

FINAL SCOPING REPORT

ENVIRONMENTAL
IMPACT ASSESSMENT
PROCESS FOR THE
PROPOSED
DEVELOPMENT OF THE
CARISSA WIND ENERGY
FACILITY AND
ASSOCIATED
INFRASTRUCTURE,
NEAR BEAUFORT WEST,
WESTERN CAPE
PROVINCE

29 NOVEMBER 2024



BLUECRANE
ENVIRONMENTAL

PROJECT DETAILS

DFFE Reference Number	:	14/12/16/3/3/2/2637
Project Title	:	The Proposed Development of the Carissa Wind Energy Facility and Associated Infrastructure, near Beaufort West, Western Cape Province
Authors	:	Roschel Naidoo (Author) Lisa de Lange (co-author) Marélie Botha (co-author)
Consultancy	:	Blue Crane Environmental (Pty) Ltd
Registered EAP	:	Roschel Naidoo (2019/824) Lisa de Lange (2020/2150) Marélie Botha (2021/3834)
Applicant	:	AMDA Oscar (Pty) Ltd
Report Status	:	Final Scoping Report submitted to DFFE for decision-making
Submission Date	:	29 November 2024
Report Reference	:	Blue Crane Environmental, (2024). Final Scoping Report: The Proposed Development of the Carissa Wind Energy Facility and Associated Infrastructure, near Beaufort West, Western Cape Province



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GLOSSARY OF TERMS AND ACRONYMS

CEA	Cumulative Effects Assessment
DFFE	Department of Forestry, Fisheries and the Environment
DM	District Municipality
DMRE	Department of Mineral Resources and Energy
DWS	Department of Water and Sanitation
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
EIA	Environmental Impact Assessment
EMPr	Environmental Management Programme
EP	Equator Principles
EPFI	Equator Principles Financial Institutions
Environmental impact	Any change to the environment, whether adverse or beneficial, wholly or partially resulting from an organization's environmental aspects.
EWT	Endangered Wildlife Trust
GNR	Government Notice Regulation
HWC	Heritage Western Cape
I&AP	Interested and Affected Party
IAP	Invasive Alien Plant
IBA	Important Bird Area
IDP	Integrated Development Plan
IFC	International Finance Corporation
IPP	Independent Power Producer
IRP	Integrated Resource Plan
kV	Kilo Volt
KBA	Key Biodiversity Area

LILIO	Loop-In Loop-Out
LM	Local Municipality
Mitigate	Activities designed to compensate for unavoidable environmental damage.
MTS	Main Transmission Substation
MW	Megawatt
MYA	Million Years Ago
NEMA	National Environmental Management Act No. 107 of 1998
NERSA	National Energy Regulator of South Africa
NSR	Noise Sensitive Receptor
NWA	National Water Act No. 36 of 1998
PA	Project Area
PFA	Project Focus Area
PAOI	Project Area of Influence
POSA	Plants of South Africa
PPP	Public Participation Process
PV	Photovoltaic
REEA database	Renewable Energy Environmental Applications Database
REIPPP	Renewable Energy Independent Power Producer Procurement Programme
SAHRA	South African Heritage Resources Agency
SCC	Species of Conservation Concern
SDF	Spatial Development Framework
SEF	Solar Energy Facility
S&EIA	Scoping and EIA Process
SPP	Solar Power Plant
VU	Vegetation Unit
WEF	Wind Energy Facility

SUBMISSION OF THE FINAL REPORT

AMDA Oscar (Pty) Ltd is proposing the development of the Carissa Wind Energy Facility (WEF) and associated infrastructure for the purpose of commercial electricity generation on an identified site located on several properties located within the Western Cape Province situated within the Beaufort West and Prince Albert Local Municipalities and the Central Karoo District Municipality area of jurisdiction.

Blue Crane Environmental (Pty) Ltd has been appointed as the independent environmental consultant to undertake the required Environmental Impact Assessment Process (EIA) as per the requirements of the EIA Regulations 2014, as amended, promulgated in terms of the National Environmental Management Act (NEMA; Act No. 107 of 1998).

As the development of the Carissa WEF has the potential to result in negative impacts on the environment, Application for Environmental Authorisation (EA) must be made to the relevant decision-maker. The decision-making authority is the National Department of Forestry, Fisheries and the Environment (DFFE).

This is the final Scoping Report. The draft Scoping Report was made available for a 30-day review and comment period to all registered Interested and/or Affected Parties (I&APs) to provide opportunity to raise comment and concern regarding the proposed development and to participate in the public participation process. The 30-day period was from **Wednesday, 23 October 2024 to Friday, 22 November 2024 (both days inclusive)**.

This final Scoping Report is submitted to the DFFE for decision-making on the Scoping Phase and Plan of Study for the EIA in order for the S&EIA process to progress to the next phase, which is the EIA Phase.

This report therefore represents the findings of the Scoping Phase of the EIA process and contains the following sections and information:

- **Section 1: Introduction** - provides background to the development and the Scoping & EIA (S&EIA) process.
- **Section 2: Project Description and Site Selection Process** - provides a description of all project related details, including alternatives and the process followed by the Applicant for site selection of the preferred site.
- **Section 3: Policy and Legislative Context** - provides a description of the policy and legislative context considering the proposed development, and also provides an indication of how the development responds to these aspects.
- **Section 4: Need and Desirability** - describes the need and desirability of the proposed development within the site and for the broader area.
- **Section 5: Approach to the Process** - outlines the approach followed in terms of the S&EIA Process.
- **Section 6: Public Participation Process** - outlines the approach followed in terms of the Public Participation Process.
- **Section 7: Description of the Affected Environment** - describes the current environment within which the development is proposed, including biophysical and socio-economic aspects.
- **Section 8: Impact Assessment** - provides an assessment of the potential impacts associated with the development and provides recommendations for the mitigation of significant impacts.

- **Section 9: Cumulative Impact Assessment** - provides an assessment of the potential cumulative impacts associated with the development and other developments and provides recommendations for the mitigation of significant impacts, where relevant.
- **Section 10: EIA Plan of Study** - provides the plan of study to be followed for the EIA Phase of the process.
- **Section 11: Conclusion** - presents the conclusions and recommendations based on the findings of the final Scoping Report.

EXECUTIVE SUMMARY

AMDA Oscar (Pty) Ltd intends to develop an up to 1 000 MW Wind Energy Facility (WEF) and associated infrastructure, known as the Carissa Wind Energy Facility (WEF), on several affected properties, all of which are situated within the Registration Division Beaufort West, situated within the Beaufort West and Prince Albert Local Municipalities and the Central Karoo District Municipality area of jurisdiction. The proposed Carissa WEF is located approximately 31 km south of the centre of the town of Beaufort West and approximately 57 km northeast of the centre of the town of Prince Albert.

Blue Crane Environmental (Pty) Ltd has been appointed to undertake the Scoping and Environmental Impact Assessment (S&EIA) Process for the proposed development. Activities required for the development of the WEF which are listed under Listing Notice 1, 2 and 3 (GN.R. 327, 325 and 324) implies that the development could potentially have a significant impact on the environment that will require mitigation. A thorough assessment process is required as described in Regulations 21 -24 of the EIA Regulations 2014, as amended, to obtain Environmental Authorisation (EA).

This is the final Scoping Report. The draft Scoping Report was made available to I&APs, stakeholders and the competent authority for a 30-day review and comment period. Potential sensitive areas present within the project site have been identified through the Scoping Phase and this report provides an overview of the sensitivity of the Carissa WEF development area. The detail is based on the desktop review of available baseline information for the development area, as well as the sensitivity data received from specialist site visits and studies undertaken during the Scoping Phase.

Based on the high-level assessments, it has been predicted that the proposed development will ensure the optimal utilisation of resources and land. All potential negative environmental impacts can be effectively mitigated through the recommended mitigation measures and no residual negative impacts are foreseen. Furthermore, positive impacts associated with the development can be effectively enhanced and the significance thereof increased through the implementation of enhancement measures. The potentially most significant environmental impacts associated with the development, as identified in this final Scoping Report, are briefly summarised below.

Predicted impacts during the construction phase:

During the construction phase (period of up to 24 months) negative impacts are foreseen over the short term. The potentially most significant negative impacts relate to habitat destruction caused by clearance of vegetation; impacts on avifauna due to establishment of new infrastructure, and temporary increase in traffic disruptions and movement patterns. Some positive impact is anticipated which includes socio-economic impacts such as the creation of direct and indirect employment opportunities, economic multiplier effects from the use of local goods and services.

Predicted impacts during the operational phase:

During the operational phase, the site will serve as a WEF, and the potential impacts will take place over a period of 20 - 25 years. The negative impacts are generally associated with habitat destruction caused by clearance of vegetation, displacement of priority avian species from important habitats, collision and electrocutions of avifauna, bat mortality due to turbine collision, visual impact of sensitive visual receptors occurring for motorists that drive passed the proposed facility, shadow flicker impacts caused by operational turbines and noise and vibration impacts from the turbine. The provision of

sustainable services delivery also needs to be confirmed. The operational phase will have a direct positive impact through the creation of employment opportunities and skills development, development of non-polluting, renewable energy infrastructure and contribution to economic development and social upliftment.

Predicted impacts during the decommissioning phase:

The negative impacts generally associated with the decommissioning phase include: habitat destruction caused by clearance of vegetation and the loss of permanent employment. However, skilled staff will be eminently employable, and a number of temporary jobs will also be created in the process. It is not expected that the facility will be decommissioned, but rather that the technology used will be upgraded.

Predicted cumulative impacts:

Further to the above, cumulative impacts could arise as other similar projects are constructed in the area. According to the Department of Forestry, Fisheries and Environment (DFFE) database, there are twenty-seven (27), similar developments that are proposed within 30 km of Carissa WEF.

It is recommended that the competent authority approve the Scoping Report and Plan of Study for the EIA so that the Application may move forward to the EIA Phase for further assessment. This is based on the fact that no fatal flaws have been identified for the development of the Carissa WEF and associated infrastructure, as well as the potential opportunity to avoid, manage and mitigate the impacts associated with the proposed development.

1 INTRODUCTION

The Applicant, AMDA Oscar (Pty) Ltd, is proposing the development of a Wind Energy Facility (WEF) and associated infrastructure, known as Carissa WEF. The proposed Carissa WEF is located approximately 31 km south of the centre of the town of Beaufort West and approximately 57 km northeast of the centre of the town of Prince Albert in the Beaufort West and Prince Albert Local Municipalities and the Central Karoo District Municipality.

The development will comprise up to 154 wind turbines and associated infrastructure and will have a contracted capacity of up to 1 000 MW. The proposed Carissa WEF will traverse several properties: Portion 6 of Farm Dale Ajalon No. 322; Farm Meyers Poort No. 326; Portion 3 (Portion of Portion 2) of Farm Vlakfontein No. 325; Remaining Extent of Farm Palmietfontein No. 370; Portion 2 of Farm Palmietfontein No. 370; Portion 3 of Farm Jagers Kraal No. 327; Portion 6 of Farm Jagers Kraal No. 327; Remaining Extent of Farm Vetkoe Kraal No. 369; Portion 2 of Farm Vetkoe Kraal No. 369; Portion 3 of Farm Vetkoe Kraal No. 369; Portion 1 of Farm Brits Eigendom No. 374; Portion 2 of Farm Brits Eigendom No. 374; Portion 8 of Farm Brits Eigendom No. 374; Portion 12 of Farm Brits Eigendom No. 374; Portion 14 of Farm Brits Eigendom No. 374; Portion 16 of Farm Brits Eigendom No. 374; Portion 19 of Farm Brits Eigendom No. 374; Portion 20 of Farm Brits Eigendom No. 374; Remaining Extent of Farm No. 380; and Portion 6 of Farm No. 380. All affected properties are situated in the Registration Division Beaufort West. Further detail is provided in section 2 below.

The site will be accessed via the N12 national road. Four (04) access points have been strategically determined given the large site extent (refer to Figure 1.1 and 1.2 below for the locality and regional maps also appended to this DSR as Figure A and B). A development area¹ / site of up to 41 699 ha hectares has been identified for assessment as part of the Scoping and Environmental Impact Assessment (S&EIA) process, which is fully assessed as part of this final Scoping Report, inclusive of the grid connection infrastructure required to connect the proposed development to the national grid.

The development area has been identified as being highly desirable due to its suitable climatic conditions, topography (i.e., in terms of slope), environmental conditions (i.e., medium to high agricultural potential, ecological sensitivity and archaeology, depending on the type of impact), proximity to the Eskom grid connection infrastructure, and proximity to the existing roads located off the N12 national road and other public and provincial roads that surround the site (i.e., to facilitate the movement of machinery, equipment, infrastructure and people during the construction phase). Furthermore, various other WEFs have been authorised within the surrounding area of the development area / site and therefore the placement of the Carissa WEF adjacent to and in close proximity provides an opportunity to consolidate all potential negative and positive environmental impacts within the landscape and thereby reducing the distribution of such negative impacts throughout the area.

It is the intention of the Applicant to develop the project in order to contribute renewable energy to Phase 1 of the Hive Green Hydrogen facility proposed within the Port of Ngqura, a Strategic Integrated Project (SIP) with significant social and economic importance to the Republic of South Africa.

¹ The development area is defined as the area within the affected properties under assessment for the placement of the development footprint which will house all infrastructure associated with the development. The final development footprint will only be defined within the EIA phase of the process.

Figure 1.3 provides a map of the affected properties associated with the Carissa WEF.

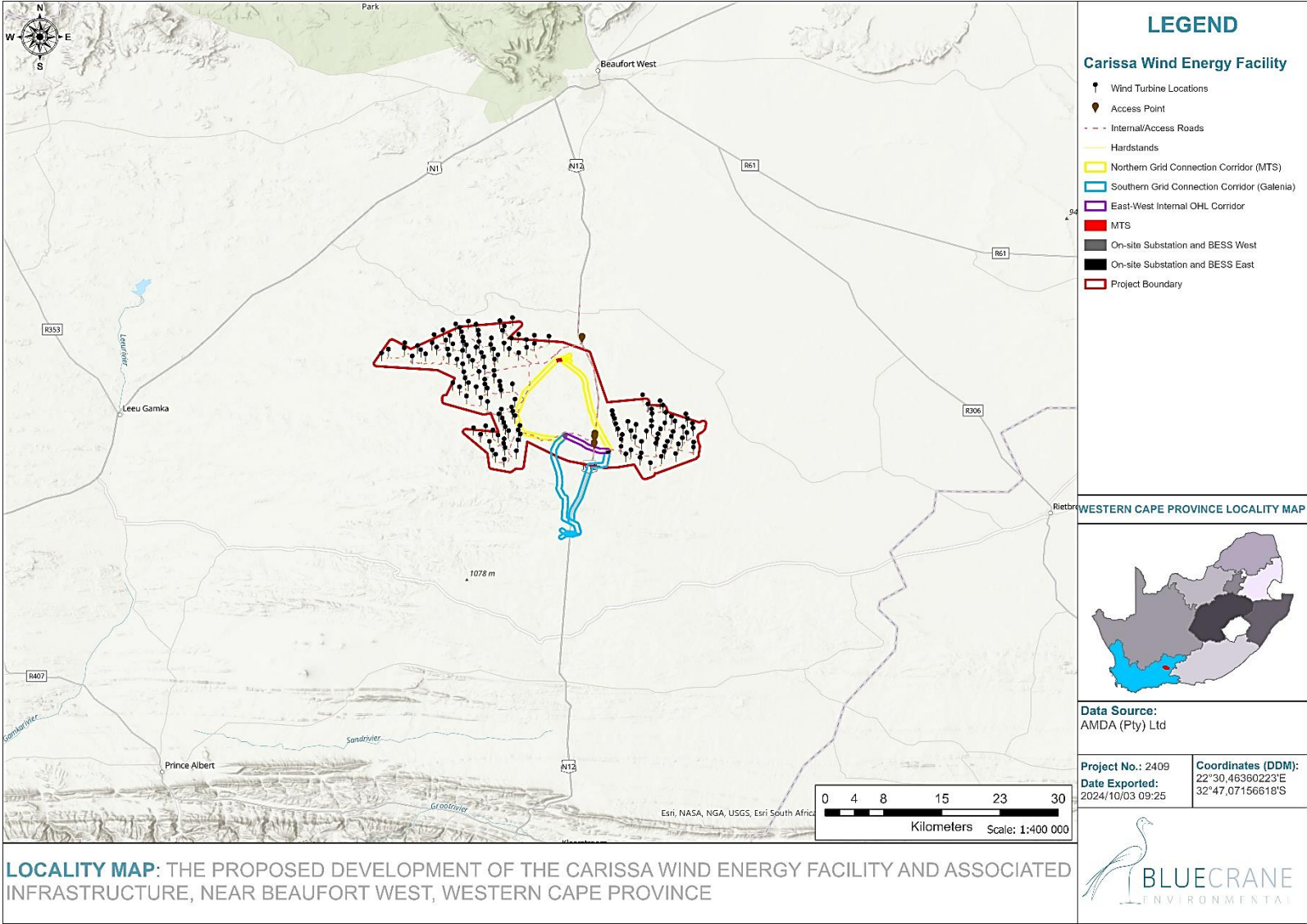


Figure 1.1: Locality Map of the Proposed Carissa WEF

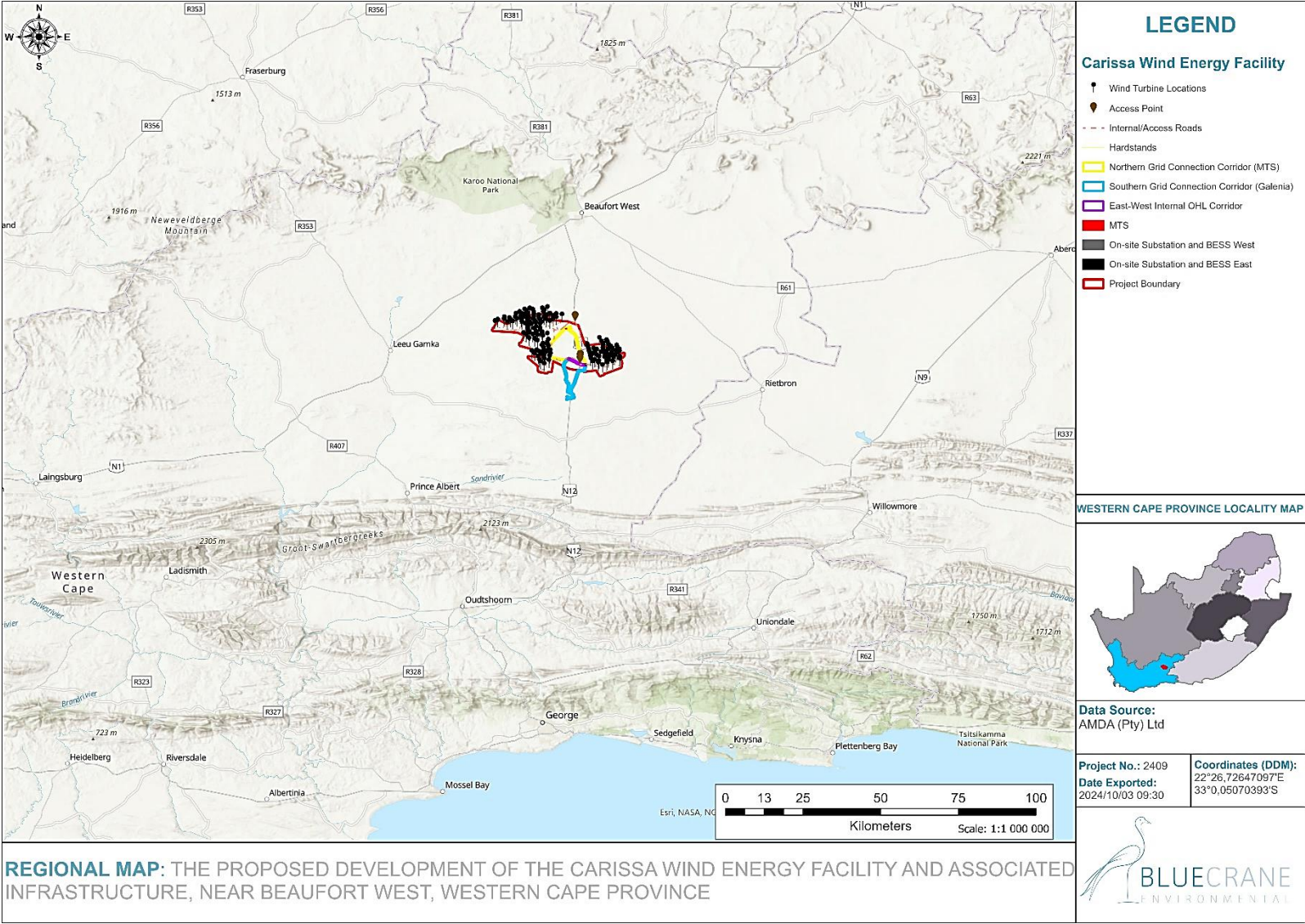


Figure 1.2: Regional Map of the Proposed Carissa WEF

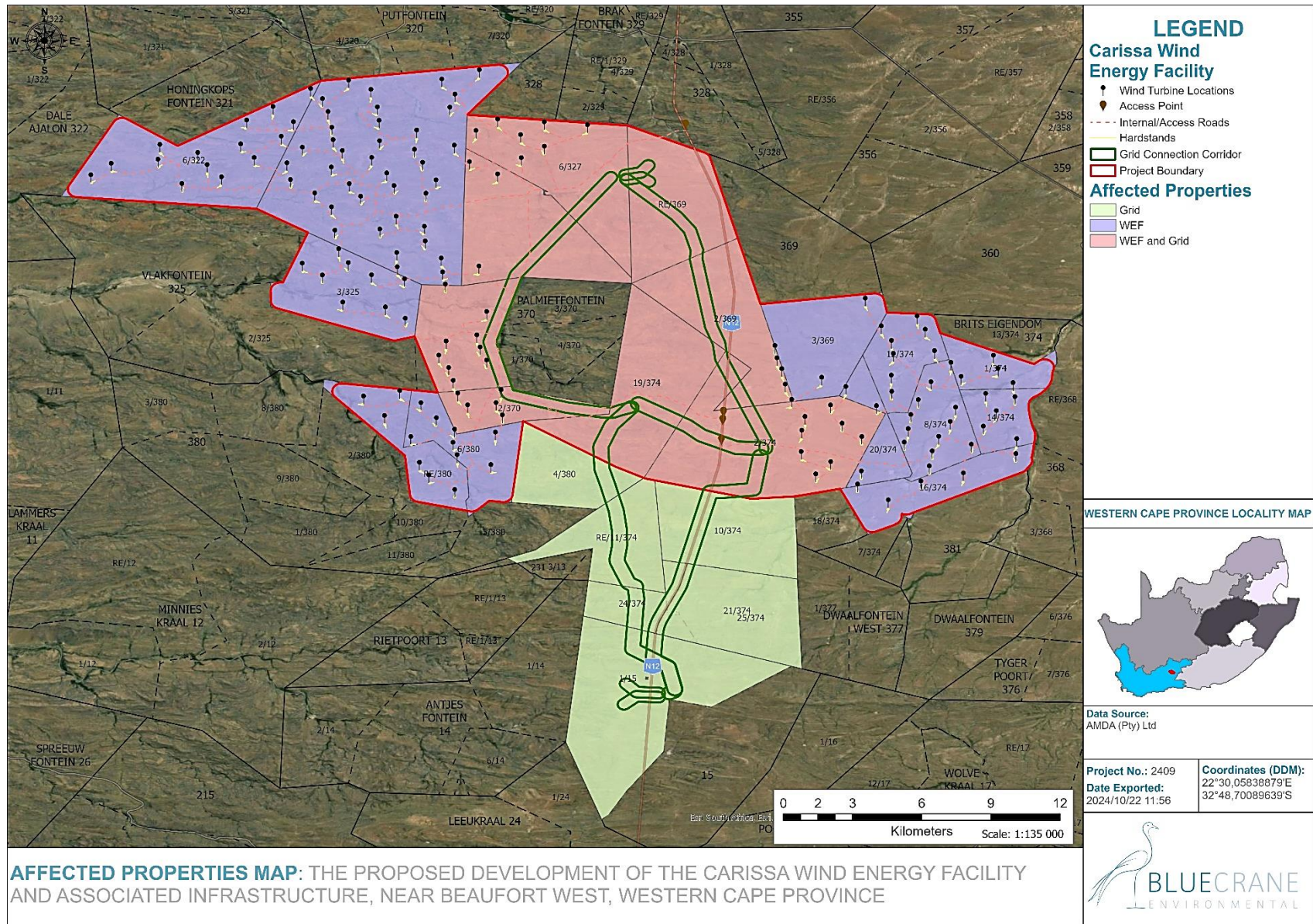


Figure 1.3: Affected Properties Associated with the Carissa WEF

1.1 Project Overview

For the development of the Carissa WEF specific infrastructure and key components are required to be constructed and operated to enable the generation of electricity through the use of wind technology. The main components are as follows:

- Up to 154 wind turbines (including turbine hardstand areas);
- Two on-site facility substations and two Eskom switching stations (up to 132 kV);
- Power lines (underground and overhead) including 33 kV cabling between the project components and the on-site facility substations/switching stations;
- An on-site 400 kV / 132 kV Main Transmission Substation (MTS);
- Two (02) grid connection corridor options to connect the on-site facility substations/switching stations to the proposed MTS (on-site or off-site Eskom Galenia MTS²);
- Up to 132 kV double circuit overhead power lines to connect the facility to the proposed MTS (on-site or off-site Eskom Galenia MTS);
- Up to 132 kV internal overhead power line to connect the two (02) facility substations/switching stations (east-west substations/switching stations);
- Up to 400 kV LILLO connection to connect/tie the proposed MTS (on-site or off-site) into the planned or existing 400 kV overhead power lines;
- Auxiliary buildings;
- Construction Site Camps;
- Battery Energy Storage Systems (BESS);
- Temporary and permanent laydown areas;
- Batching plant; and
- Internal and perimeter access roads.

Majority of the site is located within the Beaufort West Renewable Energy Development Zone (REDZ) with two small portions falling outside of the REDZ. Additionally, the project lies within the Central Transmission Power Corridor with a portion of the southern grid connection corridor option falling outside of the power corridor. Refer to Figures 1.4 and 1.5 below.

Also refer to Appendix F2 as attached to this DSR.

² Note the off-site Galenia MTS will not be applied for as a part of the proposed Carissa WEF project. The off-site MTS forms part of a separate and independent application.

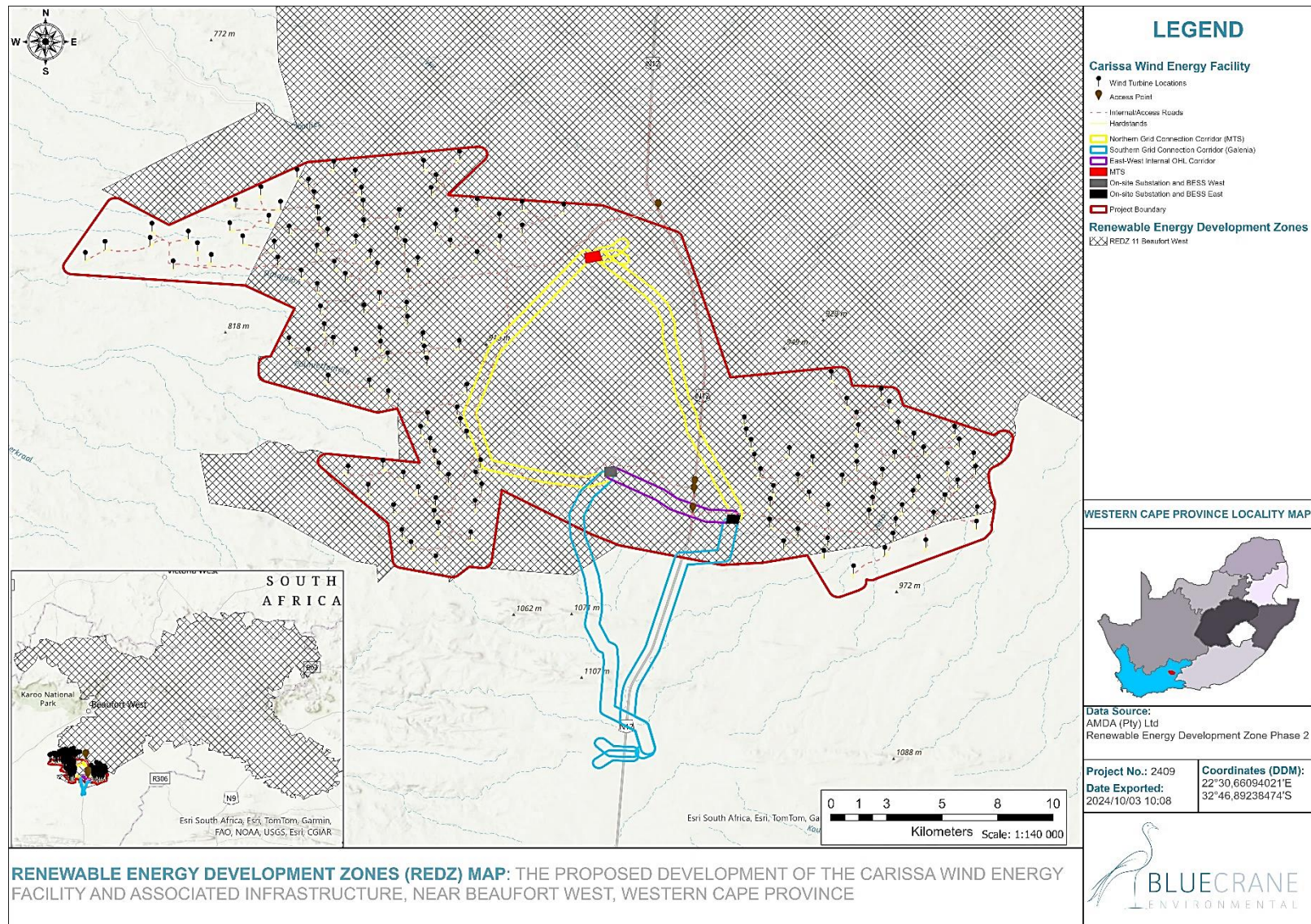


Figure 1.4: Map indicating the Carissa WEF located within the Beaufort West Renewable Energy Development Zone (REDZ)

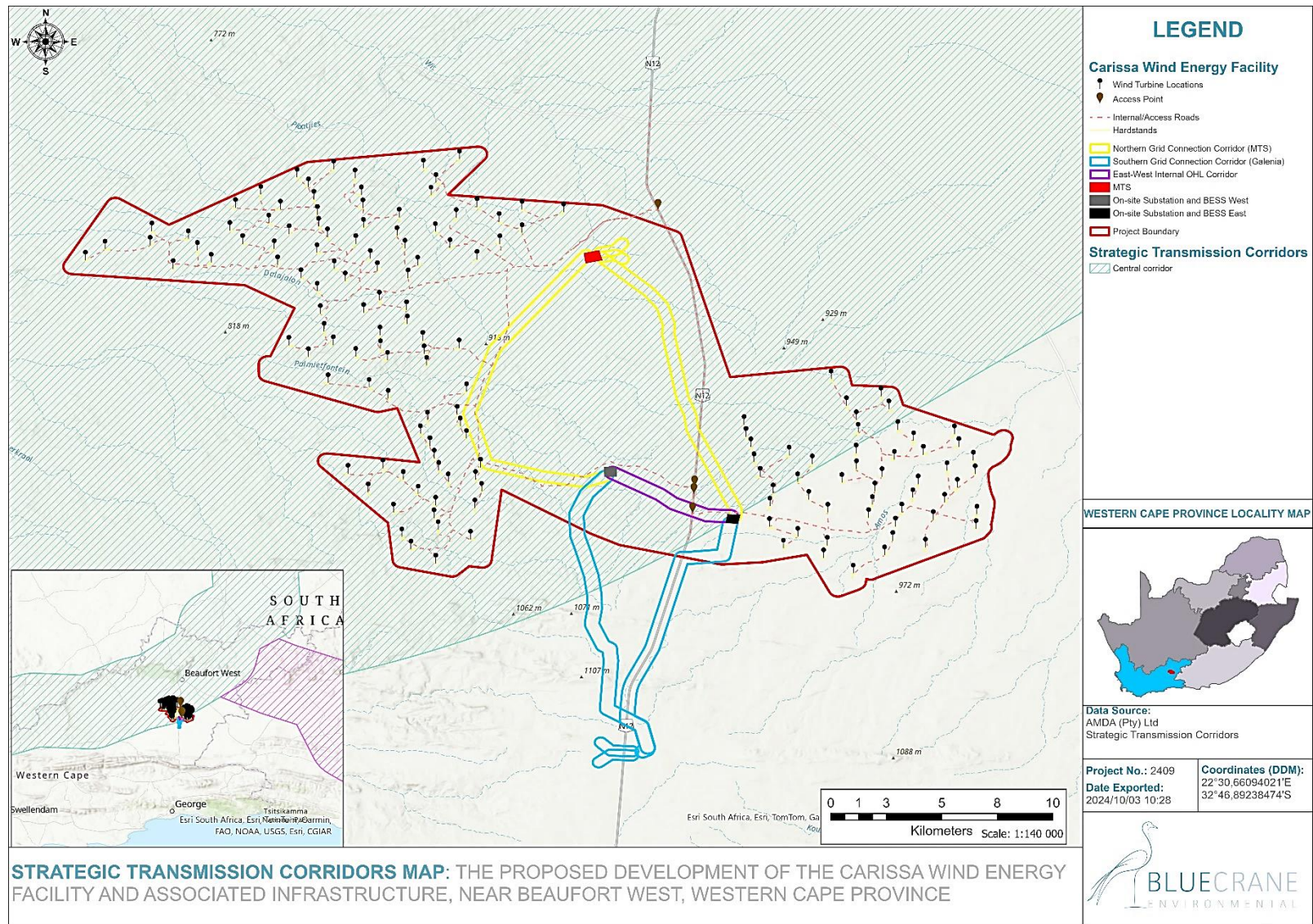


Figure 1.5: Map indicating the Carissa WEF located within the Central Transmission Corridor

1.2 Requirement for the Environmental Impact Assessment Process

The construction and operation of the Carissa WEF is subject to the requirements of the EIA Regulations, 2014, as amended, published in terms of Section 24(5) of the National Environmental Management Act³ (NEMA) 107 of 1998. NEMA provides for the authorisation of certain activities referred to as “listed activities”. In terms of Section 24(1) of NEMA, the potential impact on the environment associated with such 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.

The main listed activity triggered by the proposed WEF is Activity 1 of Listing Notice 2 (GN.R. 325), which relates to the development of facilities or infrastructure for the generation of electricity from a renewable resource where the generating capacity is 20 megawatts or more. The proposed Carissa WEF will have a capacity of up to 1 000 MW.

Table 1.1 below indicates all preliminary listed activities triggered in terms of the EIA Regulations and provide a project description in terms of the activity trigger. It must be noted that the listed activities may changes throughout the S&EIA process as detailed investigations are completed and ground-truthed information becomes available.

Table 1.1: Listed Activities Applied For

Relevant notice:	Activity No (s)	Description of each listed activity as per project description:
GNR. 327 (as amended in 2017)	Activity 11(i)	<ul style="list-style-type: none"> “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 275 kilovolts”. The project entails the development of: <ul style="list-style-type: none"> 33 kV cabling between the project components and the on-site facility substations/switching stations; Two (02) on-site facility substations/switching stations (up to 132 kV each); Up to 132 kV double circuit overhead power lines to connect the facility to the proposed MTS (on-site or off-site); and Up to 132 kV internal overhead power line to connect the two (02) facility substations/switching stations (east-west substations/switching stations).
GNR. 327 (as amended in 2017)	Activity 12(ii)(a)(c)	<ul style="list-style-type: none"> “The development of (ii) infrastructure or structures with a physical footprint of 100 square metres or more; (a) within a watercourse, or (c) within 32 meters of a watercourse measured from the edge of a watercourse.”

³ NEMA is the national legislation that provides for the authorisation of certain controlled activities known as “listed activities”.

Relevant notice:	Activity No (s)	Description of each listed activity as per project description:
		<ul style="list-style-type: none"> Several watercourses exist within the site which will be traversed by internal access roads. Infrastructure may be located within 32 m from a watercourse.
GNR. 327 (as amended in 2017)	Activity 14	<ul style="list-style-type: none"> <i>"The development and related operation of facilities or 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."</i> The project will require the storage and handling of dangerous goods or substances and these will be in the form of petroleum substances, oils, paints and other chemicals / substances required for the construction and operation of the Project. The capacity of dangerous goods is expected to be less than 500 m³.
GNR. 327 (as amended in 2017)	Activity 19	<ul style="list-style-type: none"> <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 meters from a watercourse."</i> Several watercourses exist within the site which will be traversed by internal access roads resulting to the excavation and removal of soil of more than 10 cubic metres.
GNR. 327 (as amended in 2017)	Activity 24(ii)	<ul style="list-style-type: none"> <i>"The development of a road (ii) with reserve wider than 13,5 meters, or where no reserve exists where the road is wider than 8 meters"</i>. New roads are required with a construction footprint width of up to 14 m. Existing roads will require widening of up to 14 m and/or lengthening by more than 1 km, to accommodate the movement of heavy vehicles, cable trenching activities, and V-drains.
GNR. 327 (as amended in 2017)	Activity 28(ii)	<ul style="list-style-type: none"> <i>"Residential, mixed, retail, commercial, industrial or institutional developments where such land was used for agriculture or afforestation on or after 1998 and where such development (ii) will occur outside an urban area, where the total land to be developed is bigger than 1 hectare"</i>. The total area to be developed for the facility and associated infrastructure is greater than 1 ha and occurs outside an urban area in an area currently used for agriculture. The identified development area under assessment is up to 41 699 ha.
GNR. 327 (as amended in 2017)	Activity 48(i)(a)(c)	<ul style="list-style-type: none"> <i>"The expansion of (i) infrastructure or structures where the physical footprint is expanded by 100 square metres or more where such expansion occurs (a) within a watercourse or (c) if no</i>

Relevant notice:	Activity No (s)	Description of each listed activity as per project description:
		<p><i>development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse.</i></p> <ul style="list-style-type: none"> Existing roads will require widening of up to 14 m and/or lengthening by more than 1 km, to accommodate the movement of heavy vehicles, cable trenching activities, and V-drains. Several watercourses exist within the site which will be traversed by internal access roads (including existing roads to be upgraded). Infrastructure may be located within 32 m from a watercourse.
GNR. 327 (as amended in 2017)	Activity 56(ii):	<ul style="list-style-type: none"> <i>“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...”</i> Existing roads will require widening of up to 14 m and/or lengthening by more than 1 km, to accommodate the movement of heavy vehicles, cable trenching activities, and V-drains.
GNR. 325 (as amended in 2017)	Activity 1	<ul style="list-style-type: none"> <i>“The development of facilities or infrastructure for the generation of electricity from a renewable resource where the electricity output is 20 megawatts or more”.</i> The proposed wind energy facility will generate up to 1 000 megawatts of electricity through the use of a renewable resource.
GNR. 325 (as amended in 2017)	Activity 9	<ul style="list-style-type: none"> <i>“The development of facilities or infrastructure for the transmission and distribution of electricity with a capacity of 275 kilovolts or more, outside an urban area or industrial complex...”</i> The project entails the development of: <ul style="list-style-type: none"> An on-site MTS with a capacity of up to 400 kV; and Up to 400 kV LILCO connection to connect/tie the proposed MTS (on-site or off-site) into the existing 400 kV overhead power lines.
GNR. 325 (as amended in 2017)	Activity 15	<ul style="list-style-type: none"> <i>“The clearance of an area of 20 hectares or more of indigenous vegetation.”</i> The cumulative area of indigenous vegetation to be cleared for the entire project (excluding linear components) will exceed 20 hectares. The identified development area under assessment is up to 41 699 ha.
GNR. 324 (as amended in 2017)	Activity 4(i)(ii)(aa)	<ul style="list-style-type: none"> <i>“The development of a road wider than 4 metres with a reserve less than 13,5 metres (i) Western Cape (ii) outside urban areas (aa) areas containing indigenous vegetation.”</i>

Relevant notice:	Activity No (s)	Description of each listed activity as per project description:
		<ul style="list-style-type: none"> New roads are required with a construction footprint width of up to 14 m. Existing roads will require widening of up to 14 m and/or lengthening by more than 1 km, to accommodate the movement of heavy vehicles, cable trenching activities, and V-drains. The site is located within the Western Cape province and outside of urban areas. The development footprint will be cleared of indigenous vegetation for the establishment of the renewable energy facility. The development area under assessment is up to 41 699 ha.
GNR. 324 (as amended in 2017)	Activity 12(i)(ii)	<ul style="list-style-type: none"> <i>"The clearance of an area of 300 square metres or more of indigenous vegetation in the (i) Western Cape, (ii) within critical biodiversity areas identified in bioregional plans."</i> The cumulative area of indigenous vegetation to be cleared for the entire project (excluding linear components) will exceed 300 square metres. The identified development area under assessment is up to 41 699 ha. The proposed development is located within the Western Cape and contains Critical Biodiversity Areas (CBA) 1.
GNR. 324 (as amended in 2017)	Activity 14(ii)(a)(c)(i)(i)(ff)	<ul style="list-style-type: none"> <i>"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 (i) Western Cape (i) outside urban areas (ff) Critical biodiversity areas or ecosystem service areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plan."</i> Several watercourses / drainage lines exist within the site which will be traversed by internal access roads. Infrastructure may be located within 32 m from a watercourse/drainage line. The proposed development is located within the Western Cape and contains Critical Biodiversity Areas (CBA) 1.
GNR. 324 (as amended in 2017)	Activity 18(i)(ii)(aa)	<ul style="list-style-type: none"> <i>"The widening of a road by more than 4 metres, or the lengthening of a road by more than 1 kilometre (i) Western Cape (ii) All areas outside urban areas (aa) areas containing indigenous vegetation."</i> New roads are required with a construction footprint width of up to 14 m. Existing roads will require widening of up to 14 m and/or lengthening by more than 1 km, to accommodate the movement of heavy vehicles, cable trenching activities, and V-drains. Several watercourses exist within the site which will be traversed by internal access roads. Infrastructure may be located within 32 m from a watercourse. The development area is located in the Western Cape and outside of urban areas. The site area will be cleared of indigenous vegetation

Relevant notice:	Activity No (s)	Description of each listed activity as per project description:
		for the establishment of the renewable energy facility. The development area is up to 41 699 ha.
GNR. 324 (as amended in 2017)	Activity 23(ii)(a)(c)(i)(i)(ff)	<ul style="list-style-type: none"> • “The expansion of (ii) infrastructure or structures where the physical footprint is expanded by 10 square metres or more; where such expansion occurs (a) within a watercourse and (c) in no development setback has been adopted, within 32 metres of a watercourse, measured from the edge of a watercourse, within (i) Western Cape, (i) outside urban areas, (ff) Critical biodiversity areas or ecosystem service areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans.” • Existing roads will require widening of up to 14 m and/or lengthening by more than 1 km, to accommodate the movement of heavy vehicles, cable trenching activities, and V-drains. Several watercourses exist within the site which will be traversed by internal access roads (including existing roads to be upgraded). Infrastructure may be located within 32 m from a watercourse. The proposed development is located within the Western Cape and contains Critical Biodiversity Areas (CBA) 1.

