are expected to be similar to those associated with construction activities and therefore in certain instances, these impacts are not considered separately within this chapter. This section of the report must be read together with the detailed specialist studies contained in **Appendix D** to **M**.

The development of the project will comprise the following phases:

» *Pre-Construction and Construction* – will include pre-construction surveys; site preparation; establishment of access roads, construction camps, batching plant, laydown areas, and facility infrastructure; construction of foundations involving excavations and cement pouring; the transportation of components/construction equipment to site, manoeuvring and operating cranes for unloading and installation of equipment; laying cabling; and commissioning of new equipment and site rehabilitation. The construction phase for the Ummbila Emoyeni Wind Energy Facility is dependent on the number of turbines to be erected, but is estimated at 24 months (for each phase).

» *Operation* – will include the operation of the wind farm and the generation of electricity, which will be fed into the national grid via new 3 x 33/132kV onsite collector substations and new 3 x 132kV overhead power lines to be connected to a proposed 400/132kV MTS. The operation phase of the Ummbila Emoyeni Wind Energy Facility is expected to be approximately 20 - 30 years (with maintenance).

» *Decommissioning* – depending on the economic viability of the wind farm, the length of the operation phase may be extended beyond a 20 - 30 year period. At the end of the project's life, decommissioning will include site preparation, disassembling of the components of the wind farm, clearance of the relevant infrastructure at the site and rehabilitation.

9.1. Legal Requirements as per the EIA Regulations, 2014 (as amended), for the undertaking of an Environmental Impact Assessment Report

This chapter of the EIA Report includes the following information required in terms of the EIA Regulations, 2014 - Appendix 3: Scope of Assessment and Content of Environmental Impact Assessment Reports:

Requirement	Relevant Section
3(1)(h)(v) the impacts and risks identified including the nature, significance, consequence, extent, duration and probability of the impacts, including the degree to which these impacts (aa) can be reversed, (bb) may cause irreplaceable loss of resources, and (cc) can be avoided, managed or mitigated.	The impacts and risks associated with the development of the Ummbila Emoyeni Wind Energy Facility, including the nature, significance, consequence, extent, duration and probability of the impacts and the degree to which the impact can be reversed and cause an irreplaceable loss of resources are included in **sections 9.3.2, 9.4.2, 9.5.2, 9.6.2, 9.7.2, 9.8.2, 9.9.2, 9.10.2, 9.11.2** and **9.12.2.**
3(1)(h)(vii) positive and negative impacts that the proposed activity and alternatives will have on the environment and on the community that may be affected focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects.	The positive and negative impacts associated with the development of the Ummbila Emoyeni Wind Energy Facility are included in **sections 9.3.2, 9.4.2, 9.5.2, 9.6.2, 9.7.2, 9.8.2, 9.9.2, 9.10.2, 9.11.2** and **9.12.2.**

Requirement	Relevant Section
3(1)(h)(viii) the possible mitigation measures that could be applied and the level of residual risk.	The mitigation measures that can be applied to the impacts associated with the Ummbila Emoyeni Wind Energy Facility are included in **sections 9.3.2, 9.4.2, 9.5.2, 9.6.2, 9.7.2, 9.8.2, 9.9.2, 9.10.2, 9.11.2** and **9.12.2.**
3(1)(i) a full description of the process undertaken to identify, assess and rank the impacts the activity and associated structures and infrastructure will impose on the preferred development footprint on the approved site as contemplated in the accepted scoping report through the life of the activity, including (i) a description of all environmental issues and risks that were identified during the environmental impact assessment process and (ii) an assessment of the significance of each issue and risk and an indication of the extent to which the issue and risk could be avoided or addressed by the adoption of mitigation measures.	A description of all environmental impacts identified for the Ummbila Emoyeni Wind Energy Facility during the EIA process, and the extent to which the impact significance can be reduced through the implementation of the recommended mitigation measures provided by the specialists are included in **sections 9.3.2, 9.4.2, 9.5.2, 9.6.2, 9.7.2, 9.8.2, 9.9.2, 9.10.2, 9.11.2** and **9.12.2.**
3(1)(j) an assessment of each identified potentially significant impact and risk, including (i) cumulative impacts, (ii) the nature, significance and consequences of the impact and risk, (iii) the extent and duration of the impact and risk, (iv) the probability of the impact and risk occurring, (v) the degree to which the impact and risk can be reversed, (vi) the degree to which the impact and risk may cause irreplaceable loss of resources and, (vii) the degree to which the impact and risk can be avoided, managed or mitigated.	An assessment of each impact associated with the development of the Ummbila Emoyeni Wind Energy Facility, including the nature and significance, the extent and duration, the probability, the reversibility, and the potential loss of irreplaceable resources, as well as the degree to which the significance of the impacts can be mitigated are included in **sections 9.3.2, 9.4.2, 9.5.2, 9.6.2, 9.7.2, 9.8.2, 9.9.2, 9.10.2, 9.11.2** and **9.12.2.**
3(1)(m) based on the assessment, and where applicable, recommendations from specialist reports, the recording of proposed impact management outcomes for the development for inclusion in the EMPr as well as well as for inclusion as conditions of authorisation.	Mitigation measures recommended by the various specialists for the reduction of the impact significance are included in **sections 9.3.2, 9.4.2, 9.5.2, 9.6.2, 9.7.2, 9.8.2, 9.9.2, 9.10.2, 9.11.2** and **9.12.2.**

9.2. Quantification of Areas of Disturbance on the Site

Site-specific impacts associated with the construction and operation of the Ummbila Emoyeni Wind Energy Facility relate to the direct loss of vegetation and species of special concern, disturbance of animals and loss of habitat and impacts on soils. A wind farm is, however, dissimilar to most other power generation facilities in that it does not result in whole-scale disturbance or loss to a site (from a biophysical perspective). In order to assess the impacts associated with Ummbila Emoyeni Wind Energy Facility, it is necessary to understand the extent of the affected area.

The development footprint (**Figure 9.1**) will include affected areas, which will comprise of turbine footprints (maximum of 111 turbines each with a hardstand of 75m x 120m and a foundation of a diameter of up to 40m per turbine, internal access roads (permanent width of up to 12 – 13m), 3 x onsite collector substations (each being 5ha), construction compound, (with an extent of 300m x 300m, but split into 3ha each of 150m x 200m comprising a batching plant of up to 4 – 7ha, 3 x O&M office of ~1.5ha each and 3 x construction compound (including site office) of ~3ha each), a Battery Energy Storage System (2 -3ha in extent within the footprint of the collector substation), and a temporary laydown area. The maximum area of disturbance is

approximated to be 390ha in extent (this is also the extent of the development footprint), some of which will be temporary and will be rehabilitated following construction.

Wherever possible, existing access roads will be utilised to access the project site and development footprint, essentially reducing the extent of disturbance resulting from access road construction. It is unlikely that access roads will need to be upgraded as part of the proposed development.

9.3. Potential Impacts on Terrestrial Ecology (including flora and fauna)

The development of the Ummbila Emoyeni Wind Energy Facility is likely to result in a variety of impacts associated largely with the disturbance, loss and transformation of intact vegetation and faunal habitat to hard infrastructure such as turbine foundations and service areas, roads, operations buildings etc. Potential impacts and the relative significance of the impacts are summarised below (refer to **Appendix D** for more details).

9.3.1 Results of the Terrestrial Ecology Impact Assessment

Figure 9.2 illustrates the sensitivities identified within the faunal, floral and terrestrial biodiversity assessments in relation to the indicative layout provided by the Applicant and assessed within this EIA. Sensitivities include:

- Freshwater resources – very high sensitivity (no-go)
- Primary grassland (CBA: Irreplaceable) – very high sensitivity (no-go)
- Primary grassland (CBA: Optimal) – high sensitivity
- Secondary grassland – medium to high sensitivity
- Primary grassland – medium sensitivity
- Cultivated areas – Low sensitivity
- Infrastructure – very low sensitivity

From a developmental perspective, development within the Low (cultivated areas) and Low-Medium (secondary grassland) sensitive areas is most suitable/preferable. Development within the primary grassland areas, that are not included within the CBAs (medium sensitive) is regarded as acceptable, with the implementation of appropriate mitigation measures. Development within the Irreplaceable CBAs is regarded as unacceptable, and these areas should be regarded as "No-Go" areas for the Wind Energy Facility development. In terms of the development of the Wind Energy Facility within the Optimal CBAs, some placement of wind turbines, cabling and access roads, within these Optimal Natural Areas, is regarded acceptable. Construction activities within these areas, will however have to be restricted as far as possible, and to a small as possible area. Existing access routes should be used as far as possible.

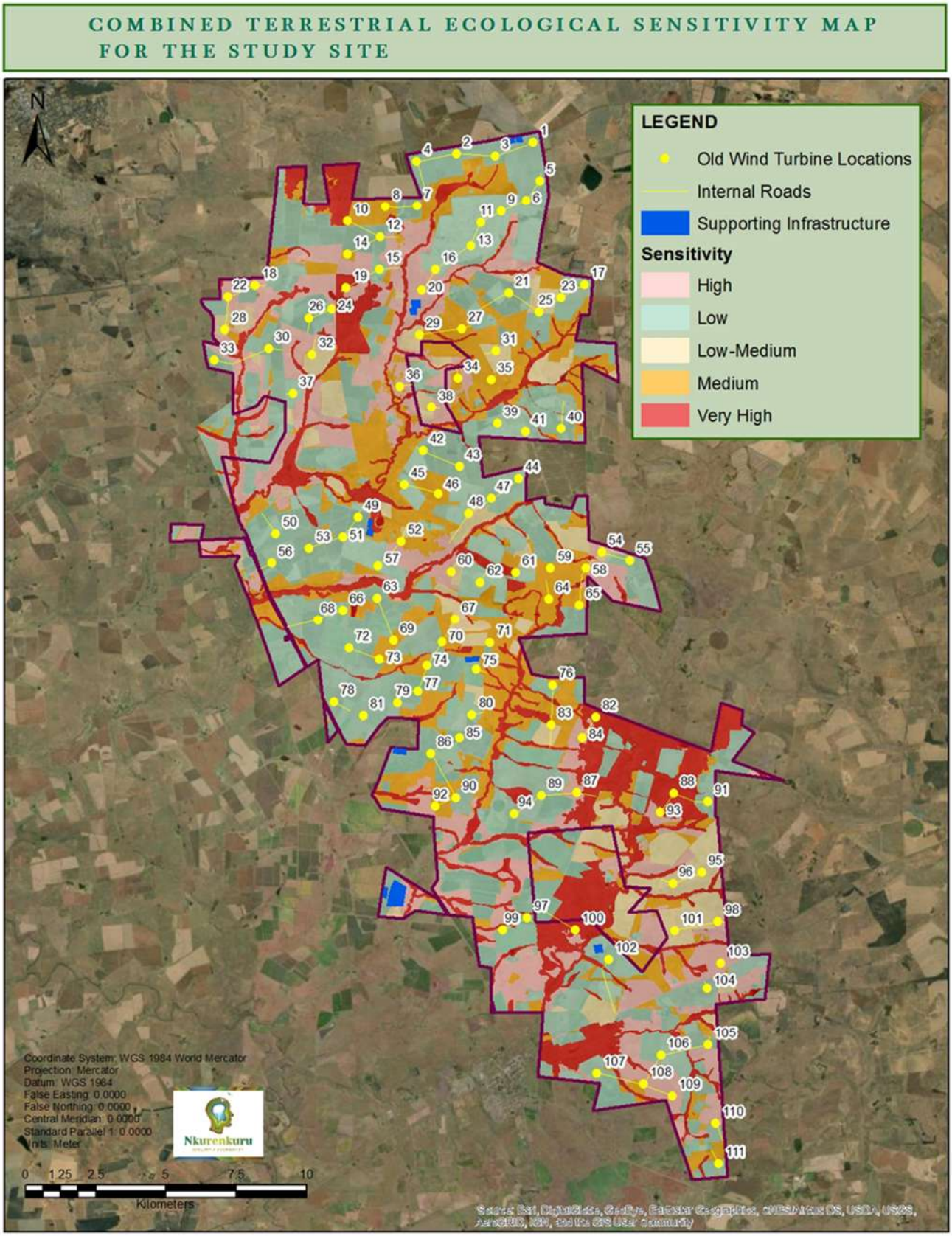


Figure 9.2: Terrestrial ecological sensitivity map of the project site

9.3.2 *Description of Impacts on Terrestrial Ecology*

Potential ecological impacts resulting from the proposed development would stem from a variety of different activities and risk factors associated with the construction and operation phases of the project including the following:

Construction:

- Human presence and uncontrolled access to the site may result in negative impacts on fauna and flora through poaching of fauna and uncontrolled collection of plants for traditional medicine or other purpose.
- Site clearing and exploration activities for site establishment.
- Vegetation clearing could impact listed plant species. Vegetation clearing would also lead to the loss of vegetation communities and habitats for fauna and avifauna and potentially the loss of faunal as well as avifaunal species, habitats and ecosystems. On a larger and cumulative scale (if numerous and uncontrolled developments are allowed to occur in the future) the loss of these vegetation communities and habitats may potentially lead to a change in the conservation status of the affected vegetation type as well as the ability of this vegetation type and associated features to fulfil its ecological responsibilities (functions). The above impact is most likely to be low due to the fact that most of the development area is situated within an area which has been somewhat degraded due to long term overgrazing.
- Soil compaction and increased erosion risk would occur due to the loss of plant cover and soil disturbance created during the construction phase. This may potentially impact the downstream watercourses, wetlands and aquatic habitats, mainly due to an increase of surface water and silt inflow from the surrounding disturbed areas (these potential impacts on downslope wetland features have been assessed within the freshwater resource study and assessment). These potential impacts may result in a reduction in the buffering capacities of the landscape during extreme weather events.
- Movement of construction vehicles and placement of infrastructure within the boundary of the drainage line may lead to the disturbance of these habitats, removal of vegetation cover and a potential increase in erosion which may eventually spread into downstream areas.
- Invasion by alien plants may be attributed to excessive disturbance to vegetation, creating a window of opportunity for the establishment of these alien invasive species. In addition, regenerative material of alien invasive species may be introduced to the project site by machinery traversing through areas with such plants or materials that may contain regenerative materials of such species.
- Presence and operation of construction machinery on the project site. This will create a physical impact as well as generate noise, potential pollution and other forms of disturbance at the site.
- Increased human presence can lead to poaching, illegal plant harvesting and other forms of disturbance such as fire.

Operation:

- The facility will require management and if this is not done effectively, it could impact adjacent intact areas through impacts such as erosion and the invasion of alien plant species.

Decommissioning:

- During decommissioning, the potential impacts will be very similar to that of the Construction Phase, although with slightly lower significance.

9.3.3 *Impact tables summarising the significance of impacts on terrestrial ecology during construction, operation and decommissioning (with and without mitigation)*

Construction Phase Impacts

Nature: *Potential impacts on vegetation and listed or protected plant species*

Vegetation clearing for access roads, turbines and their service areas and other infrastructure will impact on vegetation and protected plant species.

Impacts on vegetation and protected plant species would occur due to the construction of the facility and associated infrastructure. This impact is regarded as the most likely and significant impact and will lead to direct loss of vegetation including protected species.

The most likely consequences include:
» Local loss of habitat (to an extent as a natural ground covering will be maintained where possible).
» Very small and local disturbance to processes maintaining local biodiversity and ecosystem goods and services.
» A potential loss of a few local protected species.

	Without mitigation	**With mitigation**
Extent	Whole Site (2)	Local (1)
Duration	Permanent (5)	Long-term (4)
Magnitude	Moderate (6)	Minor (4)
Probability	Definite (5)	Probable (3)
Significance	**High (65)**	**Low (27)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Moderate
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes, to a large extent	

Mitigation:
» Preconstruction walk-through of the final development footprint for protected species that would be affected and that can be translocated.
» Since a large proportion of the identified protected species at the site are succulents and geophytes, the potential for successful translocation is high. Before construction commences individuals of listed species within the development footprint that would be affected, should be counted and marked and translocated where deemed necessary by the ecologist conducting the pre-construction walk-through survey, and according to the recommended ratios. Permits from the relevant provincial authorities, will be required to relocate and/or disturb listed plant species.
» Any individuals of protected species affected by and observed within the development footprint during construction should be translocated under the supervision of the ECO and/or Contractor's Environmental Officer (EO).
» Pre-construction environmental induction for all construction staff on site to ensure that basic environmental principles are adhered to. This includes awareness to no littering, appropriate handling of pollution and chemical spills, avoiding fire hazards, minimising wildlife interactions, remaining within demarcated construction areas etc.
» Demarcate all areas to be cleared with construction tape or similar material where practical. However, caution should be exercised to avoid using material that might entangle fauna.
» ECO and/or Contractor's EO to provide supervision and oversight of vegetation clearing activities and other activities which may cause damage to the environment, especially at the initiation of the project, when the majority of vegetation clearing is taking place.
» Ensure that laydown areas, construction camps and other temporary use areas are located in areas of low and medium sensitivity and are properly fenced or demarcated as appropriate and practically possible.
» All vehicles to remain on demarcated roads and no unnecessary driving in the veld outside these areas should be allowed.

» Regular dust suppression during construction, if deemed necessary, especially along access roads.
» No plants may be translocated or otherwise uprooted or disturbed for rehabilitation or other purpose without express permission from the ECO and or Contractor's EO.
» No fires should be allowed on-site.

Residual Impacts:
Some transformation of vegetation is likely to occur during construction. As this area is already, to some extent, in a transformed state, further transformation is not likely to be significant. However, any transformations caused by the development will take a very long time to restore and as such is regarded as a residual impact.

Nature: *Direct Faunal Impacts*

Increased levels of noise, pollution, disturbance and human presence during construction will be detrimental to fauna. Sensitive and shy fauna would move away from the area during the construction phase as a result of the noise and human activities present, while some slow-moving species would not be able to avoid the construction activities and might be killed. Some impact on fauna is highly likely to occur during construction.

	Without mitigation	**With mitigation**
Extent	Whole Site (2)	Local (1)
Duration	Long-term (4)	Short Duration (2)
Magnitude	Moderate (6)	Minor (3)
Probability	Highly Probable (4)	Probable (3)
Significance	**Medium (48)**	**Low (18)**
Status (positive or negative)	Negative	Negative
Reversibility	Moderate	Moderate
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Noise and disturbance during the construction, decommission and during maintenance phases cannot be avoided but would be transient in nature and with appropriate mitigation; no long-term impacts from the construction phase can be expected.	

Mitigation:
» Site access should be controlled and no unauthorised persons should be allowed onto the site.
» Any fauna directly threatened by the associated activities should be removed to a safe location by a suitably qualified person.
» The collection, hunting or harvesting of any plants or animals at the site should be strictly forbidden. Personnel should not be allowed to wander off the demarcated site.
» Fires should not be allowed on site.
» All hazardous materials should be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel and oil spills that occur at the site should be cleaned up in the appropriate manner as related to the nature of the spill.
» All construction vehicles on site should adhere to a low speed limit (30km/h) to avoid collisions with susceptible species such as snakes and tortoises.
» Construction vehicles limited to a minimal footprint on site (no movement outside of the earmarked footprint).

Residual Impacts:
The altered development area will contain a lower diversity of habitat types and niches for faunal species, however faunal diversity was in any way confirmed to be limited and as such this potential residual impact can be regarded as low.

Operation Phase Impacts

Nature: *Soil erosion and associated degradation of ecosystems*

Following construction, there will be a lot of disturbed and loose soil at the site which will render the area vulnerable to erosion. Erosion is one of the greater risk factors associated with the development and it is therefore critically important that proper erosion control structures are built and maintained over the lifespan of the project.		
	Without mitigation	**With mitigation**
Extent	Neighbouring Areas (3)	Local (1)
Duration	Permanent (5)	Very Short Duration (1)
Magnitude	Moderate (7)	Minor (3)
Probability	Highly Probable (4)	Probable (3)
Significance	**Medium (60)**	**Low (15)**
Status (positive or negative)	Negative	Negative
Reversibility	Low – if erosion has reached severe levels the impacts will not be remedied easily	High
Irreplaceable loss of resources?	Potential loss of important resources.	No
Can impacts be mitigated?	Yes, to a large extent	
Mitigation: » Any erosion problems observed along access roads or any hardened/engineered surface should be rectified immediately and monitored thereafter to ensure that they do not re-occur. » All bare areas (excluding agricultural land and the development footprint), affected by the development, should be re-vegetated with locally occurring species, to bind the soil and limit erosion potential where applicable. » Re-instate as much of the eroded area to its pre-disturbed, "natural" geometry (no change in elevation and any banks not to be steepened) where possible. » Roads and other disturbed areas should be regularly monitored for erosion problems and problem areas should receive follow-up monitoring by the EO to assess the success of the remediation. » Topsoil must be removed and stored separately from subsoil. Topsoil must be reapplied where appropriate as soon as possible in order to encourage and facilitate rapid regeneration of the natural vegetation on cleared areas. » Practical phased development and vegetation clearing must be practiced so that cleared areas are not left un-vegetated and vulnerable to erosion for extended periods of time.		
Residual Impacts: The loss of fertile soil and soil capping resulting in areas which cannot fully rehabilitate itself with a good vegetation cover. With appropriate avoidance and mitigation residual impacts will be very low.		

Nature: *Alien plant invasion* Increased alien plant invasion is one of the greatest risk factors associated with this development following the construction phase. The disturbed and bare ground that is likely to be present at the site during and after construction would leave the site vulnerable to alien plant invasion for some time if not managed. Furthermore, the National Environmental Management Biodiversity Act (Act No. 10 of 2004), as well as the Conservation of Agricultural Resources Act, (Act No. 43 of 1983) requires that listed alien species are controlled in accordance with the Act.		
	Without mitigation	**With mitigation**
Extent	Neighbouring Areas (3)	Local (1)
Duration	Permanent (5)	Very Short Duration (1)
Magnitude	Moderate (6)	Small (2)
Probability	Highly Probable (4)	Probable (3)
Significance	**Medium (56)**	**Low (12)**
Status (positive or negative)	Negative	Negative
Reversibility	Moderate	High
Irreplaceable loss of resources?	Potential loss of important resources due to the replacement of natural vegetation by invading alien plants	No

Can impacts be mitigated?	Yes

Mitigation:

- The successful reduction in the threat (significance) posed by Alien Invasive Plants relies on a detailed;
  - Site-specific eradication and management programme for alien invasive plants;
  - Site-specific Vegetation Rehabilitation Management Plan; and
  - The meticulous implementation of this Management Plan.
- Such an Alien Invasive and Vegetation Rehabilitation Management Plan must subsequently be included in the Environmental Management Programme (EMPr).
- Regular monitoring by the operation and maintenance team for alien plants must occur and could be conducted simultaneously with erosion monitoring.
- When alien plants are detected, these must be controlled and cleared using the recommended control measures for each species to ensure that the problem is not exacerbated or does not re-occur and increase to problematic levels.
- Clearing methods must aim to keep disturbance to a minimum.
- No planting or importing any listed invasive alien plant species (all Category 1a, 1b and 2 invasive species) to the site for landscaping, rehabilitation or any other purpose must be undertaken.

Residual Impacts:

If the above recommended mitigation measures are strictly implemented and some re-establishment and rehabilitation of natural vegetation is allowed the residual impact will be very low.

Decommissioning Phase Impacts

Nature: *Direct faunal impacts*

Increased levels of noise, pollution, disturbance and human presence during decommissioning will be detrimental to fauna. Sensitive and shy fauna would move away from the area during this phase as a result of the noise and human activities present, while some slow-moving species would not be able to avoid the construction activities and might be killed. Some impact on fauna is highly likely to occur during construction.

	Without mitigation	**With mitigation**
Extent	Whole Site (2)	Local (1)
Duration	Short Duration (2)	Short Duration (2)
Magnitude	Minor (3)	Small (2)
Probability	Highly Probable (4)	Improbable (2)
Significance	**Medium (28)**	**Low (10)**
Status (positive or negative)	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Noise and disturbance during the decommission and during maintenance phases cannot be avoided but would be transient in nature and with appropriate mitigation; no long-term impacts from the construction phase can be expected.	

Mitigation:

- Site access should be controlled and no unauthorised persons should be allowed onto the site.
- Any fauna directly threatened by the associated activities should be removed to a safe location by a suitably qualified person.
- The collection, hunting or harvesting of any plants or animals at the site should be strictly forbidden. Personnel should not be allowed to wander off the demarcated site.
- Fires should not be allowed on site.
- All hazardous materials should be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel and oil spills that occur at the site should be cleaned up in the appropriate manner as related to the nature of the spill.

» All vehicles on site should adhere to a low speed limit (30km/h) to avoid collisions with susceptible species such as snakes and tortoises. » Vehicles limited to a minimal footprint on site (no movement outside of the earmarked footprint).
Residual Impacts: None.

Nature: *Soil erosion and associated degradation of ecosystems*

Following decommissioning, there will be a lot of disturbed and loose soil at the site which will render the area vulnerable to erosion.

	Without mitigation	**With mitigation**
Extent	Neighbouring Areas (3)	Local (1)
Duration	Long Term (4)	Very Short Duration (1)
Magnitude	Moderate (6)	Small (2)
Probability	Highly Probable (4)	Probable (3)
Significance	**Medium (52)**	**Low (12)**
Status (positive or negative)	Negative	Negative
Reversibility	Low – if erosion has reached severe levels the impacts will not be remedied easily	High
Irreplaceable loss of resources?	Potential loss of important resources.	No
Can impacts be mitigated?	Yes, to a large extent	

Mitigation:

» Any erosion problems observed should be rectified immediately and monitored thereafter to ensure that they do not re-occur.
» There should be regular monitoring for erosion for at least 2 years after decommissioning by the applicant to ensure that no erosion problems develop as a result of the disturbance, and if they do, to immediately implement erosion control measures.
» All bare areas, affected by the development, should be re-vegetated with locally occurring species, to bind the soil and limit erosion potential where applicable.
» Re-instate as much of the eroded area to its pre-disturbed, "natural" geometry (no change in elevation and any banks not to be steepened) where possible.

Residual Impacts:
None.

Nature: *Alien plant invasion*

Increased alien plant invasion is one of the greatest risk factors associated with this development following the decommission phase. The disturbed and bare ground that is likely to be present at the site during and after decommissioning would leave the site vulnerable to alien plant invasion for some time if not managed. Furthermore, the National Environmental Management Biodiversity Act (Act No. 10 of 2004), as well as the Conservation of Agricultural Resources Act, (Act No. 43 of 1983) requires that listed alien species are controlled in accordance with the Act.

	Without mitigation	**With mitigation**
Extent	Neighbouring Areas (3)	Local (1)
Duration	Permanent (5)	Very Short Duration (1)
Magnitude	Moderate (6)	Small (2)
Probability	Highly Probable (4)	Probable (3)
Significance	**Medium (56)**	**Low (12)**
Status (positive or negative)	Negative	Negative

Reversibility	Moderate	High
Irreplaceable loss of resources?	Potential loss of important resources due to the replacement of natural vegetation by invading alien plants	No
Can impacts be mitigated?	Yes	
Mitigation: » The successful reduction in the treat (significance) posed by Alien Invasive Plants relies on a detailed; ∗ Site-specific eradication and management programme for alien invasive plants; ∗ Site-specific Vegetation Rehabilitation Management Plan; and ∗ The meticulous implementation of this Management Plan. » Such an Alien Invasive and Vegetation Rehabilitation Management Plans must subsequently be included in the Environmental Management Programme (EMPr). » Due to the disturbance at the site alien plant species are likely to be a long-term problem at the site following decommissioning and regular control will need to be implemented until a cover of indigenous species has returned. » When alien plants are detected, these must be controlled and cleared using the recommended control measures for each species to ensure that the problem is not exacerbated or does not re-occur and increase to problematic levels. » Clearing methods must aim to keep disturbance to a minimum. » No planting or importing any listed invasive alien plant species (all Category 1a, 1b and 2 invasive species) to the site for landscaping, rehabilitation or any other purpose must be undertaken.		
Residual Impacts: None.		

9.3.5 Overall Result

From a botanical and ecological perspective, it was found that the study area is mostly comprised of either Moderate (7549 ha; 20.7%) or Low (14496 ha; 39.7%) sensitivity. This large extent of low sensitivity areas is fortunate and means that there are ample areas for the development to occur. Various "Very High" sensitivity areas also occur throughout the study area (comprising features such as wetlands, ephemeral rivers and streams, seepages, and other drainage lines). Furthermore, various CBA and ESA areas occur throughout the study area. Development is highly discouraged within the areas classified as CBA Irreplaceable Areas and development within CBA Optimal Areas should be avoided as far as possible.

A total of 198 plant species were found within the study area, which consisted of 158 native, 0 Red List, 6 protected, 0 Mpumalanga endemic, 39 alien, and 11 NEM:BA listed invasive species.

A total of 32 mammal species, 6 amphibians and 10 reptile species were recorded within the projects site. No amphibian or reptile SCC were recorded within the project site; however, 4 mammal SCC were recorded within the project site namely; Serval (Near Threatened), Brown hyena (Near Threatened); Vlei rat (Near Threatened), Cape clawless otter (Near Threatened) and South African hedgehog (Near Threatened). It was determined that the development will not detrimentally impact these populations/individual SCC.

During this assessment it was determined that the study area contains numerous habitat variations, and include Drainage, Fallow Land, Natural Clay, Natural Dolerite, Natural Loam Soil, Natural Rock Turf, Natural Sandstone, and Disturbed areas. Each of these areas (excluding disturbed areas) have certain unique species, with drainage areas having the highest number (i.e., many of its species are not shared with the other habitats). Development should therefore not proceed within drainage areas, which are all classified as "Very High" sensitivity. Natural rock turf and natural clay areas had the lowest number of species that

occurred only in those types, and development should therefore aim to occur within these habitat types, since this would minimize the loss of unique biodiversity.

None of the proposed turbine localities occur within drainage areas ("Very High" sensitivity). However, internal access routes will cross drainage areas at sixteen locations. A total of fourteen (14) wind turbines are planned within the natural areas classified as CBA Optimal Areas ("Very High" sensitivity), five (5) wind turbines are planned within natural areas classified as CBA Irreplaceable Areas ("Very High" sensitivity). Furthermore, a total of twenty (20) turbines occur within natural areas, that fall outside of any CBAs (eight of these turbines fall within ESAs) and have subsequently been classified as "Medium" in terms of sensitivity (as determined by the authors of this report via desktop mapping and ground truthing).

A new optimised layout has been proposed (refer to Chapter 11), and according to this layout no wind turbines will be located within any CBA Irreplaceable Areas, with only six wind turbines planned within CBA Optimal Areas. Thus, according to this optimized layout, almost all of the sensitive areas will be avoided and the Ummbila WEF will not significantly impact sensitive areas or impact conservation targets set out by the province.

There are no impacts associated with the proposed wind energy facility that cannot be mitigated to a low level. Its local environmental impact can be reduced to an acceptable magnitude. Likewise, the contribution of the proposed wind energy facility to the cumulative impact in the area would be low and is acceptable. As such, there are no fatal flaws associated with the development and no terrestrial ecological considerations that should prevent it from proceeding. Therefore, it is the opinion of the specialists that the development may be authorised within the specified area, subject to the implementation of the recommended mitigation measures.

9.4. Potential Impacts on Freshwater Ecology

The development of the Ummbila Emoyeni Wind Energy Facility is likely to result in a variety of impacts from an aquatic perspective. Potential impacts and the relative significance of the impacts are summarised below (refer to **Appendix E** for more details).

9.4.1 Results of the Freshwater Impact Assessment

The dominant drainage/wetland features within the project site are the floodplain wetlands, within which almost all of the other wetland features apart from a few endorheic wetland features (7 depression wetlands and 7 seepages), drain into directly. All of the freshwater resource features on and around the site are intermittent or ephemeral, being inundated only for brief periods each year, with periods of drought that are unpredictable in duration.

Artificial wetland features (impoundments/dams) are also a noteworthy hydrological feature within the project site with one-hundred and twenty dam features present within the project site. Most of these dam features are instream impoundments (especially common within the channelled valley-bottom wetlands) and are typically fairly small farm dams which is fairly easily breached or allow some seepage.

Sensitivities that occur specifically within the project site for the Ummbila Emoyeni Wind Energy Facility that may be vulnerable to damage from the proposed project are shown in **Figure 9.3**. All endorheic wetland features, wetland features that are not directly connected to the larger extensive wetland network or that have been fractured/isolated through agricultural practices are classified as High Sensitive. Even though

these wetland features do not provide functions and services to the extent of the more connected and larger wetland features, these wetlands still provide some functions and services. Furthermore, most of these wetland features are fairly small and any direct impacts on these wetland habitats may have a significant impact on the drivers of these wetland features as well as the associated biodiversity. Another feature of these wetlands is the fact that, even though small in size, the are located within relatively small catchment areas, thus these wetlands' percentage coverage in relationship to their catchments are fairly significant, making these wetland features vulnerable to catchment disturbances.

The following buffer areas are recommended, and should be implemented for maintaining the freshwater resource features REC (Recommended Ecological Category) allowing the persistence of the current present ecological status as well as their functions and services.

- All small, endorheic seepages and depressions with a High Ecological Importance: 50m buffers from the outer edge of the freshwater resource features.
- All larger interconnected wetland features with Very Ecological Importance: 100m buffers from the outer edge of the freshwater resource features.
- All freshwater features with their buffer areas have been classified as either Very High- or High sensitive and should be regarded as "No-Go" areas apart from the following activities and infrastructure which may be allowed (although restricted to an absolute minimum footprint):
  - only activities relating to the route access and cabling:
    - the use/upgrade of existing roads and watercourse crossings are the preferred options;
    - Where no suitable existing roads and watercourse crossings exist, the construction of new access roads and watercourse crossings can be allowed, however this should be deemed as a last resort.
    - All underground cabling should be laid either within access roads or next to access roads (as close as possible).

In terms of the indicative layout assessed within this EIA, only fifteen wetland features will be impacted through access and underground cable route crossings. No other infrastructure is located within any freshwater resource feature.

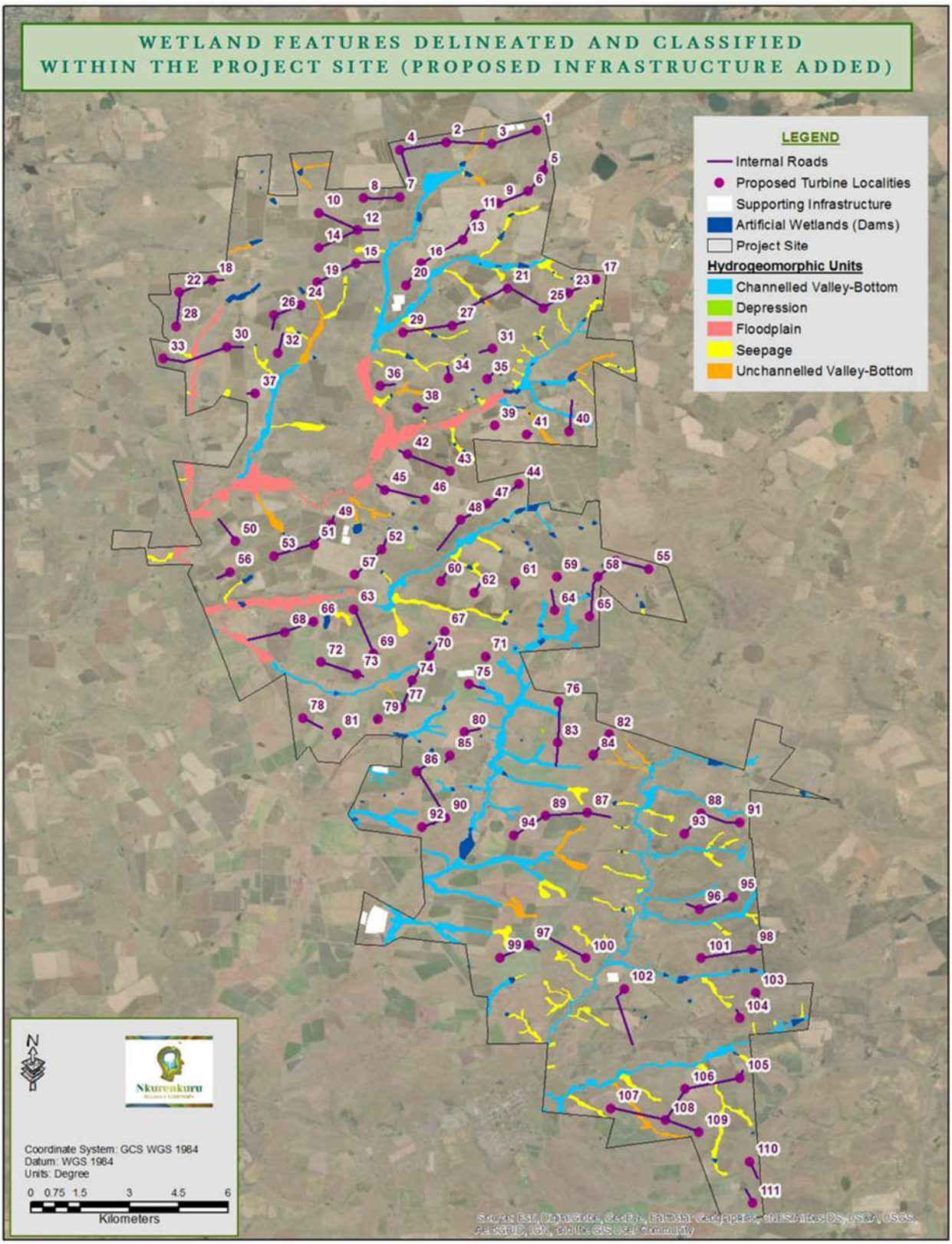


Figure 9.3: Mapping delineated and classified hydrogeomorphic wetland units occurring within the study area in relation to the proposed infrastructure

9.4.2 Description of Impacts on Freshwater Ecology

Potential impacts on aquatic ecology resulting from the proposed turbines and supporting infrastructure include the following:

Planning and construction:
The proposed wind energy facility is anticipated to require high intensity disturbance of a limited surface area at the site of each wind turbine. Concrete foundations for the turbine towers will need to be constructed as well as permanent hard standing bases of compacted gravel adjacent to each turbine location for the cranes used to construct the turbines. Internal collector substations, warehouses, batching plants, and an Operational and Maintenance Building would also need to be constructed within the site. Temporary laydown areas and a construction site would need to be placed within the site for the construction works.

In terms of the layout assessed, all of the above-mentioned supporting infrastructure are located well outside any freshwater resource features as well as their associated buffer areas and as such impacts on freshwater resource features will be avoided.

In terms of the location of the wind turbines, no wind turbines are located within any of the delineated freshwater resource features as well as their recommended buffer areas and as such direct impacts on freshwater resource features will be avoided.

Activities during the construction phase of the project could be expected to result in some disturbance of vegetation cover for clearing and preparation of the turbines and supporting infrastructure, this may potentially lead to some indirect impacts on downslope freshwater resource features. There is also the potential for some water quality impacts associated with the batching of concrete, from hydrocarbon spills or associated with the other construction activities on the site. Only a limited amount of water is utilised during construction for the batching of concrete for wind turbines and other construction activities.

Generally, with mitigation measures in place, impacts will be localised, short-term and of low intensity and the project is expected to have a low to very low overall significance in terms of its impact on the identified aquatic ecosystems in the area.

Operation:
During the operation phase the turbines will operate continuously, unattended and with low maintenance required for the duration of the wind energy facility's life (±20 years). The wind energy facility is likely to be monitored and controlled remotely, with maintenance only taking place when required. The hard surfaces created by the development may lead to increased runoff, in particular on surfaces with a steeper gradient. This may lead to increased erosion and sedimentation of the downslope areas.

Subsequently, a localised long-term impact (more than 20 years) of low intensity (depending on the distance between the turbines and the freshwater features) could be expected that would have a very low overall significance post-mitigation in terms of its impact on the identified freshwater resource features in the area.

Decommissioning:
During decommissioning, the potential freshwater impacts will be very similar to that of the Construction Phase, although the potential for water quality and flow related risks will be lower.

Potential impacts on aquatic ecology resulting from the proposed associated linear infrastructure (access roads and MV cabling) include the following:

Planning and construction:
The internal access roads and MV Cabling will need to cross some freshwater resource features, some of which will be on existing gravel roads.

The proposed construction will involve the upgrade of the existing local road network and where no available routes are available, new routes will be constructed. It is envisaged that most of the proposed road development will be an upgrade of existing infrastructure, with only limited construction of new road sections.

The major direct impacts associated with the internal roads relate to the:
- Transformation and/or loss of habitat within the rivers and riparian areas (e.g. habitat infilling for road fill embankments, alteration of profiles at crossings).
- Transformation and/or loss of indigenous vegetation within the riparian zones.
- Potential invasive alien plant growth.
- Potential flow and water quality impacts.
- Potential impacts on the soil (erosion of watercourse channels).

Potential indirect impacts associated with the internal roads may include the following:
- Habitat fragmentation: Fragmentation of habitat and reduced ecological connectivity.
- Reduced habitat patch size and core to edge ratio.
- Increased intensity of edge disturbances, as a result of construction activities (e.g. noise, dust and light pollution).
- Invasion of construction corridor with alien invasive species and increased alien invasive propagule sources within proximity to the freshwater habitats. Increased alien invasive plant invasion, alteration of plant species composition, degradation of freshwater habitat.

Operation:
Potential impacts associated with the internal roads may include the following:
- Direct transformation and modification of habitat.
- The increase in road surface will likely result in an increase in surface runoff / stormwater discharges to the freshwater resource features. Road networks tend to intercept, direct and concentrate flows which potentially may change the volume and timing of peak flows reaching aquatic ecosystems. This increase in peak discharge may significantly increase the stream power, thereby increasing the risk of erosion and channel incision. In addition, the diversion of flow through culverts at road crossings will narrow the width of the flow / concentrate flows and increase the velocity of flows at the culvert outlets. These impacts may result in the following consequences:
  - Stream bed and bank erosion (incision and widening).
  - Increase in sediment inputs to downstream freshwater ecosystems/habitats, subsequently affecting the movement of water and water quality.

Decommissioning:
During decommissioning, the potential freshwater impacts will be very similar to that of the Construction Phase, although the potential for water quality and flow related risks will be lower.

9.4.3 *Impact tables summarising the significance of impacts on freshwater ecology during construction, operation and decommissioning (with and without mitigation)*

Construction Phase Impacts

Nature: *Loss of freshwater resource features during the construction*

Possible ecological consequences may include:
» Reduction in representation and conservation of freshwater ecosystem/habitat types.
» Reduction in the supply of ecosystem goods & services.
» Reduction/loss of habitat for aquatic dependent flora & fauna.
» Reduction in and/or loss of species of conservation concern (i.e. rare, threatened/endangered species).

Internal roads and the underground cabling option are the only two aspects that will directly impact aquatic habitats through the direct disturbance and replacement of the of riparian/aquatic/wetland zones along the crossing points.

These disturbances will be the greatest during the construction and again in the decommissioning phases as the related disturbances could result in the loss and/or damage to vegetation and alteration of natural geomorphological and hydrological processes within the freshwater resource features. Compacted soils are also not ideal for supporting vegetation growth as they inhibit seed germination.

	Without mitigation	**With mitigation**
Extent	Neighbouring Areas (3)	Local (1)
Duration	Permanent (5)	Long-term (4)
Magnitude	Moderate (6)	Minor (4)
Probability	Highly Probable (4)	Probable (3)
Significance	**Medium (56)**	**Low (27)**
Status (positive or negative)	Negative	Negative
Reversibility	Low – Destruction of wetland vegetation will not be remedied easily.	Low – Destruction of wetland vegetation will not be remedied easily.
Irreplaceable loss of resources?	Local loss of resources	No loss of resources
Can impacts be mitigated?	Yes, to a large extent	

Mitigation:

Wind turbines and supporting infrastructure (excluding roads and MV cabling):
» The recommended buffer areas between the delineated freshwater resource features and proposed project activities should be maintained.
» Vegetation clearing should occur in a phased manner to minimise erosion and/or run-off.
» Any areas disturbed during the construction phase should be encouraged to rehabilitate as fast and effectively as possible and where deemed necessary by the ECO or Contractor's EO, artificial rehabilitation (e.g. re-seeding with collected or commercial indigenous seed mixes) should be applied in order to speed up the rehabilitation process in critical areas (e.g. steep slopes and unstable soils).

Internal access roads:
» Existing crossings should be utilized/upgraded.
» Where no existing crossings are available the construction of new crossings can be considered.
» Where new watercourse/wetland crossings are required, the engineering team must provide an effective means to minimise the potential upstream and downstream effects of sedimentation and erosion (erosion protection) as well minimise the loss of riparian vegetation (reduce footprint as much as possible).
» All crossings over watercourses/wetlands should be such that the flow within the channels is not impeded and should be constructed perpendicular to the river/wetland channel.
» The erosion and stormwater management measures included in the stormwater management plan for the wind energy facility must be implemented.

- Where new roads need to be constructed, the existing road infrastructure should be rationalised and any unnecessary roads decommissioned and rehabilitated to reduce the disturbance of the area within the river beds.
- During the construction phase, monitor culverts to see if erosion issues arise and if any erosion control is required.
- Where possible, culvert bases must be placed as close as possible with natural levels in mind so that these don't form additional steps / barriers.
- Vegetation clearing should occur in a phased manner to minimise erosion and/or run-off.
- Any areas disturbed during the construction phase should be encouraged to rehabilitate as fast and effective as possible and were deemed necessary by the ECO or Contractor's EO, artificial rehabilitation (e.g. re-seeding with collected or commercial indigenous seed mixes) should be applied in order to speed up the rehabilitation process in critical areas (e.g. steep slopes and unstable soils).
- All alien plant re-growth must be monitored, and should it occur, these plants should be eradicated.
- Road infrastructure and cable alignments should coincide as far as possible to minimise the impact.
- Any disturbed areas should be rehabilitated and monitored to ensure that these areas do not become subject to erosion or invasive alien plant growth.
- During construction, disturbance to the freshwater ecosystems should be limited as far as possible.
- Disturbed areas may need to be rehabilitated and revegetated.
- Mitigation and follow up monitoring of residual impacts (alien vegetation growth and erosion) may be required.

Underground MV cabling:

- The underground MV cabling, where crossing watercourses/wetlands, should be laid within the access roads (existing), or if not possible, within the shoulder or at least within 3m of the road shoulder.
- Ideally the construction disturbance footprint should be kept to an area no wider than 5m.
- All material stockpiles should be located outside freshwater resource features.
- Excavated soils should be stockpiled on the upslope side of the excavated trench so that eroded sediments off the stockpile are washed back into the trench.
- Excavated soils will need to be replaced in the same order as excavated from the trench, i.e. sub-soil must be replaced first and topsoil must be replaced last (this will maximise opportunity for re-vegetation of disturbed areas).
- Closure and rehabilitation of the disturbed areas should commence as soon as the laying of underground cable has been completed.
- The areas where vegetation is destroyed and disturbed will however need to be monitored against invasion by alien vegetation and, if encountered, will need to be removed.
- If natural re-vegetation is unsuccessful, seeding and planting of the area will need to be implemented.
- There should be reduced activity at the site after large rainfall events when the soils are wet.
- No driving off of hardened roads should occur immediately following large rainfall events until soils have dried out and the risk of bogging down has decreased.
- Any disturbed areas should be rehabilitated and monitored to ensure that these areas do not become subject to erosion.
- During decommissioning, disturbance to the freshwater ecosystems should be limited as far as possible.
- Disturbed areas may need to be rehabilitated and revegetated.

Residual Impacts:

Without Mitigation:

- Locally altered vegetation structure,
- Possible impact on the remaining catchment due to changes in run-off characteristics in the development site.

With Mitigation:

- Residual impacts are unlikely to occur within these freshwater resource habitats.

Nature: *Increase in sedimentation and erosion*

Caused by soil erosion and earthworks that are associated with construction activities.

Possible ecological consequences associated with this impact may include:
» Deterioration in freshwater ecosystem integrity.
» Reduction/loss of habitat for aquatic dependent flora & fauna.

This may furthermore, influence water quality downstream.

	Without mitigation	**With mitigation**
Extent	Neighbouring Areas (3)	Local (1)
Duration	Long Term (4)	Short Duration (2)
Magnitude	Moderate (6)	Minor (3)
Probability	Highly Probable (4)	Probable (3)
Significance	**Medium (52)**	**Low (18)**
Status (positive or negative)	Negative	Negative
Reversibility	Moderate	High
Irreplaceable loss of resources?	Local loss of resources	Unlikely
Can impacts be mitigated?	Yes, to a large extent	

Mitigation:

Wind turbines and supporting infrastructure (excluding roads and MV cabling):
» The recommended buffer areas between the delineated freshwater resource features and proposed project activities should be maintained.
» Vegetation clearing should occur in a phased manner to minimise erosion and/or run-off.
» Any erosion problems observed to be associated with the project infrastructure should be rectified as soon as possible and monitored thereafter to ensure that they do not re-occur.
» All bare areas, as a result of the development, should be revegetated with locally occurring species, to bind the soil and limit erosion potential.
» There should be reduced activity at the site after large rainfall events when the soils are wet. No driving off of hardened roads should occur immediately following large rainfall events until soils have dried out and the risk of bogging down has decreased.
» Any stormwater within the site must be handled in a suitable manner, i.e. trap sediments, and reduce flow velocities
» Stormwater from hardstand areas, buildings and the substation must be managed using appropriate channels and swales when located within steep areas.

Internal access roads:
» The duration of construction work within the watercourses/wetlands must be minimised as far as practically possible through proper planning and phasing.
» Vegetation clearing should occur in a phased manner to minimise erosion and/or run-off.
» Any areas disturbed during the construction phase should be encouraged to rehabilitate as fast and effective as possible and where deemed necessary by the ECO or Contractor's EO, artificial rehabilitation (e.g. re-seeding with collected or commercial indigenous seed mixes) should be applied in order to speed up the rehabilitation process in critical areas (e.g. steep slopes and unstable soils).
» Any erosion problems observed during the construction phase should be rectified as soon as possible and monitored thereafter to ensure that they do not re-occur.
» Silt traps should be used where there is a danger of topsoil eroding and entering streams and other sensitive areas. These silt traps must be regularly monitored and maintained and replaced / repaired immediately as and when required. These measures should be regularly checked, maintained and repaired when required to ensure that they are effective
» Construction of gabions and other stabilisation features to prevent erosion must be undertaken, if deemed necessary.
» Under no circumstances must new channels be created for flow diversion and conveyance purposes unless approved as part of an EA or WUL.
» No stormwater runoff must be allowed to discharge directly into any watercourse/wetland along roads, and flows should thus be allowed to dissipate over a broad area covered by natural vegetation.

- There should be reduced activity during the construction phase at the site after large rainfall events when the soils are wet. No driving off of hardened roads should occur immediately following large rainfall events until soils have dried out and the risk of bogging down has decreased.
- Existing crossings should be utilized/upgraded.
- Where no existing crossings are available the construction of new crossings can be considered.
- Where new watercourse/wetland crossings are required, the engineering team must provide an effective means to minimise the potential upstream and downstream effects of sedimentation and erosion (erosion protection) as well minimise the loss of riparian/wetland vegetation (reduce footprint as much as possible).
- All crossings over watercourses/wetlands should be such that the flow within the channels is not impeded and should be constructed perpendicular to the river channel/ and wetland feature.
- During the construction phase, monitor culverts to see if erosion issues arise and if any erosion control is required.
- Where possible, culvert bases must be placed as close as possible with natural levels in mind so that these don't form additional steps / barriers.
- Vegetation clearing should occur in a phased manner to minimise erosion and/or run-off.
- Any areas disturbed during the construction phase should be encouraged to rehabilitate as fast and effective as possible and were deemed necessary by the ECO or Contractor's EO, artificial rehabilitation (e.g. re-seeding with collected or commercial indigenous seed mixes) should be applied in order to speed up the rehabilitation process in critical areas (e.g. steep slopes and unstable soils).

Underground MV cabling:

- The underground MV cabling, where crossing watercourses/wetlands, can be laid within the access roads (existing), or if not possible, within the shoulder or at least within 3m of the road shoulder.
- All construction activities occurring directly within the watercourses/wetlands to take place within the dry season.
- Ideally the construction disturbance footprint should be kept to an area no wider than 5 m.
- Regular monitoring for erosion.
  - Any erosion problems observed, to be associated with the relating activity, should be rectified as soon as possible and monitored thereafter to ensure that they do not re-occur.
  - Silt traps should be used where there is a danger of topsoil or material stockpiles eroding and entering streams and other sensitive areas.
  - Construction of gabions and other stabilisation features to prevent erosion, if deemed necessary.
- Closure and rehabilitation of the disturbed areas should commence as soon as the laying of underground cable has been completed.
  - Soils should be landscaped to the natural landscape profile with care taken to ensure that no preferential flow paths or berms remain.
- The areas where vegetation is destroyed and disturbed will need to be monitored for invasion by alien vegetation and, if encountered, will need to be removed.
- If natural re-vegetation is unsuccessful, seeding and planting of the area will need to be implemented.
- There should be reduced activity at the site after large rainfall events when the soils are wet.
- No driving off of hardened roads should occur immediately following large rainfall events until soils have dried out and the risk of bogging down has decreased.
- Watercourse/wetland areas other than the immediate areas of crossing are to be demarcated as no-go areas for vehicles and construction personnel. The immediate crossings within a watercourse/wetland area is therefore permissible for trenching as well as the associated machinery, vehicles and construction personnel.
- Excavated soils should be stockpiled on the upslope side of the excavated trench so that eroded sediments off the stockpile are washed back into the trench.
- Excavated soils will need to be replaced in the same order as excavated from the trench, i.e. sub-soil must be replaced first and topsoil must be replaced last (this will maximise opportunity for re-vegetation of disturbed areas).

Residual Impacts:

Altered streambed morphology. Due to the extent and nature of the development this residual impact is unlikely to occur.

Nature: *Potential impact on localised surface water quality* During preconstruction and construction, chemical pollutants (hydrocarbons from equipment and vehicles, cleaning fluids, cement powder, wet concrete, shutter-oil, etc.) associated with site-clearing machinery, construction and maintenance activities could be washed downslope via the ephemeral systems.		
	Without mitigation	**With mitigation**
Extent	Neighbouring Areas (3)	Local (1)
Duration	Very Short Duration (1)	Very Short Duration (1)
Magnitude	Moderate (7)	Minor (4)
Probability	Probable (3)	Improbable (2)
Significance	**Medium (33)**	**Low (12)**
Status (positive or negative)	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	Local loss of resources	Unlikely
Can impacts be mitigated?	Yes, to a large extent	
Mitigation: Wind turbines and supporting infrastructure (excluding roads and MV cabling): » Implement appropriate measures to ensure strict use and management of all hazardous materials used on site. » Implement appropriate measures to ensure Strict management of potential sources of pollutants (e.g. litter, hydrocarbons from vehicles and machinery, cement during construction etc.). » Implement appropriate measures to ensure containment of all contaminated water by means of careful run-off management on the development site. » Implement appropriate measures to ensure strict control over the behaviour of construction workers. » Working protocols incorporating pollution control measures (including approved method statements by the contractor) should be clearly set out in the Construction Environmental Management Plan (CEMP) for the project and strictly enforced. » Appropriate ablution facilities should be provided for construction workers during construction and on-site staff during the operation of the substation and wind energy facility.		
Residual Impacts: Residual impacts will be negligible after appropriate mitigation.		

Operation Phase Impacts

Nature: *Impact on watercourse/wetland systems through the possible increase in surface runoff on watercourse/wetland form and function during the operation and decommissioning phases* This might occur during the operation phase, when hard or compacted surfaces (hard engineered surfaces, roads etc.) increase the volume and velocity of the surface runoff. This could impact the hydrological regime through the increase in flows that are concentrated in certain areas. If flows are too concentrated with high velocities, scour and erosion may occur, with a complete reduction or disturbance of riparian habitat.		
	Without mitigation	**With mitigation**
Extent	Whole Site (2)	Local (1)
Duration	Long Term (4)	Long Term (4)
Magnitude	Moderate (6)	Minor (4)
Probability	Probable (3)	Improbable (2)
Significance	**Medium (36)**	**Low (18)**
Status (positive or negative)	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	Unlikely	Unlikely
Can impacts be mitigated?	Yes, to a large extent	
Mitigation:		

Wind turbines and supporting infrastructure (excluding roads and MV cabling):

- Any stormwater within the site must be handled in a suitable manner as per the management measures in stormwater management plan.
- Stormwater from hardstand areas, buildings and the substation must be managed using appropriate channels and swales when located within steep areas.
- No stormwater runoff must be allowed to discharge directly into the watercourses. The runoff should rather be dissipated over a broad area covered by natural vegetation or managed using appropriate channels and swales when located within steep embankments.
- Stormwater run-off infrastructure must be maintained to mitigate both the flow and water quality impacts of any stormwater leaving the wind energy facility site.