Appendix 2 of the EIA Regulations 2014, as amended, contains the objectives to be achieved through the undertaking of a Scoping process. The following objectives have been considered, undertaken and achieved through a consultative process within this final Scoping Report for the Carissa WEF:

- Identify the relevant policies and legislation relevant to the activity;
- Motivate the need and desirability of the proposed activity, including the need and desirability of the activity in the context of the preferred location;
- Identify and confirm the preferred activity and technology alternative through an identification of impacts and risks and ranking process of such impacts and risks;
- Identify and confirm the preferred site, through a detailed site selection process, which includes an identification of impacts and risks inclusive of identification of cumulative impacts and a ranking process of all the identified alternatives focusing on the geographical, physical, biological, social, economic, and cultural aspects of the environment;
- Identify the key issues to be addressed in the assessment phase;
- Agree on the level of assessment to be undertaken, including the methodology to be applied, the expertise required as well as the extent of further consultation to be undertaken to determine the impacts and risks the activity will impose on the preferred site through the life of the activity, including the nature, significance, consequence, extent, duration and probability of the impacts to inform the location of the development footprint within the preferred site; and
- 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.

1.3 Details of the Environmental Assessment Practitioner and Independent Specialists

In accordance with Regulation 12 of the EIA Regulations 2014, as amended (GN.R. 326), AMDA Oscar (Pty) Ltd has appointed Blue Crane Environmental (Pty) Ltd (Blue Crane Environmental) as the independent Environmental Assessment consultant to undertake the Scoping and Environmental Impact Assessment (S&EIA) process and prepare the final Scoping Report for the proposed development. Neither Blue Crane Environmental nor any of the appointed independent specialists are subsidiaries of, or are affiliated to AMDA Oscar (Pty) Ltd.

Regulation 13(1)(a) and (b) requires that an independent and suitably qualified and experienced Environmental Assessment Practitioner (EAP) must conduct the Scoping and EIA (S&EIA) process. In terms of the independent status of the EAP, a declaration is attached as Appendix A to this report. The expertise of the EAP is also summarised in the curriculum vitae included as part of Appendix A.

The details of the Registered EAP are as follows:

Table 1.2: Details of the Registered EAP

Contact Person:	Roschel Naidoo
EAPASA Registration:	2019/824
Telephone:	+27 (63) 062-7725
Electronic Mail:	roschel@bcrane.co.za / carissa@bcrane.co.za
Contact Person:	Lisa de Lange
EAPASA Registration:	2020/2150
Telephone:	+27 (84) 920-3111
Electronic Mail:	lisa@bcrane.co.za / carissa@bcrane.co.za
Contact Person:	Marélie Botha
EAPASA Registration:	2021/3834
Telephone:	+27 (82) 493 5166
Electronic Mail:	marelie@bcrane.co.za / carissa@bcrane.co.za

Regulation 13(1)(a) and (b) determines that independent and suitably qualified, experienced and independent specialists should conduct the specialist studies, in the event where the specialist is not independent, a specialist should be appointed to externally review the work of the specialist as contemplated in sub regulation (2), must comply with sub-regulation 1. In terms of the independent status

of the specialists, their declarations are attached as Appendix E15 to this report. The expertise of the specialists is summarised in their respective reports.

Refer to Table 1.3 for the details of the independent specialists.

Table 1.3: Details of the Independent Specialists

Study	Prepared by	Contact Person
Terrestrial Biodiversity Impact Assessment	The Biodiversity Company	Andrew Husted
Aquatic Biodiversity Impact Assessment	Biosphere	Justin Bezuidenhout
Avifaunal Impact Assessment	Holland & Associates	Anja Albertyn
Bat Assessment	Animalia	Werner Marais
Soil and Agricultural Impact Assessment	Johann Lanz	Johann Lanz
Visual Impact Assessment	Donaway Environmental Consultants	Johan Botha
Social Impact Assessment	Donaway Environmental Consultants	Johan Botha
Noise Impact Assessment	EARES	Morné de Jager
Heritage Impact Assessment	Ubique	Sky-Lee Fairhurst / Heidi Fivaz / Jan Engelbrecht
Paleontological Impact Assessment	Banzai Environmental	Elize Butler
Traffic Impact Assessment	BVi Consulting Engineers	Adrian Tarrant
Geotechnical Assessment	Outeniqua Geotech	Iain Paton
Risk Assessment	ISHECON	Debbie Mitchell

1.4 Assumptions and Limitations

The following assumptions and limitations are applicable to this final Scoping Report:

- It is assumed that all information provided by the Applicant and I&APs to Blue Crane Environmental is correct and valid at the time it was provided.
- It is assumed that the development area identified by the Applicant is a technically suitable site for the establishment of the Carissa WEF and associated infrastructure.
- It is assumed that the Applicant has consulted / is in the process of consulting with Eskom in terms of connection into existing Eskom infrastructure.
- Conclusions of independent specialist studies undertaken and this final Scoping Report assume that any potential impacts on the environment associated with the proposed development will be avoided, mitigated, or offset by the careful design of the facility layout through an optimisation process to be undertaken during the EIA Phase.
- It is assumed that the Applicant will consider and avoid all sensitive areas and environmental features not conducive for the placement of infrastructure.
- This final Scoping Report and its investigations/ results are project-specific, and therefore no other power generation alternatives have been considered.

Refer to the specialist studies provided in Appendices E1-E13 for limitations specific to the independent specialist studies.

1.5 Legal Requirements Complied with in Section 1 as per the Requirements of the EIA Regulations, 2014 (as amended)

This final Scoping Report has been prepared in accordance with the requirements of the EIA Regulations published on 08 December 2014 (as amended) promulgated in terms of Chapter 5 of the National Environmental Management Act (Act No. 107 of 1998). This section of the report includes the following information required in terms of Appendix 2: Content of the scoping report:

Requirement	Relevant Section
2(a) the details of the (i) EAP who prepared the report and (ii) the expertise of the EAP, including a curriculum vitae.	The details of the EAP who prepared the report and the expertise of the EAP is included in section 1.3. The curriculum vitae of the EAP is included in Appendix A.
2(d) a description of the scope of the proposed activity, including (i) all listed and specified activities triggered.	All listed activities triggered by the development are included in Table 1.1 of section 1.2.
2(i) an undertaking under oath or affirmation by the EAP in relation to (i) the correctness of the information provided in the report; (ii) the inclusion of comments and inputs from stakeholders and interested and affected parties; and (iii) any information provided by the EAP to interested and affected parties and any responses by the EAP to comments or inputs made by interested or affected parties.	The Declaration of the EAP and undertaking under oath is included in Appendix A.

Requirement	Relevant Section
2(j) an undertaking under oath or affirmation by the EAP in relation to the level of agreement between the EAP and interested and affected parties on the plan of study for undertaking the environmental impact assessment.	The Declaration of the EAP and undertaking under oath is included in Appendix A.

2 PROJECT DESCRIPTION AND SITE SELECTION PROCESS

This section provides the details of the project proposed including the project infrastructure and alternatives. Furthermore, this section considers the site selection process and approach undertaken by the Applicant for the Carissa WEF and associated infrastructure.

2.1 Location of the Proposed Development

A development area of up to 41 699 ha has been identified within various affected properties for assessment for the placement of the development footprint which will ultimately house the Carissa WEF and associated infrastructure. The location information related to the grid connection infrastructure is also provided. The details of the location are included in Table 2.1 below.

Table 2.1: General Site and Location Information

Description of affected farm portions	<u>Wind Energy Facility:</u>
	<ul style="list-style-type: none"> • Portion 6 of Farm Dale Ajalon No. 322 • Farm Meyers Poort No. 326 • Portion 3 (Portion of Portion 2) of Farm Vlakfontein No. 325 • Remaining Extent of Farm Palmietfontein No. 370 • Portion 2 of Farm Palmietfontein No. 370 • Portion 3 of Farm Jagers Kraal No. 327 • Portion 6 of Farm Jagers Kraal No. 327 • Remaining Extent of Farm Vetkoe Kraal No. 369 • Portion 2 of Farm Vetkoe Kraal No. 369 • Portion 3 of Farm Vetkoe Kraal No. 369 • Portion 1 of Farm Brits Eigendom No. 374 • Portion 2 of Farm Brits Eigendom No. 374 • Portion 8 of Farm Brits Eigendom No. 374 • Portion 12 of Farm Brits Eigendom No. 374 • Portion 14 of Farm Brits Eigendom No. 374 • Portion 16 of Farm Brits Eigendom No. 374 • Portion 19 of Farm Brits Eigendom No. 374 • Portion 20 of Farm Brits Eigendom No. 374 • Remaining Extent of Farm No. 380 • Portion 6 of Farm No. 380
	<u>Southern Grid Connection Corridor (Option 1):</u>
	<ul style="list-style-type: none"> • Portion 2 of Farm Palmietfontein No. 370 • Portion 19 of Farm Brits Eigendom No. 374 • Portion 2 of Farm Brits Eigendom No. 374

	<ul style="list-style-type: none"> • Portion 4 of Farm No. 380 • Remaining Extent of Portion 11 of Farm Brits Eigendom No. 374 • Portion 10 of Farm Brits Eigendom No. 374 • Portion 24 of Farm Brits Eigendom No. 374 • Portion 25 of Farm Brits Eigendom No. 374 • Portion 1 of Farm Trakas Kuilen No. 15 <p><u>Northern Grid Connection Corridor (Option 2):</u></p> <ul style="list-style-type: none"> • Remaining Extent of Farm Palmietfontein No. 370 • Portion 2 of Farm Palmietfontein No. 370 • Portion 3 of Farm Jagers Kraal No. 327 • Portion 6 of Farm Jagers Kraal No. 327 • Portion 19 of Farm Brits Eigendom No. 374 • Portion 2 of Farm Brits Eigendom No. 374 • Portion 2 of Farm Vetkoe Kraal No. 369 • Remaining Extent of Farm Vetkoe Kraal No. 369 <p><u>Access Road 1 (existing unnamed gravel road off of the N12):</u></p> <ul style="list-style-type: none"> • Portion 3 of Farm No. 328 <p><u>Access Road 2 (new access point off of the N12):</u></p> <ul style="list-style-type: none"> • Portion 2 of Farm Brits Eigendom No. 374 <p><u>Access Road 3 (existing unnamed gravel road off of the N12):</u></p> <ul style="list-style-type: none"> • Portion 2 of Farm Brits Eigendom No. 374 <p><u>Access Road 4 (new access point off of the N12):</u></p> <ul style="list-style-type: none"> • Portion 2 of Farm Brits Eigendom No. 374
Province	<ul style="list-style-type: none"> • Western Cape
Local Municipality	<ul style="list-style-type: none"> • Beaufort West and Prince Albert Local Municipalities
District Municipality	<ul style="list-style-type: none"> • Central Karoo District Municipality
Ward numbers	<ul style="list-style-type: none"> • Ward 2 – Prince Albert Local Municipality • Ward 6 – Beaufort west Local municipality
Closest towns	<ul style="list-style-type: none"> • The proposed Carissa WEF is located approximately 31 km south of the centre of the town of Beaufort West and approximately 57 km northeast of the centre of the town of Prince Albert.
21 Digit Surveyor General codes	<p><u>Wind Energy Facility:</u></p> <ul style="list-style-type: none"> • Portion 6 of Farm Dale Ajalon No. 322 C00900000000032200006 • Farm Meyers Poort No. 326

	<p>C00900000000032600000</p> <ul style="list-style-type: none"> • Portion 3 (Portion of Portion 2) of Farm Vlakfontein No. 325 C00900000000032500003 • Remaining Extent of Farm Palmietfontein No. 370 C00900000000037000000 • Portion 2 of Farm Palmietfontein No. 370 C00900000000037000002 • Portion 3 of Farm Jagers Kraal No. 327 C00900000000032700003 • Portion 6 of Farm Jagers Kraal No. 327 C00900000000032700006 • Remaining Extent of Farm Vetkoe Kraal No. 369 C00900000000036900000 • Portion 2 of Farm Vetkoe Kraal No. 369 C00900000000036900002 • Portion 3 of Farm Vetkoe Kraal No. 369 C00900000000036900003 • Portion 1 of Farm Brits Eigendom No. 374 C00900000000037400001 • Portion 2 of Farm Brits Eigendom No. 374 C00900000000037400002 • Portion 8 of Farm Brits Eigendom No. 374 C00900000000037400008 • Portion 12 of Farm Brits Eigendom No. 374 C00900000000037400012 • Portion 14 of Farm Brits Eigendom No. 374 C00900000000037400014 • Portion 16 of Farm Brits Eigendom No. 374 C00900000000037400016 • Portion 19 of Farm Brits Eigendom No. 374 C00900000000037400019 • Portion 20 of Farm Brits Eigendom No. 374 C00900000000037400020 • Remaining Extent of Farm No. 380 C00900000000038000000 • Portion 6 of Farm No. 380 C00900000000038000006 <p><u>Southern Grid Connection Corridor (Option 1):</u></p> <ul style="list-style-type: none"> • Portion 2 of Farm Palmietfontein No. 370 C00900000000037000002 • Portion 19 of Farm Brits Eigendom No. 374 C00900000000037400019 • Portion 2 of Farm Brits Eigendom No. 374 C00900000000037400002 • Portion 4 of Farm No. 380 C00900000000038000004
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	<ul style="list-style-type: none"> • Remaining Extent of Portion 11 of Farm Brits Eigendom No. 374 C00900000000037400011 • Portion 10 of Farm Brits Eigendom No. 374 C00900000000037400010 • Portion 24 of Farm Brits Eigendom No. 374 C00900000000037400024 • Portion 25 of Farm Brits Eigendom No. 374 C00900000000037400025 • Portion 1 of Farm Trakas Kuilen No. 15 C0610000000001500001 <p><u>Northern Grid Connection Corridor (Option 2):</u></p> <ul style="list-style-type: none"> • Remaining Extent of Farm Palmietfontein No. 370 C00900000000037000000 • Portion 2 of Farm Palmietfontein No. 370 C00900000000037000002 • Portion 3 of Farm Jagers Kraal No. 327 C00900000000032700003 • Portion 6 of Farm Jagers Kraal No. 327 C00900000000032700006 • Portion 19 of Farm Brits Eigendom No. 374 C00900000000037400019 • Portion 2 of Farm Brits Eigendom No. 374 C00900000000037400002 • Portion 2 of Farm Vetkoe Kraal No. 369 C00900000000036900002 • Remaining Extent of Farm Vetkoe Kraal No. 369 C00900000000036900000 <p><u>Access Road 1 (existing unnamed gravel road off of the N12):</u></p> <ul style="list-style-type: none"> • Portion 3 of Farm No. 328 C00900000000032800003 <p><u>Access Road 2 (new access point off of the N12):</u></p> <ul style="list-style-type: none"> • Portion 2 of Farm Brits Eigendom No. 374 C00900000000037400002 <p><u>Access Road 3 (existing unnamed gravel road off of the N12):</u></p> <ul style="list-style-type: none"> • Portion 2 of Farm Brits Eigendom No. 374 C00900000000037400002 <p><u>Access Road 4 (new access point off of the N12):</u></p> <ul style="list-style-type: none"> • Portion 2 of Farm Brits Eigendom No. 374 C00900000000037400002
Area under assessment (Development Area)	<ul style="list-style-type: none"> • Up to 41 699 ha

Photographs of the site

- Included in the Plates as an appendix to the Report

Two (02) grid connection corridor options have been identified for assessment for the placement of the grid connection infrastructure to transmit energy generated from the on-site substations / switching stations to the proposed on-site and/or off-site MTS. The grid connection options are as follows:

Southern Grid Connection Corridor (Option 1):

- Two (02) on-site facility substations/switching stations (i.e., one to the east of the facility and one to the west of the facility) up to 132 kV each;
- Two (02) grid connection corridors to connect the on-site facility substations/switching stations to the proposed off-site Galenia Main Transmission Substation⁴ (MTS). Each corridor is up to 15 km long and up to 600 m wide;
- Up to 132 kV internal overhead power line to connect the two (02) facility substations/switching stations (east-west substations/switching stations). The power line will be located within a 600 m wide corridor;
- Up to 132 kV double circuit overhead power lines to connect the facility substations/switching stations to the off-site Galenia MTS; and
- Up to 400 kV Loop-in-Loop-out (LILO) connection to connect/tie the proposed Galenia MTS into the existing 400 kV overhead power lines. The overhead power lines will be placed within 500 m and up to 2 km long grid corridors.

Northern Grid Connection Corridor (Option 2):

- Two (02) on-site facility substations/switching stations (i.e., one to the east of the facility and one to the west of the facility) up to 132 kV each;
- Two (02) grid connection corridors to connect the on-site facility substations/switching stations to the proposed on-site Main Transmission Substation (MTS). Each corridor is up to 17 km long and up to 500 m wide;
- Up to 132 kV internal overhead power line to connect the two (02) facility substations/switching stations (east-west substations/switching stations). The power line will be located within a 600 m wide corridor;
- Up to 132 kV double circuit overhead power lines to connect the facility substations/switching stations to the proposed on-site MTS; and
- Up to 400 kV Loop-in-Loop-out (LILO) connection to connect/tie the proposed on-site MTS into the existing 400 kV overhead power lines. The overhead power lines will be placed within 500 m and up to 1.6 km long grid corridors.

The full extent of the development area and the two grid connection options have been considered as part of this final Scoping Report with the aim of confirming the suitability of the area from an environmental and social perspective and thereby to enable the identification of a suitable development footprint for the placement of the infrastructure. The development footprint will be defined based on the outcomes of the scoping phase and will be further assessed in the EIA phase, which will include the assessment of a detailed facility layout.

The properties on which the facility is to be constructed will be leased by AMDA Oscar (Pty) Ltd from the property owners for the life span of the project (minimum of 25 years).

⁴ Note that the off-site Galenia MTS will not be applied for as a part of the proposed Carissa WEF project. The off-site MTS forms part of a separate and independent application.

The area surrounding the Carissa WEF is characterised mostly by agricultural development with scattered farmsteads. The development area is located in a rural setting with the current land use of the site being natural grazing. Most residential dwellings featuring in the vicinity of the project area are scattered in a heterogeneous fashion, typical of a rural agricultural area. Land use is mostly agricultural activities (game and sheep farming) and wilderness areas (including eco-tourism). Refer to plates 1 – 24 under Appendix G for photographs of the affected properties and assessment / development area.

2.2 Details of the Infrastructure Proposed

The development footprint associated with the Carissa WEF will include specific infrastructure that will be developed as part of the facility layout.

The infrastructure to be developed is specifically related to the preferred technology to be installed to generate electricity from the wind resource, which in this case is wind turbine technology. Wind is used to produce electricity by converting the kinetic energy of air in motion into electricity⁵. Wind rotates the rotor blades of wind turbines, which convert kinetic energy into rotational energy. This rotational energy is transferred by a shaft to the generator, thereby producing electrical energy.

A wind farm is a site designated to be used for wind power generation. It's made up of a group of wind turbine generators spread across the land in order to take maximum advantage of the wind. There are three types of wind farms⁶:

1. On-shore - at least 3 km inland from the coast, and is the most common as in the case of the proposed Carissa WEF;
2. Near-shore - less than 3 km from the coast; and
3. Off-shore - in the open sea or in lakes many miles from the shore. These are less frequent and are located in places where they do not infringe upon pre-existing businesses or important sailing routes.

Contrary to popular belief, WEF's take up very little land in proportion to the amount of renewable energy that they can produce.

Wind turbines work on the simple principle that instead of using electricity to make wind, like a fan, wind turbines use wind to make electricity. Wind turns the propeller-like blades of a turbine around a rotor, which spins a generator, which then creates electricity⁷. The renewable energy produced by each wind turbine is channelled downward into electrical ground cables. The signals that control wind turbine functions are also transmitted via ground cables. The wind turbines on a wind farm are connected to each other by underground cabling. The turbines are linked to transformers and inverters and into facility substations/switching stations. The renewable energy produced is then channelled there and is then channelled into the electric grid via power lines to meet sustainable energy needs⁸.

⁵ <https://www.irena.org/Energy-Transition/Technology/Wind-energy>

⁶ <https://www.enelgreenpower.com/learning-hub/renewable-energies/wind-energy/wind-farm>

⁷ <https://www.energy.gov/eere/wind/how-do-wind-turbines-work>

⁸ <https://www.enelgreenpower.com/learning-hub/renewable-energies/wind-energy/wind-farm>



Figure 2.1: An Example of a Typical On-Shore WEF

In terms of the S&EIA process currently underway for Carissa WEF, the optimised layout plan/development footprint will only become available following the completion of the Scoping Phase as the Applicant requires the results (including the locations of all sensitive environmental features and areas not suitable for the placement of infrastructure) to consider the suitability of the development area for the careful placement of the development footprint.

The design of the detailed layout will consider and adhere to the limitations of the development area and aspects such as environmentally sensitive areas, roads, buildings and houses, fencing and servitudes on site. The total surface area proposed for the layout will include the wind turbine footprint, access and maintenance roads and associated infrastructure (buildings, power inverters, power line, battery energy storage system, on-site substations and switching substations and perimeter fences).

Table 2.2 below provide the technical details of the Carissa WEF available at the Scoping Phase of the development.

Table 2.2: Technical Details of the Proposed Infrastructure for the Carissa WEF

Component	Description / dimension
Type of technology	<ul style="list-style-type: none"> Wind Turbine
Number of wind turbines	<ul style="list-style-type: none"> Up to 154
Area of Wind Turbines	<ul style="list-style-type: none"> Up to 300 ha
Generation capacity	<ul style="list-style-type: none"> Up to 1 000 MW
Structure height	<ul style="list-style-type: none"> Height of wind turbines up to 280 m (maximum tip height) Hub Height up to 180 m Buildings up to 12 m Power lines up to 30 m (depending on the terrain but will ensure minimum overhead line clearances from buildings and surrounding infrastructure) Fencing up to 2 m

Component	Description / dimension
Rotor diameter	<ul style="list-style-type: none"> Up to 200 m (assuming blade length is 100 m)
Blade length	<ul style="list-style-type: none"> Up to 100 m
Area of the Battery Energy Storage Systems (BESS)	<ul style="list-style-type: none"> To be confirmed. The infrastructure will be located within the development area and preferably next to the proposed substations.
Capacity of the BESS	<ul style="list-style-type: none"> Up to 10 000 MWh
BESS Technology	<ul style="list-style-type: none"> Li-Ion battery (Technically Preferred Alternative 1) Vanadium Redox Flow Battery (Alternative 2) Zinc-hybrid Ion Battery (Alternative 3)
Area of the facility substations and switching stations (<i>including BESS</i>)	<ul style="list-style-type: none"> On-Site Facility Substation and Eskom Switching Station (East): up to 25 ha On-Site Facility Substation and Eskom Switching Station (West): up to 25 ha
Capacity of the facility substations and switching stations	<ul style="list-style-type: none"> On-Site Facility Substation and Eskom Switching Station (East): up to 132 kV On-Site Facility Substation and Eskom Switching Station (West): up to 132 kV
Area of the Main Transmission Substation (MTS)	<p><u>Southern Grid Connection Corridor (Option 1):</u></p> <ul style="list-style-type: none"> Off-site Galenia MTS: up to 36 ha (<i>does not form part of the proposed Carissa WEF project</i>). <p><u>Northern Grid Connection Corridor (Option 2):</u></p> <ul style="list-style-type: none"> On-site MTS: up to 36 ha
Capacity of MTS	<p><u>Southern Grid Connection Corridor (Option 1):</u></p> <ul style="list-style-type: none"> Off-site Galenia MTS: up to 400 kV (<i>part of a separate application</i>) <p><u>Northern Grid Connection Corridor (Option 2):</u></p> <ul style="list-style-type: none"> On-site MTS: up to 400 kV
Grid connection Solution	<p><u>Southern Grid Connection Corridor (Option 1):</u></p> <ul style="list-style-type: none"> Two (02) on-site facility substations/switching stations (i.e., one to the east of the facility and one to the west of the facility) up to 132 kV each; Two (02) grid connection corridors to connect the on-site facility substations/switching stations to the proposed off-site Galenia MTS. Each corridor is up to 15 km long and up to 600 m wide; Up to 132 kV internal overhead power line to connect the two (02) facility substations/switching stations (east-west)

Component	Description / dimension
	<p>substations/switching stations). The power line will be located within a 600 m wide corridor;</p> <ul style="list-style-type: none"> Up to 132 kV double circuit overhead power lines to connect the facility substations/switching stations to the off-site Galenia MTS; and Up to 400 kV Loop-in-Loop-out (LILO) connection to connect/tie the proposed Galenia MTS into the existing 400 kV overhead power lines. The overhead power lines will be placed within 500 m and up to 2 km long grid corridors. <p><u>Northern Grid Connection Corridor (Option 2):</u></p> <ul style="list-style-type: none"> Two (02) on-site facility substations/switching stations (i.e., one to the east of the facility and one to the west of the facility) up to 132 kV each; Two (02) grid connection corridors to connect the on-site facility substations/switching stations to the proposed on-site MTS. Each corridor is up to 17 km long and up to 500 m wide; Up to 132 kV internal overhead power line to connect the two (02) facility substations/switching stations (east-west substations/switching stations). The power line will be located within a 600 m wide corridor; Up to 132 kV double circuit overhead power lines to connect the facility substations/switching stations to the proposed on-site MTS; and Up to 400 kV Loop-in-Loop-out (LILO) connection to connect/tie the proposed on-site MTS into the existing 400 kV overhead power lines. The overhead power lines will be placed within 500 m and up to 1.6 km long grid corridors.
Length of grid corridor	<p><u>Southern Grid Connection Corridor (Option 1):</u></p> <ul style="list-style-type: none"> Up to 16 km <p><u>Northern Grid Connection Corridor (Option 2):</u></p> <ul style="list-style-type: none"> Up to 17 km
Width of grid corridor	<p><u>Southern Grid Connection Corridor (Option 1):</u></p> <ul style="list-style-type: none"> Up to 600 m <p><u>Northern Grid Connection Corridor (Option 2):</u></p> <ul style="list-style-type: none"> Up to 500 m
Width of the power line servitude	<ul style="list-style-type: none"> Up to 31 m - 132 kV power lines Up to 55 m - 400 kV power lines
Laydown area dimensions	<ul style="list-style-type: none"> Four (04) temporary laydown areas will be required and strategically placed at different points within the development area due to the large site extent. Temporary laydown areas will occupy a cumulative area of up to 67 ha.

Component	Description / dimension
	<ul style="list-style-type: none"> Area and details of permanent laydown areas to be confirmed during the detailed EIA phase.
Area occupied by buildings <i>(Note these are not considered alternatives. Due to the large site extent a number of supporting infrastructure will be required)</i>	<u>Access Control Security Buildings:</u> <ul style="list-style-type: none"> Access Control Security Building 1: up to 1 ha Access Control Security Building 2: up to 1 ha Access Control Security Building 3: up to 1 ha <u>Operations and Maintenance (O&M) Building Area:</u> <ul style="list-style-type: none"> O&M Building Area 1 (West): up to 1 ha O&M Building Area 2 (East): up to 1 ha
Supporting Infrastructure	<u>Construction Site Camp:</u> <ul style="list-style-type: none"> Construction Site Camp 1 (West): up to 4 ha Construction Site Camp 2 (East): up to 4 ha <u>Batching Plants:</u> <ul style="list-style-type: none"> A total of 6 batching plants are required and will be located at strategic points across the development area. A cumulative area of up to 40 ha will be occupied by the temporary batching plants. <u>Material Handling Area:</u> <ul style="list-style-type: none"> A total of 4 material handling areas are required and located at strategic points across the development area. A cumulative area of up to 8 ha will be occupied by the temporary material handling areas. These Material Handling Areas are required to off-load trucks and prepare components to then be transported to their final location.
Width of internal roads	<ul style="list-style-type: none"> Up to 14 m during construction, rehabilitated to up to 12 m during operational phase (including the V-drains and the cable trenches)
Length of internal roads	<ul style="list-style-type: none"> Up to 500 km
Width of main access roads	<ul style="list-style-type: none"> Up to 14 m during construction, rehabilitated to up to 12 m during operational phase (including the V-drains and the cable trenches)
Length of main access roads	<ul style="list-style-type: none"> Up to 100 km

A draft layout has been provided by the Applicant for assessment as part of the Scoping Phase. The draft layout shows the development area of up to 41 699 ha with an indication of the placement of wind turbines and some auxiliary infrastructure such as BESS; laydown areas; access control security buildings; Operations and Maintenance (O&M) building area; construction site camp; batching plants; material handling area; main access points. The two grid connection corridor options are also displayed. Refer to Figure 2.2 below which indicates the draft scoping development area as discussed within this final Scoping Report (FSR).

However as this is only the Scoping Phase of the EIA process the Applicant has indicated that an optimisation approach will be followed once the Scoping Phase is completed to enable the consideration and avoidance of all sensitive environmental features and areas present within the development area and thereby provide an opportunity to holistically consider all sensitivities and design an environmentally appropriate development footprint / facility layout to be assessed in the EIA phase.

The co-ordinates of the turbine locations and the main assessment areas are provided in Table 2.3 below. However, these coordinates will be further refined during the detailed EIA phase.

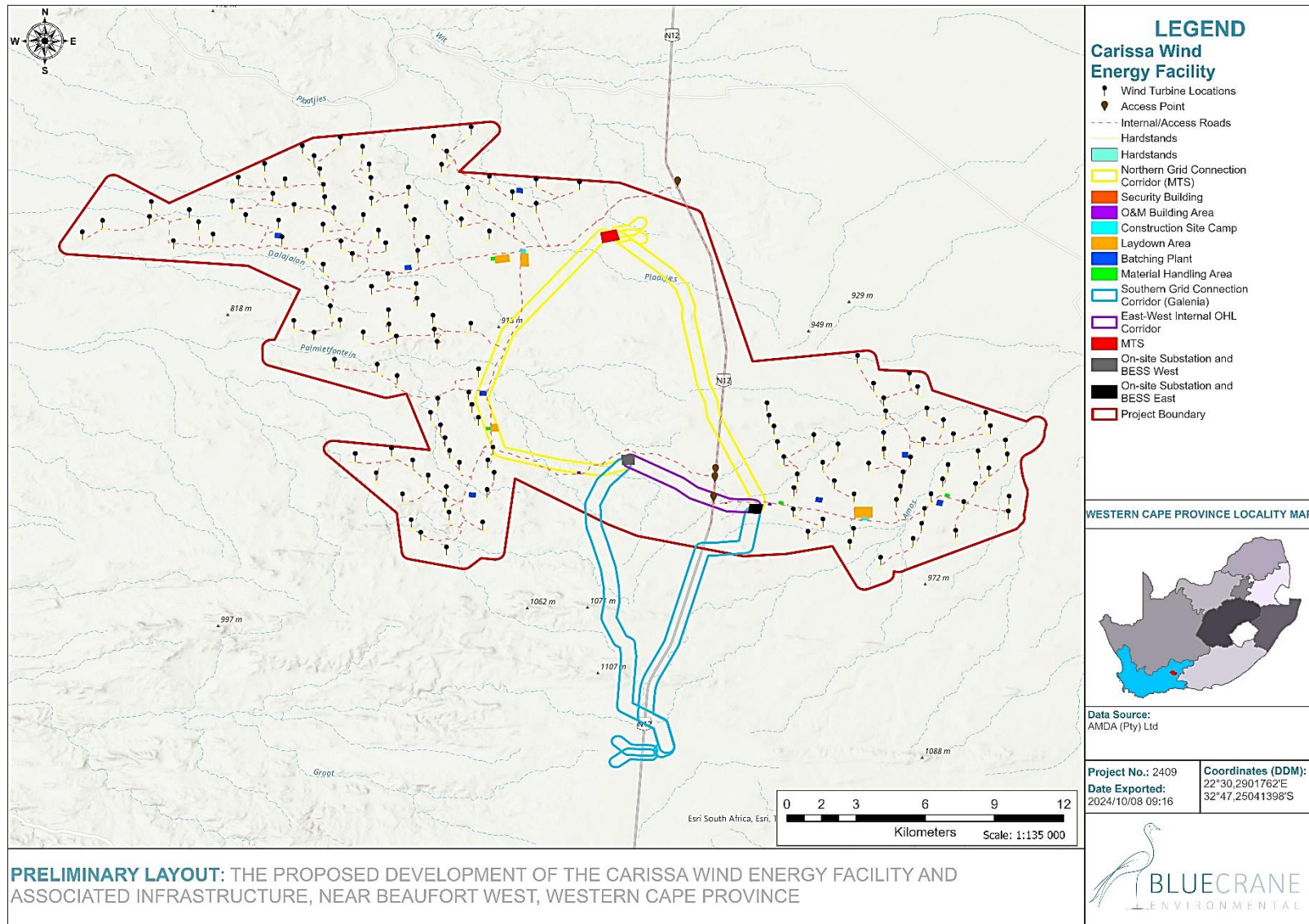


Figure 2.2: Draft Layout Plan for the Proposed Carissa WEF Assessed as Part of this Final Scoping Report

Table 2.3: Co-ordinates Associated with the Carissa WEF Development Area

Co-ordinates		
Item / Point	Latitude	Longitude
Turbine Number		
1	32°42'10.90"S	22°18'59.96"E
2	32°42'28.40"S	22°18'28.77"E
3	32°41'42.10"S	22°20'14.40"E
4	32°42'4.79"S	22°20'11.60"E
5	32°42'42.04"S	22°20'48.10"E
6	32°41'54.68"S	22°21'12.31"E
7	32°42'13.16"S	22°21'26.78"E
8	32°41'4.85"S	22°22'27.36"E
9	32°41'41.43"S	22°22'18.19"E
10	32°42'2.28"S	22°22'38.67"E
11	32°40'44.05"S	22°23'7.61"E
12	32°41'29.73"S	22°23'20.18"E
13	32°41'7.56"S	22°23'38.81"E
14	32°40'16.63"S	22°24'5.23"E
15	32°41'46.67"S	22°23'52.54"E
16	32°42'10.68"S	22°23'28.85"E
17	32°42'36.28"S	22°23'34.18"E
18	32°42'16.99"S	22°24'36.76"E
19	32°43'52.32"S	22°25'50.80"E
20	32°40'3.85"S	22°25'3.33"E
21	32°40'51.97"S	22°24'31.99"E
22	32°41'16.09"S	22°24'37.51"E
23	32°41'34.98"S	22°24'39.49"E
24	32°41'51.67"S	22°24'53.59"E
25	32°42'42.70"S	22°25'4.16"E
26	32°42'56.73"S	22°24'11.31"E
27	32°43'18.24"S	22°24'37.00"E
28	32°43'53.93"S	22°24'42.06"E

Co-ordinates		
Item / Point	Latitude	Longitude
29	32° 44' 28.20"S	22° 26' 16.68"E
30	32° 40' 17.97"S	22° 25' 37.43"E
31	32° 40' 45.02"S	22° 25' 47.38"E
32	32° 41' 5.60"S	22° 25' 49.87"E
33	32° 41' 36.85"S	22° 25' 50.69"E
34	32° 42' 2.45"S	22° 25' 38.47"E
35	32° 42' 26.31"S	22° 26' 1.54"E
36	32° 42' 45.63"S	22° 26' 12.67"E
37	32° 43' 1.95"S	22° 25' 21.61"E
38	32° 43' 48.14"S	22° 26' 59.02"E
39	32° 43' 32.76"S	22° 26' 15.81"E
40	32° 44' 10.60"S	22° 27' 0.25"E
41	32° 44' 36.84"S	22° 27' 24.76"E
42	32° 44' 58.15"S	22° 27' 26.80"E
43	32° 41' 20.47"S	22° 26' 47.45"E
44	32° 41' 49.96"S	22° 26' 43.98"E
45	32° 42' 10.05"S	22° 26' 56.49"E
46	32° 42' 37.00"S	22° 27' 16.79"E
47	32° 42' 57.32"S	22° 27' 1.48"E
48	32° 40' 45.47"S	22° 27' 38.08"E
49	32° 41' 43.63"S	22° 27' 44.95"E
50	32° 40' 2.38"S	22° 27' 25.98"E
51	32° 39' 48.15"S	22° 28' 23.39"E
52	32° 44' 44.45"S	22° 23' 51.94"E
53	32° 45' 2.62"S	22° 24' 22.93"E
54	32° 44' 22.22"S	22° 24' 47.93"E
55	32° 44' 43.69"S	22° 25' 2.57"E
56	32° 45' 2.34"S	22° 25' 38.09"E
57	32° 45' 44.20"S	22° 24' 54.05"E
58	32° 44' 50.18"S	22° 26' 17.48"E

Co-ordinates		
Item / Point	Latitude	Longitude
59	32°45'8.59"S	22°26'28.69"E
60	32°45'51.77"S	22°25'59.31"E
61	32°46'9.26"S	22°26'29.65"E
62	32°41'21.26"S	22°28'18.07"E
63	32°41'8.15"S	22°30'2.57"E
64	32°42'3.05"S	22°29'27.35"E
65	32°41'3.81"S	22°28'51.23"E
66	32°41'27.67"S	22°29'26.34"E
67	32°41'45.43"S	22°30'2.68"E
68	32°41'12.60"S	22°31'8.76"E
69	32°42'9.05"S	22°28'8.26"E
70	32°42'27.91"S	22°28'51.07"E
71	32°44'49.06"S	22°28'22.56"E
72	32°45'16.84"S	22°27'30.93"E
73	32°46'59.77"S	22°39'59.49"E
74	32°42'31.97"S	22°21'48.71"E
75	32°46'44.14"S	22°27'32.03"E
76	32°47'5.76"S	22°27'20.81"E
77	32°47'24.81"S	22°27'35.97"E
78	32°40'25.48"S	22°27'46.00"E
79	32°45'58.90"S	22°28'34.27"E
80	32°46'34.83"S	22°28'19.20"E
81	32°46'53.49"S	22°28'24.10"E
82	32°47'13.40"S	22°28'34.04"E
83	32°48'24.05"S	22°38'30.45"E
84	32°48'8.63"S	22°25'25.68"E
85	32°48'38.31"S	22°25'57.68"E
86	32°48'42.06"S	22°27'17.11"E
87	32°49'10.64"S	22°26'37.88"E
88	32°49'50.27"S	22°26'51.08"E

Co-ordinates		
Item / Point	Latitude	Longitude
89	32°50'9.74"S	22°27'5.63"E
90	32°50'32.22"S	22°27'45.03"E
91	32°48'0.21"S	22°26'21.07"E
92	32°48'18.72"S	22°26'53.47"E
93	32°48'59.64"S	22°27'44.89"E
94	32°49'19.79"S	22°27'42.32"E
95	32°49'38.70"S	22°27'48.84"E
96	32°49'53.90"S	22°28'40.27"E
97	32°47'44.60"S	22°27'42.82"E
98	32°48'22.39"S	22°28'4.89"E
99	32°48'37.65"S	22°28'58.06"E
100	32°49'4.15"S	22°28'47.33"E
101	32°48'18.72"S	22°28'48.37"E
102	32°47'59.02"S	22°28'56.18"E
103	32°45'39.18"S	22°38'13.58"E
104	32°47'40.43"S	22°37'6.76"E
105	32°46'51.59"S	22°35'55.14"E
106	32°47'27.11"S	22°36'5.85"E
107	32°47'50.97"S	22°36'11.04"E
108	32°48'14.11"S	22°36'20.78"E
109	32°48'40.66"S	22°36'41.18"E
110	32°49'1.69"S	22°36'36.14"E
111	32°49'34.33"S	22°36'35.25"E
112	32°49'49.97"S	22°37'20.40"E
113	32°50'8.82"S	22°36'57.45"E
114	32°47'54.55"S	22°37'43.60"E
115	32°48'22.96"S	22°37'20.21"E
116	32°48'51.02"S	22°37'37.96"E
117	32°49'11.50"S	22°38'8.06"E
118	32°50'4.25"S	22°38'7.25"E

Co-ordinates		
Item / Point	Latitude	Longitude
119	32°48'2.29"S	22°38'53.82"E
120	32°49'20.04"S	22°39'12.93"E
121	32°50'24.32"S	22°38'1.44"E
122	32°50'48.73"S	22°38'48.46"E
123	32°46'21.66"S	22°38'37.95"E
124	32°46'44.10"S	22°38'53.49"E
125	32°47'4.09"S	22°38'56.48"E
126	32°47'37.23"S	22°38'53.28"E
127	32°48'14.84"S	22°39'34.45"E
128	32°48'37.71"S	22°39'22.97"E
129	32°48'59.45"S	22°39'18.94"E
130	32°46'6.44"S	22°39'32.88"E
131	32°46'26.90"S	22°39'45.37"E
132	32°47'17.73"S	22°40'24.60"E
133	32°47'39.25"S	22°40'40.03"E
134	32°47'47.42"S	22°39'53.99"E
135	32°47'6.82"S	22°41'29.42"E
136	32°47'27.01"S	22°41'36.50"E
137	32°48'5.57"S	22°41'17.67"E
138	32°48'26.56"S	22°40'31.72"E
139	32°48'48.51"S	22°40'23.33"E
140	32°49'11.33"S	22°40'5.71"E
141	32°49'33.72"S	22°39'55.69"E
142	32°49'56.71"S	22°39'51.26"E
143	32°50'19.77"S	22°39'38.28"E
144	32°47'48.87"S	22°41'59.54"E
145	32°48'10.36"S	22°42'2.33"E
146	32°48'55.69"S	22°41'13.79"E
147	32°49'23.50"S	22°40'55.66"E
148	32°50'7.40"S	22°40'43.37"E

Co-ordinates		
Item / Point	Latitude	Longitude
149	32°49'15.02"S	22°42'5.14"E
150	32°49'37.90"S	22°42'3.81"E
151	32°47'10.56"S	22°35'58.22"E
152	32°48'31.90"S	22°41'34.02"E
153	32°40'32.14"S	22°24'23.32"E
154	32°48'4.14"S	22°27'49.88"E
Item / Point	Latitude	Longitude
East On-Site Substation and BESS		
A ⁹	32°49'13.78"S	22°35'28.48"E
B	32°49'14.32"S	22°35'49.50"E
C	32°49'28.96"S	22°35'45.51"E
D	32°49'28.26"S	22°35'25.38"E
West On-Site Substation and BESS		
A	32°47'58.19"S	22°32'12.41"E
B	32°47'57.89"S	22°32'32.47"E
C	32°48'13.60"S	22°32'32.83"E
D	32°48'13.76"S	22°32'13.13"E
Proposed Northern MTS		
A	32°42'17.36"S	22°31'40.62"E
B	32°42'12.65"S	22°32'5.11"E
C	32°42'28.75"S	22°32'10.46"E
D	32°42'33.80"S	22°31'43.55"E
Access Control Security Buildings 1		
A	32°42'36.01"S	22°30'36.38"E
B	32°42'36.01"S	22°30'37.87"E
C	32°42'36.98"S	22°30'37.89"E
D	32°42'36.99"S	22°30'36.37"E
Access Control Security Buildings 2		

⁹ Point 'A' begins at the north western corner and rotates in a clockwise direction

Co-ordinates		
Item / Point	Latitude	Longitude
A	32°47'49.95"S	22°32'22.70"E
B	32°47'50.68"S	22°32'23.97"E
C	32°47'51.45"S	22°32'23.29"E
D	32°47'50.77"S	22°32'22.03"E
Access Control Security Buildings 3		
A	32°49'11.79"S	22°34'50.70"E
B	32°49'11.30"S	22°34'53.08"E
C	32°49'12.73"S	22°34'53.45"E
D	32°49'13.20"S	22°34'51.16"E
Operations and Maintenance Building 1		
A	32°48'24.16"S	22°31'5.09"E
B	32°48'24.14"S	22°31'9.68"E
C	32°48'26.95"S	22°31'9.66"E
D	32°48'26.95"S	22°31'5.09"E
Operations and Maintenance Building 2		
A	32°49'12.19"S	22°35'57.62"E
B	32°49'12.86"S	22°36'1.56"E
C	32°49'15.98"S	22°36'0.83"E
D	32°49'15.16"S	22°35'56.90"E
Construction Site Camp 1		
A	32°42'42.97"S	22°29'39.50"E
B	32°42'42.84"S	22°29'46.38"E
C	32°42'49.99"S	22°29'46.39"E
D	32°42'50.05"S	22°29'39.29"E
Construction Site Camp 2		
A	32°49'34.28"S	22°38'18.77"E
B	32°49'34.29"S	22°38'30.51"E
C	32°49'38.51"S	22°38'30.55"E
D	32°49'38.48"S	22°38'18.79"E

Co-ordinates		
Item / Point	Latitude	Longitude
Laydown Area 1		
A	32° 42' 50.38"S	22° 29' 39.49"E
B	32° 42' 50.34"S	22° 29' 49.52"E
C	32° 43' 8.25"S	22° 29' 50.37"E
D	32° 43' 8.04"S	22° 29' 39.73"E
Laydown Area 2		
A	32° 42' 54.28"S	22° 29' 0.27"E
B	32° 42' 51.69"S	22° 29' 19.76"E
C	32° 43' 0.89"S	22° 29' 21.30"E
D	32° 43' 3.32"S	22° 29' 1.23"E
Laydown Area 3		
A	32° 47' 11.80"S	22° 28' 53.44"E
B	32° 47' 11.66"S	22° 29' 1.80"E
C	32° 47' 21.22"S	22° 29' 4.07"E
D	32° 47' 21.26"S	22° 28' 54.32"E
Laydown Area 4		
A	32° 49' 19.48"S	22° 38' 9.48"E
B	32° 49' 19.36"S	22° 38' 35.04"E
C	32° 49' 33.94"S	22° 38' 35.14"E
D	32° 49' 33.94"S	22° 38' 9.78"E
Batching Plant 1 (temporary)		
A	32° 41' 8.94"S	22° 29' 32.86"E
B	32° 41' 10.31"S	22° 29' 41.95"E
C	32° 41' 16.83"S	22° 29' 42.10"E
D	32° 41' 15.62"S	22° 29' 32.76"E
Batching Plant 2 (temporary)		
A	32° 43' 7.82"S	22° 26' 41.72"E
B	32° 43' 7.38"S	22° 26' 50.96"E
C	32° 43' 13.88"S	22° 26' 51.73"E
D	32° 43' 13.96"S	22° 26' 41.89"E

Co-ordinates		
Item / Point	Latitude	Longitude
Batching Plant 3 (temporary)		
A	32°42'18.11"S	22°23'23.73"E
B	32°42'18.35"S	22°23'32.74"E
C	32°42'25.08"S	22°23'32.63"E
D	32°42'24.67"S	22°23'23.42"E
Batching Plant 4 (temporary)		
A	32°46'20.61"S	22°28'36.73"E
B	32°46'20.72"S	22°28'45.90"E
C	32°46'27.04"S	22°28'46.07"E
D	32°46'27.15"S	22°28'36.56"E
Batching Plant 5 (temporary)		
A	32°48'55.88"S	22°28'20.32"E
B	32°48'56.54"S	22°28'29.86"E
C	32°49'3.11"S	22°28'28.86"E
D	32°49'2.13"S	22°28'19.76"E
Batching Plant 6 (temporary)		
A	32°49'3.69"S	22°37'10.55"E
B	32°49'4.98"S	22°37'19.99"E
C	32°49'11.35"S	22°37'18.14"E
D	32°49'9.93"S	22°37'9.19"E
Batching Plant 7 (temporary)		
A	32°47'54.88"S	22°39'22.04"E
B	32°47'55.15"S	22°39'30.44"E
C	32°48'2.65"S	22°39'30.09"E
D	32°48'2.13"S	22°39'22.19"E
Batching Plant 8 (temporary)		
A	32°49'8.14"S	22°40'16.08"E
B	32°49'9.29"S	22°40'23.94"E
C	32°49'16.69"S	22°40'21.94"E
D	32°49'15.32"S	22°40'14.16"E

Co-ordinates		
Item / Point	Latitude	Longitude
Material Handling Area 1 (temporary)		
A	32°42'55.35"S	22°28'53.43"E
B	32°42'54.90"S	22°28'59.05"E
C	32°42'59.07"S	22°28'59.17"E
D	32°42'59.37"S	22°28'53.59"E
Material Handling Area 2 (temporary)		
A	32°47'15.90"S	22°28'46.21"E
B	32°47'15.80"S	22°28'52.22"E
C	32°47'19.68"S	22°28'52.41"E
D	32°47'19.75"S	22°28'46.16"E
Material Handling Area 3 (temporary)		
A	32°49'9.74"S	22°36'13.88"E
B	32°49'11.02"S	22°36'19.89"E
C	32°49'14.69"S	22°36'19.17"E
D	32°49'13.36"S	22°36'13.00"E
Material Handling Area 4 (temporary)		
A	32°48'58.36"S	22°40'28.08"E
B	32°48'59.97"S	22°40'33.99"E
C	32°49'3.65"S	22°40'33.10"E
D	32°49'2.10"S	22°40'26.82"E
Southern Grid Connection Corridor ¹⁰ (Option 1)		
East on-site substation to off-site MTS		
Start	32°49'17.87"S	22°35'34.57"E
Bend	32°50'19.24"S	22°35'14.70"E
Bend	32°50'23.37"S	22°34'15.28"E
Middle	32°52'28.07"S	22°33'33.61"E
Bend	32°53'44.06"S	22°32'56.51"E

¹⁰ Co-ordinates of the center of the corridors are provided at FSR

Co-ordinates		
Item / Point	Latitude	Longitude
Bend	32°54'42.40"S	22°32'52.13"E
Bend	32°54'59.76"S	22°33'14.49"E
Bend	32°55'26.29"S	22°33'18.78"E
End	32°55'36.59"S	22°33'3.66"E
West on-site substation to off-site MTS		
Start	32°48'8.33"S	22°32'21.67"E
Bend	32°49'14.77"S	22°31'28.03"E
Middle	32°52'4.17"S	22°31'55.61"E
Bend	32°52'52.45"S	22°32'19.65"E
Bend	32°54'27.16"S	22°32'20.70"E
Bend	32°54'52.59"S	22°33'12.03"E
End	32°55'35.04"S	22°33'26.91"E
LILO Corridor A ¹¹		
Start	32°55'33.18"S	22°33'6.52"E
Middle	32°55'30.72"S	22°32'23.81"E
End	32°55'11.98"S	22°32'0.52"E
LILO Corridor B ¹²		
Start	32°55'39.73"S	22°33'6.48"E
Middle	32°55'37.70"S	22°32'22.76"E
End	32°55'55.50"S	22°31'56.77"E
Northern Grid Connection Corridor ¹³ (Option 2)		
East on-site substation to on-site MTS		
Start	32°49'25.53"S	22°35'38.27"E
Middle	32°45'50.88"S	22°34'15.64"E
Bend	32°43'39.28"S	22°33'47.05"E
End	32°42'20.18"S	22°32'0.64"E

¹¹ End point towards the northern direction

¹² End point towards the southern direction

¹³ Co-ordinates of the centre of the corridors are provided at FSR

Co-ordinates		
Item / Point	Latitude	Longitude
West on-site substation to on-site MTS		
Start	32°48'7.03"S	22°32'23.44"E
Bend	32°48'24.49"S	22°31'43.20"E
Bend	32°47'55.01"S	22°29'7.18"E
Bend	32°46'32.97"S	22°28'38.33"E
Middle	32°45'52.83"S	22°28'53.75"E
Bend	32°44'52.92"S	22°29'18.70"E
End	32°42'17.93"S	22°31'51.73"E
LILO Corridor A ¹⁴		
Start	32°42'18.78"S	22°31'57.64"E
Middle	32°42'13.17"S	22°32'30.43"E
End	32°41'55.77"S	22°32'47.34"E
LILO Corridor B ¹⁵		
Start	32°42'24.99"S	22°31'59.59"E
Middle	32°42'20.26"S	22°32'31.49"E
End	32°42'32.34"S	22°32'50.05"E
East and West Grid Connection Corridor ¹⁶ (Options 1 & 2)		
Start	32°48'3.44"S	22°32'16.82"E
Middle	32°48'56.76"S	22°34'7.85"E
End	32°49'18.81"S	22°35'44.86"E
Main Access Points (Main Entrance)		
Access Point 1	32°41'8.48"S	22°33'38.79"E
Access Point 2	32°48'29.37"S	22°34'36.44"E
Access Point 3	32°48'41.58"S	22°34'35.32"E
Access Point 4	32°49'12.09"S	22°34'33.31"E

¹⁴ End point towards the northern direction

¹⁵ End point towards the southern direction

¹⁶ Co-ordinates of the center of the corridors are provided at FSR

2.3 Site Selection Process

The process undertaken by the Applicant for the identification of the preferred site / development area was through an investigation of prospective sites and properties in the Beaufort West area. The investigation involved the consideration of specific characteristics within the Western Cape Province and specifically between the Beaufort West and Prince Albert areas. The characteristics considered were identified by the Applicant as the main aspects that play a role in the opportunities and limitations for the development of a WEF. The characteristics considered, and the results thereof, are discussed in the sections below. The Applicant considered that should these characteristics not be favourable for the development of a wind energy facility, then some limitations and challenges may be expected.

Wind Resource - The Applicant firstly considered the available wind resource for the Western Cape Province and the Beaufort West area through the consideration of various datasets and variables. Through the consideration of the datasets which analyses wind presence and speed, as well as meteorological information and geographical factors, it was confirmed that the Beaufort West area, and in particular the general area of the proposed site / development area, is suitable for the development of a WEF. According to the IPP Quarterly Report dated March 2021, South Africa offers exceptional wind resource potential throughout most of the country, but particularly along our extended 3 000 km coastline. The country's wind resource has been comprehensively mapped in a publicly available Wind Atlas to support planning and wind power development. Refer to Figure 2.3 below. Wind IPPs are largely located along the coastal regions of the Eastern Cape and Western Cape provinces, based on the strong wind flows along these shores. However, a large share of wind IPPs are also located in the Northern Cape.

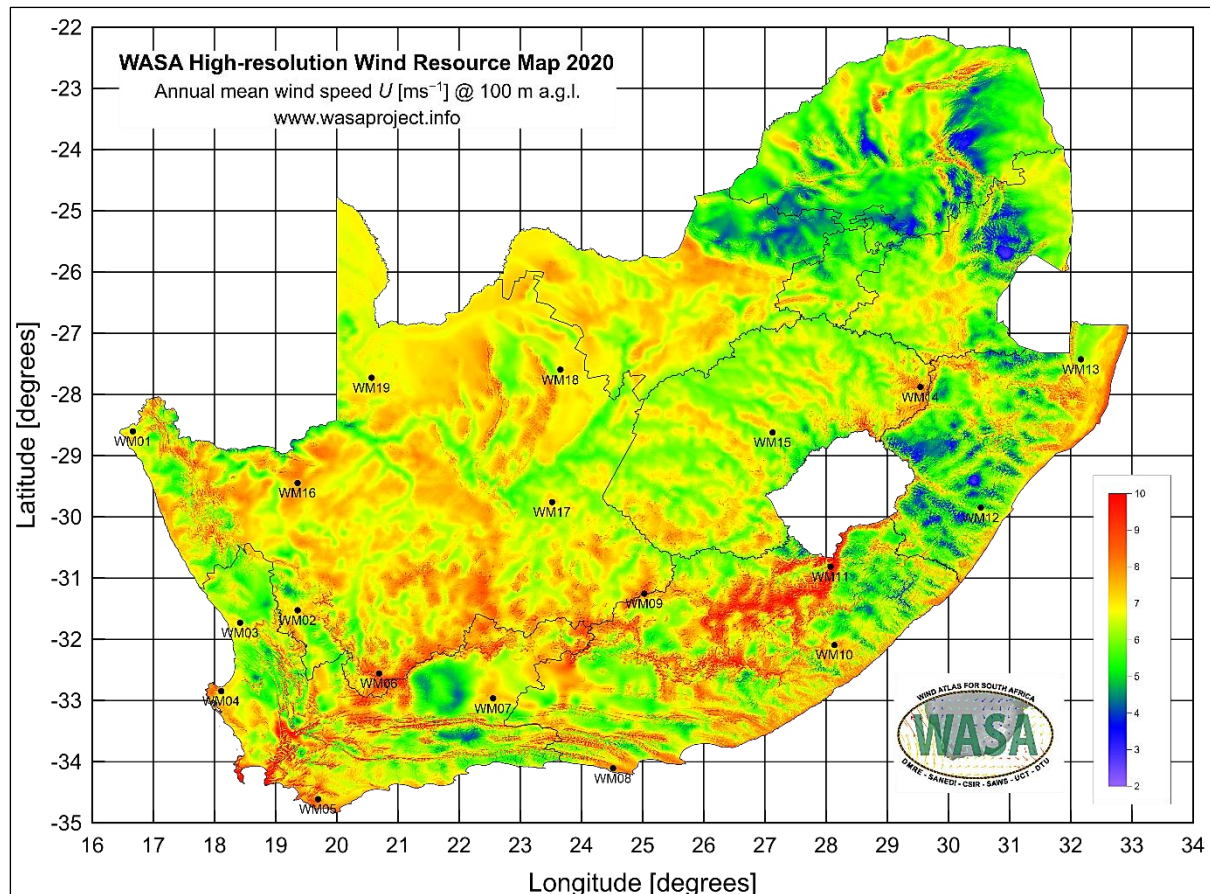


Figure 2.3: WASA High Resolution Wind Resource Map: Mean Wind Speed [ms^{-1}] @ 100 m a.g.l. Dec 2020 (3.3 km WRF + 250 m WAsP modelling) (source: <https://www.wasaproject.info/>)

Land Availability – In order to develop the Carissa WEF with a contracted capacity of up to 1 000 MW sufficient space is required for the placement of turbine hard stands and associated infrastructure. The site /development area was identified within the Western Cape Province and in close proximity to the Beaufort West and Prince Albert towns following the confirmation of the wind resource. The properties included in the site / development area are some of the available privately-owned land parcels in the area that can be developed and that have been made available by the landowners. Furthermore, the willingness of the respective landowners to consent to the development on the affected properties was also considered by the Applicant. The combination of the extent of the affected properties enables the consideration of a large development area (i.e., up to 41 699 ha) for the assessment and placement of the development footprint which will be defined at the detailed EIA phase.

Access to the National Grid - Following the confirmation of sufficient available land for the development of the WEF, the Applicant considered the possible grid connection points in order to evacuate the generated electricity into the national grid. This was considered as a vital aspect by the Applicant for the project. Within the surrounding area of the proposed Carissa WEF development area, existing and viable grid connection infrastructure is available. The Applicant specifically considers two (02) grid connection options which includes 132 kV overhead power lines to an off-site or on-site MTS. The MTS (on-site or off-site) will then connect into existing 400 kV overhead power lines via a Loop-In-Loop-Out (LILO) connection. The Applicant considered this as a benefit to the project and environment as a whole to reduce the on-ground disturbance by power lines within the area as well as the associated visual intrusion.

Geographical and Socio-Economic Considerations - Most of the surrounding area has a low number of farmsteads/ buildings that are sparsely populated. The area is located in an agricultural region with natural grazing as the most prominent activities. The Applicant considered the potential opportunity for Carissa WEF to bring some opportunity to the area, to an extent, considering the development and growth opportunities associated with the project.

Availability of Existing Infrastructure - The availability of existing infrastructure was also considered by the Applicant as this will enable the WEF to make use of infrastructure already available and thereby reduce the disturbance associated with the construction and operation of the associated infrastructure. The existing road network within the surrounding areas and within the site / development area makes access manageable. The Applicant also considered the fact that the directly surrounding area has little infrastructure related to intense residential uses, which may be affected by the development of a WEF.

Topographical Considerations - From a topographical perspective there are very few physical constraints present on site which would have an effect on the efforts required for the construction and installation of the wind turbines. The project is situated in a region with a regular, undulating landscape. Landforms include kopjes, ridges, plains, and undulating hills with some steep slopes adjacent to watercourses. These landforms extend outward from the proposed development over a considerable distance. The most prominent nearby mountains are the Swartberg Mountains located approximately 50 km to the south and the Nuweveld Mountains located approximately 35 km to the north near Beaufort West. The average elevation above mean sea level (AMSL) in the region is approximately 850 m. The site area, in general, drains east and west.

Consideration of Sensitive Environmental Features Through Environmental Screening – Following the confirmation of the Carissa WEF preferred site / development area as being technically feasible for the development of a wind energy facility, the developer set out to screen the site, and assess the main constraints and opportunities and whether or not there were any potential fatal flaws or significant no-go areas that might compromise or limit the development of the WEF. The screening exercise included the consideration of desktop information as well as the undertaking of on-site surveys mainly relating to ecological features and sensitive habitats and features associated with wetlands, birds and bats present within the site.

The approach applied by the Applicant in terms of the site selection for the Carissa WEF demonstrates due consideration of the sustainability of the site for the development of a wind facility, which is in line with a typical mitigation hierarchy (Figure 2.4). The hierarchy is as follows:

1. First Mitigation: avoidance of adverse impacts as far as possible by use of preventative measures (in this instance a sensitivity analysis assisted in the avoidance of identified sensitive areas).
2. Second Mitigation: minimisation or reduction of adverse impacts to 'as low as practicable' through implementation of mitigation and management measures.
3. Third Mitigation: remedy or compensation for adverse impacts, which are unavoidable and cannot be reduced further.

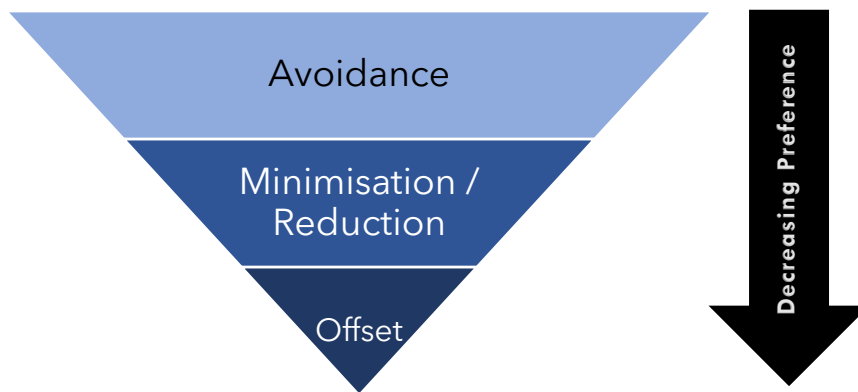


Figure 2.4: Typical Mitigation Hierarchy

2.4 Alternatives Under Assessment

This section describes the alternatives under consideration for the Carissa WEF. In terms of the Regulations only 'feasible' and 'reasonable' alternatives should be considered for development. The process undertaken by the Applicant for the identification of alternatives has been an iterative process and will continue to be an iterative process between the EAP and the Applicant in order to ensure that the preferred alternative proposed for authorisation is ultimately appropriate from a technical feasibility perspective as well as an environmental perspective. Refer to Table 2.4 for an overview of the alternatives being considered.

Table 2.4: Summary of the Alternatives Considered

Alternatives considered	Description of the Alternative relating to the development
Site Specific and Layout Alternatives	<p>One preferred site / development area has been identified for the development of the Carissa WEF based on specific site characteristics. The development area of up to 41 699 ha is considered to be sufficient for the development of a WEF with a contracted capacity of up to 1 000 MW.</p> <p>Prior to the initiation of the S&EIA process, alternative properties / sites were considered and pre-screened by the Applicant to determine the preferred location for the proposed development area. The selection of a potential wind farm site includes several key aspects including wind resource, grid connection suitability, existing infrastructure as well as environmental and social constraints, topography and access. This proposed project site was selected based on the above criteria ahead of other regional properties / sites due to the cumulative assessment and consideration of all criteria. This process takes several months to complete and ensures that the least environmentally sensitive site is selected in the specific region for further development.</p> <p>Based on the reasons above no site or development area alternatives have been put forward or assessed further during the S&EIA process for this proposed development. The placement of wind energy facilities is dependent on the factors discussed above, all of which are favourable at the proposed site location.</p>

Alternatives considered	Description of the Alternative relating to the development
	The facility layout / development footprint of the infrastructure will be optimised throughout the EIA process to ensure that the relevant environmental constraints are considered and avoided, thereby resulting in a facility layout which can be considered as being environmentally appropriate for development.
Activity Alternatives	Only the development of a renewable energy facility is considered by AMDA Oscar (Pty) Ltd. Due to the location of the site / development area and the suitability of the wind resource, only the development of a wind energy facility is considered feasible considering the natural resources available to the area and the current land-use activities undertaken within the site (i.e., agricultural activities).
Technology Alternatives	<p>Only the development of a WEF is considered due to the characteristics of the site, including the natural resources available. The technology proposed to be utilised is therefore wind turbines.</p> <p>For the development of the Battery Energy Storage System (BESS) three alternatives are under consideration:</p> <ul style="list-style-type: none"> • Li-Ion battery (Technically Preferred - Alternative 1) • Vanadium Redox Flow Battery (Alternative 2) • Zinc-hybrid Ion Battery (Alternative 3)
'Do-nothing' Alternative	The option to not construct the Carissa WEF. No impacts (positive or negative) are expected to occur on the social and environmental sensitive features or aspects located within the surrounding areas of the site. The opportunities associated with the development of the facility for the Beaufort West and Prince Albert areas/towns will not be made available.

The sections below provide more detail on the alternatives under consideration.

2.4.1 Site-Specific and Layout Alternatives

As indicated in section 2.3 and Table 2.4 above, a site selection process has been undertaken by the Applicant for the identification of the development area. The development area is large in extent (i.e., up to 41 699 ha) and therefore represents an opportunity to consider and avoid the sensitive environmental areas and features through the careful planning and placement of the development footprint.

The process to ultimately identify the preferred development footprint / layout alternative will be as follows:

1. The entire extent of the development area (i.e., 41 699 ha) is fully assessed as part of the Scoping Phase and within this final Scoping Report.
2. The Applicant and EAP will then consider all final and confirmed environmental sensitivities for the site and through the use of spatial mapping consider the areas that need to be avoided and are not available for the placement of infrastructure. This will provide guidance to the Applicant for the

design and placement of infrastructure as part of the development footprint to be put forward for assessment as part of the EIA Phase.

3. At the commencement of the EIA Phase the Applicant will provide to the EAP a draft facility layout which will be assessed by the EAP in the EIA Report. This layout will then also be provided to the independent specialists for assessment as part of the impact assessment and thereby also provide feedback on the suitability of the draft layout. The layout will also be made available to I&APs as part of the 30-day review and comment period of the draft EIA Report.
4. Should any further concerns be raised by the specialists and I&APs regarding the layout (including potential infringement into sensitive environmental features/areas) the Applicant will undertake an optimisation process to ensure that the placement of infrastructure is in line with the environmental constraints and therefore result in a layout that can be considered as appropriate from an environmental perspective.
5. The optimised layout will then be put forward for authorisation.

Therefore, the current layout provided and assessed as part of the Scoping Phase provides an indication of the up to 41 699 ha development area and the preliminary location for the associated infrastructure. The layout to be included in the draft EIA Report will provide more detail and consider the limitations of the site from an environmental perspective. Figure 2.5 provides an indication of the footprint currently under assessment as part of the Scoping Phase.

In terms of the location of the associated infrastructure, this will be further defined (spilt-out) during the detailed EIA phase as only a general location for associated infrastructure has been presented in this final Scoping Report, for example, the BESS and on-site east and west substations.

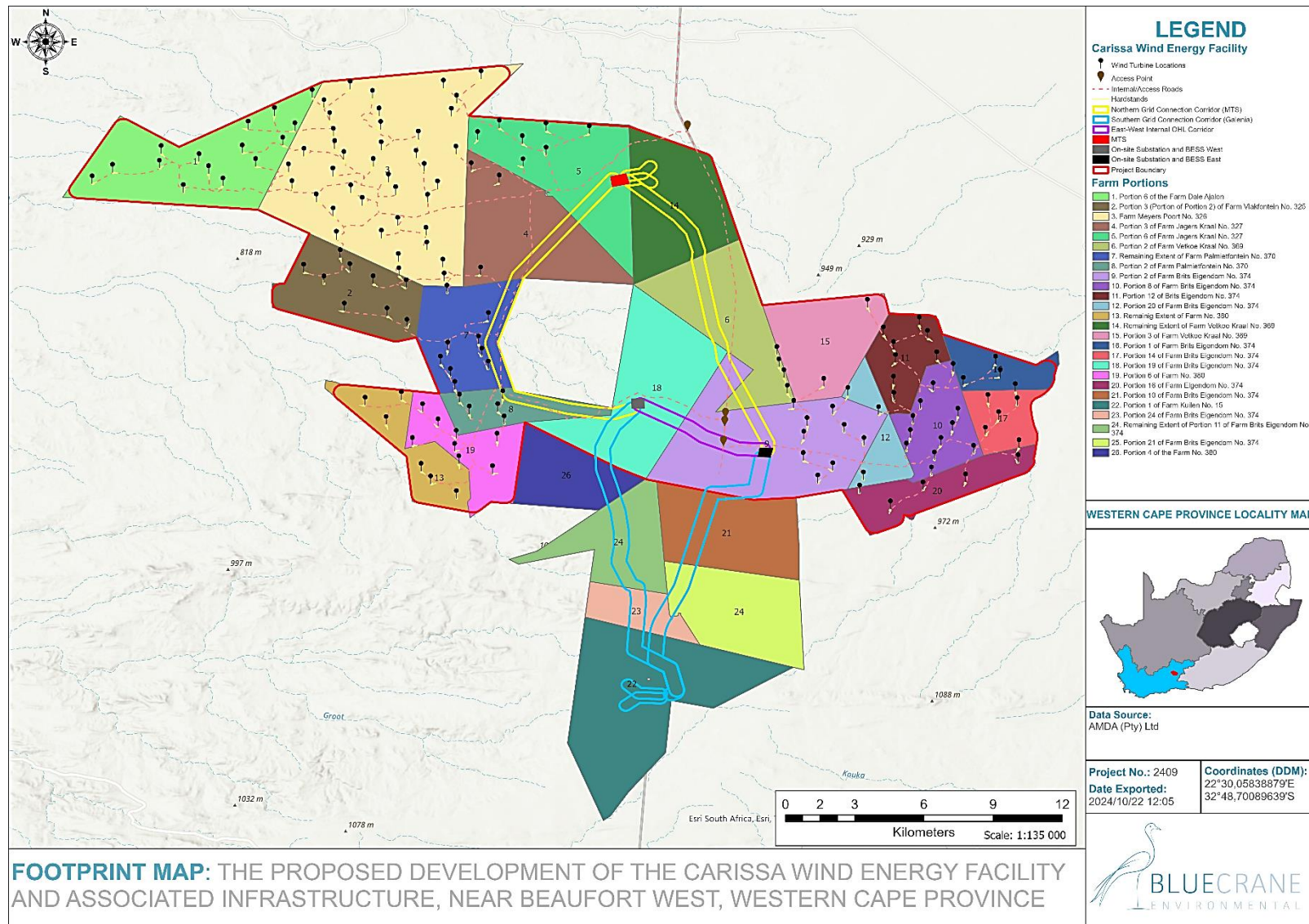


Figure 2.5: Carissa WEF Footprint Under Assessment as Part of the Scoping Phase

2.4.2 Activity Alternatives

The activity alternative considers whether the development of a WEF would be the most appropriate use of the land in terms of energy generation.

When considering AMDA Oscar (Pty) Ltd, the company is by trade a renewable energy project development company and as such will only consider the development of renewable energy activities. Considering the available natural energy resources and the extent of land available within the area and the lack of other natural resources such as water in terms of use for development and operation, it is considered that wind and solar energy developments are preferred within the identified site. Furthermore, the surrounding and neighbouring properties are also authorised to house wind facilities.

Considering the location of the site and the fact that there are proposed wind facilities within the surrounding area, the potential for cumulative impacts associated with the development of wind facilities is expected to occur. The cumulative impacts can be mitigated against resulting to a low to high negative significance on the surrounding environment, depending on the type of impact. The development of the Carissa WEF in itself is considered a positive addition with regards to implementing this technology in the identified location (i.e., site). Furthermore, the grid connection infrastructure to connect the WEF to the national grid is present within the vicinity of the site.

In terms of alternative renewable energy generation options available, solar energy and the use of Concentrated Solar Power (CSP) technology has been considered.

Due to the local climatic conditions, a solar energy facility is not considered preferable as the area does not have a significantly competitive solar resource available that would provide the same electricity yield as that of the Carissa WEF. Furthermore, the applicant has opted for the generation of electricity via wind power rather than the use of solar PV based on the renewable energy resource available for the area, which is predominantly a wind resource as well as the preferred commercial renewable energy resource, driven by industry demand. The solar PV alternative is therefore regarded as not feasible and will not be evaluated further.

CSP technology has the same hindrances as solar PV discussed above for the Carissa WEF site, and requires large volumes of water, a major constraint for this type of technology considering the water challenges and limitation experienced in the semi-arid Karoo and the country as a whole. Based on the above, this alternative is not considered feasible or reasonable and will not be considered further in this report.

2.4.3 Technology Alternatives

As AMDA Oscar (Pty) Ltd is an Independent Power Producer (IPP), only renewable energy technologies are being considered for the generation of up to 1 000 MW of electricity. Considering the local resources available (i.e., wind and solar irradiation) for such technologies, the footprint requirements for such developments and the current land use of the site (i.e., agricultural activity), the site is considered most suitable for the establishment of a wind energy facility. This has been confirmed through the wind data collected for the area and other technical characteristics available within the surrounding areas of the site.

For the development of the Carissa WEF, technology alternatives were considered in terms of the type of turbine technology and Battery Energy Storage Systems (BESS). These are detailed below. The associated infrastructure is also described below:

2.4.3.1 Wind Turbines

Wind turbines are mounted on a tower at a specified height to capture the most energy. In the case of the proposed Carissa WEF, the turbines will have a height of up to 280 m (maximum tip height) with a hub height of up to 180 m. The taller the turbine, the stronger the wind, as there are fewer obstacles in its path. A total of 154 wind turbines are proposed. The kinetic energy produced by wind results to the rotation of the wind turbines and their propeller-like blades thereby generating electricity. A wind turbine comprises of three (03) rotor blades and a nacelle which is mounted at the top of a tapered steel or concrete tower. The mechanical power produced by the rotating blades is transmitted to the generator located within the nacelle¹⁷. A typical design of a turbine is provided below.

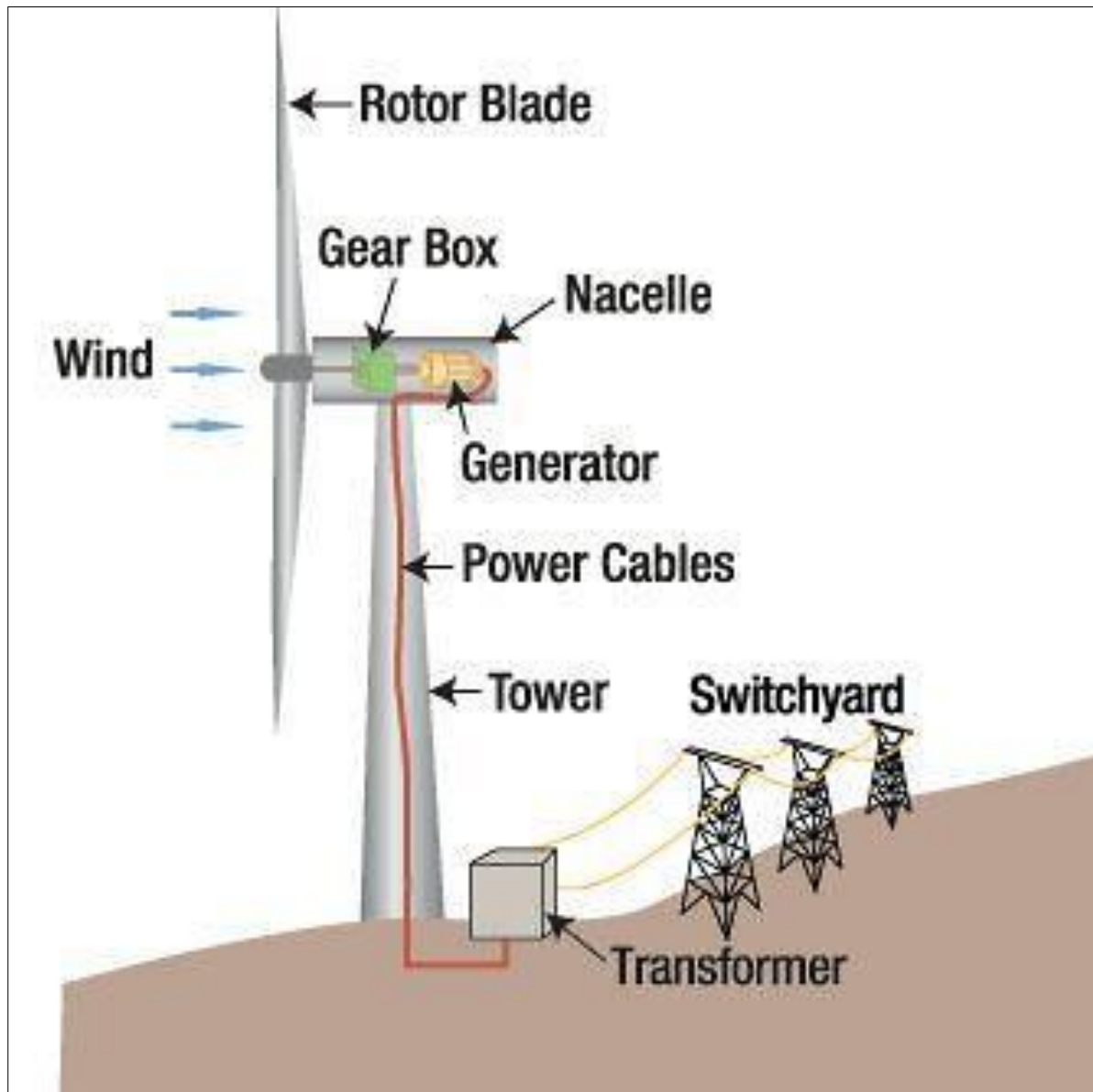


Figure 2.6: Typical Turbine Design (Source: Tennessee Valley Authority, Wikimedia)

¹⁷ Savannah Environmental (2022). Merino Wind Farm Northern Cape Province. EIA Report

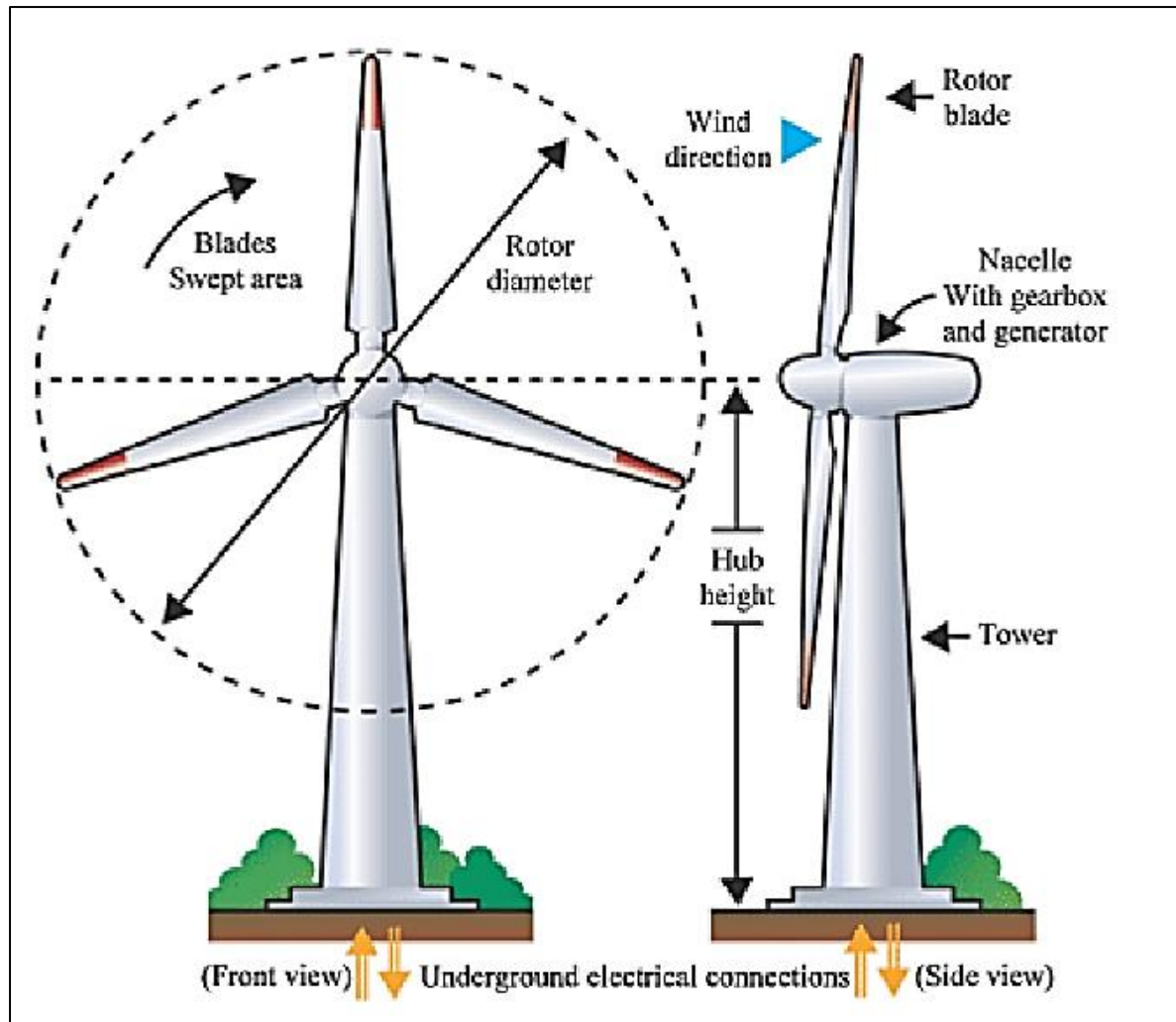


Figure 2.7: Front and Side View of a Typical Wind Turbine (<https://encyclopedia.pub/entry/37676>)

The components of a turbine¹⁸ include:

- The **foundation** which is a large, heavy structural block of concrete in the ground that supports the entire turbine and the forces acting on it.

¹⁸ <https://www.enelgreenpower.com/learning-hub/renewable-energies/wind-energy/wind-turbine>



Figure 2.8: Example of Typical Reinforced Concrete Spread Foundations for Wind Turbines (Preliminary Geotechnical and Environmental Geology Report, 2024)

- The **tower** is usually made of concrete or steel, although wood (which is generally considered less harmful to the environment) can also be used. The tower usually has three sections and is assembled on-site. Its height varies, but it is generally the same as the diameter of the circle that the blades create when they spin. The tower also contains the power cables that connect the nacelle to the transformer on the ground.



Figure 2.9: Example of Turbine Tower Establishment
(<https://www.heavyquipmag.com/2021/11/03/job-story-liebherr-lr-11000-crawler-crane-at-work-to-install-wind-turbines-in-austria/>)

- The **nacelle** is located on top of the tower and can turn 360° on its own axis, depending on the direction of the wind. It is named after the part of the wing of an airplane that contains the jet engines. It houses the key mechanical elements i.e., the gear box and generator.
- The **rotor** with two blades is cheaper and faster than three-blade rotors, but they are also noisier and they vibrate.
- The **hub**, as with the propellers on an airplane, the hub is the nose that points forward at the centre of the tower and where the blades are attached to it. The hub is connected to the mechanical parts in the nacelle, which is located behind it.
- The **blades** are located on top of the turbine. Wind causes the air pressure on one side of the blade to decrease and the difference from the other side creates both lift and drag: when the lift is stronger than the drag, the rotor will spin.



Figure 2.10: Turbine Nacelle, Hub and Blades (<https://www.enelgreenpower.com/learning-hub/renewable-energies/wind-energy/wind-turbine>)

There are two basic types of turbines¹⁹:

Horizontal-axis wind turbines are what many people picture when thinking of wind turbines.

Most commonly, they have three blades and operate "upwind," with the turbine pivoting at the top of the tower so the blades face into the wind.



Vertical-axis wind turbines come in several varieties, including the eggbeater-style Darrieus model, named after its French inventor.

These turbines are omnidirectional, which means that they don't need to be adjusted to point into the wind to operate.



The Applicant, AMDA Oscar (Pty) Ltd, proposes the use of the Horizontal-axis wind turbines.

2.4.3.2 Battery Energy Storage System (BESS)

A BESS is a type of energy storage power station that uses a group of batteries to store electrical energy. These battery containers will stand in a dedicated area next to each of the proposed on-site substations (i.e., east and west on-site substations).

Two (02) BESS technology alternatives are under consideration for the Carissa WEF. These include:

- Solid State Battery Electrolytes - Solid state battery electrolytes, such as lithium-ion (Li-ion), zinc hybrid cathode, sodium ion, flow (e.g., zinc iron or zinc bromine), sodium sulphur (NaS), zinc air and lead acid batteries, can be used for grid applications. Compared to other battery options, Li-ion batteries are highly efficient, have a high energy density and are lightweight. As a result of the declining costs, Li-ion technology now accounts for more than 90% of battery storage additions globally (IRENA, 2019).
- Redox-Flow Technology - Flow batteries use solid electrodes and liquid electrolytes. The most used flow battery is the Vanadium Redox Flow Battery (VRFB), which is a type of rechargeable flow battery that employs vanadium ions in different oxidative states to store chemical potential energy.

The BESS is considered a key element in modern day energy systems making it a versatile technology alternative that can operate in various network configurations and structural set ups, such as (Eskom BESS guideline brochure, 2023):

- On-grid which refers to being connected to the main electrical grid where the BESS can provide services such as load balancing and frequency regulation.
- Off-grid which refers to BESS being the primary source of power, often combined with renewable energy sources like solar or wind, to supply electricity in remote areas or during grid outages.
- Centralised setup systems which refer to a large BESS being located at a central point and provide services to the surrounding area.
- Decentralised setup system which refers to smaller BESS units that can be distributed across various locations for example in residential or commercial buildings to enhance the local power quality and grid stability.

A typical BESS comprises of several components that work together to enable functionality which include:

Battery Packs

- Units that house multiple rechargeable batteries, efficiently storing and releasing energy

Inverter

- Converts battery output (DC) into usable alternating current (AC) for devices and grid connection

Battery Management System

- Monitors and manages battery performance, charge state, and health, ensuring safety and optimal operation

¹⁹ <https://www.energy.gov/eere/wind/how-do-wind-turbines-work#type>

<u>Cooling and Thermal Management</u> <ul style="list-style-type: none"> • Maintains safe battery operating temperatures by managing heat generated during charging and discharging
<u>Control System</u> <ul style="list-style-type: none"> • Maintains safe battery operating temperatures by managing heat generated during charging and discharging
<u>Energy Management System</u> <ul style="list-style-type: none"> • Analyses real-time data, energy prices, and grid conditions to optimise BESS operation for maximum efficiency and cost-effectiveness
<u>DC-DC Converters</u> <ul style="list-style-type: none"> • In certain configurations, these devices manage voltage levels for efficient energy transfer between components
<u>Enclosure and Safety Systems</u> <ul style="list-style-type: none"> • Provides physical protection against environmental factors and implements safety measures to prevent hazards like thermal runaway and fires
<u>Monitoring and Control Interfaces</u> <ul style="list-style-type: none"> • Allows real-time monitoring and adjustment of BESS performance and parameters
<u>Grid Connection and Power Electronics</u> <ul style="list-style-type: none"> • Facilitates BESS interaction with the grid, delivering services such as frequency regulation, voltage support, and demand response
<u>Communication Systems</u> <ul style="list-style-type: none"> • Enables communication with external entities, like grid operators, for coordinates and efficient operation

Batteries may be classified as either solid state or flow batteries. Solid state batteries use solid electrodes and electrolytes. Flow batteries on the other hand use solid electrodes and liquid electrolytes. The Developer proposes the implementation of solid-state batteries (Lithium-ion) as the preferred alternative.