Internal access roads:

- No stormwater runoff must be allowed to discharge directly into any water course along roads, and flows should thus be allowed to dissipate over a broad area covered by natural vegetation.
- For the crossing of small seasonal to ephemeral watercourses with sandy substrates and gentle gradients:
  - Road structures should be stabilized up to the level of the watercourse bed to allow for natural flow across the road.
  - It is crucial that the road surface is level within the watercourse without any flow concentration.
- Where the road structure will be built up to the level of the terrestrial land adjacent to the river bed (larger seasonal watercourses with stronger flows, deeper channels and steeper embankments):
  - Engineering team must provide an effective means to allow/simulate natural flow patterns without the consecration/modification of flow through the culverts which must be incorporated into the detailed stormwater management plans based on the final design of the wind energy facility.
  - Culverts should be sized to transport not only water, but other materials that might be mobilized (i.e. debris) and cause blockages to flow.
  - Appropriate erosion protection measures must be installed to reduce bed erosion / scour.
- The base (invert) of culverts must be aligned with the natural ground level of the bed of the channel to limit risks of erosion. Where necessary, additional measures such as drop-inlets or stepped inlet weirs must be constructed to address such risks.

Underground MV cabling:

- The underground grid line, where crossing watercourses, can be laid within the access roads (existing), or if not possible, within the shoulder or at least within 3m of the road shoulder.
- Refer to the mitigation measures provided below addressing sedimentation and erosion.

Residual Impacts:
Altered streambed/wetland morphology. Due to the extent and nature of the development this residual impact is unlikely to occur.

Nature: *Increase in sedimentation and erosion*

For the operation phase, this refers to the alteration in the physical characteristics of freshwater resource features as a result of increased turbidity and sediment deposition, caused by soil erosion, as well as instability and collapse of unstable soils during project operation. Possible ecological consequences associated with this impact may include:

- Deterioration in freshwater ecosystem integrity.
- Reduction/loss of habitat for aquatic dependent flora & fauna.

	Without mitigation	**With mitigation**
Extent	Neighbouring Areas (3)	Local (1)
Duration	Long Term (4)	Very Short Duration (1)
Magnitude	Moderate (6)	Minor (4)
Probability	Highly Probable (4)	Probable (3)
Significance	**Medium (52)**	**Low (18)**
Status (positive or negative)	Negative	Negative
Reversibility	Moderate	High

Irreplaceable loss of resources?	Local loss of resources	Unlikely
Can impacts be mitigated?	Yes, to a large extent	

Mitigation:

Wind turbines and supporting infrastructure (excluding roads and MV cabling):

» Any erosion problems observed to be associated with the project infrastructure should be rectified as soon as possible and monitored thereafter to ensure that they do not re-occur.
» All bare areas, as a result of the development, should be revegetated with locally occurring species, to bind the soil and limit erosion potential.
» Any stormwater within the site must be handled in a suitable manner, i.e. trap sediments, and reduce flow velocities
» Stormwater from hardstand areas, buildings and the substation must be managed using appropriate channels and swales when located within steep areas.
» Stormwater run-off infrastructure must be maintained to mitigate both the flow and water quality impacts of any storm water leaving the wind energy facility site.

Internal access roads:

» Any disturbed areas should be encouraged to rehabilitate as fast and effectively as possible and where deemed necessary by the ECO or Contractor's EO, artificial rehabilitation (e.g. re-seeding with collected or commercial indigenous seed mixes) should be applied in order to speed up the rehabilitation process in critical areas (e.g. steep slopes and unstable soils).
» Any erosion problems observed should be rectified as soon as possible and monitored thereafter to ensure that they do not re-occur.
» Silt traps should be used where there is a danger of topsoil eroding and entering streams and other sensitive areas. These silt traps must be regularly monitored and maintained and replaced / repaired immediately as and when required. These measures should be regularly checked, maintained and repaired when required to ensure that they are effective.

Underground MV cabling:

» Regular monitoring for erosion.
  - Any erosion problems observed, to be associated with the relating activity, should be rectified as soon as possible and monitored thereafter to ensure that they do not re-occur.
  - Silt traps should be used where there is a danger of topsoil or material stockpiles eroding and entering streams and other sensitive areas.
» The areas where vegetation is destroyed and disturbed will need to be monitored against invasion by alien vegetation and, if encountered, will need to be removed.
» If natural re-vegetation is unsuccessful, seeding and planting of the area will need to be implemented.

Residual Impacts:

Altered streambed/wetland morphology. Due to the extent and nature of the development this residual impact is unlikely to occur.

Decommissioning Phase Impacts

Nature: *Loss of freshwater resource features*

Possible ecological consequences may include:

» Reduction in representation and conservation of freshwater ecosystem/habitat types.
» Reduction in the supply of ecosystem goods & services.
» Reduction/loss of habitat for aquatic dependent flora & fauna.
» Reduction in and/or loss of species of conservation concern (i.e. rare, threatened/endangered species).

Internal roads and the underground cabling option are the only two aspects that will directly impact aquatic habitats through the direct disturbance and replacement of the of riparian/aquatic/wetland zones along the crossing points.

These disturbances will be the greatest during the construction and again in the decommissioning phases as the related disturbances could result in the loss and/or damage to vegetation and alteration of natural geomorphological and hydrological processes within the freshwater resource features. Compacted soils are also not ideal for supporting vegetation growth as they inhibit seed germination.		
	Without mitigation	**With mitigation**
Extent	Neighbouring Areas (3)	Local (1)
Duration	Permanent (5)	Long-term (4)
Magnitude	Moderate (6)	Minor (4)
Probability	Highly Probable (4)	Probable (3)
Significance	**Medium (56)**	**Low (27)**
Status (positive or negative)	Negative	Negative
Reversibility	Low – Destruction of wetland vegetation will not be remedied easily.	Low – Destruction of wetland vegetation will not be remedied easily.
Irreplaceable loss of resources?	Local loss of resources	No loss of resources
Can impacts be mitigated?	Yes, to a large extent	
Mitigation: Wind turbines and supporting infrastructure (excluding roads and MV cabling): » Any areas disturbed during the decommissioning phase should be encouraged to rehabilitate as fast and effectively as possible and where deemed necessary by the ECO or Contractor's EO, artificial rehabilitation (e.g. re-seeding with collected or commercial indigenous seed mixes) should be applied in order to speed up the rehabilitation process in critical areas (e.g. steep slopes and unstable soils). Internal access roads and underground MV cabling: » During decommissioning, disturbance to the freshwater ecosystems should be limited as far as possible. o Disturbed areas will need to be rehabilitated and revegetated o Mitigation and follow up monitoring of residual impacts (alien vegetation growth and erosion) will be required.		
Residual Impacts: Without Mitigation: » Locally altered vegetation structure, » Possible impact on the remaining catchment due to changes in run-off characteristics in the development site. With Mitigation: » Residual impacts are unlikely to occur within these freshwater resource habitats.		

Nature: *Increase in sedimentation and erosion* Caused by soil erosion and earthworks that are associated with decommissioning activities. Possible ecological consequences associated with this impact may include: » Deterioration in freshwater ecosystem integrity. » Reduction/loss of habitat for aquatic dependent flora & fauna. This may furthermore, influence water quality downstream		
	Without mitigation	**With mitigation**
Extent	Neighbouring Areas (3)	Local (1)
Duration	Long Term (4)	Short Duration (2)
Magnitude	Moderate (6)	Minor (3)
Probability	Highly Probable (4)	Probable (3)
Significance	**Medium (52)**	**Low (18)**
Status (positive or negative)	Negative	Negative

Reversibility	Moderate	High
Irreplaceable loss of resources?	Local loss of resources	Unlikely
Can impacts be mitigated?	Yes, to a large extent	

Mitigation:

Wind turbines and supporting infrastructure (excluding roads and MV cabling):

» Any erosion problems observed should be rectified immediately and monitored thereafter to ensure that they do not re-occur.
» There should be regular monitoring for erosion for at least 2 years after decommissioning by the applicant to ensure that no erosion problems develop as a result of the disturbance, and if they do, to immediately implement erosion control measures.
» All bare areas, affected by the development, should be re-vegetated with locally occurring species, to bind the soil and limit erosion potential where applicable.
» There should be reduced activity at the site after large rainfall events when the soils are wet. No driving off of hardened roads should occur immediately following large rainfall events until soils have dried out and the risk of bogging down has decreased.

Internal access roads and underground MV cabling:

» The duration of decommissioning work within the watercourses/wetlands must be minimised as far as practically possible through proper planning and phasing.
» Watercourse/wetland areas other than the immediate impact areas are to be demarcated as no-go areas for vehicles and construction personnel. The immediate decommissioning site within a watercourse/wetland area is therefore permissible for activities associated with the decommissioning phase.
» Any areas disturbed during the construction phase should be encouraged to rehabilitate as fast and effectively as possible and where deemed necessary by the ECO or Contractor's EO, artificial rehabilitation (e.g. re-seeding with collected or commercial indigenous seed mixes) should be applied in order to speed up the rehabilitation process in critical areas (e.g. steep slopes and unstable soils).
» Any erosion problems observed during the construction and operational phases should be rectified as soon as possible and monitored thereafter to ensure that they do not re-occur.
» There should be regular monitoring for erosion for at least 2 years after decommissioning by the applicant to ensure that no erosion problems develop as a result of the disturbance, and if they do, to immediately implement erosion control measures.
» Silt traps should be used where there is a danger of topsoil eroding and entering streams and other sensitive areas. These silt traps must be regularly monitored and maintained and replaced / repaired immediately as and when required. These measures should be regularly checked, maintained and repaired when required to ensure that they are effective.
» Excavated soils should be stockpiled on the upslope side of the excavated trench so that eroded sediments off the stockpile are washed back into the trench.
» Excavated soils will need to be replaced in the same order as excavated from the trench, i.e. sub-soil must be replaced first and topsoil must be replaced last (this will maximise opportunity for re-vegetation of disturbed areas).
» There should be reduced activity during the decommissioning phase at the site after large rainfall events when the soils are wet. No driving off of hardened roads should occur immediately following large rainfall events until soils have dried out and the risk of bogging down has decreased.

Residual Impacts:

Altered streambed morphology. Due to the extent and nature of the development this residual impact is unlikely to occur.

Nature: *Potential impact on localised surface water quality*

During decommissioning, chemical pollutants (hydrocarbons from equipment and vehicles, cleaning fluids, cement powder, wet concrete, shutter-oil, etc.) associated with site-clearing machinery, construction and maintenance activities could be washed downslope via the ephemeral systems.

	Without mitigation	With mitigation
Extent	Neighbouring Areas (3)	Local (1)
Duration	Very Short Duration (1)	Very Short Duration (1)
Magnitude	Moderate (7)	Minor (4)
Probability	Probable (3)	Improbable (2)
Significance	**Medium (33)**	**Low (12)**
Status (positive or negative)	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	Local loss of resources	Unlikely
Can impacts be mitigated?	Yes, to a large extent	
Mitigation: » Implement appropriate measures to ensure strict use and management of all hazardous materials used on site. » Implement appropriate measures to ensure Strict management of potential sources of pollutants (e.g. litter, hydrocarbons from vehicles and machinery, cement during construction etc.). » Implement appropriate measures to ensure containment of all contaminated water by means of careful run-off management on the development site. » Implement appropriate measures to ensure strict control over the behaviour of decommissioning workers. » Working protocols incorporating pollution control measures (including approved method statements by the contractor) should be clearly set out in a Decommissioning Environmental Management Plan (EMP) for the project and strictly enforced. » Appropriate ablution facilities should be provided for workers during decommissioning of the substation and wind energy facility.		
Residual Impacts: Residual impacts will be negligible after appropriate mitigation.		

9.4.4 Overall Result

All endorheic wetland features, wetland features that are not directly connected to the larger extensive wetland network or that have been fractured/isolated through agricultural practices are classified as High Sensitive. Even though these wetland features do not provide functions and services to the extent of the more connected and larger wetland features, these wetlands still provide some functions and services. Furthermore, most of these wetland features are fairly small and any direct impacts on these wetland habitats may have a significant impact on the drivers of these wetland features as well as the associated biodiversity. Another feature of these wetlands is the fact that, even though small in size, the are located within relatively small catchment areas, thus these wetlands' percentage coverage in relationship to their catchments are fairly significant, making these wetland features vulnerable to catchment disturbances.

The following buffer areas are recommended, and should be implemented for maintaining the freshwater resource features REC (Recommended Ecological Category) allowing the persistence of the current present ecological status as well as their functions and services.

- All small, endorheic seepages and depressions with a High Ecological Importance: 50m buffers from the outer edge of the freshwater resource features.
- All larger interconnected wetland features with Very Ecological Importance: 100m buffers from the outer edge of the freshwater resource features.
- All freshwater features with their buffer areas have been classified as either Very High- or High sensitive and should be regarded as "No-Go" areas apart from the following activities and infrastructure which may be allowed (although restricted to an absolute minimum footprint):
  - only activities relating to the route access and cabling:
    - the use/upgrade of existing roads and watercourse crossings are the preferred options;

- Where no suitable existing roads and watercourse crossings exist, the construction of new access roads and watercourse crossings can be allowed, however this should be deemed as a last resort.
- All underground cabling should be laid either within access roads or next to access roads (as close as possible).

With mitigation measures in place, impacts on the freshwater resource features' integrity and functioning can be potentially reduced to sufficiently low levels. This would be best achieved by incorporating the recommended management & mitigation measures into an Environmental Management Programme (EMPr) for the site, together with appropriate rehabilitation guidelines and ecological monitoring recommendations.

Based on the outcomes of this study it is my considered opinion that the proposed project detailed in this report could be authorised from a freshwater resource perspective.

Since there are watercourses present within the development area of the Ummbila Emoyeni Wind Energy Facility as identified in the Freshwater Impact Assessment (**Appendix E**), and since water may be abstracted from boreholes for use during the construction and operational phases, a water use authorisation for the project will be required from the DWS for water uses identified in Section 21(a), Section 21(c) and 21(i) of the National Water Act (Act 36 of 1998).

9.5. Potential Impacts on Avifauna

The development of the Ummbila Emoyeni Wind Energy Facility is likely to result in a variety of impacts from an avifaunal perspective. Potential impacts and the relative significance of the impacts are summarised below (refer to **Appendix F** for more details).

9.5.1 Results of the Avifauna Impact Assessment

Summary Pre-Construction Bird Monitoring

Pre-construction bird monitoring was undertaken over a period of 12 months within the project area. The pre-construction bird monitoring included the identification of twelve vantage points, five drive transects, and 15 walk transects of 500m in length across the project site. A total of 102 species (5 805 birds) were recorded during the walk transects conducted across the full pre-construction bird monitoring period.

A total of 26 target species were recorded during vantage point monitoring over the pre-application monitoring period. A total of 72 observations of 18 target species (comprising 235 birds) were recorded during 703.12km of drive transect observations. Avifauna target species identified during the full pre-construction monitoring period are as follows:

» African Harrier-hawk
» Amur Falcon
» Black Sparrowhawk
» Black-chested Snake- eagle
» Black-winged Kite
» Black-winged Pratincole
» Blue Crane

- Blue Korhaan
- Cape Vulture
- Common Buzzard
- Greater Kestrel
- Grey-crowned Crane
- Grey-winged Francolin
- Lanner Falcon
- Marsh Owl
- Martial Eagle
- Montagu's Harrier
- Northern Black Korhaan
- Pallid Harrier
- Peregrine Falcon
- Rock Kestrel
- Secretarybird
- Southern Bald Ibis
- Spotted Eagle-owl
- White Stork
- Yellow-billed Kite

Avifaunal Sensitivity

Many species of conservation concern in the broader area identified during the Reconnaissance Study as having potential to occur in the project site were not recorded during the full pre-construction avifaunal monitoring programme. Notably no Black Harrier, African Marsh Harrier, Black Stork, Wattled Crane, African Grass Owl, Botha's Lark, Rudd's Lark or Yellow-breasted Pipit were recorded. This is likely due to the high level of existing habitat modification and existing impacts across the preferred site. Nevertheless, impacts to remaining areas of natural or near-natural habitat should be avoided or reduced as far as practically possible. To reduce or avoid impacts on sensitive habitats such as wetland environments, these areas are to be avoided and flow-control measures are to be implemented to reduce potential effects of erosion or sedimentation altering the hydrology of the area. These areas are considered to have the highest avifaunal sensitivity, as such features attract birds (such as Blue Crane, Black-winged Pratincole, Greater Flamingo, Grey-crowned Crane and waterfowl) and rivers/drainage lines are often used as movement corridors. Other patches of natural vegetation are considered to be medium sensitivity due to their overall contribution to habitat connectivity for species within the IBA and foraging areas for species such as Secretarybird, Blue Korhaan, Denham's Bustard and Black-winged Pratincole, amongst others.

From an avifaunal perspective, however, the relatively small total area of habitat destruction from permanent infrastructure associated with the proposed development is unlikely to pose a significant impact on the long-term persistence or viability of avifaunal species in the area. The primary threat to these species is likely to rather be associated with the risk of collision fatalities, therefore areas and flights that appeared to represent preferred foraging or movement corridors for avifaunal species of conservation concern were considered to have high avifaunal sensitivity.

Species utilising the highly modified agricultural areas are likely resilient to disturbance and ongoing activity, including habitat modification. These areas are of low avifaunal sensitivity and are the preferred areas for development activities as well as permanent and temporary structures such as site buildings and lay-down areas. However, species utilising these areas, such as Southern Bald Ibis, remain at risk to collision when

commuting to and from foraging areas. Flight paths that represented an elevated risk or preferred movement corridors have been considered to be of high avifaunal sensitivity and are to be avoided. High sensitivity areas are no-go for the development of wind turbines and blade tips are not to encroach on these areas. Linear infrastructure (including roads) can traverse these areas where necessary following the implementation of appropriate mitigation measures. Development in medium sensitivity areas should be avoided and reduced wherever practically possible.

The resultant avifaunal sensitivity of the preferred site has been mapped in relation to the indicative development layout (refer to **Figure 9.4**). Several wind turbines (plus 100 m radius representing an assumed blade length) encroach on the revised areas of high avifaunal sensitivity. Note that the 100m is a conservative blade length (blade length and not radius is the important figure) but nonetheless, these will be considered to be relocated, should it be possible to achieve the target generating output of the development within fewer wind turbines, or additional mitigation implemented as recommended in the avifaunal assessment. These include WTGs 6, 9, 11, 13, 19, 24, 26, 28, 29, 30, 32, 34, 36, 49, 52, 59, 61, 64, 82, 83, 84, 96, 100, 101. Nevertheless, all wind turbines in the proposed layout avoid areas identified to be of Very High Avifaunal Sensitivity (wind turbine no-go) areas.

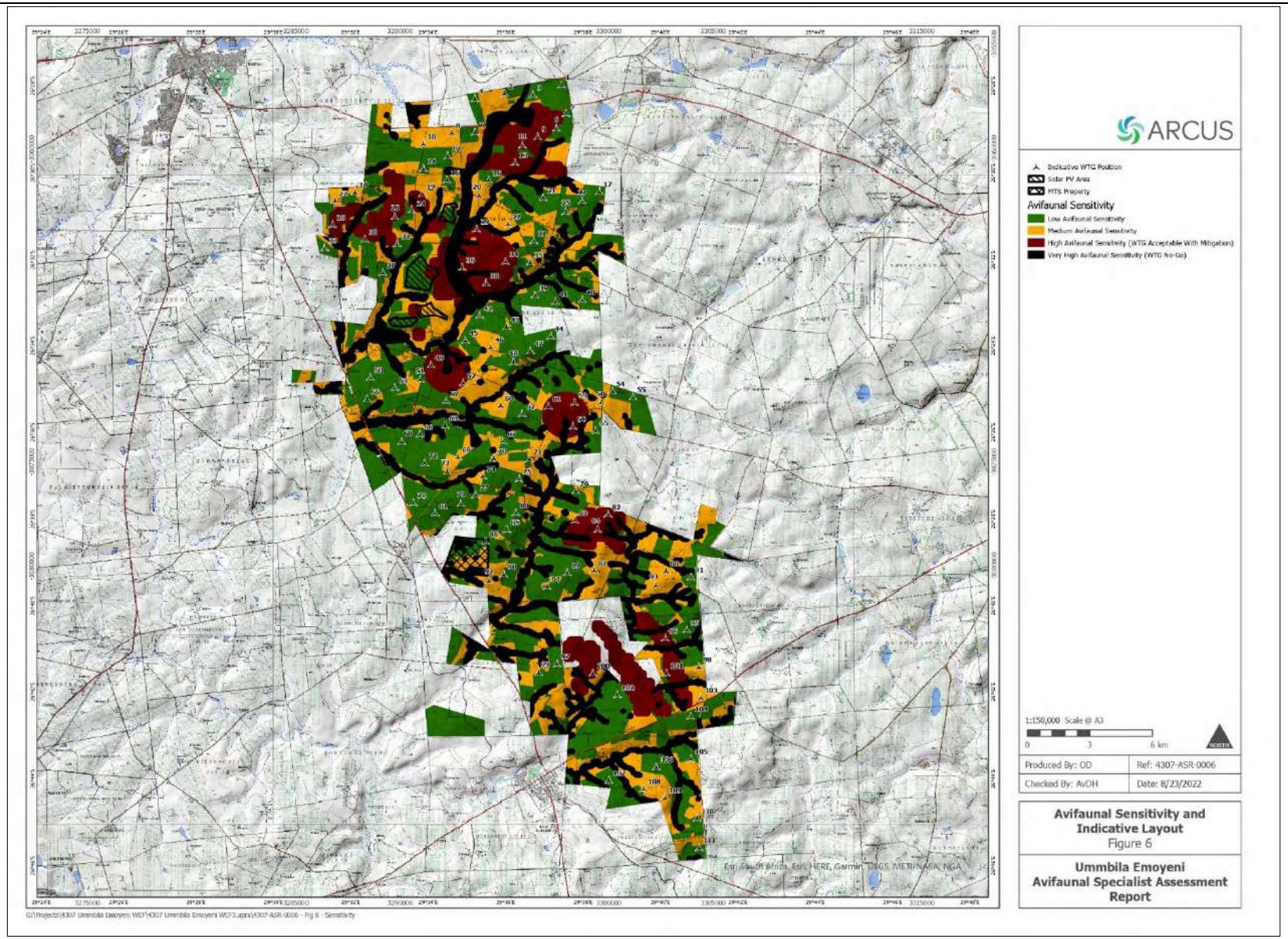


Figure 9.4: Avifaunal sensitivities overlain on the indicative layout.

9.5.2 *Description of Avifaunal Impacts*

The following key potential impacts on avifauna, arising from the proposed development of the wind energy facility and associated infrastructure, have been identified for assessment:

Construction Phase:
- Direct habitat destruction – modification, removal and clearing of vegetation for development of infrastructure such as temporary laydown areas, site buildings, wind turbine bases, and access roads.
- Disturbance/displacement – indirect habitat loss and/or reduced breeding success due to displacement by noise and activity associated with machinery and construction activity.
- Direct mortality – fatalities of avifauna due to vehicle collision, entrapment, entanglement or collision with temporary infrastructure (e.g., fencing), entrapment in uncovered excavations and increase predation pressure.

Operation phase:
- Direct habitat destruction – contamination of habitats due to routine operational maintenance activity.
- Disturbance/displacement – indirect habitat loss, reduced breeding success, obstruction of movement corridors due to displacement by infrastructure and noise/activity associated with ongoing, routine operational tasks/maintenance activities.
- Direct mortality – fatalities of avifauna due to wind turbine collision, collision or entrapment with perimeter fencing, and electrocution from electrical components.

Decommissioning phase:
- As per construction phase.
-

9.5.3 *Impact tables summarising the significance of impacts on avifauna during construction, operation and decommissioning (with and without mitigation)*

Construction Phase Impacts

Nature: *Direct habitat destruction*

Direct habitat destruction associated with wind energy facilities is generally low relative to the overall size of the project area. This impact is largely unavoidable, resulting in some birds being displaced from the project site.

The habitats present in the proposed development site are not unique to the site and the agricultural/natural matrix is similar throughout the broader area. The more natural or near-natural grasslands that remain in these areas are, however, under increasing pressure from various other impacts as such coal mining, especially strip-mining (which is expanding rapidly in Mpumalanga), urban sprawl, commercial crop production and rangeland grazing/burning mismanagement.

The loss of habitat associated with clearing will not likely have a significant negative impact on the long-term viability or persistence of avifaunal species or populations in the area following the implementation of appropriate mitigation measures. Mitigation measures largely include avoiding areas of elevated sensitivity wherever possible, utilising existing access routes as far as possible and implementing appropriate erosion control measures to reduce down-stream effects of erosion, associated habitat loss, sedimentation and changes to infiltration/flow regimes.

	Without mitigation	**With mitigation**
Extent	Local (2)	Footprint (1)
Duration	Long-term (4)	Short-term (2)
Magnitude	Low (4)	Minor (2)
Probability	Definite (5)	Definite (5)

Significance	**Medium (50)**	**Low (25)**
Status (positive or negative)	Negative	Negative
Reversibility	Yes	Yes
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Partially	

Mitigation:

- Infrastructure to avoid Very High Sensitivity areas only, linear infrastructure (including roads) permitted.
- The footprint within Medium Sensitivity areas should be minimized and avoided wherever possible, although WTGs are allowed in this area.
- Pre-construction walk-through of the approved development footprint must be undertaken to ensure that sensitive habitats and species are avoided wherever possible.
- Laydown and other temporary infrastructure to be placed within Low sensitivity areas, preferably previously transformed areas, wherever possible.
- Appropriate run-off and erosion control measures are to be implemented where required.
- A site-specific environmental management programme (EMPr) must be implemented, which gives appropriate and detailed description of how construction activities must be conducted to reduce unnecessary destruction of habitat (e.g. no open fires outside of designated areas).
- All contractors are to adhere to the EMPr and should apply good environmental practice during construction.
- All hazardous materials should be stored in the appropriate manner to prevent contamination of the site and downstream environments. Any accidental chemical, fuel and oil spills that occur at the site should be cleared as appropriate for the nature of the spill.
- Existing roads and farm tracks should be used where possible.
- The minimum footprint areas of infrastructure should be used wherever possible, including road widths and lengths.
- No off-road driving should be permitted in areas not identified for clearing.
- An Environmental Site Officer (ESO) must form part of the on-site team to ensure that the EMPr is implemented and enforced and an Environmental Control Officer (ECO) must be appointed to oversee the implementation activities and monitor compliance for the duration of the construction phase.
- Following construction, rehabilitation of areas disturbed by temporary laydown areas and facilities must be undertaken.

Residual Impacts:

Habitat cleared for the construction of permanent facilities will not be available for use by many avifaunal species during the operational lifespan of the development. No long-term residual impacts are likely to negatively influence the viability or persistence of the avifaunal community of the receiving environment.

Nature: *Disturbance and Displacement*

Indirect loss of habitat from disturbance during the construction phase is temporary in nature and is expected to result largely from the presence of heavy machinery and increased activity of construction personnel. The remaining patches of natural or near- natural vegetation that occur across the site are already under existing levels of disturbance from agricultural activities that include the regular use of large agricultural machinery required for commercial crop production in immediately adjacent fields. Similarly, disturbance resulting from grazing of livestock occur within the natural or near-natural areas themselves and therefore it is expected that any species particularly sensitive to anthropogenic disturbance are unlikely to occur within the proposed project area through displacement by existing impacts.

In addition, the habitats present in the vicinity of the proposed development are not unique to the site and are relatively widespread in the area so any displacement from the immediate vicinity that may occur will not likely incur a high energetic cost as suitable habitat is widely available nearby. The proximity of nearby suitable habitat makes it likely that species will return to areas that have not been physically altered by the proposed development once construction activity ceases.

There are no confirmed active nest locations in proximity to the proposed development site where breeding success is likely to be negatively impacted upon through disturbance or displacement during the construction phase.

	Without mitigation	**With mitigation**
Extent	Local (2)	Local (2)
Duration	Very Short-term (1)	Very Short-term (1)
Magnitude	Minor (2)	Minor (2)
Probability	Low Likelihood (2)	Low Likelihood (2)
Significance	**Low (10)**	**Low (10)**
Status (positive or negative)	Negative	Negative
Reversibility	Yes	Yes
Irreplaceable loss of resources?	Unlikely	Unlikely
Can impacts be mitigated?	Yes	

Mitigation:

- A site specific EMPr must be implemented, which gives appropriate and detailed description of how construction activities must be conducted.
- All contractors are to adhere to the EMPr and should apply good environmental practice during construction.
- Environmental Officer to oversee activities and ensure that the site specific EMPr is implemented and enforced.
- Maximum use of existing access road and servitudes.
- Existing and novel access roads are to be suitably upgraded or constructed to prevent damage and erosion resulting from increased vehicular traffic and construction vehicles.
- No off-road driving in undesignated areas.
- Speed limits (30 km/h) should be strictly enforced on site to reduce unnecessary noise.
- Construction camps should be lit with as little light as practically possible, with the lights directed downwards where appropriate.
- The movement of construction personnel should be restricted to the construction areas on the project site.
- No dogs or cats other than those of the landowners should be allowed on site.
- The appointed Environmental Officer must be trained to identify the potential Red Data species as well as the signs that indicate possible breeding by these species.
- The Environmental Officer must then, during audits/site visits, make a concerted effort to look out for such breeding activities of SCCs (e.g. cranes, Secretarybird), and such efforts may include the training of construction staff (e.g. in Toolbox talks) to identify Red Data species, followed by regular questioning of staff as to the regular whereabouts on site of these species.
- If any avifaunal SCCs are confirmed to be breeding (e.g. if a nest site is found), construction activities within 500 m of the breeding site must cease, and an avifaunal specialist is to be contacted immediately for further assessment of the situation and instruction on how to proceed.
- Prior to construction, an avifaunal specialist should conduct a site walkthrough, covering the final road and power line routes as well as temporary laydown areas and facilities, to identify any nests/breeding/roosting activity of sensitive species.
- The results of which may inform the final construction schedule in close proximity to that specific area, including abbreviating construction time, scheduling activities around breeding activity, and lowering levels of associated noise.

Residual Impacts:
None.

Nature: *Direct Mortality*

Fatalities of avifaunal species can occur through collision with vehicles as traffic in the area increases due to construction activity. Large-bodied and ground dwelling species (e.g. korhaans and bustards) are at increased risk, but this impact can be effectively mitigated against. Temporary fencing can result in collisions, entrapment or

entanglement if not suitably installed. Similarly ground dwelling avifauna (particularly chicks) can fall into uncovered excavations and become entrapped.		
	Without mitigation	**With mitigation**
Extent	Local (2)	Local (2)
Duration	Very Short-term (1)	Very Short-term (1)
Magnitude	Minor (2)	Minor (2)
Probability	Distinct Possibility (3)	Low Likelihood (2)
Significance	**Low (15)**	**Low (10)**
Status (positive or negative)	Negative	Negative
Reversibility	Yes	Yes
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation: » Maximum use of existing access road and servitudes. » No off-road driving in undesignated areas. » Speed limits (30 km/h) should be strictly enforced on site to reduce probability of vehicle collisions. » The movement of construction personnel should be restricted to the construction areas on the project site. » No dogs or cats other than those of the landowners should be allowed on site. » Any holes dug should not be left open for extended periods of time to prevent entrapment by ground dwelling avifauna or their young and only be dug when required and filled in soon thereafter. » Temporary fencing must be suitably constructed, e.g. if double layers of fencing are required for security purposes they should be positioned at least 2 m apart to reduce the probability of entrapment by larger bodied species that may find themselves between the two fences. » Roadkill is to be reported to the ECO and removed as soon as possible.		
Residual Impacts: None.		

Operation Phase Impacts

Nature: *Direct Habitat Destruction*

Mesic Highveld grasslands receive relatively high rainfall and habitats are sensitive to alterations of flow regimes and infiltration rates, with wetlands forming an important component for many avifaunal species in the area. Several potential risks to the long-term functioning and persistence of these environments exist which, if unmitigated, could result in the long-term degradation or permanent loss of habitats. Fortunately, the potential risks are relatively easy to mitigate very effectively and are largely standard practice for these types of developments.

Increased runoff from hard surfaces during the operational phase has the potential to increase the risk of habitat destruction through erosion which can alter flow regimes and water tables, drain wetland environments or increase sedimentation downstream. These potential impacts are also easy to mitigate through the appropriate use of flow and erosion control measures.

	Without mitigation	**With mitigation**
Extent	Local (2)	Footprint (1)
Duration	Long-term (4)	Short-term (2)
Magnitude	High (8)	Minor (2)
Probability	Definite (5)	Improbable (2)
Significance	**High (70)**	**Low (10)**
Status (positive or negative)	Negative	Negative
Reversibility	Difficult	Yes
Irreplaceable loss of resources?	Yes	No
Can impacts be mitigated?	Very Effectively	

Mitigation: » Flow- and erosion control measures are to be implemented where appropriate to reduce uncontrolled runoff from hard surfaces. » The operational environmental management programme must include site specific measures for the effective management and treatment of any wastewater to be produced.
Residual Impacts: None.

Nature: *Disturbance and Displacement*

Indirect loss of habitat from disturbance during the operational phase is associated with ongoing operational activity as well as more discrete periods of routine maintenance tasks. Similar to the construction phase, the avifauna in the area already experience levels of disturbance and therefore species particularly sensitive to disturbance are unlikely to frequent the area.

	Without mitigation	**With mitigation**
Extent	Local (2)	Local (2)
Duration	Very Short-term (1)	Very Short-term (1)
Magnitude	Minor (2)	Minor (2)
Probability	Low Likelihood (2)	Low Likelihood (2)
Significance	**Low (10)**	**Low (10)**
Status (positive or negative)	Negative	Negative
Reversibility	Yes	Yes
Irreplaceable loss of resources?	Unlikely	Unlikely
Can impacts be mitigated?	Yes	

Mitigation:

» A site specific operational EMPr must be implemented, which gives appropriate and detailed description of how operational and maintenance activities must be conducted to reduce unnecessary disturbance.

» All contractors are to adhere to the environmental management programme and should apply good environmental practice during all operations.

Residual Impacts:

None.

Nature: *Collision with Infrastructure*

Wind energy facilities can cause bird fatalities through the collision of birds with moving turbine blades, the most effective mitigation for collision impacts currently available is wind farm placement, as well as specific turbine placement within a wind energy facility to avoid high use areas.

Notable records of Southern Bald Ibis and Secretarybird were made during pre-application avifaunal monitoring, however these are relatively localised in their utilisation of the preferred site. Prior to the implementation of mitigation measures, the probability of individual collisions of these species occurring nevertheless remains distinct. Should collisions of these species occur, however, the levels of potential collisions would likely be low given the relatively low number of flight-paths of target species recorded across the site. Therefore, even prior to the implementation of mitigation measures, low incidence of collision fatalities would not likely result in population level impacts beyond the broader area. Environmental processes are likely to continue, but in a modified way. The extent, magnitude and probability of this potential impact will be further reduced through the implementation of the mitigation hierarchy such as avoidance mitigation through informed infrastructure layouts and explicit threshold-actuated adaptive management (if required).

	Without mitigation	**With mitigation**
Extent	Broader Area (4)	Local (3)

Duration	Long-term (4)	Long-term (4)
Magnitude	Moderate (6)	Low (4)
Probability	Highly Probable (4)	Distinct Possibility (3)
Significance	**Medium (56)**	**Medium (33)**
Status (positive or negative)	Negative	Negative
Reversibility	Partial	Partial
Irreplaceable loss of resources?	Possible	Possible
Can impacts be mitigated?	Yes	

Mitigation:

- The minimum number of WTGs should be constructed to achieve the required MW output.
- WTGs must not be constructed within any designated Very High Sensitivity (no-go) areas.
- Additional mitigation (as detailed below) must be implemented for WTGs placed within High and Medium sensitivity areas.
- Observer-based Shut-down-on-demand or similar technology is to be implemented for all WTGs placed in High Sensitivity areas as well as those WTGs that remain within 3 000m of VPs 1, 2, 3 and 10.
- The painting (red or black) of a single blade of each WTG in these areas should be investigated and employed pending approval from the Civil Aviation Authority (CAA).
- Internal power lines should be buried wherever possible.
- If one or more avifaunal SCC carcasses are located and determined likely to have resulted from collisions with infrastructure in any sensitivity area over the lifespan of the facility the fatality is to be appropriately recorded and reported to an avifaunal specialist to determine the most appropriate action.
- If double layers of fencing are required for security purposes they should be positioned at least 2 m apart to reduce the probability of entrapment by larger bodied species that may find themselves between the two fences.
- Develop and implement a carcass search and bird activity monitoring programme in-line with the latest applicable guidelines.
- Regular reviews of operational phase monitoring data (activity and carcass) and results to be conducted by an avifaunal specialist.
- The above reviews should strive to identify sensitive locations including WTGs and areas of increased collisions that may require additional mitigation.
- An operational monitoring programme for any novel overhead power lines must be implemented to locate potential collision fatalities.
- Any fatalities located should be reported to Birdlife South Africa (BLSA) and the Endangered Wildlife Trust (EWT).

Residual Impacts:

Current mitigation measures, while effective, are not capable of completely preventing collisions and some residual impact will remain. Residual impacts will be reduced through mitigation measures and regularly monitored and reviewed to inform additional mitigation actions such as elevated levels of shut-down-on-demand or curtailment (if required). It is unlikely that the proposed development will have a significant negative impact on the long-term viability and persistence of SCCs in the area.

Nature: *Electrocution*

Avifaunal fatalities caused by electrocution from energized infrastructure.

	Without mitigation	**With mitigation**
Extent	Local (2)	Local (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	Minor (2)	Small (0)
Probability	Low Likelihood (2)	Improbable (1)
Significance	**Low (16)**	**Low (6)**
Status (positive or negative)	Negative	Negative
Reversibility	Yes	Yes

Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation: » Internal power lines should be buried wherever possible. » Any fatalities located should be reported to Birdlife South Africa (BLSA) and the Endangered Wildlife Trust (EWT). » Prevent birds from nesting in substation infrastructure through exclusion covers or spikes if required (determined on a case-by-case basis).		
Residual Impacts: None.		

9.5.4 Overall Result

The Avifauna Impact Assessment identified that all impacts associated with the development of the Ummbila Emoyeni Wind Energy Facility will be of low, medium and high significance before mitigation, and can be mitigated to an acceptable level of impact (i.e., medium and low significance, depending on the impact being considered). The impacts rated to be of high significance pre-mitigation are not considered as fatal flaws, provided the prescribed mitigation measures are implemented. One of these mitigation measures includes avoiding areas to be of very high sensitivity (no-go). Secondly, the implementation of additional mitigation measures such as observer-based shut-down-on-demand in areas of elevated recorded passage rates will be highly effective at reducing the likelihood of collisions as large flocks of birds are easily detected.

Based on the screening study, reconnaissance study, and results of the pre-construction avifauna monitoring programme conducted for the Ummbila Emoyeni Wind Energy Facility, it is the avifaunal specialist's informed opinion that the proposed development will not have a significant negative impact on the viability or persistence of avifaunal populations (particularly avifaunal species of conservation concern) in the area following the implementation of mitigation measures. It is the specialist's opinion that the proposed development can be approved from an avifaunal perspective and that the indicative positions of all 111 wind turbines in the layout are acceptable.

9.6. Potential Impacts on Bats

Various potential impacts on bats have been identified to be associated with the development of the Ummbila Emoyeni Wind Energy Facility. The potential impacts and the relative significance of the impacts are summarised below (refer to **Appendix G** for more details).

9.6.1 Results of the Bat Impact Assessment

Summary Pre-Construction Bat Monitoring

Pre-construction bat monitoring was undertaken over a period of 12 months for the project site. A total of 156 931 bat passes were recorded across 371 sample nights, 83 % of which were attributed to Cape serotine. Thirteen (13) percent of total activity was attributed to Egyptian free-tailed bat. The remaining four species accounted for 5 % of all activity (refer to **Figure 9.5**).

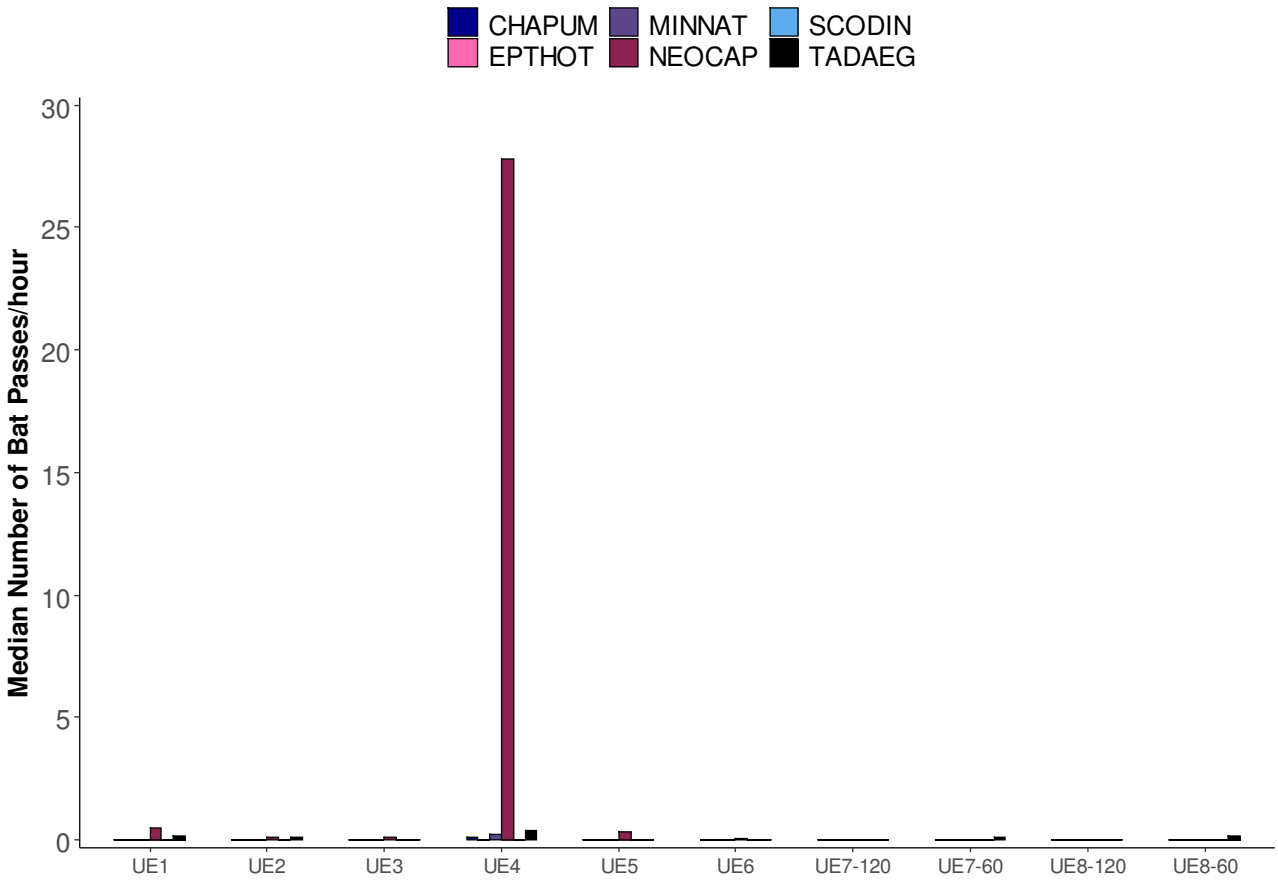


Figure 9.5: Bar chart showing the medium number of bat passes per night at each monitoring location per species

Bat Sensitivity

Bat roosting sites in the project site are relatively limited and unlikely to support large congregations of bats, with no underground sites (e.g., caves, mines, sinkholes) present. The closest known major bat roost is approximately 75km north of the project site. Although occasional ridges and rocky outcrops are features of the landscape, none are present in the project site. Bats are likely to roost in buildings associated with farmsteads within and bordering the project site, especially Cape Serotine and Egyptian Free-tailed Bat. The building inspections on site did not reveal any roosting bats but evidence (e.g., fur-oil-stained exit/entry points) suggests that bats are using these features. Trees growing at these farmsteads and elsewhere on site where they form clumps could also provide roosting spaces for bats.

Sensitive features within the project site at which bat foraging activity may be concentrated include farm buildings (and within built up areas for some species) where they would forage for insects attracted to lighting, dams and wetland areas, within and along the edge of woodland/tree patches, and over cultivated areas (refer to **Figure 9.6** and **Table 9.1**).

Table 9.1: Features used to assign spatial risk categories in the project site for bats

Risk Level		
Low	**Medium**	**No-Go**
Heavily modified land	CBA Optimal	Farm Dams
Moderately modified land	ESA Landscape corridor	Wetlands
	ESA Local corridor	Trees

Risk Level		
Low	**Medium**	**No-Go**
	Other Natural Areas	Buildings
		Rivers/Streams
		Wetlands
		CBA Irreplaceable Areas

To avoid collision impacts, no part of the wind turbines, including the blade tips, shall intrude into the no-go buffers. The turbine assessed has a rotor diameter of 170m and hub height of 150m. Thus, to ensure the turbine blades do not cross into the bat buffers, an additional distance of 42m must be added to the 200m no-go buffers. Six turbines in the proposed indicative layout assessed in this EIA (**Figure 9.6**) are currently located within no-go areas: WTG10, WTG61, WTG82, WTG88, WTG100, and WTG101. These turbines must be relocated into low and medium sensitivity areas. In addition, several locations of the construction compounds, laydown areas, batching plants, and substations associated with the wind energy facility, specifically Substation and O&M 1 and Batching Plant 3, Construction Laydown Area 3 and a small portion of Batching Plant 2, Construction Compound 2, also need to be adjusted so that they are outside no-go Areas (refer to **Figure 9.7**).

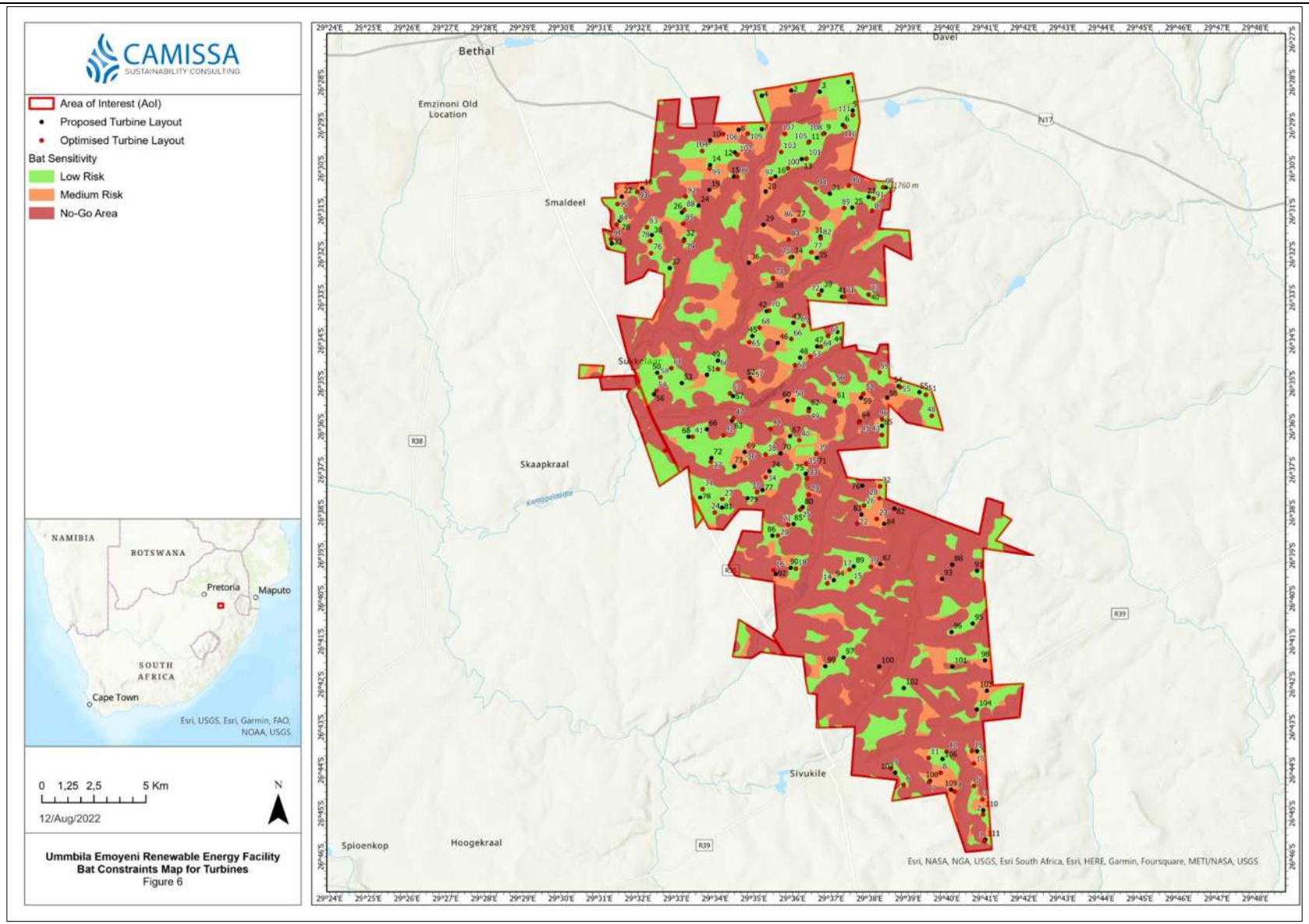


Figure 9.6: Bat constraints overlain on the layout for the Ummbila Emoyeni Wind Energy Facility

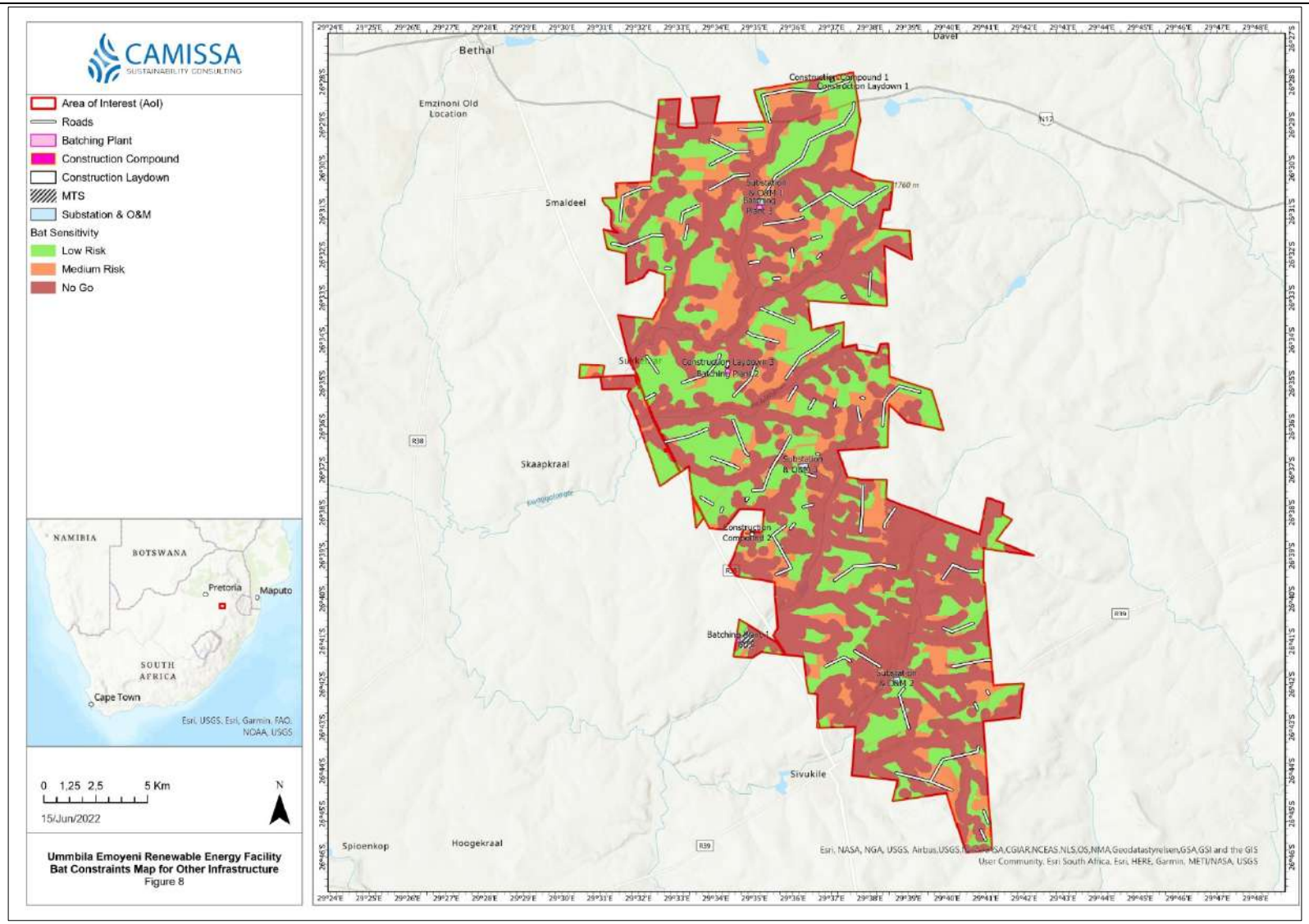


Figure 9.7: Bat constraints overlain on other infrastructure associated with the Ummbila Emoyeni Wind Energy Facility

9.6.2 *Description of Bat Impacts*

Wind farms impact bats directly because bats collide with spinning wind turbine blades, and indirectly through the modification of habitats, including disturbance or destruction of roosting, foraging and commuting spaces. The potential impacts to bats as a result of construction and operation activities include the following:

- Modification of bat foraging/commuting habitat.
- Destruction of/Disturbance to bat roosts.
- Bat mortality.
- Disturbance to bats.

9.6.3 *Impact tables summarising the significance of impacts on bats during the construction, operation and decommissioning phases (with and without mitigation)*

Construction Phase Impacts

Nature: *Modification of bat habitat (roosting, foraging, commuting)* Vegetation clearing for access roads, turbines and their service areas and other infrastructure, as well as noise and dust generated during the construction phase, will impact bats by removing habitat used for foraging and commuting, through disturbance, and displacement. This impact is likely to have species specific effects; clutter edge species (e.g., Cape serotine) are more likely to be impacted by habitat modification given their greater association with physical habitat features compared to high-flying species (e.g., Egyptian free-tailed bat). Construction of infrastructure associated with the wind energy facility could result in destruction (direct impact) of bat roosts (trees, buildings) and disturbance (indirect impact) of bat roosts potentially resulting in roost abandonment. Bat mortality can occur if roosts which contain bats are destroyed. Installation of new infrastructure in the landscape (e.g., buildings, turbines, road culverts) can inadvertently provide new roosting spaces for some bat species, attracting them to areas with wind turbines and potentially increasing the likelihood of collisions.		
	Without mitigation	**With mitigation**
Extent	Site (1) - The impact will be limited to the site of development.	Site (1) - Even with mitigation, the impact will still occur across the same extent hence there is no reduction in the quantified effect.
Duration	Short-term (2) - The impact will persist for the duration of the construction period, but displacement could persist for the duration of operation.	Short-term (2) - Even with mitigation, the impact will still occur for the same duration hence there is no reduction in the quantified effect.
Magnitude	Low (5) - Given the limited habitat modification relative to remaining habitat this impact is likely to only cause a slight impact on processes as bats will find alternative habitat. Roosts are critical for bat life history thus impacts to roosts could impact on ecological processes. However, no major confirmed roosts have been found within the project site and hence it is unlikely this impact will have a high magnitude.	Low (3) - The application of the mitigation measures may lower the magnitude of impact but not remove it completely.

Probability	Probable (3) - The responses of bats to habitat modification due to wind turbines is largely understudied but it is reasonable to assume that there will be some level of species-specific displacement effect. Since no confirmed roosts have been located, it is unlikely that this impact will occur.	Improbable (2) - The application of the mitigation measures may lower the probability of impact but not remove it completely. Since no confirmed roosts have been located, no buildings will be destroyed, and potential roosting spaces are buffered by 200m, it is unlikely that this impact will occur.
Significance	**Low (24)**	**Low (12)**
Status (positive or negative)	Negative	Negative
Reversibility	Yes	Yes
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	

Mitigation:

Avoid:

» Limit potential for bats to roost in project infrastructure (e.g., buildings, turbines, road culverts) by ensuring they are properly sealed such that bats cannot gain access.
» No construction activities at night.
» No placement of infrastructure (except roads) within 200m of key habitat features specifically including tree clumps, buildings, dams/wetlands, and rivers/streams (see no-go Areas in **Figure 9.4**). Relocate WTG10, WTG61, WTG82, WTG88, WTG100, and WTG101. This has been done and the optimised layout (Chapter 11 of the EIA Report) reflects this.
» Maintain a minimum blade sweep of 30m to avoid impacts to lower flying bats such as clutter-edge species (e.g., Cape serotine, Natal long-fingered bat).