Solid-State Vs Flow Batteries

Solid state batteries have a greater energy density than flow batteries, they are more tolerant to high temperatures and don't store potentially flammable and toxic electrolytes as flow batteries do²⁰. Solid state batteries are self-contained and make use of either liquid, gel or solid-state electrolytes. The electrolyte used in solid-state batteries typically consist of chemicals such as Nickel Cadmium (NiCad), Lead Acid (Pb), Sodium Sulphur (NaS), Lithium-Ion (Li-ion) or Sodium Nickel Chloride / ZEBRA (NaNiCl). Coolants and refrigerants (tetrafluoroethane and ethylene glycol) are stored within sealed thermal

²⁰ SRK CONSULTING. 2021. Proposed Melkhout Battery Energy Storage System (BESS), Humansdorp, Eastern Cape. Final Basic Assessment Report.

management systems within the batteries²¹. The compression of the anode, cathode and electrolyte produces the added benefit of taking up less space than a flow battery. Risks associated with solid state batteries include the accidental spillage of electrolyte, which is hazardous and may contaminate soil and ground- and/or surface water. The batteries, however, consist of a closed system with primary and secondary containment and a monitoring system.

Lithium-Ion Battery Technology (Alternative 1 – Preferred)

Lithium-ion (Li-ion) with Lithium iron phosphate technology, is one of the leading technologies and has been considered further in this Scoping and EIA Process. The Li-ion technology is currently the most widely used and assessed battery storage technology available.

Lithium-ion batteries get their name from the transfer of lithium ions between the electrodes, both when energy is injected for storage purposes and when it is extracted. Within the lithium family there are a variety of different chemistries and designs from numerous suppliers. Instead of metallic lithium, Li-ion batteries use lithiated metal oxides as the cathode, and carbon typically serves as the anode. Lithium-ion battery cells consist of a positive electrode and a negative electrode with a separator in between them. Lithium ions move between the two electrodes during charging and discharging while electrons are forced through external circuitry for generating or storing power. Lithium ions flow from the positive metal oxide electrode to the negative graphite electrode while the battery is charging. The ions flow in reverse when the battery is discharging²².

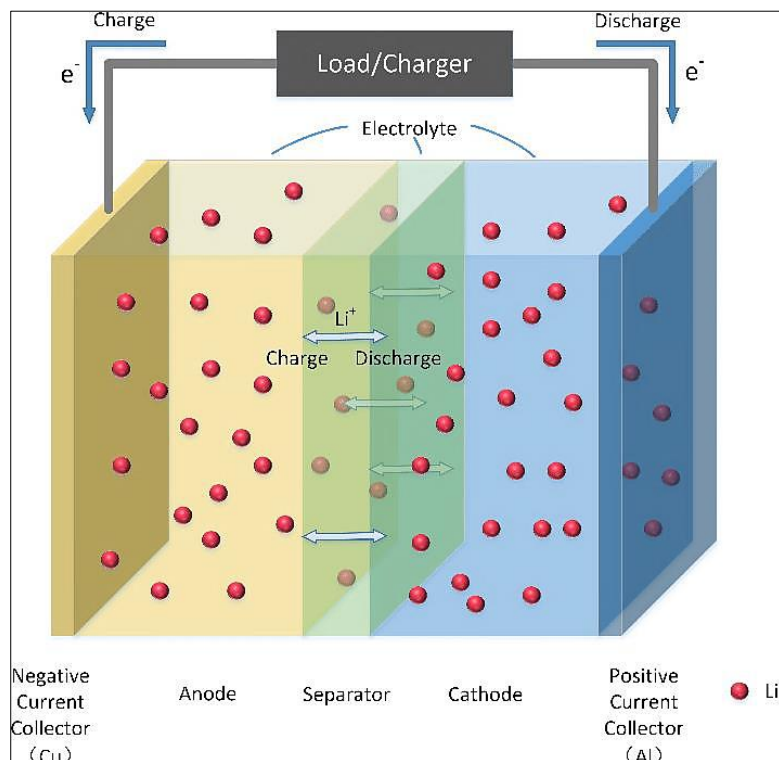


Figure 2.11: Illustration of a Typical Lithium-Ion Battery (Enviroworks, 2022)

The Lithium-Ion cells allows them to be constructed as modules and scaled. The battery packs can then be combined with inverters and controls systems and packaged into BESS at manufacturing facilities. The BESS can then be containerised and easily transported. The containerised BESS can be placed on a

²¹ ENVIROWORKS. 2022. Proposed Installation of the Battery Energy Storage System (BESS) at the Ashton Substation, Ashton, Langeberg Local Municipality, Western Cape Province. Draft Basic Assessment Report.

²² ENVIROWORKS. 2022. Proposed Installation of the Battery Energy Storage System (BESS) at the Ashton Substation, Ashton, Langeberg Local Municipality, Western Cape Province. Draft Basic Assessment Report.

simple foundation at a development site and electrically connected. Therefore, construction activities on site, as in the case of the current project, would entail developing associated infrastructure, such as foundations, for the containerised BESS which will be transported, installed, and connected on site.

Table 2.5: Advantages and Disadvantages of Lithium-Ion Battery Technology²³

Advantages	Disadvantages
<ul style="list-style-type: none"> • High level of energy efficiency. • Relatively high energy density. • Fast response to unpredictable variations in demand and generation. • Low maintenance. • Relatively long lifecycle (approximately 10 to 15 years' service life). • Ability to offset grid fluctuations. • Currently the most widely used BESS technology. 	<ul style="list-style-type: none"> • Fire risk due to thermal runaway. • High cost due to limited abundance in lithium. • Risk of annual degradation. • Battery protection is required. • Power and energy capacity directly coupled (expensive to scale).

Lithium-Ion batteries in particular offer lots of benefits compared to lead-acid batteries and other lithium batteries. These include²⁴:

- Longer life span
- No maintenance
- Extremely safe
- Lightweight
- Improved discharge and charge efficiency

Lithium-Ion batteries are more costly than most other batteries, however, their longer life span and zero maintenance requirements makes these batteries most desirable.

Based on the details and descriptions provided above, the Applicant prefers the implementation of **Solid-State battery technologies, such as Lithium-ion (Li-ion)**. No storage of electrolytes is required, and no on-site assembly of the BESS infrastructure will be undertaken.

Vanadium Redox Flow Battery (Alternative 2)

The vanadium redox flow battery uses the properties of vanadium in different oxidation states. Vanadium has the property that it may exist in four different oxidation states in solution. This property of vanadium is used to make the battery. The benefit of this battery is that it is rechargeable. The operating temperature of these batteries is low. They are very bulky but have a lower relative cost. They are used in power management, pumps, grid energy storage²⁵.

Zinc-Hybrid Ion Battery (Alternative 3)

Zinc-hybrid batteries utilise abundant, inexpensive, and non-flammable materials. Zinc-hybrid batteries use electricity from the grid to split zincate into zinc, water, and oxygen. This splitting charges the zinc particles, which can store electricity for weeks at a time. When electricity is needed, the charged zinc is

²³ CES. 2020. Proposed Dassiesridge Battery Energy Storage System Near Uitenhage, Eastern Cape Province. Final Basic Assessment Report

²⁴ <https://www.super-b.com/en/lithium-iron-phosphate-batteries/benefits-lithium-batteries>

²⁵ <https://www.sciencedirect.com/topics/engineering/vanadium-redox-flow-battery>

combined with oxygen which simultaneously releases the stored electricity and produces more zincate. This zincate is recycled and used to begin the process over again.

The battery is comprised of three parts²⁶:

- Zinc Regenerator – Generates charged zinc particles.
- Storage Tank – Holds the potassium hydroxide electrolyte and charged zinc.
- Power Stack – A fuel cell that turns the zinc back to zincate and delivers the charge back to the grid.

Zinc-ion batteries will become a lower-cost alternative to lithium-ion. Paired with their long service life, this will allow zinc-ion batteries to offer a far lower cost of storage than can be achieved with lithium-ion today²⁷.

Considering the nature of the project, any of three (03) battery technologies mentioned above would be envisaged for implementation.

AMDA Oscar (Pty) Ltd is most likely to locate the BESS in a single dedicated area standing next to the on-site facility substation should this be deemed feasible from an engineering perspective.

2.4.4 'Do-Nothing' Alternative

This alternative considers the option of 'do nothing' and maintaining the status quo of the affected environment. The description provided in section 7 of this report could be considered the baseline conditions (*status quo*) to persist should the no-go / 'do nothing' alternative be preferred. The site / development area is currently zoned for agricultural land uses. Should the proposed activity not proceed, the site will remain unchanged and will continue to be used for the current land uses present. The area associated with the development area has limited agricultural potential with natural grazing. The potential opportunity costs in terms of alternative land use income through rental for the energy facility and the supporting social and economic development in the area would be lost if the *status quo* persists.

It must also be noted that an opportunity will be lost to contribute to the Green Hydrogen National Program forms part of the Energy Strategic Integrated Project No. 20e, which was gazetted by Honourable Minister Patricia De Lille in Government Gazette 437658 on 6 December 2022. These projects are classified as Strategic Integrated Projects (SIP) and are to be managed within the requirements as set out in the Infrastructure Development Act (Act No. 23 of 2014) and its amendments.

Further to the above, the 'do-nothing' alternative is not a preferred alternative, because if the wind energy facility is not developed the following positive impacts will also 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.
- Potential economic upliftment and growth for the communities located in the surrounding area where goods and services will be utilised during the construction and operation phases of the Carissa WEF.
- Meeting of future demand for additional generation in a most economic and rapid manner.

²⁶ <https://www.energytech.com/energy-storage/article/21274212/energy-innovation-exploring-iron-air-and-zinc-hybrid-batteries-as-lithium-ion-alternatives>

²⁷ <https://www.powermag.com/zinc-ion-batteries-are-a-scalable-alternative-to-lithium-ion/>

- Provision of clean, renewable energy in an area where the renewable energy resource is optimally available.

2.5 Project Development Phases and Services Required

This section provides an indication of the activities to be undertaken within the different development phases of the project as well as the services that will be required. Refer to Table 2.6.

Table 2.6: Summary of the Activities to be Undertaken in the Development Phases

Design and Pre-Construction Phase	<ul style="list-style-type: none"> • Post-authorisation factors influence the final design of the facility and therefore small-scale modifications such as turbine micro-siting are expected. • The EPC Contractor, responsible for the overall construction of the project, will attempt to comply with the approved facility design as far as possible. However, the construction process is dynamic and unforeseen changes to the project specifications may take place. • Prior to construction commencement, surveys will be required including, but not limited to confirmation of the micro-siting footprint (i.e., the precise location of the turbine placement, substations and the plant's associated infrastructure) and a geotechnical survey. • Geotechnical surveys are executed by geotechnical engineers and geologists with the purpose to design earthworks and foundations for structures and to execute earthwork repairs necessitated due to changes in the subsurface environment.
Construction Phase	<ul style="list-style-type: none"> • The majority of the labour force is expected to be sourced from the surrounding towns, and no labour will be accommodated on-site during the construction period. This is however dependent on the availability of the required skills in the area. • At the peak of construction, the proposed project is likely to create a maximum of 1 500 employment opportunities. These employment opportunities will be temporary, and will last for a period of up to 24 months (i.e., the length of construction). • Employment opportunities generated during the construction phase will include low skilled, semi-skilled, and skilled opportunities. • Employment opportunities for the proposed WEF will peak during the construction phase and significantly decline during the operation phase. • Access to the site will be established for the construction of the facility. Within the facility development footprint itself, access will be required from new / existing roads for construction purposes (and limited access for maintenance during operation). • Site preparation activities will include clearance of vegetation. These activities will require the stripping of topsoil which will need to be stockpiled, backfilled and / or spread on site. • The use of local borrow-pits may be required. • The national, regional, secondary and proposed internal access roads will be used to transport all components and equipment required during the construction phase of the facility. Some of the components (i.e., substation transformer and turbines) may be defined as abnormal loads in terms of

	<p>the National Road Traffic Act (No. 93 of 1996) (NRTA)²⁸ by virtue of the dimensional limitations.</p> <ul style="list-style-type: none"> • Laydown and storage areas will be required for typical construction equipment. Once the required equipment has been transported to site, a dedicated equipment construction camp and laydown area will need to be established adjacent to the workshop area. The laydown area will be used for the general placement / storage of construction equipment as well as the storage of wind components including cranes required for the erection and assembly of the turbines. • Installation of the turbines and structural and electrical infrastructure will be undertaken that is required for the operation of the facility. • For turbine establishment, a crane hard stand is required at each turbine location. Concrete foundations will also need to be constructed at each turbine location to support a mounting ring. The type of concrete foundations will be influenced by the site geotechnical conditions. • The Battery Energy Storage System will be installed as per the factory instructions. • The establishment of the auxiliary infrastructure (including the substations) and support buildings will require the clearing of vegetation and levelling of the development site, and the excavation of foundations prior to construction. Laydown areas for building materials and equipment associated with these buildings will also be required. • A power line is constructed by surveying the power line route / corridor, constructing foundations for the towers, installing the towers, stringing the conductors, and finally rehabilitating disturbed areas and protecting erosion sensitive areas. • Once construction is completed and all construction equipment has been removed, the site will be rehabilitated where practical and reasonable. In addition, on full commissioning of the wind energy facility, any access points which are not required during operation must be closed and rehabilitated accordingly.
Operation Phase	<ul style="list-style-type: none"> • The facility is expected to operate for a minimum of 25 years. • The facility will operate continuously, 7 days a week. • While the facility will be largely self-sufficient, monitoring and periodic maintenance activities will be required. Key elements of the Operation and Maintenance (O&M) plant include monitoring and reporting the performance of the facility, conducting preventative and corrective maintenance, receiving visitors, and maintaining security. • Up to 100 permanent staff and additional contractors (number varies) for temporary ad hoc maintenance will be required.
Decommissioning Phase	<ul style="list-style-type: none"> • The economic viability of the facility following the initial 25-year operational lifespan, will determine if the facility will be decommissioned or the operational phase will be extended. • If it is deemed financially viable to extend the operational phase, existing components would either continue to operate, or be dissembled and

²⁸ A permit will be required in accordance with Section 81 of the NRTA which pertains to vehicles and loads which may be exempted from provisions of the Act.

	<p>replaced with new, more efficient technology / infrastructure available at the time. This replacement will be within the ambit of the Environmental Authorisation.</p> <ul style="list-style-type: none"> • Site preparation activities include confirming the integrity of the access to the site to accommodate the required decommissioning equipment. • The equipment to be removed will depend on the land use proposed for the site at the time. • All above ground facilities that are not intended for future use at the site will be removed. Much of the above ground wire and steel, are recyclable materials and would be recycled to the extent feasible. • The site will be rehabilitated and can be returned to agriculture or another beneficial land-use, to be determined through consultation with the affected landowner.
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Specific services will be required during all phases of the development. This includes water provision, stormwater management, sanitation, waste management and electricity. These are discussed in the sections below.

1. Water Provision

Adequate provision of water will be a prerequisite for the development. Four (04) options will be considered, in order of priority by the Developer:

- a. Water will be supplied from the Local Municipality (LM). The Applicant / Developer will approach the LM to enquire whether they can provide all or part of the total water requirements of the Project. Specific arrangements will be agreed with the LM in a Service Level Agreement (SLA), following the receipt of the EA.
- b. An existing borehole(s) on site, subject to the National Water Act (NWA) requirements.
- c. A new borehole(s) on site, subject to NWA requirements.
- d. Water supply from a Private Contractor, which may include extraction from any bulk water supply lines nearby to the site.

The estimated amount of water required during the 24-month construction phase is 249 810 m³. The estimated maximum amount of water required during the 25-year operational phase is 5 703 m³.

2. Stormwater Management

To avoid soil erosion, it is recommended that the clearing of vegetation be limited. Stormwater management and mitigation measures will be included in the Environmental Management Programme (EMPr) to be submitted as part of the EIA Report.

3. Sanitation

Chemical toilets will be utilised during the construction phase and removed / emptied by an appointed contractor for treatment at a licensed facility off site.

No effluent will be produced during operation of the facility, except for normal sewage from site and operations staff. This will be collected and treated as per best practice standards using a conservancy tank. Sewage may be stored in a conservancy tank and collected (honey-sucker) by a service provider, either the Local Municipality or a Private Contractor, and treated at an approved facility off site.

4. Waste Management

During the construction phase, solid waste will mainly be in the form of construction material, hazardous waste (i.e., fuel, grease, etc.), excavated substrate and domestic solid waste. All waste will be disposed of in scavenger proof bins and temporarily placed in a central location for removal by an appointed contractor to be disposed into a registered landfill site. Where possible the re-use and recycling of waste material will be encouraged. Any other waste and excess material will be removed once construction is complete and disposed of at a registered waste facility. Once the S&EIA process is concluded, the Applicant will request confirmation from the municipality that they have sufficient capacity at the registered landfills for the solid waste.

During the operational phase household waste will be removed to a licensed landfill site by a private contractor or by the local municipality particularly where re-use and recycling is not practical.

5. Electricity Provision

Electricity supply during construction will be provided by either on-site diesel generators or arranged with the Local Municipality or Eskom Distribution, via an existing or new 11 kV or 22 kV power line.

During operation, the electricity will be supplied by the WEF / via the main grid connection or via the installed construction supply. Efficient electricity appliances will be used as far as possible on site. Where possible, borehole pumps will be powered by the WEF.

2.6 Legal Requirements Complied with in Section 2 as per the Requirements of the EIA Regulations, 2014 (as amended)

This section of the report includes the following information required in terms of Appendix 2: Content of the scoping report:

Requirement	Relevant Section
2(b) the location of the activity, including (i) the 21-digit Survey General code of each cadastral land parcel; (ii) where available, the physical address and farm name, (iii) where the required information in items (i) and (ii) is not available, the coordinates of the boundary of the property or properties.	The details of the location of the Carissa WEF is included in section 2.1. This includes the relevant Survey General codes of the affected properties.
2(c) a plan which located the proposed activity or activities applied for 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 draft / preliminary layout plan considered as part of the Scoping Phase is discussed and included in section 2.4.1. The formal map is also included as Figure H2.
2(d) a description of the scope of the proposed activity, including (ii) a description of the activities to be undertaken, including associated structures and infrastructure.	The details of the infrastructure proposed to be developed is fully described in section 2.2. A description of the activities to be undertaken for the various development phases is included in section 2.5.

Requirement	Relevant Section
2(g) a full description of the process followed to reach the proposed preferred activity, site and location of the development footprint within the site, including (i) details of all the alternatives considered, (ix) the outcome of the site selection matrix; (x) if no alternatives, including alternative locations for the activity were investigated, the motivation for not considering such and (xi) a concluding statement indicating the preferred alternatives, including preferred location of the activity	The site selection process followed by the Applicant is described in section 2.3. The details of all alternatives considered as part of this final Scoping Report is included and described in section 2.4.

3 POLICY AND LEGISLATIVE CONTEXT

This section provides an overview of the policy and legislative context considering the nature of the proposed development and the area within which the Carissa WEF is proposed. The section further identifies the relevant legislation, policies, plans, guidelines, spatial tools, municipal development planning frameworks, and instruments that may be relevant to the Carissa WEF.

3.1 National, Provincial and Local Policy and Planning Context

Environmental decision making with regards to wind energy facilities is based on numerous policy and legislative documents on national, provincial and local level. These documents inform decisions on project level environmental authorisations issued by the National Department of Forestry, Fisheries and the Environment (DFFE) as well as comments from local and district authorities. Moreover, it is significant to note that they also inform strategic decision making reflected in the IDPs and SDFs.

The following acts and policies and their applicability to the proposed development are briefly summarised:

National Level:

- The Constitution of the Republic of South Africa, 1996 (Act No. 108 of 1996).
- National Environmental Management Act, 1998 (Act No. 107 of 1998) [NEMA].
- The National Energy Act, 2008 (Act 34 of 2008).
- Electricity Regulation Act (Act No. 4 of 2006) (as amended).
- National Water Act, 1998 (Act No. 36 of 1998).
- National Environmental Management: Biodiversity Act (10 of 2004) (NEMBA).
- National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008).
- National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004).
- The National Heritage Resources Act, 1999 (Act No. 25 of 1999).
- Conservation of Agricultural Resources Act, 1983 (Act No. 85 of 1983).
- Subdivision of Agricultural Land Act (70 of 1970) (SALA).
- Spatial Planning and Land Use Management Act, 2013 (Act 16 of 2013). (SPLUMA).
- The National Forests Act, 1998 (Act 84 of 1998).
- The National Road Traffic Act (93 of 1996) (NRTA).
- The White Paper on the Energy Policy of the Republic of South Africa (1998).
- The White Paper on Renewable Energy (2003).
- Integrated Resource Plan (IRP) for South Africa (2010-2030).
- National Development Plan of 2030.
- National Infrastructure Plan of South Africa (2012).
- New Growth Path Framework (2010).
- Climate Change Bill (2018).
- Climate Change Bill (2021) – for public comment.
- Strategic Integrated Projects (SIPs) (2010 – 2030).
- Strategic Environmental Assessment (SEA) for wind and solar PV Energy in South Africa (2014).
- Astronomy Geographic Advantage Act (Act No. 21 of 2007)
- Aviation Act (Act No 74 of 1962) 13th amendment of the Civil Aviation Regulations (CARS) 1997

Provincial Level:

- Western Cape Provincial Strategic Plan 2019 – 2024 (2019)
- Western Cape Provincial Spatial Development Framework 2020
- Western Cape Climate Change Response Strategy: Vision 2050 (2022)

District Level:

- Central Karoo District Municipality Integrated Development Plan 2023-2024 (2023)
- Central Karoo District Municipality Spatial Development Framework 2019 (2019)

Local Level:

- Beaufort West Local Municipality Integrated Development Plan (5th Generation Review) 2022-2027 (2023)
- Beaufort West Local Municipality Spatial Development Framework 2022/2023 (2022)
- Prince Albert Local Municipality 2024-2025 Final Amended Integrated Development: Fifth Generation 2022-2027
- Prince Albert Local Municipality Spatial Development Framework (2021)

The key principles and objectives of each of the legislative and policy documents are briefly summarised in Tables 3.1 and 3.2 below to provide a reference framework for the implications for the proposed wind development.

3.2 International Policy and Planning Context

Further to the above the policy and planning context on an international level is briefly considered.

1. United Nations Framework Convention on Climate Change (UNFCCC) and Conference of the Party (COP)

Climate change is one of the major global challenges of the 21st century that require global response. The adverse impacts of climate change include persistent drought and extreme weather events, rising sea levels, coastal erosion and ocean acidification, further threatening food security, water, energy and health, and more broadly efforts to eradicate poverty and achieving sustainable development. Combating climate change would require substantial and sustained reductions in GHG emissions, which together with adaptation, can limit climate change risks. The convention responsible for dealing with climate change is the United Nations Framework Convention on Climate Change (UNFCCC).

The UNFCCC was adopted in 1992 and entered into force in 1994. It provides the overall global policy framework for addressing the climate change issue and marks the first international political response to climate change. The UNFCCC sets out a framework for action aimed at stabilising atmospheric concentrations of Greenhouse Gases (GHGs) to avoid dangerous anthropogenic interference with the climate system.

The UNFCCC has established a variety of arrangements to govern, coordinate and provide for oversight of the arrangements described in the documentation. The oversight bodies take decisions, provide regular guidance, and keep the arrangements under regular review in order to enhance and ensure their effectiveness and efficiency. The Conference of Parties (COP), established by Article 7 of the Convention, 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.

At the Sharm el-Sheikh Climate Change Conference (COP27), countries came together to take action towards achieving the world's collective climate goals as agreed under the Paris Agreement and the Convention. The conference took place from 6-20 November 2022 in Sharm el-Sheikh, Egypt.

Five key takeaways from the conference have been identified which will shape the priorities from climate action in 2023 and beyond. These are indicated below:

1. *Establishing a dedicated fund for loss and damage* – An agreement was made to provide loss and damage funding for vulnerable countries hit hard by floods, droughts and other climate disasters. This is in order to enable countries to have financial capacity to respond to loss and damage associated with catastrophic effects of climate change.
2. *Maintaining a clear intention to keep 1.5°C within reach* – The UN's Intergovernmental Panel on Climate Change indicates that limiting warming to around 1.5°C requires global greenhouse gas emissions to peak before 2025 at the latest, and be reduced by 43% by 2023. However, current projections show that the world is off course to keep 1.5°C in reach.
3. *Holding businesses and institutions to account* – There is new focus on accountability when it comes to the commitments made by sectors, businesses and institutions.
4. *Mobilizing more financial support for developing countries* – Finance is key to combat climate change. Mitigation, adaptation, loss and damage and climate technology requires sufficient funds to function properly and yield the desired results. COP27 created a pathway to align the broader finance flows towards low emissions and climate resilient development.
5. *Making the pivot toward implementation* – COP27 was expected to focus on implementation for “every corner of human activity”.

The COP 28 UN Climate Change Conference in Dubai, the United Arab Emirates, was the biggest of its kind- which ran from 30 November to 13 December 2023. COP 28 was particularly momentous as it marked the conclusion of the first ‘global stocktake’ of the world’s efforts to address climate change under the Paris Agreement. Having shown that progress was too slow across all areas of climate action, from reducing greenhouse gas emissions, to strengthening resilience to a changing climate, to getting the financial and technological support to vulnerable nations, countries responded with a decision on how to accelerate action across all areas by 2030. This includes a call on governments to speed up the transition away from fossil fuels to renewables such as wind and solar power in their next round of climate commitments. Among other things, the decision also calls on parties to contribute, in a nationally-determined manner, to global efforts on:

- Tripling renewable energy capacity globally and doubling the global average annual rate of energy efficiency improvements by 2030;
- Accelerating efforts towards the phase down of unabated coal power;
- Accelerating efforts globally towards net zero emission energy systems, utilising zero- and low-carbon fuels well before or by around mid-century;
- Transitioning away from fossil fuels in energy systems, in a just, orderly, and equitable manner, accelerating action in this critical decade, so as to achieve net zero by 2050 in keeping with the science;
- Accelerating zero and low-emission technologies, including, inter alia, renewables, nuclear, abatement and removal technologies such as carbon capture and utilisation and storage, particularly in hard-to-abate sectors, and low-carbon hydrogen production;
- Accelerating and substantially reducing non-carbon-dioxide emissions globally including, in particular, methane emissions by 2030;

- Accelerating the reduction of emissions from road transport on a range of pathways, including through development of infrastructure and rapid deployment of zero and low-emission vehicles; and
- Phasing out inefficient fossil fuel subsidies that do not address energy poverty or just transitions, as soon as possible.

2. The Equator Principles IV (July, 2020)

The Equator Principles (EPs) IV constitute a financial industry benchmark used for determining, assessing, and managing a project's environmental and social risks. The EPs are primarily intended to provide a minimum standard for due diligence to support responsible risk decision-making. In addition, these principles are used to ensure that projects financed by the Equator Principles Financial Institutions (EPFI) are developed in a manner that is socially responsible and reflects sound environmental management practices. The EPs are applicable to infrastructure projects (such as the proposed project) and apply globally to all industry sectors.

The EPs comprise the following principles:

Principle 1: Review and Categorisation

Principle 2: Environmental and Social Assessment.

Principle 3: Applicable Environmental and Social Standards.

Principle 4: Environmental and Social Management System and Equator Principles Action Plan

Principle 5: Stakeholder Engagement

Principle 6: Grievance Mechanism

Principle 7: Independent Review

Principle 8: Covenants

Principle 9: Independent Monitoring and Reporting

Principle 10: Reporting and Transparency

When a project is proposed for financing, the Equator Principle Financial Institution (EPFI) will categorise it based on the magnitude of its potential environmental and social risks and impacts.

Projects can be categorised as follows:

- **Category A:** Projects with potential significant adverse environmental and social risks and / or impacts that are diverse, irreversible or unprecedented.
- **Category B:** Projects with potential limited adverse environmental and social risks and / or impacts that are few in number, generally site-specific, largely reversible and readily addressed through mitigation measures.
- **Category C:** Projects with minimal or no adverse environmental and social risks and / or impacts.

Based on the above-mentioned criteria, the Carissa WEF can be anticipated to be categorised as a Category B project.

Category A and Category B projects require that an assessment process be conducted to address the relevant environmental and social impacts and risks associated with the project. Such an assessment may include the following where applicable:

- An assessment of the baseline environmental and social conditions.
- Consideration of feasible environmentally and socially preferable alternatives.
- Requirements under host country laws and regulations, applicable international treaties and agreements.
- Protection and conservation of biodiversity (including endangered species and sensitive ecosystems in modified, natural and Critical Habitats) and identification of legally protected areas.
- Sustainable management and use of renewable natural resources (including sustainable resource management through appropriate independent certification systems).
- Use and management of dangerous substances.
- Major hazards assessment and management.
- Efficient production, delivery and use of energy.
- Pollution prevention and waste minimisation, pollution controls (liquid effluents and air emissions), and solid and chemical waste management.
- Viability of project operations in view of reasonably foreseeable changing weather patterns / climatic conditions, together with adaptation opportunities.
- Cumulative impacts of existing projects, the proposed project, and anticipated future projects.
- Respect of human rights by acting with due diligence to prevent, mitigate and manage adverse human rights impacts.
- Labour issues (including the four core labour standards), and occupational health and safety.
- Consultation and participation of affected parties in the design, review and implementation of the project.
- Socio-economic impacts.
- Impacts on affected communities, and disadvantaged or vulnerable groups.
- Gender and disproportionate gender impacts.
- Land acquisition and involuntary resettlement.
- Impacts on indigenous peoples, and their unique cultural systems and values.
- Protection of cultural property and heritage.
- Protection of community health, safety and security (including risks, impacts and management of Project's use of security personnel).
- Fire prevention and life safety.

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 Project. In terms of the EPs, South Africa is a non-designated country (as at 04 March 2020), 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.

Carissa WEF is under assessment in accordance with the requirements of the EIA Regulations 2014, as amended (GN.R. 326), published in terms of Section 24(5) of NEMA, which is South Africa's national

legislation providing for the authorisation of certain listed activities. Through this assessment, all potential social and environmental risks are identified and assessed, and appropriate mitigation measures proposed.

3. IFC's Performance Standards on Environmental and Social Sustainability (January 2012)

The IFC's Performance Standards on Environmental and Social Sustainability were developed by the IFC and were last updated on 01 January 2012. The overall objectives of the IFC Performance Standards are:

- To fight poverty;
- To do no harm to people or the environment;
- To fight climate change by promoting low carbon development;
- To respect human rights;
- To Promote gender equity;
- To provide information prior to project development, free of charge and free of external manipulation;
- To collaborate with the project developer to achieve the PS;
- To provide advisory services; and
- To notify countries of any Trans boundary impacts as a result of a project.

The Performance Standards comprise the following:

Performance Standard 1:	Assessment and Management of Environmental and Social Risks and Impacts.
Performance Standard 2:	Labour and Working Conditions.
Performance Standard 3:	Resource Efficiency and Pollution Prevention.
Performance Standard 4:	Community Health, Safety and Security.
Performance Standard 5:	Land Acquisition and Involuntary Resettlement.
Performance Standard 6:	Biodiversity Conservation and Sustainable Management of Living Natural Resources.
Performance Standard 7:	Indigenous Peoples.
Performance Standard 8:	Cultural Heritage.

Performance Standard 1 establishes the importance of:

- i) Integrated assessment to identify the social and environmental impacts, risks, and opportunities of projects.
- ii) Effective community engagement through disclosure of project-related information and consultation with local communities on matters that directly affect them.
- iii) The management of social and environmental performance throughout the life of a project through an effective Environmental and Social Management System (ESMS).

Performance Standard 1 requires that a process of environmental and social assessment be conducted, and an ESMS appropriate to the nature and scale of the project and commensurate with the level of its

environmental and social risks and impacts be established and maintained. Performance Standard 1 is the overarching standard to which all the other standards relate. Performance Standard 2 through 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, Performance Standard 2 through 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 Carissa WEF it is anticipated at this stage of the S&EIA process that Performance Standards 1, 2, 3, 4, 6, and 8 may be applicable to the development.

Table 3.1: Legislative Context Relevant to Carissa WEF

Legislation and Relevant Authority	Summary and Relevance for the Development
<p>The Constitution of South Africa (Act No. 108 of 1996)</p> <p>Administering Authority:</p> <p>National Government</p>	<p>The Constitution is the supreme law of the Republic and all law and conduct must be consistent with the Constitution. The Chapter on the Bill of Rights contains a number of provisions, which are relevant to securing the protection of the environment. Section 24 states that “everyone has the right to (a) an environment that is not harmful to their health or well-being and (b) to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that – (i) prevent pollution and ecological degradation; (ii) promote conservation; and (iii) secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development. The Constitution therefore, compels government to give effect to the people’s environmental right and places government under a legal duty to act as a responsible custodian of the country’s environment. It compels government to pass legislation and use other measures to protect the environment, to prevent pollution and ecological degradation, promote conservation and secure sustainable development.</p> <p>The development of the Carissa WEF and the aspects related thereto considers the creation of an environment which is not harmful or degraded through the implementation of appropriate mitigation measures.</p>
<p>The National Environmental Management Act (Act No. 107 of 1998)</p> <p>Administering Authority:</p> <p>National Department of Environmental Affairs (now known as the Department of Forestry, Fisheries and the Environment) and the Western Cape Province</p>	<p>NEMA provides for co-operative governance by establishing principles and procedures for decision-makers on matters affecting the environment. An important function of the Act is to serve as an enabling Act for the promulgation of legislation to effectively address integrated environmental management. Some of the principles in the Act are accountability; affordability; cradle to grave management; equity; integration; open information; polluter pays; subsidiary; waste avoidance and minimisation; co-operative governance; sustainable development; and environmental protection and justice.</p> <p>The mandate for EIA lays with the National Environmental Management Act (107 of 1998) and the EIA Regulations No. 324, 325, 326, and 327 promulgated in terms of Section 24 of NEMA. The EIA Regulations determine that an Environmental Authorisation is required for certain listed activities, which might have a detrimental effect on the environment.</p> <p>The S&EIA process undertaken for the Carissa WEF is in-line with the requirements of NEMA for the Application for Environmental Authorisation.</p>

Legislation and Relevant Authority	Summary and Relevance for the Development
Department of Environmental Affairs & Development Planning (DEA&DP)	
The National Energy Act (Act No. 34 of 2008) Administering Authority: Department of Mineral Resources and Energy	<p>One of the objectives of the National Energy Act was to promote diversity of supply of energy and its sources. In this regard, the preamble makes direct reference to renewable resources, including wind: “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, taking into account environmental management requirements (...); to provide for (...) increased generation and consumption of renewable energies...” (Preamble).</p> <p>Considering that the Carissa WEF is proposed to make use of renewable energy technology and the wind resource for the generation of electricity, the proposed project is in-line with the Act.</p>
Electricity Regulation Act (Act No. 4 of 2006) (as amended) Administering Authority: National Energy Regulator of South Africa (NERSA)	<p>The Act provides a national regulatory framework for the electricity supply industry. The Act requires registration and licensing of anyone wanting to generate, transmit, reticulate, distribute, trade, or import and export electricity.</p> <p>One of the requirements for the REIPPPP is for the Proponent to hold an environmental authorisation for the proposed project. The REIPPPP is guided by the National Energy Act, one of the purposes of which is to promote sustainable development of renewable energy infrastructure.</p>
The National Water Act (Act No. 36 of 1998) Administering Authority: Department of Water Affairs (now known as	<p>Sustainability and equity are identified as central guiding principles in the protection, use, development, conservation, management and control of water resources. The intention of the Act is to promote the equitable access to water and the sustainable use of water, redress past racial and gender discrimination, and facilitate economic and social development. The Act provides the rights of access to basic water supply and sanitation, and environmentally, it provides for the protection of aquatic and associated ecosystems, the reduction and prevention of pollution and degradation of water resources.</p>

Legislation and Relevant Authority	Summary and Relevance for the Development
Department of Water and Sanitation)	<p>As this Act is founded on the principle that National Government has overall responsibility for and authority over water resource management, including the equitable allocation and beneficial use of water in the public interest, a person can only be entitled to use water if the use is permissible under the Act. Chapter 4 of the Act lays the basis for regulating water use.</p> <p>The feasibility of the activities related to the development of WEF facility and related gridline infrastructure were assessed. For the gridline infrastructure it was found that potential impacts on the freshwater aquatic features fall outside of the regulated area however, it is recommended that activities remain outside of the regulated buffers and adhered to all mitigation measures provided. The WEF development area could potentially contribute to aquatic disturbances and potential impacts that may deteriorate the overall ecoservices of the freshwater features during the construction phase. Refer to Appendix E2 for the aquatic ecological assessment report.</p>
<p>National Environmental Management: Biodiversity Act (10 of 2004) (NEMBA)</p> <p>Administering Authority:</p> <p>Department of Forestry, Fisheries and the Environment (DFFE)</p>	<p>"The Act calls for the management of all biodiversity within South Africa. The 2007 Threatened or Protected Species Regulations (GN.R. 150, as amended) provides protection through a permit system as well as through the identification of restricted activities. If required, the relevant permits will be applied for."</p> <p>The Act also provides for duty of care with regards to control of alien species.</p>
<p>National Environmental Management: Waste Act (Act No. 59 of 2008)</p> <p>Administering Authority:</p>	<p>NEMWA has been developed as part of the law reform process enacted through the White Paper on Integrated Pollution and Waste Management and the National Waste Management Strategy (NWMS). The objectives of the Act relate to the provision of measures to protect health, well-being and the environment, to ensure that people are aware of the impact of waste on their health, well-being and the environment, to provide for compliance with the measures, and to give effect to section 24 of the Constitution in order to secure an environment that is not harmful to health and well-being.</p> <p>Regulations No. R921 (of 2013) promulgated in terms of Section 19(1) of the National Environmental Management: Waste Act (59 of 2008) determines that no person may commence, undertake or conduct a waste management activity listed in this schedule</p>

Legislation and Relevant Authority	Summary and Relevance for the Development
Department of Forestry, Fisheries and the Environment (DFFE)	unless a license is issued in respect of that activity. It is not envisaged that a waste permit will be required for the proposed development as no listed activities in terms of waste management are expected to be triggered.
National Environment Management: Air Quality Act (Act No. 39 of 2004) Administering Authority: Department of Forestry, Fisheries and the Environment (DFFE)	<p>The objective of this Act is to protect the environment by providing reasonable measures for the protection and enhancement of the quality of air in the Republic; the prevention of air pollution and ecological degradation; and securing ecologically sustainable development while promoting justifiable economic and social development.</p> <p>Regulations No. R248 (of 31 March 2010) promulgated in terms of Section 21(1)(a) of the National Environmental Management Act: Air Quality Act (39 of 2004) determine that an Atmospheric Emission License (AEL) is required for certain listed activities, which result in atmospheric emissions which have or may have a detrimental effect on the environment. The Regulation also sets out the minimum emission standards for the listed activities. It is not envisaged that an Atmospheric Emission License will be required for the proposed development.</p>
The National Heritage Resources Act (Act No. 25 of 1999) Administering Authority: Heritage Western Cape	<p>The Act aims to introduce an integrated and interactive system for the management of heritage resources, to promote good governance at all levels, and empower civil society to nurture and conserve heritage resources so that they may be bequeathed to future generations and to lay down principles for governing heritage resources management throughout the Republic.</p> <p>The Act protects and manages certain categories of heritage resources in South Africa. For the purposes of the Heritage Resources Act, a “heritage resource” includes any place or object of cultural significance. In this regard the Act makes provision for a person undertaking an activity listed in Section 28 of the Act to notify the resources authority. The resources authority may request that a heritage impact assessment be conducted if there is reason to believe that heritage resources will be affected.</p> <p>Heritage Western Cape (HWC) is required to provide comment on the proposed project. In line with HWC requirements, a Notification of Intent to Develop (NID) has been submitted to the HWC for the proposed project. A Heritage Impact Assessment (HIA) and a Paleontological Impact Assessment (PIA) has been submitted to HWC. The Heritage Impact Assessment undertaken for the Carissa WEF is included as Appendix E9. According to the Palaeontological Impact Assessment (Appendix E10) a high palaeontological significance has been allocated for the construction phase of the Carissa WEF and associated infrastructure pre-mitigation and a medium significance post-mitigation.</p>

Legislation and Relevant Authority	Summary and Relevance for the Development
<p>Conservation of Agricultural Resources Act (Act No. 85 of 1983)</p> <p>Administering Authority:</p> <p>National and Provincial Government</p>	<p>The objective of the Act is to provide control over the utilisation of the natural agricultural resources of the Republic in order to promote the conservation of the soil, the water sources and the vegetation and the combating of weeds and invader plants; and for matters connected therewith.</p> <p>Consent will be required from the Department of Agriculture, Land Reform and Rural Development (DALRRD) in order to confirm agricultural sensitivity and to approve the long-term lease agreement. An agricultural agro-ecosystem specialist assessment has been provided for the Carissa WEF and included as Appendix E5. The assessment confirms high sensitivity as a result of cropping status, but only for small, isolated patches of cropland that will be avoided by the development infrastructure, anyway.</p> <p>According to the Agricultural Agri-Ecosystem Assessment (Appendix E5), rehabilitation after disturbance to agricultural land is managed by the Conservation of Agricultural Resources Act (Act 43 of 1983 - CARA). A consent in terms of CARA is required for the cultivation of virgin land. Cultivation is defined in CARA as “any act by means of which the topsoil is disturbed mechanically”. The purpose of this consent for the cultivation of virgin land is to ensure that only land that is suitable as arable land is cultivated. Therefore, despite the above definition of cultivation, disturbance to the topsoil that results from construction of infrastructure does not constitute cultivation as it is understood in CARA. This has been corroborated by Anneliza Collett (Acting Scientific Manager: Natural Resources Inventories and Assessments in the Directorate: Land and Soil Management of the Department of Agriculture, Land Reform and Rural Development (DALRRD)). The construction and operation of the facility will therefore not require consent from the Department of Agriculture, Land Reform and Rural Development in terms of this provision of CARA.</p>
<p>Subdivision of Agricultural Land Act (Act No. 70 of 1970) (SALA)</p> <p>Administering Authority:</p> <p>Department of Agriculture, Land Reform and Rural Development (DALRRD)</p>	<p>The purpose of this Act is to control the subdivision of agricultural land and, in connection therewith, the use of agricultural land. Applications are lodged with Department of Agriculture, Land Reform and Rural Development (DALRRD) to allow for the subdivision of agricultural land, as well as other prohibited actions in terms of the Act. An application for the change of land use (re-zoning) for the development on agricultural land will be lodged by the Project Applicant for approval in terms of the SALA as required.</p> <p>According to the Agricultural Agri-Ecosystem Assessment (Appendix E5), the development requires approval from the National Department of Agriculture, Land Reform and Rural Development (DALRRD) because it is on agriculturally zoned land. This approval is separate to the Environmental Authorisation. There are two (02) approvals that apply. The first is a <i>No Objection</i> Letter for the change in land use. This letter is one of the requirements for receiving municipal rezoning. This application requires</p>