Minimise:

» Minimise clearing of vegetation, minimise disturbance and destruction of farm buildings on site, minimise removal of trees, and where this is required, these features should be examined for roosting bats. This study assumes that all buildings and trees are potentially roosts and must be buffered by 200m since numerous species use these features for roosting.
» Apply good construction abatement control practices to reduce emissions and pollutants (e.g., noise, erosion, waste) created during construction.

Restore:

» Rehabilitate all areas disturbed during construction, (including aquatic habitat).

Residual Impacts:

After the application of the mitigation measures, the residual impact of habitat modification should be relatively low because the amount of habitat lost will be low compared to remaining habitat for bats in the project site. Further, the application of buffers to key bat habitats should limit the impact of habitat loss, displacement and disturbance since some bat species (e.g., Cape serotine) would still be able to access favourable spaces (e.g., commuting along drainage networks which are buffered and hence providing relatively safe passage between turbines).

Despite undertaking roost surveys, no roosting bats were discovered but it is highly likely bats are roosting in buildings within the project site since other roosting spaces are limited. Hence some residual impact could occur to unidentified roosts.

Operation Phase Impacts

Nature: *Bat Fatality*

Bat mortality (direct impact) through collisions and/or barotrauma with wind turbine blades is the principal impact of wind energy facilities on bats.		
	Without mitigation	**With mitigation**
Extent	Local (3) - The impact will mainly be limited to the site of development, but bats can be attracted to, or move through, the wind farm from beyond the site.	Local (3) - The impact will mainly be limited to the site of development, but bats can be attracted to, or move through, the wind farm from beyond the site.
Duration	Long term (4) - The impact will persist for the duration of the operation of the wind farm.	Long term (4) - The impact will persist for the duration of the operation of the wind farm.
Magnitude	Moderate (6) - Median bat passes per hour ranged from low to high risk, varying spatially and temporally. Given the limitations of acoustic monitoring it is reasonable to assume a moderate impact overall.	Low (3) - Mitigation measures for bats (e.g., curtailment) have consistently been shown to be effective in reducing bat fatality hence the magnitude of impacts will be lower through its application.
Probability	Highly Probable (4) - Bat fatality has been reported at all wind farms where this has been investigated in South Africa thus it is highly probably bat fatality will occur at the wind farm.	Improbable (2) - The application of the mitigation measures may lower the probability of impact but not remove it completely.
Significance	**Medium (52)**	**Low (20)**
Status (positive or negative)	Negative	Negative
Reversibility	No	No
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	

Mitigation:

Avoid:

» No placement of turbines within 200m of key habitat features specifically including tree clumps, buildings, dams/wetlands, and rivers/streams to reduce spatial overlap between bats and wind turbines. Relocate WTG10, WTG61, WTG82, WTG88, WTG100, and WTG101. This has been done and the optimised layout (Chapter 11 of the EIA Report) reflects this.

» Maintain a minimum blade sweep of 30 m to avoid impacts to lower flying bats such as clutter-edge species (e.g., Cape serotine, Natal long-fingered bat).

Minimise:

» Implement fatality monitoring throughout the operational phase and apply curtailment or deterrents if fatality thresholds are exceeded. Annual fatality threshold per Least Concern species = 353 individuals. Annual fatality threshold per Species of Special Concern = 1 individual for each of [African Straw-coloured fruit bat, Wahlberg's Epauletted fruit bat, Percival's Short-eared Trident bat, Blasius's Horseshoe bat, Egyptian Rousette].

» A Biodiversity Management Plan (BMP) for bats must be developed which includes the design of a post-construction fatality monitoring program (PCFM) for bats, and an adaptive management response plan that provides an escalating scale of mitigation (e.g., curtailment) should fatality thresholds be exceeded.

Residual Impacts:

The application of mitigation measures, specifically curtailment, can reduce bat fatality but not completely remove the risk. Hence, some residual risk is expected but this is likely to be within acceptable limits of change, particularly through the use of fatality thresholds.

Decommissioning Phase Impacts

Nature: *Modification of Bat Habitat* Impacts during the decommissioning phase will be indirect and involve disturbance to bats through excessive noise and dust, and damage to vegetation.		
	Without mitigation	**With mitigation**
Extent	Site (1) - The impact will be limited to the site of development.	Site (1) - Even with mitigation, the impact will still occur for the same duration hence there is no reduction in the quantified effect.
Duration	Short-term (2) - The impact will persist for the duration of the decommissioning phase.	Short-term (2) - Even with mitigation, the impact will still occur for the same duration hence there is no reduction in the quantified effect.
Magnitude	Low (4) - Given the limited habitat modification relative to remaining habitat this impact is likely to only cause a slight impact on processes as bats will find alternative habitat. Most decommissioning activities will take place during daylight hours when bats are not active, lessening the impact magnitude.	Minor (2) - The application of the mitigation measures will likely result in limited impacts to bats.
Probability	Improbable (2) - Decommissioning activities will probably not impact bats.	Very Improbable (1) - Decommissioning activities are very unlikely to impact bats with mitigation.
Significance	**Low (14)**	**Low (5)**
Status (positive or negative)	Negative	Negative
Reversibility	Yes	Yes
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	

Mitigation:

Avoid:

» No decommissioning activities at night.
» Avoid removal of trees and clearing of vegetation.

Minimise:

» Minimise disturbance of farm buildings on site and other bat roosting sites, and where this is required, these features should be examined for roosting bats. This study assumes that all buildings and trees are potentially roosts and must be buffered by 200m since numerous species use these features for roosting.
» Apply good abatement control practices to reduce emissions and pollutants (e.g., noise, erosion, waste) created during decommissioning.

Restore:

» Rehabilitate all areas disturbed during throughout the operation of the project(including aquatic habitat).

Residual Impacts:

There are unlikely to be major residual impacts because of decommissioning activities on site provided habitat restoration is implemented successfully.

9.6.4 Overall Result

Based on the bat activity recorded at the site proposed for the Ummbila Emoyeni Wind Energy Facility, the significance ratings for the majority of the impacts to bats posed by the development are predicted to be low and medium significance before mitigation. After mitigation, all impacts are predicted to be low. Based on the opportunity for reduction of the impacts through appropriate mitigation measures from a medium significance to a low, acceptable significance, no fatal flaws are expected to occur. One such mitigation measure entails the relocation of WTG10, WTG61, WTG82, WTG88, WTG100, and WTG101, which are currently located within no-go areas. In addition, the locations of the construction compounds, laydown areas, batching plants, and substations associated with the wind energy facility also need to be adjusted so that they are outside no-go areas. The optimised layout and revised optimised layout presented in Chapter 11 of this EIA Report addresses this requirement.

During operation, bat fatality monitoring must be undertaken to search for bat carcasses beneath wind turbines to measure the residual impact of the wind energy facility on bats for a minimum of two years. Curtailment and/or acoustic deterrents must be used if operational phase fatality monitoring indicates that species fatality thresholds have been exceeded to minimise impacts, maintain the impacts to bats within acceptable limits of change and prevent declines in the impacted bat population. Provided these mitigation measures are adhered to, it is the specialist's opinion that the project assessed can be approved.

9.7. Assessment of Impacts on Soils Agricultural Potential

Various impacts have been identified with the development of the Ummbila Emoyeni Wind Energy Facility from an agricultural perspective. The potential impacts and the relative significance of the impacts are summarised below (refer to **Appendix H** for more details).

9.7.1 Results of the Soils and Agricultural Potential Assessment

Four main sensitive soil forms were identified within the project site, namely the Vaalbos, Avalon, Ermelo and Tukulu soil forms. The land capability sensitivity (DAFF, 2017) indicates a range of sensitivities expected throughout the project site, which predominantly covers "Moderately Low" to "Moderate" sensitivities. Smaller patches are characterised by sensitivities up to "Moderately High" (refer to **Figure 9.8**). Furthermore, various crop field boundaries were identified by means of the DFFE Screening Tool (2022), which are predominantly characterised by "High" sensitivities with one area being classified as "Very High" sensitivity (Refer to **Figure 9.9**).

The specialist has recommended that such high potential crop fields be avoided by relocating wind turbines and associated infrastructure (e.g., laydown areas, substations, etc.) from the areas characterised by "High" to "Very High" crop fields in order to ensure that these crop fields are preserved, where possible. In a case where relocating the project infrastructure is not feasible, the developer should engage with the owners of the crop fields for an appropriate compensation. Approximately 22 turbines are located within sensitive crop fields.

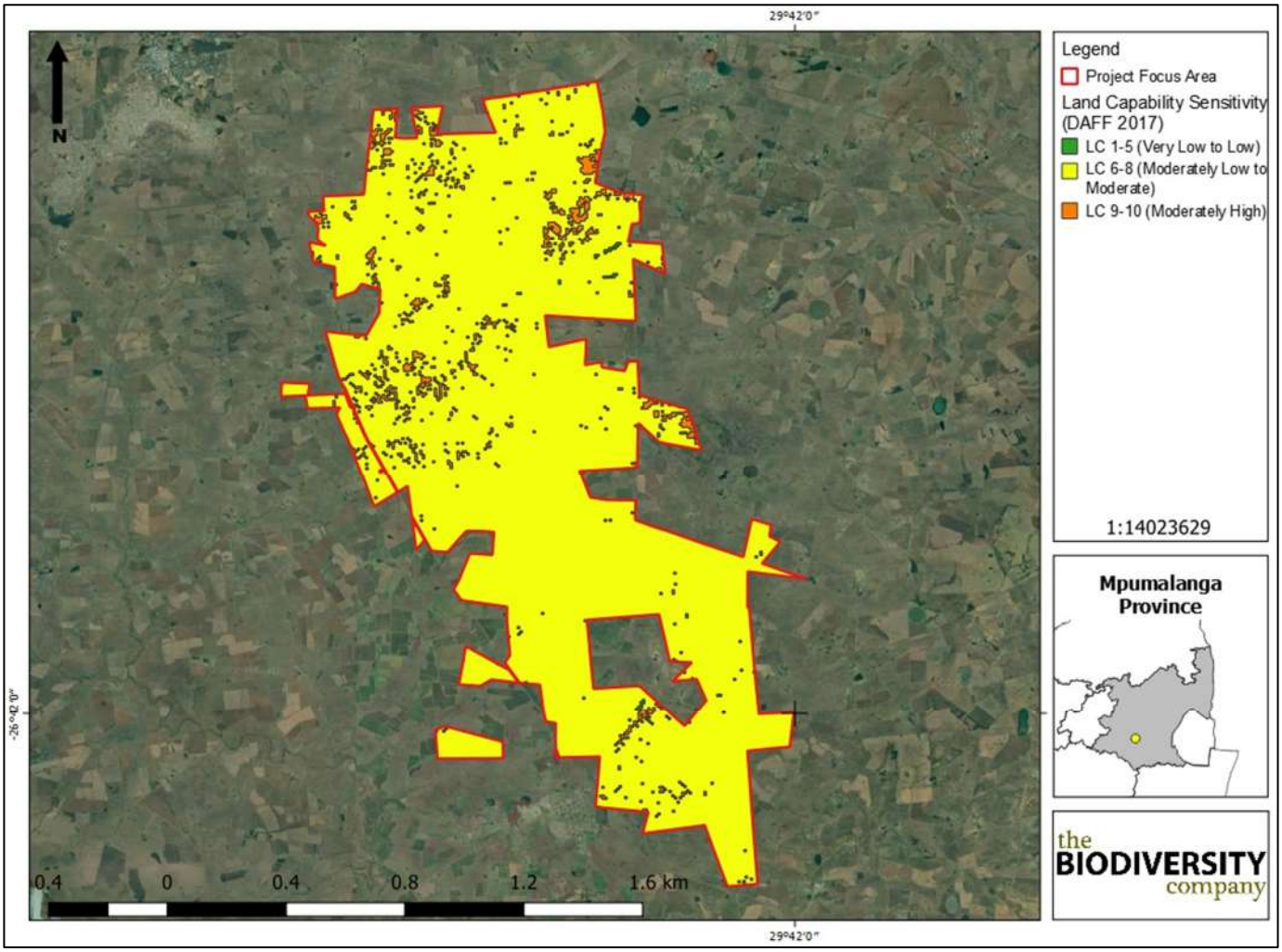


Figure 9.8: Land sensitivity capability for the project site (DAFF, 2017)

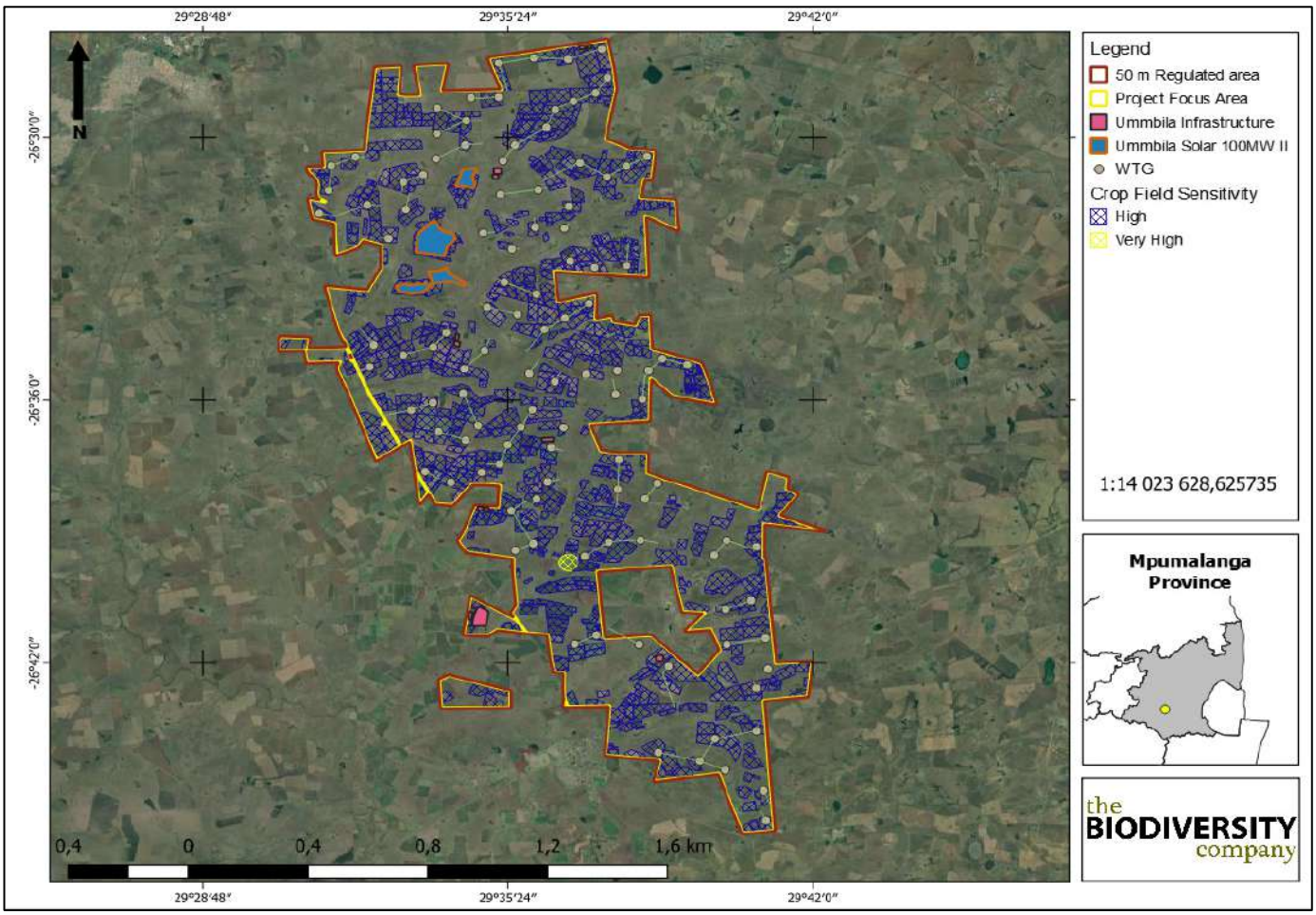


Figure 9.9: Project infrastructure in relation to the sensitive crop fields

9.7.2 Description of Impacts on Soils and Agricultural Potential

The impact assessment considered the calculated sensitivities associated with the soil resources expected to be impacted upon by the relevant components. This impact assessment purely focused on the impacts expected towards natural resources (in specific, the soil and associated land capability).

9.7.3 Impact tables summarising the significance of impacts on soils and agricultural potential during the construction, operation and decommissioning phases (with and without mitigation)

Construction Phase Impacts

Nature: *Loss of land capability*

The proposed development will result in the stripping of topsoil and alterations to the existing land uses. The changes in the land use within the areas affected by project infrastructure will be from agricultural to renewable development (wind). The proposed activities will impact on areas expected to be of high agricultural production (in some areas), with some aspects affecting "Moderately Low" to "Moderate" sensitivity areas. It is possible that suitable agricultural land could become fragmented, resulting in these smaller portions no longer being deemed feasible to farm.

During the construction phase, turbine foundations will be established and clearing would have to be undertaken for all other infrastructure associated with the wind energy facility. Access roads will be created with trenches being dug for the installation of relevant cables/pipelines. Construction of substation sites will take place. Contractor and

laydown yards will also be cleared with construction material being transported to laydown yards. Potential erosion is expected during the construction phase due to some erodable soils within the footprint, such as the Vaalboos and Tukulu soil forms. The removal of vegetation and changes to the local topography could result in an alteration to surface run-off dynamics. Erosion of the area could result in further loss of topsoil, and soil forms suitable for agriculture.		
	Without mitigation	**With mitigation**
Extent	Local (3)	Local (2)
Duration	Long Term (4)	Short Term (2)
Magnitude	Moderate (6)	Low (4)
Probability	Probable (3)	Improbable (2)
Significance	**Medium (39)**	**Low (18)**
Status (positive or negative)	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation: Limited mitigation is required given the fact that the pre- mitigation significance rating has been scored as "Medium – Negative" and the post- mitigation significance rating being scored as "Low – Negative". The following specific measures are intended to secure a low residual risk: » Avoidance of all high agricultural production land and other actively cultivated areas. Where avoidance is not feasible, stakeholder engagement should occur to compensate affected landowners. » Make use of existing roads or upgrades tracks before new roads are constructed. The number and width of internal access routes must be kept to a minimum. » A stormwater management plan must be implemented for the development. The plan must provide input into the road network and management measures. » Turbine foundations must be (preferably) located in already disturbed areas that are not actively cultivated. » Rehabilitation of the area must be initiated from the onset of the project. Soil stripped from infrastructure placement can be used for rehabilitation efforts. » An alien invasive plant species and control programme must be implemented from the onset of the project.		
Residual Impacts: Limited residual impacts will be associated with these activities, assuming that all prescribed mitigation measures be strictly adhered to.		

Operation Phase Impacts

Nature: *Loss of land capability* During the operational phase, limited impacts are foreseen. Concrete areas will be equipped with drains to reduce soil erosion on exposed areas. Only the footprint area will be disturbed to minimise soil and vegetation disturbance of the surrounding area. Revegetation will be carried out on exposed surrounding areas to avoid surface erosion. Maintenance of vegetation, the wind farm and associated infrastructure structures will have to be carried out throughout the life of the project. It is expected that these maintenance practices can be undertaken by means of manual labour. The operational phase of the project (constructed infrastructure) includes anthropogenic movement and activities. The relevant infrastructure will be occupied by professionals throughout the lifetime of the operation. Besides compaction and erosion caused by increased traffic and surface water run-off for the area, few aspects are expected to be associated with this phase. The spread of alien invasive species will be a risk, predominantly adjacent to developed areas (edge effect).		
	Without mitigation	**With mitigation**
Extent	Local (2)	Site (1)
Duration	Long term (4)	Medium term (4)
Magnitude	Low (4)	Minor (2)

Probability	Probable (3)	Improbable (2)
Significance	**Medium (30)**	**Low (12)**
Status (positive or negative)	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation: Limited mitigation is required given the fact that the pre- mitigation significance rating has been scored as "Medium – Negative" and the post- mitigation significance rating being scored as "Low – Negative". Further general mitigation is however detailed as the impacts are low. » Only the proposed access area and roads should be disturbed to reduce any unnecessary compaction. » Prevent any spills from occurring. Machines must be parked within hard park areas and must be checked daily for fluid leaks. » All excess soil (soil that are stripped and stockpiled to make way for foundations) must be stored, continuously rehabilitated to be used for rehabilitation of eroded areas. » If a spill occurs, it is to be cleaned up immediately and reported to the appropriate authorities.		
Residual Impacts: Limited residual impacts will be associated with these activities, assuming that all prescribed mitigation measures be strictly adhered to.		

Decommissioning Phase Impacts

No significant impacts are identified for the decommissioning phase. However, the following generation mitigation measures have been detailed for the decommissioning phase:

» Restore vegetation cover by means of revegetating indigenous grass species. Mixed stands or monocultures will work sufficiently for revegetation purposes. Mixed stands tend to blend in with indigenous vegetation species and are more natural. Monocultures however could achieve high productivity. In general, indigenous vegetation should always be preferred due to various reasons including the aesthetical presence thereof as well as the ability of the species to adapt to its surroundings.
» All areas outside of the footprint areas that will be degraded (by means of vehicles, laydown yards etc.) must be ripped where compaction has taken place. According to the Department of Primary Industries and Regional Development, ripping tines must penetrate to just below the compacted horizons (approximately 300 – 400mm) with soil moisture being imminent to the success of ripping. Ripping must take place within 1-3 days after seeding, and also following a rain event to ensure a higher moisture content. To summarise:
  * Rip all compacted areas outside of the developed areas that have been compacted.
  * This must be done by means of a commercial ripper that has at least two rows of tines.
» Ripping must take place between 1 and 3 days after seeding and following a rainfall event (seeding must therefore be carried out directly after a rainfall event). Plant phase plants which are characterised by fast growing and rapid spreading conditions. Seed germination, seed density and seed size are key aspects to consider before implementing revegetation activities. The number of seed should be limited to ensure that competition between plants is kept to a minimum. During the establishment of seed density, the percentage of seed germination should be taken into consideration. E curvula is one of the species recommended due to the ease of which it germinates. This species is also easily sown by means of hand propagation and hydro seeding. The following species are recommended for rehabilitation purposes:
  * *Eragrostis teff;*

- *Cynodon species (Indigenous and altered types);*
- *Chloris gayana;*
- *Panicum maximum;*
- *Digitaria eriantha;*
- *Anthephora pubescens; and*
- *Cenchrus ciliaris.*

9.7.4 Overall Result

The Soils and Agricultural Potential Impact Assessment identified that all impacts associated with the development of the Ummbila Emoyeni Wind Energy Facility will be of medium significance before mitigation, and can be mitigated to an acceptable level of impact (i.e., low significance). It is the specialist's opinion that the proposed development will have an overall low residual impact on the agricultural production ability of the land. The proposed activity will result in the segregation of some high production agricultural land. It is recommended that the location of infrastructure avoid areas of high agricultural production. If avoidance is not feasible, stakeholder engagement must be undertaken to compensate landowners for high crop field land use areas where necessary. It is the specialist's opinion that the project be approved subject to implementation of the recommended mitigation measures.

9.8. Assessment of Impacts on Heritage Resources (including archaeology, palaeontology and cultural landscape)

Potential impacts on heritage resources and the relative significance of the impacts associated with the development of the Ummbila Emoyeni Wind Energy Facility are summarised below (refer to **Appendix I**).

9.8.1 Results of the Heritage Impact Assessment

Archaeology

The field assessment has determined that the area proposed for development has medium to high local historic significance. The broader cultural landscape consists of old farmhouses, kraals, circular stone structures, and the remnants of old water pumps, feeding and water troughs.

Even though the area is rich in history, no significant archaeological heritage resources were identified during the field assessment. No Stone Age or Iron Age heritage resources were identified during the survey. The few heritage resources that were identified consist of the ruins of older farm structures and kraals. Due to the paucity of older farm structures in the area as a result of demolition, it is recommended that the identified ruins and kraals remain untouched and that a safety buffer should exist around all such structures.

The field assessment identified six burial grounds or graves close to or within the proposed development footprint. All graves are of high local significance as a result of their social and cultural value, and are therefore graded IIIA.

Palaeontology

The area proposed for development is underlain by Permian ages sandstone and shale of the Vryheid Formation, Jurassic aged dolerite and quaternary aged alluvium with a very high, very low, and moderate palaeontological sensitivity. Significant fossils are expected in areas where deep excavations (>1.5m) are

planned in areas indicated in red on the palaeontological sensitivity map (refer to **Figure 9.10 and 9.11**). It should be noted however that these areas are not regarded as no-go areas for development. The specialist has however recommended the implementation of a chance find procedure in the event that fossils are discovered during excavating activities.

Deep weathering and extensive agricultural disturbance prevented the recording of fossils over most of the inspected areas, but it is significant to note that in the few places where exposures were noticed, highly significant fossils were recorded. In areas underlain by the Vryheid Formation, the field investigation confirmed the potential for the presence of fossils, and most of the important fossil structures were recorded.

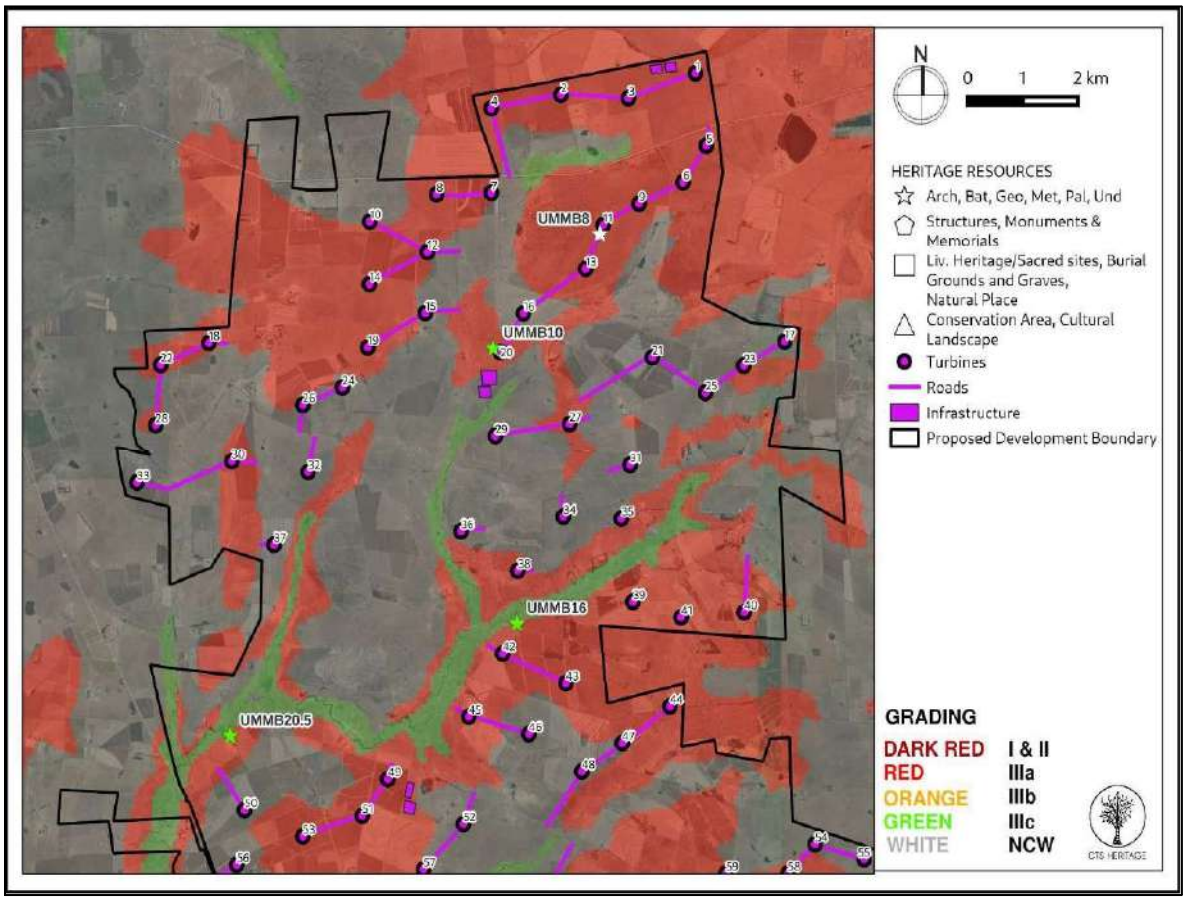


Figure 9.10: Map showing the palaeontological sensitivity of the site and palaeontological heritage resources identified within the project site (northern section)

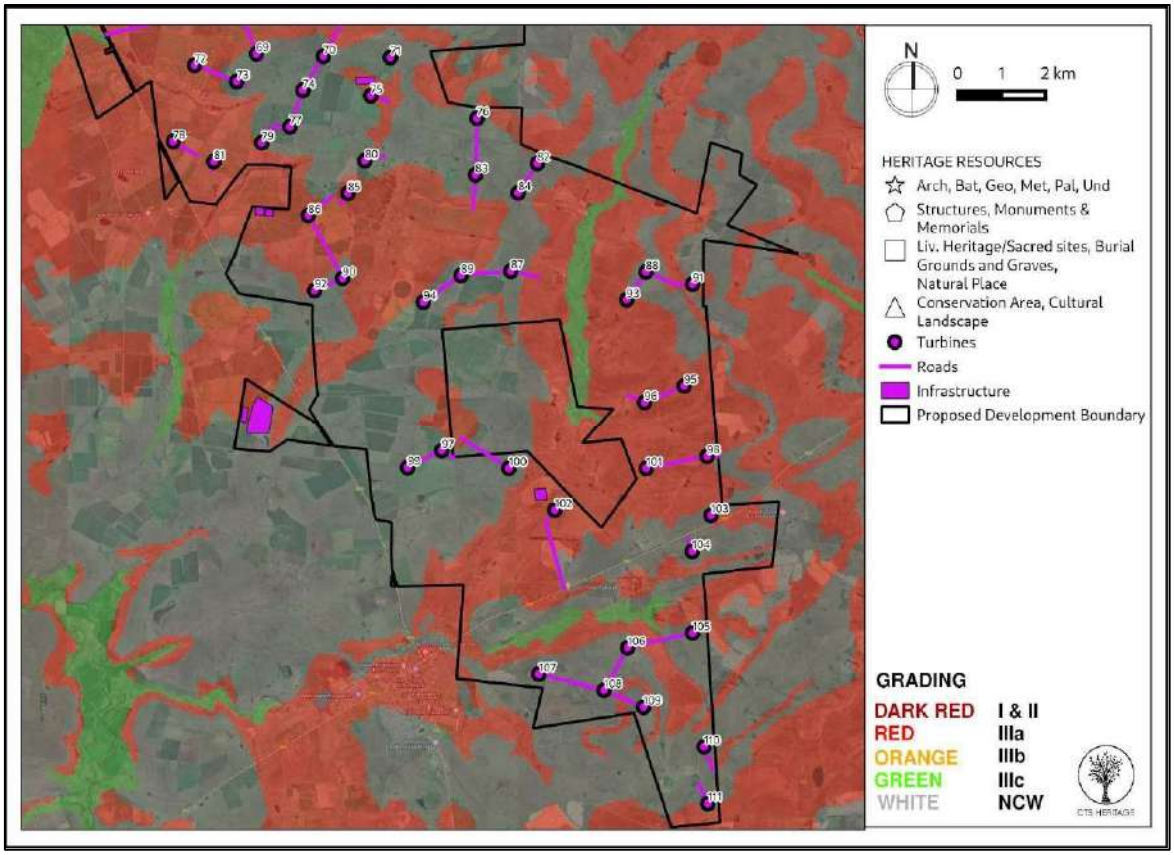


Figure 9.11: Map showing the palaeontological sensitivity of the site and palaeontological heritage resources identified within the project site (southern section)

Cultural Landscape

Possible receptors within the landscape which could be sensitive to landscape change have been identified and include the towns of Bethal and Morgenzon; the Silver Water and Rievlei Nature Reserves; local farmsteads and homesteads; and the N17, R35, R38, R39 and unsurfaced local roads.

The N17 that runs through the northern section of the development area marks the primary approach from Ermelo (established in the 1870's) to Bethal (established in the 1880's) and as such, the area proposed for development provides a significant gateway between these two historic towns. As with most National Routes, the alignment of the N17 follows the old regional route of the R29 which itself is likely based on historic routes between these significant towns. The way that the local farmsteads and roads interact with each other and elements of the landscape such as topography and river courses etc. all act as contributing elements to the cultural landscape. These elements are mapped in **Figure 9.12. and 9.13** below.

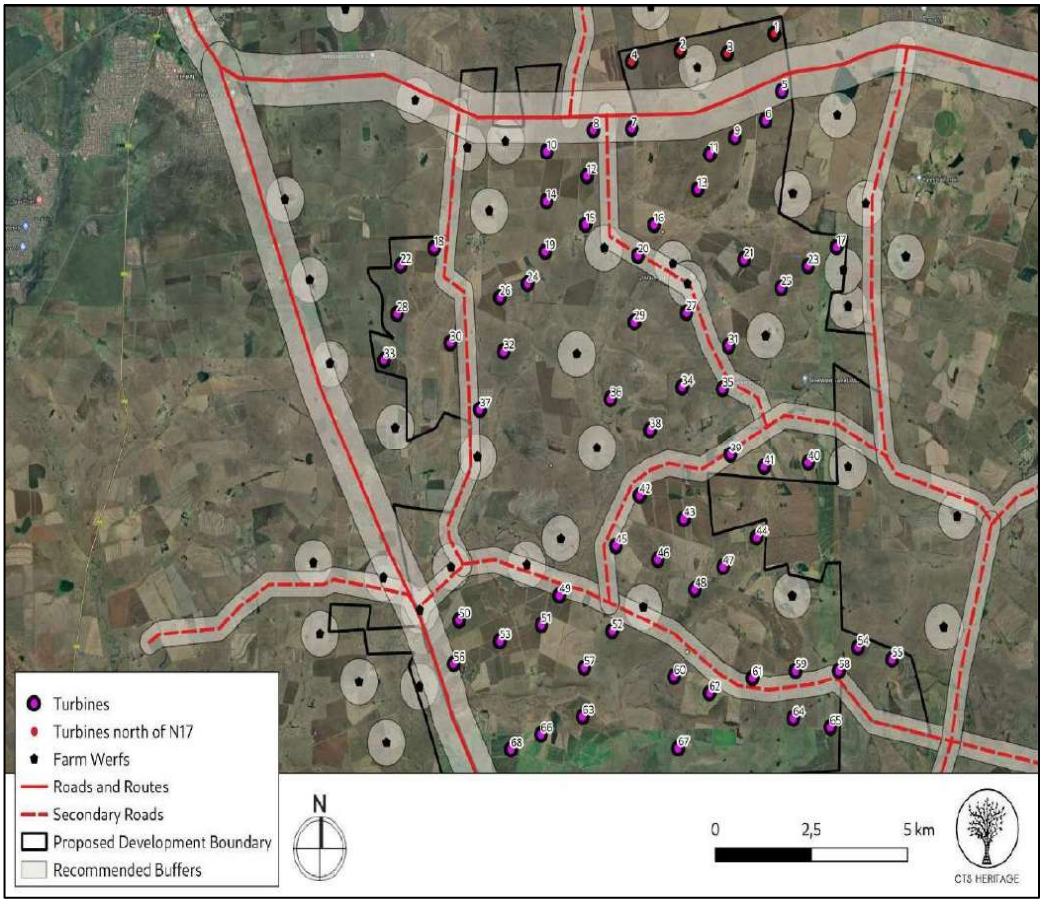


Figure 9.12: Cultural landscape features identified within the northern section of the project site

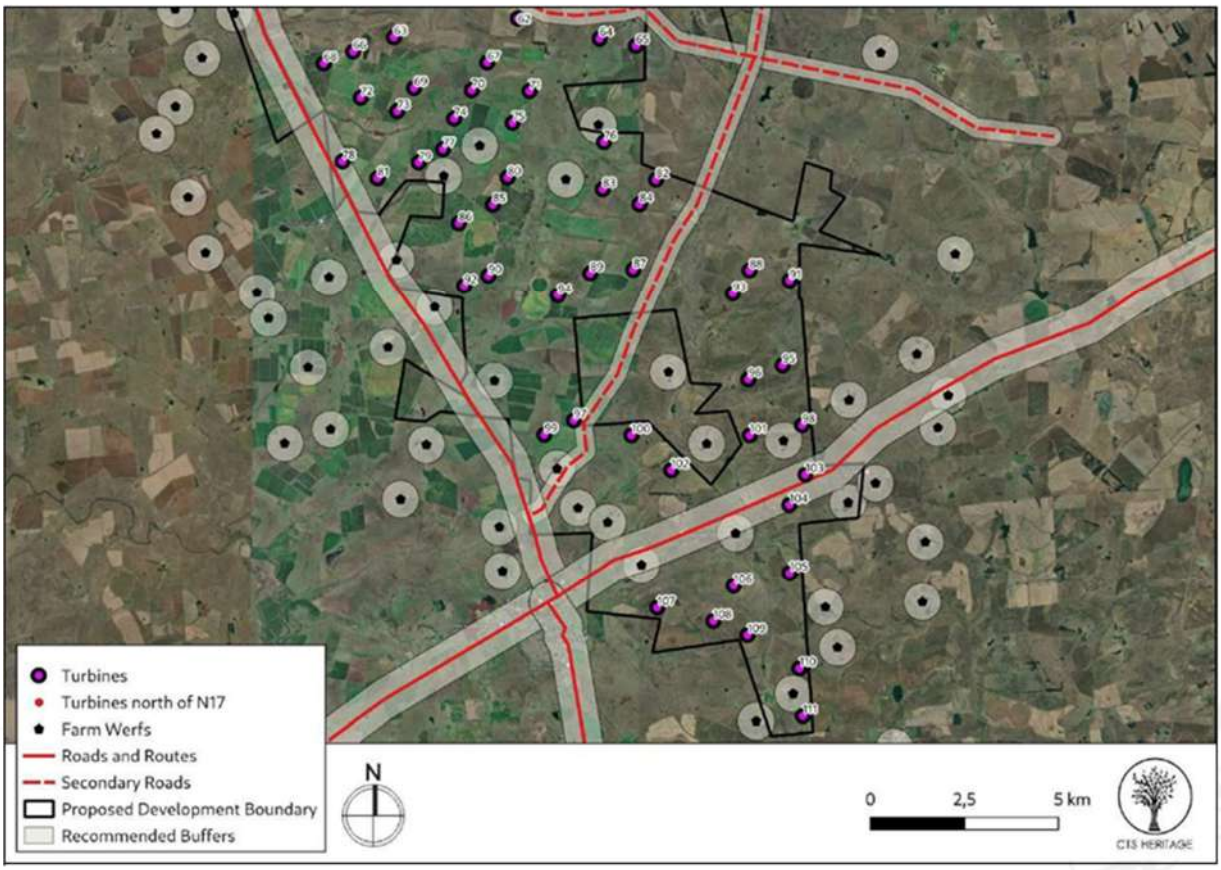


Figure 9.13: Cultural landscape features identified within the southern section of the project site

9.8.2 Description of the Heritage Impacts

The following impacts are expected from a heritage perspective:
» Destruction of archaeological heritage.
» Destruction of palaeontological heritage.
» Negative impact to significant cultural landscapes.

9.8.3 Impact tables summarising the significance of impacts on heritage during construction, operation and decommissioning (with and without mitigation)

Construction Phase Impacts

Archaeology

Nature: *Impact to archaeological heritage resources* The area proposed for development is known to conserve heritage resources of archaeological significance that may be impacted by the proposed development.		
	Without mitigation	**With mitigation**
Extent	Site (1) - Localised within the site boundary	Site (1) - Localised within the site boundary
Duration	Permanent (5) - Where manifest, the impact will be permanent	Permanent (5) - Where manifest, the impact will be permanent
Magnitude	High (8) - Some significant archaeological resources were identified within the development area	High (8) - Some significant archaeological resources were identified within the development area
Probability	Highly Probable (4) - It is possible that any significant archaeological resources will be impacted	Very Improbable (1) - It is extremely unlikely that any significant archaeological resources will be impacted
Significance	**Medium (56)**	**Low (14)**
Status (positive or negative)	Negative	Negative
Reversibility	Any impacts to heritage resources that do occur are irreversible	Any impacts to heritage resources that do occur are irreversible
Irreplaceable loss of resources?	Unlikely	Unlikely
Can impacts be mitigated?	Yes	
Mitigation: » A 50m no-go development buffer is implemented around all burial ground sites including Observations 001, 005, 006, 008, 012 and 013. » A Management Plan for the ongoing conservation of these burials is developed prior to construction, along with a Guide on how to identify marked and unmarked burials and how to proceed should previously unidentified burials be uncovered during the construction process. » The historic farm werf cluster (refer to **Figure 8.16 under Chapter 8)** is not impacted by the development. » Turbine 101 must be relocated 300m east along the road alignment to ensure that no human remains are impacted by the development. » The road to Turbine 60 must be relocated to ensure that a no-development buffer of at least 50m is implemented around the burial site 013 so that no impact takes place.		
Residual Impacts: Should any significant archaeological resources be impacted (however unlikely) residual impacts may occur, including a negative impact due to the loss of potentially scientific cultural resources.		

Palaeontology

Nature: *Impact to palaeontological heritage resources* The area proposed for development is known to conserve heritage resources of palaeontological significance that may be impacted by the proposed development.		
	Without mitigation	**With mitigation**
Extent	Site (1) - Localised within the site boundary	Site (1) - Localised within the site boundary
Duration	Permanent (5) - Where manifest, the impact will be permanent	Permanent (5) - Where manifest, the impact will be permanent
Magnitude	High (8) - No highly significant palaeontological resources were identified within the development area; however, the geology underlying the development area is very sensitive for impacts to significant fossils	High (8) - No highly significant palaeontological resources were identified within the development area; however, the geology underlying the development area is very sensitive for impacts to significant fossils
Probability	Definite (5) - It is extremely likely that significant palaeontological resources will be negatively impacted	Low (1) - It is extremely unlikely that any significant paleontological resources will be negatively impacted
Significance	**High (70)**	**Low (14)**
Status (positive or negative)	Negative	Negative
Reversibility	Any impacts to heritage resources that do occur are irreversible	Any impacts to heritage resources that do occur are irreversible
Irreplaceable loss of resources?	Likely	Unlikely
Can impacts be mitigated?	Yes	

Mitigation:

» The Chance Fossil Finds Procedure must be implemented for the duration of construction activities:
  - Training:
    - Workmen and foremen need to be trained in the procedure to follow in instances of accidental discovery of fossil material, in a similar way to the Health and Safety protocol. A brief introduction to the process to follow in the event of possible accidental discovery of fossils should be conducted by the designated Environmental Control Officer (ECO) for the project, or the foreman or site agent in the absence of the ECO It is recommended that copies of the attached poster and procedure are printed out and displayed at the site office so that workmen may familiarise themselves with them and are thereby prepared in the event that accidental discovery of fossil material takes place.
  - Actions to be undertaken:
    - One person in the staff must be identified and appointed as responsible for the implementation of the protocol in instances of accidental fossil discovery and must report to the ECO or site agent. If the ECO or site agent is not present on site, then the responsible person on site should follow the protocol correctly in order to not jeopardize the conservation and well-being of the fossil material.
    - Once a workman notices possible fossil material, he/she should report this to the ECO or site agent. Procedure to follow if it is likely that the material identified is a fossil:
      - The ECO or site agent must ensure that all work ceases immediately in the vicinity of the area where the fossil or fossils have been found.
      - The ECO or site agent must inform SAHRA of the find immediately. This information must include photographs of the findings and GPS co-ordinates.

- The ECO or site agent must compile a Preliminary Report and fill in the attached Fossil Discoveries: Preliminary Record Form within 24 hours without removing the fossil from its original position. The Preliminary Report records basic information about the find including:
  - The date.
  - A description of the discovery.
  - A description of the fossil and its extent (e.g., position and depth of find).
  - Where and how the find has been stored.
  - Photographs to accompany the preliminary report: (
    - ✓ A scale must be used.
    - ✓ Photos of location from several angles.
    - ✓ Photos of vertical section should be provided.
    - ✓ Digital images of hole showing vertical section (side).
    - ✓ Digital images of fossil or fossils.

» Upon receipt of this Preliminary Report, SAHRA will inform the ECO or site agent whether or not a rescue excavation or rescue collection by a palaeontologist is necessary.

* Exposed finds must be stabilised where they are unstable and the site capped, e.g. with a plastic sheet or sand bags. This protection should allow for the later excavation of the finds with due scientific care and diligence. SAHRA can advise on the most appropriate method for stabilisation.
* If the find cannot be stabilised, the fossil may be collect with extreme care by the ECO or the site agent and put aside and protected until SAHRA advises on further action. Finds collected in this way must be safely and securely stored in tissue paper and an appropriate box. Care must be taken to remove the all fossil material and any breakage of fossil material must be avoided at all costs.
* No work may continue in the vicinity of the find until SAHRA has indicated, in writing, that it is appropriate to proceed.

Residual Impacts:
Should any significant palaeontological resources be impacted (however unlikely) residual impacts may occur, including a negative impact due to the loss of potentially scientific cultural resources

Cultural Landscape

Nature: *Impact to cultural landscape*

The broader context of the area proposed for development has cultural significance that may be impacted by the proposed development.

	Without mitigation	**With mitigation**
Extent	Regional (5)	Regional (5)
Duration	Long-term (4) - Where manifest, the impact will be long term – for the duration of the wind energy facility lifetime	Long-term (4) - Where manifest, the impact will be long term – for the duration of the wind energy facility lifetime
Magnitude	High (8) - No highly significant palaeontological resources were identified within the development area; however, the geology underlying the development area is very sensitive for impacts to significant fossils	High (8) - No highly significant palaeontological resources were identified within the development area; however, the geology underlying the development area is very sensitive for impacts to significant fossils
Probability	Definite (5) - It is extremely likely that significant palaeontological resources will be negatively impacted	Low (1) - It is extremely unlikely that any significant paleontological resources will be negatively impacted
Significance	**High (70)**	**Low (14)**

Status (positive or negative)	Negative	Negative
Reversibility	Any impacts to heritage resources that do occur are reversible once the wind energy facility infrastructure is removed	Any impacts to heritage resources that do occur are reversible once the wind energy facility infrastructure is removed
Irreplaceable loss of resources?	Unlikely	Unlikely
Can impacts be mitigated?	Yes	
Mitigation: » Because of the gateway role played by the N17 as a gateway route between the historic town of Ermelo and Bethal, turbines should be located on only one side of the N17 to avoid a "canyon" effect on this National route (i.e. the relocation of turbines 1, 2, 3 and 4). This has been considered in the optimised layout presented in Chapter 11 of this EIA Report. » A 500m no development buffer should be implemented on either side of the N17, R35 and R39. » A 200m no development buffer should be implemented on either side of the secondary routes that run through the development area. » A 500m no development buffer must be implemented around the identified farm werfs.		
Residual Impacts: N/A		

9.8.4 Overall Result

The Heritage Impact Assessment identified that all impacts associated with the development of the Ummbila Emoyeni Wind Energy Facility will be of medium and high significance before mitigation, and can be mitigated to an acceptable level of impact (i.e., low significance). The impacts rated to be of high significance pre-mitigation are not considered as fatal flaws, provided the prescribed mitigation measures are implemented.

According to the Heritage Impact Assessment, the proposed landscape is relatively typical of the region and is not protected." However, the nature of the relationship between various landscape elements such as the farm werfs and road network contributes to the sense of place of this rural landscape.

Even though the area is rich in history, no significant archaeological heritage resources were identified during the field assessment. No Stone Age or Iron Age heritage resources were identified during the survey. The few heritage resources that were identified consist of the ruins of older farm structures and kraals. Due to the paucity of older farm structures in the area as a result of demolition, it is recommended that the identified ruins and kraals remain untouched and that a safety buffer should exist around all such structures. The field assessment identified six burial grounds or graves close to or within the proposed development footprints of turbines and roads. All graves are of high local significance as a result of their social and cultural value, and are therefore graded IIIA. Turbines impacting on such sites should be relocated as recommended.

No palaeontological no-go areas have been identified within the project areas. With the exception of one fossil site of low scientific value, none of the recorded fossil sites overlaps directly with, or lies close to (< 20 m) the proposed infrastructure and no modification of the layouts through micro-siting is proposed here on palaeontological grounds.

Based on the outcomes of the Heritage Impact Assessment, it is not anticipated that the proposed development of the wind energy facility and its associated infrastructure will negatively impact on significant heritage resources on condition that:

- A 500m no development buffer should be implemented on either side of the N17, R35 and R39.
- A 200m no development buffer should be implemented on either side of the secondary routes that run through the development area.
- A 500m no development buffer must be implemented around the identified farm werfs.
- A 50m no-go development buffer is implemented around all burial ground sites including Observations 001, 005, 006, 008, 012 and 013.
- A Management Plan for the ongoing conservation of these burials is developed prior to construction, along with a Guide on how to identify marked and unmarked burials and how to proceed should previously unidentified burials be uncovered during the construction process.
- The historic farm werf cluster (refer to **Figure 8.16 under Chapter 8)** is not impacted by the development.
- Turbine 101 must be relocated 300m east along the road alignment to ensure that no human remains are impacted by the development.
- The road to Turbine 60 must be relocated to ensure that a no-development buffer of at least 50m is implemented around the burial site 013 so that no impact takes place.
- The Chance Fossil Finds Procedure must be strictly adhered to for excavations exceeding 1.5m located within the Vryheid Formation.
- Although all possible care has been taken to identify sites of cultural importance during the investigation of the study area, it is always possible that hidden or subsurface sites could be overlooked during the assessment. If any evidence of archaeological sites or remains (e.g. remnants of stone-made structures, indigenous ceramics, bones, stone artefacts, ostrich eggshell fragments, charcoal and ash concentrations), fossils, burials or other categories of heritage resources are found during the proposed
- development, work must cease in the vicinity of the find and SAHRA must be alerted immediately to determine an appropriate way forward.

9.9. Assessment of Noise Impacts

Wind turbines produce sound, primarily due to mechanical operations and aerodynamic effects of the blades. Modern wind turbine manufacturers have virtually eliminated the noise impact caused by mechanical sources and instituted measures to reduce the aerodynamic effects. But, as with many other activities, the wind turbines emit sound power levels at a level that can impact on areas at some distance away (up to 2000m). When potentially sensitive receptors are nearby, care must be taken to ensure that the operations at the wind farm do not cause undue annoyance or otherwise interfere with the quality of life of the receptors. Potential noise impacts and the relative significance of the impacts are summarised below (refer to **Appendix J**).

9.9.1 Results of the Noise Impact Assessment

Noise-Sensitive Receptors

Potential noise-sensitive developments, receptors and communities were identified using tools such as Google Earth up to a distance of 2 000m (recommendation SANS 10328:2003) from wind turbine locations. These receptors are highlighted in **Figure 9.14**. Also indicated on this figure are generalized 500, 1 000 and 2 000m buffer zones. Generally, noises from wind turbines:

- Could be significant within 500m, with receptors staying within 500m from operational wind turbines subject to noises at a potentially sufficient level to be considered disturbing.
- Are normally limited to a distance of approximately 1 000m from operational wind turbines. Night-time ambient sound levels could be elevated and the potential noise impact measurable.

» Likely to be audible up to a distance of 2 000m at night. Noises from the wind turbines are of a low concern at distances greater than 2 000m, although the sound of the wind turbines may be audible at greater distances during certain metrological phenomena (sound levels are generally very low at distances greater than 2 000m).

Projected Noise Levels for Future Operational Activities

While the significance of daytime noise impacts was considered, times when a quiet environment is desired (at night for sleeping, weekends etc.) are more critical. Surrounding receptors would desire and require a quiet environment during the night-time (22:00 – 06:00) timeslot and ambient noise levels during the night-time period is critical.

Noise models were developed considering the conceptual operational activities, with the potential noise rating level contours associated with the potential operational activities illustrated in:

» **Figure 9.15** when considering the worst-case sound pressure level (SPL) WTG, with the WTG operating at a wind speed of 8 m/s.

» **Figure 9.16** when considering the reported noise level (as reported on the Nordex website) of the Nordex N163 5.X WTG, with the WTG operating at a wind speed of 8 m/s.