Legislation and Relevant Authority	Summary and Relevance for the Development
	<p>a motivation backed by good evidence that the development is acceptable in terms of its impact on the agricultural production potential of the development site. The agricultural assessment report will serve that purpose.</p> <p>The second approval is a consent for long-term lease required in terms of the Subdivision of Agricultural Land Act (Act 70 of 1970) (SALA). SALA approval is not required if the lease is over the entire farm portion. If DALRRD approval for the development has already been obtained in the form of the No Objection letter, then SALA approval is likely to be readily forthcoming. SALA approval can only be applied for once the Municipal Rezoning Certificate and Environmental Authorisation has been obtained.</p> <p>Power lines require the registration of a servitude for each farm portion crossed. In terms of SALA, the registration of a power line servitude requires written consent of the Minister unless either of the following two (02) conditions apply:</p> <ol style="list-style-type: none"> 1. if the servitude width does not exceed 15 metres; and 2. if Eskom is the applicant for the servitude. <p>If one or both conditions apply, then no agricultural consent is required. The second condition is likely to apply. Eskom is currently exempt from agricultural consent for power line servitudes.</p>
<p>Spatial Planning and Land Use Management Act, 2013 (Act 16 of 2013) (SPLUMA)</p> <p>Administering Authority:</p> <p>Local and Provincial Authorities</p>	<p>This suite of legislation provides the framework for spatial planning and regulates the use and development of land.</p> <p>An application for the change of land use (re-zoning) for the development on agricultural land will be lodged by the Project Applicant for approval in terms of the SPLUMA as required.</p>
<p>The National Forests Act, 1998 (Act No. 84 of 1998)</p>	<p>The purpose of this Act is to:</p> <p>(a) promote the sustainable management and development of forests for the benefit of all;</p>

Legislation and Relevant Authority	Summary and Relevance for the Development
<p>Administering Authority:</p> <p>Department of Environmental Affairs (now known as the Department of Forestry, Fisheries and the Environment)</p>	<p>(b) create the conditions necessary to restructure forestry in State forests;</p> <p>(c) provide special measures for the protection of certain forests and trees;</p> <p>(d) promote the sustainable use of forests for environmental, economic, educational, recreational, cultural, health and spiritual purposes.</p> <p>(e) promote community forestry;</p> <p>(f) promote greater participation in all aspects of forestry and the forest products industry by persons disadvantaged by unfair discrimination.</p> <p>Section 12(1) read with S15(1) of the NFA stated that the Minister may declare a particular tree, group of trees, woodland; or trees belonging to a particular species, to be a protected tree, group of trees, woodland or species. A list of protected tree species was gazetted in GN.R. 635 of 06 December 2019. The effect of the declaration is that no person may (a) cut, disturb, damage or destroy; or (b) possess, collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree, or any forest product derived from a protected tree, except under a license granted by the Minister; or in terms of an exemption published by the Minister in the Gazette.</p> <p>A Terrestrial Biodiversity (including Plant and Animal Species) Impact Assessment Report has been undertaken for the Carissa WEF and is included in Appendix E1.</p>
<p>National Road Traffic Act (93 of 1996) (NRTA)</p> <p>Administering Authority:</p> <p>Department of Roads and Public Works</p>	<p>Certain vehicles and loads cannot be moved on public roads without exceeding the limitations in terms of the dimensions and/or mass as prescribed in the Regulations of the NRTA. Due to the large size of some of the facility's component, they will need to be transported via "abnormal loads".</p> <p>The site is accessible via the existing N12 National Road which runs through the middle of the development area and other public and provincial roads that are in close proximity to the site.</p>
<p>Astronomy Geographic Advantage Act (Act No. 21 of 2007)</p>	<p>The Astronomy Geographic Advantage (AGA) Act (No. 21 of 2007) provides for the preservation and protection of areas within South Africa that are uniquely suited for optical and radio astronomy; for intergovernmental co-operation and public consultation on matters concerning nationally significant astronomy advantage areas and for matters connected thereto.</p>

Legislation and Relevant Authority	Summary and Relevance for the Development
Administering Authority: South African Radio Astronomy Observatory (SARAO)	<p>Chapter 2 of the Act allows for the declaration of astronomy advantage areas whilst Chapter 3 pertains to the management and control of astronomy advantage areas. Management and control of astronomy advantage areas include, amongst others, the following:</p> <ul style="list-style-type: none"> • Restrictions on use of radio frequency spectrum in astronomy advantage areas • Declared activities in core or central astronomy advantage area • Identified activities in coordinated astronomy advantage area; and • Authorisation to undertake identified activities. <p>The development area proposed for the Carissa WEF falls outside of areas considered to be uniquely suited in terms of nationally significant astronomy advantage areas.</p>
Aviation Act (Act No 74 of 1962) 13th amendment of the Civil Aviation Regulations (CARS) 1997 Administering Authority: South African Civil Aviation Authority (CAA)	<p>Any structure exceeding 45 m above ground level or structures where the top of the structure exceeds 150 m above the mean ground level, the mean ground level considered to be the lowest point in a 3 km radius around such structure.</p> <p>Structures lower than 45 m, which are considered as a danger to aviation shall be marked as such when specified.</p> <p>Overhead wires, cables etc., crossing a river, valley or major roads shall be marked and in addition their supporting towers marked and lighted if an aeronautical study indicates it could constitute a hazard to aircraft.</p> <p>Section 14 of Obstacle limitations and marking outside aerodrome or heliport – CAR Part 139.01.33 relates specifically to appropriate marking of wind energy facilities.</p> <p>This Act will find application during the operational phase. Appropriate marking on the project infrastructure is required to meet the specifications as detailed in the CAR Part 139.01.33. An obstacle approval for the Carissa WEF is required to be obtained from the CAA.</p>

Legislation and Relevant Authority	Summary and Relevance for the Development
<p>The Environment Conservation Act (Act 73 of 1989)</p> <p>Administering Authority:</p> <p>Department of Environmental Affairs (now known as the Department of Forestry, Fisheries and the Environment)</p>	<p>The Environment Conservation Act (ECA) allows the Minister of Environment, Forestry and Fisheries to make regulations regarding noise, among other concerns. While most sections of this Act have been repealed with the promulgation of the NEMA, Section 25 of this Act is still in effect.</p> <p>Section 25 of the Environment Conservation Act (ECA) accommodates Regulations regarding noise, vibration and shock: The Minister may make regulations with regard to the control of noise, vibration and shock, concerning –</p> <ul style="list-style-type: none"> (a) the definition of noise, vibration and shock; (b) the prevention, reduction or elimination of noise, vibration and shock; (c) the levels of noise, vibration and shock which shall not be exceeded, either in general or by specified apparatus or machinery or in specified instances or places; (d) the type of measuring instrument which can be used for the determination of the levels of noise, vibration and shock, and the utilisation and calibration thereof; (e) the powers of provincial administrations and local authorities to control noise, vibration and shock; and (f) any other matter which he may deem necessary or expedient in connection with the effective control and combating of noise, vibration and shock. <p>A noise impact assessment has been undertaken for the proposed Carissa WEF which is in line with the requirements of the ECA. Refer to Appendix E8.</p>
<p>National Noise Control Regulations (GN R154 of 1992)</p> <p>Administering Authority:</p> <p>Department of Environmental Affairs (now known as the Department of Forestry,</p>	<p>The Noise Control Regulations (NCR) were promulgated in terms of section 25 of the ECA. The NCRs were revised under Government Notice Number R. 55 of 14 January 1994 to make it obligatory for all authorities to apply the regulations.</p> <p>Subsequently, in terms of Schedule 5 of the Constitution of South Africa of 1996 legislative responsibility for administering the noise control regulations was devolved to provincial and local authorities. Provincial noise control regulations exist in the Free State, Gauteng and Western Cape provinces.</p> <p>A noise impact assessment has been undertaken for the proposed Carissa WEF which is in line with the requirements of the ECA. Refer to Appendix E8.</p>

Legislation and Relevant Authority	Summary and Relevance for the Development
Fisheries and the Environment)	

Table 3.2: Policy Context Relevant to the Carissa WEF

Policy and Relevant Authority	Summary and Relevance for the Development
<p>The White Paper on the Energy Policy of the Republic of South Africa (1998)</p> <p>Administering Authority:</p> <p>Department of Mineral Resources and Energy (DMRE)</p>	<p>The White Paper on the Energy Policy of the Republic of South Africa establishes the international and national policy context for the energy sector, and identifies the following energy policy objectives:</p> <ul style="list-style-type: none"> • Increasing access to affordable energy services • Improving energy governance • Stimulating economic development • Managing energy-related environmental and health impacts • Securing supply through diversity • Energy policy priorities <p>The White Paper sets out the advantages of renewable energy and states that Government believes that renewables can in many cases provide the least cost energy service, particularly when social and environmental costs are included. The White Paper acknowledges that South Africa has neglected the development and implementation of renewable energy applications, despite the fact that the country's renewable energy resource base is extensive, and many appropriate applications exist.</p> <p>The White Paper notes that renewable energy applications have specific characteristics that need to be considered. Advantages include:</p> <ul style="list-style-type: none"> • Minimal environmental impacts in operation in comparison with traditional supply technologies; and • Generally lower running costs, and high labour intensities.

Policy and Relevant Authority	Summary and Relevance for the Development
	<p>Disadvantages include:</p> <ul style="list-style-type: none"> • 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. <p>The Carissa WEF is in line with this policy as it proposes the generation of renewable energy from the wind resource.</p>
<p>The White Paper on Renewable Energy (2003)</p> <p>Administering Authority:</p> <p>Department of Mineral Resources and Energy (DMRE)</p>	<p>This White Paper on Renewable Energy supplements the White Paper on Energy Policy, which recognises that the medium and long-term potential of renewable energy is significant. This Paper sets out Government's vision, policy principles, strategic goals and objectives for promoting and implementing renewable energy in South Africa.</p> <p>The White Paper notes that while South Africa is well-endowed with renewable energy resources that have the potential to become sustainable alternatives to fossil fuels, these have thus far remained largely untapped. Government's long-term goal is the establishment of a renewable energy industry producing modern energy carriers that will offer in future years a sustainable, fully non-subsidised alternative to fossil fuels. The medium-term (10-year) target set in the White Paper is: <i>10 000 GWh (0.8 Mtoe) renewable energy contribution to final energy consumption by 2013, to be produced mainly from biomass, wind, solar and small-scale hydro. The renewable energy is to be utilised for power generation and non-electric technologies such as solar water heating and bio-fuels. This is approximately 4% (1 667 MW) of the projected electricity demand for 2013 (41 539 MW) (Executive Summary, ix).</i></p> <p>The amount of energy that can be extracted from the wind depends on its speed. The higher the wind speed, the more energy can be harnessed to generate electricity on a large scale. However, this requires large tracts of land to install enough wind turbines or generators, which are also noisy.</p> <p>Wind as an energy source is only practical in areas that have strong and steady winds. South Africa has fair wind potential, especially along the coastal areas of Western and Eastern Cape.</p> <p>The Carissa WEF is in line with this paper as it proposes the generation of renewable energy from the wind resource.</p>

Policy and Relevant Authority	Summary and Relevance for the Development
<p>Integrated Resource Plan (IRP) for South Africa (2010-2030)</p> <p>Administering Authority:</p> <p>Department of Mineral Resources and Energy (DMRE)</p>	<p>The Integrated Resource Plan for Electricity for South Africa of 2010–2030 (further referred to as the IRP) is a “living plan” which is expected to be revised and updated continuously as necessary due to changing circumstances. According to the Summary of the plan the current IRP for South Africa, which was originally initiated by the Department of Energy (DoE) in June 2010 (the Department is now known as Department of Mineral Resources and Energy), led to the Revised Balanced Scenarios (RBS) for the period 2010–2030.</p> <p>“This scenario was derived based on the cost-optimal solution for new build options (considering the direct costs of new build power plants), which was then “balanced” in accordance with qualitative measures such as local job creation”. In addition to all existing and committed power plants, the RBS included 11,4 GW of renewables, which relates to the proposed Carissa WEF. In 2010 several changes were made to the IRP model. The main changes in the IRP were the disaggregation of renewable energy technologies to explicitly display solar photovoltaic (PV), concentrated solar power (CSP), and wind options (RSA, 2011a).</p> <p>The summary of the IRP further explains that traditional cost-optimal scenarios were developed based on the previously mentioned changes in the IRP. This resulted in the Policy-Adjusted IRP, which stated that:</p> <p>“The installation of renewables (solar PV, CSP and wind) has been brought forward in order to accelerate a local industry; To account for the uncertainties associated with the costs of renewables and fuels, a nuclear fleet of 9,6 GW is included in the IRP; The emission constraint of the RBS (275 million tons of carbon dioxide per year after 2024) is maintained; and Energy efficiency demand-side management (EEDSM) measures are maintained at the level of the RBS” (RSA, 2011a:6).</p> <p>“The Policy-Adjusted IRP includes the same amount of coal and nuclear new builds as the RBS, while reflecting recent developments with respect to prices for renewables. In addition to all existing and committed power plants (including 10 GW committed coal), the plan includes 9,6 GW of nuclear; 6,3 GW of coal; 17,8 GW of renewables; and 8,9 GW of other generation sources” (RSA, 2011a:6).</p> <p>In conclusion the IRP recommends that an accelerated roll-out in renewable energy options should be allowed with regards to the benefits of the localization in renewable energy technologies (RSA, 2011a). It is however important to take note that since the release of the IRP in 2011 there has been a number of developments in the energy sector of South Africa. Therefore, the IRP was updated and was open for comments until March of 2017. The new IRP of 2019 was formally published in October 2019. For the revision scenario, analysis was conducted. The results revealed that for the period ending 2030 that: “The committed</p>

Policy and Relevant Authority	Summary and Relevance for the Development
	<p><i>Renewable Energy Independent Power Producers Programme, including the 27 signed projects and Eskom capacity rollout ending with the last unit of Kusile in 2022, will provide more than sufficient capacity to cover the projected demand and decommissioning of plants up to approximately 2025”; “Imposing annual build limits on renewable energy will not affect the total cumulative capacity and the energy mix for the period up to 2030”; and “the scenario without renewable energy annual build limits provides the least-cost option by 2030” (RSA, 2018:34).</i></p> <p>Lastly, the draft IRP of 2018 also included the scenario analysis for the period post 2030. Here it was observed that: “Imposing annual build limits on renewable energy will restrict the cumulative renewable installed capacity and the energy mix for this period; adopting no annual build limits on renewables or imposing a more stringent strategy to reduce greenhouse gas emissions implies that no new coal power plants will be built in the future unless affordable cleaner forms of coal-to-power are available; and the scenario without renewable energy annual build limits provides the least-cost option by 2050” (RSA, 2018:34–35).</p> <p>In the final IRP of 2019 key considerations were taken into account together with required actions to be taken for the IRP of 2019 to be credible. In terms of renewable energy technologies like solar and wind, the IRP stated that “<i>The application of renewable build limits ‘smoothes out’ the capacity allocations for wind and solar PV which provides a constant pipeline of projects to investment; this addresses investor confidence</i>”. The decision stated against this key consideration is to “<i>retain the current annual build limits on renewables (wind and PV) pending the finalization of a just transition plan</i>” (RSA, 2019:46). Hereby the IRP also recognises renewable technologies’ potential to diversify the electricity mix, create new industries and job opportunities and localize across the value chain (RSA, 2019:13).</p> <p>The Carissa WEF is in line with this plan as it proposes the generation of renewable energy from the wind resource and will contribute to the energy mix of the country as set out in this plan.</p>
National Development Plan of 2030 Administering Authority:	<p>The National Development Plan aims to “eliminate poverty and reduce inequality by 2030” (RSA, undated). In order to eliminate or reduce inequality, the economy of South Africa needs to grow faster in order to benefit all South Africans. In May 2010 a Draft National development Plan was drafted, which highlighted the nine (9) key challenges for South Africa. The highest priority areas according to the plan are considered to be the creation of employment opportunities and to improve the quality of national education. In this regard, the plan sets out three (3) priority areas, namely, to raise employment by a faster growing economy, improve the quality of education, and to build the capability of the state in order to play a more developmental and</p>

Policy and Relevant Authority	Summary and Relevance for the Development
The Presidency: National Planning Commission	<p>transformative role. One of the key challenges identified was that the economy is unsustainably resource intensive and the acceleration and expansion of renewable energy was identified as a key intervention strategy to address this challenge.</p> <p>The Carissa WEF will contribute to the intervention strategy as identified within the plan.</p>
<p>National Infrastructure Plan of South Africa (2012)</p> <p>Administering Authority:</p> <p>Presidential Infrastructure Coordinating Commission</p>	<p>In the year 2012 the South African Government adopted a National Infrastructure Plan (hereafter referred to as the Plan). The aim of this Plan is to transform the economic landscape, while strengthening the delivery of basic services and creating new employment opportunities. This Plan also supports the integration of African communities, and also sets out the challenges and enablers that our country needs in order to respond to the planning and development of infrastructure with regards to fostering economic growth (RSA, 2012). The Plan has developed eighteen (18) strategic integrated projects (further referred to as SIPs). These SIPs stretch over all nine (9) provinces, covering social and economic infrastructure, and projects that enhances development and growth. Of the eighteen (18), five (5) are geographically focused, three (3) spatial, three (3) energy, three (3) social infrastructure, two (2) knowledge, one (1) regional integration, and one (1) water and sanitation focussed. The three (3) SIPs according to the Plan, which are energy focused and correlate to the proposed project are as follow:</p> <ul style="list-style-type: none"> • SIP 8: Green energy in support of the South African economy; • SIP 9: Electricity generation to support socio-economic development; and • SIP 10: Electricity transmission and distribution for all. <p>SIP 8 according to the Plan “support sustainable green energy initiatives on a national scale through a diverse range of clean energy options as envisaged in the IRP 2010 and support bio-fuel production facilities”. The purpose of SIP 9 according to the Plan is to “accelerate the construction of new electricity generation capacity in accordance with the IRP 2010 to meet the needs of the economy and address historical imbalances”. SIP 9 should also monitor the implementation of major projects such as new power stations like Medupi, Kusile and Ingula. Lastly, SIP 10 aims to “expand the transmission and distribution network to address historical imbalances, provide access to electricity for all and support economic development” (RSA, 2012:20).</p> <p>The Carissa WEF is in line with this plan as it proposes the generation of renewable energy from the wind resource which supports socio-economic development and will contribute to meeting the electricity demand of the country as set out in this plan. The Carissa WEF has been awarded a SIP status.</p>

Policy and Relevant Authority	Summary and Relevance for the Development
<p>New Growth Path Framework</p> <p>Administering Authority:</p> <p>Department of Economic Development</p>	<p>The New Growth Path was developed after 16 years of South Africa's democracy, to respond to emerging opportunities and risks while building on policies. This framework provides a dynamic vision on how to collectively achieve a more developed, equitable and democratic society and economy. This framework mainly reflects the commitment of the South African Government to create employment opportunities for its people in all economic policies (RSA, 2011b).</p> <p>This framework sets out the markers for job creation and growth and identify where there are viable changes in the character and structure of production, in order to create a more inclusive, greener economy in the long-term. It is stated in the framework that in order for this framework to reach its objectives, the Government is committed to:</p> <ul style="list-style-type: none"> • Identify the possible areas of employment creation; and • Develop a policy to facilitate employment creation especially with regards to social equity, sustainable employment and growth in the creation of employment activities (RSA, 2011b). <p>This framework also identifies investments in five key areas, one of which is energy. This framework also states that the green economy is a priority area, which includes the construction of and investment in renewable energy technologies like wind (RSA, 2011b). In this regard it will also assist creating employment opportunities over the medium- and long-term.</p> <p>Considering that the construction of and investment in renewable energy is a key area identified within the framework, the Carissa WEF is considered to be in-line with the framework.</p>
<p>Climate Change Bill (2018)</p> <p>Administering Authority:</p> <p>National Department of Environmental Affairs (now known as the Department of Forestry,</p>	<p>On 08 June 2018 the Minister of Environmental Affairs published the 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. The following objectives are set within the Bill:</p> <ul style="list-style-type: none"> • Provide for the coordinated and integrated response to climate change and its impacts by all spheres of government in accordance with the principles of cooperative governance; • Provide for the effective management of inevitable climate change impacts through enhancing adaptive capacity, strengthening resilience and reducing vulnerability to climate change, with a view to building social, economic, and

Policy and Relevant Authority	Summary and Relevance for the Development
Fisheries and the Environment)	<p>environmental resilience and an adequate national adaptation response in the context of the global climate change response;</p> <ul style="list-style-type: none"> • Make a fair contribution to the global effort to stabilise greenhouse gas concentrations in the atmosphere at a level that avoids dangerous anthropogenic interference with the climate system within a timeframe and in a manner that enables economic, employment, social and environmental development to proceed in a sustainable manner. <p>The Carissa WEF comprises a renewable energy generation facility and would not result in the generation or release of emissions during its operation.</p>
Climate Change Bill (2021) Administering Authority: National Department of Forestry, Fisheries and the Environment	<p>The Department of Forestry, Fisheries and the Environment has published a new Climate Change Bill for public comment. The bill notes that climate change represents an urgent threat to human societies and the planet, and requires an effective, progressive and incremental response from both government and citizens.</p> <p>It recognises that South Africa has a global responsibility to reduce greenhouse gasses and that the anticipated impacts arising as a result of climate change have the potential to undermine achieving of the country's developmental goals.</p> <p>The main objective of the bill is to enable the development of an effective climate change response and the long-term, just transition to a climate-resilient and lower-carbon economy and society, and to provide for matters connected therewith.</p> <p>The Carissa WEF comprises a renewable energy generation facility and would not result in the generation or release of emissions during its operation.</p>
Strategic Integrated Projects (SIPs) (2010 – 2030) Administering Authority:	<p>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 renewable energy facilities:</p>

Policy and Relevant Authority	Summary and Relevance for the Development
The Presidential Infrastructure Coordinating Committee	<ul style="list-style-type: none"> • 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 Carissa WEF will generate electricity and social and economic upliftment; development and growth will take place within the surrounding communities. <p>As per the gazette of the Honourable Minister of the Department of Public Works and Infrastructure, the Carissa WEF project falls under the Green Hydrogen National Program SIP 20e: Hive Ammonia (Eastern Cape).</p>
Strategic Environmental Assessment (SEA) for wind and solar PV Energy in South Africa (2014) Administering Authority: National Department of Environmental Affairs (now known as the Department of Forestry, Fisheries and the Environment)	<p>The Department of Forestry, Fisheries and the Environment (DFFE) has committed to contribute to the implementation of the National Development Plan and National Infrastructure Plan by undertaking Strategic Environmental Assessments (SEAs) to identify adaptive processes that integrate the regulatory environmental requirements for Strategic Integrated Projects (SIPs) while safeguarding the environment. The wind and solar photovoltaic (PV) SEA was accordingly commissioned by DEA in support of SIP 8, which aims to facilitate the implementation of sustainable green energy initiatives.</p> <p>This SEA identifies areas where large scale wind and solar PV energy facilities can be developed in terms of SIP 8 and in a manner that limits significant negative impacts on the environment, while yielding the highest possible socio-economic benefits to the country. These areas are referred to as Renewable Energy Development Zones (REDZs).</p> <p>The REDZs also provide priority areas for investment into the electricity grid. Currently one of the greatest challenges to renewable energy development in South Africa is the saturation of existing grid infrastructure and the difficulties in expanding the grid. Proactive investment in grid infrastructure is likely to be the most important factor in determining the success of REDZs. Although it is intended for the SEA to facilitate proactive grid investment in REDZs, such investment should not be limited to these areas. Suitable wind and solar PV development should still be promoted across the country and any proposed development must be evaluated on its own merit.</p> <p>Majority of the Carissa WEF site is located with the Beaufort West Renewable Energy Development Zone (REDZ) with two (02) small portions falling outside of the REDZ. Additionally, the project lies within the Central Transmission Power Corridor with a small portion of the southern grid connection corridor option falling outside of the power corridor.</p>

Policy and Relevant Authority	Summary and Relevance for the Development
<p>Western Cape Provincial Strategic Plan 2019 – 2024</p> <p>Administering Authority:</p> <p>Western Cape Province</p>	<p>The Western Cape Government commits to building a values-based competent state that enables opportunity and promotes responsibility in a safer Western Cape.</p> <ul style="list-style-type: none"> • We will live and be held accountable to our values as a government and we will continue to build the capable state on this foundation. • We will continue delivering opportunities to our people and we will expect them to take responsibility for improving their own lives. • We will make this Province safer under the Rule of Law. <p>This vision is expressed in the five strategic priorities identified for 2019-2024, our Vision-inspired Priorities.</p> <p>Vision: “A safe Western Cape where everyone prospers”</p> <ul style="list-style-type: none"> • Safe and Cohesive Communities: The Western Cape is a place where residents and visitors feel safe. • Growth and Jobs: An enabling environment for the private sector and markets to drive growth and create jobs. • Empowering People: Residents of the Western Cape have opportunities to shape their lives and the lives of others, to ensure a meaningful and dignified life. • Mobility and Spatial Transformation: Residents live in well-connected, vibrant, and sustainable communities and move around efficiently on safe, affordable, low-carbon public transport. • Innovation and Culture: Government services are delivered to the people of the Western Cape in an accessible, innovative, and citizen-centric way. <p>The Carissa WEF will promote growth and employment opportunities.</p>
<p>Western Cape Provincial Spatial Development Framework 2020</p>	<p>The spatial vision of the Western Cape Province is as follows:</p> <p><i>“A highly skilled innovation driven, resource efficient, connected, high opportunity and collaborative society”.</i></p>

Policy and Relevant Authority	Summary and Relevance for the Development
Administering Authority: Western Cape Province	<p>The spatial goals of the Western Cape are set out as follows:</p> <ul style="list-style-type: none"> • More inclusivity, productivity, competitiveness and opportunities in urban and rural space-economies. • Better protection of spatial assets (e.g., cultural and scientific landscapes) and strengthened resilience of natural and built environments. • Improved effectiveness in the governance of urban and rural areas. <p>As part of the vision set out for the Western Cape Province the following underpin the vision.</p> <ul style="list-style-type: none"> • Everyone has access to a good education, and the cities, towns and rural villages are places of innovation and learning. • All households can access basic services that are delivered resource efficiently, residents use land and finite resources prudently, and safe guard their ecosystems. • Living and working are healthy, safe, enabling and accessible, and all have access to the region's unique lifestyle offering. • There are livelihoods prospects available to urban and rural residents, and opportunities for them to find employment and development enterprises in these markets. • Urban and rural communities are inclusive, integrated, connected and collaborate. • Urban and rural areas are effectively managed.
Western Cape Climate Change Response Strategy: Vision 2050 (March 2022) Administering Authority: Western Cape Department of Environmental Affairs and Development	<p>The Western Cape Climate Change Response Strategy: Vision 2050 (WCCCRS) describes a climate future that the Western Cape province will strive towards. It is centred on a Vision and four Guiding Objectives defining the direction of climate change response action for the region, with corresponding targets and actions. The strategy provides a set of necessary actions under each guiding objective.</p> <p>The vision for the Western Cape is indicated as follows: <i>“Our vision is to be a net zero emissions and climate resilient province by 2050, built on an equitable and inclusive economy and society that thrives despite the shocks and stresses posed by climate change”</i></p> <p>The Strategy includes a Climate Action Pathway, which identifies the actions required for achieving the ‘Vision 2050’. Transitioning in an equitable and inclusive manner to zero net emissions by 2050 forms part of the objectives with improved energy resilience</p>

Policy and Relevant Authority	Summary and Relevance for the Development
Planning – Climate Change Directorate	<p>listed for the milestones to be achieved between 2025-2030. Two crucial transitions are listed that are deemed realistic given rapid development in renewable energy. The transitions are (1) a shift from internal combustion engines to electric mobility, and (2) a massive shift from fossil fuel-based energy to renewable energy sources.</p> <p>Immediate actions are also indicated, two of which relate to the development of renewable energy, namely:</p> <ul style="list-style-type: none"> ○ Increase in the share of renewable energy and decentralised energy systems in the overall energy mix, and improving energy security, through the Western Cape Municipal Energy Resilience Initiative. ○ Continued improvement in the resource efficiency of, and renewable energy uptake in the Provincial building portfolio. <p>The development of the Carissa WEF will contribute to the strategy of the Province, albeit to a limited extent.</p>
<p>Central Karoo District Municipality Integrated Development Plan 2023-2024</p> <p>Administering Authority:</p> <p>Central Karoo District Municipality</p>	<p>Vision</p> <p><i>“Working together in development and growth.”</i></p> <p>Mission</p> <p>Central Karoo a place where we envisage and ensure economic growth and social development and sustainability, whilst maintaining its rural character, embracing and developing the diversity of its people.</p> <p>Strategic Objectives</p> <ul style="list-style-type: none"> • Facilitate good governance principles and effective stakeholder participation. • Build a well capacitated workforce, skilled youth and communities. • Improve and maintain district roads and promote safe roads transport. • Prevent and minimise the impact of possible disasters and improve public safety in the region. • Promote safe, healthy and socially stable communities through the provision of a sustainable environmental health service. • Promote regional, economic development, tourism and growth opportunities. • Deliver a sound and efficient administrative and financial service to achieve sustainability and viability in the region.

Policy and Relevant Authority	Summary and Relevance for the Development
	The development of the Carissa WEF will contribute to the goals of the area, albeit to a limited extent.
<p>Central Karoo District Municipality Spatial Development Framework 2019</p> <p>Administering Authority:</p> <p>Central Karoo District Municipality</p>	<p>Vision</p> <p><i>“Working together in sustainable spatial development and growth towards a resilient Central Karoo.”</i></p> <p>Unpacking the spatial vision, the key phrases imply the following:</p> <p>“Working together” – seeking partnership driven solutions, realising that the challenges facing the Karoo are multi-faceted and cannot be addressed only by the local sphere of government. Solutions must involve the district, provincial and national spheres of government, state owned enterprises, as well as multiple private sector role layers as well, such as corporates, businesses and farmers who play a critical role in job creation and the improvement of the lives of the people of the Central Karoo.</p> <p>“Sustainable Spatial Development and Growth” – Economic growth is a priority, but this economic growth must be done in a manner that does not harm the current and future inhabitants of the Central Karoo. Sustainable Spatial Development and Growth must ensure that economic and human growth and development initiatives undertaken in the region does not undermine, and ideally enhance, the sustainability of the ecological, social, economic and built environment. Furthermore, spatial growth must be undertaken in a manner that is consistent with the 5 SPLUMA principles of efficiency, spatial resilience, spatial justice, spatial sustainability and good administration. These principles will be unpacked in the various policies that will follow later sections of this SDF.</p> <p>“Towards a Resilient Central Karoo” – a Central Karoo that can withstand sudden shocks or gradual changes to ecological, climate, social or economic systems. Such shocks could be climate related (flooding, heat waves, drought, frosts); ecological (breakdown of ecological systems such as water or biodiversity that renders services to the people of the Karoo); social (increases in crime, service delivery protests, social unrest and drug-related); economic (economic decline or stagnation and increasing joblessness). A resilient region is one where the economy is diversified, where the people are employable, skilled and employed, and where the natural environment provides adequate natural resources, including a sufficient reserve of such resources in times of scarcity and stress. Essentially, the region needs to not exceed its inherent carrying capacity to sustain human life as well as continued biodiversity integrity. Specifically, the Karoo is a water stressed region, and hence water resilience is the cornerstone of the future resilience of the region, in a way that either enhances or undermines future growth and development, depending on how this future resource is managed, as well as how climate change impacts the region.</p>

Policy and Relevant Authority	Summary and Relevance for the Development
	<p>From Vision to Strategy</p> <p>It is proposed that this vision is anchored on the following four strategies and pillars of implementing this vision:</p> <ul style="list-style-type: none"> • A region that protects the environment, enhances resilience and capitalises on and honours the karoo charm in support of a vibrant people and economy. • Improve regional and rural accessibility and mobility for people and goods in support of a resilient economy. • Allocate government resources, infrastructure and facilities in a manner that uplifts and skills people and focuses on maximising impact on the most possible people, while providing a basic level of service for all. • Partnership-driven governance and administration towards improving financial and non-financial sustainability and resilience. <p>The development of the Carissa WEF will contribute to the goals of the area, albeit to a limited extent.</p>
<p>Beaufort West Local Municipality Integrated Development Plan (5th Generation Review) 2022-2027</p> <p>Administering Authority:</p> <p>Beaufort West Local Municipality</p>	<p>Vision</p> <p><i>“Beaufort West in the Central Karoo, the economic gateway to the Western Cape, where people are developed and living together in harmony.”</i></p> <p>Mission</p> <p>To reflect the will of the South African people as reflected in the Constitution and by Parliament:</p> <p>Service Delivery: To provide excellent services to the residents of Beaufort West Municipality.</p> <p>Growing the economy: To implement infrastructure to grow the economy and create jobs.</p> <p>Staff: To have an equipped, skilled and motivated staff establishment.</p> <p>Well-run administration: Establish a sound, efficient and effective administration for the Municipality.</p> <p>Financial Sustainability: Collecting all debtors and paying creditors in time.</p>

Policy and Relevant Authority	Summary and Relevance for the Development
	<p>Sport centre: To become the sport and recreational mecca of the Karoo, creating harmony and unity.</p> <p>Safe place: To create a crime-free, safe and healthy environment.</p> <p>Reduce Poverty: To reduce poverty and promote the empowerment of women, youth and people living with disabilities.</p> <p>Values</p> <ul style="list-style-type: none"> • Integrity which includes honesty, fairness and respect; • Trust; • Responsibility and accountability; • Harnessing diversity; • Participative decision-making; • Transparency; • Professionalism including friendliness, and • Efficient service delivery. <p>Strategic Objectives</p> <ul style="list-style-type: none"> • Provide, maintain and expand basic services to all people in the municipal area. • Sustainable, safe and healthy environment. • Promote broad-based growth and development. • Maintain an ethical, accountable and transparent administration. • Enabling a diverse and capacitated workforce. • Uphold sound financial management principles and practices. <p>The development of the Carissa WEF will contribute to the goals of the area, albeit to a limited extent.</p>
Beaufort West Local Municipality Spatial	<p>The Vision for the Municipality is as follows:</p> <p><i>“Wilderness tourism and transport gateway to the people, mountains and plains of the Central Karoo.”</i></p>

Policy and Relevant Authority	Summary and Relevance for the Development
<p>Development Framework 2022/2023</p> <p>Administering Authority:</p> <p>Beaufort West Local Municipality</p>	<p>The spatial development framework for the municipality comprises the following elements:</p> <ul style="list-style-type: none"> • Bio-regions; • Spatial Planning Categories (SPCs); • Sustaining the Economy • Major Infrastructure Projects; • Major Tourism Destinations; • Land Reform; • Urban Related Development; • Urban Design Guidelines; • Potential Rural Nodes and Periodic Rural Markets; and, • Settlement Hierarchy. <p>The development of the Carissa WEF will contribute to the goals of the area, albeit to a limited extent.</p>
<p>Prince Albert Local Municipality 2024-2025 Final Amended Integrated Development: Fifth Generation 2022-2027</p> <p>Administering Authority:</p> <p>Prince Albert Local Municipality</p>	<p>The Fifth-Generation Integrated Development Plan cycle allows for the adoption of a new 5-Year Strategic Plan that articulates the development agenda for the Prince Albert Local Municipality for the period 2022 - 2027. The development strategy of the Local Municipality is <i>“To ensure a sustainable Prince Albert, where all sectors is aligned for the betterment and benefit of the municipal area as a whole. To create an enabling environment for the inhabitants of Prince Albert towards guaranteed job opportunities and thus a better livelihood and citizen satisfaction.”</i></p> <p>In terms of the Municipal Development Strategy of the Municipality consideration is given to Local Economic Development (LED) and Tourism. It is indicated that the role of the Municipality is to facilitate economic development by creating a conducive environment for business development and unlock opportunities to increase participation amongst all sectors of society in the mainstream economy. Government cannot plan or implement LED effectively if the private sector, who is the key driver of a local economy, is not included in such development processes. A Focal Point identified under LED Green Energy / Renewable Energy / Technology is listed, with the associated interventions being alternative green energy, solar energy, wind farms and waste to energy.</p>

Policy and Relevant Authority	Summary and Relevance for the Development
	The development of the Carissa WEF will contribute to the strategy of the Local Municipality, albeit to a limited extent.
<p>Prince Albert Local Municipality Spatial Development Framework (2021)</p> <p>Administering Authority:</p> <p>Prince Albert Local Municipality</p>	<p>Strategy G of the Spatial Development Framework considers Partnership-driven governance and administration towards improved financial and non-financial sustainability and resilience.</p> <p>Prince Albert, as part of the Central Karoo, must seek partnership-driven solutions, realising that the challenges are multi-faceted and cannot be addressed only by the local sphere of government. It is therefore required that a range of partnerships be explored to find a shared service solution within the Central Karoo that ensures shared financial viability along with the administrative and logistical burdens associated with servicing a sparse region. Focus areas of potential partnership between all spheres of government and civil society pertaining to Prince Albert Municipality include:</p> <ul style="list-style-type: none"> ○ Water; ○ Gas; ○ Energy (specifically renewable energy); ○ Rural mobility; and ○ Tourism. <p>Furthermore, the SDF does provide specific restrictions in terms of the placement of wind energy infrastructure within the landscape that will need to be adhered to by the Applicant.</p> <p>The development of the Carissa WEF will contribute to the strategy of the Local Municipality, albeit to a limited extent.</p>

3.3 Legal Requirements Complied with in Section 3 as per the Requirements of the EIA Regulations, 2014 (as amended)

This section of the report includes the following information required in terms of Appendix 2: Content of the scoping report:

Requirement	Relevant Section
2(e) a description of the policy and legislative context within which the development is proposed including an identification of all 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.	The entire section 3 provides a description of the policy and legislative context relevant to the proposed Carissa WEF.

4 NEED AND DESIRABILITY

The need and desirability of a development is linked to whether the site is appropriate, receptive and desirable for the development of a wind facility and the need for the development on an international, national, provincial and local level.

4.1 Need for the Proposed Development

The need for the development has been confirmed from a regulatory perspective considering the results of section 3 that indicates how the Carissa WEF “fits” into and contribute to the electricity generation of the country and the contributions made to the fight against climate change.

Over 90% of South Africa’s electricity generation is coal based, the World bank estimates that this results in an annual, per capita carbon emission of ~8.9 tons per person. Based on 2008 fossil-fuel CO₂ emissions statistics released by the Carbon Dioxide Information Analysis Centre, South Africa is the 13th largest carbon dioxide emitting country in the world and the largest emitter in Africa (Boden, et al. 2011). In August 2021 an article confirmed that South Africa is the 12th highest greenhouse gas emitter in the world (source: <https://www.news24.com/fin24/economy/eskom-will-only-able-to-meet-global-air-quality-standards-by-2050-owing-to-financial-woes-20210818>).

Please note: The Integrated Resource Plan of 2024 is included below to present the most recent developments within the electricity industry of South Africa, although it is still only in draft format and therefore the focus should remain on the 2019 version until the final document is released.

Table 4.1: Published Draft IRP 2024

	Coal	Gas – IPP Programme	Gas – Eskom	Dispatchable Capacity	Nuclear	Hydro	Pumped Storage	CSP	Solar PV	Wind	Hybrid IPP Programme	Distributed Generation ^a	BESS – IPP Programme	BESS – Eskom	Unserviced Energy (TWh)
Current Base (MW)	38 800	1 005	2 825	-	1 860	1 600	2 732	500	2 287	3 443	-	5 000	-	20	
2024	720							100			150	900		199	13.06
2025	720	1 220							2 115	644	476	900	513	141	7.63
2026										140		900			7.66
2027		1 000								684		900	2 000	615	4.55
2028		1 000	3 000						500			900	615		0.22
2029									500	1 500		900			0.25
2030		1 000		1 376					500	1 500		900			0.27
Additional New Capacity (MW)	1 440	4 220	3 000	1 376				100	3 615	4 468	626	6 300	3 743	360	
<div> <div></div> Installed Capacity <div></div> Capacity under construction <div></div> Capacity procured <div></div> New Capacity <div></div> Distributed Generation Capacity for own use <div></div> Unserved Energy, preferred as low as possible </div>															

There is a current drive and trend for alternative energy in the country to combat climate change as per the Paris Agreement signed by South Africa. The Paris Agreement pursues efforts to limit the rise in the climatological average global temperature to 1.5 °C above pre-industrial levels. According to data from the Copernicus Climate Change Service, July 2023 was the hottest July on record, measuring between 1.5 °C and 1.6 °C hotter than the average before the widespread use of fossil fuels. Based on the data the need for decarbonisation is at a significant stage and must receive attention to ensure a Just Energy Transition (JET) for the country.

When considering the current position of South Africa in terms of CO₂ emissions, the country lies amongst the top 15 largest emitters of carbon dioxide worldwide. The National Greenhouse Gas Inventory Report (Dec 2022) indicates in 2020 81% of the total emissions of South Africa was emitted by the energy sector. Within the energy sector the energy industries were the main contributor (62.4 %) followed by transport (12.7 %) and manufacturing industries and construction (8.8 %).

The Energy Council of South Africa estimated in February 2023 that South Africa would need 56 GW of wind and solar PV generation, 8 GW of battery storage and 5 GW of gas-driven power to “provide an appropriate balance between energy security and energy sustainability” by 2030. These numbers are required for the decommissioning of 12 GW of older and more emission-intensive coal generation in terms of Just Energy Transition. In terms of the current developments in the country it was confirmed in June 2023 by Engineering News that 66 GW of wind and solar projects are currently at different stages of development. Refer to Figure 4.1.

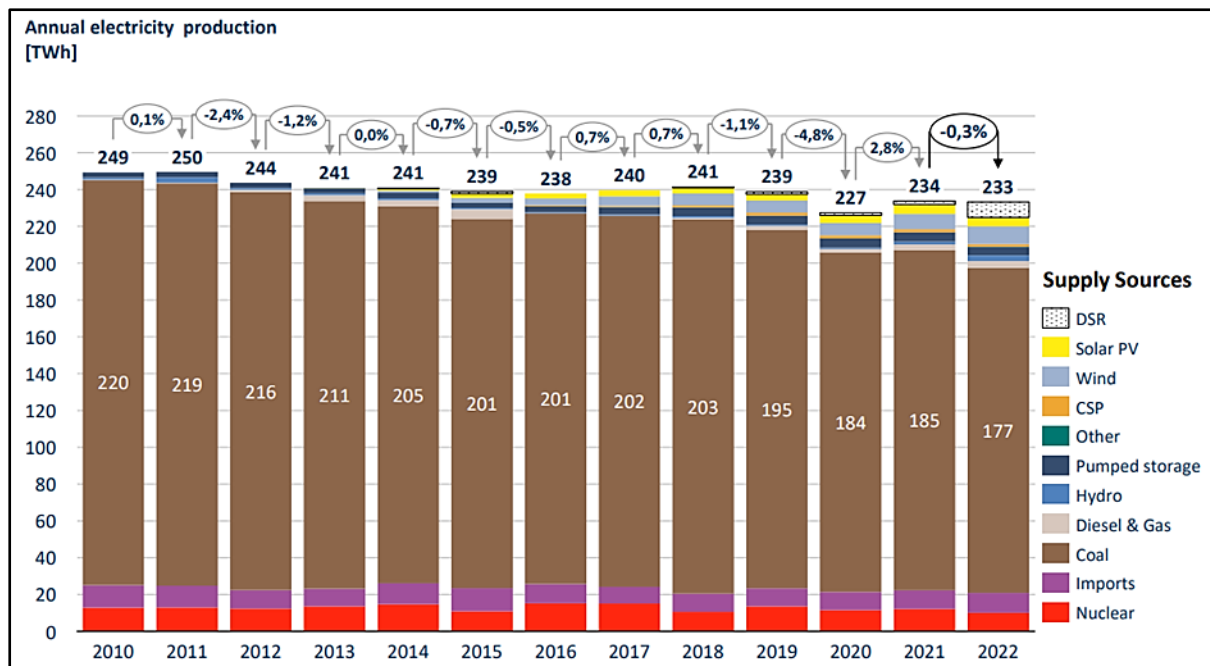


Figure 4.1: Annual Electricity Production in South Africa from 2010 to 2022

According to an article by the Daily Maverick (May 2023), there have been six bid windows released as part of the REIPPPP to date, four of which have projects connected to the grid, totalling about 6 000 MW (6 GW) of installed capacity. This only makes up for only 5% of SA's energy supply. According to the 2019 IRP, about 30 GW of new generation capacity, most of which consists of renewables, must be added to the grid by 2030 (<https://www.dailymaverick.co.za/article/2023-05-02-mega-bid-window-to-be-released-to-market-in-june-but-sas-big-challenge-is-grid-capacity-says-electricity-minister/>).