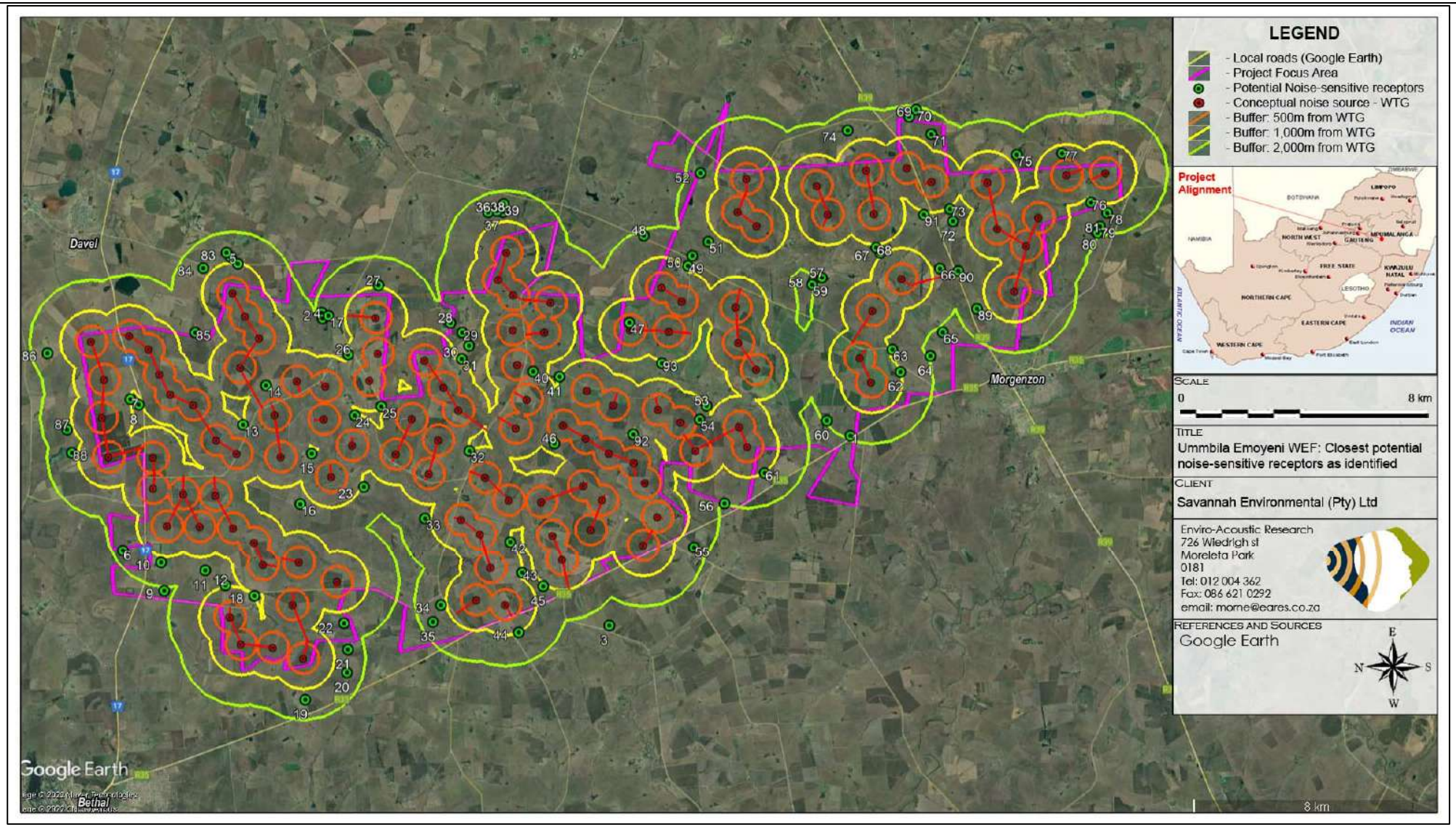


Figure 9.14: Noise-sensitive developments located within the surrounding area and the project site for the Ummbila Emoyeni Wind Energy Facility

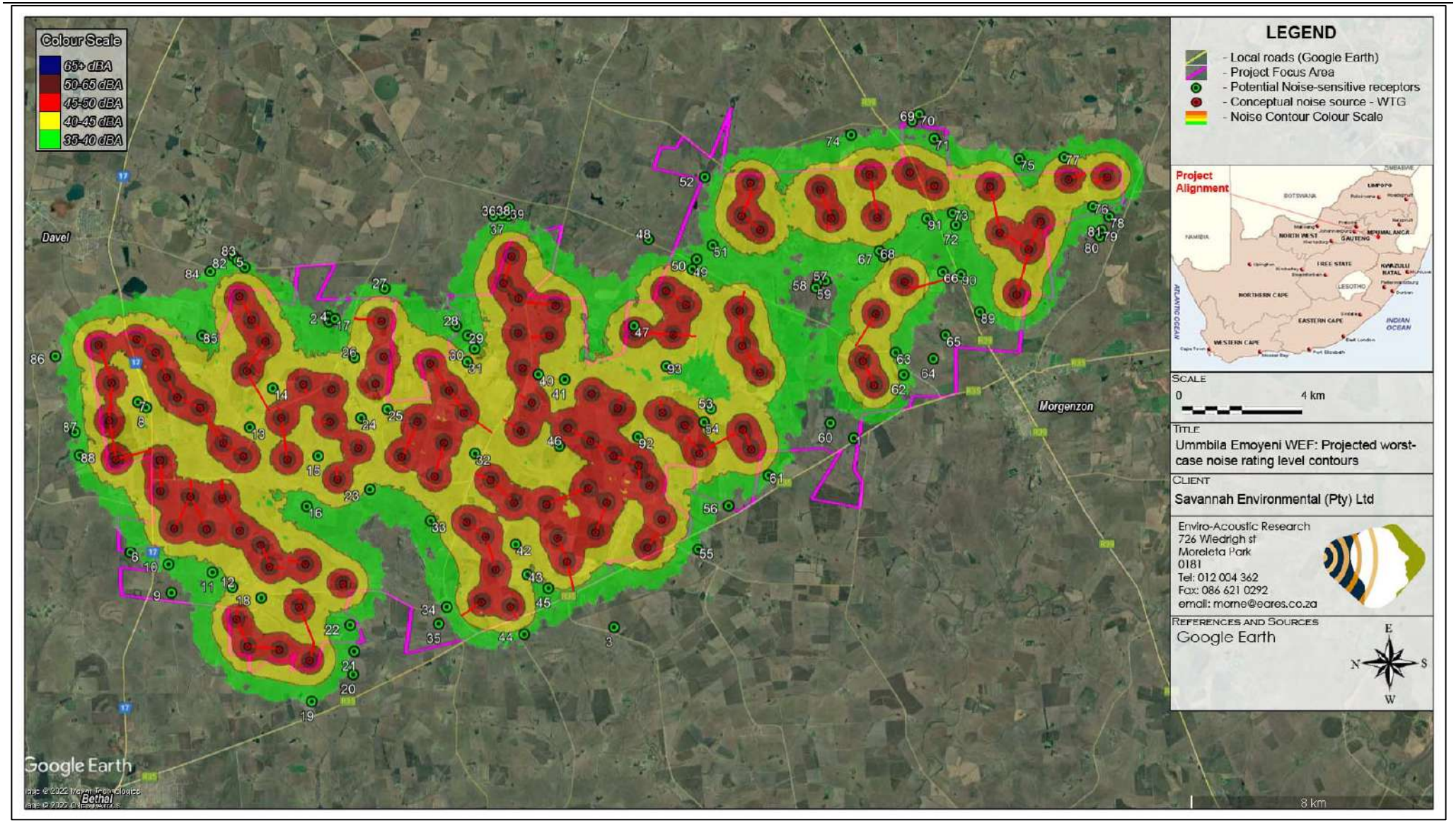


Figure 9.15: Projected noise-levels for the operation of the Ummbila Emoyeni Wind Energy Facility (worst-case SPL of 109.2 dBA re 1 pW)

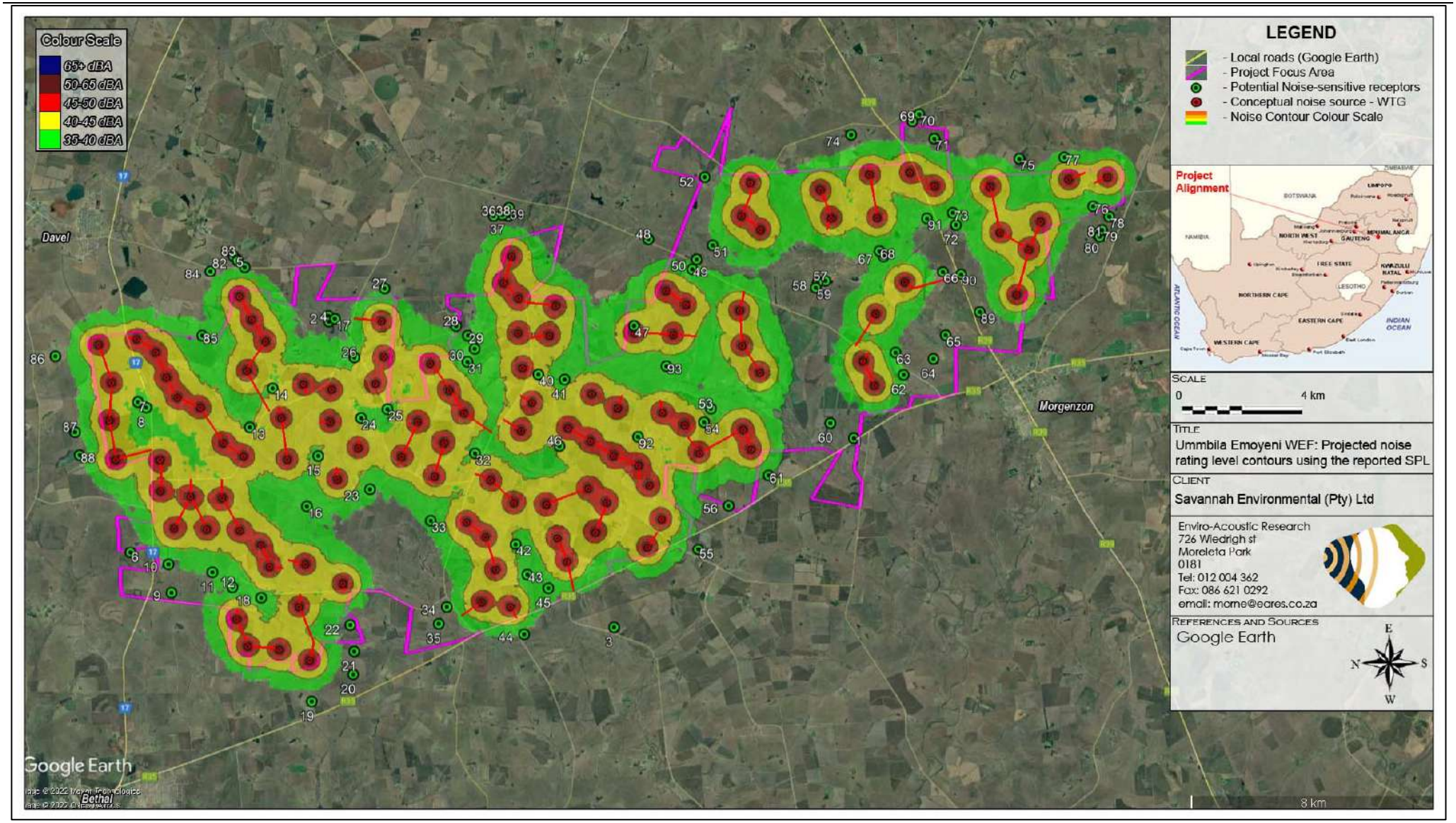


Figure 9.16: Projected noise-levels for the operation of the Ummbila Emoyeni Wind Energy Facility (reported SPL of 106.4 dBA re 1 pW)

9.9.2 Description of Noise Impacts

Construction Phase

During the construction phase, the undertaking of specific activities will result in noise impacts. The activities include:

- Site survey and preparation;
- Establishment of site entrance, internal access roads, contractors compound and passing places;
- Civil works to sections of the public roads to facilitate turbine delivery;
- Construction of foundations;
- Transport of components and equipment to site;
- Establishment of laydown and hard standing areas;
- Erection of the turbines;
- Construction of the substation;
- Establishment of ancillary infrastructure; and
- Site rehabilitation.

There are a number of factors that determine the audibility as well as the potential of a noise impact on receptors. Maximum noises generated can be audible over a large distance, however, are generally of very short duration. If maximum noise levels however exceed 65 dBA at a receptor, or if it is clearly audible with a significant number of instances where the noise level exceeds the prevailing ambient sound level with more than 15 dB, the noise can increase annoyance levels and may ultimately result in noise complaints.

Other activities that may generate noise during the construction phase include the use of the concrete batching plant on site, blasting which may be required as part of the civil works to clear obstacles or to prepare foundations, and construction traffic.

Operation Phase

The proposed development would be designed to have an operational life of up to 25 years with the possibility to further expand the lifetime of the wind farm. The only development related activities on-site will be routine servicing (access roads and light traffic) and unscheduled maintenance. The noise impact from maintenance activities is insignificant, with the main noise source being the wind turbine blades and the nacelle (components inside) as highlighted in the following sections.

Noise emitted by wind turbines can be associated with two types of noise sources. These are aerodynamic sources due to the passage of air over the wind turbine blades and mechanical sources which are associated with components of the power train within the turbine, such as the gearbox and generator and control equipment for yaw, blade pitch, etc. These sources normally have different characteristics and can be considered separately. In addition, there are other noise sources of lower levels, such as the substations and traffic (maintenance).

Decommissioning Phase

The potential for a noise impact to occur during the decommissioning and closure phase will be much lower than that of the construction and/or operational phases. If required, the noise levels for decommissioning can be compared with the daytime construction phase noise level and the noise impact is similar or less.

Noise Impacts on Animals

A significant amount of research was undertaken during the 1960's and 70's on the effects of aircraft noise on animals. While aircraft noise has a specific characteristic that might not be comparable with industrial noise, the findings should be relevant to most noise sources. A general animal behavioural reaction to aircraft noise is the startle response with the strength and length of the startle response to be dependent on the following:

- which species is exposed;
- whether there is one animal or a group of animals, and
- whether there have been some previous exposures.
-

Overall, the research suggests that species differ in their response to noise depending on the duration, magnitude, characteristic and source of the noise, as well as how accustomed the animals are to the noise (previous exposure).

Extraneous noises impact on animals as it can increase stress levels and even impact on their hearing. Masking sounds may affect their ability to react to threats, compete and seek mates and reproduce, hunt and forage, communicate and generally to survive.

Unfortunately, there are numerous other factors in the faunal environment that also influence the effects of noise. These include predators, weather, changing prey/food base and ground-based disturbance, especially anthropogenic. This hinders the ability to define the real impact of noise on animals.

The only animal species studied in detail are humans, and studies are still continuing in this regard. These studies also indicate that there is considerable variation between individuals, highlighting the loss of sensitivity to higher frequencies as human's age. Sensitivity also varies with frequency with humans. Considering the variation in the sensitivity to frequencies and between individuals, this is likely similar with all faunal species. Some of these studies are repeated on animals, with behavioural hearing tests being able to define the hearing threshold range for some animals.

Only a few faunal (animal) species have been studied in a bit more detail so far, with the potential noise impact on marine animals most likely the most researched subject, with a few studies that discuss behavioural changes in other faunal species due to increased noises. Few studies indicate definitive levels where noises start to impact on animals, with most based on laboratory level research that subject animals to noise levels that are significantly higher than the noise levels these animals may experience in their environment (excluding the rare case where bats and avifauna fly extremely close to an anthropogenic noise, such as from a moving car or the blades of a wind turbine).

Domesticated Animals

It has been observed that most domesticated animals are generally not bothered by noise, excluding most impulsive noises.

Wildlife

Studies indicated that most animals adapt to noises, and would even return to a site after an initial disturbance, even if the noise is continuous. The more sensitive animals that might be impacted by noise would most likely relocate to a quieter area. Noise impacts are therefore very highly species dependent.

Avifauna

As with other terrestrial faunal species, noise (character of sound or change in level) will impact on avifauna (birds of a particular region and/or habitat). Anthropogenic noises result in physical damage to ears, increased stress, flight or flushing, changes in foraging and other behavioural reactions. Ortega (2012) summarized that additional responses (with ecological similar controls) include the avoidance of noisy areas, changes in reproductive success and changes in vocal communication. However, as with other faunal species, there are no guidelines to assess at which sound pressure level avifaunal will start to exhibit any response.

9.9.3 *Impact tables summarising the significance of impacts on noise during construction, operation and decommissioning (with and without mitigation)*

Construction Phase Impacts

Nature: *Daytime construction activities relating to the construction of access roads* Construction of roads during the day may increase ambient sound levels temporarily. Construction activities closer than 100m from the identified NSR could result in noise levels exceeding 55 dBA, higher than the IFC recommended noise limits for daytime residential use. Construction activities closer than 250m from the identified NSR could result in noise levels exceeding 45 dBA, higher than the daytime zone sound levels for a rural area. Considering the location of proposed access roads (to be constructed), NSR90 is located ±132m, with NSR47 is located ±247m from potential access road construction areas.		
	Without mitigation	**With mitigation**
Extent	Footprint (1) - The impacted area extends only as far as the activity, such as footprint occurring within the total site area.	Footprint (1) - The impacted area extends only as far as the activity, such as footprint occurring within the total site area.
Duration	Temporary (1) - The noise impact relating to road construction activities will be less than a year.	Temporary (1) - The noise impact relating to road construction activities will be less than a year.
Magnitude	High (8) - The construction and/or upgrading of access roads may raise the noise levels as high as 50 dBA (at NSR90).	High (8) - The construction and/or upgrading of access roads may raise the noise levels as high as 50 dBA (at NSR90).
Probability	Improbable (1) – It is improbable that the higher noise level and change in ambient sound levels will impact on the closest NSR.	Improbable (1) – It is improbable that the higher noise level and change in ambient sound levels will impact on the closest NSR.
Significance	**Low (10)**	**Low (10)**
Status (positive or negative)	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	Low	Low
Can impacts be mitigated?	N/A	
Mitigation:		

» Significance of the construction noise impact is low for the scenario as conceptualized and additional mitigation measures are not required.
Residual Impacts: Significance of noise from road construction activities will be low for the scenario as conceptualized.

Nature: *Daytime construction traffic passing noise sensitive receptors*

Various construction vehicles passing close to potential NSR may increase ambient sound levels and create disturbing noises for a portion of the construction period. Construction traffic passing within 50m from the identified NSR could result in noise levels exceeding 55dBA (depending on the speed and number of vehicles), higher than the IFC recommended noise limits for daytime residential use. Construction traffic may pass as close as 50m from NSR25, and within 60m from NSR 01, 26 and 63. Traffic noises will be clearly audible during passing and could change the ambient sound levels NSR staying within 100m from access routes.

	Without mitigation	**With mitigation**
Extent	Site (2) - The impact could affect the whole, or a significant portion of the footprint.	Site (2) - The impact could affect the whole, or a significant portion of the footprint.
Duration	Temporary (1) - The noise impact relating to road construction activities will be less than a year.	Temporary (1) - The noise impact relating to road construction activities will be less than a year.
Magnitude	Very High (10) – Construction traffic passing NSR staying close to the access roads may raise the noise levels as high as 55 dBA (at closest NSR).	Very High (10) – Construction traffic passing NSR staying close to the access roads may raise the noise levels as high as 55 dBA (at closest NSR).
Probability	Possible (2) - It is possible that the increased noise level and change in ambient sound levels will impact on the closest NSR.	Possible (2) - It is possible that the increased noise level and change in ambient sound levels will impact on the closest NSR.
Significance	**Low (26)**	**Low (26)**
Status (positive or negative)	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	Low	Low
Can impacts be mitigated?	N/A	

Mitigation:

» Significance of the construction noise impact is low for the scenario as conceptualized and additional mitigation measures are not required.

Residual Impacts:
Significance of noise from road construction activities will be low for the scenario as conceptualized.

Nature: *Daytime wind turbine construction activities*

Various construction activities (development of the hard standing areas, excavation and concreting of foundations and the erection of the wind turbines) taking place simultaneously during the day will increase ambient sound levels due to air-borne noise.

	Without mitigation	**With mitigation**
Extent	Site (2) - The noise impact would extent from the footprint, potentially as far as 1 000m.	Site (2) - The noise impact would extent from the footprint, potentially as far as 1 000m.
Duration	Short-term (2) - The noise impact relating to construction phase will last 1 – 5 years.	Short-term (2) - The noise impact relating to construction phase will last 1 – 5 years.

Magnitude	Moderate (6) – The construction of WTG may raise the noise levels as high as 49.4 dBA (at NSR47).	Moderate (6) – The construction of WTG may raise the noise levels as high as 49.4 dBA (at NSR47).
Probability	Probable (2) - It is improbable that the higher noise level and change in ambient sound levels will impact on the closest NSR.	Probable (2) - It is improbable that the higher noise level and change in ambient sound levels will impact on the closest NSR.
Significance	**Low (20)**	**Low (20)**
Status (positive or negative)	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	Low	Low
Can impacts be mitigated?	N/A	
Mitigation: » Significance of the construction noise impact is low for the scenario as conceptualized and additional mitigation measures are not required.		
Residual Impacts: Significance of noise from road construction activities will be low for the scenario as conceptualized.		

Nature: *Night-time wind turbine construction activities* Various construction activities (likely limited to the pouring of concrete as well as erection of WTG components) taking place simultaneously at night will increase ambient sound levels due to air-borne noise.		
	Without mitigation	**With mitigation**
Extent	Site (2) - The noise impact would extent from the footprint, potentially as far as 1 000m.	Site (2) - The noise impact would extent from the footprint, potentially as far as 1 000m.
Duration	Short-term (2) – The noise impact relating to construction phase will last 1 – 5 years.	Short-term (2) – The noise impact relating to construction phase will last 1 – 5 years.
Magnitude	High (8) – The construction of WTG may raise the noise levels as high as 49.4 dBA (at NSR47).	Moderate (6) – The construction of WTG may raise the noise levels as high as 49.4 dBA (at NSR47).
Probability	Likely (3) – It is likely that the increased noise level and change in ambient sound levels will impact on the closest NSR.	Possible (2) - It is likely that the increased noise level and change in ambient sound levels will impact on the closest NSR.
Significance	**Medium (36)**	**Low (20)**
Status (positive or negative)	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	Low	Low
Can impacts be mitigated?	Yes	
Mitigation: Significance of the construction noise impact is medium for the scenario as conceptualized and additional mitigation measures are required and recommended as follows: » If the structures located at NSR47 are used for residential purposes at the time of constructing the project, the resident(s) must be relocated, or the WTG located within 1 000m from these NSR should be moved further than 1 000m from these NSR. » The applicant should plan the night-time construction schedule that simultaneous activities are only required at one WTG location (located within 1 000m from an NSR). Other construction activities can continue, but should take place further than 1 000m from NSR.		

» The applicant should minimise active equipment at night, planning the completion of noisiest activities (such as pile driving, rock breaking and excavation) during the daytime period.
Residual Impacts: Significance of the construction noise impact is low for the scenario as conceptualized and additional mitigation measures are not required.

Operation Phase Impacts

Nature: *Daytime operation of WTG considering worst-case SPL*

Wind turbines operating simultaneously during the day. Increases in residual noise levels due to air-borne noise from the wind turbines. It is likely that the noise from the WTG will exceed the potential ambient sound levels (using a worst-case SPL of 109.2 dBA re 1 pW) and the worst-case noise levels from the WTG will be more than 45 dBA at NSR 40, 46 and 47.

Probability of a daytime noise impacting on an NSR is normally lower than with a night-time impact. It should be noted that noises from the WTG may be audible during the day but daytime noises are unlikely to be a disturbing noise.

	Without mitigation	**With mitigation**
Extent	Site (2) - The noise impact would extent from the footprint, potentially as far as 1 000m.	Site (2) - The noise impact would extent from the footprint, potentially as far as 1 000m.
Duration	Long-term (4) - There is a risk of a noise impact occurring during the life-time of the project, i.e., more than 20 years.	Long-term (4) - There is a risk of a noise impact occurring during the life-time of the project, i.e., more than 20 years.
Magnitude	High (8) – Worst-case noise rating levels may be as high as 50.9 dBA (at NSR47).	Moderate (6) - Daytime operational noise is expected to be audible during quiet periods at the closest houses.
Probability	Likely (3) - It is likely that the increased noise level and change in ambient sound levels will impact on NSR47.	Improbable (1) - It is improbable that the increased noise level and change in ambient sound levels will impact on the closest NSR.
Significance	**Medium (42)**	**Low (12)**
Status (positive or negative)	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	Low	Low
Can impacts be mitigated?	Yes	

Mitigation:

Significance of the operational noise impact is medium for the scenario as conceptualized and additional mitigation measures are required and recommended:

» If the structure located at NSR47 is used for residential purposes at the time of implementation of the wind farm, the resident(s) must be relocated, or the WTG located within 1,000m from NSR47 should be moved further than 1,000m from the NSR.

» Active noise monitoring (i.e., the measurement of noise levels at identified locations) is recommended throughout the operation phase. For a WTG with a SPL of 109.2 dBA (re 1 pW), ambient sound levels could be measured at NSR 7, 8, 13, 14, 15, 18, 24, 25, 26, 32, 40, 41, 42, 43, 46, 54 and 92 before the development of the wind energy facility, with the measurements repeated after the first year of operation. Should any of these locations not be used for residential purposes, measurements at these NSR would not be required.

» Should a reasonable and valid noise complaint be registered, the developer must investigate the noise complaint as per the guidelines in sub-section 12.1 and 12.2 of the noise impact assessment (**Appendix J**). Once-off noise measurements must be conducted at the location of the person that registered a valid and reasonable noise complaint. The measurement location should consider the direct surroundings to ensure that other sound sources cannot influence the reading. These measurement locations can be reduced accordingly if the NSRs are relocated or the dwellings are no longer used for residential purposes.

Residual Impacts: Significance of the daytime operational noise impact is low post-mitigation for the scenario as conceptualized and additional mitigation measures are not required.

Nature: *Night-time operation of WTG considering worst-case SPL*

Wind turbines operating simultaneously at night with increases in ambient sound levels due to air-borne noise from the WTG. It is likely that the noise from the WTG will exceed the potential ambient sound levels (using a worst-case SPL of 109.2 dBA re 1 pW) at a number of closest NSR between a wind speed of 4 and 12 m/s, and the worst-case noise levels from the WTG will be more than 45 dBA at a number of NSR. Noises from the WTG will be audible up to 2 000m at night.

	Without mitigation	**With mitigation**
Extent	Regional (3) - The noise impact could extent further than 1 000m from the WTG.	Regional (3) - The noise impact could extent further than 1 000m from the WTG.
Duration	Long-term (4) – There is a risk of a noise impact occurring during the life-time of the project, i.e., more than 20 years.	Long-term (4) – There is a risk of a noise impact occurring during the life-time of the project, i.e., more than 20 years.
Magnitude	High (8) – Worst-case noise rating levels may be as high as 50.9 dBA (at NSR47).	Low (4) - Daytime operational noises is expected to be audible during quiet periods at the closest houses.
Probability	Definite (5) - It is definite that the increased noise level will impact on NSR47.	Possible (2) - It is improbable that the increased noise level and change in ambient sound levels will impact on the closest NSR.
Significance	**High (75)**	**Low (24)**
Status (positive or negative)	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	Low	Low
Can impacts be mitigated?	Yes	

Mitigation:

Significance of the operational noise impact is high for the scenario as conceptualized and additional mitigation measures are required and recommended:

- NSR47 – If this structure is used for residential purposes at the time of implementation of the project the resident(s) must be relocated, or the WTG located within 1 000m from NSR47 should be moved further than 1 000m from the NSR.
- NSR 40 and 46 – If the structures at these locations are used for residential purposes at the time of implementation of the project:
  - the resident(s) could be relocated, or;
  - the WTG located within 1 000m from these NSR be moved further than 1 000m from these NSR; or
  - the applicant can select to use a quieter WTG (with a SPL less than 108.5 dBA as per the IEC 61400-14 certificate) within 1 500m from NSR 40 and 46.
- Active noise monitoring (i.e., the measurement of noise levels at identified locations) is recommended throughout the operation phase. For a WTG with a SPL of 109.2 dBA (re 1 pW), ambient sound levels could be measured at NSR 7, 8, 13, 14, 15, 18, 24, 25, 26, 32, 40, 41, 42, 43, 46, 54 and 92 before the development of the wind energy facility, with the measurements repeated after the first year of operation. Should any of these locations not be used for residential purposes, measurements at these NSR would not be required.
- Should a reasonable and valid noise complaint be registered, the developer must investigate the noise complaint as per the guidelines in sub-section 12.1 and 12.2 of the noise impact assessment. Once-off noise measurements must be conducted at the location of the person that registered a valid and reasonable noise complaint. The measurement location should consider the direct surroundings to ensure that other sound sources cannot influence

the reading. These measurement locations can be reduced accordingly if the NSRs are relocated or the dwellings are no longer used for residential purposes.
Residual Impacts: Significance of the daytime operational noise impact is low for the scenario as conceptualized and additional mitigation measures are not required.

Nature: *Night-time operation of WTG considering reported SPL*

Wind turbines operating simultaneously at night with increases in ambient sound levels due to air-borne noise from the WTG. It is likely that the noise from the WTG will exceed the potential ambient sound levels (using the reported SPL of 106.4 dBA re 1 pW) at a number of closest NSR between a wind speed of 4 and 12 m/s, and the noise levels from the WTG will be more than 45 dBA at NSR 47. Noises from the WTG will be audible up to 2 000m at night.

	Without mitigation	**With mitigation**
Extent	Regional (3) - The noise impact could extent further than 1 000m from the WTG.	Regional (3) - The noise impact could extent further than 1 000m from the WTG.
Duration	Long-term (4) – There is a risk of a noise impact occurring during the life-time of the project, i.e., more than 20 years.	Long-term (4) – There is a risk of a noise impact occurring during the life-time of the project, i.e., more than 20 years.
Magnitude	High (8) – Worst-case noise rating levels may be as high as 50.9 dBA (at NSR47).	Low (4) – Daytime operational noises is expected to be audible during quiet periods at the closest houses.
Probability	Definite (5) – It is definite that the increased noise level will impact on NSR47.	Possible (2) - It is improbable that the increased noise level and change in ambient sound levels will impact on the closest NSR.
Significance	**High (75)**	**Low (24)**
Status (positive or negative)	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	Low	Low
Can impacts be mitigated?	Yes	

Mitigation:

Significance of the operational noise impact is high for the scenario as conceptualized and additional mitigation measures are required and recommended:

- If the structure located at NSR47 is used for residential purposes at the time of implementation of the project the resident(s) must be relocated, or the WTG located within 1 000m from NSR47 should be moved further than 1 000m from the NSR.
- Active noise monitoring (i.e., the measurement of noise levels at identified locations) is recommended throughout the operation phase. For a WTG with a SPL of 109.2 dBA (re 1 pW), ambient sound levels could be measured at NSR 7, 8, 13, 14, 15, 18, 24, 25, 26, 32, 40, 41, 42, 43, 46, 54 and 92 before the development of the wind energy facility, with the measurements repeated after the first year of operation. Should any of these locations not be used for residential purposes, measurements at these NSRs would not be required.
- Should a reasonable and valid noise complaint be registered, the developer must investigate the noise complaint as per the guidelines in sub-section 12.1 and 12.2 of the noise impact assessment. Once-off noise measurements must be conducted at the location of the person that registered a valid and reasonable noise complaint. The measurement location should consider the direct surroundings to ensure that other sound sources cannot influence the reading. These measurement locations can be reduced accordingly if the NSRs are relocated or the dwellings are no longer used for residential purposes.

Residual Impacts:

Significance of the daytime operational noise impact is low post-mitigation for the scenario as conceptualized and additional mitigation measures are not required.

9.9.4 Overall Result

It was determined that the potential noise impacts, without mitigation, would be:

- of a **low significance** for the daytime construction of the access roads;
- of a **low significance** for the daytime construction traffic passing NSR;
- of a **low significance** for the daytime construction activities (hard standing areas, excavation and concreting of foundations and the erection of the wind turbines and other infrastructure);
- of a **medium significance** for the night-time construction activities. Mitigation is available to reduce the significance of the noise impact to **low**;
- of a **medium significance** for daytime operational activities (noises from wind turbines) when considering the worst-case SPL, with mitigation available to reduce the significance of the daytime noise impact to **low**;
- of a **high significance** for night-time operational activities (noises from wind turbines) when considering the worst-case SPL, with mitigation available to reduce the significance of the night-time noise impact to **low**; and
- of a **high significance** for night-time operational activities (noises from wind turbines) when considering the reported SPL, with mitigation available to reduce the significance of the night-time noise impact to **low**.

Most of the higher significance ratings relate to the potential noise impact on NSR 40, 46 and 47. While there may be a noise impact of high significance during the operational phase (medium for night-time construction activities), this can be reduced to a low significance with the implementation of the recommended mitigation measures. Because the total projected noise levels will exceed the rural rating levels, with the projected noise level exceeding 42 dBA, active noise monitoring is recommended. Once-off noise measurements are recommended at NSRs located within the 42 dBA noise level contour before the wind energy facility is developed, to be repeated once within a year after the wind energy facility is fully operational.

The applicant can reduce the noise levels to less than 45 dBA at all receptors (structures used for residential purposes) through the implementation of the recommended mitigation measures, and it is therefore recommended that the proposed Ummbila Emoyeni Wind Energy Facility and associated infrastructure project be authorized. The proposed layout (i.e., turbine placement) is considered to be acceptable from a noise perspective with the implementation of appropriate mitigation measures to ensure that the total noise levels are less than 45 dBA at all structures used for residential purposes.

It should be noted that the applicant must re-evaluate the noise impact:

- should the layout be revised where:
  - any WTG, located within 1 000 m from an identified and verified NSR, are moved closer to the NSR;
  - any new WTG are introduced within 1 500 m from an identified and verified NSR;
  - the number of WTG within 2 000 m from any identified and verified NSR are increased; and
- should the applicant make use of a wind turbine with a maximum SPL exceeding 109 dBA re 1 pW.

9.10. Assessment of Visual Impacts

Negative impacts on visual receptors will occur during the undertaking of construction activities and the operation of the Ummbila Emoyeni Wind Energy Facility. Potential impacts and the relative significance of the impacts are summarised below (refer to **Appendix K**).

9.10.1 Results of the Visual Impact Assessment

Site Sensitivity

The following sensitivities have been identified from a visual perspective (refer to **Figure 9.17**):

- Highly sensitive areas include:
  - Areas immediately surrounding settlement and homesteads development of which is likely to significantly change the character of views for residents. A 1000m buffer is proposed which should be sufficient to ensure that development does not totally dominate views. It is possible that receptors (owners /residents) have no concern regarding the development of these areas, in which case the sensitivity rating will reduce.
  - Corridors beside the main roads that could be affected including the N17, the R35, and the R39. This is deemed sensitive because development in this corridor is likely to be highly obvious to people travelling along the roads the proposed 500m corridor should be sufficient to ensure that development does not totally dominate views.

Note: The difference in the proposed buffer width reflects the relatively high importance of permanent views for residents from homesteads relative to transient views of travellers from roads.

- Medium sensitivity areas include:
  - Watercourses and a buffer of 250m either side of watercourses. These areas are proposed in order to protect these natural features within the proposed focus area.
- Low sensitivity areas include:
  - Valley side slopes the development of which is likely to make the project least obvious from surrounding areas. The fact that development may be focused on areas with relatively low sensitivity does not preclude the necessity for mitigation.

The elements associated with the proposed Ummbila Emoyeni Wind Energy Facility will be visible to varying degrees, with the proposed turbines visible over an extensive area. A key point to consider in terms of visual impacts is the potential for shadow flicker. Using internationally adopted guidelines will see the turbines set back approximately 2km (10x rotor diameter) from homesteads. This shadow flicker risk area is indicated on the sensitivity mapping (refer to **Figure 9.17**). A shadow flicker study has been undertaken to assess the impact of shadow flicker on homesteads located within the shadow flicker risk areas and will inform the final layout of the facility.

Normally, it would be recommended to keep development off ridgelines as this can make it more obvious over a distance. When dealing with wind turbines however, the height of the turbine can be critical in terms of performance and any potential visual benefit is marginal due to the height of turbine structures. Maintaining ridgelines free of ancillary infrastructure is however recommended. The directly affected landscape is neither protected nor is it rare so from a landscape perspective; therefore, there are no no-go areas from a visual perspective.

Considering the sensitivity map showing the visual sensitivities overlain on the indicative wind farm layout assessed in this EIA, the following can be noted:

- Three turbines are located within the high sensitivity area beside the N17.
- Two turbines are located within the high sensitivity area beside the R35.

- Two turbines are located in the high sensitivity area beside the R39.
- Approximately 95 turbines are located within the shadow flicker risk area (i.e. 2km (10x rotor diameter) from homesteads).
- Fourteen turbines are located within or on the edge of the 1 000m homestead buffer.

Whilst not un-attractive, the affected main roads are not scenic routes. They are also not important tourist routes. The more turbines that are located too close to these roads, however, the greater the view is dominated by the structures. It is also likely that moving turbines in a motorist's view could be a distraction from the road. Therefore, the turbines within the high sensitivity zone cannot be omitted on aesthetic grounds, but it is suggested that the Roads Authority review the proposed locations.

Views of wind turbines are enjoyed by a large proportion of the population who see them as elegant structures and an indication of progress towards clean energy. A proportion of the population also dislike views of wind turbines as they see them as spoiling views of rural areas. It is difficult to predict people's point of view. The sensitivity mapping is an indication of the areas within which wind turbines are likely to visually dominate. The decision as to whether or not to be happy in having a turbine structure close to a homestead is personal to the affected individuals. According to the visual impact assessment, one cannot disregard objections to wind energy infrastructure and cannot speculate as to the legitimacy thereof or motivation. It is however 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.

Zones of Theoretical Visibility

Zones of Theoretical Visibility (ZTV) are defined as "a map usually digitally produced showing areas of land within which a development is theoretically visible". ZVTs for the proposed development have been assessed using Global Mapper GIS.

The turbine layout ZTV assessment indicates the following:

- The proposed turbine field is likely to be visible over the majority of the 4km buffer (short distance) within which turbines are likely to be seen as prominent features.
- The proposed turbine field is likely to be visible over the majority of the 10km buffer (mid distance) within which turbines are likely to be seen as relatively prominent features.
- The proposed turbine field is only likely to be visible over higher sections of the landscape that are mainly comprised of minor ridgelines within the 30km buffer (long distance). Within this distance, turbines will only be prominent in clear visibility and when visible will be seen as part of the wider landscape.
- Outside the 30km buffer, turbines are unlikely to be seen as being prominent in the landscape in any conditions.
- There are a large number of homesteads and local unsurfaced roads within the 10km buffer from which turbines could be prominent. This may be locally mitigated by stands of trees particularly in the vicinity of farmsteads.
- It is likely that the turbine field will be prominent within views from the edges of the settlements facing the project.
- The turbine field is likely to be prominent from the Silver Waters Private Nature Reserve.
- The turbine field may be visible under clear conditions from sections of the Rietvlei Private Nature Reserve but it will be seen as part of the wider landscape.

The onsite substation layout ZTV assessment indicates the following:

- None of the proposed on-site substations are likely to be highly visible.

- Each of the proposed substations will have a homestead located at approximately 1km from which the substation will be visible. In each case, existing vegetation should play a significant role in largely screening the substations from the homesteads.
- The proposed on-site substations may be visible intermittently to main roads, however, they are unlikely to be highly obvious.

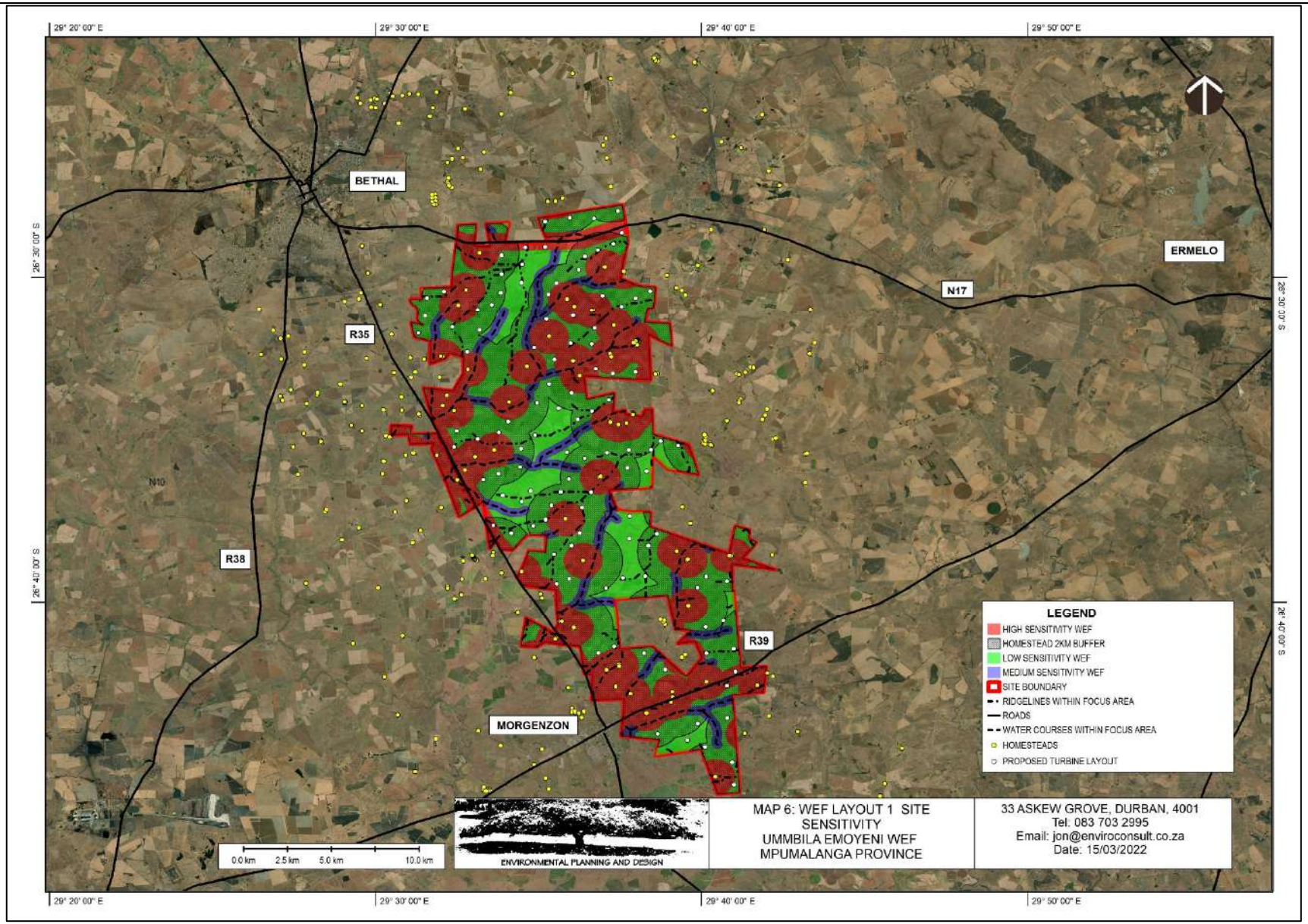


Figure 9.17: Visual sensitivities identified within the project site

9.10.2 Description of Visual Impacts

The following list of possible impacts have been identified;

- The proposed development could change the character and sense of place of the landscape setting;
- The proposed development could change the character of the landscape as seen from the local roads;
- The proposed development could change the character of the landscape as seen from local agricultural homesteads;
- The proposed development could change the character of the landscape as seen from private nature reserves;
- Shadow Flicker impacts; and
- Lighting impacts.

9.10.3 Impact table summarising the significance of visual impacts during construction, operation and decommissioning (with and without mitigation)

Construction, Operation and Decommissioning Phase Impacts

Nature: *The proposed development could change the character and sense of place of the landscape setting (Landscape Change)*

The proposed wind energy facility is located within a landscape area with an overriding rural character. The character of the affected area is relatively typical within the region. Other large scale industrial operations including mining operations and power stations are relatively obvious in the region. Whilst the proposed project will create a new large scale industrial node within the agricultural landscape, this is not entirely out of character with the broader region.

It will however be a significant local character change.

	Without mitigation	**With mitigation**
Extent	Local (2)	Local (2)
Duration	Long term (4)	Long term (4)
Magnitude	High (8)	Moderate (6)
Probability	Definite (5)	Highly Probable (4)
Significance	**High (70)**	**Medium (48)**
Status (positive or negative)	Some people find the sight of turbines as visually interesting, others see the sight of turbines as a major benefit as it is evidence of much needed power generation. However some people particularly those who may be dependent on maintaining rural views for tourism are likely to see the change in a negative light. In terms of character change the turbines will detract from the rural character. Negative	Due to the fact that the project is generally in keeping with regional landscape character it is unlikely to be seen as negative from within the region Neutral.
Reversibility	High	High
Irreplaceable loss of resources?	The proposed development can be dismantled and removed at the end of the operational phase. There will therefore be **no irreplaceable loss**. However, given the likely long term	**No irreplaceable loss**

	nature of the project, it is likely that a proportion of stakeholders will view the loss of view as irreplaceable.	
Can impacts be mitigated?	Yes	

Mitigation/Management:

Planning:

» Relocate turbines located in critical character areas to less sensitive areas.
» Minimise disturbance of the land beneath the turbine layout to ensure that associated infrastructure is sited in such a way that it minimises visual impact.
» Ensure that non reflective finishes are used on turbines, particularly blades.

Operations:

» Maintain current agricultural land uses.

Decommissioning:

» Remove infrastructure not required for the post-decommissioning use of the site.
» Rehabilitate and monitor areas for vegetation cover post-decommissioning and implement remedial actions.

Residual Impacts:

The residual risk relates to loss of natural vegetation cover being obvious on decommissioning of the proposed project. It is therefore critical that effective rehabilitation is undertaken.

Nature: *The proposed development could change the character of the landscape as seen from local main roads*

The N17, the R35 and the R39 are the main roads that will be particularly impacted within 4km of the proposed turbines. All three of these roads pass through the turbine field and so some sections will have turbines located on both sides of the road. All three roads will also have extensive views over the turbine field and will have numerous turbines within 4km which means that they will be prominent features. All three roads also have turbines within 500m of the main carriageway. These are likely to be visually imposing. All other affected roads generally fall in the long-distance category (10-30km distance). The impact is likely to consist of occasional views of the facility for motorists as they travel over the undulating landform. Views will therefore be intermittent, only prominent in clear visibility and will be seen as part of the wider landscape.

	Without mitigation	**With mitigation**
Extent	Main Roads within 4km Site and immediate surroundings (2) Main Roads within 10km Site and immediate surroundings (2) Main Roads within 30km Region (3)	Main Roads within 4km Site and immediate surroundings (2) Main Roads within 10km Site and immediate surroundings (2) Main Roads within 30km Region (3)
Duration	Long term (4)	Long term (4)
Magnitude	Main Roads within 4km - High (8) Main Roads within 10km - Low (4) Main Roads within 30km - Minor (2)	Main Roads within 4km - Moderate to High (7) Main Roads within 10km - Minor to Low (3) Main Roads within 30km - Minor to Small (1)
Probability	Main Roads within 4km - Definite (5) Main Roads within 10km - Probable (3) Main Roads within 30km – Improbable (2)	Main Roads within 4km - Definite (5) Main Roads within 10km - Probable (3) Main Roads within 30km - Improbable (2)

Significance	**Main Roads within 4km - High (70)** **Main Roads within 10km - Medium (30)** **Main Roads within 30km - Low (18)**	**Main Roads within 4km - High (65)** **Main Roads within 10km - Low (27)** **Main Roads within 30km - Low (16)**
Status (positive or negative)	Some people find the sight of turbines as visually interesting, others see the sight of turbines as a major benefit as it is evidence of much needed power generation. However, some people particularly those who may be dependent on maintaining rural views for tourism are likely to see the change in a negative light. Positive - Negative	Positive - Negative
Reversibility	High	High
Irreplaceable loss of resources?	The proposed development can be dismantled and removed at the end of the operational phase. There will therefore be no irreplaceable loss. However, given the likely long term nature of the project, it is likely that a proportion of stakeholders will view the loss of view as irreplaceable.	No irreplaceable loss.
Can impacts be mitigated?	Yes	

Mitigation/Management:

Planning:

» Relocate turbines within 500m of main roads.
» Minimise disturbance of the land beneath the turbine layout to ensure that associated infrastructure is sited in such a way that it minimises visual impact.
» Ensure that non reflective finishes are used on turbines, particularly blades.

Operations:

» Maintain current agricultural land uses.

Decommissioning:

» Remove infrastructure not required for the post-decommissioning use of the site.
» Rehabilitate and monitor areas for vegetation cover post-decommissioning and implement remedial actions.

Residual Impacts:

The residual risk relates to loss of natural vegetation cover being obvious on decommissioning of the proposed project. It is therefore critical that effective rehabilitation is undertaken.

Nature: *The proposed development could change the character of the landscape as seen from local minor unsurfaced roads*

There are several unsurfaced roads that run close to and through the proposed turbine field. All of these roads are within 4km of the proposed turbines which means that the turbine structures are likely to be prominent features.

Whilst some sections of roads are important for local recreation and tourism, the majority of road users are likely to be more interested in agricultural productivity rather than aesthetics.

The relatively low numbers of vehicles that use these roads is also likely to make the visual impacts less significant.

	Without mitigation	**With mitigation**

Extent	Roads within 4km - Site and immediate surroundings (2) Roads within 10km - Site and immediate surroundings (2) Roads within 30km – Region (3)	Roads within 4km - Site and immediate surroundings (2) Roads within 10km - Site and immediate surroundings (2) Roads within 30km - Region (3)
Duration	Long term - (4)	Long term - (4)
Magnitude	Roads within 4km - Moderate to High (7) Roads within 10km - Low (4) Roads within 30km - Minor to Low (3)	Roads within 4km - Moderate (6) Roads within 10km Minor to Low (3) Roads within 30km - Minor to Small (1)
Probability	Roads within 4km - Definite (5) Roads within 10km - Probable (3) Roads within 30km - Improbable (2)	Roads within 4km – Definite (5) Roads within 10km - Probable (3) Roads within 30km - Improbable (2)
Significance	**Roads within 4km - High (65)** **Roads within 10km - Medium (30)** **Roads within 30km - Low (20)**	**Roads within 4km - Medium (60)** **Roads within 10km - Medium (27)** **Roads within 30km - Low (16)**
Status	Some people find the sight of turbines as visually interesting, others see the sight of turbines as a major benefit as it is evidence of much needed power generation. However some people particularly those who may be dependent on maintaining rural views for tourism are likely to see the change in a negative light. Positive - Negative	Positive - Negative
Reversibility	High	High
Irreplaceable loss	The proposed development can be dismantled and removed at the end of the operational phase. There will therefore be no irreplaceable loss. However, given the likely long term nature of the project, it is likely that a proportion of stakeholders will view the loss of view as irreplaceable.	No irreplaceable loss.
Can impacts be mitigated?	Yes	

Mitigation / Management:

Planning:

» Minimise disturbance of the land beneath the turbine layout to ensure that associated infrastructure is sited in such a way that it minimises visual impact;
» Ensure that non reflective finishes are used on turbines, particularly blades.

Operations:

» Maintain current agricultural land uses.

Decommissioning:

» Remove infrastructure not required for the post-decommissioning use of the site; » Rehabilitate and monitor areas for vegetation cover post-decommissioning and implement remedial actions.
Residual Impacts: The residual risk relates to loss of natural vegetation cover being obvious on decommissioning of the proposed project. It is therefore critical that effective rehabilitation is undertaken.

Nature: *The proposed development could change the character of the landscape as seen from homesteads*

There are a large number of homesteads within the proposed development area and within the surrounding rural landscape. These are largely comprised of farmsteads and agricultural workers houses.

The applicant has allowed a buffer of 1km between any homestead and the closest turbine which should ensure that the view of turbines does not totally dominate views. Most farmsteads are also set amongst large trees which will help to screen views of turbines. Impacts are also likely to be mitigated by the fact that landowners are likely to benefit financially from the proposed project and the majority of residents are likely to be more interested in productivity of the land rather than aesthetics.

	Without mitigation	**With mitigation**
Extent	Homesteads within 4km - Site and immediate surroundings (2) Roads within 10km - Site and immediate surroundings (2) Roads within 30km - Region (3)	Homesteads within 4km - Site and immediate surroundings (2) Roads within 10km - Site and immediate surroundings (2) Roads within 30km - Region (3)
Duration	Long term (4)	Long term (4)
Magnitude	Homesteads within 4km - Moderate to High (7) Homesteads within 10km - Low (4) Homesteads within 30km - Minor to Low (3)	Homesteads within 4km - Moderate (6) Homesteads within 10km - Minor to Low (3) Homesteads within 30km - Minor to Small (1)
Probability	Homesteads within 4km - Definite (5) Homesteads within 10km - Probable (3) Homesteads within 30km - Improbable (2)	Homesteads within 4km - Definite (5) Homesteads within 10km – Probable (3) Homesteads within 30km - Improbable (2)
Significance	**Homesteads within 4km - High (65)** **Homesteads within 10km - Medium (30)** **Homesteads within 30km - Low (20)**	**Homesteads within 4km - Medium (60)** **Homesteads within 10km - Low (27)** **Homesteads within 30km - Low (16)**
Status	Some people find the sight of turbines as visually interesting, others see the sight of turbines as a major benefit as it is evidence of much needed power generation. However some people particularly those who may be dependent on maintaining rural views for	Positive - Negative

	tourism are likely to see the change in a negative light. Positive - Negative	
Reversibility	High	High
Irreplaceable loss	The proposed development can be dismantled and removed at the end of the operational phase. There will therefore be no irreplaceable loss. However, given the likely long term nature of the project, it is likely that a proportion of stakeholders will view the loss of view as irreplaceable.	No irreplaceable loss.
Can impacts be mitigated?	Yes	

Mitigation / Management:

Planning:

» Relocate turbines located in critical character areas to less sensitive areas.
» Minimise disturbance of the land beneath the turbine layout to ensure that associated infrastructure is sited in such a way that it minimises visual impact.
» Ensure that non reflective finishes are used on turbines, particularly blades.

Operations:

» Maintain current agricultural land uses.

Decommissioning:

» Remove infrastructure not required for the post-decommissioning use of the site.
» Rehabilitate and monitor areas for vegetation cover post-decommissioning and implement remedial actions.

Residual Impacts:

The residual risk relates to loss of natural vegetation cover being obvious on decommissioning of the proposed project. It is therefore critical that effective rehabilitation is undertaken.

Nature: *The proposed development could change the character of the landscape as seen from Nature Reserves*

There are two nature reserves that are most likely to be affected including:

» The Silver Waters Nature Reserve which is a private facility and is primarily a local tourism facility offering accommodation in tranquil surroundings around a large dam; and
» The Rietvlei Nature Reserve which is also a private nature reserve

Silver Waters is located within the proposed turbine field. The closest turbine is approximately 1.4km from the closest accommodation unit within the reserve. Rietvlei is located approximately 15.7km from the closest turbine. The analysis has indicated that whilst existing vegetation will screen the majority of the turbine field from Silver Waters, a number of turbines will be highly conspicuous from the reserve (VP 2). The analysis has also indicated that turbines are likely to be visible from sections of Rietvlei but only prominent in clear visibility (VP 6).

	Without mitigation	**With mitigation**
Extent	Silver Waters - Site and immediate surroundings (2) Rietvlei - Region (3)	Silver Waters - Site and immediate surroundings (2) Rietvlei - Region (3)
Duration	Long term (4)	Long term (4)
Magnitude	Silver Waters - High (8) Rietvlei - Low to Minor (3)	Silver Waters - Moderate to Low (5) Rietvlei - Minor to Small (1)

Probability	Silver Waters - Definite (5) Rietvlei - Probable (3)	Silver Waters - Probable (3) Rietvlei - Improbable (2)
Significance	**Silver Waters – High (70)** **Rietvlei - Medium (30)**	**Silver Waters - Medium (33)** **Rietvlei - Low (16)**
Status	Because the proposed development is unlikely to be visually obvious, it is unlikely to be seen as a negative impact. Neutral	Neutral
Reversibility	High	High
Irreplaceable loss	The proposed development can be dismantled and removed at the end of the operational phase. There will therefore be no irreplaceable loss.	No irreplaceable loss.
Can impacts be mitigated?	Yes	

Mitigation / Management:

Planning

» Relocation of closest turbines to Silver Waters.
» Minimise disturbance of the land beneath the turbine layout to ensure that associated infrastructure is sited in such a way that it minimises visual impact.
» Ensure that non reflective finishes are used on turbines, particularly blades.

Operations:

» Maintain current agricultural land uses.

Decommissioning:

» Remove infrastructure not required for the post-decommissioning use of the site.
» Rehabilitate and monitor areas for vegetation cover post-decommissioning and implement remedial actions.

Residual Impacts:

The residual risk relates to loss of natural vegetation cover being obvious on decommissioning of the proposed project. It is therefore critical that effective rehabilitation is undertaken.

Nature: *Shadow Flicker*

The term "shadow flicker" refers to the flickering effect caused when rotating wind turbine blades periodically cast shadows over neighbouring properties as they turn, through constrained openings such as windows. The analysis has shown that a number of farmsteads could be affected by shadow cast by the turbine structures. If buildings are in shadow during clear weather when the turbine is turning, then they are likely to be affected by shadow flicker.

A shadow flicker study has been undertaken (Appendix T). As long as the mitigation measures recommended in this study are undertaken, the impact of shadow flicker is likely to have a low significance.

Nature: *The potential visual impact of aircraft warning, operational, safety and security lighting of the facility at night*

The environment surrounding the proposed facility is not totally dark. Existing lighting is typically comprised of:

» Bright lighting areas associated with existing largescale industrial operations that are generally located in excess of 25km away.
» Bright lighting areas associated with settlements including Bethal, Morgonzon and Ermelo.
» Occasional low intensity lighting associated with homesteads and farms in the surrounding rural area.

Lighting associated with the facility is likely to include:
» Security and operational lighting at key installation areas such as the control room and on-site substations; and
» Aircraft warning lights located on the nacelle of each turbine.

From experience of other similar projects, aircraft warning lighting is typically comprised of red lights with an intensity and performance requirement range of up to 4 nautical miles which is approximately 8km. Subject to weather conditions, lighting at night may be visible at a greater distance but the performance is likely to deteriorate significantly with distance. Security and operational lighting could be comprised of high mast flood lighting which not only lights necessary areas on the site but also sheds light on large surrounding areas. Aircraft warning lighting is a requirement of the South African Civil Aviation Authority. Security and operational lighting are practical requirements needed to secure, maintain and run the facility. Aircraft warning lights therefore are a legal requirement that will create additional lighting that is likely to be visible over a limited area and is unlikely to cause nuisance. However, security and operational lighting has the potential to be visible over a large area and create nuisance for local residents. Therefore, mitigation of impacts of operational and security lighting is only likely to be possible and likely to be most effective.

	Without mitigation	**With mitigation**
Extent	Aircraft warning lighting - Site and immediate surroundings (2) Security lighting - Region (3)	Aircraft warning lighting - Site and immediate surroundings (2) Security lighting - Site and immediate surroundings (2)
Duration	Long term (4)	Long term (4)
Magnitude	Aircraft warning lighting - Minor to Small (1) Security lighting – Moderate (6)	Aircraft warning lighting - Minor to Small (1) Security lighting - Minor to Low (3)
Probability	Aircraft warning lighting - Probable (3) Security lighting - Definite (5)	Aircraft warning lighting - Probable (3) Security lighting - Improbable (2)
Significance	**Aircraft warning lighting - Low (21)** **Security lighting - High (65)**	**Aircraft warning lighting - Low (21)** **Security lighting - Low (18)**
Status	Aircraft warning lighting - Given the limited range as well as there being no nuisance created, this is unlikely to be seen as a negative impact. Neutral Security Lighting - This has the potential to create a new area of intense lighting. It also has the potential to create nuisance for local residents. Unmitigated it is therefore likely to be seen as a negative impact. Negative.	Aircraft warning lighting - Neutral Security Lighting - Neutral
Irreplaceable loss	No irreplaceable loss	No irreplaceable loss
Can impacts be mitigated?	Aircraft warning lighting – No Security and operational lighting - Yes	

Mitigation / Management:

Planning:
» Careful design of security and operational lighting.
» Ensure that operational lighting is only activated, when necessary, the splitting of circuits and use of movement sensors should be considered.

» Ensure that security lighting is only activated, when necessary, the use of movement sensors and / or infra-red systems should be considered. » No high mast lighting should be used. Operation: » Ensure that the intention of the original lighting design is maintained throughout the operational phase. Decommissioning: » Ensure that all lighting facilities are removed.
Residual Impacts: There are no residual risks

9.10.4 Overall Result

It was determined that the potential visual impacts would include:

- The impact on the landscape in the area was assessed as having a local impact of medium significance and a regional impact of low significance after mitigation.
- The impact relating to views from local main roads was assessed as having a medium significance within 10km and of low significance within 30km after mitigation.
- The impact relating to views from local unsurfaced minor roads was assessed as having a medium significance within 10km and of low significance within 30km after mitigation.
- The impact relating to views from local homesteads was assessed as having a Medium Negative Significance without mitigation and a Low Significance after mitigation.
- The impact relating to views from private nature reserves was assessed as having a medium significance from Silver Waters and low significance from Rietvlei.
- The impact relating to shadow flicker will be of low significance with appropriate mitigation.
- The impact relating to lighting (both aircraft warning lighting and security and operational lighting) was assessed as likely to have low significance with mitigation.