A 7th Bid window is currently underway which calls for the development of 5 000 MW of new generation capacity, which will include 1 800 MW of Solar PV and 3 200 MW of Wind Power.

In early 2023 the Just Energy Transition Investment Plan (JET IP), (2023-2027), was released which sets out the scale of need and the investments required to achieve the de-carbonisation within the country. The investment plan sets out the funding requirements for the years 2023-2027 to achieve the energy transition of the country. The funding requirements are set out in Tables 4.2 and 4.3 below.

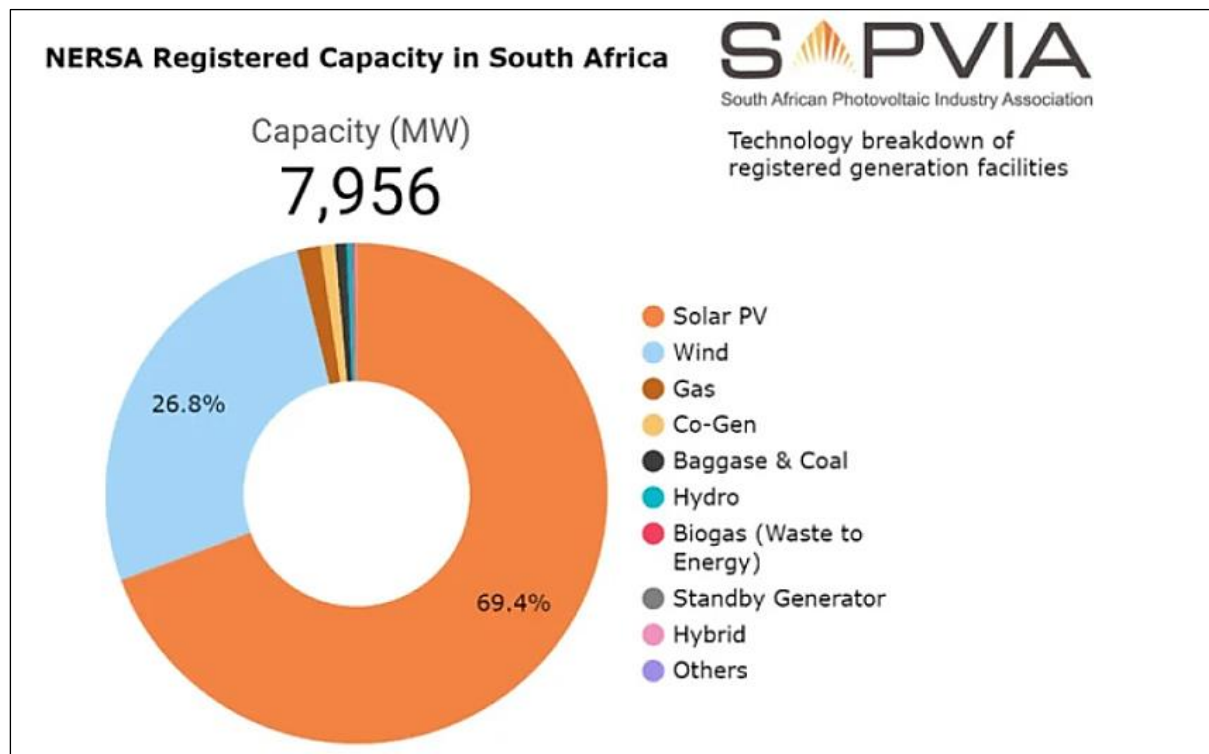
Table 4.2: Funding Requirements for 2023-2027 as Per the Just Energy Transition Investment Plan

Funding requirements 2023–2027	ZAR billion (US\$ billion)
Electricity Sector	711.4 (47.2)
New Energy Vehicle (NEV) Sector	128.1 (8.5)
Green Hydrogen (GH ₂) Sector	319 (21.2)
Skills development	2.7 (0.18)
Municipal capacity	319.1 (21.3)
TOTAL	1 480 (98.7)

Table 4.3: National Electricity Sector Infrastructure Investment Needs as Per the Just Energy Transition Investment Plan

National electricity sector's infrastructure investment needs	ZAR billion
Coal plant decommissioning	4.1
Transmission	131.8
Distribution	13.8
New solar photovoltaic (PV)	233.2
New wind	241.7
New batteries	23.1
TOTAL	647.7

As of July 2024, the total registered capacity stood at 7 956 MW. With the total wind registrations comprising 26.8% of the total. Wind projects account for 38% of registered capacity of projects that are 100 MW and larger²⁹.

**Figure 4.2:** NERSA Registered Capacity in South Africa as of July 2024 (<https://sapvia.co.za/nersa-private-generation-registration-update-july-2024/>)

Considering the above, there is a definite need for the development of wind facilities in the country.

4.2 Access to Electricity in the Site Development Area

Energy is required for cooking, heating, and lighting purposes. Individuals' access to different energy sources for cooking, heating, and lighting purposes is significant, as the burning of fuel sources such as

²⁹ <https://sapvia.co.za/nersa-private-generation-registration-update-july-2024>

wood, coal, and / or animal dung over extensive periods of time could result in negative health impacts for household members. Health impacts would be most significantly experienced by those vulnerable members of society, such as young children, pregnant women, and the elderly.

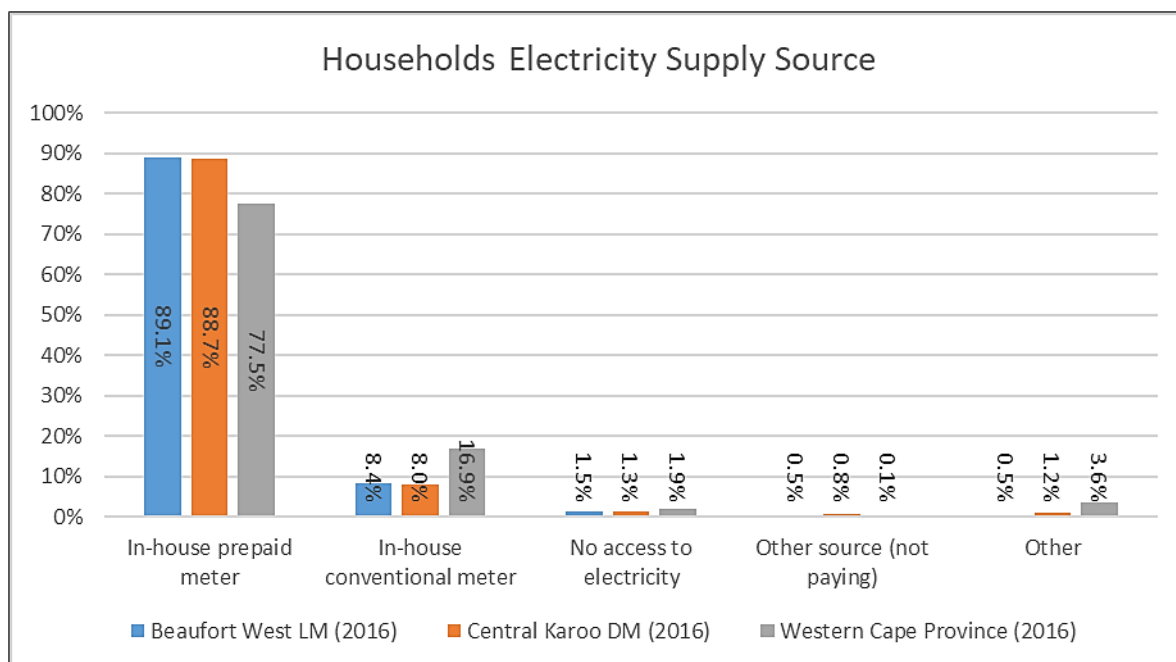


Figure 4.3: Energy Sources for Households in the Western Cape Province, Central Karoo DM and Beaufort West LM (Community Survey 2016)

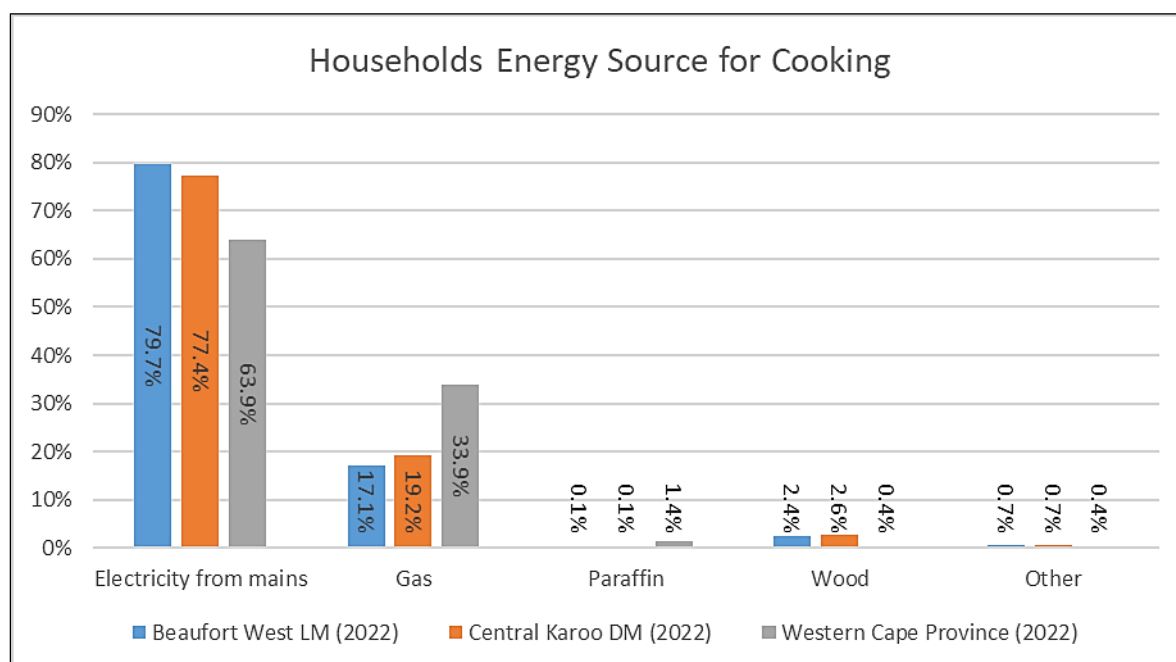


Figure 4.4: Energy Sources for Cooking in the Western Cape Province, Central Karoo DM and Beaufort West LM (Census 2022)

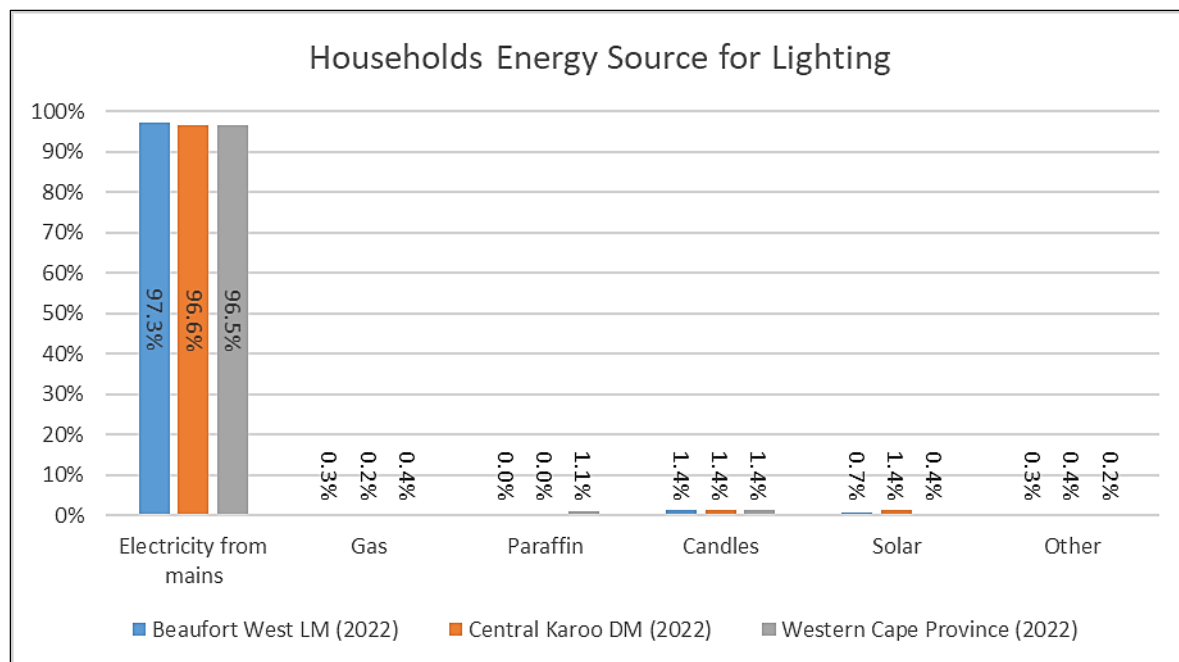


Figure 4.5: Energy Sources for Lighting in the Western Cape Province, Central Karoo DM and Beaufort West LM (Census 2022)

According to the Community Survey 2016, 97.5% of households in the Beaufort West LM, 96.7% in the Central Karoo DM and 94.3% in the Western Cape Province had access to in-house prepaid or conventional meters for electricity. No access to electricity were the lowest in the Central Karoo DM at 1.3%, while the Western Cape Province had the highest ratio at 1.9%. Some households in the Beaufort West LM, Central Karoo DM and Western Cape Province obtained their electricity from sources not paid for, this may be illegal connections which could lead to significant health risks.

The Census 2022 data review electricity supply in a different manner than in 2016. The data indicate that 79.7% of households in the Beaufort West LM used energy as a source for cooking and 97.3% for lighting. In the Central Karoo DM, 77.4% of households used electricity as their main source for cooking and 96.6% for lighting in their households. The majority ratios for the Western Cape Province were similar to the Beaufort West LM and Central Karoo DM at 63.9% for cooking and 96.5% for lighting in these households. The use of gas was the second most mentionable energy source for cooking in all three regions.

4.3 Receptiveness of the Site and Desirability of the Development

The receptiveness of the site / development area for the construction and operation of the Carissa WEF has been informed by the site selection process undertaken by the Applicant. The site selection process considered specific site characteristics in order to understand whether the site is suitable for the placement of the infrastructure. Refer to section 2.3.

The main aspects considered as part of the site selection process was renewable resource i.e., wind; land availability, access to the national grid, geographical and socio-economic considerations, availability of existing infrastructure, topography and consideration of sensitive environmental features through environmental screening. Through this process the Applicant confirmed the receptiveness of the site for the development.

The feasibility of the site for the development provides an indication of the desirability of the development within the site. The Carissa WEF is proposed to be constructed outside of the urban edge

of the nearby towns on privately-owned properties currently used for agricultural practises (grazing and game farming). The affected farm portions have not been considered for an alternative future land use such as urban development or mining.

Therefore, the site proposed for the development displays characteristics which contribute to the overall desirability.

The facility's contribution towards sustainable development and the associated benefits to society in general is listed below:

- Utilisation of significant renewable energy resource and increased supply - 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.
- Reduced dependence on fossil fuels – The operation of the Carissa WEF will have a positive macro-economic impact by contributing to the reduction of South Africa's dependence on fossil fuel generated power and assisting the country in meeting its growing electricity demand.
- Contribution to the fight against climate change - 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. The development of the Carissa WEF, and the associated electricity generated as a result of the facility, will result in considerable savings in tons of CO₂ emissions.
- Reduction of Pollution - The use of wind for power generation is a non-consumptive use of a natural resource which produces zero emissions during its operation. The release of by-products through the burning of fossil fuels for electricity generation have a particularly hazardous impact on human health and contribute to ecosystem degradation.
- Protection 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.
- Socio-Economic Benefits - The project activity is likely to have significant long-term, indirect positive social impacts that may extend to a regional and even national and global scale. The larger scale impacts are to be derived in the utilisation of wind power and the experience gained through the construction and operation of the wind facility. In future, this experience can be employed at other similar facilities/ installations in South Africa. As a result of the excellent renewable energy resources and competitive procurement processes, both wind power and solar PV power have now been proven as cheaper forms of energy generation in South Africa 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.
- Employment - The development, procurement, installation, maintenance and management of renewable energy facilities have significant potential for job creation and skills development in South Africa. The main benefit of the proposed development operating in the area is that local companies or contractors will be hired for the duration of the construction period. The operational phase will provide permanent job opportunities to the local communities from the surrounding area since security

guards and general labourers will be required on a full-time basis. Approximately 1 500 employment opportunities will be created during the construction phase and approximately 100 temporary and permanent employment opportunities during the operational phase.

4.4 Legal Requirements Complied with in Section 4 as per the Requirements of the EIA Regulations, 2014 (as amended)

This section of the report includes the following information required in terms of Appendix 2: Content of the scoping report:

Requirement	Relevant Section
2(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 location.	The need and desirability of the development of the Carissa WEF has been fully considered within section 4.

5 APPROACH TO THE PROCESS

The development of the Carissa WEF requires Environmental Authorisation in accordance with the requirements of Section 24 of NEMA and the EIA Regulations 2014, as amended, (GN.R. 326). The applicant has appointed Blue Crane Environmental (Pty) Ltd, as the independent environmental consultant responsible for undertaking the S&EIA process required in support of the application for EA.

This section provides an indication of the approach which has been followed as part of the S&EIA Process. A S&EIA process refers to a process undertaken in accordance with the EIA Regulations, 2014, as amended, specifically GN.R. 326 of the Regulations. The EIA process involved the consideration and identification of direct, indirect, and cumulative, environmental impacts associated with a proposed project or activity and assess the significance of the identified impacts on the environment. Figure 5.1 below provides an indication of the EIA process followed.

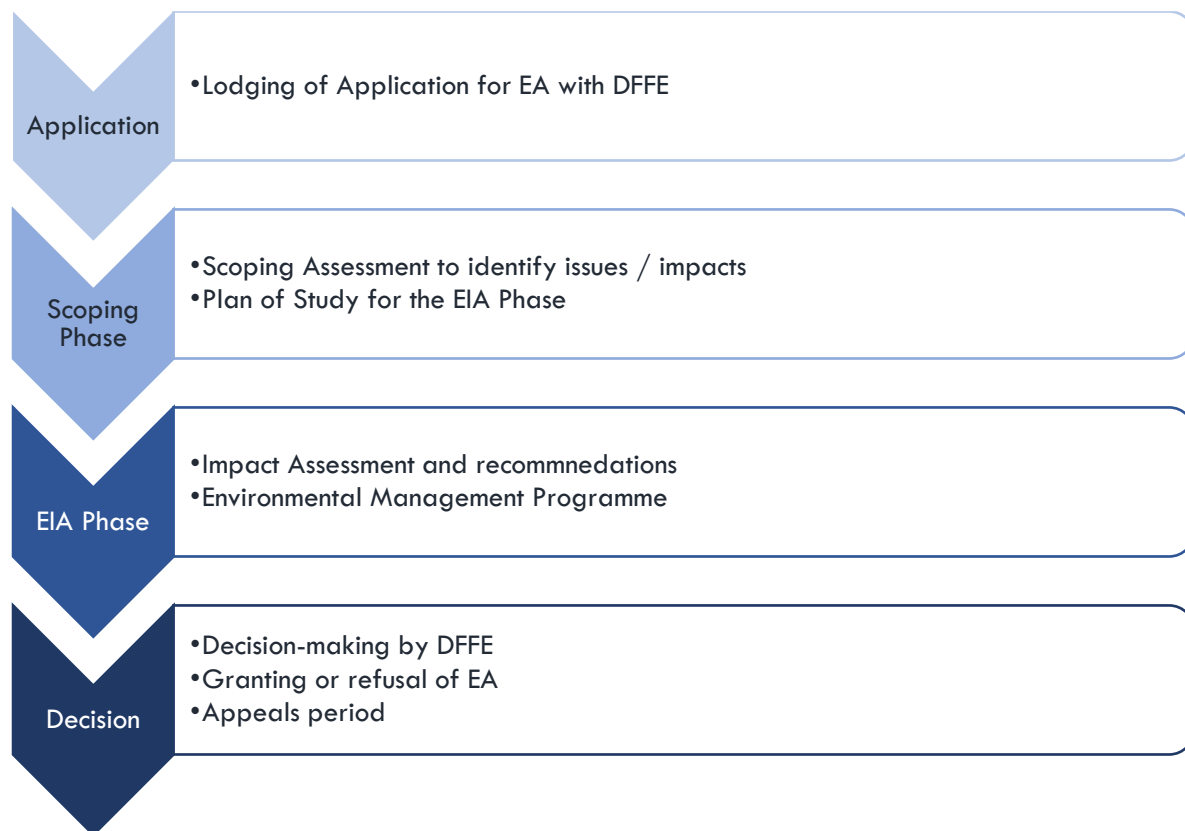


Figure 5.1: The Phases of an EIA Process

The National Environmental Management Act (No. 107 of 1998) (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 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 EA. Due to the fact that the Carissa WEF is a power generation facility and therefore relates to the IRP 2010 – 2030, the National Department of Forestry, Fisheries and the Environment (DFFE) has been identified as the Competent Authority in terms of GN.R. 779 of 01 July 2016. The Western Cape Provincial Department of Environmental Affairs and Development Planning (DEA&DP) is the Commenting Authority on the

project. It is confirmed that DEA&DP have been consulted since the commencement of the S&EIA process and are registered on the I&AP database.

In terms of the EIA Regulations, 2014 (as amended) the S&EIA process is subject to pre-scribed timeframes that must be adhered to. These prescribed timeframes must be adhered to otherwise the Application for Environmental Authorisation will lapse and the process will be required to be restarted. Figure 5.2 provides the prescribed timeframes of the S&EIA process underway, including the relevant public participation process timeframes for the collection of comments.

The final Scoping Report and Plan of Study for the EIA is submitted to the competent authority for decision-making within 44 days of lodging the Application for Environmental Authorisation (this timeframe includes a 30-day review and comment period of the draft Scoping Report). The final EIA Report must be submitted to the competent authority for decision-making on the Application for Environmental Authorisation within 106 days of receipt of the Acceptance of Scoping (this timeframe includes a 30-day review and comment period of the draft EIA Report and Environmental Management Programme (EMPr)).

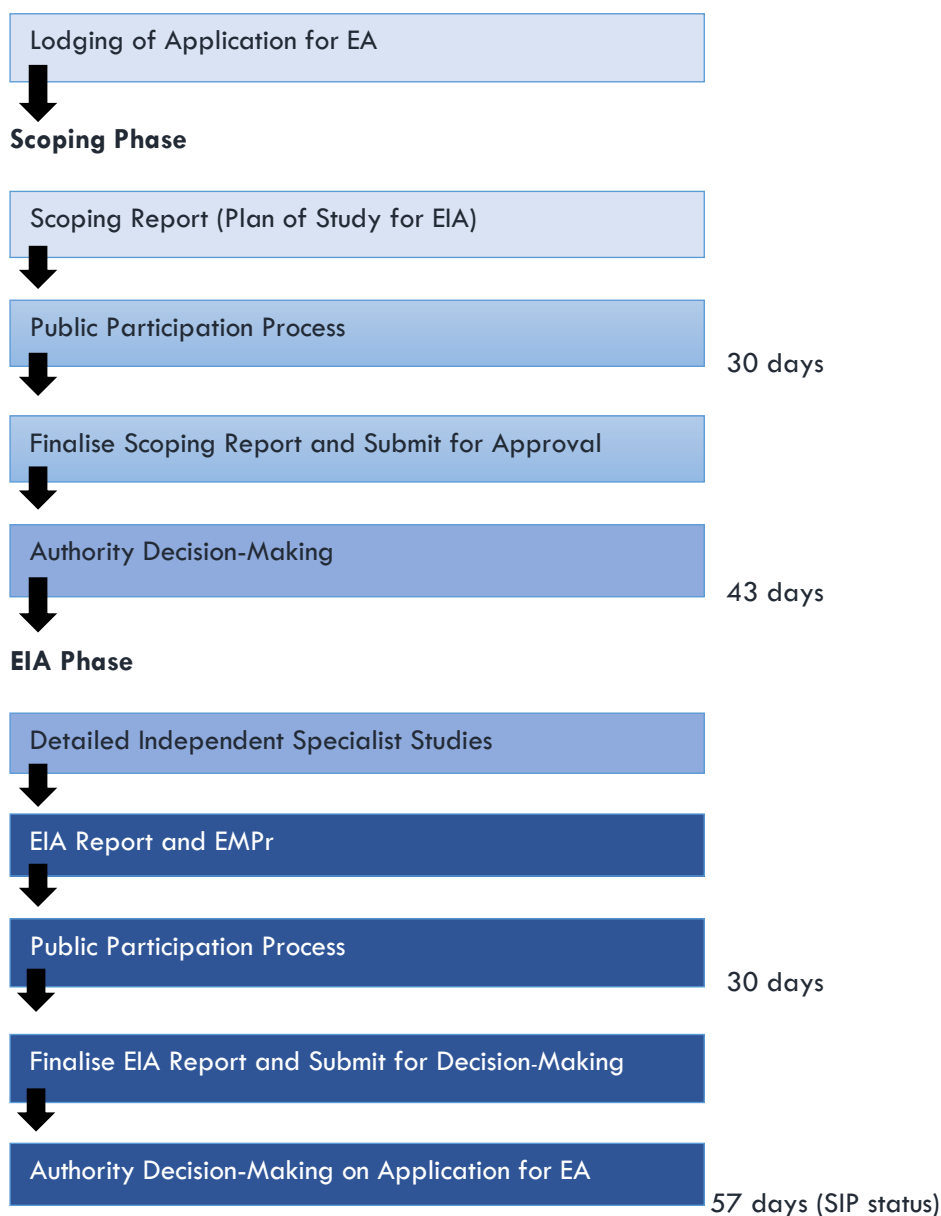


Figure 5.2: Prescribed Timeframes Associated with the S&EIA Process

5.1 Assessment of Potential Impacts and Issues

As part of the Scoping Phase independent specialists have been appointed to scope out and identify potential environmental impacts and issues that will need to be assessed in detail as part of the EIA Phase of the process. The independent specialists also provide an assessment of the potential impacts and provide preliminary recommendations for the mitigation and management of the identified impacts. The impacts will be assessed in more detail during the EIA Phase of the S&EIA process and the recommendations and mitigation measures will be refined accordingly.

In terms of GN.R. 960 (promulgated on 05 July 2019) and Regulation 16(1)(b)(v) of the EIA Regulations, 2014, (as amended), the submission of a Screening Tool Report generated from the national web based environmental screening tool is compulsory for the submission of applications in terms of Regulations 21 – 24 of the EIA Regulations. The requirement for the submission of a Screening Tool Report for the Carissa WEF is applicable as it triggers Regulation 21 of the EIA Regulations, 2014 (as amended).

Table 5.1, 5.2 and 5.3 included below provides an indication of the specialist studies identified by the DFFE Screening Tool Reports (STRs) (Appendix B) within the different applicable categories, an indication of whether the studies were undertaken or not and a motivation or confirmation of the studies being included or not. *Note that a combined assessment was undertaken by the EAP as well as the independent specialists of the project in its entirety. The motivation provided in the tables below therefore addresses the project as a whole.*

Kindly refer to the Site Sensitivity Verification Report (SSVR) included under Appendix D of this final Scoping Report. The SSVR further details reasons for exclusion of specialist studies where applicable.

Table 5.1: Specialist Studies Identified by the National Web-Based Screening Tool, Wind Category and Specialist Studies Completed³⁰

Theme	Specialist Study Undertaken (yes/no)	Verified Sensitivity Rating	Comment/Motivation
Agriculture Theme Sensitivity: High	Yes	High	<p>Feature(s): Land capability; 09. Moderate-High/10. Moderate-High</p> <p>The soil and agricultural assessment confirm the high sensitivity rating by the screening tool that is based on the cropping status component of sensitivity, only for those areas that have been verified as cropland. It should be noted that croplands in this environment are restricted to small, isolated patches that are usually associated with farmsteads and located close to watercourses. None of the croplands on site will be impacted by any of the development infrastructure.</p> <p>Refer to Appendix E5 for the soil and agricultural impact assessment.</p>
Animal Species Theme Sensitivity: High	Yes	High Avifauna Sensitivity	<p>Feature(s): Aves-<i>Circus maurus</i>; Aves-<i>Neotis ludwigii</i>; Aves-<i>Polemaetus bellicosus</i></p> <p>The specialist site inspection and pre-application avifaunal monitoring confirmed the presence of 13 SCC, including those identified by the Screening Tool. Five (05) of the confirmed SCC are red-listed as Endangered (Black Harrier, Ludwig's Bustard, Martial Eagle, Secretarybird and Tawny Eagle), five (05) are red-listed as Vulnerable (Black Stork, Blue Crane, Lanner Falcon, Southern Black Korhaan, and Verreaux's Eagle) and three (03) are red-listed as Near threatened.</p>

³⁰ Sensitivity rating colours as indicated in the DFFE Screening tool

Theme	Specialist Study Undertaken (yes/no)	Verified Sensitivity Rating	Comment/Motivation
		Medium Terrestrial Fauna Sensitivity	<p>Therefore, the results are confirmed as high sensitivity.</p> <p>Refer to Appendix E3 for the Avifauna Impact Assessment Report.</p> <p>According to the terrestrial fauna assessment, the high sensitivity is disputed and should be allocated a medium sensitivity. High SEI areas contain habitat that is intact and capable of supporting recorded and some expected SCCs. However, majority of the area is Medium SEI. Layout avoids High SEI areas.</p> <p>Refer to Appendix E1 for the Terrestrial Biodiversity Assessment.</p>
<p>Aquatic Biodiversity Theme</p> <p>Sensitivity: Very High</p>	Yes	Very High	<p>Feature(s): CBA 1: Aquatic. ESA 1: Aquatic. FEPA Subcatchment. Rivers-AB. Rivers-C. Wetlands (River). Wetlands - Lower Karoo Bioregion (Depression)</p> <p>The screening tool clearly presents the aquatic sensitivity features within the project area. In this instance, the majority of the project area falls under a “High Sensitivity” as they act as Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs) with Good (AB) river conditions that form an integral part of FEPA sub-catchments with the depression wetlands hosting vegetation of the Lower Karoo Bioregion.</p> <p>Refer to Appendix E2 for the Aquatic Impact Assessment.</p>
<p>Archaeological and Cultural Heritage Theme</p> <p>Sensitivity: Low</p>	Yes	Medium	<p>Feature(s): None identified</p> <p>Due to the presence of structures representative of typical Karoo-style longhouse architecture, stone kraals and other structures predominantly older than 60 years speaking to the history and culture of the early European farmers in the area, marked and possible unmarked graves, and an identified stone age knapping site of high significance noting the presence of Khoi-San inhabitants throughout</p>

Theme	Specialist Study Undertaken (yes/no)	Verified Sensitivity Rating	Comment/Motivation
			<p>the region, it is proposed that the area be considered of medium historical and cultural heritage significance.</p> <p>Refer to Appendix E9 for the HIA.</p>
Avian Theme Sensitivity: Low	Yes	High	<p>Feature(s): Area outside sensitivities</p> <p>It must be noted that the Screening Tool does not contain reliable data for the avian theme outside of Renewable Energy Development Zones (REDZ), and the sensitivity rating for the avifauna (wind) theme is only an indication of sensitivity in the area of the Carissa WEF, which is located mostly inside the Beaufort West REDZ.</p> <p>The specialist site sensitivity verification disputes the low sensitivity (areas that possibly do not support priority populations of threatened species that are susceptible to impacts from wind energy facilities) due to the confirmed presence of 30 priority species for wind energy facilities (as defined by (Retief, et al., 2014), including 13 SCC. The sensitivity in terms of the avifauna (wind) theme is determined as high (Includes habitat likely to be of importance to priority bird species sensitive to wind energy developments, Critically Endangered, Endangered bird species and/or Vulnerable bird species; and habitat likely to be of importance to endemic and/or range-restricted bird species that are susceptible to impacts from wind energy facilities).</p> <p>Refer to Appendix E3 for the Avifauna Impact Assessment Report.</p>
Bats Theme Sensitivity: High	Yes	High	<p>Feature(s): Within 500 m of a river. Wetland. Within 500 m of a wetland.</p> <p>The sensitivities of the National Screening Tool have been considered by the specialist. The sensitivity map produced through this study deviates somewhat from the Screening Tool map, which is considered a courser output. The deviations are based on assessment of satellite mapping features, site visits and recorded bat activity from site, and therefore includes additional details of sensitivities not identified by the National Screening Tool. It is recommended that the sensitivity map produced</p>

Theme	Specialist Study Undertaken (yes/no)	Verified Sensitivity Rating	Comment/Motivation
			<p>by the specialist be adhered to as the preferred spatial constraints reference. However, this does not alter the overall finding of the Screening Tool report and it is agreed that a full bat impact assessment is required.</p> <p>Refer to Appendix E4 for the Bat Impact Assessment.</p>
Civil Aviation (Wind) Theme Sensitivity: High	No	Low	<p>Feature(s): Dangerous and restricted airspace as demarcated.</p> <p>No negative impacts are expected to occur on civil aviation and potential impacts will be site specific and can be mitigated. This is based on the fact that there are currently existing Eskom overhead power lines present in the area and traverse the proposed sites of the WEF.</p> <p>The Civil Aviation Authority has been consulted regarding the development of the project since the commencement of the S&EIA Process. No specific negative impacts or issues have been raised to date by the CAA regarding the project.</p>
Defence Theme Sensitivity: Low	No	Low	<p>Feature(s): None identified</p> <p>No defence site has been identified in the surrounding areas from the proposed site. The impacts stemming from the proposed development is not expected to result to any impact on potential defence sites nearby. The South African National Defence Force (SANDF) has been identified as an I&AP and will be kept informed of the project as the process advances. No comment has been received from SANDF to date.</p>
Flicker Theme Sensitivity: Very High	Yes	Very High	<p>Feature(s): Potential temporarily or permanently inhabited residence</p> <p>The very high sensitivity is confirmed as 17 shadow flicker receptors identified within a 10-rotor diameter distance from a WTG (2 000 m as per WTG specifications).</p>

Theme	Specialist Study Undertaken (yes/no)	Verified Sensitivity Rating	Comment/Motivation
			Refer to Appendix E6 for the Visual Impact Assessment with comprises of the detailed flicker assessment.
Landscape (Visual) Theme Sensitivity: Very High	Yes	Very High	<p>Feature(s): Mountain tops and high ridges. Slope more than 1:4. Within 250 m of a river.</p> <p>The VIA determines the following sensitivities:</p> <ul style="list-style-type: none"> Slope between 1:4 and 1:10 - High - Impact on visual aesthetics of landscape features. Impact on sense of place. Within 500 m of a river - High - Impact on visual aesthetics of landscape features. Impact on sense of place. Slope less than 1:10 - Low - Impact on visual aesthetics of landscape features. Impact on sense of place. Within 1 000 m of a wetland - Medium - Impact on visual aesthetics of landscape features. Impact on sense of place. Mountain tops and high ridges - Very High - Increase in visibility and impact on visual aesthetics of landscape features. Impact on sense of place. Slope more than 1:4 - Very High - Impact on visual aesthetics of landscape features. Impact on sense of place. Within 250 m of a river - Very High - Impact on visual aesthetics of landscape features. Impact on sense of place. <p>Refer to Appendix E6 for the Visual Impact Assessment.</p>
Palaeontology Theme Sensitivity: Very High	Yes	Very High	<p>Feature(s): Features with a very high paleontological sensitivity.</p> <p>Well-preserved to weathered fossils were identified in the development site. These fossil finds are thus in agreement with the Very High Palaeontological Sensitivity of the SAHRIS PalaeoMap and DFFE Screening tool.</p>

Theme	Specialist Study Undertaken (yes/no)	Verified Sensitivity Rating	Comment/Motivation
			Refer to Appendix E10 for the Paleontological Impact Assessment.
Noise Theme Sensitivity: Very High	Yes	Very High	<p>Feature(s): Potential temporarily or permanently inhabited residence.</p> <p>Potential noise-sensitive activities were identified (verified during the site visits) and marked as green dots. There are a number of structures used for residential purposes associated with the areas identified to have a “very high” sensitivity to noise (within the project focus area) and the site sensitivity verification agrees with the findings of the online screening tool.</p> <p>However, there are also a number of areas identified to have a “very high” sensitivity to noise, though there are no noise-sensitive activities associated with these areas. This site sensitivity verification therefore disputes the finding of the online screening tool for those areas.</p> <p>There are therefore a number of potential noise-sensitive receptors within the project focus area.</p> <p>Refer to Appendix E8 for the Noise Impact Assessment.</p>
Plant Species Theme Sensitivity: Medium	Yes	Medium	<p>Feature(s): Sensitive species 383. Peersia frithii. Sensitive species 1212. Tritonia florentiae. Sensitive species 1039.</p> <p>The medium sensitivity is validated. High SEI areas contain habitat that is intact and capable of supporting recorded and some expected SCCs. However, majority of the area is Medium SEI. Layout avoids High SEI areas.</p> <p>Refer to Appendix E1 for the Terrestrial Impact Assessment.</p>
RFI Theme Sensitivity: Low	No	Low	<p>Feature(s): Low sensitivity for telecommunications; none; more than 60 km from a Weather Radar installation</p>

Theme	Specialist Study Undertaken (yes/no)	Verified Sensitivity Rating	Comment/Motivation
			The desktop study is inconclusive as no further information related to the weather radar installation could be confirmed. The impacts stemming from the proposed development is not expected to result to any impact on potential weather radar nearby. However, the South African Radio Astronomy Observatory (SARAO) and the South African Weather Services (SAWS) have been identified as an I&AP and will be kept informed of the project as the process advances. No comment has been received from SARAO to date.
Terrestrial Biodiversity Theme Sensitivity: Very High	Yes	High to Very Low	<p>Feature(s): ESA 2: Restore from other land use. CBA 2: Terrestrial. CBA 1: Terrestrial. FEPA Subcatchment.</p> <p>The sensitivity rating of the various habitats presents were allocated as follows:</p> <ul style="list-style-type: none"> Rocky Outcrops - High - Disputed – Habitat remains in good condition and delivers important ecological functions. Some minor disturbance evident in the form of grazing pressure. Layout largely avoids High SEI areas. Karoo Shrub Grasslands High - Disputed - Habitat remains in good condition and delivers important ecological functions. Some minor disturbance evident in the form of grazing pressure. Karoo Shrubland - Medium - Disputed - Habitat remains in good condition and delivers important ecological functions. Some minor disturbance evident in the form of grazing pressure. Modified - Very Low - Disputed - Habitat is entirely transformed. Water Recourse – High - Disputed - Habitat remains in good condition and delivers important ecological functions such as vital water recourse of mammals in the surrounding area as well as shelter. Layout largely avoids High SEI areas. <p>Refer to Appendix E1 for the Terrestrial Impact Assessment.</p>
Vulture Species Theme	Yes	Low	<p>Feature(s): Affecting an area <1% of the population</p> <p>The Screening Tool results for the vulture theme were confirmed as of low sensitivity, with no vultures recorded during pre-application monitoring or by SABAP2 in the area. As no vulture protocol for</p>

Theme	Specialist Study Undertaken (yes/no)	Verified Sensitivity Rating	Comment/Motivation
Sensitivity: Low			the vulture theme has been gazetted to date, there is no legal requirement for this theme and assessments would be conducted in line with Appendix 6 of the NEMA EIA Regulations, 2014, as amended. The potential presence of far-ranging vultures during the lifetime of the facility was considered as possible. Refer to Appendix E3 for the Avifauna Impact Assessment Report.
Social Theme Sensitivity: N/A	Yes	N/A	A social impact assessment has been undertaken for the proposed development. Refer to Appendix E7.
Geotechnical Theme Sensitivity: N/A	Yes	N/A	The consideration of geotechnical aspects is considered to be of a technical concern rather than an environmental concern. The detailed Geotechnical Assessment will be conducted before construction begins as part of the micro-siting of the facility layout. Refer to Appendix E12.
Traffic Assessment Sensitivity: N/A	Yes	N/A	A Traffic Impact Assessment has been undertaken for the project. Refer to Appendix E11.

Table 5.2: Specialist Studies Identified by the National Web-Based Screening Tool, Power Line (Option 1 – Preferred) Category and Specialist Studies Completed

Theme	Specialist Study Undertaken (yes/no)	Verified Sensitivity Rating	Comment/Motivation
Agriculture Theme Sensitivity: High	Yes	High	Feature(s): Land capability; 09. Moderate-High/10. Moderate-High. The soil and agricultural assessment confirm the high sensitivity rating by the screening tool that is based on the cropping status component of sensitivity, only for those areas that have been verified

Theme	Specialist Study Undertaken (yes/no)	Verified Sensitivity Rating	Comment/Motivation
			<p>as cropland. It should be noted that croplands in this environment are restricted to small, isolated patches that are usually associated with farmsteads and located close to watercourses. None of the croplands on site will be impacted by any of the development infrastructure.</p> <p>Refer to Appendix E5 for the soil and agricultural impact assessment.</p>
Animal Species Theme Sensitivity: High	Yes	High Avifauna Sensitivity Medium Terrestrial Fauna Sensitivity	<p>Feature(s): Aves-<i>Neotis ludwigii</i>. Aves-<i>Polemaetus bellicosus</i>. Aves-<i>Afrotis afra</i>.</p> <p>The specialist site inspection and pre-application avifaunal monitoring confirmed the presence of 13 SCC, including those identified by the Screening Tool. Five (05) of the confirmed SCC are red-listed as Endangered (Black Harrier, Ludwig's Bustard, Martial Eagle, Secretarybird and Tawny Eagle), five (05) are red-listed as Vulnerable (Black Stork, Blue Crane, Lanner Falcon, Southern Black Korhaan, and Verreaux's Eagle) and three (03) are red-listed as Near threatened.</p> <p>Therefore, the results are confirmed as high sensitivity.</p> <p>Refer to Appendix E3 for the Avifauna Impact Assessment Report.</p> <p>According to the terrestrial fauna assessment, the high sensitivity is disputed and should be allocated a medium sensitivity. High SEI areas contain habitat that is intact and capable of supporting recorded and some expected SCCs. However, majority of the area is Medium SEI. Layout avoids High SEI areas.</p> <p>Refer to Appendix E1 for the Terrestrial Biodiversity Assessment.</p>
Aquatic Biodiversity Theme	Yes	Very High	<p>Feature(s): CBA 1: Aquatic. ESA 1: Aquatic. FEPA Subcatchment. Rivers-AB. Rivers-C.</p> <p>The screening tool clearly presents the aquatic sensitivity features within the project area. In this instance, the majority of the project area falls under a "High Sensitivity" as they act as Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs) with Good (AB) river conditions that</p>

Theme	Specialist Study Undertaken (yes/no)	Verified Sensitivity Rating	Comment/Motivation
Sensitivity: Very High			<p>form an integral part of FEPA sub-catchments with the depression wetlands hosting vegetation of the Lower Karoo Bioregion.</p> <p>Refer to Appendix E2 for the Aquatic Impact Assessment.</p>
Archaeological and Cultural Heritage Theme Sensitivity: Low	Yes	Medium	<p>Feature(s): None identified</p> <p>Due to the presence of structures representative of typical Karoo-style longhouse architecture, stone kraals and other structures predominantly older than 60 years speaking to the history and culture of the early European farmers in the area, marked and possible unmarked graves, and an identified stone age knapping site of high significance noting the presence of Khoi-San inhabitants throughout the region, it is proposed that the area be considered of medium historical and cultural heritage significance.</p> <p>Refer to Appendix E9 for the HIA.</p>
Civil Aviation (Wind) Theme Sensitivity: High	No	Low	<p>Feature(s): Dangerous and restricted airspace as demarcated</p> <p>No negative impacts are expected to occur on civil aviation and potential impacts will be site specific and can be mitigated. This is based on the fact that there are currently existing Eskom overhead power lines present in the area and traverse the proposed sites of the WEF.</p> <p>The Civil Aviation Authority has been consulted regarding the development of the project since the commencement of the S&EIA Process. No specific negative impacts or issues have been raised to date by the CAA regarding the project.</p>
Defence Theme Sensitivity: Low	No	Low	<p>Feature(s): None identified</p> <p>No defence site has been identified in the surrounding areas from the proposed site. The impacts stemming from the proposed development is not expected to result to any impact on potential</p>

Theme	Specialist Study Undertaken (yes/no)	Verified Sensitivity Rating	Comment/Motivation
			defence sites nearby. The South African National Defence Force (SANDF) has been identified as an I&AP and will be kept informed of the project as the process advances. No comment has been received from SANDF to date.
Palaeontology Theme Sensitivity: Very High	Yes	Very High	<p>Feature(s): Features with a very high paleontological sensitivity</p> <p>Well-preserved to weathered fossils were identified in the development site. These fossil finds are thus in agreement with the Very High Palaeontological Sensitivity of the SAHRIS PalaeoMap and DFFE Screening tool.</p> <p>Refer to Appendix E10 for the Paleontological Impact Assessment.</p>
Plant Species Theme Sensitivity: Medium	Yes	Medium	<p>Feature(s): Sensitive species 383. <i>Peersia frithii</i>. <i>Tritonia florentiae</i>. Sensitive species 1039</p> <p>The medium sensitivity is validated. High SEI areas contain habitat that is intact and capable of supporting recorded and some expected SCCs. However, majority of the area is Medium SEI. Layout avoids High SEI areas.</p> <p>Refer to Appendix E1 for the Terrestrial Impact Assessment.</p>
Terrestrial Biodiversity Theme Sensitivity: Very High	Yes	High to Very Low	<p>Feature(s): ESA 2: Restore from other land use. CBA 2: Terrestrial. CBA 1: Terrestrial. FEPA Subcatchment</p> <p>The sensitivity rating of the various habitats presents were allocated as follows:</p> <ul style="list-style-type: none"> Rocky Outcrops - High - Disputed – Habitat remains in good condition and delivers important ecological functions. Some minor disturbance evident in the form of grazing pressure. Layout largely avoids High SEI areas. Karoo Shrub Grasslands High - Disputed - Habitat remains in good condition and delivers important ecological functions. Some minor disturbance evident in the form of grazing pressure.

Theme	Specialist Study Undertaken (yes/no)	Verified Sensitivity Rating	Comment/Motivation
			<ul style="list-style-type: none"> Karoo Shrubland - Medium - Disputed - Habitat remains in good condition and delivers important ecological functions. Some minor disturbance evident in the form of grazing pressure. Modified - Very Low - Disputed - Habitat is entirely transformed. Water Recourse – High - Disputed - Habitat remains in good condition and delivers important ecological functions such as vital water recourse of mammals in the surrounding area as well as shelter. Layout largely avoids High SEI areas. <p>Refer to Appendix E1 for the Terrestrial Impact Assessment.</p>

Table 5.3: Specialist Studies Identified by the National Web-Based Screening Tool, Power Line (Option 2) Category and Specialist Studies Completed

Theme	Specialist Study Undertaken (yes/no)	Verified Sensitivity Rating	Comment/Motivation
Agriculture Theme Sensitivity: High	Yes	High	<p>Feature(s): Land capability; 09. Moderate-High/10. Moderate-High</p> <p>The soil and agricultural assessment confirm the high sensitivity rating by the screening tool that is based on the cropping status component of sensitivity, only for those areas that have been verified as cropland. It should be noted that croplands in this environment are restricted to small, isolated patches that are usually associated with farmsteads and located close to watercourses. None of the croplands on site will be impacted by any of the development infrastructure.</p> <p>Refer to Appendix E5 for the soil and agricultural impact assessment.</p>

Theme	Specialist Study Undertaken (yes/no)	Verified Sensitivity Rating	Comment/Motivation
Animal Species Theme Sensitivity: High	Yes	High Avifauna Sensitivity Medium Terrestrial Fauna Sensitivity	<p>Feature(s): Aves-<i>Neotis ludwigii</i>. Aves-<i>Polemaetus bellicosus</i>.</p> <p>The specialist site inspection and pre-application avifaunal monitoring confirmed the presence of 13 SCC, including those identified by the Screening Tool. Five (05) of the confirmed SCC are red-listed as Endangered (Black Harrier, Ludwig's Bustard, Martial Eagle, Secretarybird and Tawny Eagle), five (05) are red-listed as Vulnerable (Black Stork, Blue Crane, Lanner Falcon, Southern Black Korhaan, and Verreaux's Eagle) and three (03) are red-listed as Near threatened.</p> <p>Therefore, the results are confirmed as high sensitivity.</p> <p>Refer to Appendix E3 for the Avifauna Impact Assessment Report.</p> <p>According to the terrestrial fauna assessment, the high sensitivity is disputed and should be allocated a medium sensitivity. High SEI areas contain habitat that is intact and capable of supporting recorded and some expected SCCs. However, majority of the area is Medium SEI. Layout avoids High SEI areas.</p> <p>Refer to Appendix E1 for the Terrestrial Biodiversity Assessment.</p>
Aquatic Biodiversity Theme Sensitivity: Very High	Yes	Very High	<p>Feature(s): CBA 1: Aquatic. ESA 1: Aquatic. FEPA Subcatchment. Rivers-AB. Rivers-C. Wetlands (River)</p> <p>The screening tool clearly presents the aquatic sensitivity features within the project area. In this instance, the majority of the project area falls under a "High Sensitivity" as they act as Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs) with Good (AB) river conditions that form an integral part of FEPA sub-catchments with the depression wetlands hosting vegetation of the Lower Karoo Bioregion.</p> <p>Refer to Appendix E2 for the Aquatic Impact Assessment.</p>

Theme	Specialist Study Undertaken (yes/no)	Verified Sensitivity Rating	Comment/Motivation
Archaeological and Cultural Heritage Theme Sensitivity: Low	Yes	Medium	<p>Feature(s): None identified</p> <p>Due to the presence of structures representative of typical Karoo-style longhouse architecture, stone kraals and other structures predominantly older than 60 years speaking to the history and culture of the early European farmers in the area, marked and possible unmarked graves, and an identified stone age knapping site of high significance noting the presence of Khoi-San inhabitants throughout the region, it is proposed that the area be considered of medium historical and cultural heritage significance.</p> <p>Refer to Appendix E9 for the HIA.</p>
Civil Aviation (Wind) Theme Sensitivity: High	No	Low	<p>Feature(s): Dangerous and restricted airspace as demarcated</p> <p>No negative impacts are expected to occur on civil aviation and potential impacts will be site specific and can be mitigated. This is based on the fact that there are currently existing Eskom overhead power lines present in the area and traverse the proposed sites of the WEF.</p> <p>The Civil Aviation Authority has been consulted regarding the development of the project since the commencement of the S&EIA Process. No specific negative impacts or issues have been raised to date by the CAA regarding the project.</p>
Defence Theme Sensitivity: Low	No	Low	<p>Feature(s): None identified</p> <p>No defence site has been identified in the surrounding areas from the proposed site. The impacts stemming from the proposed development is not expected to result to any impact on potential defence sites nearby. The South African National Defence Force (SANDF) has been identified as an I&AP and will be kept informed of the project as the process advances. No comment has been received from SANDF to date.</p>

Theme	Specialist Study Undertaken (yes/no)	Verified Sensitivity Rating	Comment/Motivation
Palaeontology Theme Sensitivity: Very High	Yes	Very High	<p>Feature(s): Features with a very high paleontological sensitivity</p> <p>Well-preserved to weathered fossils were identified in the development site. These fossil finds are thus in agreement with the Very High Palaeontological Sensitivity of the SAHRIS PalaeoMap and DFFE Screening tool.</p> <p>Refer to Appendix E10 for the Paleontological Impact Assessment.</p>
Plant Species Theme Sensitivity: Medium	Yes	Medium	<p>Feature(s): Sensitive species 383. <i>Peersia frithii</i>. <i>Tritonia florentiae</i>.</p> <p>The medium sensitivity is validated. High SEI areas contain habitat that is intact and capable of supporting recorded and some expected SCCs. However, majority of the area is Medium SEI. Layout avoids High SEI areas.</p> <p>Refer to Appendix E1 for the Terrestrial Impact Assessment.</p>
Terrestrial Biodiversity Theme Sensitivity: Very High	Yes	High to Low	<p>Feature(s): ESA 2: Restore from other land use. CBA 2: Terrestrial. CBA 1: Terrestrial. FEPA Subcatchment</p> <p>The sensitivity rating of the various habitats presents were allocated as follows:</p> <ul style="list-style-type: none"> Rocky Outcrops - High - Disputed – Habitat remains in good condition and delivers important ecological functions. Some minor disturbance evident in the form of grazing pressure. Layout largely avoids High SEI areas. Karoo Shrub Grasslands High - Disputed - Habitat remains in good condition and delivers important ecological functions. Some minor disturbance evident in the form of grazing pressure. Karoo Shrubland - Medium - Disputed - Habitat remains in good condition and delivers important ecological functions. Some minor disturbance evident in the form of grazing pressure. Modified - Very Low - Disputed - Habitat is entirely transformed.

Theme	Specialist Study Undertaken (yes/no)	Verified Sensitivity Rating	Comment/Motivation
			<ul style="list-style-type: none">Water Recourse – High - Disputed - Habitat remains in good condition and delivers important ecological functions such as vital water recourse of mammals in the surrounding area as well as shelter. Layout largely avoids High SEI areas. <p>Refer to Appendix E1 for the Terrestrial Impact Assessment.</p>

5.2 Impact Assessment Methodology

The Environmental Impact Assessment (EIA) aims to identify the various possible environmental impacts that could result from the proposed activity. Different impacts need to be evaluated in terms of its significance and in doing so highlight the most critical issues to be addressed. Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. The total number of points scored for each impact indicates the level of significance of the impact.

Impact assessment must take account of the nature, scale, and duration of impacts on the environment whether such impacts are positive or negative. Each impact is also assessed according to the project phases:

- planning
- construction
- operation
- decommissioning

Table 5.4 provides the impact rating system applied in this final Scoping Report.

Table 5.4: Impact Rating Methodology

NATURE		
Include a brief description of the impact of the environmental parameter being assessed in the context of the project. This criterion includes a brief written statement of the environmental aspect being impacted by a particular action or activity.		
GEOGRAPHICAL EXTENT		
This is defined as the area over which the impact will be experienced.		
1	Site	The impact will only affect the site.
2	Local/district	Will affect the local area or district.
3	Province/region	Will affect the entire province or region.
4	International and National	Will affect the entire country.
PROBABILITY		
This describes the chance of occurrence of an impact.		
1	Unlikely	The chance of the impact occurring is extremely low (Less than a 25% chance of occurrence).
2	Possible	The impact may occur (Between a 25% to 50% chance of occurrence).

3	Probable	The impact will likely occur (Between a 50% to 75% chance of occurrence).
4	Definite	Impact will certainly occur (Greater than a 75% chance of occurrence).
DURATION		
This describes the duration of the impacts. Duration indicates the lifetime of the impact as a result of the proposed activity.		
1	Short term	The impact will either disappear with mitigation or will be mitigated through natural processes in a span shorter than the construction phase (0 – 1 years), or the impact will last for the period of a relatively short construction period and a limited recovery time after construction, thereafter it will be entirely negated (0 – 2 years).
2	Medium term	The impact will continue or last for some time after the construction phase but will be mitigated by direct human action or by natural processes thereafter (2 – 10 years).
3	Long term	The impact and its effects will continue or last for the entire operational life of the development but will be mitigated by direct human action or by natural processes thereafter (10 – 30 years).
4	Permanent	The only class of impact that will be non-transitory. Mitigation either by man or natural process will not occur in such a way or such a time span that the impact can be considered indefinite.
INTENSITY/ MAGNITUDE		
Describes the severity of an impact.		
1	Low	Impact affects the quality, use and integrity of the system/component in a way that is barely perceptible.
2	Medium	Impact alters the quality, use and integrity of the system/component but system/component still continues to function in a moderately modified way and maintains general integrity (some impact on integrity).
3	High	Impact affects the continued viability of the system/component, and the quality, use, integrity and functionality of the system or component is severely impaired and may temporarily cease. High costs of rehabilitation and remediation.

4	Very high	Impact affects the continued viability of the system/component, and the quality, use, integrity and functionality of the system or component permanently ceases and is irreversibly impaired. Rehabilitation and remediation often impossible. If possible, rehabilitation and remediation often unfeasible due to extremely high costs of rehabilitation and remediation.
REVERSIBILITY		
This describes the degree to which an impact can be successfully reversed upon completion of the proposed activity.		
1	Completely reversible	The impact is reversible with implementation of minor mitigation measures.
2	Partly reversible	The impact is partly reversible but more intense mitigation measures are required.
3	Barely reversible	The impact is unlikely to be reversed even with intense mitigation measures.
4	Irreversible	The impact is irreversible, and no mitigation measures exist.
IRREPLACEABLE LOSS OF RESOURCES		
This describes the degree to which resources will be irreplaceably lost as a result of a proposed activity.		
1	No loss of resource	The impact will not result in the loss of any resources.
2	Marginal loss of resource	The impact will result in marginal loss of resources.
3	Significant loss of resources	The impact will result in significant loss of resources.
4	Complete loss of resources	The impact is result in a complete loss of all resources.
CUMULATIVE EFFECT		
This describes the cumulative effect of the impacts. A cumulative impact is an effect which in itself may not be significant but may become significant if added to other existing or potential impacts emanating from other similar or diverse activities as a result of the project activity in question.		
1	Negligible cumulative impact	The impact would result in negligible to no cumulative effects.
2	Low cumulative impact	The impact would result in insignificant cumulative effects.
3	Medium cumulative impact	The impact would result in minor cumulative effects.

4	High cumulative impact	The impact would result in significant cumulative effects
SIGNIFICANCE		
<p>Significance is determined through a synthesis of impact characteristics. Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. The calculation of the significance of an impact uses the following formula: (Extent + probability + reversibility + irreplaceability + duration + cumulative effect) x magnitude/intensity.</p> <p>The summation of the different criteria will produce a non-weighted value. By multiplying this value with the magnitude/intensity, the resultant value acquires a weighted characteristic which can be measured and assigned a significance rating.</p>		
Points	Impact significance rating	Description
6 to 28	Negative low impact	The anticipated impact will have negligible negative effects and will require little to no mitigation.
6 to 28	Positive low impact	The anticipated impact will have minor positive effects.
29 to 50	Negative medium impact	The anticipated impact will have moderate negative effects and will require moderate mitigation measures.
29 to 50	Positive medium impact	The anticipated impact will have moderate positive effects.
51 to 73	Negative high impact	The anticipated impact will have significant effects and will require significant mitigation measures to achieve an acceptable level of impact.
51 to 73	Positive high impact	The anticipated impact will have significant positive effects.
74 to 96	Negative very high impact	The anticipated impact will have highly significant effects and are unlikely to be able to be mitigated adequately. These impacts could be considered "fatal flaws".
74 to 96	Positive very high impact	The anticipated impact will have highly significant positive effects.

The potential impacts that may be associated with the Carissa WEF has been identified and is listed in Section 8 of this final Scoping Report. An impact assessment is provided of the potential impacts.

5.3 Legal Requirements Complied with in Section 5 as per the Requirements of the EIA Regulations, 2014 (as amended)

This section of the report includes the following information required in terms of Appendix 2: Content of the scoping report:

Requirement	Relevant Section
2(g) a full description of the process followed to reach the proposed preferred activity, site and location of the development footprint, including (vi) the methodology used in identifying and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks associated with the alternatives.	Section 5 of this final Scoping Report provides the process followed in terms of the S&EIA process and also provides the details of the methodology used to assess the potential impacts and the significance thereof.

6 PUBLIC PARTICIPATION PROCESS

The Public Participation Process (PPP) has been undertaken in accordance with the requirements of Chapter 6, Regulations 39 to 44 of the EIA Regulations 2014, as amended (GN.R. 326). The availability and sharing of information provide the foundation of the public participation process, which includes creating opportunities for Interested and/or Affected Parties (I&APs) to become actively involved from the commencement of the S&EIA process.

Variables of a development provide an indication of the level of public participation that would be required. The variables considered include:

- The scale / extent of the potential impacts;
- The sensitivity and vulnerability of the affected environment, and its social aspects and the degree to which the project may create controversy; and
- The characteristics and current conditions of the affected parties.

The sections below provide an indication of the tasks which have been completed for the public participation process and the applicable regulation(s) in the EIA Regulations 2014 (as amended), that are complied with.

6.1 Identification of Stakeholder and Interested and / or Affected Parties

The identification of potentially affected stakeholders and I&APs has been undertaken through a process of networking and referral, obtaining information from existing stakeholder databases, liaison with potentially affected parties in the greater study area and a registration process involving the placement of the site notices on the affected properties and the publishing of an advert in a local newspaper. Furthermore, previous project experience in the Western Cape area has also contributed towards the identification of the potential I&APs for the Carissa WEF.

Key stakeholders and affected and surrounding landowners have been identified and automatically registered on the project database. Other stakeholders are required to formally register their interest in the project.

All relevant stakeholder and I&AP information has been recorded within a register of I&APs, as per the requirements of Regulation 42 of the EIA Regulations, 2014 (as amended). Refer to Appendix C3 for the list of registered I&APs.

The identification and registration of I&APs will be an on-going process for the duration of the S&EIA Process. The database of I&APs will be updated throughout the process and will act as a record of the I&APs involved in the public participation process.

In terms of the EIA Regulations 2014, as amended, the following has been complied with:

42 A proponent or applicant must ensure the opening and maintenance of a register of I&APs and submit such a register to the competent authority, which register must contain the names, contact details and addresses of –

- (a) All persons who, as a consequence of the public participation process conducted in respect of that application, have submitted written comments or attended meetings with the proponent, applicant or EAP;
- (b) All persons who have requested the proponent or applicant, in writing, for their names to be placed on the register; and
- (c) All organs of state which have jurisdiction in respect of the activity to which the application relates.

6.2 Formal Notification

The EIA process was announced through the submission of an invitation / notification to the Organs of State, potentially affected and neighbouring landowners and general public to register as I&APs, and thereby obtain access to all project related information. This was achieved through:

- Placement of site notices announcing the EIA process at visible points along the boundary of the site, in accordance with the requirements of the EIA Regulations. Photographs and the GPS co-ordinates of the site notices are contained in Appendix C2. The site notices were placed on 19 April 2024 in isiXhosa, English and Afrikaans.
- Placement of an advertisement in English and Afrikaans announcing the EIA process for the project and inviting members of the public to register themselves as I&APs on the project database in the Beaufort West, Prince Albert, Laingsburg Advertiser on 19 April 2024. The tear sheet of the newspaper advert is contained in Appendix C1.
- Compilation of a Background Information Document (BID) providing technical and environmental details on the development and how to become involved in the EIA process. The BID was distributed to identified stakeholders and I&APs (including surrounding and affected landowners) on 12 August 2024. Refer to Figure 6.1 which provides a map of the affected and adjacent landowners to the site under assessment.
- Identified I&APs, including key stakeholders representing various sectors, were directly informed of the EIA process on 12 August 2024 via registered post, telephone calls, WhatsApp's and emails (as relevant). The BID was distributed with the notification.
- The draft Scoping Report was made available to all I&APs for a 30-day review and comment period from **23 October 2024 to 22 November 2024 (inclusive of both days)**. Dropbox was the main platform utilised for providing access to the reporting documents. Hard copies of the report was made available on request and where an I&AP indicated that they do not have the resources to view the report on an online platform. Furthermore, the draft Scoping Report was uploaded to the Blue Crane Environmental website (<https://www.bcrane.co.za/public-documents/>) which enables any party from the public to automatically register on the project database and gain access to the documents available for review. A reminder of the review and comment period dates was also be sent to the registered I&APs a few days before the conclusion of the review period.
- I&AP's and organs of state were requested to provide their comments on the report in writing by 22 November 2024. All comments submitted during the 30-day review and comment period have been documented and compiled into a Comments and Response Report included as part of this final Scoping Report for decision-making.

In terms of the EIA Regulations 2014, as amended, the following has been complied with:

- 41.(2)(a) Fixing a notice board at a place conspicuous to and accessible by the public at the boundary, on the fence or along the corridor of –

- (i) The site where the activity to which the application or proposed application relates is or is to be undertaken; and
 - (ii) Any alternative site.
- 41.(2)(b) Giving written notice, in any of the manners provided for in section 47D of the Act, to –
- (i) The occupiers of the site and, if the proponent or applicant is not the owner or person in control of the site on which the activity is to be undertaken, the owner or person in control of the site where the activity is or is to be undertaken and to any alternative site where the activity is to be undertaken;
 - (ii) Owners, persons in control of, and occupiers of land adjacent to the site where the activity is or is to be undertaken and to any alternative site where the activity is to be undertaken;
 - (iii) The municipal councillor of the ward in which the site and alternative site is situated and any organisation of ratepayers that represent the community in the area;
 - (iv) The municipality which has jurisdiction in the area;
 - (v) Any organ of state having jurisdiction in respect of any aspect of the activity; and
 - (vi) Any other party as required by the competent authority.
- 41.(2)(c) Placing an advertisement in –
- (i) One local newspaper; or
 - (ii) Any official Gazette that is published specifically for the purpose of providing public notice of applications or other submissions made in terms of these Regulations;
- 41.(2)(d) Placing an advertisement in at least one provincial newspaper or national newspaper, if the activity has or may have an impact that extends beyond the boundaries of the metropolitan or district municipality in which it is or will be undertaken: Provided that this paragraph need not be complied with if an advertisement has been placed in an official Gazette referred to in paragraph (c)(ii); and
- 41.(2)(e) Using reasonable alternative methods, as agreed to by the competent authority, in those instances where a person is desirous of but unable to participate in the process due to –
- (i) Illiteracy;
 - (ii) Disability; or
 - (iii) Any other disadvantage.

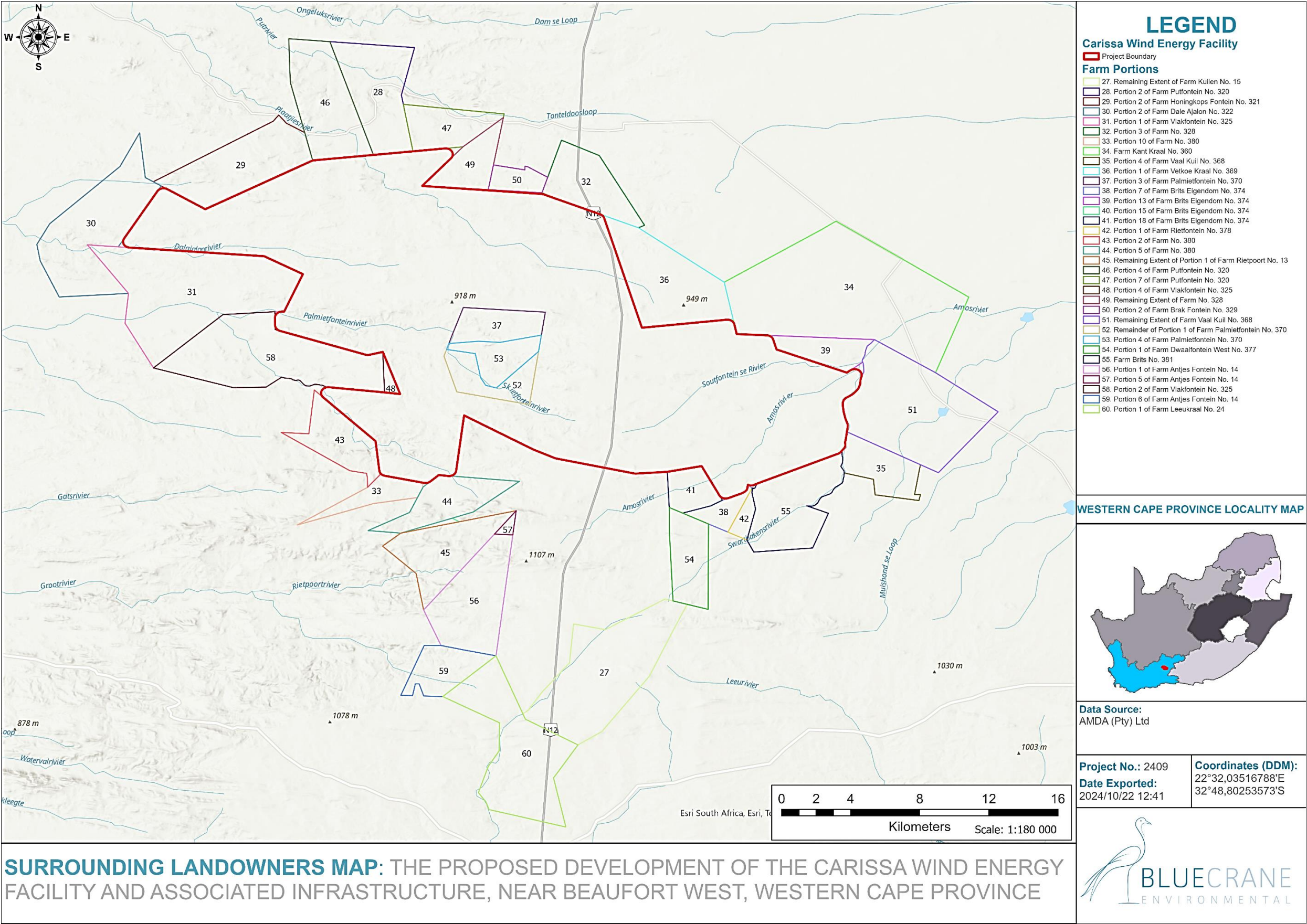


Figure 6.1: Map of Affected and Surrounding Landowners

6.3 Registered I&APs Entitled to Comment on the Reports and Plans

All registered I&APs on the database (Appendix C3) were notified, as appropriate, of the availability of the draft Scoping Report for a 30-day review and comment period. The I&APs were invited to comment on the draft Scoping Report within the stipulated 30-day timeframe (from **23 October 2024 to 22 November 2024**). The notification was distributed to the I&APs on 23 October 2024.

Proof of notification and correspondence is included in Appendix C4.

All written comments received following notification of the S&EIA process and prior to the release of the draft Scoping Report for review and comment have been included in the comments and responses report as part of this draft Scoping Report as Appendix C6.

All written comments received during the 30-day review and comment period have also been recorded, included and addressed in a comments and responses report submitted to the DFFE with this final Scoping Report for decision-making.

The C&R Report includes detailed responses from members of the EIA project team and / or Applicant to the issues and comments raised during the public participation process.

The C&R report consists of written comments and issues received:

- on the notification of the EIA process;
- per e-mail, fax or telephonically; and
- during the 30-day review of the draft Scoping Report.

In terms of the EIA Regulations 2014, as amended, the following has been complied with:

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 sub regulation (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.

6.4 Legal Requirements Complied with in Section 6 as per the Requirements of the EIA Regulations, 2014 (as amended)

This section of the report includes the following information required in terms of Appendix 2: Content of the scoping report:

Requirement	Relevant Section
2(g) a full description of the process followed to reach the proposed preferred activity, site and location of the development footprint, including (ii) details of the public participation process undertaken in terms of regulation 41 of the Regulations, including copies of supporting documents and inputs	The public participation process, that has been undertaken in terms of Regulation 41 of the EIA Regulations 2014, as amended, is fully described and included in Section 6. Proof of all correspondence and proof of the public participation tasks completed is included in Appendix C of this final Scoping Report.
2(g)(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	A summary of the issues raised by I&APs during the 30-day review and comment period of the draft Scoping Report is included in this final Scoping Report submitted to the DFFE for decision-making under Appendix C6.

7 DESCRIPTION OF THE AFFECTED ENVIRONMENT

The following sections provide general information on the biophysical and socio-economic attributes associated with the preferred alternative (i.e., the location of the development area within the affected property). The information provided below aims to assist the reader in understanding the receiving environment within which the project is proposed. This chapter was supplemented by research of existing available information; information gathered from on-site investigations and as received from various specialist investigations. Refer to Table 1.3 for a list of specialists that were consulted for the proposed Carissa WEF. All specialist studies are included in Appendix E.

7.1 Description of the Study Area

As presented in the Social Impact Assessment (Appendix E7), the proposed Carissa WEF is located within the Western Cape Province.

Western Cape Province

The Western Cape Province, located at the southern tip of South Africa, boasts a diverse geographical and economic landscape. It is bordered by the Atlantic Ocean to the west and the Indian Ocean to the south, with the Eastern Cape Province to the east and the Northern Cape Province to the north. Cape Town, the provincial capital, also serves as South Africa's legislative capital and is the second most populous city in the country after Johannesburg. Other notable cities and towns in the Western Cape include Vredenburg, Saldanha, Worcester, Stellenbosch, George, and Oudtshoorn.

The province is renowned for its varied topography. Along the southern coastline are mountainous regions, including the famous Table Mountain. As one moves inland, the landscape transitions into the arid Karoo regions and further north into rocky escarpments. This diverse terrain is complemented by a rich array of tourist attractions such as the iconic Table Mountain, the Cape Winelands, and the Cape Floral Kingdom, one of the six floral kingdoms in the world.

Economically, the Western Cape is driven by tourism, agriculture, and marine fisheries. The marine fisheries sector supports both small-scale and large-scale fishing operations, benefiting coastal communities and contributing significantly to the economy. Agriculture is a major economic pillar, with the province producing a variety of export products including table grapes, apples, pears, peaches, wines, and brandies. The tourism sector is equally robust, offering numerous national parks, scenic beaches, and attractions like the Garden Route. The Winelands region, encompassing Stellenbosch, Paarl, Wellington, and Franschhoek, is particularly notable for its dual role in wine production for export and as a destination for wine tourism.

Administratively, the Western Cape is divided into the City of Cape Town Metropolitan Municipality and five district municipalities, which are further subdivided into 24 local municipalities. This structure supports the governance and management of the province's diverse and dynamic economic and social landscapes.

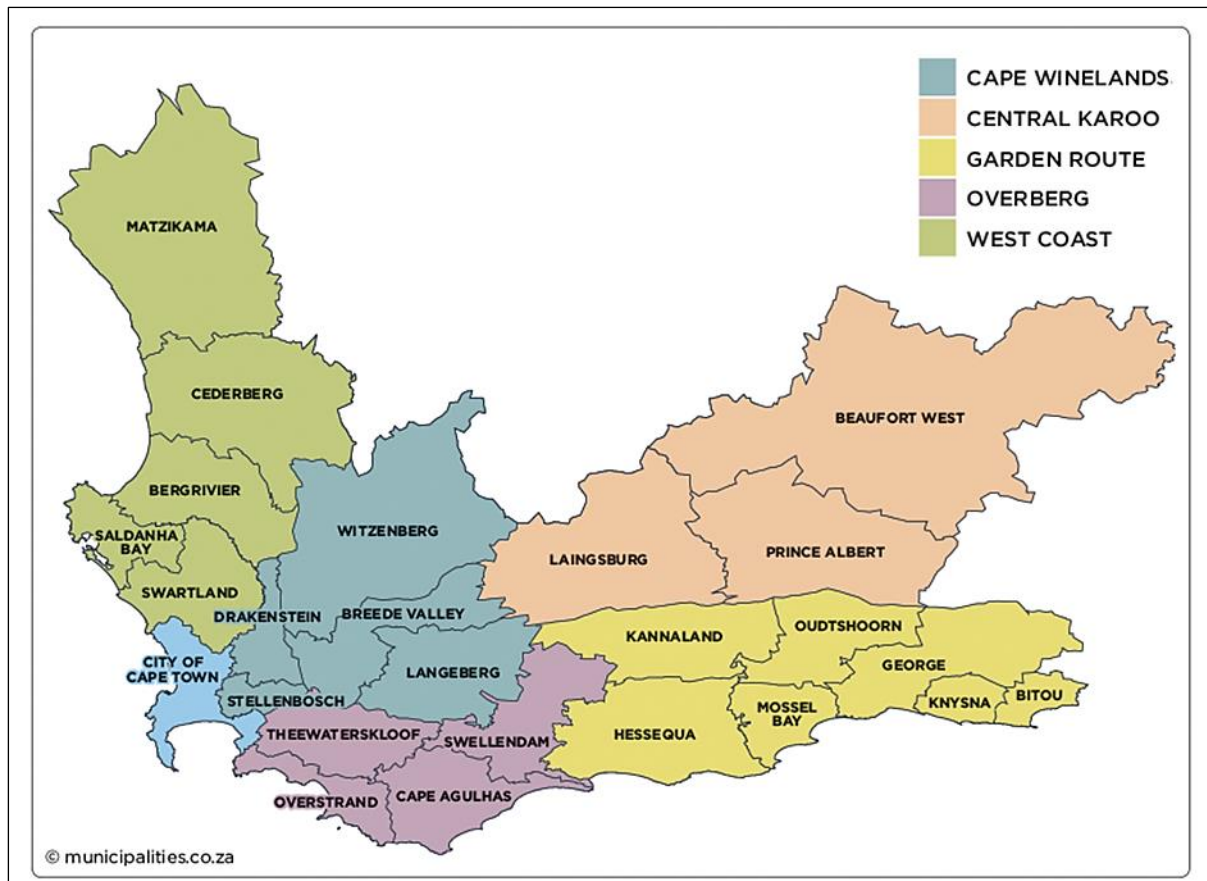


Figure 7.1: Map Showing the DMs of the Western Cape Province (Source: www.municipalities.co.za)

Central Karoo District Municipality

The Central Karoo District Municipality (DM) is a Category C municipality located in the north-eastern part of the Western Cape Province. It is bordered by Garden Route DM to the south, Cape Winelands DM to the west, Northern Cape Province to the north, and Eastern Cape Province to the east. The district municipality encompasses several towns including Beaufort West, Klaarstroom, Laingsburg, Leeu Gamka, Matjiesfontein, Merweville, Murraysburg, Nelspoort, Prince Albert, and Welgemoed.

The N1 national road traverses the district municipality, linking the Gauteng Province with Cape Town and other regions within the Western Cape Province. Central Karoo is the largest district in the province, making up a third of its geographical area. It is comprised of three local municipalities: Laingsburg, Prince Albert, and Beaufort West. The seat of the district is Beaufort West.

The Central Karoo is a low rainfall desert region, located on South Africa's central high-plateau and in the rain shadow of the Cape Fold mountains. It is classified as a cold desert climate (BWk) in terms of the Köppen climate. The region probably presents the most desolated and barren face of the Greater Karoo. The average rainfall is less than 200 mm and the 'soil' for the greater part is shallow and blueish shale that supports a very sparse and stunted vegetation, mostly succulents and the ubiquitous renosterbos loved by merino sheep. Due to the low carrying capacity of the land, sheep farms are enormous (up to 50 000 ha), as are, in consequence, the distance between homesteads.

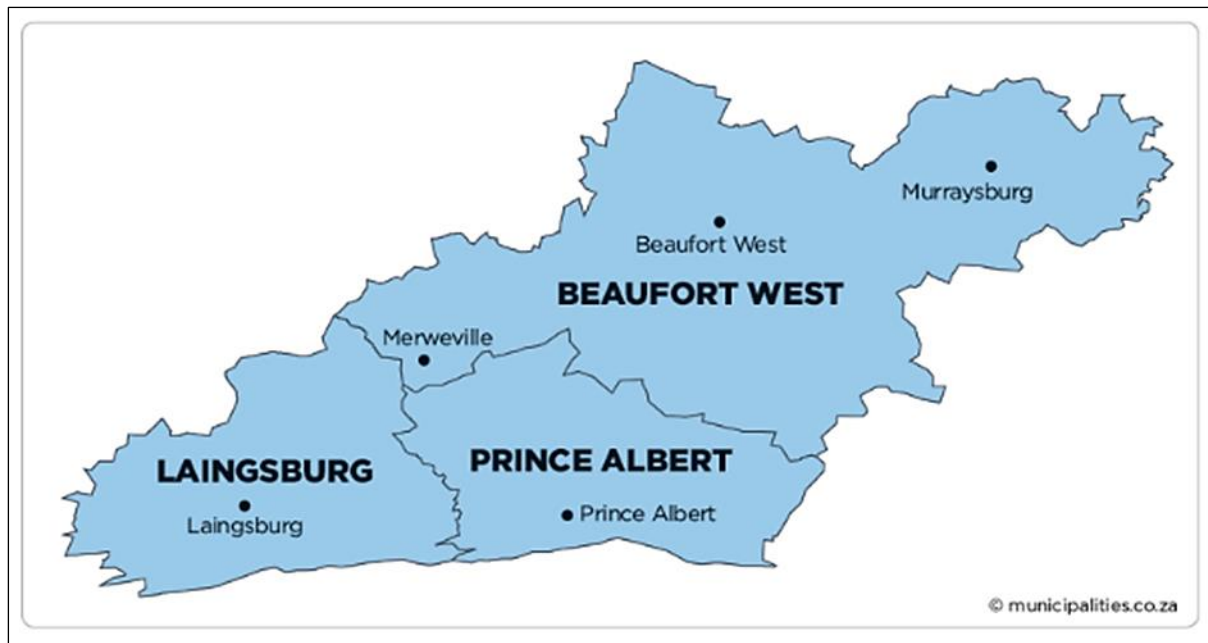


Figure 7.2: Map Showing the LMs of the Central Karoo DM (Source: www.municipalities.co.za)

Beaufort West Local Municipality

The Beaufort West Local Municipality (LM) is a Category B Municipality situated in the northern part of the Central Karoo DM, a subdivision of the Western Cape Province. The municipality shares its borders with the other two local municipalities of the Central Karoo DM, with the Prince Albert LM to the south and the Laingsburg LM to the south-west. The remaining borders is shared with the Northern Cape Province to the north and the Eastern Cape Province to the east. The local municipality encompasses several towns including Beaufort West, Merweville, Murraysburgh and Nelspoort.

Beaufort West is the oldest municipality in South Africa. The new district was proclaimed on 27 November 1818. The then governor of the Cape, Lord Charles Somerset, named the town and district 'Beaufort' in honour of his father, the 5th Duke of Beaufort. To avoid confusion with Fort Beaufort and Port Beaufort, the name 'Beaufort' was changed to Beaufort West in the 1860s.

Project Area

The proposed development is situated in the Karoo, which covers a large part of South Africa. The Karoo captivates visitors with its unique sense of place. Renowned for its delectable Karoo lamb chops, this region offers more than just culinary delights. It is a land of vast open spaces, adorned with undulating landforms and majestic mountains that stretch as far as the eye can see. As daylight fades, the Karoo unveils a breath-taking display of stars, illuminating the night sky with their celestial beauty. Yet, it is not only the natural wonders that make the Karoo special. The warmth and friendliness of its people create an inviting atmosphere, where one can experience genuine hospitality and a sense of belonging. Amidst the tranquillity and stillness of the Karoo, a profound peace washes over visitors, offering respite from the clamour of the modern world.

Most of the surrounding area has a low number of farmsteads/ buildings that are sparsely populated. The area is located in the agricultural region of the area with livestock, predominantly sheep farming as the most prominent activities. The topography within 3 km of the project area contains only modest variations in elevation, with a maximum elevation change of 966 meters and an average elevation of 851 meters above sea level. The area within 3 km of Beaufort West the nearest town is covered by

artificial surfaces (52%) and shrubs (43%). Within 16 km it is predominantly covered by shrubs (90%), and within 80 km by shrubs (89%) and bare soil (11%).

The Carissa WEF is proposed to be constructed outside of the urban edge of the surrounding towns on privately-owned properties currently used for grazing. The affected farm portions have not been considered for an alternative future land use such as urban development, agricultural production or mining.

7.2 Biophysical Environment

The biophysical environment is described with specific reference to soils, agricultural potential, vegetation and landscape features, climate, biodiversity, heritage features (in terms of archaeology and palaeontology), the visual landscape and the social environment to be affected. The area surrounding the proposed development is characterised mostly by agricultural development. The project area is in a rural setting with the current land use of the site being natural grazing predominantly sheep farming. These features are described in more detail below.

7.3 Geotechnical and Environmental Geology

The study involved the undertaking of site visits on 17 March 2024 and 17 August 2024. The aim of the investigation was to conduct a baseline study to characterise the geological and geotechnical nature of the site and to investigate potential environmental impacts that may arise due to the proposed project. The investigation was conducted primarily to assess the general suitability of the site for the proposed development in terms of the location, topography, geology and geotechnical conditions, and to identify any potential geotechnical hazards which may have an impact on the development of the site and the receiving environment.

7.3.1 Site Topography

The topography of the area was broadly characterised as having an undulating terrain with low hills and extensive rocky plains with long dry grass and low thorny shrubs. Vegetation along the natural drainage lines was slightly thicker, predominantly consisting of Vachellia Karroo.



Figure 7.3: Typical Terrain and Vegetation Types of the Site

Climate data for the nearest major economic centre, Beaufort West, indicated a dry climate with low average annual precipitation of 392 mm with very hot summers and cool winters. According to the Köppen-Geiger classification, the prevailing climate in this region is categorised as BSk (cold, semi-arid). The Weinert climatic-N Value (Weinert, 1980) for the site area was 16 (dry), indicating the dominance of mechanical weathering processes.

7.3.2 Site Geology

The geological map of the area on a 1:250 000 scale indicated that the geology of the proposed Carissa WEF consisted of mudstone, sandstone and thin cherty beds of the Teekloof and Abrahamskraal Formations of the Adelaide Subgroup, Beaufort Group. Refer to Figure 7.4 below.