The proposed project will generally result in landscape and visual impacts of low to high significance. Subject to mitigation measures being undertaken, particularly the necessary shadow flicker study and the recommended mitigation measures, from a Landscape and Visual Impact perspective, it is the specialist's opinion that there is no reason why the proposed development should not be authorised.

9.11. Assessment of Socio-Economic Impacts

Potential social impacts and the relative significance of the impacts associated with the development of the Ummbila Emoyeni Wind Energy Facility are summarised below (refer to **Appendix L**).

9.11.1 Results of the Socio-Economic Impact Assessment

The development of renewable energy is strongly supported at a national, provincial, and local level. The development of and investment in renewable energy is supported by the National Development Plan (NDP), New Growth Path Framework and National Infrastructure Plan, which all refer to and support renewable energy. The Mpumalanga Economic Growth & Development Path, the Gert Sibande District Municipality Integrated Development Plan IDP)and the IDPs for the Govan Mbeki, Lekwa and Msukaligwa local municipalities also support the development of renewable energy. The development of the proposed wind farm is therefore supported by key policy and planning documents.

9.11.2 Description of Socio-Economic Impacts

Impacts are expected to occur with the development of the Ummbila Emoyeni Wind Energy Facility during the construction, operation and decommissioning phases. Both positive and negative impacts are identified and assessed.

Impacts during construction include:
» Impact on production.
» Impact on the Gross Domestic Product (GDP).
» Impact on employment creation.
» Skills development.
» Household income and standard living.
» Temporary increase in government revenue.
» Change in sense of place.
» Safety and security.
» Agricultural operations.
» Influx of people.
» Daily movement patterns.

Impacts during the operation phase include:
» Impact on production.
» Impact on the GDP.
» Employment creation.
» Household income and standard of living.
» Increase in government revenue.
» Rental revenue for landowners.
» Improvement in energy sector generation.
» Visual and sense of place impacts.
» Impacts on agricultural operations.

9.11.3 Impact tables summarising the significance of socio-economic impacts during construction, operation and decommissioning (with and without mitigation measures)

Construction Phase Impacts

Nature: *Expenditure associated with the construction of the proposed 900MW Wind Farm will impact on the production of the local economy* The proposed Wind Energy Facility will cost R 10 billion (in total, R2 billion each) (2022 prices) to establish. This will equate to a total impact of R 40,7 billion (direct, indirect, and induced) on production/new business sales in the country. The localised expenditure on the project will stimulate the local and national economies albeit for a temporary period of 24 months during construction.		
	Without enhancement	**With enhancement**
Extent	National (4)	National (4)
Duration	Short-term (1)	Short-term (1)
Magnitude	High (8)	High (8)
Probability	Definite (5)	Definite (5)
Significance	**High (65)**	**High (65)**

Status (positive or negative)	Positive	Positive
Reversibility	Medium	Medium
Irreplaceable loss of resources?	No	No
Can impacts be enhanced?	Yes (enhance)	Yes
Enhancement: » The project developer should use locally sourced inputs where feasible in order to maximize the benefit to the local economy. » Sub-contracting of local construction companies to occur as far as possible for the construction of facilities.		
Residual Impact: Short term Economic injection into the local and regional economy.		

Nature: *Temporary increase in country's GDP due to capital expenditure during the construction period*

It is estimated that the project will increase the GDP directly in the country by R 2,8 billion in 2022 prices, which will translate into a total impact of R 11,6 billion (direct, indirect, and induced) of Gross Domestic Product (GDP). These effects will take place for the duration of construction.

The greatest effects on production and GDP stimulated during construction activities will be created through the multiplier effects, specifically through a combination of production and consumption induced effects. The former refers to the impact generated along backwards linkages when the project creates demand for goods and services required for construction and subsequently stimulates the business sales of the suppliers of inputs that are required to produce these goods and services. The latter refers to the effects of household spending which is derived from an increase in salaries and wages directly and indirectly stimulated by the project's expenditure.

Sectors and industries that will experience the greatest stimulus from this expenditure include:
» Basic metals, structural metal products and other fabricated metal products industries
» Trade
» Insurance
» Transport services
» Electrical machinery and apparatus

	Without enhancement	**With enhancement**
Extent	National (4)	National (4)
Duration	Short-term (1)	Short-term (1)
Magnitude	High (8)	High (8)
Probability	Definite (5)	Definite (5)
Significance	**High (65)**	**High (65)**
Status (positive or negative)	Positive	Positive
Reversibility	Medium	Medium
Irreplaceable loss of resources?	No	No
Can impacts be enhanced?	Yes (enhance)	Yes
Enhancement: » The project developer is to use locally sourced inputs where feasible in order to maximize the benefit to the economy.		
Residual Impact: Short term Economic injection into the local and regional economy.		

Nature: *The construction of the 900MW Wind Farm will positively impact the community and beyond by creating a number of job opportunities (albeit temporary)*

The construction of the facility will create 2 417 Full Time Equivalent (FTE) employment positions over the course of the development. The total number of jobs that will be created is estimated to 9 840 (including direct, indirect and induced). Furthermore, if most of the local staff comes from the Local Municipality it will have a positive effect on local unemployment.

Beyond the direct employment opportunities that will be created by the project during the construction phase the development will also have a positive spin-off effect on the employment situation in other sectors of the national and local economies. Through the procurement of local goods (i.e., consumption induced effects) the project will support an estimated total of 4 220 FTE employment positions (indirect). Most of these positions will be in sectors such as construction, business services and trade. The expenditure on the project outside of the local economies will also have a positive effect on employment creation, albeit for a temporary period of 24 months (per phase).

Through the production and consumption induced impacts the project is envisioned to create an estimated additional 3 203 FTE employment (induced) positions. Given that a significant portion of the multiplier effects will be generated through backward linkages, more than half of these FTE employment positions will be created along the supply chain and amongst industries providing inputs to the businesses in the supply chain. Throughout the construction phase it is recommended that the developer encourage the EPC contractor to fill as many local positions as possible using labour from within the Local Municipality rather than from outside of the municipal boundaries.

	Without enhancement	**With enhancement**
Extent	Regional (3)	Regional (3)
Duration	Short-term (1)	Short-term (1)
Magnitude	High (8)	High (8)
Probability	Definite (5)	Definite (5)
Significance	**Medium (60)**	**Medium (60)**
Status (positive or negative)	Positive	Positive
Reversibility	Medium	Medium
Irreplaceable loss of resources?	No	No
Can impacts be enhanced?	Yes (enhance)	Yes

Enhancement:

- Organise local community meetings to advise the local labour on the project that is planned to be established and the jobs that can potentially be applied for.
- Where feasible, effort must be made to employ locally in order to create maximum benefit for the communities.

Residual Impact:
No residual impacts are applicable.

Nature: *Employees will develop and enhance skills thereby increasing experience and knowledge*

The construction of the proposed facility is likely to have a positive impact on the skills development in South Africa. During the turbine component assembly and tower manufacturing period which is included as part of the construction phase and is planned to be conducted in Mpumalanga, it is likely that foreign technical experts will be involved. This will present an opportunity for skills and knowledge transfer between these technical experts and local manufacturers. It is also expected that the construction staff involved in the project will gain knowledge and experience in respect of the development of wind energy facilities.

This will be highly beneficial given South Africa's target of generating 17 742 MW from wind energy by 2030 (Department Energy, 2011). More skilled local construction staff would most likely also lower the cost of future wind projects in the province. In addition to the direct effects of the project on skills development in the country and the local economy, the project could contribute to the development of the local research and development (R&D) and manufacturing industries associated with wind technology. This could be achieved through partnerships with the

University of Mpumalanga (situated in the Mbombela Local Municipality). Partnerships of this nature could further enhance the development of new skills and expertise.		
	Without enhancement	**With enhancement**
Extent	Regional (3)	Regional (3)
Duration	Permanent (5)	Permanent (5)
Magnitude	Low (4)	Moderate (5)
Probability	Definite (5)	Definite (5)
Significance	**Medium (60)**	**High (65)**
Status (positive or negative)	Positive	Positive
Reversibility	Low	Low
Irreplaceable loss of resources?	No	No
Can impacts be enhanced?	Yes (enhance)	Yes
Enhancement: » In order to maximise the positive impact, it is suggested that the project company provide training courses for employees where feasible to ensure that employees gain as much as possible from the work experience. » Facilitate the transfer of knowledge between experienced employees and the staff. » Perform a skills audit to determine the potential skills that could be sourced in the area.		
Residual Impact: Skills developed during the project can be utilised in future.		

Nature: *Employed individuals will increase the income of their respective households and thereby experience an improvement in their standard of living*

The proposed Project will create an estimated total of 9 840 South African based FTE employment positions during construction generating R 5,5 billion of revenue for the affected households in the country through direct, indirect, and induced effects. Of this figure R 1,3 billion will be paid out in the form of salaries and wages to those individuals directly employed during the construction phase. The remaining R 4,1 billion in households' earnings will be generated through indirect and induced effects resulting from project expenditure. Although temporary, this increase in household earnings will have a positive effect on the standard of living for these households. This is especially applicable to the households benefitting from the project that reside in the Local Municipality and broader Mpumalanga.

	Without enhancement	**With enhancement**
Extent	Local (2)	Local (2)
Duration	Short-term (1)	Short-term (1)
Magnitude	High (8)	High (8)
Probability	Definite (5)	Definite (5)
Significance	**Medium (55)**	**Medium (55)**
Status (positive or negative)	Positive	Positive
Reversibility	Medium	Medium
Irreplaceable loss of resources?	No	No
Can impacts be enhanced?	Yes (enhance)	Yes
Enhancement: » Local employment will benefit local households and the local area.		
Residual Impacts: No residual impacts are applicable.		

Nature: *The investment in the facility will generate revenue for the government during the construction period through a combination of personal income tax, VAT, companies' tax etc*

The investment in the facility will generate revenue for the government during the construction period through a combination of personal income tax, VAT, companies' tax etc. Additional government revenue will also be earned through corporate income tax, however since the gross operating surplus of the EPC contractor employed to construct the facility is not known, an estimate of the overall corporate income tax value is not possible at this stage. Government earnings will be distributed by national government to cover public spending which includes amongst others the provision and maintenance of transport infrastructure, health, and education services as well as other public goods.		
	Without enhancement	**With enhancement**
Extent	Local (2)	N/A
Duration	Short-term (1)	N/A
Magnitude	High (8)	N/A
Probability	Highly probable (4)	N/A
Significance	**Medium (44)**	N/A
Status (positive or negative)	Positive	N/A
Reversibility	Medium	N/A
Irreplaceable loss of resources?	No	N/A
Can impacts be enhanced?	N/A	N/A
Enhancement: » No enhancement measures are required.		
Residual Impacts: No residual impacts are applicable.		

Nature: *Sense of place impacts (visual, noise and dust)*		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Short duration (1)	Short duration (1)
Magnitude	Moderate (6)	Low (6)
Probability	Definite (5)	Highly probable (4)
Significance	**Medium (40)**	**Medium (32)**
Status (positive or negative)	Negative	Negative
Reversibility	Medium	Medium
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	Yes
Mitigation: » Ensure proper health and safety plans in place during the construction period to ensure safety on and around site during construction » Install screens around the construction site to reduce the visual impact of construction on surrounding properties » Site watering (or use of appropriate dust suppressant) from time to time to reduce dust emitting from the construction site		
Residual Impacts: No residual impacts are applicable.		

Nature: *The in-migration of job seekers to the area could be perceived to result in increased criminal activity* The perception exists from the landowners that an influx of jobseekers, and / or construction workers to an area is a contributor to increased criminal activities in an area, such as increased safety and security risk for neighbouring properties and damage to property, increased risk of veld fire, stock theft, and crime etc. It is confirmed by the developer that patrols will be put in place to ensure the safety of the infrastructure and the household where the Project will be located.

	Without mitigation	With mitigation
Extent	Local (1)	Local (1)
Duration	Short duration (1)	Short duration (1)
Magnitude	Moderate (6)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	**Low (24)**	**Low (18)**
Status (positive or negative)	Negative	Negative
Reversibility	Medium	Medium
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	Yes

Mitigation:

» Have a detailed consultation and communication plan with neighbouring property owners to keep them informed with regards to construction progress, issues and potential dangers
» Ensure proper health and safety plans in place during the construction period to ensure safety on and around site during construction, including fencing of the property and site access restriction

Residual Impacts:
A minimal amount of migrant labour will be employed by the proposed project and remain in the area.

Nature: *Loss of agricultural space*

As construction begins at the proposed site, disturbances will likely be minimal. The presence of construction machinery, increased traffic to and from the site (transporting staff, equipment, and material) and staff on or near the site will likely be the largest disturbances.

The longer construction continues, the greater the disturbances will likely be. As the turbines and infrastructure are erected there is likely to be an increased disturbance as turbines and structures become increasingly visible in the surrounding area. Once construction is completed the disturbances associated with the vehicular traffic, equipment and staff will be reduced and the remaining disturbance will be that of the wind farm itself. According to the landowner's surveys they indicated that some agricultural land will be lost, interference with agricultural activities (especially large implements) and aerial spraying will be the negative influences, as well as reconstruction of animal camps and access roads, however, they indicated that they are not sure on the amount and which infrastructure will be located on their properties. Thus, the initial impact on the agricultural operations will be minor. This will be confirmed by the agricultural assessment.

	Without mitigation	With mitigation
Extent	Local (1)	Local (1)
Duration	Short duration (1)	Short duration (1)
Magnitude	Moderate (6)	Low (4)
Probability	Definite (5)	Definite (5)
Significance	**Medium (40)**	**Medium (30)**
Status (positive or negative)	Negative	Negative
Reversibility	Medium	Medium
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	Yes

Mitigation:

» Construct the wind turbines on parts where the least arable land will be affected.

Residual Impacts:
No residual impacts are applicable.

Nature: *An impact on the demographics of the area as a result of in-migration in response to job opportunities will occur*		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Short duration (1)	Short duration (1)
Magnitude	Moderate (6)	Low (4)
Probability	Highly Probable (4)	Highly Probable (4)
Significance	**Medium (32)**	**Low (24)**
Status (positive or negative)	Negative	Negative
Reversibility	Medium	Medium
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	Yes
Mitigation: » Where feasible, effort must be made to employ local labour in order to create maximum benefit for the communities and limit in-migration. » Train unemployed local community members with insufficient skills and increase absorption of local labour thereby decreasing in-migration.		
Residual Impacts: Workers remaining after the construction period without work will put strain on public resources.		

Nature: *An increase in traffic due to construction vehicles and heavy vehicles could create short-term disruptions and safety hazards for current road users and an increase in the demand for basic services*

The proposed wind energy facility will create and estimated 2 417 FTE employment positions (South African based positions) for the duration of the project. Given that these workers will require services there is likely to be an increase in the demand for social services, access to water and electricity. Given the proximity of the development site to Hendrina, it is most likely that the health facilities in the area will experience additional demand for medical services brought about by the influx of job seekers.

These connections will, however, be minimal and it is unlikely to alter the demand significantly. The effects of the project on road infrastructure should also be considered as it is highly likely that the development will lead to an increase in traffic volumes on surrounding roads. The deterioration of these roads could place additional financial burdens on the municipality through additional maintenance costs. Additional traffic volumes are also likely to impact the condition of secondary roads used to access surrounding farms. According to the transport study for the proposed project, the number of abnormal loads vehicles was estimated and found to be able to be accommodated by the road network (JG Afrika, 2021).

Based on the above discussion it is expected that the basic service provision, health facilities and road infrastructure will be under additional strain during the construction period. Given that the project is anticipated to attract additional people to the area the significance of the impact is considered to be medium. These impacts can however be mitigated if the developer engages with the local municipalities and plans accordingly.

	Without mitigation	**With mitigation**
Extent	Local (2)	Local (1)
Duration	Short duration (1)	Short duration (1)
Magnitude	Moderate (6)	Low (4)
Probability	Highly probable (4)	Highly probable (4)
Significance	**Medium (36)**	**Low (24)**
Status (positive or negative)	Negative	Negative
Reversibility	Medium	Medium
Irreplaceable loss of resources?	No	No

Can impacts be mitigated?	Yes	Yes

Mitigation:

- Provide public transportation service for workers in order to reduce congestion on roads.
- Partner with local municipalities and other prominent users of the local roads to upgrade them to meet the required capacity and intensity of the vehicles related to the planned construction activities.
- Transportation contractors must adhere to the road rules and regulations.
- Utilise only designated access routes & entrance/exits from the site.
- Implement appropriate signage & road safety measures at entrance/exit to the site and on site.

Residual Impacts:
No residual impacts are applicable.

Operation Phase Impacts

Nature: *Expenditure associated with the operation of the proposed wind farm will have a positive impact on production*

The proposed facility will require an annual operational expenditure of R 45 million over 20 years. The total impact on production in the country as a result of the project's operations will equate to R 121,5 million per annum in 2022 prices for the 20 years. Aside from the utilities sector, industries that will experience the greatest stimulus from the project will include electrical machinery and apparatus, insurance, trade, transport service and chemical production industry.

It is estimated that the project will generate R 73,8 million of value add per year over the 20-year period (comprising gross operating surplus before taxes and labour) and taxes. The production and consumption induced multiplier effects of the project are considered to be relatively small compared to conventional electricity generating industries. This is because the energy source used to produce electricity by the proposed wind energy facility is free, unlike conventional power stations where raw inputs (i.e., coal) and the transport thereof comprise a significant portion of operating expenditure. It is for this reason that such a facility is a highly attractive business venture.

	Without enhancement	**With enhancement**
Extent	Local (2)	Local (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	High (8)	High (8)
Probability	Highly probable (4)	Highly probable (4)
Significance	**Medium (56)**	**Medium (56)**
Status (positive or negative)	Positive	Positive
Reversibility	Medium	Medium
Irreplaceable loss of resources?	No	No
Can impacts be enhanced?	Yes (enhance)	Yes

Enhancement:

- The project developer should make effort to use locally sourced inputs where feasible in order to maximize the benefit to the local economy.
- Local Small and Medium Enterprises are to be approached to investigate the opportunities for supplying inputs required for the maintenance and operation of the facility, as far as feasible.

Residual Impacts:
No residual impacts are applicable.

Nature: *Positive impact on GDP due to operating expenditure during operations*

In addition to the positive production and GDP impacts arising from expenditure related to the operation of the wind energy facility, the local economy is anticipated to be positively stimulated by expenditure related to the developer's intended socio-economic development contributions in the immediate area. The contribution to the Local

Municipality, although small relative to the combined size of the municipality's economy, will nevertheless be positive and more importantly, a sustainable contribution.		
	Without enhancement	**With enhancement**
Extent	Local (2)	Local (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	High (8)	High (8)
Probability	Highly probable (4)	Highly probable (4)
Significance	**Medium (56)**	**Medium (56)**
Status (positive or negative)	Positive	Positive
Reversibility	Medium	Medium
Irreplaceable loss of resources?	No	No
Can impacts be enhanced?	Yes (enhance)	Yes
Enhancement: » The project developer is to make an effort to use locally sourced inputs where feasible in order to maximize the benefit to the local economy. » Local Small and Medium Enterprises are to be approached to investigate the opportunities for supplying inputs required for the maintenance and operation of the facility, as far as feasible.		
Residual Impacts: No residual impacts are applicable.		

Nature: *The Wind Farm will create additional employment due to maintenance of the wind turbines* The proposed Project will create an estimated 159 permanent employment positions across the operation phase of the development which, will be retained for approximately 20 years. Of these, most will be South African based positions. It is envisaged that some of the skilled and low skilled staff will be employed from within the local area with the remaining staff being sourced from other parts of Mpumalanga and the country. Aside from the direct employment opportunities, the facility will support an estimated 142 FTE employment positions created through the production and consumption induced effects. Due to the spatial allocation of procurement spending and direct employment created, most of the indirect and induced positions will also be created within the local area. The trade, agriculture and community and personal services sectors will benefit the most from these new employment opportunities.		
	Without enhancement	**With enhancement**
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Low (4)	Low (4)
Probability	Highly Probable (4)	Highly Probable (4)
Significance	**Medium (36)**	**Medium (36)**
Status (positive or negative)	Positive	Positive
Reversibility	Low	Low
Irreplaceable loss of resources?	No	No
Can impacts be enhanced?	Yes (enhance)	Yes
Enhancement: » Where feasible, effort must be made to employ locally in order to create maximum benefit for the communities.		
Residual Impacts: No residual impacts are applicable.		

Nature: *Employed individuals will increase the income of their respective households and therefore improve their standard of living*

The creation of an estimated 429 FTE employment positions throughout the country will generate R 20,3 million of personal income (2022 prices), which will be sustained for the entire duration of the Project's lifespan. Given the average household size in affected local municipalities and nationally, this increase in household earnings will support several people. The sustainable income generated as a result of the Project's operation will positively affect the standard of living of all benefitting households. This is specifically applicable to the Local Municipality, as the average income per employee at the facility would far exceed the average household income within these municipalities. Skills development coupled with sustainable employment creation opportunities as a result of the Developer's intended SED spend, are expected to contribute towards an improved standard of living amongst families that might not have had a sustainable income previously.		
	Without enhancement	**With enhancement**
Extent	Local (2)	Local (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	Moderate (6)	Moderate (6)
Probability	Highly Probable (4)	Highly Probable (4)
Significance	**Medium (48)**	**Medium (48)**
Status (positive or negative)	Positive	Positive
Reversibility	Medium	Medium
Irreplaceable loss of resources?	No	No
Can impacts be enhanced?	Yes (enhance)	Yes
Enhancement: » Employing locally will increase benefit to local households and the local area.		
Residual Impacts: No residual impacts are applicable.		

Nature: *Government revenue will be derived from the proposed development* The proposed Project will, through property taxes and salaries and wages payments, contribute towards both local and national government revenue. At a local level, the Project will contribute to local government through payments for utilities used in the operation of the Project. It will also increase its revenue through an increase in property taxes compared to the current level. Given that the Local Municipality has a relatively small economy, any additional income would greatly benefit the Municipality. On a national level, the revenue derived by the Project during its operations, as well as the payment of salaries and wages to permanent employees will contribute to the national fiscus. Although it is impossible to trace exactly how such revenue is allocated, any additional revenue generated means that national governments can increase its spending on public goods and services.		
	Without enhancement	**With enhancement**
Extent	Local (2)	N/A
Duration	Long term (4)	N/A
Magnitude	Moderate (6)	N/A
Probability	Highly Probable (4)	N/A
Significance	**Medium (48)**	N/A
Status (positive or negative)	Positive	N/A
Reversibility	Medium	N/A
Irreplaceable loss of resources?	No	N/A
Can impacts be enhanced?	N/A	N/A
Enhancement: » No enhancement measures are required.		
Residual Impacts: No residual impacts are applicable.		

Nature: *Increase in revenue due to rental paid for landowners where the wind turbines will be located*		
	Without enhancement	**With enhancement**
Extent	Local (2)	N/A
Duration	Long-term (4)	N/A
Magnitude	Moderate (6)	N/A
Probability	Highly Probable (4)	N/A
Significance	**Medium (48)**	N/A
Status (positive or negative)	Positive	N/A
Reversibility	Medium	N/A
Irreplaceable loss of resources?	No	N/A
Can impacts be enhanced?	N/A	N/A
Enhancement: » No enhancement measures are required.		
Residual Impacts: No residual impacts are applicable.		

Nature: *Improved energy security and energy sector will result due to the development of the wind farm* The development of the wind farm will lead to a sustainable increase in the supply of electricity for the country. It was noted in Section 3 that lack of electricity and load shedding has had a notable impact on the economy of the country and is one of the reasons stated by foreign investors for the lack of investment in the country. With an improved supply of power to industry, there is likely to be an improvement in the economy as a whole. It should be noted that while these wind farms alone are unlikely to make a large impact in the shortages of electricity in the country, the cumulative impact of all the proposed wind energy products in the country will be substantial. The combined energy production for the Project will be up to 900MW which begins to reflect a notable positive injection into the energy generation capacity from the region.		
	Without enhancement	**With enhancement**
Extent	National (5)	N/A
Duration	Long term (4)	N/A
Magnitude	Moderate (6)	N/A
Probability	Highly probable (4)	N/A
Significance	**Medium (60)**	N/A
Status (positive or negative)	Positive	N/A
Reversibility	Low	N/A
Irreplaceable loss of resources?	Yes	N/A
Can impacts be enhanced?	N/A	N/A
Enhancement: » No enhancement measures are required.		
Residual Impacts: No residual impacts are applicable.		

Nature: *Visual and sense of place impacts* The effects on the community's sense of place will initially be felt during the construction period and will continue into the operation phase. The assessment of the negative change in the sense of place that was examined in the construction phase will likely be in place during the operation phase due to the long-term presence of Project

infrastructure. However, according to the landowners' survey, the Project will not have a significant negative impact on the sense of place.		
	Without mitigation	**With mitigation**
Extent	Local (2)	N/A
Duration	Long term (4)	N/A
Magnitude	Low (4)	N/A
Probability	Definite (5)	N/A
Significance	**Medium (50)**	N/A
Status (positive or negative)	Negative	N/A
Reversibility	Low	N/A
Irreplaceable loss of resources?	Yes	N/A
Can impacts be mitigated?	N/A	N/A
Mitigation: » No mitigation measures are required.		
Residual Impacts: No residual risks are applicable.		

Nature: *Loss of agricultural space* The impact of agricultural land was assessed through a survey that was distributed among the landowners. Some of the landowners indicated that they will be impacted by reduced dryland farming portions due to the wind turbines. According to the landowner's surveys they indicated that some agricultural land will be lost, interference with agricultural activities (especially large implements) and aerial spraying will be the negative influences, as well as reconstruction of animal camps and access roads, however, they indicated that they are not sure on the amount and which infrastructure will be located on their properties. Thus, the initial impact on the agricultural operations will be minor. This will be confirmed by the agricultural assessment.		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Long Term (4)	Long Term (4)
Magnitude	Low (4)	Low (4)
Probability	Highly probable (4)	Highly probable (4)
Significance	**Medium (36)**	**Medium (36)**
Status (positive or negative)	Negative	Negative
Reversibility	Medium	Medium
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	Yes
Mitigation: » Construct the wind turbines on parts where the least arable land will be affected.		
Residual Impacts: No residual impacts are applicable.		

Decommissioning Phase Impacts

Upon the expiry of the wind farm's lifespan, the facility would need to be disbanded, although the facility would likely be upgraded in order to maintain and prolong the lifespan of the facility. If the facility is decommissioned, the land will be rehabilitated in order to return it to pre-project conditions. This also means that all impacts whether positive or negative, which take place during the operation phase will cease to exist. At the same time spending on the disassembly of the components and rehabilitation of land will

increase the demand for construction services and other industries, thus stimulating economic activity in the local area, albeit over a temporary period. Socio-economic impacts stimulated during the decommissioning phase are expected to be similar to those that took place during the construction phase. However, people who were permanently employed at the facility during the operational phase will lose their jobs during the decommissioning phase.

9.11.4 Overall Result

Both positive and negative impacts are expected throughout the construction and operation of the proposed wind energy facility. Positive impacts during both construction and operation are expected to be of medium and high significance pre-enhancement and can be increase to medium and high post-enhancement. Negative impacts during both construction and operation are expected to be of medium and low significance pre-mitigation and can be reduced to medium (different score) and low significance post-mitigation, depending on the type of impact.

The net positive impacts associated with the development and operation of the proposed project are expected to outweigh the net negative effects. The project is also envisaged to have a positive stimulus on the local economy and employment creation, leading to the economy's diversification and a small reduction in the unemployment rate. The project should therefore be considered for development. It should, however, be acknowledged that the negative impacts would be largely borne by the nearby farms and households residing on them, whilst the positive impacts will be distributed throughout both the local and national economies. Due to this imbalance, it is recommended that the mitigation measures suggested be strictly adhered to. Application of these mitigation measures will ensure that the negative impacts on the nearby farms and businesses are minimised and that the distribution of the potential benefits of the project are more balanced.

9.12. Assessment of Impacts on Traffic

Potential impacts on the traffic components of the affected area and the relative significance of the impacts associated with the development of the Ummbila Emoyeni Wind Energy Facility are summarised below (refer to **Appendix M**).

9.12.1 Results of the Traffic Impact Assessment

It is assumed that if components are imported to South Africa, it will be via the Port of Richards Bay in KwaZulu-Natal, or the ports of East London and Ngqura in the Eastern Cape. The Port of Richards Bay is located ~460km travel distance from the proposed site whilst the ports of East London and Ngqura are respectively located ~1 130km and 1 200km travel distance from the proposed site. The Port of Richards Bay is the preferred port of entry; however, the ports of East London and Ngqura can be used as alternatives, should the Port of Richards Bay not be available.

The proposed site is bounded by the N17 in the south, the R39 in the south and east and the R35 in the west. Access to the proposed site can be obtained from any of these three roads, depending on the traffic volumes of each road. The road carrying the least traffic will be considered as the best option. There is also an existing network of unnumbered gravel roads that might be suitable as a main access road to the proposed site.

9.12.2 Description of Traffic Impacts

The potential transport related impacts are described below.

- Construction Phase
  - Construction related traffic.
  - The construction traffic would also lead to noise and dust pollution.
- Operational Phase
  - During operation, it is expected that staff and security will visit the facility. Approximately thirty (30) full-time employees will be stationed on site. The traffic generated during this phase will be minimal and will not have an impact on the surrounding road network.
- Decommissioning Phase
  - This phase will result in the same impact as the construction phase as similar trips are expected.

9.12.3 Impact tables summarising the significance of impacts on traffic during the construction and operation phases (with and without mitigation)

Construction Phase Impacts

Nature: *Traffic congestion during the construction phase and increase in noise and dust*

The impact will occur due to added pressure on the road network due to the increase in traffic associated with the transport of equipment, material and staff to site during the construction phase. Traffic congestion possible along the N17, R39 and R35, depending on the main access route selected.

Increase in noise and dust will occur due to the increase in construction traffic associated with the transport of equipment, material and staff to site during the construction phase.

	Without mitigation	**With mitigation**
Extent	Local (2) - Pressure will only be added on the local road network.	Local (2) - Local (2) - Pressure will only be added on the local road network.
Duration	Short-term (2) - The construction period will last between 1 – 2 years.	Short-term (2) - The construction period will last between 1 – 2 years.
Magnitude	Moderate (6) - The increase in traffic will have a moderate impact on traffic operations.	Low (2) - The increase in traffic will have a low impact on traffic operations.
Probability	Highly probable (4) – The possibility of the impact on traffic operations is highly probable.	Probable (3) – The possibility of the impact on traffic operations if probable.
Significance	**Medium (40)**	**Low (18)**
Status (positive or negative)	Negative	Negative
Reversibility	Completely reversible	Completely reversible
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	

Mitigation:

- The delivery of wind turbine components to the site must be staggered and trips must be scheduled to occur outside of peak traffic periods.
- Reduce the construction period.
- The use of mobile batching plants and quarries in close proximity to the site must be considered as this would decrease the impact on the surrounding road network.
- Regular maintenance of gravel roads by the Contractor during the construction and decommissioning phases.

» It its recommended to avoid staggered intersections on the main access road. Intersections should rather be consolidated or realigned as far as possible. » Dust suppression of gravel roads during the construction and decommissioning phases, as required. » Staff and general trips should occur outside of peak traffic periods as far as possible. » Any low hanging overhead lines (lower than 5.1 m) e.g., Eskom and Telkom lines, along the proposed routes will have to be moved to accommodate the abnormal load vehicles. » The preferred route should be surveyed to identify problem areas e.g., intersections with limited turning radii and sections of the road with sharp horizontal curves or steep gradients, which may require modification. After the road modifications have been implemented, it is recommended to undertake a "dry-run" with the largest abnormal load vehicle, prior to the transportation of any turbine components, to ensure that the delivery of the turbines will occur without disruptions. This process is to be undertaken by the haulage company transporting the components and the contractor, who will modify the road and intersections to accommodate abnormal vehicles. It needs to be ensured that the gravel sections of the haulage routes remain in good condition and will need to be maintained during the additional loading of the construction phase and reinstated after construction is completed. » The internal gravel roads will require grading with a road grader to obtain a flat even surface and the geometric design of these gravel roads needs to be confirmed at detailed design stage. This process is to be undertaken by a civil engineering consultant or a geometric design professional. The road designer should take cognizance that roads need to be designed with smooth, relatively flat gradients to allow an abnormal load vehicle to ascend to the top of a hill.
Residual Impacts: Traffic will return to normal levels after construction is completed.

Operation Phase Impacts

The operational phase will not generate any significant traffic volumes. During operation, it is expected that maintenance and security staff will periodically visit the facility. It is assumed that approximately 30 full-time employees will be stationed on site (subject to change). Based on experience with similar projects, the number of full-time employees is generally low and consequently, the associated trips are negligible. The traffic generated during this phase will be minimal and will not have an impact on the surrounding road network.

Decommissioning Phase Impacts

The decommissioning phase will result in the same impact as the construction phase as similar trips are expected. The potential traffic impact will be of medium significance before mitigation measures during the construction and decommissioning phases. However, considering that this is temporary and short term in nature, the impact can be mitigated to an acceptable level of low significance.

9.12.4 Overall Result

The construction and decommissioning phases of a wind farm are the only significant traffic generators and therefore noise, dust and exhaust pollution will be higher during these phases. The duration of these phases is short term i.e., the impact of the Wind Farm on traffic on the surrounding road network is temporary. The access point to the proposed site has been assessed and was found to be acceptable from a transport perspective. The development is supported from a transport perspective provided that the recommendations and mitigation measures are adhered to.

9.13. Risks Associated with Energy Storage

A Battery Energy Storage Systems (BESS) comprising a solid-state battery system will allow for energy storage for an extended period. The general purpose and utilisation of the BESS will be to save and store excess electrical output from the facility as it is generated, allowing for a timed release to the national grid when the capacity is required. The BESS will be contained within insulated containers and will connect to the on-site facility substation via underground cabling. **Figure 9.18** provides a general illustration of a BESS.

Figure 9.18: Example of battery storage units integrated as part of wind farm (Source: http://ultrabattery.com/applications/stationary-energy-storage/)

The risks associated with battery technologies are generally well understood and researched. The primary risks relate to fire hazards and the potential for a condition known as 'thermal runaway'. Thermal runaway occurs in situations where an increase in temperature changes the conditions in a way that causes a further increase in temperature, often leading to a destructive result. The risks detailed in the table below considers only the risks associated with on-site use of battery energy storage systems.

Possible risks associated with the construction and operation of the BESS from a technical perspective within the development footprint of the Ummbila Emoyeni Wind Energy Facility are limited to health and safety aspects during the project life cycle of the BESS. The risks identified for the construction and operation of the BESS are detailed below. Mitigation measures have been included within the project EMPr (refer to **Appendix O**).

Table 9.2: Risks associated with Battery Energy Storage Systems

Nature of Risk	*Likelihood*	*Impact*	*Mitigation / Management of Risk*
1. Mechanical breakdown/ Exposure to high temperatures » Incidents where the batteries are broken or exposed to temperature above room temperature could lead to overheating as well as fires which can affect infrastructure components of the BESS. » Leakages of substances contained within the battery cells (should they not be assembled off-site).	Low	» Fires, electrocutions and spillage of toxic substances into the surrounding environment. » Spillage of hazardous substances into the surrounding environment. » Soil contamination – leachate from spillages which could lead to an impact of the productivity of soil forms in affected areas. » Water pollution – spillages into surrounding watercourses as well as groundwater. » Health impacts – on the surrounding communities, particularly those relying on watercourses (i.e. rivers, streams, etc) as a primary source of water.	Operators are trained and competent to operate the BESS. Training should include the discussion of the following: ∗ Potential impact of electrolyte spills on groundwater; ∗ Suitable disposal of waste and effluent; ∗ Key measures in the EMPr relevant to worker's activities; ∗ How incidents and suggestions for improvement can be reported. » Training records should be kept on file and be made available during audits. » Battery supplier user manuals safety specifications and Material Safety Data Sheets (MSDS) are filed on site at all times. » Compile method statements for approval by the Technical/SHEQ Manager for the operation and management and replacement of the battery units / electrolyte for the duration of the project life cycle. Method statements should be kept on site at all times. » Provide signage on site specifying the types of batteries in use and the risk of exposure to hazardous material and electric shock. Signage should also specify how electrical and chemical fires should be dealt with by first responders, and the potential risks to first responders (e.g. the inhalation of toxic fumes, etc.). » Firefighting equipment should readily be available at the BESS area and within the site. » Maintain strict access control to the BESS area. » Ensure all maintenance contractors / staff are familiar with the supplier's specifications. » Undertake daily risk assessment prior to the commencement of daily tasks at the BESS. This should consider any aspects which could result in fire or spillage, and appropriate actions should be taken to prevent these. » Standard Operating Procedures (SOPs) should be made available by the Supplier to ensure that the batteries are handled in accordance with required best practices.

Nature of Risk	Likelihood	Impact	Mitigation / Management of Risk
			» Spill kits must be made available to address any incidents associated with the flow of chemicals from the batteries into the surrounding environment. » The assembly of the batteries on-site should be avoided as far as possible. Activities on-site for the BESS should only be limited to the placement of the container wherein the batteries are placed. » Undertake periodic inspections on the BESS to ensure issues are identified timeously and addressed with the supplier where relevant. » The applicant in consultation with the supplier must compile and implement a Leak and Detection Monitoring Programme during the project life cycle of the BESS. » Batteries must be strictly maintained by the supplier or suitably qualified persons for the duration of the project life cycle. No unauthorised personnel should be allowed to maintain the BESS.
2. Generation of hazardous waste » The incorrect disposal of the batteries and the associated components could have an adverse impact on the environment.	Medium	» Spillage of hazardous substances into the surrounding environment. » Soil contamination – leachate from the disposed batteries into the soil, which could lead to an impact of the productivity of soil forms in affected areas. » Water pollution – leachate from the disposed batteries spilling into surrounding watercourses as well as groundwater. » Health impacts – on the surrounding communities, particularly those relying on watercourses (i.e. rivers, streams, etc) as a primary source of water.	» Damaged and used batteries must be removed from site by the supplier or any other suitably qualified professional for recycling or appropriate disposal. » The applicant should obtain a cradle to grave battery management plan from the supplier during the planning and design phase of the system. The plan must be kept on site and adhered to.

9.14. Assessment of the 'Do Nothing' Alternative

The 'do-nothing' alternative (i.e., no-go alternative) is the option of not constructing the Ummbila Emoyeni Wind Energy Facility. Should this alternative be selected, there would be no environmental impacts on the site or to the surrounding local area due to the construction and operation activities of a wind farm. All baseline information provided in this report relates to the current situation on site and in the surrounding area, and can be considered the no-go alternative. Impacts are limited to the status quo. All negative impacts, specifically related to the development of the wind farm, discussed in this report will not materialise. In addition, positive impacts identified to be associated with the project will be foregone. These are described below.

a) Land use and agriculture

Various crop field boundaries within the project site were identified by means of the DFFE Screening Tool (2022), which are predominantly characterised by "High" sensitivities with one area being classified as "Very High" sensitivity. The crop fields within the project site are cultivated (mixture of mainly maize with some soya bean cultivation), and therefore, there are a number of agricultural employment opportunities generated by this land use within the project site. However, it is not envisaged that the number of agricultural employment opportunities generated by the agricultural activities within the project site would exceed the number of skilled, semi-skilled and unskilled employment opportunities that would be created by the construction and operation of the Ummbila Emoyeni Wind Energy Facility (240 temporary jobs during construction and 30 permanent jobs during operation). The development of the wind energy facility would therefore result in a significant gain in employment numbers for the area in which the project site is located, albeit only for the construction phase, especially since the gain in employment numbers will not be accompanied by any losses in agricultural employment as a result of the proposed development since agricultural activities can continue on the site together with the operation of the wind farm. The implementation of the 'do nothing' alternative would result in the lost opportunity for this additional employment.

In addition, the directly affected landowners would obtain an income from the wind farm (as the developer would pay a percentage of the revenue generated to the landowner in accordance with the lease agreement for the use of the land). This would contribute towards the financial stability of the landowners which would in turn contribute to the financial viability of the farming practices on the property. The implementation of the 'do nothing' alternative would retain the current land-use, fore-going the opportunity to generate renewable energy from the wind resource in the area and at the same time continue the current agricultural activities on areas that fall outside of the wind energy facility footprint.

The 'do nothing' alternative would result in a lost opportunity for the landowners (in terms of implementing a compatible land use option, while still retaining the current land use, as well as a loss in long-term revenue), the region (in terms of employment opportunities) and the country (in terms of renewable energy). From this perspective the no-go alternative is not preferred when considering land use and agricultural aspects of the project site. Use of the identified site for the development of the proposed wind energy facility is considered to be a preferred land use as the benefits will outweigh the impacts.

From a visual perspective, however, the implementation of the 'do-nothing' alternative will conserve the landscape as it currently is. Transformation will lead to a change in the sense of place for the area; however, no fatal flaws have been identified in this regard. According to the landowners' survey undertaken as part

of the socio-economic impact assessment, the Project will not have a significant negative impact on the sense of place.

b) Socio-economic impact

Social: The impacts of pursuing the no-go alternative are both positive and negative as follows:

» The benefits would be that there is no disruption from an influx of jobseekers into the area, nuisance impacts (traffic, noise and dust during construction), visual impacts and safety and security impacts. The impact is therefore neutral.
» There would however be an opportunity lost in terms of job creation, skills development and associated economic business opportunities for the local economy, as well as a loss of the opportunity to generate energy from a renewable resource without creating detrimental effects on the environment.

New Business: Some of the positive spin off effects that are to ensue from the project expenditure will be localised in the communities located near the site, such as the towns of Bethal and Morgenzon. The local services sector and specifically the trade, transportation, catering and accommodation, renting services, personal services and business services are expected to benefit the most from the project activities during the construction phase. New business sales that will be stimulated as a result of the establishment of the wind farm, albeit for a temporary period, will be lost with the implementation of the 'do nothing' alternative. Therefore, from a business perspective, the 'do-nothing' alternative is not preferred as there is a loss of new business opportunities.

Employment: The development of the Ummbila Emoyeni Wind Energy Facility within the Govan Mbeki, Lekwa, and Msukaligwa Local Municipalities will aid in a reduction of the unemployment rate. If the wind farm is not developed then the unemployment rate will not be positively influenced by the proposed development. The upliftment and socio-economic benefits for individuals within local communities would be forfeited with the implementation of the 'do nothing' alternative. Therefore, from an employment perspective, the 'do-nothing' alternative is not preferred as there is a loss of employment opportunities.

Skills development: The establishment of the Ummbila Emoyeni Wind Energy Facility will offer numerous opportunities for skills transfer and development. This is relevant for both on-site activities and manufacturing activities. Various renewable energy facilities are proposed to be developed in the area and in the Mpumalanga Province, which means that the transfer of skills from foreign experts to the local engineers and construction workers will take place, similar to what has taken place where other renewable energy facilities have been constructed and operated within the province. The skills training and transfer benefits for individuals within local communities would be forfeited with the implementation of the 'do nothing' alternative.

Municipal goals: The opportunity to contribute to the innovative energy sourcing methods as identified by the Govan Mbeki, Lekwa, and Msukaligwa Local Municipalities as per a draft policy which sets out the criteria which will enable the evaluation of renewable energy generation infrastructure to be developed in a manner that will limit the potential negative impacts thereof will not be met should the Ummbila Emoyeni Wind Energy Facility not be constructed with the implementation of the 'do nothing' alternative.

Foregoing the proposed development would not necessarily compromise the development of renewable energy facilities in South Africa. However, the socio-economic benefits for local communities at this location and within the surrounding area would be forfeited. The area has experienced social challenges which has

resulted in the need for socio-economic upliftment. The socio-economic impact assessment concluded that there would be greater social benefits associated with the project than the 'do nothing' alternative.

Therefore, from a socio-economic perspective, the 'do-nothing' alternative is not preferred due to the loss of socio-economic benefits associated with the project when considering the current socio-economic conditions of the area.

c) Impact on electricity supply and targets regarding renewable energy

At a broader scale, the benefits of additional capacity to the electricity grid and those associated with the introduction of renewable energy would not be realised. Although the Ummbila Emoyeni Wind Energy Facility is only proposed to contribute a contracted capacity of up to 900MW to the grid capacity, this would assist in meeting the electricity demand for the relevant private off-takers and would also assist in meeting the government's goal for renewable energy and the energy mix. The generation of electricity from renewable energy resources offers a range of potential socio-economic and environmental benefits for South Africa. These benefits include:

- Increased energy security through the provision of new capacity that can be quickly added to the grid;
- Resource saving (i.e. fossil fuels and water);
- Exploitation of South Africa's significant renewable energy resource;
- Pollution reduction;
- Climate friendly development;
- Support for international agreements;
- Employment creation;
- Acceptability to society; and
- Support to a new industry sector.

At present, South Africa is some way off from fully exploiting the diverse gains from renewable energy and from achieving a considerable market share in the renewable energy industry. South Africa's electricity supply remains heavily dominated by coal-based power generation, with the country's significant renewable energy potential largely untapped to date. This is particularly true in the Mpumalanga Province where the majority of South Africa's coal-fired generation is located and will be decommissioned in the next 10 – 15 years.

The Integrated Resource Plan (IRP) (2019) provides for the development of 6 000MW of capacity from large scale solar energy facilities by 2030. The IRP essentially drives the assortment of energy to be implemented for South Africa which is known as the energy mix of the country, considering various generation technologies.

9.14.1 Conclusion

The no-go option is the continuation of the existing land use, i.e. maintain the status quo. As detailed in the sections above, there would be no environmental impacts on the site or to the surrounding local area due to the construction and operation activities of a wind farm with the implementation of this alternative. All negative impacts, specifically related to the development of the wind farm, discussed in this report will not materialise.

The 'do-nothing' alternative will do little to influence the renewable energy targets set by government. However, as the project site experiences ample wind resource and optimal grid connection opportunities, not developing the Ummbila Emoyeni Wind Energy Facility would see such an opportunity being lost. In addition, the Mpumalanga Province will not benefit from additional generated power being evacuated directly into the Province's grid. As current land use activities can continue on the site once the project is operational, the loss of the land to this project during the operation phase (less than 1% of the larger project site) is not considered significant. Therefore, from a regional perspective, the 'do-nothing' alternative is not preferred as there is a perceived loss of benefits for the regional area.

From the specialist studies undertaken, no environmental fatal flaws were identified to be associated with the Ummbila Emoyeni Wind Energy Facility subject to implementation of the recommended mitigation measures. All impacts associated with the project can be mitigated to acceptable levels. If the wind energy facility is not developed, the following positive impacts will not be realised:

- Job creation from the construction and operation phases.
- Economic benefit to participating landowners due to the revenue that will be gained from leasing the land to the developer.
- Meeting of energy generation mix in a most economic and rapid manner.
- Provision of clean, renewable energy in an area where it is optimally available.

As detailed above, the 'do-nothing' alternative will result in a number of lost opportunities. The 'do nothing' alternative is therefore not preferred and not proposed to be implemented for the development of the Ummbila Emoyeni Wind Energy Facility.

CHAPTER 10: ASSESSMENT OF POTENTIAL CUMULATIVE IMPACTS

As identified and assessed in Chapter 9, a wind farm development may have effects (positive and negative) on natural resources, the social environment and on the people living in a project area. The preceding impact assessment chapter has reported on the assessment of the impacts associated with the Ummbila Emoyeni Wind Energy Facility largely in isolation (from other similar developments).

This chapter assesses the potential for the impacts associated with the project to become more significant when considered in combination with the other operating or proposed wind farm projects within the area.

10.1. Legal Requirements as per the EIA Regulations, 2014 (as amended), for the undertaking of an Environmental Impact Assessment Report

This chapter of the EIA Report includes the following information required in terms of the EIA Regulations, 2014 - Appendix 3: Scope of Assessment and Content of Environmental Impact Assessment Reports:

Requirement	Relevant Section
3(1)(j)(i) an assessment of each identified potentially significant impact and risk, including cumulative impacts.	The cumulative impacts associated with the development of the Ummbila Emoyeni Wind Energy Facility are included and assessed within this chapter.

10.2 Approach taken to Assess Cumulative Impacts

The cumulative impacts that have the potential to be compounded through the development of the wind farm and its associated infrastructure in proximity to other similar developments include impacts such as those listed below. The role of the cumulative assessment is to confirm if such impacts are relevant to the Ummbila Emoyeni Wind Energy Facility within the project site being considered for the development. This assessment considers whether the cumulative impact will result in:

- Unacceptable loss of threatened or protected vegetation types, habitat, or species through clearing, resulting in an impact on the conservation status of such flora, fauna, or ecological functioning.
- Unacceptable risk to freshwater features through disturbance associated with construction activities and increased runoff and erosion during the operation phase.
- Unacceptable risk to avifauna through habitat loss, displacement, and collision with wind turbines.
- Unacceptable risk to bats through loss of habitat, infringement on roosting or breeding areas, or risk to collision-prone species.
- Unacceptable loss of high agricultural potential areas presenting a risk to food security and increased soil erosion.
- Unacceptable loss of heritage resources (including palaeontological and archaeological resources and the cultural landscape).
- Unacceptable increase in ambient noise conditions, resulting in an impact on the normal functioning of the occupants of the area.
- Complete or whole-scale change in the sense of place and character of an area and unacceptable visual intrusion.
- Unacceptable impact on traffic and road conditions.

» Unacceptable negative impact to socio-economic factors and components.

Further to the above, positive cumulative impacts are also expected and will be associated with socio-economic aspects and benefits.

Figure 10.1 indicates the location of the Ummbila Emoyeni Wind Energy Facility in relation to all other proposed renewable energy facilities known to be located within the surrounding area of the project site. These projects were identified using the DFFE Renewable Energy Database and current knowledge of projects operating and being proposed in the area. For the assessment of cumulative impacts, only developments within a 30km radius from the proposed Ummbila Emoyeni Wind Energy Facility were considered (**Table 10.1** and **Figure 10.1**), which is in line with the DFFE requirements.

Table 10.1: Renewable energy facilities located within the broader area (within a 30km radius) of the Ummbila Emoyeni Wind Energy Facility project site

Project Name	Project Status
Majuba Solar PV Facility	Authorised
Tutuka Solar PV Facility	Authorised
Forzando North Coal Mine Solar PV Facility	Authorised
Hendrina Renewable Energy Complex	In process

In addition to the renewable energy facilities listed above, one new renewable energy facility (i.e., one Solar Energy Facility) is proposed adjacent to the Ummbila Emoyeni Wind Energy Facility is proposed by Emoyeni Renewable Energy Farm (Pty) Ltd (**Table 10.2**):

Table 10.2: The proposed Ummbila Cluster of Renewable Energy Facilities

Project Name	Contracted Capacity
Ummbila Emoyeni Solar Energy Facility	150MW

At the time of writing this EIA Report, the facility listed in **Table 10.2** was still in process of obtaining Environmental Authorisation, and the facilities listed in **Table 10.1** had already received authorisation, with the exception of the Hendrina Renewable Energy Complex, for which the process to obtain authorisation is still in process. There are no operational facilities. The potential for cumulative impacts is summarised in the sections which follow and have been considered within the specialist studies (refer to **Appendices D – M**).

It should be noted that not all renewable energy developments presently under consideration by various IPPs will be built for operation. Not all proposed developments will be granted the relevant permits by the relevant authorities (DFFE, DMRE, NERSA and Eskom) and this is because of the following reasons:

» There may be limitations to the capacity of the existing or future Eskom grid.
» Not all applications will receive a positive Environmental Authorisation.
» There are stringent requirements to be met by applicants in terms of the REIPPP Programme and private off-taker bids, and a highly competitive process that only selects the best projects.
» Not all proposed projects will be viable because of lower renewable resources on some sites.
» Not all proposed projects will be able to reduce the associated negative impacts to acceptable levels or be able to mitigate the impacts to acceptable levels (fatally flawed).
» Not all proposed facilities will eventually be granted a generation license by NERSA and sign a Power Purchase Agreement with Eskom or private offtaker.

» Not all developers will be successful in securing financial support to advance their projects further.

As there is uncertainty whether all the above-mentioned renewable energy projects will be implemented, it is also difficult to quantitatively assess the potential cumulative impacts. The cumulative impacts of other known renewable energy projects in the broader area and the Ummbila Emoyeni Wind Energy Facility are therefore qualitatively assessed in this Chapter.

It is important to explore the potential for cumulative impacts on a quantitative basis as this will lead to a better understanding of these impacts and the potential for mitigation that may be required. The scale at which the cumulative impacts are assessed is important. For example, the significance of the cumulative impact on the regional or national economy will be influenced by renewable energy developments throughout South Africa, while the significance of the cumulative impact on visual amenity may only be influenced by renewable energy developments that are in closer proximity to each other, e.g., up to 30 km to 50 km apart. For practical purposes a sub-regional scale of 30km has been selected for this cumulative impact evaluation. This is in accordance with the DFFE requirements specified within the Acceptance of Scoping for the project.

In the sections below, a summary of the potential for a cumulative impact resulting from several renewable energy developments within a 30km radius of the Ummbila Emoyeni Wind Energy Facility are explored (refer also to the specialist reports contained in **Appendix D** to **M**). Impacts are assessed accordingly in terms of the proposed project in isolation and the impact considering other projects within the area or the cumulative impact, assuming the implementation of mitigation, as was deemed relevant by the specialist. The approach taken by the various specialists in assessing cumulative impacts is informed by the scale at which the impact is likely to occur.

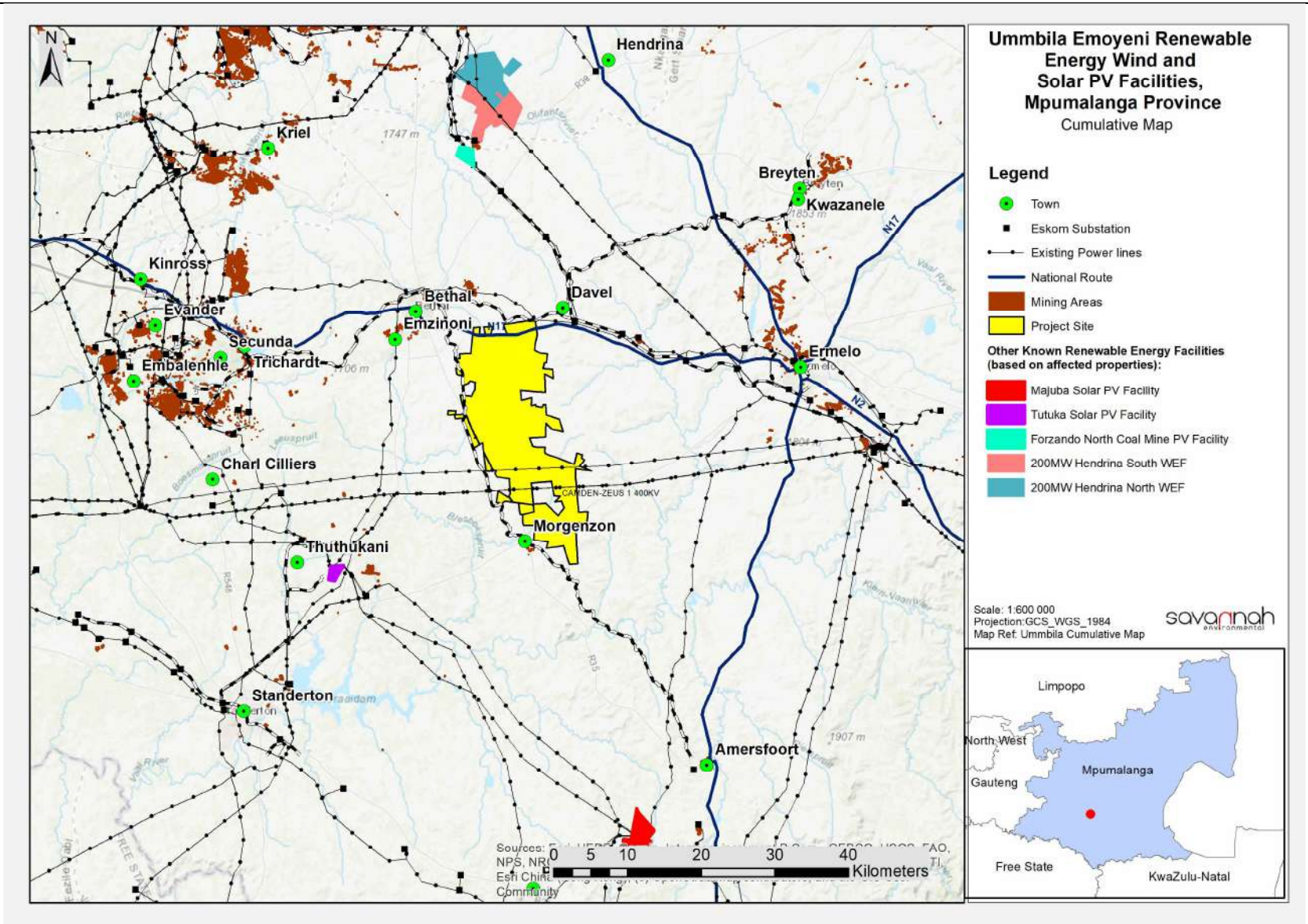


Figure 10.1: Cumulative map illustrating other approved and/or constructed renewable energy facilities located within a 30km radius of the Ummbila Emoyeni Wind Energy Facility

10.3 Cumulative Impacts on Terrestrial Ecology (including flora and fauna)

Ecosystems consist of a mosaic of many different patches. The size of natural patches affects the number, type and abundance of species they contain. At the periphery of patches, influences of neighbouring patches become apparent, known as the 'edge effect'. Patch edges may be subjected to increased levels of heat, dust, desiccation, disturbance, invasion of exotic species and other factors. Edges seldom contain species that are rare, habitat specialists or species that require larger tracts of undisturbed core habitat. Fragmentation due to development reduces core habitat and greatly extends edge habitat, which causes a shift in the species composition, which in turn puts great pressure on the dynamics and functionality of ecosystems.

Cumulative impacts of developments on population viability of species can be reduced significantly if new developments are kept as close as possible to existing developed and/or transformed areas or, where such is not possible, different sections of a development be kept as close together as possible. Thus, new power lines should follow routes of existing servitudes if such exist. Renewable energy facilities should be constructed as close as possible to existing infrastructure or substations, and if several developments are planned within close proximity, these developments should be situated as close together as possible, not scattered throughout the landscape.

The combined, cumulative footprint of all renewable energy projects (located within the 30km radius of the site) is approximately 1 418ha, covering only 0.2% of the area within the 30km radius. Of the 0.2%, the Ummbila Emoyeni Wind Energy Facility will contribute 24.4%.

Conclusion on cumulative impacts due to this and the surrounding developments:

- These renewable energy facilities will impact a very small area of the 30km area and will subsequently result in minimal transformation of intact habitats. Subsequently the cumulative threat, posed by these developments, on the ecological functioning of these habitats are very small to insignificant and it is unlikely that these renewable energy facilities will result in significant habitat fragmentation, disruption of landscape connectivity and impair the ability of these habitat types to respond to environmental fluctuations.
- Even though most of the renewable energy facilities are restricted to the vulnerable Soweto Highveld Grassland, sensitive habitats have been largely avoided, with most of the developments occurring within secondary and/or modified grasslands. and as such the cumulative impact on such habitat types and the biodiversity they sustain will be very small.
- Excessive clearing of vegetation can and will influence runoff and stormwater flow patterns and dynamics, which could cause excessive accelerated erosion of plains, and this could also have detrimental effects on the downslope freshwater resource systems.
    - Rehabilitation and revegetation of all surfaces disturbed or altered during construction is desirable.
    - Runoff from sealed surfaces or surfaces that need to be kept clear of vegetation to facilitate operation of a development needs to be monitored regularly to ensure that erosion control and stormwater management measures are adequate to prevent the degradation of the surrounding environment.
- Large-scale disturbance of indigenous vegetation creates a major opportunity for the establishment of invasive species and the uncontrolled spread of alien invasives into adjacent agricultural land and rangelands.
- A regular monitoring and eradication protocol must be part of all developments long term management plans.

» The loss of and transformation of intact habitats could compromise the status and ecological functioning of provincially identified CBAs. As already mentioned, all of the proposed renewable energy facilities are largely located in areas that have been classified as Moderately Modified, Heavily Modified and Other Natural, with very limited impacts on CBA and ESAs. In terms of the Ummbila Emoyeni Wind Energy Facility, most of the wind turbines are located within Other Natural, Heavily Modified and Moderately Modified Areas, with eleven wind turbines planned within CBA Optimal Areas, five wind turbines planned within CBA Irreplaceable Area and eight turbines within ESAs. In terms of the supporting infrastructure, some portions of the batching plants, O&M buildings and on-site substations will fall within CBA Optimal Areas with Batching Plant 2 and Construction Laydown Areas 3 slightly encroaching into CBA Irreplaceable Areas. Subsequently, according to this layout, the Ummbila Emoyeni Wind Energy Facility will slightly contribute to cumulative impacts on CBAs and potentially the conservation targets set out by the province. However, an optimized layout (which is discussed in Chapter 11 of this EIA Report) has been proposed to mitigate impacts identified through the process, and according to this layout no wind turbines will be located within any CBA Irreplaceable Areas, with only six wind turbines planned within CBA Optimal Areas. Thus, according to this optimized layout, the Ummbila Emoyeni Wind Energy Facility will very slightly contribute to cumulative impacts on CBAs but should not impact the conservation targets set out by the province.

Nature: *Impact on Critical Biodiversity Areas and broad-scale ecological processes*

Transformation of intact habitats could potentially compromise ecological processes as well as ecological functioning of important habitats and would contribute to the fragmentation of the landscape and would potentially disrupt the connectivity of the landscape for fauna and flora and impair their ability to respond to environmental fluctuations.

	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**
Extent	Local (1)	Regional (4)
Duration	Permanent (5)	Permanent (5)
Magnitude	Minor (3)	Minor (4)
Probability	Probable (3)	Probable (3)
Significance	**Low (27)**	**Medium (39)**
Status (positive or negative)	Negative	Negative
Reversibility	Moderate	Moderate
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	

Mitigation:

» The development footprint should be kept to a minimum and natural vegetation should be encouraged to return to disturbed areas.
» An open space management plan should be developed for the site, which should include management of biodiversity within the fenced area, as well as that in the adjacent rangeland.
» Reduce the footprint of the facility within sensitive habitat types as much as possible.
» All disturbed areas that are not used, such as excess road widths, should be rehabilitated with locally occurring grasses after construction to reduce the overall footprint of the development.

Nature: *Cumulative loss of natural grassland and wetland/watercourse habitats (associated with Soweto Highveld Grassland)*

Cumulative loss of natural Soweto Highveld Grassland and further increase in the fractured nature of the landscape may lead to the loss of features responsible for maintaining biodiversity and providing ecosystem goods and services and may potentially lead to: » A change in the status of the Grassland, subsequently also reducing the ability to meet national conservation obligations and targets. » A reduction in biodiversity and even the loss of some species from the area. » Fracturing and isolation of landscapes may cut off important migration routes and prevent genetic variability thus reducing "genetic health" which may in turn lead to weaker species incapable to adapt and react to potential environmental changes and consequently also to a reduction in biodiversity and the extinction of some species from certain areas. » The loss of important corridors essential for some species to allow for movement between important habitat types crucial for the survival of these species.		
	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**
Extent	Local (1)	Regional (4)
Duration	Permanent (5)	Permanent (5)
Magnitude	Small (3)	Minor (3)
Probability	Improbable (2)	Improbable (2)
Significance	**Low (18)**	**Low (24)**
Status (positive or negative)	Negative	Negative
Reversibility	Moderate	Moderate
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation: » The development footprint should be kept to a minimum and natural vegetation should be encouraged to return to disturbed areas. » An open space management plan should be developed for the site, which should include management of biodiversity within the fenced area, as well as that in the adjacent rangeland. » Reduce the footprint of the facility within sensitive habitat types as much as possible. » All disturbed areas that are not used, such as excess road widths, should be rehabilitated with locally occurring grasses after construction to reduce the overall footprint of the development. » Small to medium sized mammals can be allowed to move between the development area and surrounding areas by creating artificial passageways underneath boundary fences (this is optional and may be implemented by developer if deemed necessary).		

10.4 Cumulative Impacts on Freshwater Ecology

Of the proposed renewable energy facilities, all except for the 9.5MW Forzando North Coal Mine PV Solar Facility and the two Hendrina WEFs (South and North), are located within the Upper Vaal Water Management Area. Subsequently, the Forzando PV facility as well as the two Hendrina WEFs will be excluded from the cumulative assessment.

The proposed Ummbila WEF as well as the proposed Ummbila Solar PV Projects are located within Kwaggalaagt River's catchment which is an important tributary of the Blesbokspruit River. Subsequently these REF developments are likely to have a cumulative impact on this important freshwater resource feature as well as the wetland features associated with this river. The Tukuta PV facility is located within a separate quaternary catchment, with the Leeuspruit River being the primary drainage feature. As such this PV facility can also be excluded from the proposed cumulative impact assessment.

Based on the proposed location of the Ummbila Solar PV facilities, no freshwater resource features will be directly impacted by these PV facilities as these facilities are located well outside of any freshwater resource features as well as their recommended buffer areas. As such these PV facilities will not have a significant impact on the aquatic environment. In terms of this proposed development, the proposed layout indicates very limited impacts on their aquatic environment as the proposed structures for the most part, will avoid the delineated watercourses and wetlands with the exception of unavoidable watercourse/wetland crossings by the proposed access roads.

Subsequently, the most significant potential impact associated with the project are as a result of the associated infrastructure, most notably access road and their watercourse/wetland crossings, which can be mitigated such that its impact on the aquatic ecosystems will be of a low significance.

Subsequently it can be concluded that the cumulative impact of the proposed project would not be significant provided mitigation measures are implemented.

Nature: *Impact ecological processes as well as ecological functioning of important freshwater/wetland habitats associated with the Kwaggaspruit and Blesbokspruit*

Transformation of intact freshwater resource habitats could potentially compromise ecological processes as well as ecological functioning of important habitats and would contribute to habitat fragmentation and potential disruption of habitat connectivity and furthermore impair their ability to respond to environmental fluctuations. This is especially of relevance for larger watercourses and wetlands serving as important groundwater recharge and floodwater attenuation zones, important microhabitats for various organisms and important corridor zones for faunal movement.

	Overall impact of the proposed project considered in isolation (post mitigation)	**Cumulative impact of the project and other projects in the area (post mitigation)**
Extent	Local (2)	Local (2)
Duration	Long Term (4)	Long Term (4)
Magnitude	Small (2)	Minor (4)
Probability	Improbable (2)	Improbable (2)
Significance	**Low (16)**	**Low (20)**
Status (positive or negative)	Negative	Negative
Reversibility	Moderate to Low	Moderate to Low
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	

Mitigation:

Wind turbines and supporting infrastructure (excluding roads and MV cabling):

- The potential stormwater impacts of the proposed developments should be mitigated on-site to address any erosion or water quality impacts.
- Good housekeeping measures as stipulated in the EMPr for the project should be in place where construction activities take place to prevent contamination of any freshwater features.
- Where possible, infrastructure should coincide with existing infrastructure or areas of disturbance (such as existing roads).
- Disturbed areas should be rehabilitated through reshaping of the surface to resemble that prior to the disturbance and vegetated with suitable local indigenous vegetation.

Internal access roads and MV cabling option:

- Existing crossings should be utilized/upgraded.
- The construction of new crossings should only be considered where no other viable option exists.

- Where new water course crossings are required, the engineering team must provide an effective means to minimise the potential upstream and downstream effects of sedimentation and erosion (erosion protection) as well minimise the loss of riparian vegetation (reduce footprint as much as possible).
- All crossings over watercourses should be such that the flow within the channels is not impeded and should be constructed perpendicular to the river channel.
- Where new roads need to be constructed, the existing road infrastructure should be rationalised and any unnecessary roads decommissioned and rehabilitated to reduce the disturbance of the area within the river beds.
- During the construction and operation /decommissioning phases, monitor culverts to see if erosion issues arise and if any erosion control is required.
- Where possible culvert bases must be placed as close as possible with natural levels in mind so that these don't from additional steps / barriers.
- Vegetation clearing should occur in a phased manner to minimise erosion and/or run-off.
- Any areas disturbed during the construction phase should be encouraged to rehabilitate as fast and effective as possible and were deemed necessary by the ECO or Contractor's EO, artificial rehabilitation (e.g. re-seeding with collected or commercial indigenous seed mixes) should be applied in order to speed up the rehabilitation process in critical areas (e.g. steep slopes and unstable soils).
- All alien plant re-growth must be monitored and should it occur these plants should be eradicated.
- For new internal roads to the turbines, these should be located, as far as possible, outside of the recommended freshwater resource buffer areas.
- Road infrastructure and cable alignments should coincide as far as possible to minimise the impact.
- Any disturbed areas should be rehabilitated and monitored to ensure that these areas do not become subject to erosion or invasive alien plant growth.
- During decommissioning, disturbance to the freshwater ecosystems should be limited as far as possible. Disturbed areas may need to be rehabilitated and revegetated.
- Mitigation and follow up monitoring of residual impacts (alien vegetation growth and erosion) may be required.

10.5 Cumulative Impacts on Avifauna

Other than the Tutuka and Majuba power stations, the remaining area is largely dominated by commercial agricultural activity. It is unlikely that the proposed development will contribute significantly to the cumulative impact in the area beyond those impacts already assessed. The highest potential impacts prior to mitigation would relate to the effects on aquatic habitats (particularly during the operational phase), such as possible contamination and uncontrolled runoff from hard surfaces that may result in erosion and subsequent degradation of wetlands. However, highly effective mitigation measures exist to address these impacts.

The highest potential impacts following the implementation of mitigation measures relate to the direct destruction of habitat (primarily during the construction phase). While habitat destruction is generally low relative to the overall size of wind energy facilities, the construction of solar PV arrays is often associated with vegetation clearing and the loss of habitat excluding avifaunal species from the area over the longer-term. This impact is nevertheless unlikely to have a significant negative effect on the long-term viability or persistence of avifaunal populations in the area given the species observed and their site utilisation.

Nature: *The cumulative impact of the proposed development in context of the land-use activities found in the broader local area*		
	Overall impact of the proposed project considered in isolation (post mitigation)	**Cumulative impact of the project and other projects in the area (post mitigation)**
Extent	Footprint (1)	Footprint (1)

Duration	Short-term (2)	Short-term (2)
Magnitude	Minor (2)	Minor (2)
Probability	Improbable (2)	Definite (5)
Significance	**Low (10)**	**Medium (35)**
Status (positive or negative)	Negative	Negative
Reversibility	Yes	Yes
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	Yes

Mitigation:

- Infrastructure to avoid Very High Sensitivity areas, linear infrastructure (including roads) permitted.
- The footprint within Medium Sensitivity areas should be minimized and avoided wherever possible.
- Pre-construction walk-through of the approved development footprint must be undertaken to ensure that sensitive habitats and species are avoided wherever possible.
- Laydown and other temporary infrastructure to be placed within Low sensitivity areas, preferably previously transformed areas, wherever possible.
- Appropriate run-off and erosion control measures are to be implemented where required.
- A site-specific environmental management programme (EMPr) must be implemented, which gives appropriate and detailed description of how construction activities must be conducted to reduce unnecessary destruction of habitat (e.g. no open fires outside of designated areas).
- All contractors are to adhere to the EMPr and should apply good environmental practice during construction.
- All hazardous materials should be stored in the appropriate manner to prevent contamination of the site and downstream environments. Any accidental chemical, fuel and oil spills that occur at the site should be cleared as appropriate for the nature of the spill.
- Existing roads and farm tracks should be used where possible.
- The minimum footprint areas of infrastructure should be used wherever possible, including road widths and lengths.
- No off-road driving should be permitted in areas not identified for clearing.
- An Environmental Site Officer (ESO) must form part of the on-site team to ensure that the EMPr is implemented and enforced and an Environmental Control Officer (ECO) must be appointed to oversee the implementation activities and monitor compliance for the duration of the construction phase.
- Following construction, rehabilitation of areas disturbed by temporary laydown areas and facilities must be undertaken.

10.6 Cumulative Impacts on Bats

For the purposes of the cumulative impact assessment, cumulative impacts are defined as the total impacts resulting from the successive, incremental, and/or combined effects of a project when added to other existing, planned and/or reasonably anticipated future projects, as well as background pressures. The project considered here is the Ummbila Emoyeni Renewable Energy Facility, consisting of wind turbines, solar PV panels and the infrastructure needed to connect these technologies to the distribution and transmission grid. The goal of this assessment was to evaluate the potential resulting impact to the vulnerability and/or risk to the sustainability of the bat species affected.

Rodhouse et al. (2019), Davy et al. (2020) and Frick et al. (2017) have all shown that in North America, Least Concern bats may be experiencing impacts due to wind farms that could result in changes to their conservation status. This may be a future scenario for widespread, common Least Concern bats species in South Africa. As such, the significance of cumulative impacts is assessed as High, especially for Natal long-fingered bat as it is possible that the project will result in an unacceptable loss to local bat populations.

Nature: *Unacceptable loss to local bat populations*		
	Overall impact of the proposed project considered in isolation (post mitigation)	**Cumulative impact of the project and other projects in the area (post mitigation)**
Extent	Site (1)	Regional (5)
Duration	Long-term (4)	Long-term (4)
Magnitude	Moderate (6)	High (9)
Probability	Probable (3)	Highly Probable (4)
Significance	**Medium (33)**	**High (72)**
Status (positive or negative)	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	Yes
Confidence in findings	Medium	
Mitigation: » No placement of turbines within 200m of key habitat features specifically including tree clumps, buildings, dams/wetlands, and rivers/streams to reduce spatial overlap between bats and wind turbines. » Maintain a minimum blade sweep of 30m to avoid impacts to lower flying bats such as clutter-edge species (e.g., Cape serotine, Natal long-fingered bat). » Implement fatality monitoring throughout the operational phase and apply curtailment or deterrents if fatality thresholds are exceeded. Annual fatality threshold per Least Concern species = 353 individuals. Annual fatality threshold per Species of Special Concern = 1 individual for each of [African Straw-coloured fruit bat, Wahlberg's Epauletted fruit bat, Percival's Short-eared Trident bat, Blasius's Horseshoe bat, Egyptian Rousette].		

10.7 Cumulative Impacts on Soils and Agricultural Potential

The project site measures approximately 28 000ha. It is proposed that ~900MW WTG layout will be developed. It is estimated (for this cumulative component) that 0.6ha of land will be directly developed for 2MW, totalling a development footprint of 197ha. Based on this, < 1% (0.7%) of the project area will be developed. The total extent of the High / Very High agricultural crop production area measures approximately 10 860ha, and if these areas were 'only' developed for the project, which is unlikely, the loss would amount to 18%.

The cumulative impacts have been scored "Medium," indicating that the potential incremental, interactive, sequential, and synergistic cumulative impacts. It is probable that the impact will result in spatial and temporal cumulative change.

Nature: *Loss of land capability*		
	Overall impact of the proposed project considered in isolation (post mitigation)	**Cumulative impact of the project and other projects in the area (post mitigation)**
Extent	Local (2)	Local (2)
Duration	Short Term (2)	Short Term (2)
Magnitude	Low (4)	Low (4)
Probability	Improbable (2)	Improbable (2)
Significance	**Low (18)**	**Low (18)**
Status (positive or negative)	Negative	Negative
Reversibility	High	High

Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Confidence in findings	High	

Mitigation:

- Avoidance of all high agricultural production land and other actively cultivated areas. Where avoidance is not feasible, stakeholder engagement should occur to compensate affected landowners.
- Make use of existing roads or upgrades tracks before new roads are constructed. The number and width of internal access routes must be kept to a minimum.
- A stormwater management plan must be implemented for the development. The plan must provide input into the road network and management measures.
- Rehabilitation of the area must be initiated from the onset of the project. Soil stripped from infrastructure placement can be used for rehabilitation efforts.
- An alien invasive plant species and control programme must be implemented from the onset of the project.
- Prevent any spills from occurring. Machines must be parked within hard park areas and must be checked daily for fluid leaks.
- All excess soil (soil that are stripped and stockpiled to make way for foundations) must be stored, continuously rehabilitated to be used for rehabilitation of eroded areas.
- If a spill occurs, it is to be cleaned up immediately and reported to the appropriate authorities.
- Restore vegetation cover by means of revegetating indigenous grass species. Mixed stands or monocultures will work sufficiently for revegetation purposes. Mixed stands tend to blend in with indigenous vegetation species and are more natural. Monocultures however could achieve high productivity. In general, indigenous vegetation should always be preferred due to various reasons including the aesthetical presence thereof as well as the ability of the species to adapt to its surroundings.
- All areas outside of the footprint areas that will be degraded (by means of vehicles, laydown yards etc.) must be ripped where compaction has taken place. According to the Department of Primary Industries and Regional Development, ripping tines must penetrate to just below the compacted horizons (approximately 300 – 400mm) with soil moisture being imminent to the success of ripping. Ripping must take place within 1-3 days after seeding, and also following a rain event to ensure a higher moisture content. To summarise:
  - Rip all compacted areas outside of the developed areas that have been compacted.
  - This must be done by means of a commercial ripper that has at least two rows of tines.
  - Ripping must take place between 1 and 3 days after seeding and following a rainfall event (seeding must therefore be carried out directly after a rainfall event). Plant phase plants which are characterised by fast growing and rapid spreading conditions. Seed germination, seed density and seed size are key aspects to consider before implementing revegetation activities. The number of seed should be limited to ensure that competition between plants is kept to a minimum. During the establishment of seed density, the percentage of seed germination should be taken into consideration. *E curvula* is one of the species recommended due to the ease of which it germinates. This species is also easily sown by means of hand propagation and hydro seeding. The following species are recommended for rehabilitation purposes:
    - *Eragrostis teff;*
    - *Cynodon species (Indigenous and altered types);*
    - *Chloris gayana;*
    - *Panicum maximum;*
    - *Digitaria eriantha;*
    - *Anthephora pubescens;* and
    - *Cenchrus ciliaris.*

10.8 Cumulative Impacts on Heritage (cultural landscape)

The proposed project will result in localised loss of rural landscape. However, it will not change the character of the broader landscape that is generally composed of islands of large-scale industrial operations surrounded by extensive rural areas.

At this stage, there is the potential for the cumulative impact of proposed renewable energy facilities to negatively impact the cultural landscape due to a change in the landscape character from natural wilderness and rural to semi-industrial.

To address concerns about the cumulative impact of renewable energy facilities within the greater region, a cautious approach is required in terms of assessing the desirability of such development from a cultural landscape perspective. The placement of renewable energy facilities must take cognisance of the very high visual impact on a relatively intact and representative cultural landscape, and the extremely limited ability to visually screen this infrastructural development, particularly in the case of the wind turbines.

Nature: *Cumulative impact to cultural landscape*		
	Overall impact of the proposed project considered in isolation (post mitigation)	**Cumulative impact of the project and other projects in the area (post mitigation)**
Extent	Local (1)	Local (1)
Duration	Medium-term (3)	Long-term (4)
Magnitude	High (8)	High (8)
Probability	Probable (3)	Probable (3)
Significance	**Medium (36)**	**Medium (39)**
Status (positive or negative)	Negative	Negative
Reversibility	High	Low
Irreplaceable loss of resources?	Possible	Possible
Can impacts be mitigated?	N/A	N/A
Confidence in findings	High	
Mitigation: » Implementation of recommended no development buffers along major routes.		

10.9 Cumulative Noise Impacts

There is a very low risk of cumulative noises during the construction phase since there are no other wind energy facilities proposed within the area of potential influence. Similarly, because there are no other wind energy facilities within the area of influence, there are no risk of a cumulative noise impact during operation.

10.10 Cumulative Visual Impacts

the landscape of the region can largely be described as a rural agricultural landscape within which there are large and relatively isolated industrial developments that are visible over a large area. The rural landscape generally extends to the property boundary within which the industrial elements are located meaning that there is generally no transition.

Examples of these industrial developments within 30km of the proposed WEF include the Tutuka Power Station which is approximately 28km from the proposed WEF and large scale mining operations.

The SASOL refinery at Secunda is also located just outside 30km from the proposed WEF.

Due largely to their height it is likely that mining operations will not be visible at the same time as the proposed WEF. It is likely however that taller elements such as Tutuka Power Station and the SASOL plant could be visible from some viewpoints at the same time as the proposed WEF.

There is also another WEF project (Hendrina) that is proposed approximately 25km to the north of the Ummbila WEF. At the time of reporting it is understood that application documents have just been submitted to the Competent Authority for this project. It is also likely that this project could be visible at the same time as the Ummbila WEF from areas between the two projects.

In terms of cumulative effects, these projects will reduce the distance between major industrial elements which whilst it will reinforce the current effect of large-scale industrial operations within predominantly rural areas, it will shift the balance slightly between industry and agriculture.

It needs to be stressed that at the distances from which two or more projects may be visible, the WEF projects are unlikely to be highly obvious.

The proposed project will result in a localised loss of rural landscape. However, it will not change the character of the broader landscape that is generally comprised of islands of large-scale industrial operations surrounded by extensive rural areas.

- Landscape - The proposed project was assessed as likely to have a cumulative impact contribution of low significance to an overall cumulative impact of low significance.
- Main Roads - The proposed project was assessed as likely to have a cumulative contribution of low significance to an overall cumulative impact of medium significance.
- Local Unsurfaced Roads - The project was assessed as likely to result in a low-level contribution to an overall cumulative impact of medium significance
- Homesteads - The project was assessed as likely to result in a low-level contribution to an overall cumulative impact of medium significance
- Nature Reserves - The project was assessed as likely to have no contribution to cumulative impacts.
- Shadow Flicker - There is unlikely to be a cumulative impact as the proposed project is the only one in the region that could create shadow flicker.
- Lighting - The project was assessed as likely to have a low contribution to an overall cumulative impact or medium significance.

Nature: *General cumulative change in the character and sense of place of the landscape setting*

The proposed project is located within a landscape area with an overriding rural character. Other large scale industrial operations including mining operations and power stations are relatively obvious in the region. Whilst the proposed project will create a new large scale industrial operation and change the character of an area of rural landscape, this is not entirely out of character with the region.

	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**
Extent	Region (3)	Region (3)
Duration	Long term (4)	Long term (4)
Magnitude	Minor (1)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	**Low (24)**	**Medium (33)**

Status (positive or negative)	Due to the fact that the project is generally in keeping with regional landscape character, it is unlikely to be seen as negative within the region context. Neutral	It is likely that a proportion of people will see large scale industry in the region in a negative light. Neutral - Negative
Reversibility	High	Low
Irreplaceable loss of resources?	No	Yes
Can impacts be mitigated?	Yes, possible mitigation will not change the level of significance	N/A

Mitigation:

Planning:

» Relocate turbines located in critical character areas to less sensitive areas.
» Minimise disturbance of the land beneath the turbine layout to ensure that associated infrastructure is sited in such a way that it minimises visual impact.
» Ensure that non reflective finishes are used on turbines, particularly blades.

Operations:

» Maintain current agricultural land uses.

Decommissioning:

» Remove infrastructure not required for the post-decommissioning use of the site.

Rehabilitate and monitor areas for vegetation cover post-decommissioning and implement remedial actions

Nature: *Cumulative impact on views from main roads*

The proposed project is located within a landscape area with an overriding rural character. Other large scale industrial operations including mining operations and power stations are relatively obvious in the region. Whilst the proposed project will create a new large scale industrial operation and change the character of an area of rural landscape, this is not entirely out of character with the region.

	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other industrial development in the area**
Extent	Region (3)	Region (3)
Duration	Long term (4)	Long term (4)
Magnitude	Minor (1)	Low (4)
Probability	Improbable (2)	Probable (3)
Significance	**Low (16)**	**Medium (33)**
Status (positive or negative)	Due to the fact that the project is generally in keeping with regional landscape character, it is unlikely to be seen as negative within the region context. Neutral	It is likely that a proportion of people will see large scale industry in the region in a negative light. Neutral - Negative
Reversibility	High	Low
Irreplaceable loss of resources?	No irreplaceable loss.	Yes
Can impacts be mitigated?	Yes, possible mitigation will not change the level of significance.	Unknown

Mitigation:

Planning:

» Relocate turbines within 500m of main roads.
» Minimise disturbance of the land beneath the turbine layout to ensure that associated infrastructure is sited in such a way that it minimises visual impact.

» Ensure that non reflective finishes are used on turbines, particularly blades.

Operations:

» Maintain current agricultural land uses.

Decommissioning:

» Remove infrastructure not required for the post-decommissioning use of the site.
» Rehabilitate and monitor areas for vegetation cover post-decommissioning and implement remedial actions.

Nature: *Cumulative impact on views from local unsurfaced roads*

The proposed project is located within a landscape area with an overriding rural character. Other large scale industrial operations including mining operations and power stations are relatively obvious in the region. Whilst the proposed project will create a new large scale industrial operation and change the character of an area of rural landscape, this is not entirely out of character with the region.

	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other industrial development in the area**
Extent	Region (3)	Region (3)
Duration	Long term (4)	Long term (4)
Magnitude	Minor to Small (1)	Low (4)
Probability	Improbable (2)	Probable (3)
Significance	**Low (16)**	**Medium (33)**
Status (positive or negative)	Due to the fact that the project is generally in keeping with regional landscape character, it is unlikely to be seen as negative within the region context. Neutral	It is likely that a proportion of people will see large scale industry in the region in a negative light. Neutral - Negative
Reversibility	High	Low
Irreplaceable loss of resources?	No irreplaceable loss.	Yes
Can impacts be mitigated?	Yes, possible mitigation will not change the level of significance.	

Mitigation:

Planning:

» Minimise disturbance of the land beneath the turbine layout to ensure that associated infrastructure is sited in such a way that it minimises visual impact.
» Ensure that non reflective finishes are used on turbines, particularly blades.

Operations:

» Maintain current agricultural land uses.

Decommissioning:

» Remove infrastructure not required for the post-decommissioning use of the site.
» Rehabilitate and monitor areas for vegetation cover post-decommissioning and implement remedial actions.

Nature: *Cumulative impact on local homesteads*

The proposed project is located within a landscape area with an overriding rural character. Other large scale industrial operations including mining operations and power stations are relatively obvious in the region. Whilst the proposed project will create a new large scale industrial operation and change the character of an area of rural landscape, this is not entirely out of character with the region.

	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**

Extent	Region (3)	Region (3)
Duration	Long term (4)	Long term (4)
Magnitude	Minor to Small (1)	Low (4)
Probability	Improbable (2)	Probable (3)
Significance	**Low (16)**	**Medium (33)**
Status (positive or negative)	Due to the fact that the project is generally in keeping with regional landscape character, it is unlikely to be seen as negative within the region context. Neutral	It is likely that a proportion of people will see large scale industry in the region in a negative light. Neutral - Negative
Reversibility	Medium	Low
Irreplaceable loss of resources?	No irreplaceable loss	Yes
Can impacts be mitigated?	Yes	Unknown

Mitigation:

Planning:

» Relocate turbines located in critical character areas to less sensitive areas.
» Minimise disturbance of the land beneath the turbine layout to ensure that associated infrastructure is sited in such a way that it minimises visual impact.
» Ensure that non reflective finishes are used on turbines, particularly blades.

Operations:

» Maintain current agricultural land uses.

Decommissioning:

» Remove infrastructure not required for the post-decommissioning use of the site.
» Rehabilitate and monitor areas for vegetation cover post-decommissioning and implement remedial actions.

Nature: *Lighting impacts*

Existing lighting is typically comprised of:

» Bright lighting areas associated with existing largescale industrial operations that are generally located in excess of 25km away.
» Bright lighting areas associated with settlements including Bethal, Morgonzon and Ermelo.
» Occasional low intensity lighting associated with homesteads and farms in the surrounding rural area.

There is potential for the proposed project to create a new node of intense lighting levels which could be obvious within the region. However, with appropriate mitigation, and under normal operating conditions, lighting associated with the proposed project will not raise local lighting levels significantly higher than the current situation. This will add minimally to cumulative lighting levels in the region.

	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**
Extent	Site (1)	Region (3)
Duration	Long term (4)	Long term (4)
Magnitude	Minor to Small (1)	Low (4)
Probability	Improbable (2)	Probable (3)
Significance	**Low (12)**	**Medium (33)**
Status (positive or negative)	Due to the fact that the project is generally in keeping with regional landscape character, it is unlikely to be seen as negative within the region context.	It is likely that a proportion of people will see large areas of intense lighting in the region in a negative light. Neutral - Negative

	Neutral	
Reversibility	Medium	High
Irreplaceable loss of resources?	No irreplaceable loss	No irreplaceable loss
Can impacts be mitigated?	Yes	Unknown
Mitigation: Planning: » Careful design of security and operational lighting. » Ensure that operational lighting is only activated, when necessary, the splitting of circuits and use of movement sensors should be considered. » Ensure that security lighting is only activated, when necessary, the use of movement sensors and / or infra-red systems should be considered. » No high mast lighting should be used. Operation: » Ensure that the intention of the original lighting design is maintained throughout the operational phase. Decommissioning: » Ensure that all lighting facilities are removed.		

10.11 Cumulative Socio-Economic Impacts

Other known authorised renewable energy facilities have been identified that will create the conditions for cumulative effect, namely Majuba Solar PV Facility, Tutuka Solar PV Facility, the Hendrina Renewable Energy Cluster, and Forzando North Coal Mine PV Facility. Only cumulative impacts that will have the potential for a significant influence are analysed:

» Increase in production - The initial investment spend on the project will inject significant business sales/ production for the local and regional economy. The economic impact arising from the initial investment will be felt throughout the economy with windfall effects benefitting related sectors in the economy.
» Employment creation - Increase in employment creation for the local workforce.
» Demographic shifts - Influx of migrant labour and job seekers due to job opportunities presented by numerous projects.

In addition to the negative cumulative impact noted above (i.e., demographic shifts), numerous positive impacts are expected to accumulate in the region such as increased production, GDP, employment, skills and household income.

The following tables summarise and rate the expected cumulative effects.

Nature: *Increase in economic production*		
	Cumulative Contribution of proposed project	**Cumulative Impact without proposed project**
Extent	Regional (3)	Regional (3)
Duration	Long term (4)	Long term (4)
Magnitude	High (8)	High (8)
Probability	Definite (5)	Definite (5)
Significance	**High (75)**	**High (75)**
Status (positive or negative)	Positive	Positive
Reversibility	Low	Low
Irreplaceable loss of resources?	No	No

Can impacts be enhanced?	Yes	Yes
Confidence in findings	High	
Enhancement: » No enhancement measures are required.		

Nature: *Increase in the number of employment opportunities*		
	Cumulative Contribution of proposed project	**Cumulative Impact without proposed project**
Extent	Regional (3)	Regional (3)
Duration	Long term (4)	Long term (4)
Magnitude	High (8)	High (8)
Probability	Highly Probable (4)	Highly Probable (4)
Significance	**Medium (60)**	**Medium (60)**
Status (positive or negative)	Positive	Positive
Reversibility	Low	Low
Irreplaceable loss of resources?	No	No
Can impacts be enhanced?	Yes	Yes
Confidence in findings	High	
Enhancement: » Employment of local residents as far as possible should be encouraged.		

Nature: *Influx of migrant labour and job seekers due to job opportunities presented by numerous projects*		
	Cumulative Contribution of proposed project	**Cumulative Impact without proposed project**
Extent	Regional (3)	Regional (3)
Duration	Medium term (3)	Medium term (3)
Magnitude	Moderate (6)	Moderate (6)
Probability	Highly probable (4)	Highly probable (4)
Significance	**Medium (48)**	**Medium (48)**
Status (positive or negative)	Negative	Negative
Reversibility	Medium	Low
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Confidence in findings	High	
Mitigation: » Where feasible, effort must be made to employ local labour in order to create maximum benefit for the communities and limit in-migration. » Provide training for unemployed local community members with insufficient skills and thus increase absorption of local labour thereby decreasing in-migration. » Manage recruitment and marketing for vacancies with a preference of residents within the municipality.		

10.12 Cumulative Traffic Impacts

To assess the cumulative impact, it was assumed that all renewable energy projects within 30km currently proposed and authorized would be constructed at the same time. This is the precautionary approach as in

reality these projects would be subject to a highly competitive bidding process. Only a handful of projects would be selected to enter into a power purchase agreement with Eskom or private offtaker, and construction is likely to be staggered depending on project-specific issues.

The construction and decommissioning phases are the only significant traffic generators for renewable energy projects. The duration of these phases is short term (i.e., the impact of the generated traffic on the surrounding road network is temporary and renewable energy facilities, when operational, do not add any significant traffic to the road network). Even if all renewable energy projects within the area are constructed at the same time, the roads authority will consider all applications for abnormal loads and work with all project companies to ensure that loads on the public roads are staggered and staged to ensure that the impact will be acceptable.

Nature: *Traffic generated by the proposed development and the associated noise and dust pollution. Traffic congestion and associated noise and dust pollution possible along the N17, R35, R39 and the existing gravel road network, depending on the main access route selected*		
	Cumulative Contribution of proposed project	**Cumulative Impact without proposed project**
Extent	Local (1)	Regional (4)
Duration	Short-term (2)	Medium-term (3)
Magnitude	Low (2)	High (8)
Probability	Probable (3)	Improbable (2)
Significance	**Low (18)**	**Medium (32)**
Status (positive or negative)	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	Yes
Confidence in findings	High	
Mitigation: » Stagger component delivery to site. » Undertake dust suppression. » Reduce the construction period. » The use of mobile batch plants and quarries in close proximity to the site must be considered. » Staff and general trips should occur outside the peak traffic periods.		

10.13 Conclusion regarding Cumulative Impacts

Cumulative impacts are expected to occur with the development of the Ummbila Emoyeni Wind Energy Facility throughout all phases of the project life cycle and within all areas of study considered as part of this EIA report. The main aim for the assessment of cumulative impacts considering the Ummbila Emoyeni Wind Energy Facility is to test and determine whether the development will be acceptable within the landscape proposed for the development, and whether the loss, from an environmental and social perspective, will be acceptable without whole-scale change.

The following conclusions can be drawn regarding the cumulative impacts associated with the project:

» There will be no unacceptable loss or impact on ecological aspects (vegetation types, species and ecological processes) due to the development of the Ummbila Emoyeni Wind Energy Facility and other

renewable energy projects within the surrounding area, provided the recommended mitigation measures are implemented. The cumulative impact is therefore acceptable.

- There will be no significant loss of sensitive and significant aquatic features. The cumulative impact is therefore acceptable.
- There will be no unacceptable risk to avifauna with the development of the Ummbila Emoyeni Wind Energy Facility and other renewable energy projects within the surrounding area, provided the recommended mitigation measures are implemented. This is due to the limited footprint expected to be associated with the renewable energy facilities proposed in authorised in the area. The cumulative impact is therefore acceptable.
- The cumulative impact relating to bat mortality is considered to be high, especially for Natal long-fingered bat as it is possible that the Ummbila Emoyeni Wind Energy Facility will result in an unacceptable loss to local bat populations. With the implementation of appropriate mitigation measures, this impact can be reduced to an acceptable level.
- The cumulative impact from a land capability perspective has been scored medium, indicating the potential for incremental, interactive, sequential, and synergistic cumulative impacts. I
- Change to the sense of place and character of the area is expected with the development of the proposed Ummbila Emoyeni Wind Energy Facility and other renewable energy facilities within a 30km radius of the site. Other large scale industrial operations including mining operations and power stations are relatively obvious in the region. Whilst the proposed project will create a new large scale industrial operation and change the character of an area of rural landscape, this is not entirely out of character with the region. The cumulative impact is therefore considered to be acceptable.
- There will be no unacceptable loss of heritage resources associated with the development of the Ummbila Emoyeni Wind Energy Facility. There will also be no unacceptable impacts to the cultural landscape as a result of the development of the facility provided that the recommended development buffers along major routes are adhered to. The cumulative impact is therefore acceptable.
- The risk of cumulative noise during the construction and operation of the wind energy facility is considered to be very low given the absence of other proposed, authorised and operational wind energy facilities within a 30km radius of the site.
- No unacceptable social impacts are expected to occur. Two positive cumulative impacts are expected to occur from a social perspective (i.e., increase in production and employment opportunities). These impacts will be of medium and high significance. Positive cumulative impacts are expected to be beneficial at a regional level. The cumulative impact is therefore acceptable.
- No unacceptable traffic impacts are expected to occur. The cumulative impact is therefore acceptable.

The cumulative impacts associated with the Ummbila Emoyeni Wind Energy Facility will be of a low significance, medium and high significance, with impacts of a high significance associated with the impacts on bats and the positive impacts on the socio-economic environment. A summary of the cumulative impacts is included in **Table 10.3** below.

Table 10.3: Summary of the cumulative impact significance for the Ummbila Emoyeni Wind Energy Facility

Specialist assessment	Overall significance of impact of the proposed project considered in isolation	Cumulative significance of impact of the project and other projects in the area
Terrestrial Ecology	Low	Low and Medium
Freshwater Ecology	Low	Low

Specialist assessment	Overall significance of impact of the proposed project considered in isolation	Cumulative significance of impact of the project and other projects in the area
Avifauna	Low	Medium
Bats	Medium	High
Soils and Agricultural Potential	Low	Low
Heritage (including archaeology, palaeontology and sense of place)	Medium	Medium
Noise	There is a very low risk of cumulative noises during the construction phase since there are no other wind energy facilities proposed within the area of potential influence. Similarly, because there are no other wind energy facilities within the area of influence, there are no risk of a cumulative noise impact.	
Visual	Low	Low and Medium
Socio-Economic	*Positive impacts:* Medium and High *Negative impacts:* Medium	*Positive impacts:* Medium and High *Negative impacts:* Medium
Traffic	Low	Medium (assuming all projects in the area are constructed at the same time)

Based on the specialist cumulative assessment and findings, the development of the Ummbila Emoyeni Wind Energy Facility and its contribution to the overall impact of all renewable energy projects to be developed within a 30km radius, it can be concluded that the Ummbila Emoyeni Wind Energy Facility cumulative impacts will be of low, medium and high significance, with impacts of a high significance mainly relating to impacts on bats and the positive impacts on the socio-economic environment. From a bats perspective, the wind energy facility may result in unacceptable loss to local bat populations, which can be reduced to an acceptable level with the implementation of recommended mitigation measures. Based on all other areas of study considered as part of this EIA report, the development of the Ummbila Emoyeni Wind Energy Facility will not result in unacceptable, high cumulative impacts and will not result in a whole-scale change of the environment.

CHAPTER 11: CONCLUSIONS AND RECOMMENDATIONS

Emoyeni Renewable Energy Farm (Pty) Ltd is proposing the development of a commercial wind energy facility and associated infrastructure on a site located ~6km south-east of Bethal and 1km east of Morgenzon, within the Mpumalanga Province. The project site is located across the Govan Mbeki, Lekwa, and Msukaligwa Local Municipalities within the Gert Sibande District on the following properties:

Parent Farm Number	Farm Portions
Farm 261 – Naudesfontein	15 R/E, 21
Farm 264 – Geluksplaats	0, 1, 3, 4, 5, 6 R/E, 8 R/E, 9R/E, 10, 11, 12
Farm 268 – Brak Fontein Settlement	6,7,10,11,12
Farm 420 – Rietfontein	8,9,10,11,12,15 R/E,16,18,19,22,32
Farm 421 - Sukkelaar	2, 2, 7, 9, 9 10, 10 11, 11 12, 12, 22 ,25 R/E, 34, 35, 36, 37, 37, 38, 39, 40, 42, 42
Farm 422 – Klipfontein	0, 2 R/E, 3 R/E, 4, 5, 6, 7, 8 R/E, 9, 10, 12, 13 R/E, 14 R/E, 16, 17, 18, 19, 20, 21, 22, 23
Farm 423 – Bekkerust	0 R/E, 1, 2 R/E, 4, 5 R/E, 6, 10, 11, 12, 13 14, 15, 17, 19 R/E, 20, 22, 23, 24,25
Farm 454 – Oshoek	4 R/E, 13, 18
Farm 455 – Ebenhaezer	0, 1, 2, 3
Farm 456 – Vaalbank	1, 2, 3, 4, 7, 8, 13, 15, 16, 17, 18, 19
Farm 457 – Roodekrans	0, 1, 4, 5, 7, 22, 23, 23
Farm 458 – Goedgedacht	0, 2, 3, 4, 4, 5, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 21, 21, 22, 23, 25, 26 R/E, 27, 28, 29, 31, 32, 33, 34, 35, 36, 37, 39, 41, 42, 43
Farm 467 – Twee Fontein	0 R/E, 1 R/E, 4 R/E, 5, 6, 7 R/E, 8, 10
Farm 469 – Klipkraal	5 R/E, 6, 7, 8
Farm 548 – Durabel	0
Farm 470 – Dorpsplaats	85
Farm 451 - Drinkwater	4, 22
Farm 452 - Brakfontein	5

The facility will have a contracted capacity of up to 900MW and will be known as the Ummbila Emoyeni Wind Energy Facility. A project site considered to be suitable for the development of a wind farm, with an extent of ~27 819ha, was identified by the project developer. The project site is the area under assessment in the EIA process. It is within the identified project site that a footprint has been identified by the developer through consideration of the sensitive environmental features and buffers identified during the Scoping Phase.

The development footprint[22] will contain the following infrastructure to enable the wind farm to generate up to 900MW:

» Up to 111 wind turbines with a maximum hub height of up to 200m. The tip height of the turbines will be up to 300m.

[22]The development footprint is the result of detailed design by the developer which the consideration of sensitive environmental features which are required to be avoided by the wind farm infrastructure.

- 33kV cabling to connect the wind turbines to the onsite collector substations, to be laid underground where practical.
- 3 x 33kV/132kV onsite collector substation (IPP Portion), each being 5ha.
- Battery Energy Storage System (BESS).
- Cabling between turbines, to be laid underground where practical.
- Construction compounds including site office (approximately 300m x 300m in total but split into 3ha each of 150m x 200m):
  - Batching plant of up to 4ha to 7ha.
  - 3 x O&M office of approximately 1.5ha each adjacent to each collector SS.
  - 3 x construction compound / laydown area, including site office of 3ha each (150m x 200m each).
- Laydown and crane hardstand areas (approximately 75m x 120m).
- Access roads of 12 -13m wide, with 12m at turning circles.

Emoyeni Renewable Energy Farm (Pty) Ltd has confirmed that the project site is particularly suitable for wind energy development from a technical perspective due to the quality of the prevailing wind resource, access to the electricity grid, compatibility with the current land use and land availability. The wind resource of the project site has been confirmed through the consideration of the datasets, involving wind presence and wind speed, as well as meteorological information and geographical factors taken from measurements on site.

A summary of the recommendations and conclusions for the proposed project is provided in this chapter.

11.1. Legal Requirements as per the EIA Regulations, 2014 (as amended), for the undertaking of an Environmental Impact Assessment Report

This chapter of the EIA Report includes the following information required in terms of Appendix 3: Scope of Assessment and Content of Environmental Impact Assessment Reports:

Requirement	Relevant Section
3(1)(k) where applicable, a summary of the findings and impact management measures identified in any specialist report complying with Appendix 6 to these Regulations and an indication as to how these findings and recommendations have been included in the final report.	A summary of the findings of the specialist studies undertaken for the Ummbila Emoyeni Wind Energy Facility has been included in **section 11.2**.
3(1)(l) an environmental impact statement which contains (i) a summary of the key findings of the environmental impact assessment, (ii) a map at an appropriate scale which superimposes the proposed activity and its associated structures and infrastructure on the environmental sensitivities of the preferred development footprint on the approved site as contemplated in the accepted scoping report indicating any areas that should be avoided, including buffers and (iii) a summary of the positive and negative impacts and risks of the proposed activity and identified alternatives.	An environmental impact statement containing the key findings of the environmental impacts of the Ummbila Emoyeni Wind Energy Facility has been included as **section 11.5**. An Environmental Sensitivity and Layout map of the Ummbila Emoyeni Wind Energy Facility has been included as **Figure 11.1** which overlays the development footprint (as assessed within the EIA) of the wind farm with the environmental sensitive features located within the development area. A summary of the positive and negative impacts associated with the Ummbila Emoyeni Wind Energy Facility has been included in **section 11.2**.

Requirement	Relevant Section
3(1)(o) any aspects which were conditional to the findings of the assessment either by the EAP or specialist which are to be included as conditions of authorisation.	All conditions required to be included in the Environmental Authorisation of the Ummbila Emoyeni Wind Energy Facility have been included in **section 11.6**.
3(q) a reasoned opinion as to whether the proposed activity should or should not be authorised, and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation.	A reasoned opinion as to whether the Ummbila Emoyeni Wind Energy Facility should be authorised has been included in **section 11.5**.

11.2 Evaluation of the Ummbila Emoyeni Wind Energy Facility

The preceding chapters of this report, together with the specialist studies contained within **Appendices D-M** provide a detailed assessment of the potential impacts that may result from the development of the Ummbila Emoyeni Wind Energy Facility. This chapter concludes the environmental assessment of the wind farm by providing a summary of the results and conclusions of the assessment of both the project site and development footprint for the wind energy facility. In so doing, it draws on the information gathered as part of the EIA process, the knowledge gained by the environmental specialists and the EAP and presents a combined and informed opinion of the environmental impacts associated with the project.

No environmental fatal flaws or unacceptable impacts were identified in the detailed specialist studies conducted, provided that the recommended mitigation measures are implemented. These measures include, amongst others, the avoidance of sensitive features within the development footprint and the undertaking of the construction and operational bird and bat monitoring, as specified by the specialists.

The potential environmental impacts associated with the Ummbila Emoyeni Wind Energy Facility assessed through the EIA process include:

- Impacts on terrestrial ecology (flora and fauna).
- Impacts on freshwater ecology.
- Impacts on avifauna.
- Impacts on bats.
- Impacts on soils and agricultural potential.
- Impacts on heritage resources, including archaeology, palaeontology and the cultural landscape.
- Noise impacts due to the construction and operation of the wind farm.
- Visual impacts on the area imposed by the components of the facility.
- Positive and negative social impacts.
- Traffic impacts.

The development footprint, as assessed in the EIA Report is presented in **Figure 11.1**.

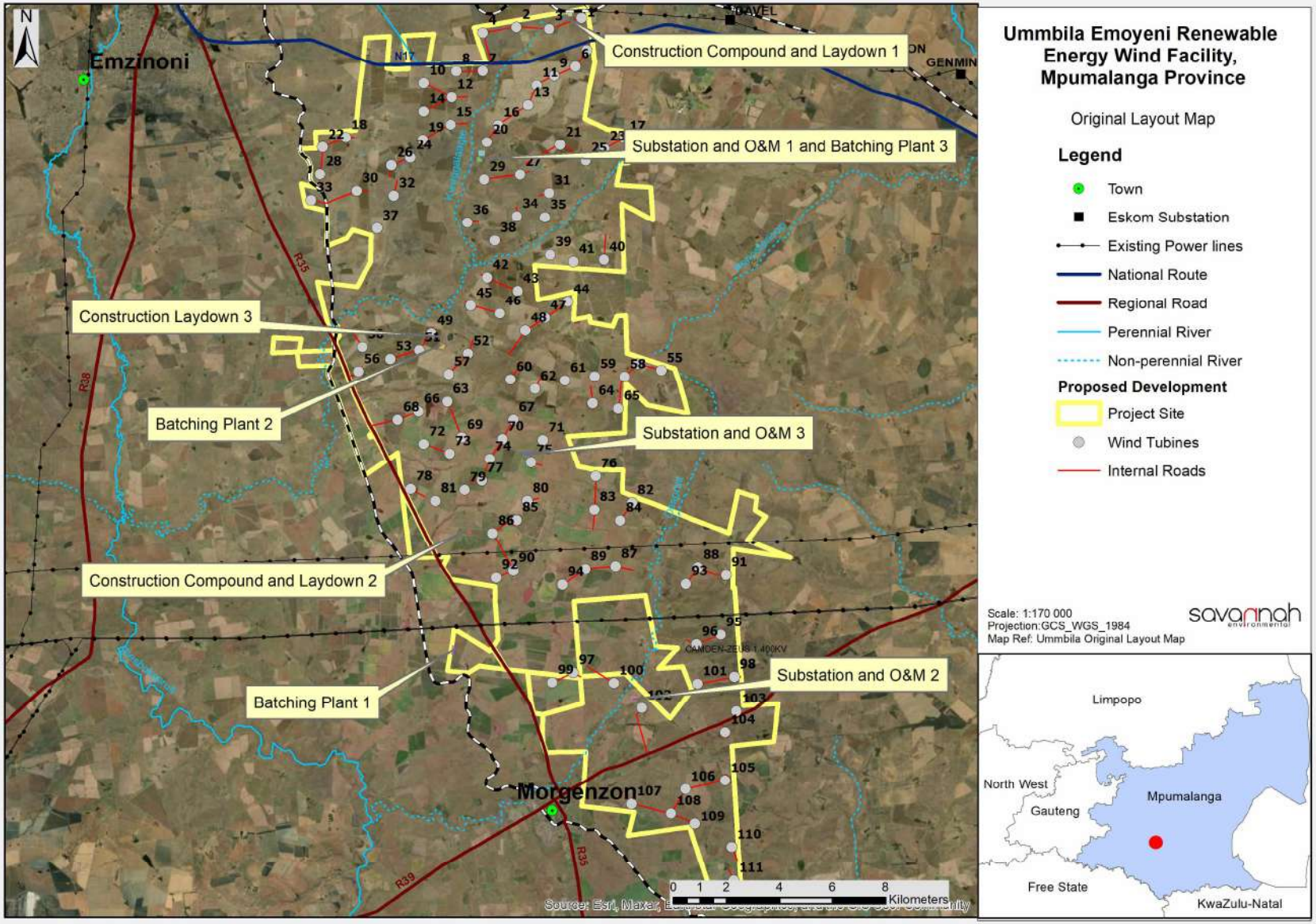


Figure 11.1: The development footprint of the Ummbila Emoyeni Wind Energy Facility, as assessed within the EIA Report

11.2.1 Impacts on Terrestrial Ecology (including flora and fauna)

From a botanical and ecological perspective, it was found that the study area is mostly comprised of either Moderate (7549 ha; 20.7%) or Low (14496 ha; 39.7%) sensitivity. This large extent of low sensitivity areas is fortunate and means that there are ample areas for the development to occur. Various "Very High" sensitivity areas also occur throughout the study area (comprising features such as wetlands, ephemeral rivers and streams, seepages, and other drainage lines). Furthermore, various CBA and ESA areas occur throughout the study area. Development is highly discouraged within the areas classified as CBA Irreplaceable Areas and development within CBA Optimal Areas should be avoided as far as possible.

A total of 198 plant species were found within the study area, which consisted of 158 native, 0 Red List, 6 protected, 0 Mpumalanga endemic, 39 alien, and 11 NEM:BA listed invasive species.

A total of 32 mammal species, 6 amphibians and 10 reptile species were recorded within the projects site. No amphibian or reptile SCC were recorded within the project site; however, 4 mammal SCC were recorded within the project site namely; Serval (Near Threatened), Brown hyena (Near Threatened); Vlei rat (Near Threatened), Cape clawless otter (Near Threatened) and South African hedgehog (Near Threatened). It was determined that the development will not detrimentally impact these populations/individual SCC.

During this assessment it was determined that the study area contains numerous habitat variations, and include Drainage, Fallow Land, Natural Clay, Natural Dolerite, Natural Loam Soil, Natural Rock Turf, Natural Sandstone, and Disturbed areas. Each of these areas (excluding disturbed areas) have certain unique species, with drainage areas having the highest number (i.e., many of its species are not shared with the other habitats). Development should therefore not proceed within drainage areas, which are all classified as "Very High" sensitivity. Natural rock turf and natural clay areas had the lowest number of species that occurred only in those types, and development should therefore aim to occur within these habitat types, since this would minimize the loss of unique biodiversity.

None of the proposed turbine localities occur within drainage areas ("Very High" sensitivity). However, internal access routes will cross drainage areas at sixteen locations. A total of fourteen (14) wind turbines are planned within the natural areas classified as CBA Optimal Areas ("Very High" sensitivity), five (5) wind turbines are planned within natural areas classified as CBA Irreplaceable Areas ("Very High" sensitivity). Furthermore, a total of twenty (20) turbines occur within natural areas, that fall outside of any CBAs (eight of these turbines fall within ESAs) and have subsequently been classified as "Medium" in terms of sensitivity (as determined by the authors of this report via desktop mapping and ground truthing).

A new optimised layout has been proposed (refer to Chapter 11), and according to this layout no wind turbines will be located within any CBA Irreplaceable Areas, with only six wind turbines planned within CBA Optimal Areas. Thus, according to this optimized layout, almost all of the sensitive areas will be avoided and the Ummbila WEF will not significantly impact sensitive areas or impact conservation targets set out by the province.

There are no impacts associated with the proposed wind energy facility that cannot be mitigated to a low level. Its local environmental impact can be reduced to an acceptable magnitude. Likewise, the contribution of the proposed wind energy facility to the cumulative impact in the area would be low and is acceptable. As such, there are no fatal flaws associated with the development and no terrestrial ecological considerations that should prevent it from proceeding. Therefore, it is the opinion of the specialists that the

development may be authorised within the specified area, subject to the implementation of the recommended mitigation measures.

11.2.2 Impacts on Freshwater Ecology

All endorheic wetland features, wetland features that are not directly connected to the larger extensive wetland network or that have been fractured/isolated through agricultural practices are classified as High Sensitive. Even though these wetland features do not provide functions and services to the extent of the more connected and larger wetland features, these wetlands still provide some functions and services. Furthermore, most of these wetland features are fairly small and any direct impacts on these wetland habitats may have a significant impact on the drivers of these wetland features as well as the associated biodiversity. Another feature of these wetlands is the fact that, even though small in size, the are located within relatively small catchment areas, thus these wetlands' percentage coverage in relationship to their catchments are fairly significant, making these wetland features vulnerable to catchment disturbances.

The following buffer areas are recommended, and should be implemented for maintaining the freshwater resource features REC (Recommended Ecological Category) allowing the persistence of the current present ecological status as well as their functions and services.

- All small, endorheic seepages and depressions with a High Ecological Importance: 50m buffers from the outer edge of the freshwater resource features.
- All larger interconnected wetland features with Very Ecological Importance: 100m buffers from the outer edge of the freshwater resource features.
- All freshwater features with their buffer areas have been classified as either Very High- or High sensitive and should be regarded as "No-Go" areas apart from the following activities and infrastructure which may be allowed (although restricted to an absolute minimum footprint):
  - only activities relating to the route access and cabling:
    - the use/upgrade of existing roads and watercourse crossings are the preferred options;
    - Where no suitable existing roads and watercourse crossings exist, the construction of new access roads and watercourse crossings can be allowed, however this should be deemed as a last resort.
    - All underground cabling should be laid either within access roads or next to access roads (as close as possible).

With mitigation measures in place, impacts on the freshwater resource features' integrity and functioning can be potentially reduced to sufficiently low levels. This would be best achieved by incorporating the recommended management & mitigation measures into an Environmental Management Programme (EMPr) for the site, together with appropriate rehabilitation guidelines and ecological monitoring recommendations.

Based on the outcomes of this study it is the specialist's considered opinion that the **proposed project detailed in this report could be authorised** from a freshwater resource perspective.

Since there are watercourses present within the development area of the Ummbila Emoyeni Wind Energy Facility as identified in the Freshwater Impact Assessment (**Appendix E**), and since water may be abstracted from boreholes for use during the construction and operational phases, a water use authorisation for the project will be required from the DWS for water uses identified in Section 21(a), Section 21(c) and 21(i) of the National Water Act (Act 36 of 1998).

11.2.3 Impacts on Avifauna

Pre-construction bird monitoring was undertaken over a period of 12 months within the project area. The pre-construction bird monitoring included the identification of twelve vantage points, five drive transects, and 15 walk transects of 500m in length across the project site. A total of 102 species (5 805 birds) were recorded during the walk transects conducted across the full pre-construction bird monitoring period.

A total of 26 target species were recorded during vantage point monitoring over the pre-construction monitoring period. A total of 72 observations of 18 target species (comprising 235 birds) were recorded during 703.12km of drive transect observations.

The following sensitivities were identified from an avifaunal perspective:
» Wetlands - Very High Avifaunal Site Ecological Importance
» Natural Grasslands – High Avifaunal Site Ecological Importance
» Agricultural/cultivated fields – Very Low Avifaunal Site Ecological Importance

Very High sensitivity areas are no-go for the development of WTGs and blade tips are not to allowed to encroach on these areas. Linear infrastructure can traverse these areas, where necessary, following the implementation of appropriate mitigation measures. WTG development is permitted within areas of high sensitivity following the implementation of additional mitigation requirements, although development within these areas should be avoided, where possible. Development in medium sensitivity areas should also be avoided and reduced wherever practically possible.

Based on the avifaunal sensitivity of the project site, wind turbines (plus 100 m radius representing an assumed blade length) within the indicative layout assessed encroach on the revised areas of high avifaunal sensitivity. Note that the 100m is a conservative blade length (blade length and not radius is the important figure) but nonetheless, these will be considered to be relocated, should it be possible to achieve the target generating output of the development within fewer wind turbines, or additional mitigation implemented as recommended in the avifaunal assessment. These include WTGs 6, 9, 11, 13, 19, 24, 26, 28, 29, 30, 32, 34, 36, 49, 52, 59, 61, 64, 82, 83, 84, 96, 100, 101. Nevertheless, all wind turbines in the proposed layout avoid areas identified to be of Very High Avifaunal Sensitivity (wind turbine no-go) areas and the wind turbine layout is therefore acceptable from an avifauna perspective.

The Avifauna Impact Assessment identified that all impacts associated with the development of the Ummbila Emoyeni Wind Energy Facility will be of low, medium and high significance before mitigation, and can be mitigated to an acceptable level of impact (i.e., medium and low significance, depending on the impact being considered). The impacts rated to be of high significance pre-mitigation are not considered as fatal flaws, provided the prescribed mitigation measures are implemented. One of these mitigation measures includes avoiding areas to be of very high sensitivity (no-go). Secondly, the implementation of additional mitigation measures such as observer-based shut-down-on-demand in areas of elevated recorded passage rates will be highly effective at reducing the likelihood of collisions as large flocks of birds are easily detected.

Based on the screening study, reconnaissance study, and results of the pre-construction avifauna monitoring programme conducted for the Ummbila Emoyeni Wind Energy Facility, it is the avifaunal specialist's informed opinion that the proposed development will not have a significant negative impact on the viability or persistence of avifaunal populations (particularly avifaunal species of conservation concern) in the area

following the implementation of mitigation measures. It is the specialist's opinion that the **proposed development can be approved** from an avifaunal perspective and that the indicative positions of all 111 wind turbines in the layout are acceptable.

11.2.4 Impacts on Bats

Pre-construction bat monitoring was undertaken over a period of 12 months for the project site in accordance with the best practice guidelines. The monitoring was designed to monitor bat activity across the area for the Ummbila Emoyeni Wind Energy Facility.

Key habitat features have been identified for bats within the project site. These habitat features present specific uses and opportunities for bats including roosts, foraging resources and commuting resources. Sensitive features within the project site at which bat foraging activity may be concentrated include farm buildings (and within built up areas for some species) where they would forage for insects attracted to lighting, dams and wetland areas, within and along the edge of woodland/tree patches, and over cultivated areas (refer to **Table 11.1**).

Table 11.1: Features used to assign spatial risk categories in the project site for bats

Risk Level		
Low	**Medium**	**No-Go**
Heavily modified land	CBA Optimal	Farm Dams
Moderately modified land	ESA Landscape corridor	Wetlands
	ESA Local corridor	Trees
	Other Natural Areas	Buildings
		Rivers/Streams
		Wetlands
		CBA Irreplaceable Areas

To avoid collision impacts, no part of the wind turbines, including the blade tips, shall intrude into the no-go buffers. The turbine assessed has a rotor diameter of 170m and hub height of 150m. Thus, to ensure the turbine blades do not cross into the bat buffers, an additional distance of 42m must be added to the 200m no-go buffers. Six turbines in the proposed indicative layout assessed in the EIA are currently located within no-go areas: WTG10, WTG61, WTG82, WTG88, WTG100, and WTG101. These turbines must be relocated into low and medium sensitivity areas. In addition, several locations of the construction compounds, laydown areas, batching plants, and substations associated with the wind energy facility, specifically Substation and O&M 1 and Batching Plant 3, Construction Laydown Area 3 and a small portion of Batching Plant 2, Construction Compound 2, also need to be adjusted so that they are outside no-go Areas. The optimised layout presented in Section 11.3 of this EIA Report addresses this requirement.

Based on the bat activity recorded at the site proposed for the Ummbila Emoyeni Wind Energy Facility, the significance ratings for the majority of the impacts to bats posed by the development are predicted to be low and medium significance before mitigation. After mitigation, all impacts are predicted to be low. Based on the opportunity for reduction of the impacts through appropriate mitigation measures from a medium significance to a low, acceptable significance, no fatal flaws are expected to occur. The specialist indicates that with the implementation of the mitigation measures, the **development of the Ummbila Emoyeni Wind Energy Facility will not result in unacceptable impacts to bats, and can be authorised**.

11.2.5 Impacts on Soils and Agricultural Potential

Four main sensitive soil forms were identified within the project site, namely the Vaalbos, Avalon, Ermelo and Tukulu soil forms. The land capability sensitivity (DAFF, 2017) indicates a range of sensitivities expected throughout the project site, which predominantly covers "Moderately Low" to "Moderate" sensitivities. Smaller patches are characterised by sensitivities up to "Moderately High". Furthermore, various crop field boundaries were identified by means of the DFFE Screening Tool (2022), which are predominantly characterised by "High" sensitivities with one area being classified as "Very High" sensitivity.

The specialist has recommended that such high potential crop fields be avoided by relocating wind turbines and associated infrastructure (e.g., laydown areas, substations, etc.) from the areas characterised by "High" to "Very High" crop fields in order to ensure that these crop fields are preserved, where possible. In a case where relocating the project infrastructure is not feasible, the developer should engage with the owners of the crop fields for an appropriate compensation. Approximately 22 turbines are located within sensitivity crop fields.

The Soils and Agricultural Potential Impact Assessment identified that all impacts associated with the development of the Ummbila Emoyeni Wind Energy Facility will be of medium significance before mitigation, and can be mitigated to an acceptable level of impact (i.e., low significance). The proposed development will have an overall low residual impact on the agricultural production ability of the land. It is the specialist's opinion that the **project be approved** subject to implementation of the recommended mitigation measures.

11.2.6 Impacts on Heritage Resources (archaeology, palaeontology and cultural landscape)

The proposed development will not have a substantial negative impact on the archaeological heritage resources identified within the proposed development area for the renewable energy facilities and associated infrastructure. No Stone Age or Iron age archaeology was identified during the field assessment. Some historical ruins and kraals of contextual historic significance, graded IIIC, were identified; however, none of these are likely to be impacted as per the layout provided and assessed.

A number of burial grounds and/or graves were identified during the field assessment (Grade IIIA) and some of these fall within areas likely to be impacted as per the proposed layout. A 50m no-go buffer has been recommended around these burial grounds. The burial ground recorded as Observation 008 is located away from any proposed infrastructure and is therefore unlikely to be impacted by the development. However, it is still recommended that a no-development area of 50m be implemented around this site to ensure that no impact takes place.

No palaeontological no-go areas have been identified within the project areas. With the exception of one fossil site of low scientific value, none of the recorded fossil sites overlap directly with, or lie close to (< 20 m) the proposed infrastructure and no modification of the layouts through micro-siting is proposed here on palaeontological grounds. One fossil site (UMB10) is located in close proximity to a proposed road and turbine; however, this site has low palaeontological significance and has been sufficiently recorded. No further mitigation is recommended for this site.

Impacts on archaeological and palaeontological heritage are expected to be of medium and high significance pre-mitigation and can be reduced to low significance post-mitigation.

The facility layout has been assessed to have a high impact on the cultural landscape pre-mitigation as some of the wind turbines fall within the no development 500m buffers along major routes such as the N17, R35 and R39 and the 200m no development buffers along secondary routes. Impacts to the cultural landscape can be reduced to be of low significance following the implementation of mitigation measures. These mitigations have been applied and no turbines are located north of the N17 or within road buffer.

Based on the outcomes of the Heritage Impact Assessment, it is **not anticipated that the proposed development of the wind energy facility and its associated infrastructure will negatively impact on significant heritage resources** on condition the recommended mitigation measures are adhered to.

11.2.7 Noise Impacts

Ambient (background) sound levels were measured over a period of up to seven nights from 9 to 15 March 2022 at five locations in the vicinity of the project site. Considering the results of the ambient sound levels and the developmental character of the area, ambient sound levels were elevated, especially at night. The acceptable zone sound level (noise rating level) during low and no-wind conditions would be typical of a rural (daytime) to suburban (night-time) noise district, e.g.: 45 dBA for the daytime period and 40 dBA for the nigh-time period.

Numerous noise-sensitive developments, receptors and communities were identified within the potential area of influence (within 2 000m from a wind turbine). Based on the results of the Noise Impact Assessment, adjustments in terms of the proposed layout are required as there are potential noise sensitive receptors are located within 1 000m of some of the wind turbines, namely, NSR47, NSR40 and NSR46. The specialist has recommended that should it be found that the structures at these noise sensitive receptors are used for residential purposes at the time of operation of the wind farm, the residents must be relocated, or the wind turbine located within 1 000m from these noise sensitive receptors must be moved further than 1 000m from these noise sensitive receptors.

Noise impacts will be of low significance for daytime construction activities, of medium significance for night-time construction activities (with mitigation proposed to reduce the significance to low), and of medium significance for day-time operation activities and high significance for night-time operation activities (with mitigation proposed to reduce the significance to low). Most of the higher significance ratings relate to the potential noise impact on NSR 40, 46 and 47.

Because the total projected noise levels will exceed the rural rating levels, with the projected noise level exceeding 42 dBA, active noise monitoring is recommended. Once-off noise measurements are recommended at the locations of NSRs located within the 42 dBA noise level contour before the wind energy facility is developed, to be repeated once within a year after the wind energy facility is fully operational.

It is **recommended that the proposed Ummbila Emoyeni Wind Energy Facility and associated infrastructure project be authorised**, provided that the applicant can reduce the noise levels to less than 45 dBA at all receptors (structures used for residential purposes) through the implementation of recommended mitigation measures. The proposed layout (i.e., turbine placement) is considered to be acceptable from a noise perspective with the implementation of appropriate mitigation measures to ensure that the total noise levels are less than 45 dBA at all structures used for residential purposes. The locations of facility substations, BESS and O&M hubs are acceptable.

11.2.8 Visual Impacts

The following sensitivities have been identified from a visual perspective:

- Highly sensitive areas include:
  - Areas immediately surrounding settlement and homesteads development of which is likely to significantly change the character of views for residents. A 1 000m buffer is proposed (and has been applied in the indicative layout) which should be sufficient to ensure that development does not totally dominate views. It is possible that receptors (owners /residents) have no concern regarding the development of these areas, in which case the sensitivity rating will reduce.
  - Corridors beside the main roads that could be affected including the N17, the R35, and the R39. This is deemed sensitive because development in this corridor is likely to be highly obvious to people travelling along the roads the proposed 500m corridor should be sufficient to ensure that development does not totally dominate views.
- Medium sensitivity areas include:
  - Watercourses and a buffer of 250m either side of watercourses. These areas are proposed in order to protect these natural features within the proposed focus area.
- Low sensitivity areas include:
  - Valley side slopes the development of which is likely to make the project least obvious from surrounding areas. The fact that development may be focused on areas with relatively low sensitivity does not preclude the necessity for mitigation.

Considering the visual sensitivities overlain on the wind farm layout, the following can be noted:
- Three turbines are located within the high sensitivity area beside the N17.
- Two turbines are located within the high sensitivity area beside the R35.
- Two turbines are located in the high sensitivity area beside the R39.
- Approximately 95 turbines are located within the shadow flicker risk area.
- Fourteen turbines are located within or on the edge of the 1 000m homestead buffer.

A visibility analysis was undertaken for the project. Based on the results of the visibility analysis, the turbines, are likely to be visible within a 10km buffer, and are only likely to be visible over high sections of the landscape within the 30km buffer. Outside the 30km buffer, turbines are unlikely to be seen as being prominent. None of the proposed onsite substations are likely to be highly visible, although they may be intermittently visible to main roads, but are unlikely to be obvious.

The proposed project will generally result in landscape and visual impacts of low to high significance, depending on the distance from the facility. Subject to mitigation measures being undertaken, particularly the necessary shadow flicker study and the implementation of recommended mitigation measures within the final design, from a Landscape and Visual Impact perspective, it is the specialist's opinion that **there is no reason why the proposed project should not be authorised**.

11.2.9 Socio-Economic Impacts

Impacts are expected to occur with the development of the Ummbila Emoyeni Wind Energy Facility during the construction, operation and decommissioning phases. Both positive and negative impacts are identified and assessed.

Impacts during construction include:

- Impact on production.
- Impact on the Gross Domestic Product (GDP).
- Impact on employment creation.
- Skills development.
- Household income and standard living.
- Temporary increase in government revenue.
- Change in sense of place.
- Safety and security.
- Agricultural operations.
- Influx of people.
- Daily movement patterns.

Impacts during the operation phase include:
- Impact on production.
- Impact on the GDP.
- Employment creation.
- Household income and standard of living.
- Increase in government revenue.
- Rental revenue for landowners.
- Improvement in energy sector generation.
- Visual and sense of place impacts.
- Impacts on agricultural operations.

Positive impacts during both construction and operation are expected to be of medium and high significance pre-enhancement and can be increase to medium and high post-enhancement. Negative impacts during both construction and operation are expected to be of medium and low significance pre-mitigation and can be reduced to medium (different score) and low significance post-mitigation, depending on the type of impact.

The net positive impacts associated with the development and operation of the proposed project are expected to outweigh the net negative effects. The project is also envisaged to have a positive stimulus on the local economy and employment creation, leading to the economy's diversification and a small reduction in the unemployment rate. It is the specialist's opinion that the **project should therefore be considered for authorisation**.

11.2.10 Traffic Impacts

It is assumed that if components are imported to South Africa, it will be via the Port of Richards Bay in KwaZulu-Natal, or the ports of East London and Ngqura in the Eastern Cape. The Port of Richards Bay is located ~460km travel distance from the proposed site whilst the ports of East London and Ngqura are respectively located ~1 130km and 1 200km travel distance from the proposed site. The Port of Richards Bay is the preferred port of entry; however, the ports of East London and Ngqura can be used as alternatives, should the Port of Richards Bay not be available.

The proposed site is bounded by the N17 in the south, the R39 in the south and east and the R35 in the west. Access to the proposed site can be obtained from any of these three roads, depending on the traffic volumes of each road. The road carrying the least traffic will be considered as the best option. There is also

an existing network of unnumbered gravel roads that might be suitable as a main access road to the proposed site.

The construction and decommissioning phases of a wind farm are the only significant traffic generators and therefore noise, dust and exhaust pollution will be higher during these phases. The duration of these phases is short term i.e., the impact of the Wind Farm on traffic on the surrounding road network is temporary. The access point to the proposed site has been assessed and was found to be acceptable from a transport perspective. The **development is supported** from a transport perspective provided that the recommendations and mitigation measures are adhered to.

11.2.11 Assessment of Cumulative Impacts

Cumulative impacts and benefits on various environmental and social receptors will occur to varying degrees with the development of several renewable energy facilities in South Africa. The degree of significance of these cumulative impacts is difficult to predict without detailed studies based on more comprehensive data/information on each of the receptors and the site-specific developments. The alignment of renewable energy developments with South Africa's National Energy Response Plan and the global drive to move away from the use of non-renewable energy resources and to reduce greenhouse gas emissions is undoubtedly positive. The economic benefits of renewable energy developments at a local, regional and national level have the potential to be significant.

The are several authorised renewable energy projects within a 30km radius of the proposed site, namely:
» Majuba Solar PV Facility.
» Tutuka Solar PV Facility.
» Forzando North Coal Mine Solar PV Facility.
» Hendrina Renewable Energy Complex.

In addition to the renewable energy facilities listed above, one new renewable energy facility (a solar energy facility) is proposed by Emoyeni Renewable Energy Farm (Pty) Ltd, within the footprint of the Ummbila Emoyeni Wind Energy Facility, namely:
» Ummbila Emoyeni Solar Energy Facility.

The Ummbila Emoyeni Renewable Energy Farm will also include grid connection infrastructure comprising a 400/132kV Main Transmission Substation (MTS), to be located between the Camden and SOL Substations, which will be looped in and out of the existing Camden-Sol 400kV transmission line; on-site switching stations (132kV in capacity) at each renewable energy facility (Eskom Portion); 132kV power lines from the switching stations at each renewable energy facility to the new 400/132kV MTS; and a collector substation with 2 x 132kV bus bars and 4 x 132kV IPP feeder bays to the onsite IPP Substation to evacuate the generated power to the national grid.

The majority of cumulative impacts associated with the Ummbila Emoyeni Wind Energy Facility will be of a low significance, medium and high significance, with impacts of a high significance associated with the impacts on bats and the socio-economic environment. A summary of the cumulative impacts is included in **Table 11.1** below.

Table 11.1: Summary of the cumulative impact significance for the Ummbila Emoyeni Wind Energy Facility

Specialist assessment	Overall significance of impact of the proposed project considered in isolation	Cumulative significance of impact of the project and other projects in the area
Terrestrial Ecology	Low	Low and Medium
Freshwater Ecology	Low	Low
Avifauna	Low	Medium
Bats	Medium	High
Soils and Agricultural Potential	Low	Low
Heritage (including archaeology, palaeontology and sense of place)	Medium	Medium
Noise	There is a very low risk of cumulative noises during the construction phase since there are no other wind energy facilities proposed within the area of potential influence. Similarly, because there are no other wind energy facilities within the area of influence, there are no risk of a cumulative noise impact.	
Visual	Low	Low and Medium
Socio-Economic	*Positive impacts:* Medium and High *Negative impacts:* Medium	*Positive impacts:* Medium and High *Negative impacts:* Medium
Traffic	Low	Medium (assuming all projects in the area are constructed at the same time)

Based on the specialist cumulative assessment and findings, the development of the Ummbila Emoyeni Wind Energy Facility and its contribution to the overall impact of all renewable energy projects to be developed within a 30km radius, it can be concluded that the Ummbila Emoyeni Wind Energy Facility cumulative impacts will be of low, medium and high significance, with impacts of a high significance mainly relating to impacts on bats and the positive impacts on the socio-economic environment. From a bats perspective, the wind energy facility may result in unacceptable loss to local bat populations, which can be reduced to an acceptable level with the implementation of recommended mitigation measures. Based on all other areas of study considered as part of this EIA report, the development of the Ummbila Emoyeni Wind Energy Facility will not result in unacceptable, high cumulative impacts and will not result in a whole-scale change of the environment.

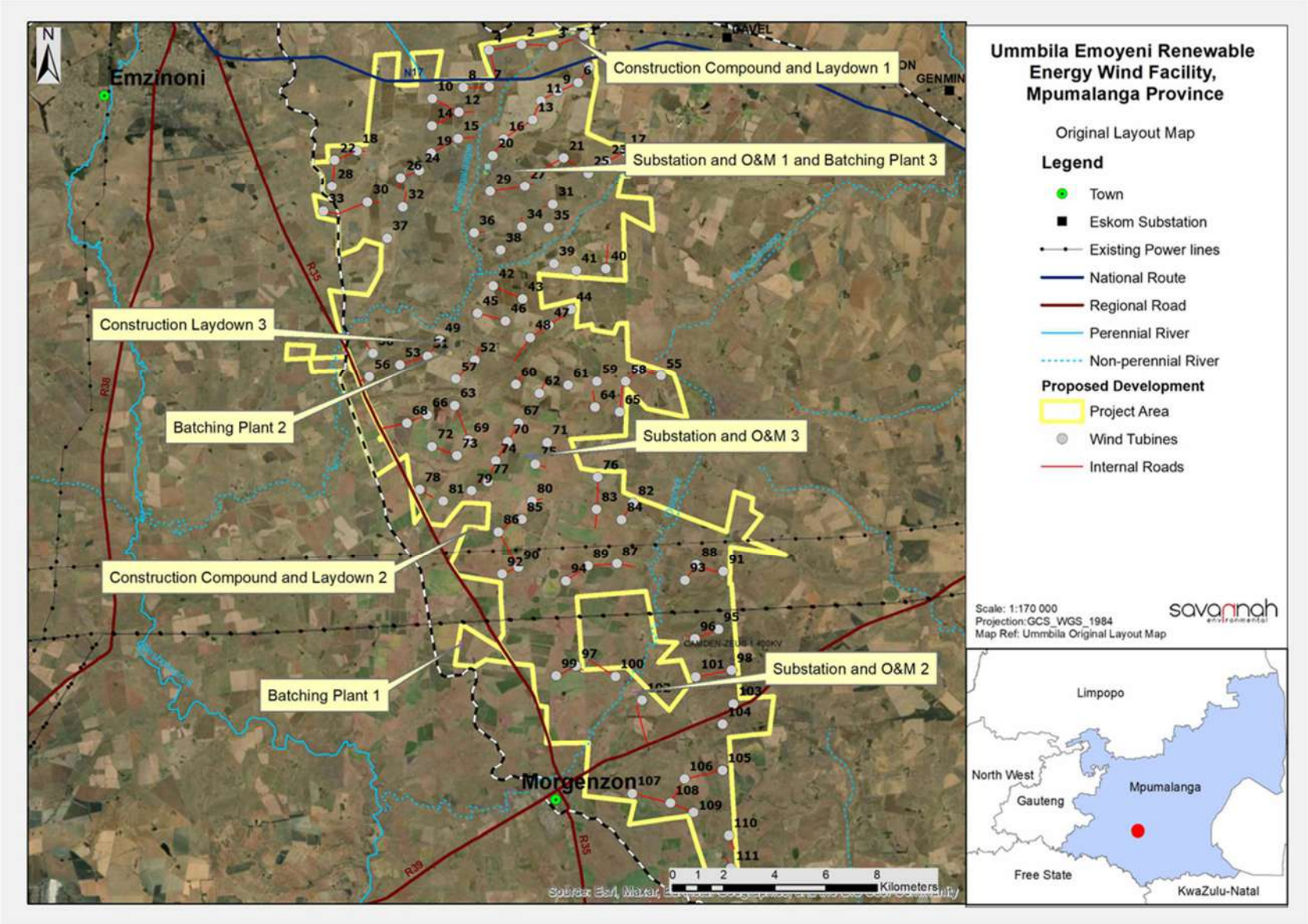


Figure 11.1: The indicative development footprint of the Ummbila Emoyeni Wind Energy Facility, as assessed within this EIA Report (also refer to **Appendix P**)

11.3. Optimisation of the Facility Layout

The indicative facility layout/development footprint assessed within this EIA Report was designed by the project developer in order to respond to and avoid the sensitive environmental and social features located within the project site, which were identified by the specialists during the Scoping Phase of the EIA process. This approach ensured the application of the mitigation hierarchy (i.e., avoid, minimise, mitigate, and offset) to the proposed project, which ultimately ensures that the development is appropriate from an environmental perspective and is suitable for development within the project site.

Considering this proposed layout, the following specialists identified and confirmed specific turbines and associated infrastructure to be unacceptably placed within the project site (refer to **Table 11.2**)

Table 11.2: Turbines and associated infrastructure not considered to be acceptable in the positions as proposed in the facility layout/development footprint based on specialist findings

Specialist finding	Turbines/associated infrastructure affected
The bats specialist indicates that six (6) turbines and some of the infrastructure associated with the wind energy facility are located within the no-go buffer areas.	» WTG10, WTG61, WTG82, WTG88, WTG100, and WTG101 » Substation and O&M 1 and Batching Plant 3, Construction Laydown Area 3 and a small portion of Batching Plant 2, Construction Compound 2
The heritage specialist indicates that one turbine is located within the 50m no-go development buffer around burial grounds, and that there is a road that infringes into the 50m no-go development buffer around burial grounds.	WTG101 and road to WTG60
The noise specialist indicates that three (3) turbines are located within 500m and 1 000m (close to the 500m buffer) of noise sensitive receptors (NSR 40, 46 and 47) and would therefore result in significant noise impacts should these residences be occupied at the time of operation of the wind farm.	WTG76, WTG67 and WTG61

Based on the findings as documented in **Table 11.2**, a revision to the facility layout was undertaken and an optimised layout[23] provided which addressed the need to relocate the turbines and associated infrastructure, as listed in **Table 11.2**.

Further scrutiny of the optimised layout by specialists (refer to **Appendix D to M**) identified and confirmed that specific turbines and associated infrastructure were still unacceptably placed within the project site (refer to **Table 11.3** and **Figure 11.2**).

Table 11.3: Turbines and associated infrastructure not considered to be acceptable in the positions as proposed in the optimised layout based on specialist findings

[23] It should be noted that the turbine numbering within the assessed and optimised layout differs.

Specialist finding	Turbines/associated infrastructure affected
The terrestrial ecology specialist indicates that some of the internal roads for the optimised layout fall within no-go areas from a terrestrial ecology perspective.	» A section of the road to WTG19 crosses a CBA1: Irreplaceable » A section of the road to WTG44 crosses a CBA1: Irreplaceable » A section of the road to WTG56 crosses a CBA1: Irreplaceable
The freshwater ecology specialist indicates that one (1) turbine from the optimised layout falls within no-go buffer around the one of the freshwater/drainage features.	WTG10
The bats specialist indicates that some of the infrastructure associated with the wind energy facility falls within bat no-go areas.	Substation and O&M 1 and Batching Plant 3, Construction Laydown Area 3 and a small portion of Batching Plant 2, Construction Compound 2
The noise specialist indicates that optimisation of the layout would change the noise levels as well as the receptors that are impacted and as such, the same mitigation measures applied to the assessed layout should be considered for the optimised layout.	N/A

Based on the findings as documented in **Table 11.3**, the optimised layout was further refined and a layout which addresses the need to relocate the turbines and associated infrastructure, as listed in **Table 11.3** was designed (refer to **Figure 11.3**). The result is that the refined optimised facility layout has repositioned turbines and associated infrastructure outside of the sensitive areas and features regarded to be no-go for development, following the principle of the mitigation hierarchy where avoidance of impact is the preferred approach. In addition, the applicant undertook a shadow flicker study as recommended by the visual specialist study (refer to **Appendix T**). A number of houses will potentially be affected by shadow flicker and would require mitigation (such as relocation of receptors or implementation of a shadow flicker protection system) to be implemented during the final planning and micro-siting of the facility.

With the implementation of the refined optimised layout, the development footprint is considered to be suitable and appropriate from an environmental perspective for the wind farm, as it ensures the avoidance, reduction and/or mitigation of all identified detrimental or adverse impacts on sensitive features as far as possible. For the avoidance of doubt, all 111 WTG positions are now placed in acceptable locations from a sensitivity perspective in the refined optimised layout.

All specialists assessed the full extent of the project site as shown in the sensitivity map. This refined Optimised Facility Layout considers the required mitigation measures as stated by the specialists and represents a positive outcome in terms of impact avoidance, reduction and mitigation. As such, the impact of this refined Optimised Facility Layout is considered to be acceptable and the layout is preferred. Final micro-siting must however be undertaken prior to construction considering all mitigation measures recommended within this EIA Report and associated specialist studies.

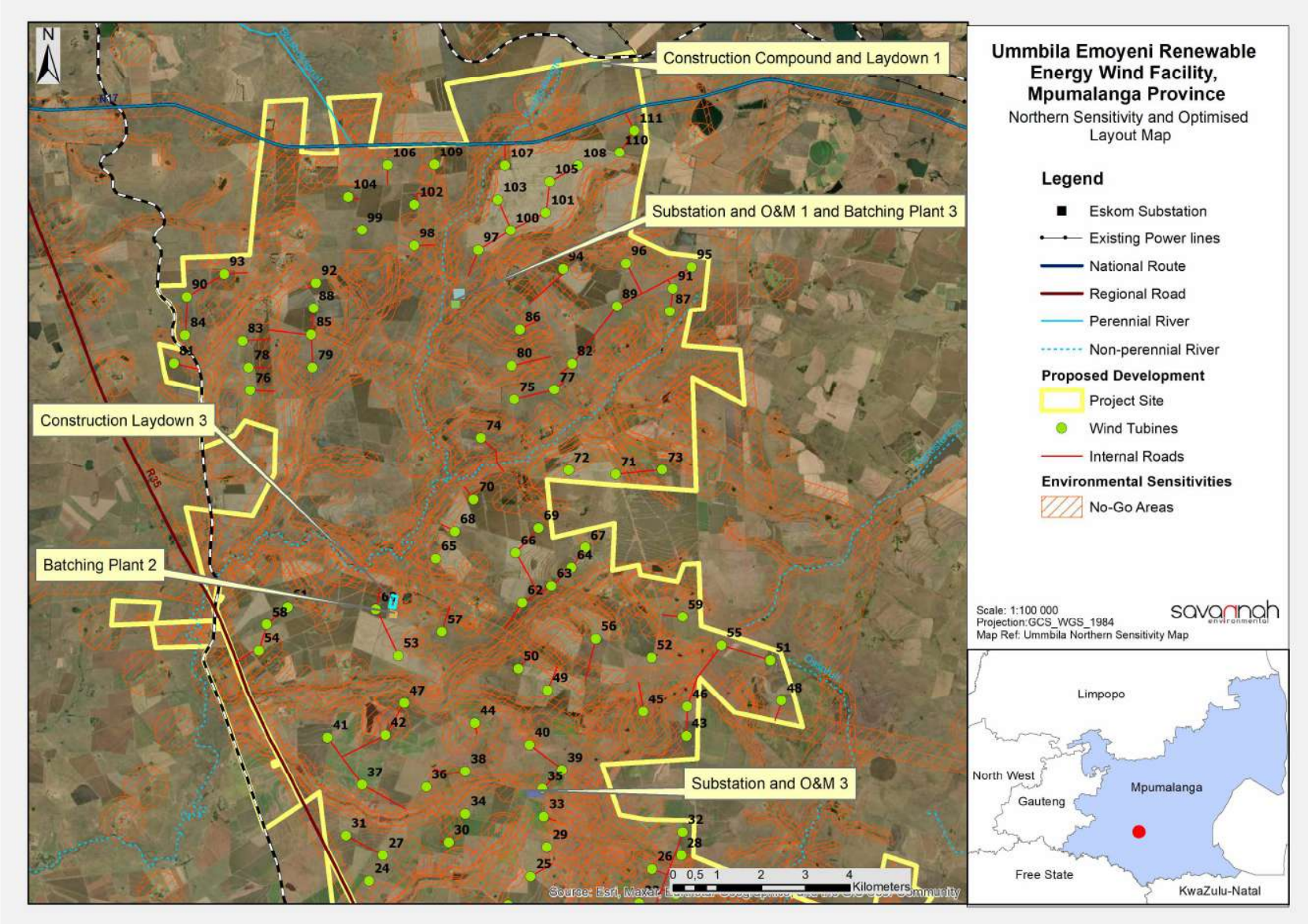


Figure 11.2a: Optimised layout for the Ummbila Emoyeni Wind Energy Facility, overlain with the identified environmental sensitivities (northern section) (also refer to **Appendix P**)

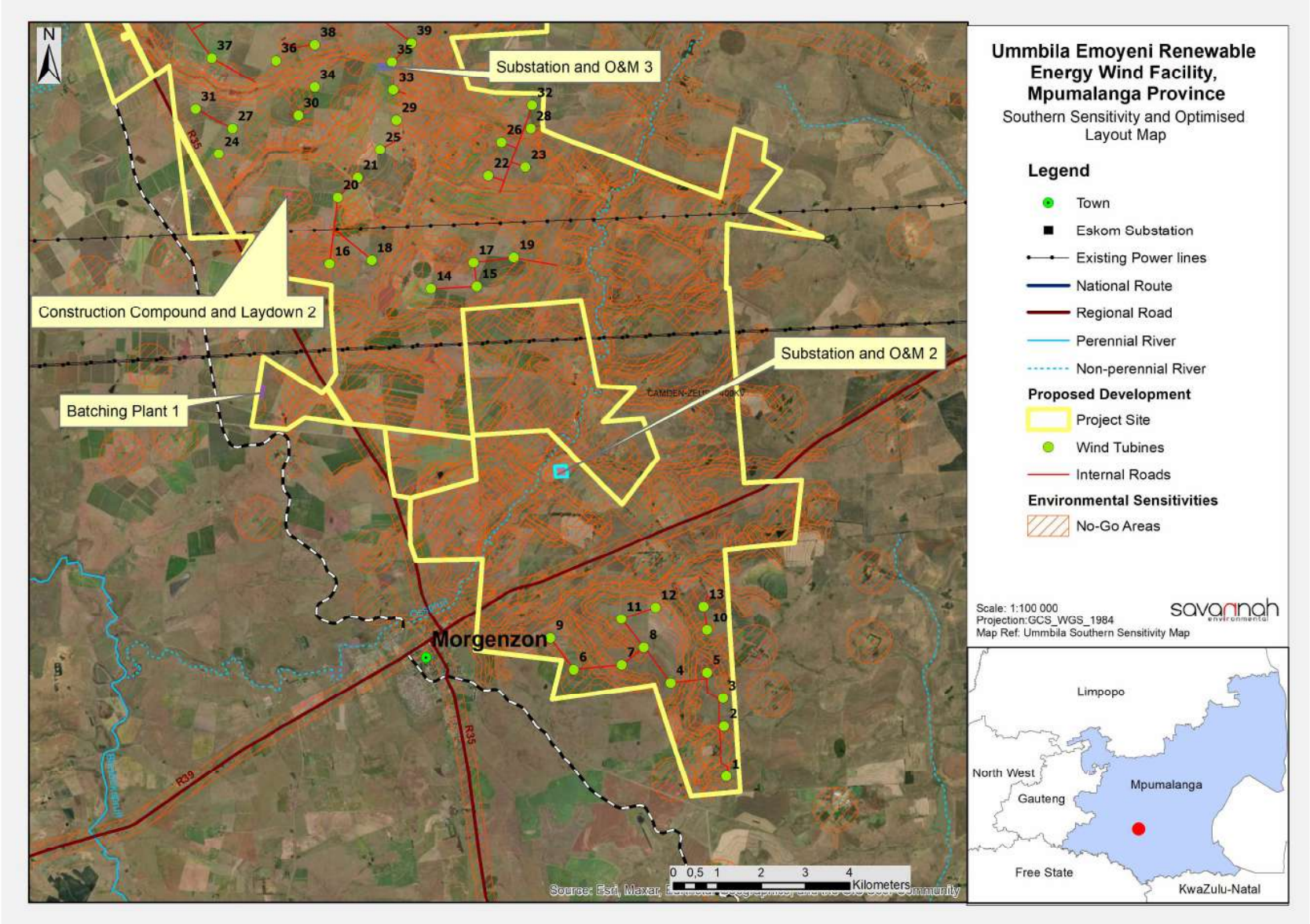


Figure 11.2b: Optimised layout for the Ummbila Emoyeni Wind Energy Facility, overlain with the identified environmental sensitivities (southern section) (also refer to **Appendix P**)

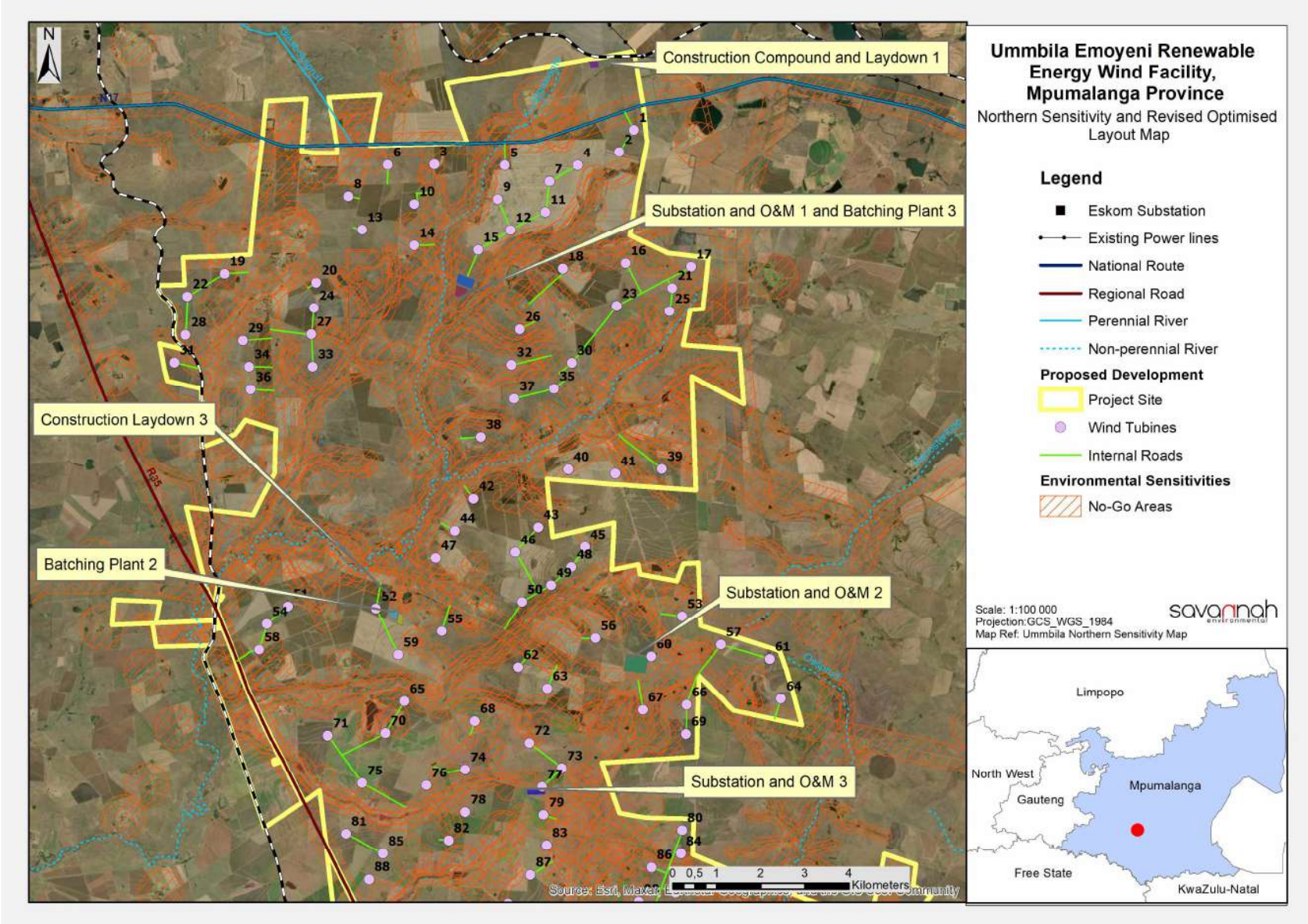


Figure 11.3a: Revised optimised layout for the Ummbila Emoyeni Wind Energy Facility considered to be acceptable for development (northern section) (also refer to **Appendix P**)

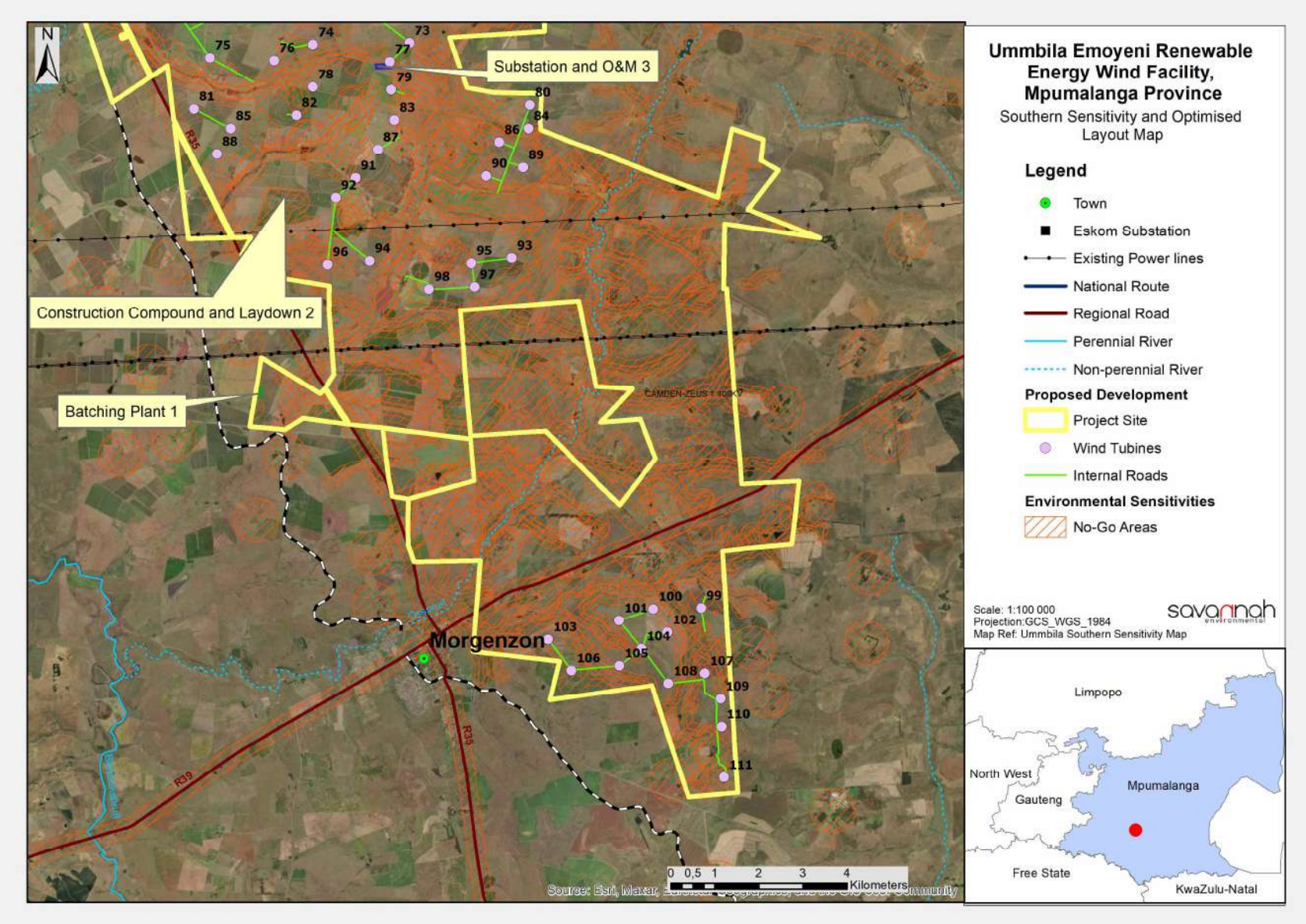


Figure 11.3b: Revised optimised layout for the Ummbila Emoyeni Wind Energy Facility considered to be acceptable for development (southern section) (also refer to **Appendix P**)

11.4. Environmental Costs versus Benefits of the Ummbila Emoyeni Renewable Energy Facility

Environmental costs (including those to the natural environment, economic and social environment) can be anticipated at a local and site-specific level and are considered acceptable provided the mitigation measures as outlined in the EIA Report and the EMPr are implemented and adhered to. No fatal flaws have been identified. These environmental costs could include:

- *Loss of biodiversity, flora and fauna due to the clearing of land for the construction and utilisation of land for the wind farm* - The cost of loss of biodiversity has been minimised/avoided through avoiding placement of project components and infrastructure within the ecological features considered to be of very high sensitivity (no-go areas).
- *Impacts on freshwater resources* - the impacts on freshwater resources have been minimised through the avoidance of the sensitive features by project infrastructure. The internal access roads and MV Cabling will however need to cross some freshwater resource features, some of which will be on existing gravel roads.
- *Visual impacts associated with the wind farm/impacts to the sense of place* - The Ummbila Emoyeni Wind Energy Facility will be visible to receptors up to a distance of 10km from the site and mainly of a high significance. No mitigation of this impact is possible (i.e., the structures will be visible in the landscape), but general mitigation and management are required as best practise to minimise secondary visual impacts which may arise from mismanagement of the site. Other large scale industrial operations including mining operations and power stations are relatively obvious in the region. Whilst the proposed project will create a new large scale industrial operation and change the character of an area of rural landscape, this is not entirely out of character with the region.
- *Loss of land for agriculture* – The development will remove areas available for agricultural activities; however, based on the small development footprint of the wind farm and the fact that agricultural activities can continue on the properties together with the wind farm, this will be limited and not significant.
- *Impacts on birds and bats* – loss of birds and bats species due to collision with turbines. The impact has been minimised through the avoidance of areas of very high sensitivity (no-go areas) and is considered to be acceptable with implementation of mitigation measures.
- *Negative impact to the cultural landscape* - The Ummbila Emoyeni Wind Energy Facility is proposed within a landscape area with an overriding rural character within which there are large industrial nodes including mining operations and coal fired power stations. Whilst the proposed project will create a new large scale industrial node within the agricultural landscape, this is not entirely out of character with the broader region. However, it will be a significant local character change.
- *Loss of heritage and palaeontological resources* – Six burial grounds were identified within and close to the project site, around which a 50m no-go buffer has been recommended. With the exception of one fossil site of low scientific value, none of the recorded fossil sites overlaps directly with, or lies close to (< 20m) the proposed infrastructure.

Benefits of the Ummbila Emoyeni Wind Energy Facility include the following:

- The project will result in important economic benefits at the local and regional scale through job creation, income and other associated downstream economic development, supporting the Just Energy Transition in the region. These will persist during the pre-construction, construction, operation and decommissioning phases of the project.

- The project provides an opportunity for a new land use on the affected properties which would result in additional financial benefits to the directly affected landowners through compensation. It is important to note that the construction and operation of a wind farm can occur in tandem with crop production.
- The project contributes towards the Provincial and Local goals for the development of renewable energy as outlined in the respective IDPs.
- The project serves to diversify the economy and electricity generation mix of South Africa through the addition of wind energy, in line with national policy regarding energy generation.
- The water requirement for a wind farm is negligible compared to the levels of water used by coal-based technologies. This generation technology is therefore supported in dry climatic areas.
- South Africa's per capita greenhouse gas emissions are amongst the highest in the world due to the reliance on fossil fuels. The Ummbila Emoyeni Wind Energy Facility will contribute to achieving goals for implementation of renewable energy and sustaining a 'green' economy within South Africa.

The benefits of the Ummbila Emoyeni Wind Energy Facility are expected to occur at a national, regional and local level. As the costs to the environment at a site-specific level have been largely limited through the appropriate placement of infrastructure on the project site within lower sensitive areas, the benefits of the project are expected to partially offset the localised environmental costs of the wind farm, provided that the mitigation measures, as recommended by the specialists are adhered to.

11.5. Overall Conclusion (Impact Statement)

The preferred activity was determined by the developer to be the development of a renewable energy facility on site using wind as the preferred technology, due to the availability of a strong wind resource, available grid capacity, benign topography, and good access. A technically viable development footprint was proposed by the developer considering environmental sensitivities identified in the scoping study and assessed as part of the EIA process. The assessment of the development footprint within the project site was undertaken by independent specialists and their findings have informed the results of this EIA Report.

From a review of the relevant policy and planning framework, it was concluded that the project is well aligned with the policy framework, and a clear need for the project is seen from a policy perspective at a local, provincial and National level.

The specialist findings from the EIA studies undertaken have indicated that there are no identified fatal flaws associated with the implementation of the development footprint within the project site subject to implementation of the recommended mitigation measures. The developer has designed a project development footprint in response to the identified sensitive environmental features and areas present within the project site. This approach is in line with the application of the mitigation hierarchy, where all the sensitive areas which could be impacted by the development have been avoided (i.e., tier 1 of the mitigation hierarchy). Feedback from the bat and heritage specialists has indicated some of the turbines and associated infrastructure need to be relocated to avoid areas of very high sensitivity (refer to **Table 11.2**). This recommendation has been adhered to by the developer which has designed an optimised layout (refer to **Figure 11.2**) which is in-line with these requirements to ensure environmental acceptability. Further scrutiny of the optimised layout identified and confirmed that specific turbines and associated infrastructure were still unacceptably placed within the project site. Based on the findings as documented in **Table 11.3**, the optimised layout was further refined and a layout which addresses the need to relocate the turbines and associated infrastructure, as listed in **Table 11.3** was designed (refer to **Figure 11.3**). The result is that the

refined optimised facility layout has repositioned turbines and associated infrastructure outside of the sensitive areas and features regarded to be no-go for development.

The impacts that are expected to remain after the avoidance of the sensitive areas by the refined optimised facility layout have been reduced to acceptable levels through the recommendation of specific mitigation measures by the specialists. The minimisation of the significance of the impacts is in line with tier 2 of the mitigation hierarchy.

Therefore, impacts can be mitigated to acceptable levels or enhanced through the implementation of the recommended mitigation or enhancement measures. This is however not relevant for the visual impact of the wind farm as the turbines will be visible regardless of the mitigation applied. This high significance rating is, however, not considered as a fatal flaw by the specialist.

As detailed in the cost-benefit analysis, the benefits of the Ummbila Emoyeni Wind Energy Facility are expected to occur at a national, regional and local level. As the costs to the environment at a site-specific level have been largely limited through the appropriate placement of infrastructure on the project site within lower sensitive areas through the avoidance of features and areas considered to be sensitive/no-go for development, the benefits of the project are expected to partially offset the localised environmental costs of the wind farm. From a social perspective, both positive and negative impacts are expected.

Through the assessment of the development footprint within the project site, it can be concluded that the development of the Ummbila Emoyeni Wind Energy Facility will not result in unacceptable environmental impacts (subject to the implementation of the recommended mitigation measures).

11.6. Overall Recommendation

Considering the findings of the independent specialist studies, the impacts identified, the development footprint proposed by the developer, the avoidance of the sensitive environmental features within the project site, as well as the potential to further minimise the impacts to acceptable levels through mitigation, it is the reasoned opinion of the EAP that the Ummbila Emoyeni Wind Energy Facility is acceptable within the landscape and can reasonably be authorised subject to implementation of the refined optimised facility layout and the mitigation and enhancement measures recommended by the specialists.

The Ummbila Emoyeni Wind Energy Facility with a contracted capacity of up to 900MW includes the following infrastructure (to be included within an authorisation issued for the project):

- Up to 111 wind turbines with a maximum hub height of up to 200m. The tip height of the turbines will be up to 300m.
- 33kV cabling to connect the wind turbines to the onsite collector substations, to be laid underground where practical.
- 3 x 33kV/132kV onsite collector substation (IPP Portion), each being 5ha.
- Battery Energy Storage System (BESS) (200MW/800MWh).
- Cabling between turbines, to be laid underground where practical.
- Construction compounds including site office (approximately 300m x 300m in total but split into 3ha each of 150m x 200m):
  - Batching plant of up to 4ha to 7ha.
  - 3 x O&M office of approximately 1.5ha each adjacent to each collector SS.

  - 3 x construction compound / laydown area, including site office of 3ha each (150m x 200m each).
- Laydown and crane hardstand areas (approximately 75m x 120m).
- Access roads of 12 -13m wide, with 12m at turning circles.

The following key conditions would be required to be included within an authorisation issued for the Ummbila Emoyeni Wind Energy Facility:

- All mitigation measures detailed within this EIA Report, as well as the specialist reports contained within **Appendices D to M** are to be implemented.
- The EMPrs (for the facility and onsite substation) as contained within **Appendix O** of this EIA Report should form part of the contract with the Contractors appointed to construct and maintain the wind farm in order to ensure compliance with environmental specifications and management measures. The implementation of this EMPr for all life cycle phases of the Ummbila Emoyeni Wind Energy Facility is considered key in achieving the appropriate environmental management standards as detailed for this project.
- Following the final design of the Ummbila Emoyeni Wind Energy Facility, a revised layout must be submitted to DFFE for review and approval prior to commencing with construction. Micro-siting must take all recommended mitigation measures into consideration. No development is permitted within the identified no-go areas as detailed in **Figure 11.3**.
- An Environmental Site Officer (ESO) must form part of the on-site team to ensure that the EMPr is implemented and enforced and an Environmental Control Officer (ECO) must be appointed to oversee the implementation activities and monitor compliance for the duration of the construction phase.
- Preconstruction walk-through of the final development footprint for protected species that would be affected and that can be translocated must be undertaken. The survey must also cover sensitive habitats and species that are required to be avoided. Permits from the relevant provincial authorities, will be required to relocate and/or disturb listed plant species.
- Observer-based Shut-down-on-demand or similar technology is to be implemented for all WTGs placed in identified high sensitivity areas as well as those WTGs that remain within 3 000m of VPs 1, 2, 3 and 10.
- Develop and implement a carcass search and bird activity monitoring programme in-line with the latest applicable guidelines. Regular reviews of operational phase monitoring data (activity and carcass) and results to be conducted by an avifaunal specialist. The above reviews should strive to identify sensitive locations including WTGs and areas of increased collisions that may require additional mitigation.
- Prevent birds from nesting in substation infrastructure through exclusion covers or spikes if required (determined on a case-by-case basis).
- Implement bat fatality monitoring throughout the operational phase and apply curtailment or deterrents if fatality thresholds are exceeded.
- If the structures located at NSR47 are used for residential purposes, the resident(s) must be relocated, or the WTG located within 1 000m from these NSR should be moved further than 1 000m from these NSR.
- Active noise monitoring (i.e., the measurement of noise levels at identified locations) is recommended throughout the operation phase at NSRs within 2000m of a wind turbine before the development of the wind energy facility, with the measurements repeated after the first year of operation. Should any of these locations not be used for residential purposes, measurements at these NSRs would not be required.
- Should a reasonable and valid noise complaint be registered, the developer must investigate the noise complaint as per the guidelines in sub-section 12.1 and 12.2 of the noise impact assessment. Once-off noise measurements must be conducted at the location of the person that registered a valid and reasonable noise complaint. The measurement location should consider the direct surroundings to

ensure that other sound sources cannot influence the reading. These measurement locations can be reduced accordingly if the NSR are relocated, or the dwelling are no longer used for residential purposes.

- In order to minimise noise impacts on NSRs used for residential purposes within 1 000m of WTGs at the time of implementation of the project:
  - the resident(s) could be relocated, or;
  - the WTG located within 1 000m from these NSR be moved further than 1 000m from these NSR; or
  - the applicant can select to use a quieter WTG (with a SPL less than 108.5 dBA as per the IEC 61400-14 certificate) within 1 500m from NSR 40 and 46.
- Implement recommendations of the shadow flicker study to inform the final design and appropriate mitigation.
- All other relevant environmental permits must be obtained prior to the construction of the facility.

A validity period of 10 years of the Environmental Authorisation is requested, should the project obtain approval from DFFE.

CHAPTER 12: REFERENCES

Ecology Impact Assessment (Terrestrial Biodiversity)

Baselga, A., 2013. Multiple site dissimilarity quantifies compositional heterogeneity among several sites, while average pairwise dissimilarity may be misleading. Ecography (Cop.). 36, 124–128. https://doi.org/10.1111/j.1600-0587.2012.00124.x

Baselga, A., 2010a. Partitioning the turnover and nestedness components of beta diversity. Glob. Ecol. Biogeogr. 19, 134–143. https://doi.org/10.1111/j.1466-8238.2009.00490.x

Baselga, A., 2010b. Multiplicative partition of true diversity yields independent alpha and beta components; additive partition does not. Ecology 91, 1974–1981. https://doi.org/10.1890/09-0320.1

Brownlie, S., Walmsley, B., Tarr, P., 2006. Guidance Document on Biodiversity, Impact Assessment and Decision Making in Southern Africa. The Southern African Institute for Environmental Assessment.

Dayaram, A., Harris, L., Grobler, B.A., van der Merwe, S., Rebelo, A.G., Powrie, L.W., Vlok, J.H.J., Desmet, P., Qabaqaba, M., Hlahane, K.M., Skowno, A.L., 2018. Vegetation Map of South Africa, Lesotho and Swaziland 2018: A description of changes since 2006. Bothalia 49, a2452.

de Villiers, C., Driver, A., Clark, B., Euston-Brown, D., Day, L., Job, N., Helme, N., Holmes, P.M., Brownlie, S., Rebelo, A.G., 2005. Fynbos Forum Ecosystem Guidelines For Environmental Assessment in the Western Cape. Fynbos Forum and Botanical Society of South Africa, Kirstenbosch.

Driver, A., Maze, K., Rouget, M., Lombard, A.T., Nel, J., Turpie, J.K., Cowling, R.M., Desmet, P., Goodman, P., Harris, J., Jonas, Z., Reyers, B., Sink, K., Strauss, T., 2005. National Spatial Biodiversity Assessment 2004: Priorities for Biodiversity Conservation in South Africa. Strelitzia 17. South African National Biodiversity Institute, Pretoria.

Ekstrom, J., Bennun, L., Mitchell, R., 2015. A cross-sector guide for implementing the Mitigation Hierarchy. The Biodiversity Consultancy, Cambridge, UK.

Government of South Africa, 2008. National Protected Area Expansion Strategy for South Africa 2008: Priorities for expanding the protected area network for ecological sustainability and climate change adaptation. Government of South Africa, Pretoria.

Mucina, L., Rutherford, M.C. (Eds.), 2006. The vegetation of South Africa, Lesotho and Swaziland. Strelitzia 19. South African National Biodiversity Institute, Pretoria.

Nel, J., Maherry, A.M., Peterson, C.P., Roux, D.J., Driver, A., Hill, L., van Deventer, H., Funke, N., Swartz, E.R., Smith-Adao, L.B., Mbona, N., Downsborough, L., Nienaber, S., 2011. Technical Report for the National Freshwater Ecosystem Priority Areas project. WRC Report No. 1801/2/11.

Phalan, B., Hayes, G., Brooks, S., Marsh, D., Howard, P., Costelloe, B., Vira, B., Kowalska, A., Whitaker, S., 2018. Avoiding impacts on biodiversity through strengthening the first stage of the mitigation hierarchy. Oryx 52, 316–324. https://doi.org/10.1017/S0030605316001034

Raimondo, D., von Staden, L., Foden, W., Victor, J.E., Helme, N., Turner, R.C., Kamundi, D.A., Manyama, P.A., 2009. Red List of South African plants 2009. Strelitzia 25. South African National Biodiversity Institute, Pretoria.

South African National Biodiversity Institute, 2019. National Biodiversity Assessment 2018: The status of South Africa's ecosystems and biodiversity. Synthesis Report. South African National Biodiversity Institute, an entity of the Department of Environment, Forestry and Fisheries. Pretoria.

South African National Biodiversity Institute, 2018. The Vegetation Map of South Africa, Lesotho and Swaziland, Mucina, L., Rutherford, M.C. and Powrie, L.W. (Editors), Version 2018 [WWW Document]. URL http://bgis.sanbi.org/Projects/Detail/186

Van Oudtshoorn, F., 2015. Veld Management: Principles and Practices. Briza Publications, Pretoria.

Freshwater Impact Assessment

Brownlie, S., Walmsley, B., Tarr, P., 2006. Guidance Document on Biodiversity, Impact Assessment and Decision Making in Southern Africa. The Southern African Institute for Environmental Assessment.

Dayaram, A., Harris, L., Grobler, B.A., van der Merwe, S., Rebelo, A.G., Powrie, L.W., Vlok, J.H.J., Desmet, P., Qabaqaba, M., Hlahane, K.M., Skowno, A.L., 2018. Vegetation Map of South Africa, Lesotho and Swaziland 2018: A description of changes since 2006. Bothalia 49, a2452.

de Villiers, C., Driver, A., Clark, B., Euston-Brown, D., Day, L., Job, N., Helme, N., Holmes, P.M., Brownlie, S., Rebelo, A.G., 2005. Fynbos Forum Ecosystem Guidelines For Environmental Assessment in the Western Cape. Fynbos Forum and Botanical Society of South Africa, Kirstenbosch.

Driver, A., Maze, K., Rouget, M., Lombard, A.T., Nel, J., Turpie, J.K., Cowling, R.M., Desmet, P., Goodman, P., Harris, J., Jonas, Z., Reyers, B., Sink, K., Strauss, T., 2005. National Spatial Biodiversity Assessment 2004: Priorities for Biodiversity Conservation in South Africa. Strelitzia 17. South African National Biodiversity Institute, Pretoria.

Government of South Africa, 2008. National Protected Area Expansion Strategy for South Africa 2008: Priorities for expanding the protected area network for ecological sustainability and climate change adaptation. Government of South Africa, Pretoria.

Manning, J.C., Goldblatt, P., 2012. Plants of The Greater Cape Floristic Region 1: The Core Cape Flora, Strelitzia 2 (IUCN, 2021)9. South African National Biodiversity Institute, Pretoria.

Mucina, L., Rutherford, M.C. (Eds.), 2006. The vegetation of South Africa, Lesotho and Swaziland. Strelitzia 19. South African National Biodiversity Institute, Pretoria.

Nel, J., Maherry, A.M., Peterson, C.P., Roux, D.J., Driver, A., Hill, L., van Deventer, H., Funke, N., Swartz, E.R., Smith-Adao, L.B., Mbona, N., Downsborough, L., Nienaber, S., 2011. Technical Report for the National Freshwater Ecosystem Priority Areas project. WRC Report No. 1801/2/11.

Raimondo, D., von Staden, L., Foden, W., Victor, J.E., Helme, N., Turner, R.C., Kamundi, D.A., Manyama, P.A., 2009. Red List of South African plants 2009. Strelitzia 25. South African National Biodiversity Institute, Pretoria.

South African National Biodiversity Institute, 2019. National Biodiversity Assessment 2018: The status of South Africa's ecosystems and biodiversity. Synthesis Report. South African National Biodiversity Institute, an entity of the Department of Environment, Forestry and Fisheries. Pretoria.

South African National Biodiversity Institute, 2018. The Vegetation Map of South Africa, Lesotho and Swaziland, Mucina, L., Rutherford, M.C. and Powrie, L.W. (Editors), Version 2018 [WWW Document]. URL http://bgis.sanbi.org/Projects/Detail/186

van Wyk, A.E., Smith, G.F., 2001. Regions of Floristic Endemism: A Review with an Emphasis on Succulents. Umdaus Press, Hatfield.

Soil Impact Assessment

Land Type Survey Staff. (1972 - 2006). Land Types of South Africa: Digital Map (1:250 000 Scale) and Soil Inventory Databases. Pretoria: ARC-Institute for Soil, Climate, and Water.

Mucina, L. & Rutherford, M.C. (Eds.). (2006). The vegetation of South Africa, Lesotho and Swaziland. Strelizia 19. South African National Biodiversity Institute, Pretoria South African.

Smith, B. (2006). The Farming Handbook. Netherlands & South Africa: University of KwaZulu-Natal Press & CTA.

Soil Classification Working Group. (1991). Soil Classification A Taxonomic system for South Africa. Pretoria: The Department of Agricultural Development.

Soil Classification Working Group. (2018). Soil Classification A Taxonomic system for South Africa. Pretoria: The Department of Agricultural Development.

Bat Impact Assessment

ACR. 2020. African Chiroptera Report 2020. V. Van Cakenberghe and E.C.J. Seamark (Eds). AfricanBats NPC, Pretoria. i-xv + 8542 pp.

Adams, A. M., M. K. Jantzen, R. M. Hamilton, and M. B. Fenton. 2012. Do you hear what I hear? Implications of detector selection for acoustic monitoring of bats. Methods in Ecology and Evolution 3:992-998.

Arnett, E. B., E. F. Baerwald, F. Mathews, Luisa Rodrigues, A. Rodríguez-Durán, J. Rydell, R. Villegas-Patraca, and C. C. Voigt. 2016. Impacts of Wind Energy Development on Bats: A Global Perspective. Pages 295 - 323 in C. C. Voigt and T. Kingston, editors. Bats in the Anthropocene: Conservation of Bats in a Changing World. Springer.

Arnett, E. B., G. D. Johnson, W. P. Erickson, and C. D. Hein. 2013. A Synthesis Of Operational Mitigation Studies To Reduce Bat Fatalities At Wind Energy Facilities In North America. A report submitted to the National Renewable Energy Laboratory. Bat Conservation International. Austin, Texas, USA.

Aronson, J. 2022. Current state of knowledge of wind energy impacts on bats in South Africa. Acta Chiropterologica 24(1).

Aronson, J., E. Richardson, K. MacEwan, D. Jacobs, W. Marais, P. Taylor, S. Sowler, H. C., and L. Richards. 2020. South African Good Practice Guidelines for Operational Monitoring for Bats at Wind Energy Facilities – ed 2. South African Bat Assessment Association.

Barclay, R. M. R., and L. D. Harder. 2003. Life histories of bats: Life in the slow lane. Pages 209-253 in T. H. Kunz and M. B. Fenton, editors. Bat Ecology. The University of Chicago Press, Chicago.

Bennun, L., J. van Bochove, C. Ng, C. Samper, H. Rainey, and H. C. Rosenbaum. 2021. Mitigating Biodiversity Impacts Associated with Solar and Wind Energy Development: Guidelines for Project Developers.

Bohmann, K., A. Monadjem, C. Lehmkuhl Noer, M. Rasmussen, M. R. K. Zeale, E. Clare, G. Jones, E. Willerslev, and M. T. P. Gilbert. 2011. Molecular Diet Analysis of Two African Free-Tailed Bats (Molossidae) Using High Throughput Sequencing. PloS one 6:e21441.

Child, M. F., L. Roxburgh, E. Do Linh San, D. Raimondo, and H. T. Davies-Mostert, editors. 2016. The Red List of Mammals of South Africa, Swaziland and Lesotho. South African National Biodiversity Institute and Endangered Wildlife Trust, South Africa.

Collins, J. 2006. Bat Surveys for Professional Ecologists: Good Practice Guidelines (3rd edn). Bat Conservation Trust, London.

Cryan, P. M., and R. M. R. Barclay. 2009. Causes of Bat Fatalities at Wind Turbines: Hypotheses and Predictions. Journal of Mammalogy 90:1330-1340.

Davy, C. M., K. Squires, and J. R. Zimmerling. 2020. Estimation of spatiotemporal trends in bat abundance from mortality data collected at wind turbines. Conservation Biology:12.

Department of Environment Forestry and Fisheries (DEFF). 2019. Phase 2 Strategic Environmental Assessment for wind and solar PV energy in South Africa. CSIR Report Number: CSIR/SPLA/SECO/ER/2019/0085 Stellenbosch, Western Cape.

Dinerstein, E., C. Vynne, E. Sala, A. R. Joshi, S. Fernando, T. E. Lovejoy, J. Mayorga, D. Olson, G. P. Asner, J. E. M. Baillie, N. D. Burgess, K. Burkart, R. F. Noss, Y. P. Zhang, A. Baccini, T. Birch, N. Hahn, L. N. Joppa, and E. Wikramanayake. 2019. A Global Deal For Nature: Guiding principles, milestones, and targets. Science Advances 5:eaaw2869.

Frick, W. F., E. F. Baerwald, J. F. Pollock, R. M. R. Barclay, J. A. Szymanski, T. J. Weller, A. L. Russell, S. C. Loeb, R. A. Medellin, and L. P. McGuire. 2017. Fatalities at wind turbines may threaten population viability of a migratory bat. Biological Conservation 209:172-177.

Fritz, B., G. Horváth, R. Hünig, Á. Pereszlényi, Á. Egri, M. Guttmann, M. Schneider, U. Lemmer, G. Kriska, and G. Gomard. 2020. Bioreplicated coatings for photovoltaic solar panels nearly eliminate light pollution that harms polarotactic insects. PloS one 15:e0243296.

Gasparatos, A., C. N. H. Doll, M. Esteban, A. Ahmed, and T. A. Olang. 2017. Renewable energy and biodiversity: Implications for transitioning to a Green Economy. Renewable and Sustainable Energy Reviews 70:161-184.

Greif, S., and B. M. Siemers. 2010. Innate recognition of water bodies in echolocating bats. Nature Communications 1:107.

Guest, E. E., B. F. Stamps, N. D. Durish, A. M. Hale, C. D. Hein, B. P. Morton, S. P. Weaver, and S. R. Fritts. 2022. An Updated Review of Hypotheses Regarding Bat Attraction to Wind Turbines. Animals 12:343.

Hein, C. D., J. Gruver, and E. B. Arnett. 2013. Relating pre-construction bat activity and post-construction bat fatality to predict risk at wind energy facilities: a synthesis. A report submitted to the National Renewable Energy Laboratory. Bat Conservation International, Austin, TX, USA.

Horn, J. W., E. B. Arnett, and T. H. Kunz. 2008. Behavioral responses of bats to operating wind turbines. The Journal of Wildlife Management 72:123-132.

Horváth, G., G. Kriska, P. Malik, and B. Robertson. 2009. Polarized light pollution: a new kind of ecological photopollution. Frontiers in Ecology and the Environment 7:317-325.

Horváth, G., B. Miklós, E. Ádám, K. György, S. István, and R. Bruce. 2010. Reducing the maladaptive attractiveness of solar panels to polarotactic insects.

International Finance Corporation (IFC). 2013. Cumulative Impact Assessment and Management: Guidance for the Private Sector in Emerging Markets. Washington D.C., USA. Available at: https://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/sustainability-at-ifc/publications/ publications_handbook_cumulativeimpactassessment.

IUCN. 2021. The IUCN Red List of Threatened Species. Version 2021-1. https://www.iucnredlist.org. Downloaded on 11 Aug 2021.

Jackson, A. L. R. 2011. Renewable energy vs. biodiversity: Policy conflicts and the future of nature conservation. Global Environmental Change 21:1195-1208.

Jung, K., and E. K. V. Kalko. 2010. Where forest meets urbanization: foraging plasticity of aerial insectivorous bats in an anthropogenically altered environment. Journal of Mammalogy 91:144-153.

Kunz, T. H., E. B. Arnett, B. M. Cooper, W. P. Erickson, R. P. Larkin, T. Mabee, M. L. Morrison, M. D. Strickland, and J. M. Szewczak. 2007a. Assessing impacts of wind-energy development on nocturnally active birds and bats: A guidance document. The Journal of Wildlife Management 71:2449-2486.

Kunz, T. H., E. B. Arnett, W. P. Erickson, A. R. Hoar, G. D. Johnson, R. P. Larkin, M. D. Strickland, R. W. Thresher, and M. D. Tuttle. 2007b. Ecological impacts of wind energy development on bats: questions, research needs, and hypotheses. Frontiers in Ecology and the Environment 5:315-324.

Lehnert, L. S., S. Kramer-Schadt, S. Schönborn, O. Lindecke, I. Niermann, and C. C. Voigt. 2014. Wind farm facilities in Germany kill noctule bats from near and far. PloS one 9:e103106.

Lintott, P. R., S. M. Richardson, D. J. Hosken, S. A. Fensome, and F. Mathews. 2016. Ecological impact assessments fail to reduce risk of bat casualties at wind farms. Current Biology 26:R1135-R1136.

Longcore, T., and C. Rich. 2004. Ecological light pollution. Frontiers in Ecology and the Environment 2:191–198.

Lovich, J. E., and J. R. Ennen. 2011. Wildlife Conservation and Solar Energy Development in the Desert Southwest, United States. Bioscience 61:982-992.

MacEwan, K., J. Aronson, E. Richardson, P. Taylor, B. Coverdale, D. Jacobs, L. Leeuwner, W. Marais, and L. Richards. 2018. South African Bat Fatality Threshold Guidelines – ed 2. South African Bat Assessment Association.

MacEwan, K., T. W. Morgan, C. A. Lötter, and A. T. Tredennick. 2020a. Bat Activity Across South Africa: Implications for Wind Energy Development. African Journal of Wildlife Research 50.

MacEwan, K., S. Sowler, J. Aronson, and C. A. Lötter. 2020b. South African Best Practice Guidelines for Pre-construction Monitoring of Bats at Wind Energy Facilities - ed 5. South African Bat Assessment Association.

Marques, J. T., A. Rainho, M. CarapuÃ§o, P. Oliveira, and J. M. Palmeirim. 2004. Foraging Behaviour and Habitat use by the European Free-Tailed Bat Tadarida teniotis. Acta Chiropterologica 6:99-110.

Miller-Butterworth, C. M., D. S. Jacobs, and E. H. Harley. 2003. Strong population substructure is correlated with morphology and ecology in a migratory bat. Nature 424:187-191.

Millon, L., C. Colin, F. Brescia, and C. Kerbiriou. 2018. Wind turbines impact bat activity, leading to high losses of habitat use in a biodiversity hotspot. Ecological Engineering 112:51-54.

Mitchell-Jones, T., and C. Carlin. 2014. Bats and Onshore Wind Turbines Interim Guidance. Natural England Technical Information Note TIN051. Natural England.

Monadjem, A., I. Conenna, P. Taylor, and C. Schoeman. 2018. Species richness patterns and functional traits of the bat fauna of arid Southern Africa. Hystrix 29.

Monadjem, A., P. J. Taylor, F. P. D. Cotterill, and M. C. Schoeman. 2020. Bats of Southern and Central Africa: A Biogeographic and Taxonomic Synthesis. 2nd edition.

MTPA. 2014. Mpumalanga Biodiversity Sector Plan Handbook.in C. Lötter M.C., M.J. and Lechmere-Oertel R.G., editor. Mpumalanga Tourism & Parks Agency, Mbombela (Nelspruit).

Mucina, L., and M. C. Rutherford. 2006. The vegetation of South Africa, Lesotho and Swaziland. Strelitzia 19. South African National Biodiversity Institute, Pretoria.

Noer, C. L., T. Dabelsteen, K. Bohmann, and A. Monadjem. 2012. Molossid bats in an African agro-ecosystem select sugarcane fields as foraging habitat. African Zoology 47:1-11.

Pretorius, M., H. Broders, and M. Keith. 2020. Threat analysis of modelled potential migratory routes for Miniopterus natalensis in South Africa. Austral Ecology 45:1110 - 1122.

Richardson, S. M., P. R. Lintott, D. J. Hosken, T. Economou, and F. Mathews. 2021. Peaks in bat activity at turbines and the implications for mitigating the impact of wind energy developments on bats. Scientific Reports 11:3636.

Robinson, M. F., and R. E. Stebbings. 1997. Home range and habitat use by the serotine bat, Eptesicus serotinus, in England. Journal of Zoology 243:117-136.

Rodhouse, T. J., R. M. Rodriguez, K. M. Banner, P. C. Ormsbee, J. Barnett, and K. M. Irvine. 2019. Evidence of region-wide bat population decline from long-term monitoring and Bayesian occupancy models with empirically informed priors. Ecology and Evolution 9:11078-11088.

Romano, W. B., J. R. Skalski, R. L. Townsend, K. W. Kinzie, K. D. Coppinger, and M. F. Miller. 2019. Evaluation of an acoustic deterrent to reduce bat mortalities at an Illinois wind farm. Wildlife Society Bulletin 43:608-618.

Rydell, J. 1992. Exploitation of insects around streetlamps by bats in Sweden. Functional Ecology 6:744-750.

Schnitzler, H.-U., and E. K. V. Kalko. 2001. Echolocation by insect-eating bats. Bioscience 51:557-568.

Sirami, C. I., D. S. Jacobs, and G. S. Cumming. 2013. Artificial wetlands and surrounding habitats provide important foraging habitat for bats in agricultural landscapes in the Western Cape, South Africa. Biological Conservation 164:30-38.

South African National Biodiversity Institute (SANBI). 2018. Terrestrial ecosystem threat status and protection level layer [Vector] 2018. Available from the Biodiversity GIS website, downloaded on 30 December 2021.

South African National Biodiversity Institute (SANBI). 2020. Species Environmental Assessment Guideline. Guidelines for the implementation of the Terrestrial Fauna and Terrestrial Flora Species Protocols for environmental impact assessments in South Africa. South African National Biodiversity Institute, Pretoria. Version 2.1 2021.

Stone, E. L. 2012. Bats and Lighting: Overview of current evidence and mitigation.

Stone, E. L., S. Harris, and G. Jones. 2015. Impacts of artificial lighting on bats: a review of challenges and solutions. Mammalian Biology 80:213-219.

Stone, E. L., G. Jones, and S. Harris. 2009. Street Lighting Disturbs Commuting Bats. Current Biology 19:1123-1127.

Svensson, A. M., and J. Rydell. 1998. Mercury vapour lamps interfere with the bat defence of tympanate moths (Operophtera spp.; Geometridae). Animal Behaviour 55:223-226.

Száz, D., D. Mihályi, A. Farkas, Á. Egri, A. Barta, G. Kriska, B. Robertson, and G. Horváth. 2016. Polarized light pollution of matte solar panels: anti-reflective photovoltaics reduce polarized light pollution but benefit only some aquatic insects. Journal of Insect Conservation 20:663-675.

Tella, J. L., D. Hernández-Brito, G. Blanco, and F. Hiraldo. 2020. Urban Sprawl, Food Subsidies and Power Lines: An Ecological Trap for Large Frugivorous Bats in Sri Lanka? Diversity 12:94.

van der Merwe, M. 1975. Preliminary study on the annual movements of the Natal clinging bat. South African Journal of Science 71:237-241.

Vaughan, N., Jones, G., and Harris, S. 1997. Habitat use by bats (Chiroptera) assessed by means of a broad-band acoustic method. Journal of Applied Ecology 34:716-730.

Visser, E., V. Perold, S. Ralston-Paton, A. C. Cardenal, and P. G. Ryan. 2019. Assessing the impacts of a utility-scale photovoltaic solar energy facility on birds in the Northern Cape, South Africa. Renewable Energy 133:1285-1294.

Voigt, C. C., A. G. Popa-Lisseanu, I. Niermann, and S. Kramer-Schadt. 2012. The catchment area of wind farms for European bats: A plea for international regulations. Biological Conservation 153:80-86.

Voigt, C. C., D. Russo, V. Runkel, and H. R. Goerlitz. 2021. Limitations of acoustic monitoring at wind turbines to evaluate fatality risk of bats. Mammal Review n/a.

Weaver, S. P., C. D. Hein, T. R. Simpson, J. W. Evans, and I. Castro-Arellano. 2020. Ultrasonic acoustic deterrents significantly reduce bat fatalities at wind turbines. Global Ecology and Conservation:e01099.

Wellig, S. D., S. Nusslé, D. Miltner, O. Kohle, O. Glaizot, V. Braunisch, M. K. Obrist, and R. Arlettaz. 2018. Mitigating the negative impacts of tall wind turbines on bats: Vertical activity profiles and relationships to wind speed. PloS one 13:e0192493.

Heritage Impact Assessment

Shahzaadee Karodia Khan, Johan Nel, 01/02/2014, HERITAGE STATEMENT FOR THE BASIC ASSESSMENT UNDERTAKEN FOR A POWERLINE UPGRADE, SYFERFONTEIN MINE, SECUNDA, MPUMALANGA PROVINCE

Anton van Vollenhoven, 10/08/2015, A report on a Cultural Heritage Impact Assessment for the Development of a De-stoning Plan at the New Denmark Colliery, close to Standerton, Mpumalanga Province

Julius CC Pistorius, 01/06/2007, A Phase 1 Heritage Impact Assessment Study for the Proposed New 88 kV Power Line Running from the Majuba Power Station near Amersfoort to the Camden Power Station near Ermelo in the Mpumalanga Province

Johnny Van Schalkwyk, 01/05/2003, Archaeological Survey of a Section of the Secunda-Mozambique Gas Pipeline Bethal and Highveld Ridge 5700 AIA Phase 1

Johnny Van Schalkwyk, 01/10/2002, A Survey of Cultural Resources for the Proposed New Tutuka-Alpha Standerton Power Transmission Line, Standerton District

Johnny Van Schalkwyk, 01/02/2004, Heritage Impact Assessment for the Planned Sivukile Extension 4 Township Lekwa Municipality

Visual Impact Assessment

Bernard Oberholzer. Guidelines for involving visual and aesthetic specialists in EIA processes, Published by the Provincial Government of the Western Cape: Department of Environmental Affairs and Development Planning, 2005

Landscape Institute and Institute of Environmental Assessment and Management, Guidelines for landscape and visual impact assessment (third edition), authors; published by E & FN Spon, 2013.

Mucina, L. & Rutherford, M.C. (eds.), 2006, The vegetation of South Africa, Lesotho and Swaziland (Strelitzia series; no. 19), South African National Biodiversity Institute, Pretoria.

United States Department of the Interior, Bureau of Land Management, 2013.

Evaluation of Glare as a Hazard for General Aviation Pilots on Final Approach, US Federal Aviation Administration, 2015. Best Management Practices for Reducing Visual Impacts of Renewable Energy Facilities on BLM Administered Lands.

Meister Consultants Group, 2014. Solar and Glare

Appendix 6, EIA Regulations (2014) as amended, promulgated under section 24 of the National Environmental Management Act, 107 of 1998. Department of Forestry Fisheries and the Environment.

Noise Impact Assessment

Ambrose, SE and Rand, RW, 2011. The Bruce McPherson Infrasound and Low Frequency Noise Study: Adverse health effects produced by large industrial wind turbines confirmed. Rand Acoustics, December 14, 2011.

Autumn, Lyn Radle, 2007: The effect of noise on Wildlife: A literature review

Atkinson-Palombo, C and Hoen, B. 2014: Relationship between Wind Turbines and Residential Property Values in Massachusetts – A Joint Report of University of Connecticut and Lawrence Berkley National Laboratory. Boston, Massachusetts

Bakker, R.H., Pedersen, E., van den Berg, G.P., Stewart, R.E., Lok,W., Bouma, J. 2012: Impact of wind turbine sound on annoyance, self-reported sleep disturbance and psychological distress. Sci. Total Environ. 15 (425), 42–51

Barber, J.R., K.R. Crooks, and K. Fristrup. 2010. The costs of chronic noise exposure for terrestrial organisms. Trends Ecology and Evolution 25(3): 180–189

Bass JH et al, 1996: Development of a wind farm noise propagation prediction model.

JH Bass, AJ Bullmore, E Sloth. Contract JOR3-CT95-0051. Renewable Energy Systems Limits, Hoare Lea & Partners Acoustics, Acoustica A/S

Bastasch, M; van Dam, J; Søndergaard, B; Rogers, A. 2006: Wind Turbine Noise - An Overview. Canadian Acoustics Vol. 34(2). pp. 7-15

Bayne EM et al, 2008: Impacts of chronic anthropogenic noise from energy-sector activity on abundance of songbirds in the boreal forest. Conservation Biology 22(5) 1186-1193.

Blickley, J.L. and Patricelli, G.L. 2010. Impacts of Anthropogenic Noise on Wildlife: Research Priorities for the Development of Standards and Mitigation. Journal of International Wildlife Law & Policy, 13:274–292.

Bolin et al, 2011: Infrasound and low frequency noise from wind turbines: exposure and health effects. Environ. Res. Lett. 6 (2011) 035103

Bowdler, D. 2005: ETSU-R-97 Why it is Wrong, Internet White Paper, New Acoustics, Dunbartonshire, Scotland, July 2005

Bowdler, Dick, 2008: Amplitude modulation of wind turbine noise: a review of the evidence

Bowdler, D. Bullmore, A. Davis, B. Hayes, M. Jiggens, M. Leventhall, G. McKenzie, A. 2009: Prediction and Assessment of Wind Turbine Noise – Agreement about relevant factors for noise assessment from wind energy projects. Acoustics, Vol 34, No 2. March/April 2009

Bray, W and James, R. 2011. Dynamic measurements of wind turbine acoustic signals, employing sound quality engineering methods considering the time and frequency sensitivities of human perception. Noise-Con 2011.

Broucek, J. 2014. Effect of Noise on Performance, Stress and Behaviour of Animals. Slovak J. Anim. Sci., 47, 2014 (2): 111-123

BWEA, 2005: Low Frequency Noise and Wind Turbines – Technical Annex

CanWEA, 2007: Wind Turbines and Sound: Review and Best Practice Guidelines. Canadian Wind Energy Association.

Chapman et al. 2013: Spatio-temporal differences in the history of health and noise complaints about Australian wind farms: evidence for the psychogenic, "communicated disease" hypothesis. Sydney School of Public Health, University of Sydney

Chief Medical Officer of Health, 2010: The Potential Health Impact of Wind Turbines, Canada

Conrady, K; Bolin, K; Sjöblom, A; Rutgersson, A. 2019: Amplitude modulation of wind turbine sound in cold climates. Applied Acoustics, Vol 158, 15 January 2020.

Cooper, 2012: Are Wind Farms too close to communities, The Acoustic Group (date posted on Wind-watch.org: Referenced on various anti-wind energy websites)

Cooper, S. Chan, C. 2020: Determination of Acoustic Compliance of Wind Farms. Acoustics 2020, 2, 416–450; doi:10.3390/acoustics2020024

Council of Canadian Academies, 2015: Understanding the Evidence: Wind Turbine Noise. Ottawa (ON): The Expert Panel on Wind Turbine Noise and Human Health. Council of Canadian Academies

Crichton et al. 2014: Can expectations produce symptoms from infrasound associated with wind turbines?. Health Psychology, Vol 33(4), Apr 2014, 360-364

CSES, 2016: Evaluation of Directive 2002/49/EC relating to the assessment and management of environmental noise. The Centre for Strategy & Evaluation Services, European Commission, Brussels.

CSIR, 2002: Integrated Environmental Management Information Series: Information Series 5: Impact Assessment. Issued by the Department of Environmental Affairs and Tourism, Pretoria

CSIR, 2015: The Strategic Environmental Assessment for Wind and Solar Photovoltaic

Energy in South Africa. Issued by the Department of Environmental Affairs and Tourism, Pretoria

Cummings, J. 2012: Wind Farm Noise and Health: Lay summary of new research released in 2011. Acoustic Ecology Institute, April 2012 (online resource: http://www.acousticecology.org/wind/winddocs/AEI_WindFarmsHealthResearch2011.pdf)

Cummings, J. 2009: AEI Special Report: Wind Energy Noise Impacts. Acoustic Ecology Institute, (online resource: http://acousticecology.org/srwind.html)

DEFRA, 2003: A Review of Published Research on Low Frequency Noise and its Effects, Report for Defra by Dr Geoff Leventhall Assisted by Dr Peter Pelmear and Dr Stephen Benton

DEFRA, 2007: Research into Aerodynamic Modulation of Wind Turbine Noise: Final Report

DELTA, 2008: EFP-06 project: Low Frequency Noise from Large Wind Turbines, a procedure for evaluation of the audibility for low frequency sound and a literature study. Danish Energy Authority

Derryberry EP et al, 2016: Patterns of song across Natural and Anthropogenic Soundscapes suggest that White-Crowned Sparrows minimize acoustic masking and maximize signal content. PLOS ONE| DOI: 10.1371/journal.pone.0154456, April 29, 2016

Dooling, R. 2002. Avian Hearing and the Avoidance of Wind Turbines. National Renewable Energy Laboratory, NREL/TP-500-30844

Dooling R. J., and A. N. Popper. 2007. The effects of highway noise on birds. Report to the California Department of Transportation, contract 43AO139. California Department of Transportation, Division of Environmental Analysis, Sacramento, California, USA

Directive 2002/49/EC of the European Parliament and of the Council relating to the assessment and management of environmental noise

Duncan, E. and Kaliski, K. 2008: Propagation Modelling Parameters for Wind Power Projects

Ellenbogen, J.M., Grace, S., Heiger-Bernays,W.J., Manwell, J.F., Mills, D.A., Sullivan, K.A., Santos, S.L. 2012: Wind Turbine Health Impact Study. Report of Independent Expert Panel. Prepared for: Massachusetts Department of Environmental Protection. Massachusetts Department of Health

Enertrag, 2008: Noise and Vibration. Hempnall Wind Farm (http://www.enertraguk.com/technical/noise-and-vibration.html)

EPA, 2009: Wind Farms Environmental Noise Guidelines. Environmental Protection Authority, Adelaide, South Australia (Updated November 2021)

EPA, 2011: Guidance Note on Noise Assessment of Wind Turbine Operations at EPA Licences Sites (NG3). Environmental Protection Agency, Office of Environmental Enforcement,

ETSU R97: 1996. 'The Assessment and Rating of Noise from Wind Farms: Working Group on Noise from Wind Turbines'

Evans Tom, Cooper Jonathan, 2012: Comparison of predicted and measured wind farm noise levels and implications for assessments of new wind farms. Acoustics Australia, Vol. 40, No. 1, April 2012.

Evans, T. Cooper, J. Lenchine, V. 2012: Infrasound Levels near Windfarms and in other Environments. Resonate Acoustics in conjunction with Environment Protection Authority, South Australia

Fégeant, O. 2002: Masking of Wind Turbine Noise: Influence of Wind Turbulence on Ambient Noise Fluctuations.

Francis, C.D. et al, 2011: Different behavioural responses to anthropogenic noise by two closely related passerine birds. Biol. Lett. (2011) 7, 850-852 doi:10.1098 / rsbl.2011.0359

Francis, C.D. et al, 2012: Noise pollution alters ecological services: enhanced pollination and disrupted seed dispersal. Proc. R Soc. B doi: 10.1098 / rsbl.2012.0230

Garrad Hassan, 2013: Summary of results of the noise emission measurement, in accordance with IEC 61400-11, of a WTGS of the type N117/3000. Doc. GLGH-4286 12 10220 258-S-0002-A (extract from GLGH-4286 12 10220 258-A-0002-A)

Gibbons, S. 2014: Gone with the Wind: Valuing the Visual Impacts of Wind turbines through House Prices, Spatial Economics Research Centre

Guillaume Dutilleux. Anthropogenic outdoor sound and wildlife: it's not just bioacoustics!. Soci´et´e Fran¸caise d'Acoustique. Acoustics 2012, Apr 2012, Nantes, France

Halfwerk, W. et al. 2011: Low-frequency songs lose their potency in noisy urban conditions. PNAS, August 30, 2011, vol. 108, no. 35, 14549-14554.

Hanning, 2010: Wind Turbine Noise, Sleep and Health. (referenced on a few websites, especially anti-wind energy. No evidence that the study has been published formally.)

Hartley, J.C., 1991: Can Bush Crickets Discriminate Frequency? University of Nottingham.

Havas, M and Colling, D. 2011: Wind Turbines Make Waves: Why Some Residents

Near Wind Turbines Become Ill. Bulletin of Science Technology & Society published online 30 September 2011

Helldin, J.O., Jung, J., Neumann, W., Olsson, M., Skarin, A. and Widemo, F. 2012. The impacts of wind power on terrestrial mammals: a synthesis. Report 6510. Swedish Environmental Protection Agency.

Hessler, D. 2011: Best Practices Guidelines for Assessing Sound Emissions From Proposed Wind Farms and Measuring the Performance of Completed Projects. Prepared for the Minnesota Public Utilities Commission, under the auspices of the National Association of Regulatory Utility Commissioners (NARUC)

HGC Engineering, 2006: Wind Turbines and Infrasound, report to the Canadian Wind Energy Association

HGC Engineering, 2007: Wind Turbines and Sound, report to the Canadian Wind Energy Association

HGC Engineering, 2011: Low frequency noise and infrasound associated with wind turbine generator systems: A literature review. Ontario Ministry of the Environment RFP No. OSS-078696.

IFC, 2007: 'Environmental, Health, and Safety General Guidelines'. International Finance Corporation, Washington

IFC, 2015: 'Environmental, Health, and Safety Guidelines for Wind Energy'. International Finance Corporation, Washington

IOA, 2013: A good practice guide to the application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise. Institute of Acoustics.

ISO 9613-2: 1996. 'Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation'

Janssen, S.A., Vos, H., Eisses, A.R., Pedersen, E. 2011: A comparison between exposure-response relationships for wind turbine annoyance and annoyance due to other noise sources. J. Acoust. Soc. Am. 130(6), 3746–53 (2011)

Jeffery et al, 2013: Adverse health effects of industrial wind turbines, Can Fam Physician, 2013 May. 59(5): 473-475

Journal of Acoustical Society of America, 2009: Response to noise from modern wind farms in the Netherlands

Kaliski K & Duncan E, 2008: Propagation modelling Parameters for Wind Power Projects.

Kaliski K & Wilson DK. 2011: Improving predictions of wind turbine noise using PE modelling. Noise-con 2011.

Kamperman GW & James RR, 2008: The "How to" guide to siting wind turbines to prevent health risks from sound

Karwowska, M. et al. 2015: The effect of varying distances from the wind turbine on meat quality of growing-finishing pigs. Ann. Anim. Sci., Vol. 15, No. 4 (2015) 1043–1054 DOI: 10.1515/aoas-2015-0051

Knopper, L.D., Ollson, C.A.,McCallum, L.C.,Whitfield Aslund, M.L., Berger, R.G., Souweine, K., McDaniel, M. 2014: Wind turbines and human health. Front. Public Health 19(2), 63

Kroesen & Schreckenberg, 2011. A measurement model for general noise reaction in response to aircraft noise. J. Acoust. Soc. Am. 129 (1), January 2011, 200-210

Lohr, B. Wright, TF. Dooling, RJ. 2003: Detection and discrimination of natural calls in masking noise by birds: estimating the active space of a signal. Animal Behavior 65:763-777

Łopucki, R. Klich, D. Gielarek, S. 2016: An assessment of non-volant terrestrial vertebrates response to wind farms – a study of small mammals. Environ Monit Assess (2016) 188: 122

Łopucki, R. Klich, D. Gielarek, S. 2017: Do terrestrial animals avoid areas close to turbines in functioning wind farms in agricultural landscapes? Environ Monit Assess (2016) 188:122

McCunney, R.J., Mundt, K.A., Colby, W.D., Dobie, R., Kaliski, K.,Blais, M. 2014: Wind turbines and health: a critical review of the scientific literature. J. Occup. Environ. Med. 56(11), e108–30

McMurtry RY, 2011: Toward a Case Definition of Adverse Health Effects in the Environs of Industrial Wind Turbines: Facilitating a Clinical Diagnosis. Bulletin of Science Technology Society. August 2011 vol. 31 no. 4 316-320

MDEP: Massachusetts Department of Environmental Protection and Massachusetts Department of Public Health. Wind Turbine Health Impact Study: Report of Independent Expert Panel

Merlin, T., Newton, S., Ellery, B., Milverton, J., Farah, C. 2013: Systematic review of the human health effects of wind farms. National Health & Medical Research Council, Canberra

Miedema, H.M., Vos, H. 2003: Noise sensitivity and reactions to noise and other environmental conditions. J. Acoust. Soc. Am. 113(3), 1492–504

Michaud, D.S., Keith, S.E., Feder, K., Voicescu, S.A., Marro, L., Than, J., Guay,M., Bower, T., Denning, A., Lavigne, E., Whelan, C. 2016: Personal and situational variables associated with wind turbine noise annoyance. J. Acoust. Soc. Am. 139(3), 1455–66

Mikolajczak, J. et al. 2013: Preliminary studies on the reaction of growing geese (Anser anser f. domestica) to the proximity of wind turbines. Pol J Vet Sci. 2013;16(4):679-86. doi: 10.2478/pjvs-2013-0096.

Minnesota Department of Health, 2009: Public Health Impacts of Wind Farms

Ministry of the Environment, 2008: Noise Guidelines for Wind Farms, Interpretation for Applying MOE NPC Publications to Wind Power Generation Facilities

Møller H, 2010: Low-frequency noise from large wind turbines. J. Acoust. Soc. Am, 129(6), June 2011, 3727 – 3744

NARUC, 2011: Assessing Sound Emissions from Proposed Wind Farms & Measuring the Performance of Completed Projects. National Association of Regulatory Utility Commissioners. US Department of Energy

Nissenbaum A, 2012: Effects of industrial wind turbine noise on sleep and health. Noise and Health, Vol. 14, Issue 60, p 237 – 243.

Noise-con, 2008: Simple guidelines for siting wind turbines to prevent health risks

Noise quest, Aviation Noise Information &Resources, 2010: https://www.noisequest.psu.edu/noiseeffects-animals.html

Norton, M.P. and Karczub, D.G.: Fundamentals of Noise and Vibration Analysis for Engineers, Second Edition, 2003

O'Neal, et al. 2011: Low frequency noise and infrasound from wind turbines. Noise Control Eng. J. 59 (2), March-April 2011

Ortega, CP. 2012. Ornithological Monographs. Chapter 2: Effects of noise pollution on birds: A brief review of our knowledge. 74(1), pp.6-22.

Oud, M. 2012: Low-frequency noise: a biophysical phenomenon (http://www.leefmilieu.nl/sites/www3.leefmilieu.nl/files/imported/pdf_s/2012_OudM_Low-frequency%20noise_0.pdf) (unpublished webresource)

Parris, M. Schneider, A. 2009: Impacts of traffic noise and traffic volume on birds of roadside habitats. Ecology and Society 14(1): 29

Parry, G. 2008: A review of the use of different noise prediction models for wind farms and the effects of meteorology. The Journal of the Acoustical Society of America 123, 3535 (2008); https://doi.org/10.1121/1.2934501

Pedersen, T. H. 2007: The "Genlyd" Noise Annoyance Model. DELTA report AV 1102/07

Pedersen, E., Hallberg, L.M., Persson, W.K. 2007: Living in the vicinity of wind turbines—a grounded theory study. Qual. Res. Psychol. 4(1–2), 49–63

Pedersen, Eja; Halmstad, Högskolan I, 2003: 'Noise annoyance from wind turbines: a review'. Naturvårdsverket, Swedish Environmental Protection Agency, Stockholm

Pedersen, E. 2011: "Health aspects associated with wind turbine noise—Results from three field studies", Noise Control Eng. J. 59 (1), Jan-Feb 2011

Phillips, CV, 2011: "Properly Interpreting the Epidemiologic Evidence About the Health Effects of Industrial Wind Turbines on Nearby Residents". Bulletin of Science Technology & Society 2011 31: 303 DOI: 10.1177/0270467611412554

Pierpont, N. 2009: "Wind Turbine Syndrome: A Report on a Natural Experiment", K Select Books, 2009

Punch, et al. 2010: Wind Turbine Noise. What Audiologists should know. Audiology Today. JulAug2010

Quinn, J.L., M.J. Whittingham, S.J. Butler, and W. Cresswell. 2006. Noise, predation risk compensation and vigilance in the chaffinch Fringilla coelebs. Journal of Avian Biology 37: 601-608

Rabin, L.A., R.G. Coss, D.H. Owings. 2006. The effects of wind turbines on antipredator behavior in California ground squirrels (Spermophilus beecheyi). Biological Conservation 131: 410-420

Renewable Energy Research Laboratory, 2006: Wind Turbine Acoustic Noise

RenewableUK, 2013: Wind Turbine Amplitude Modulation: Research to Improve Understanding as to its Cause and Effect.

SANS 10103:2008. 'The measurement and rating of environmental noise with respect to annoyance and to speech communication'.

SANS 10210:2004. 'Calculating and predicting road traffic noise'.

SANS 10328:2008. 'Methods for environmental noise impact assessments'.

SANS 10357:2004. The calculation of sound propagation by the Concave method'.

Schaub, A, J. Ostwald and B.M. Siemers. 2008. "Foraging bats avoid noise". The Journal of Experimental Biology 211: 3174-3180

Schmidt, J.H., Klokker,M. 2014: Health effects related to wind turbine noise exposure: a systematic review. PLoS ONE 9(12), e114183

Šottník, J. 2011: Influence of noise and object noisiness on animal breeding.. Šiška, B. – Hauptvogl, M. – Eliašová, M. (eds.). Bioclimate: Source and Limit of Social Development International Scientific Conference, 6th – 9th September 2011,Topoľčianky, Slovakia

Shannon, G., McKenna, M.F., Angeloni, L.M., Crooks, K.R., Fristrup, K.M., Brown, E., Warner, K.A., Nelson, M.D., White, C., Briggs, J., McFarland, S. and Wittemyer, G. 2015. A synthesis of two decades of research documenting the effects of noise on wildlife. Biological Reviews.

Sheperd, D and Billington, R. 2011: Mitigating the Acoustic Impacts of Modern Technologies: Acoustic, Health, and Psychosocial Factors Informing Wind Farm Placement. Bulletin of Science Technology & Society published online 22 August 2011, DOI: 10.1177/0270467611417841

Shepherd. D et al. 2011: Evaluating the impact of wind turbine noise on health related quality of life. Noise & Health, September-October 2011, 13:54,333-9.

Smith. M (et al) (2012): "Mechanisms of amplitude modulation in wind turbine noise"; Proceedings of the Acoustics 2012 Nantes Conference

Stigwood, M. Large, S. Stigwood, D. 2013: "Audible amplitude modulation – results of field measurements and investigations compared to psycho-acoustical assessments and theoretical research"; Paper presented at the 5th International Conference on Wind Turbine Noise, Denver 28 – 30 August 2013

Superior Health Council, 2013: Public health effects of siting and operating onshore wind turbines. Publication of the Superior Health Council No. 8738

Szymański, P. et al. 2017: The song of Skylarks Alauda arvensis indicates the deterioration of an acoustic environment resulting from wind farm start-up. https://doi.org/10.1111/ibi.12514

Tachibana, H (et al) (2013): "Assessment of wind turbine noise in immission areas"; Paper presented at the 5th International Conference on Wind Turbine Noise, Denver 28 – 30 August 2013

The Scottish Government, 2011. Planning Advice Note PAN 1/2011: Planning and Noise. https://www.gov.scot/publications/planning-advice-note-1-2011-planningnoise/pages/5/

Thorne et al, 2010: Noise Impact Assessment Report Waubra Wind Farm Mr & Mrs N Dean Report No 1537 - Rev 1

Thorne, 2010: The Problems with "Noise Numbers" for Wind Farm Noise Assessment. Bulletin of Science Technology and Society, 2011 31: 262 UK Department for Communities and Local Government, 2013: Planning practice guidance for renewable and low carbon energy. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/225689/Planning_Practice_Guidance_for_Renewable_and_Low_Carbon_Energy.pdf

USEPA, 1971: Effects of Noise on Wildlife and other animals.

Van den Berg, G.P., 2003. 'Effects of the wind profile at night on wind turbine sound'. Journal of Sound and Vibration

Van den Berg, G.P., 2004. 'Do wind turbines produce significant low frequency sound levels?'. 11th International Meeting on Low Frequency Noise and Vibration and its Control

Van den Berg, F., Pedersen, E., Bouma, J., Bakker, R. 2008: Visual and acoustic impact of wind turbine farms on residents. Final Rep.

Van den Berg, F., Verhagen, C., Uitenbroek, D. 2014: The relation between scores on noise annoyance and noise disturbed sleep in a public health survey. Int. J. Environ. Res. Public Health 11(2), 2314–27

Van Kamp, I., Davies, H. 2013: Noise and health in vulnerable groups: a review. Noise Health 15(64), 153

Van Riet, W. Claassen, P. van Rensburg, J. van Viegen & L. du Plessis. 1998. Environmental potential atlas for South Africa. J.L. van Schaik, Pretoria

Vestas, 2017: 'V150-4.0 MW Third Octave Noise Emissions'. DMS no.: 0067-4767_00, Vestas Wind Systems A/S, Denmark

Vestas, 2017: 'Performance Specification - V150-4.0/4.2 MW 50/60 Hz'. DMS no.: 0067-7067 V08, Vestas Wind Systems A/S, Denmark

Wang, Z. 2011: Evaluation of Wind Farm Noise Policies in South Australia: A Case Study of Waterloo Wind Farm. Masters Degree Research Thesis, Adelaide University 2011

Whitford, Jacques, 2008: Model Wind Turbine By-laws and Best Practices for Nova Scotia Municipalities

World Health Organization, 1999: Protection of the Human Environment; Guidelines for Community Noise

World Health Organization, 2009: Night Noise Guidelines for Europe

World Health Organization, 2018: Environmental Noise Guidelines for the European Region

WSP, 2016: Wind Turbine AM Review – Phase 2 Report. WSP Parsons Brinckerhoff for the Department of Energy and Climate Change

Zwart, M.C et al. 2014: Wind farm noise suppresses territorial defense behavior in a songbird. Behavioral Ecology arv128(1), July 2014

Traffic Impact Assessment

Google Earth Pro

SANS 10280/NRS 041-1:2008 - Overhead Power Lines for Conditions Prevailing in South Africa

Road Traffic Act (Act No. 93 of 1996)

National Road Traffic Regulations, 2000

The Technical Recommendations for Highways (TRH 11): "Draft Guidelines for Granting of Exemption Permits for the Conveyance of Abnormal Loads and for other Events on Public Roads

Social Impact Assessment

Statistics South Africa . (2016). Community Survey. Retrieved September 12, 2018, from http://cs2016.statssa.gov.za/

Adrian, T., & Natalucci, F. (2020). COVID-19 Crisis Poses Threat to Financial Stability. Retrieved June 24, 2021, from :https://blogs.imf.org/2020/04/14/covid-19-crisis-poses-threat-to-financial-stability/

Department of Economic Development. (2011). The New Growth Path Framework.

Department of Economic Development, T. a. (2016). Formulation of Provincial Spatial Economic Development Strategy, Corridor and Nodal Framework and Data Mapping.

Department of Energy. (2013). Integrated Resource Plan for Electricity 2010-2030 Update Report.

Department of Energy. (2018). Integrated Resource Plan for Electricity 2018 Update Report.

Department of Energy. (2019). Integrated Resource Plan for Electricity 2010-2030 Update Report.

Department of Minerals and Energy. (1998). White Paper on the Energy Policy of the Republic of South Africa. Republic of South Africa.

Department of Minerals and Energy. (2003). White Paper on Renewable Energy .

Department of Trade and Industry. (2016). Industrial Policy Action Plan 2016/17-2017/18.

Department of Trade and Industry. (2018). Industrial Policy Action Plan 2017/18-2020-2022.

DNA Economics. (2016). Draft Green Economy Sector Plan. Middleburg: DNA Economics.

Duvenage, A. (2020). City Press. Retrieved June 24, 2021, from https://city-press.news24.com/Business/what-the-moodys-downgrade-means-for-sa-20200330

e-SEK. (2020). Making sense of COVID-19's impact on South African businesses. Retrieved June 25, 2021, from https://www.itweb.co.za/content/wbrpOMgYbkEvDLZn

Gert Sibande District Municipality. (2021). Amended IDP.

Goldberg, A. (2015). The economic impact of load shedding: The case of South African retailersGordon Institute of Business Science - University of Pretoria. Pretoria: Gordon Institute of Business Science - University of Pretoria.

Govan Mbeki Local Municipality. (2021). Fourth Review of the Integrated Development Plan.

Govan Mbeki Municipality. (2014). Local Economic Development Strategy.

International Institute for Sustainable Development. (2018). Strategies for just energy transitions. Manitoba: IISD.

JG Afrika. (2021). Proposed Hendrina Wind Energy Facility, Mpumalanga Transport Study.

Kovaleski, D. (2019). Study shows high investor confidence in renewable energy. Retrieved June 25, 2021, from https://dailyenergyinsider.com/news/20058-study-shows-high-investor-confidence-in-renewable-energy/

Lanz, J. (2020). Agricultural pre-EIA Assessment for proposed Hendrina, Camden East I, and Camden East II wind energy facilities in Mpumalanga.

Lanz, J. (2022). Agricultural pre-EIA Assessment for proposed Hendrina, Camden East I, and Camden East II wind energy facilities in Mpumalanga.

Lekwa Local Municipality. (2021). Final Draft IDP.

Maree, D. (2019). Agribusiness South Africa. Retrieved March 9, 2022, from https://www.bizcommunity.com/Article/196/741/188061.html

McSweeney, R., & Timperley, J. (2018). The Carbon Brief Profile. Retrieved June 24, 2021, from https://www.carbonbrief.org/the-carbon-brief-profile-south-africa

Mpumalanga Economic Growth & Development Path. (2011). Mpumalanga Economic Growth & Development Path. MEGA.

Mpumalanga Nature Conservation Act 10 of 1998. (1999). Centre for Environmental Rights. Retrieved June 15, 2021, from https://cer.org.za/virtual-library/legislation/provincial/mpumalanga/mpumalanga-nature-conservation-act-10-of-1998

Mpumalanga Tourism and Park Agency. (2011). MTPA Strategic Plan. Nelspruit: MTPA.

National Department of Energy (DOE). (2019). The South African Energy Sector Report. Pretoria: Department of Energy.

National Planning Commission. (2011). The National Development Plan, Vision for 2030.

NERSA. (2020). National Electricity Industry Regulation: A different focus on the electricity supply industry challenges and possible solutions. Pretoria: National Energy Regulator of South Africa.

Nkangala District Municipality. (2019). Draft Adjusted Intergrated Development Plan.

NPC. (2012). National Development Plan: Vision for 2030.

Provincial Planning Commission. (2016). 2035 Provincial Growth and Development Plan, Building a Better Future Together.

Rchards Bay IDZ SOC. (2016). RBIDZ Annual Report 2015-2016.

REN21. (2021). The Renewables 2021 Global Status Report. Retrieved June 24, 2021, from https://www.ren21.net/wp-content/uploads/2019/05/GSR2021_Full_Report.pdf

Republic of South Africa. (1996). Constitution of the Republic of South Africa.

SACCI. (2022). Business Confidence Index.

Santander. (2020). South Africa: Foreign investment. Retrieved June 24, 2021, from https://santandertrade.com/en/portal/establish-overseas/south-africa/foreign-investment

Sihlobo, W., & Kapuya, T. (2021). Daily Maverick. Retrieved March 9, 2022, from https://www.dailymaverick.co.za/article/2021-11-08-rising-domestic-and-international-agricultural-input-costs-set-to-squeeze-both-farmers-and-consumers/

Sinding, S. (2009, May 16). Population, poverty and economic development. Retrieved from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2781831/

SiVEST. (2021). Proposed Construction of the Hendrina Renewable Energy.

SiVEST. (2022). Proposed Construction of the Hendrina Renewable Energy.

South African Government. (2011). New Growth Path Framework .

Statistics South Africa. (2011). Census. Pretoria: Statistics South Africa.

Statistics South Africa. (2016). Provincial Profile KwaZulu Natal. Pretoria: Statistics South Africa.

StatsSA. (2021). Department of Statistics South Africa. Retrieved March 15, 2022, from http://www.statssa.gov.za/?p=14660

Steve Tshwete Loval Municipality. (2010). Spatial Development Framework.

Steve Tswete Local Municipality. (2016). Local Economic Development Strategy.

Swart, P., & Goncalves, S. (2020). Downgrade of South Africa's credit rating further into junk. Retrieved June 23, 2021, from https://www.cliffedekkerhofmeyr.com/en/news/publications/2020/finance/finance-alert-11-may-downgrade-of-south-africas-credit-rating-further-i

Trade & Industry Policy Strategies. (2021). Making sense of jobs in South Africa's just energy transition: Managing the impact of a coal transition on employment. South Africa: TIPS.

uMhlathuze LM. (2016). Final IDP Review 2016/17 "Last IDP Review for the Third IDP Generation".

uThungulu DM. (2015). uThugulu Spatial Development Review.

Uthungulu DM. (2015). uThungulu Distrct Municipality Growth and Development Plan.

uThungulu DM. (2016). Integrated Development Plan 2011/12- 2016/17 Final Review.

van Wyk, C. (2020). SA's "big bazooka" stimulus package explained. Retrieved June 24, 2021, from https://www.investec.com/en_za/focus/economy/sas-big-bazooka-stimulus-package-explained.html

van Wyk, M. (2018). SABC News. Retrieved March 9, 2022, from https://www.sabcnews.com/rise-in-fuel-price-to-negatively-affect-agricultural-sector/

World Wildlife Fund. (2014). Renewable Energy Vision 2030 South Africa, Climate Change and Energy, Technical Report. WWF.