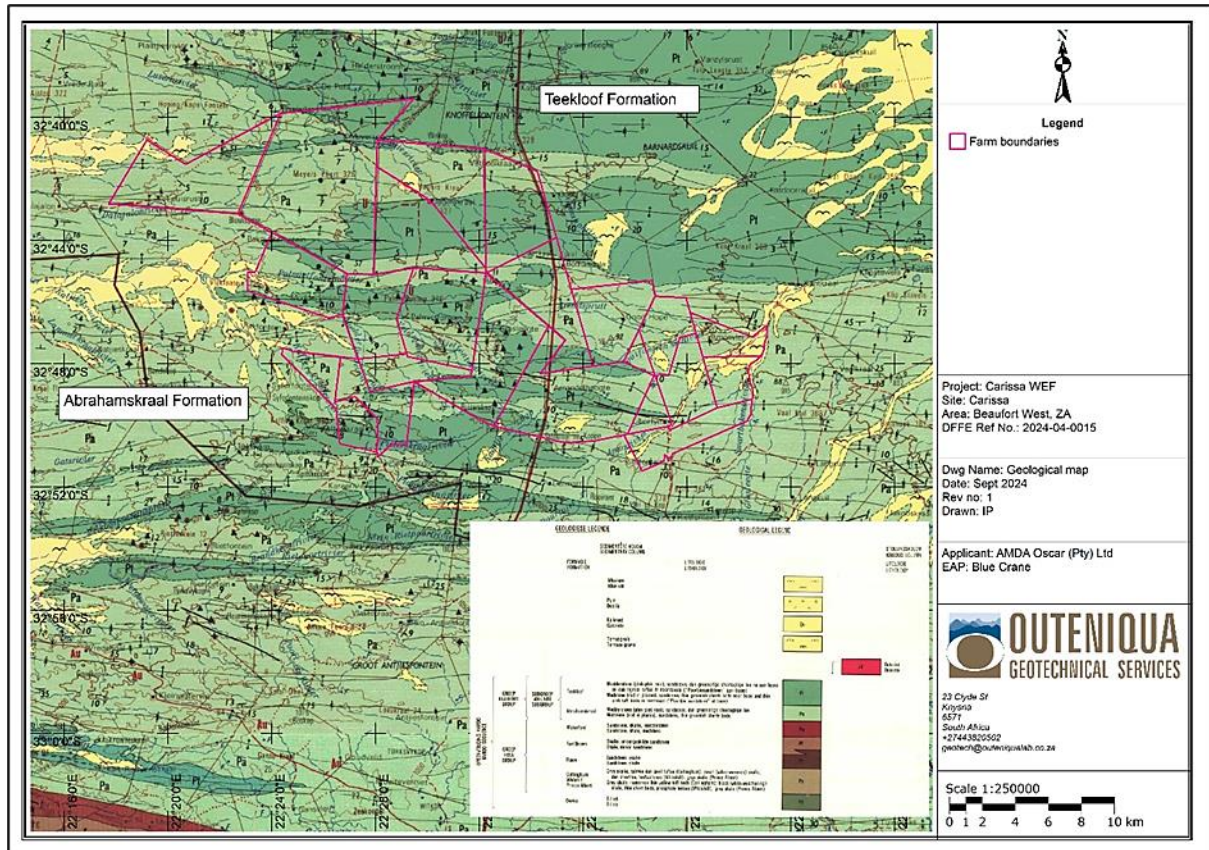


Figure 7.4: Geological Map of the Site

Overlying deposits of Quaternary alluvium were mapped along natural drainage lines (Qg - yellow on map above).

Figures 7.5 to 7.6 below indicates some geological features identified on site.



Figure 7.5: Exposure of the Local Geology in Road Cutting on the N12 near the Site



Figure 7.6: Outcrops of the Teekloof Formation in a Riverbed on the Site



Figure 7.7: Alluvial Sand and Gravel Deposits Along Natural Drainage Lines

Several small palaeofaults were indicated on the geological map due to the tectonic history of the region. According to the Seismic Hazard map of SA (Fernandez, et. al., 1992), the site was located in a zone of low seismic activity with maximum intensity of V on the Modified Mercalli Scale, or 4-5 on the Richter scale (felt by nearly everyone, loose fixtures rattled, no major damage to buildings), and a maximum peak horizontal ground acceleration of $<50\text{cm/s}^2$ (0.05g), with a 10% probability of being exceeded at least once in a period of 50 years.

7.3.3 Local Soil Types

Observations made on the site indicated that the soil types generally consisted of the following horizons:

Transported and residual soils

Thin deposits of sandy/gravelly colluvium or residual gravel covering weathered bedrock occur on rocky plains and hillslopes, and relatively thicker deposits of alluvium concentrated along natural drainage lines, consisting of a mixture of sand, gravel, cobbles and boulders. The soil thickness on the plains and hillslopes was generally thin ($<1\text{ m}$) or very thin ($<0.5\text{ m}$) and rock outcrops were commonly observed beneath the thin soil covering.



Figure 7.8: Typical Thin Sandy/Gravelly Soil Cover Overlying Low Weathered Rock Outcrops

Along natural drainage lines alluvial soil may be in the order of 1-2 m thick. Visual and tactile observations of the sandy alluvial deposits indicated these soils were moderately erodible and potentially problematic along access roads due to their loose consistency, thus prone to deep rutting along wheel tracks. The implications being the requirement for special engineering and preventative measures where roads cross drainage lines, including improved road layer works and culverts.



Figure 7.9: Thicker Deposit of Fine Alluvial/Colluvial Sand Deposits Along Wide Drainage Lines



Figure 7.10: Thick Sandy Alluvium at River Crossings

Bedrock

Dark grey, highly fractured, moderately weathered, soft mudstone interbedded with light brown, moderately fractured, slightly weathered, medium hard sandstone was observed in widespread outcrops across the site. The shallow rock could have significant implications in terms of excavations for foundations, roads and cable trenches. Harder rock types could also serve as a potentially useful source of natural construction material, such as road gravel material.

7.3.4 Terrain

The site was broadly mapped according to the expected geotechnical characteristics, including soil type and estimated thickness, slope gradients, surface water bodies, natural drainage lines, and areas with shallow groundwater or drainage problems such as marshes or vleis.

- *Terrain 1* – forms the vast majority of the site and was characterised by very low to moderate slope gradients and likely shallow bedrock within a depth range of 0-1 m below surface. Terrain 1 was expected to carry a very low risk of geotechnical stability problems, but shallow rock would likely

hamper excavations. Terrain 1 was deemed to have a very low sensitivity in terms of potential environmental impacts caused by geotechnical factors such as unstable ground. All proposed structures are planned within Terrain 1.

- *Terrain 2* – includes a 32 m buffer zone either side of the centreline of natural drainage lines where highly compressible, erodible loose sandy soils are expected with a high risk of erosion and periodic flooding. Terrain 2 was deemed to have a high geotechnical sensitivity.

All turbines are planned within Terrain 1 and therefore the foundations would typically consist of reinforced concrete gravity bases supported on bedrock. Spread foundations, such as gravity bases, would typically have a diameter of 20 m and embedded at a typical depth of 3 m, depending on the size of the structure and the underlying geotechnical profile, which would have to be investigated during on-site testing. Foundations for electrical infrastructure including substation transformers, isolators, etc and transmission towers include similar reinforced concrete gravity foundations.

7.3.5 Slope Stability and Erosion

The slope gradient on the site was generally low with some steeper areas along prominent topographic features such as hills, ridges and rivers. Due to the shallow rock expected across the majority of the site, natural slope stability problems were not considered to be a significant risk on the site. No severe erosion problems were apparent during the investigation but typical minor erosion was observed along drainage lines in Terrain 2 and this may present localised problems and challenges.



Figure 7.11: Minor Erosion Occurring Where Roads Cross Drainage Lines

7.3.6 Excavation Classification and Natural Construction Material Sources

Excavation classification would have to be determined after on-site testing, but preliminary indications were that hard excavations were expected at shallow depths less than 1 m in Terrain 1, which may affect foundations for structures, access roads, platforms and trenching for cable ducting.

On-site rock formations, dominated by sedimentary rocks were deemed to be a potentially useful source of subordinate construction materials such as general fill material along roads, on laydown areas, platforms and over and around foundations and ducting. Higher quality, hard natural stone materials for use as concrete aggregate, road subbase/base was unlikely to be available on site, but would have to be determined during on-site testing.

7.3.7 Site Classification

The geotechnical nature of the site was broadly classified at a preliminary level in accordance with South African Building Codes (SANS 10400-H Section 4.2), and the applicable site classifications are shown in Table 7.1 below.

Table 7.1: SANS10400-H Site Classification

<i>Terrain unit</i>	<i>Geotechnical Constraint</i>	<i>Expected movement (mm)</i>	<i>Site Classification</i>
1	Slightly compressible soil	<5	S
	Shallow rock		R
2	Potentially highly compressible soil	10-20	S2
	Drainage lines		P

7.3.8 Land-Use Potential and Development Constraints

Terrain 1, which comprised the majority of the site, was considered to be potentially highly suitable for the development of a WEF with only minor to moderate geotechnical constraints expected, which would be taken into consideration in the engineering design.

Terrain 2, which comprised a relatively smaller portion of the site and restricted to a buffer zone around mapped drainage lines, was considered to have a higher risk of geotechnical challenges due to the presence of thicker deposits of highly compressible and erodible sandy soils, and a risk of localised flooding during peak rainfall events.

The preliminary geotechnical investigation has established a baseline study of the local geology and geotechnical nature of the site and provided high-level development constraints for project planning. Potential negative environmental impacts relating to the geological and geotechnical character of the site were also assessed and found to have an overall low significance and were therefore generally acceptable. The investigation indicated that the site was potentially suitable for the proposed development of a WEF but that a detailed Geotechnical Site Investigation (GSI) will be required, in particular to determine the subsurface conditions for foundation design purposes.

7.4 Agricultural Assessment

An on-site investigation and verification of current agricultural land use and agricultural conditions was conducted on 21 February 2024. It was also informed by existing climate, soil, and agricultural potential data for the site. The aim of the on-site assessment was to:

1. ground-truth cropland status; and
2. ground truth the land type soil data

Soils were assessed based on the investigation of existing soil exposures in combination with indications of the surface conditions and topography. Soils were classified according to the South African soil classification system (Soil Classification Working Group, 2018).

An assessment of soils and long-term agricultural potential is in no way affected by the season in which the assessment is made, and therefore the date on which this assessment was done has no bearing on its results. The level of agricultural assessment is considered entirely adequate for an understanding of on-site agricultural production potential.

7.4.1 Site Sensitivity

The agricultural sensitivity of the site, as classified by the screening tool, is shown in Figure 7.12 below. The screening tool sensitivity requires specialist verification because of the limitations of the data sets on which it is based. All confirmed areas of high sensitivity (croplands) are shown in green outline. All areas outside of these are rated as low to medium sensitivity.

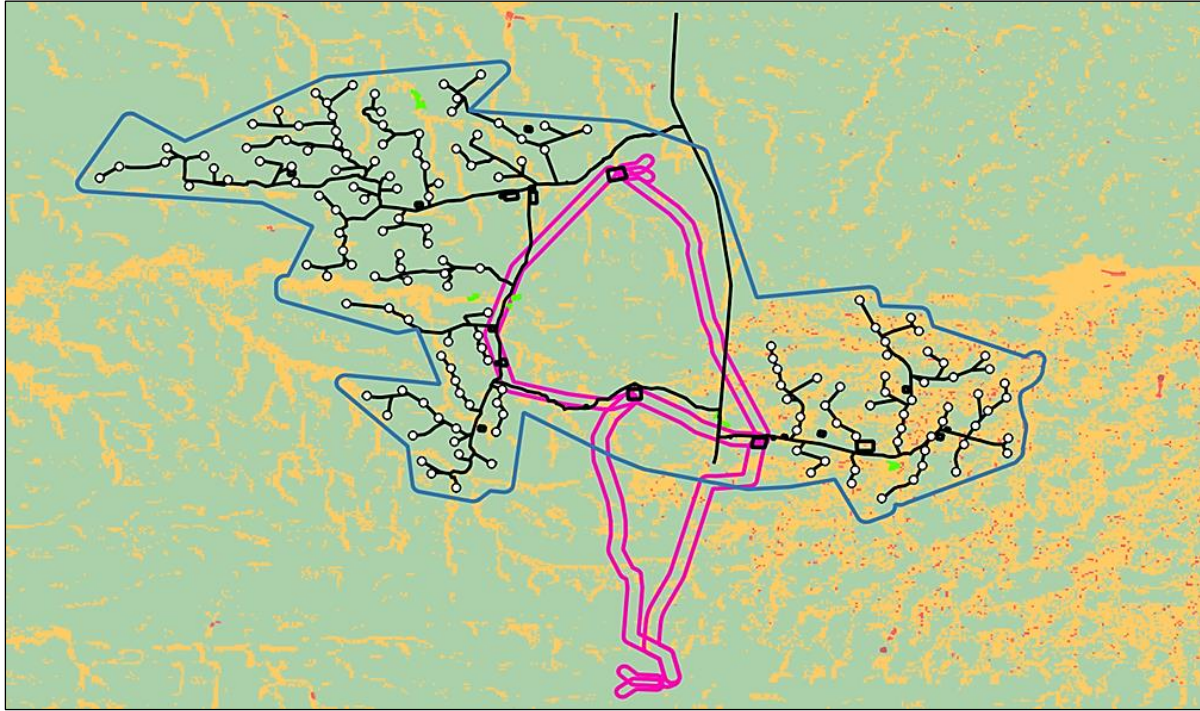


Figure 7.12: The Assessed Infrastructure Overlaid on Agricultural Sensitivity, as Given by the Screening Tool

The site sensitivities as per Figure 7.12 above are as follows:

- Green = low
- Yellow = medium
- Red = high
- Dark red = very high

This verification of agricultural sensitivity addresses both components that determine it, namely cropping status (that is whether the land is currently or has recently been used for crop production) and land capability. The screening tool classifies the assessed area as ranging from low to high agricultural sensitivity. The high sensitivity classification is due to a combination of some land being classified as cropland and some being classified as high sensitivity because of its land capability rating. However, the data set used by the screening tool to classify cropland is outdated. This assessment has verified all current areas of viable cropland, which differ from those classified as cropland by the screening tool. The verified areas of viable cropland are shown in Figure 7.12 above and Figure 7.13 below. This assessment therefore confirms the high sensitivity rating by the screening tool that is based on the cropping status component of sensitivity, only for those areas that have been verified as cropland. It should be noted that croplands in this environment are restricted to small, isolated patches that are usually associated with farmsteads and located close to watercourses. None of the croplands on site will be impacted by any of the development infrastructure.

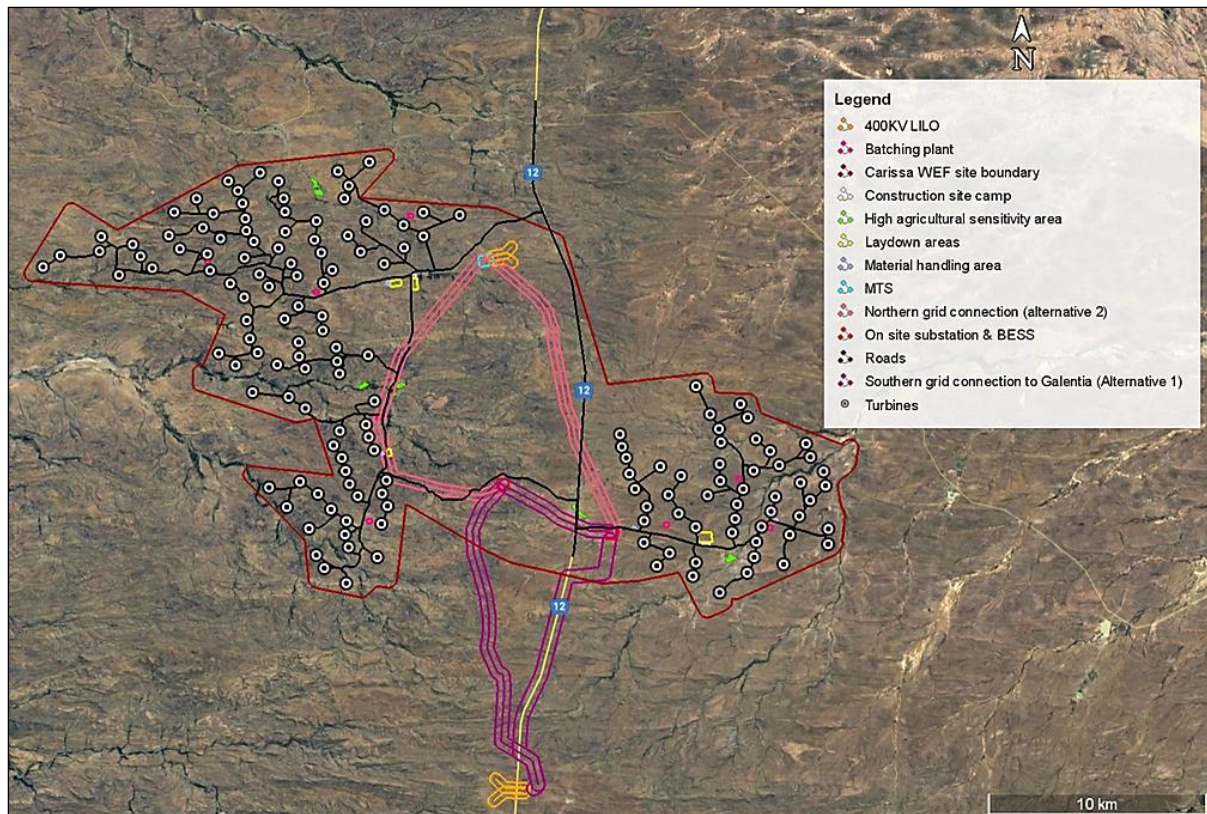


Figure 7.13: Satellite Image Map of the Development

The classified land capability of the site ranges from 4 to 9. The high sensitivity classification resulting from the land capability component of sensitivity is due to some land being classified with a land capability of 8 and 9. Note that a value of 8 is defined as high agricultural sensitivity in NEMA's agricultural protocol but does not show as high on the screening tool's output due to an error in the tool. In the agricultural assessment all areas of value 8 are treated as being classified by the screening tool as high sensitivity. The agricultural assessment disputes a classified land capability of >6 , based on an assessment that the site is unsuitable for viable rain-fed crop production. The appropriate land capability of land that is unsuitable for viable rain-fed crop production is ≤ 6 because the relationship between land capability and agricultural production potential is such that a land capability of >6 should denote land that is suitable for viable rain-fed crop production. The agricultural assessment therefore rates the entire proposed footprint as having a maximum land capability of 6 and therefore as being of medium agricultural sensitivity in terms of the land capability component of sensitivity.

To summarise, the agricultural assessment disputes some of the detail of the sensitivity classification by the screening tool. It confirms the high sensitivity rating as a result of cropping status, but only for small, isolated patches of cropland that will be avoided by the development infrastructure, anyway. It disputes a classified land capability of >6 and rates the entire assessed area as having a maximum land capability of 6.

The screening tool sensitivity of a power line corridor has very little relevance to the assessment of its agricultural impact because the impact is likely to be negligible, regardless of the agricultural sensitivity of the land which it crosses.

From an agricultural impact point of view, it is recommended that the proposed development be approved. The conclusion of the agricultural assessment on the acceptability of the proposed development and the recommendation for its approval is not subject to any conditions, other than implementation of the proposed mitigation measures.

7.5 Terrestrial Biodiversity Assessment

To determine the area's baseline ecological state and present a detailed description of the receiving environment, both a desktop assessment and field surveys were undertaken. One (01) dry season field survey was undertaken for the project from the 3rd to the 7th of June 2024 and another wet season field survey on the 26th to the 30th of August to confirm the presence of SCC, as well as any sensitive habitat features. Effort was made to cover all the different habitat types within the limits of time and access. During the survey, notes were made regarding current impacts, recording of dominant vegetation species and any sensitive or important features (e.g., drainage lines, rock outcrops, termite mounds etc.).

7.5.1 Nama-Karoo Biome

The site is situated in the Nama-Karoo biome. This biome is found in the central plateau of the western half of South Africa. The geology underlying the biome is varied, as the distribution of this biome is determined primarily by rainfall. The rain falls in summer, and varies between 100 and 520 mm per year. This also determines the predominant soil type - over 80% of the area is covered by a lime-rich, weakly developed soil over rock. Although less than 5% of rain reaches the rivers, the high erodibility of soils poses a major problem where overgrazing occurs (SANBI, 2019).

7.5.2 Topography and Climate

The topography of the area was broadly characterised as having an undulating terrain with low hills and extensive rocky plains with long dry grass and low thorny shrubs. Vegetation along the natural drainage lines was slightly thicker, predominantly consisting of *Vachellia karroo*.

Climate data for the nearest major economic centre, Beaufort West, indicated a dry climate with low average annual precipitation of 392 mm with very hot summers and cool winters (<https://en.climate-data.org>). According to the Köppen-Geiger classification, the prevailing climate in this region is categorized as BSk (cold, semi-arid). The Weinert climatic-N Value (Weinert, 1980) for the site area was 16 (dry), indicating the dominance of mechanical weathering processes.

7.5.3 Red List of Ecosystem

The Ecosystem Threat Status is an indicator of an ecosystem's wellbeing, based on the level of change in structure, function or composition. Ecosystem types are categorised as Critically Endangered (CR), Endangered (EN), Vulnerable (VU) or Least Concern (LC), based on the proportion of the original extent of each ecosystem type that remains in good ecological condition. According to the Red List of Ecosystems dataset (Skowno & Monyeki, 2021) the proposed development overlaps with a LC ecosystem. Refer to Figure 7.14 below.

7.5.4 Ecosystem Protection Level

Indicator of the extent to which ecosystems are adequately protected or under-protected. Ecosystem types are categorised as Well Protected (WP), Moderately Protected (MP), Poorly Protected (PP), or Not Protected (NP), based on the proportion of the biodiversity target for each ecosystem type that is included within one or more protected areas. Not Protected, PP or MP ecosystem types are collectively referred to as under-protected ecosystems. The Project Area of Influence (PAOI) overlaps with a PP ecosystem as indicated in Figure 7.15 below.

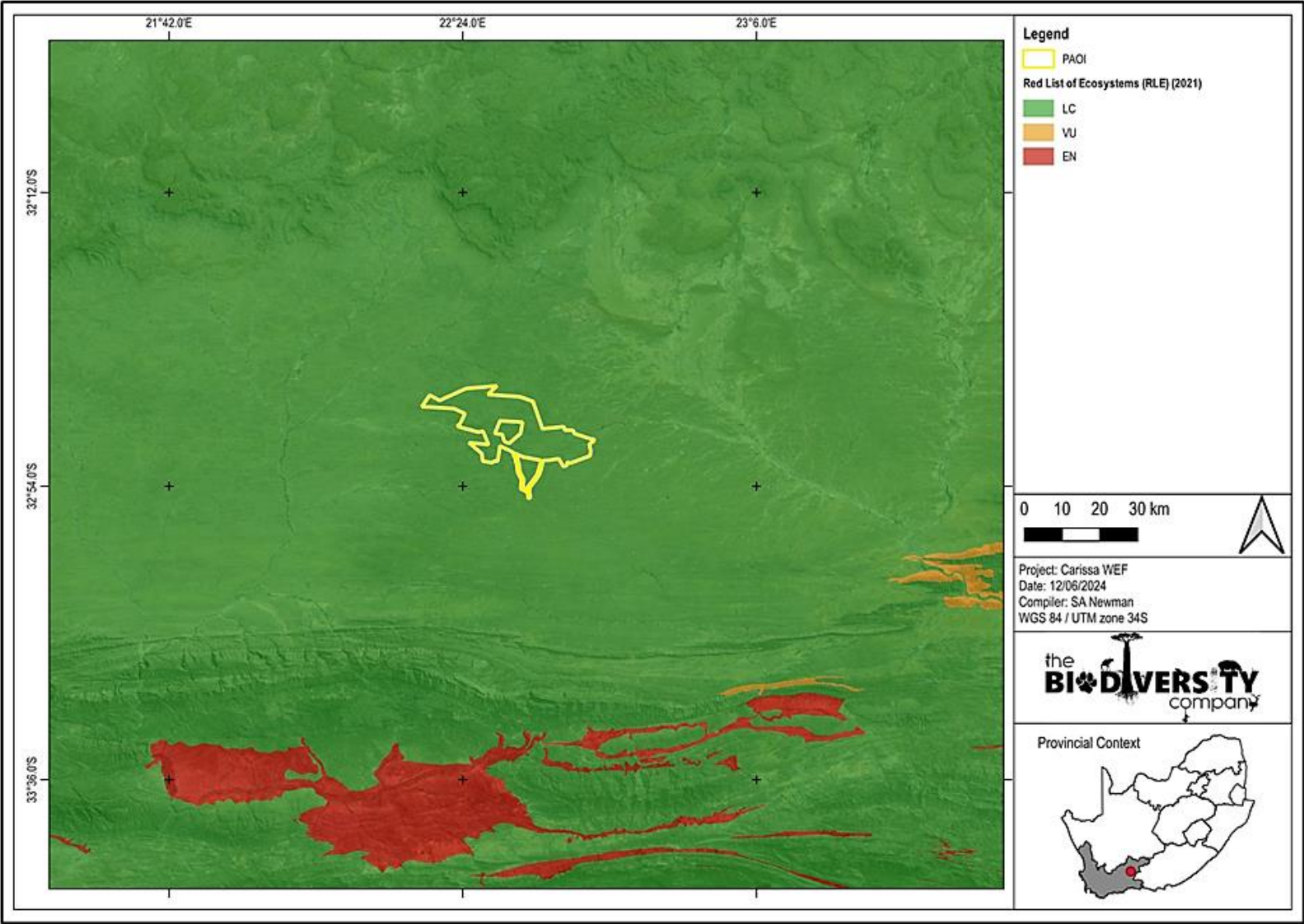


Figure 7.14: Map Illustrating the Ecosystem Threat Status Associated with the PAOI

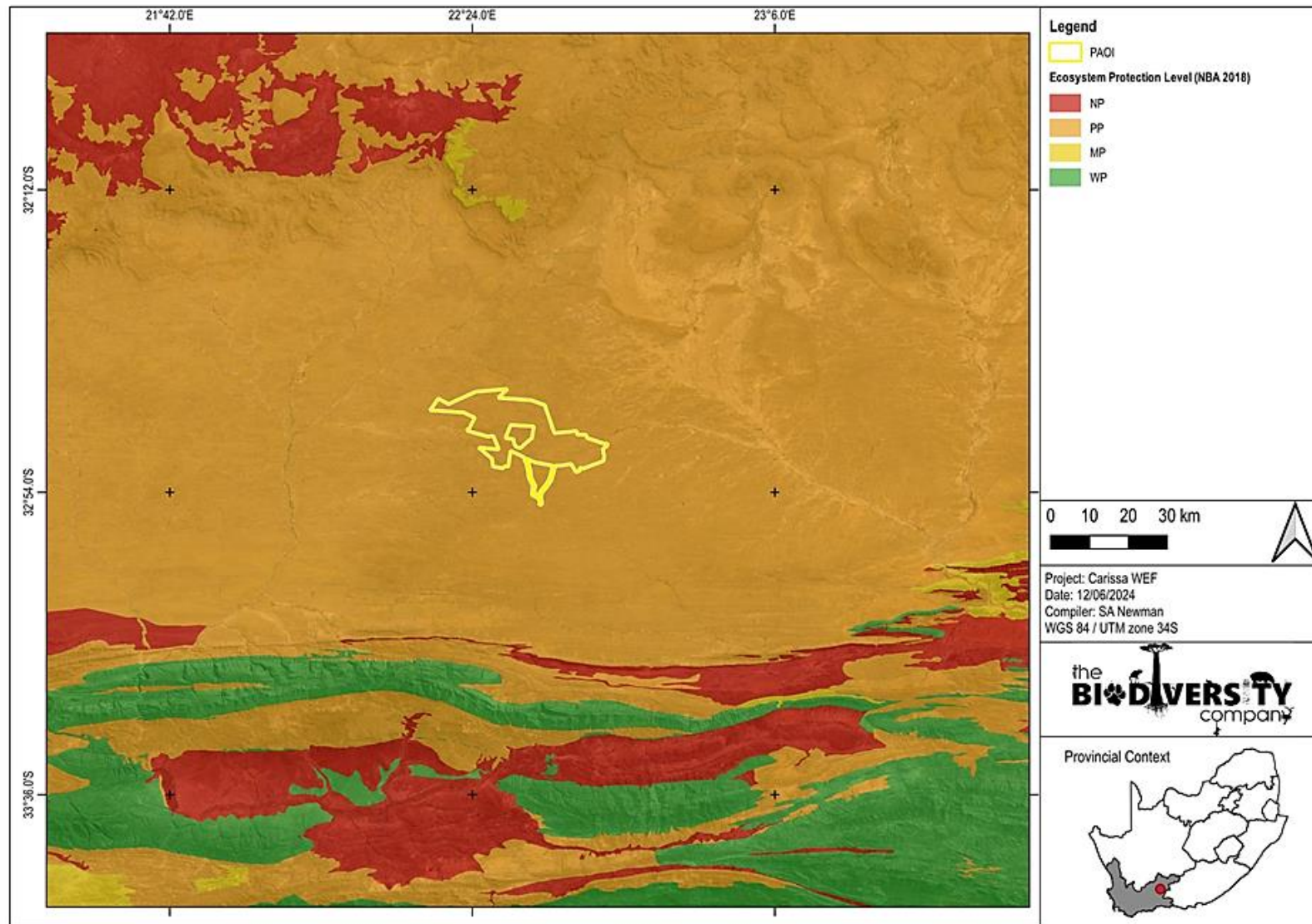


Figure 7.15: Map Illustrating the Ecosystem Protection Level Associated with the PAOI

7.5.5 Provincial Conservation Plan

The conservation of CBAs is crucial, in that if these areas are not maintained in a natural or near-natural state, biodiversity conservation targets cannot be met. Maintaining an area in a natural state can include a variety of biodiversity compatible land uses and resource uses (SANBI-BGIS, 2017).

The purpose of the Western Cape Biodiversity Sector Plan (BSP) (2017) is to inform land-use planning and development on a provincial scale and to aid in natural resource management. One of the outputs is a map of Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs). These are classified into different categories, namely CBA1 areas, CBA2 areas, ESA areas and Other Natural Areas (ONAs) based on biodiversity characteristics, spatial configuration, and requirements for meeting targets for both biodiversity patterns and ecological processes.

According to the Western Cape BSP dataset, the PAOI overlaps with a CBA 1, ESA 1, ESA 2 and Other Natural Areas. Majority of the proposed layout avoids CBA areas, with only the OHLs and small sections of internal roads overlapping with CBA. Refer to Figure 7.16 below.

7.5.6 Protected Areas

According to the protected area spatial datasets from SAPAD (2023) and SACAD (2023), the PAOI is situated ~25 km north from the nearest protected area, Gouritz Cluster Biosphere Reserve as per Figure 7.17 below. Therefore, the PAOI does not fall within range of any protected areas.

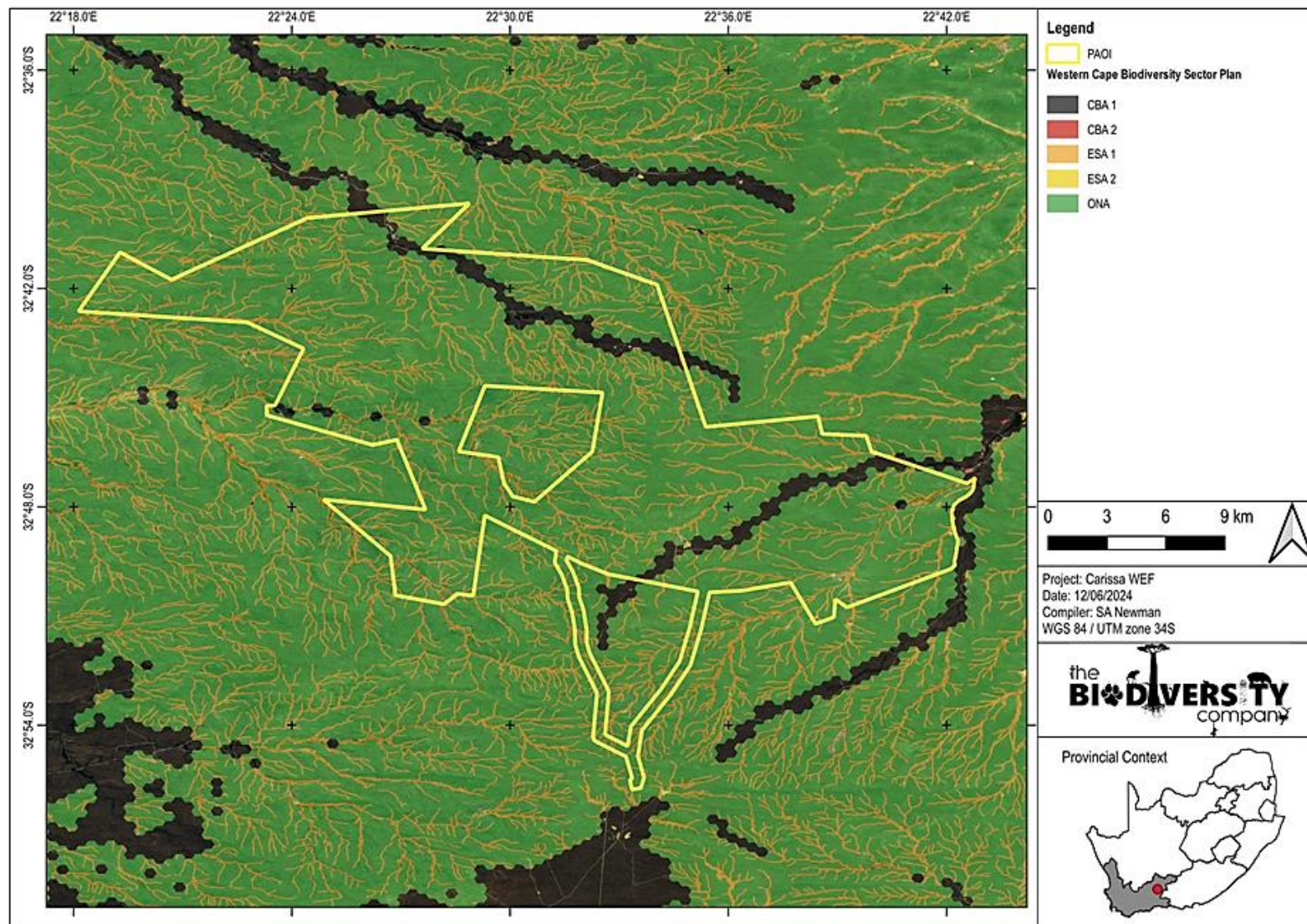


Figure 7.16: Map Illustrating the PAOI in Relation to the Western Cape Biodiversity Sector Plan

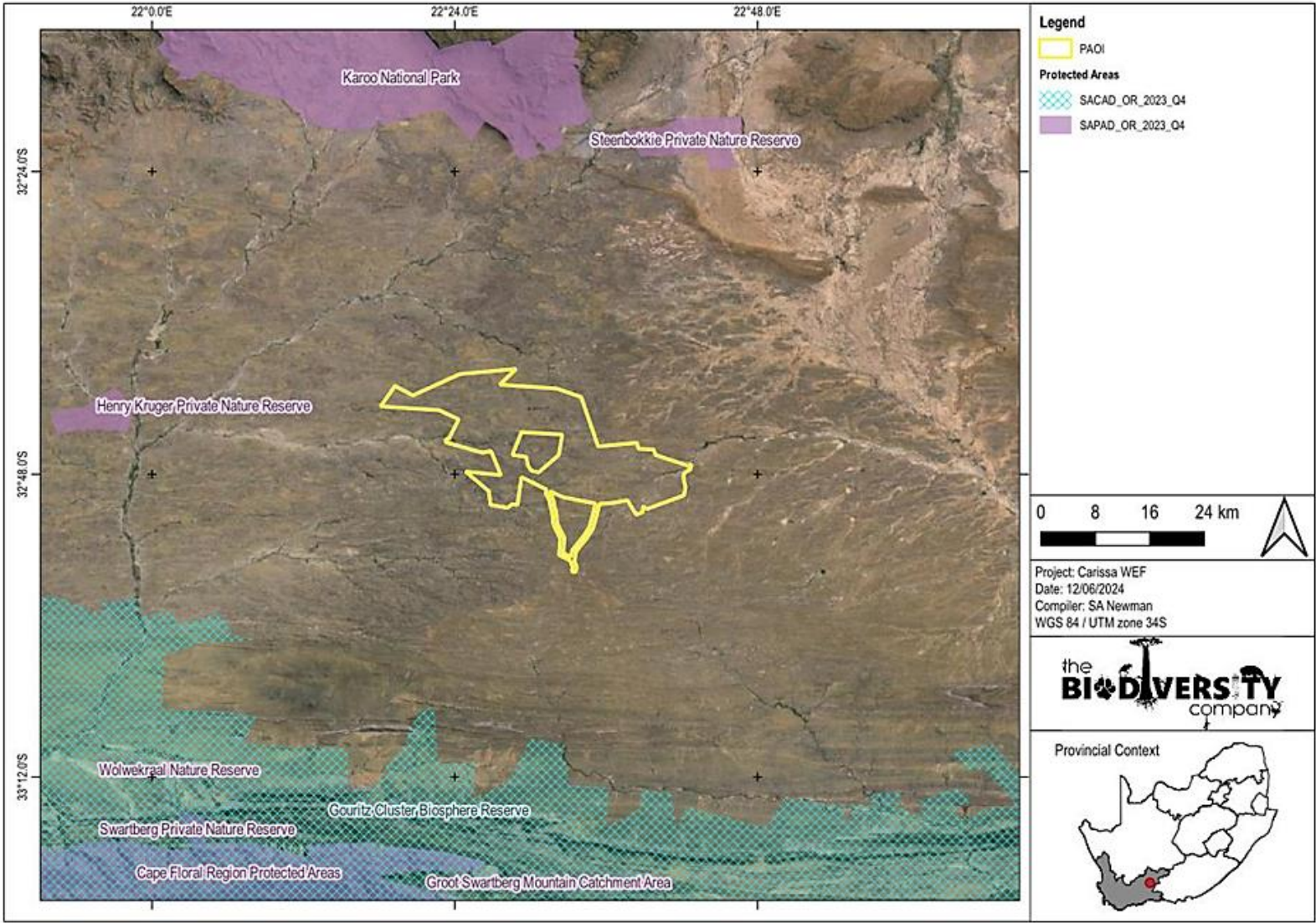


Figure 7.17: Map Illustrating the PAOI in Relation to Protected Areas

7.5.7 National Protected Areas Expansion Strategy

National Protected Area Expansion Strategy 2016 (NPAES) areas were identified through a systematic biodiversity planning process. 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 freshwater ecosystems. These areas should not be seen as future boundaries of protected areas, as in many cases only a portion of a particular focus area would be required to meet the protected area targets set in the 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 (NPAES, 2016). The PAOI does not overlap with any NPAES areas. Refer to Figure 7.18 below.

7.5.8 South African Inventory of Inland Aquatic Ecosystems

The South African Inventory of Inland Aquatic Ecosystems (SIIAE) was released with the NBA in 2018. Ecosystem threat status (ETS) of river and wetland ecosystem types are based on the extent to which each river ecosystem type had been altered from its natural condition. Ecosystem types are categorised as CR, EN, VU or LT, with CR, EN and VU ecosystem types collectively referred to as 'threatened' (Van Deventer et al., 2019; Skowno et al., 2019). The PAOI overlaps with LT rivers, and LC and unclassified wetlands. Refer to Figure 7.19 below.

7.5.9 National Freshwater Ecosystem Priority Area Status

In an attempt to better conserve aquatic ecosystems, South Africa has categorised its river systems according to set ecological criteria (i.e., ecosystem representation, water yield, connectivity, unique features, and threatened taxa) to identify Freshwater Ecosystem Priority Areas (FEPAs) (Driver et al., 2011). The FEPAs are intended to be conservation support tools and envisioned to guide the effective implementation of measures to achieve the National Environment Management Biodiversity Act's (NEM:BA) biodiversity goals (Nel et al., 2011). The PAOI overlaps with a Class C: Moderately Modified River and Non-Priority wetlands. Refer to Figure 7.20 below.

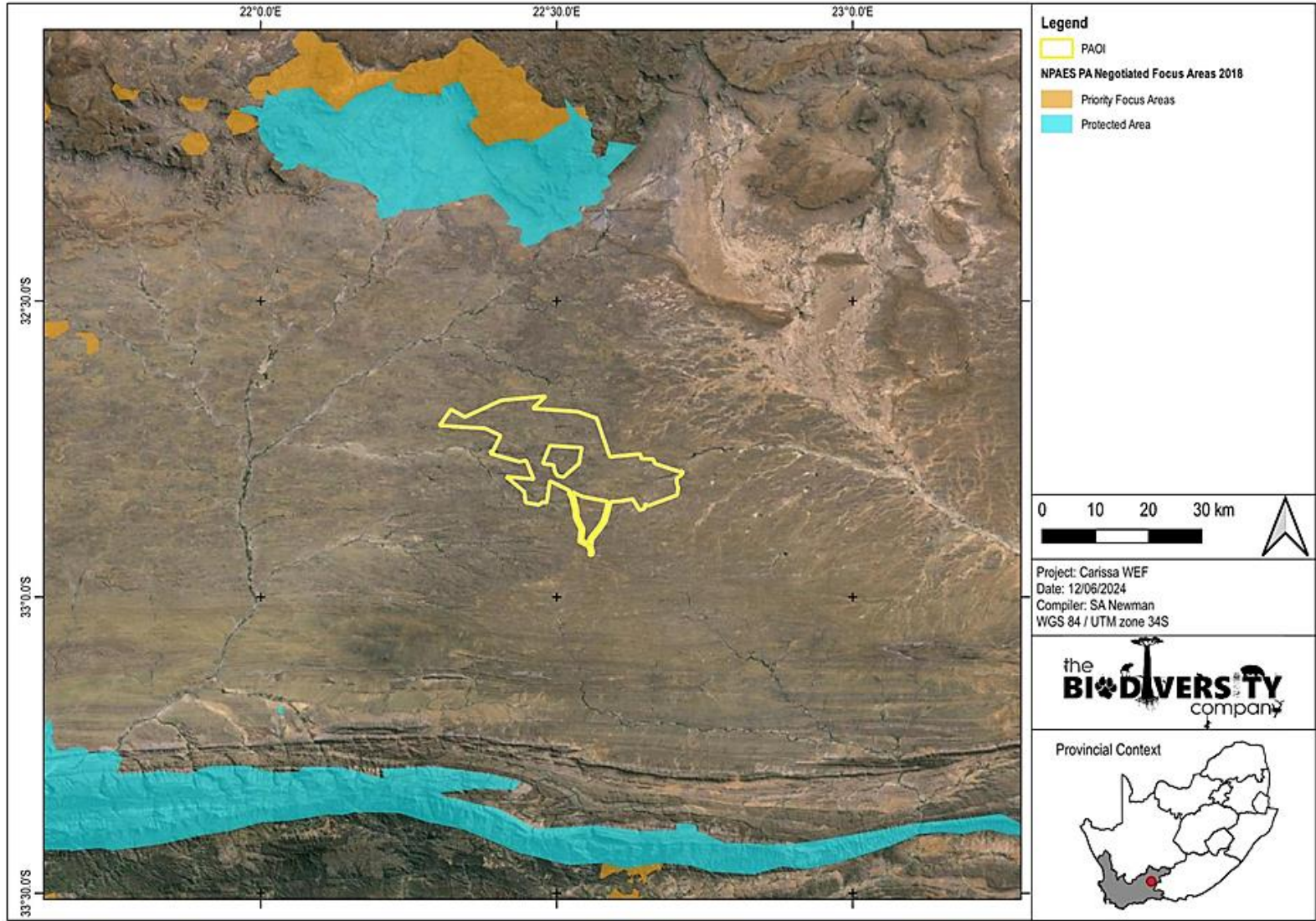


Figure 7.18: Map Illustrating the PAOI in Relation to the National Protected Areas Expansion Strategy Dataset



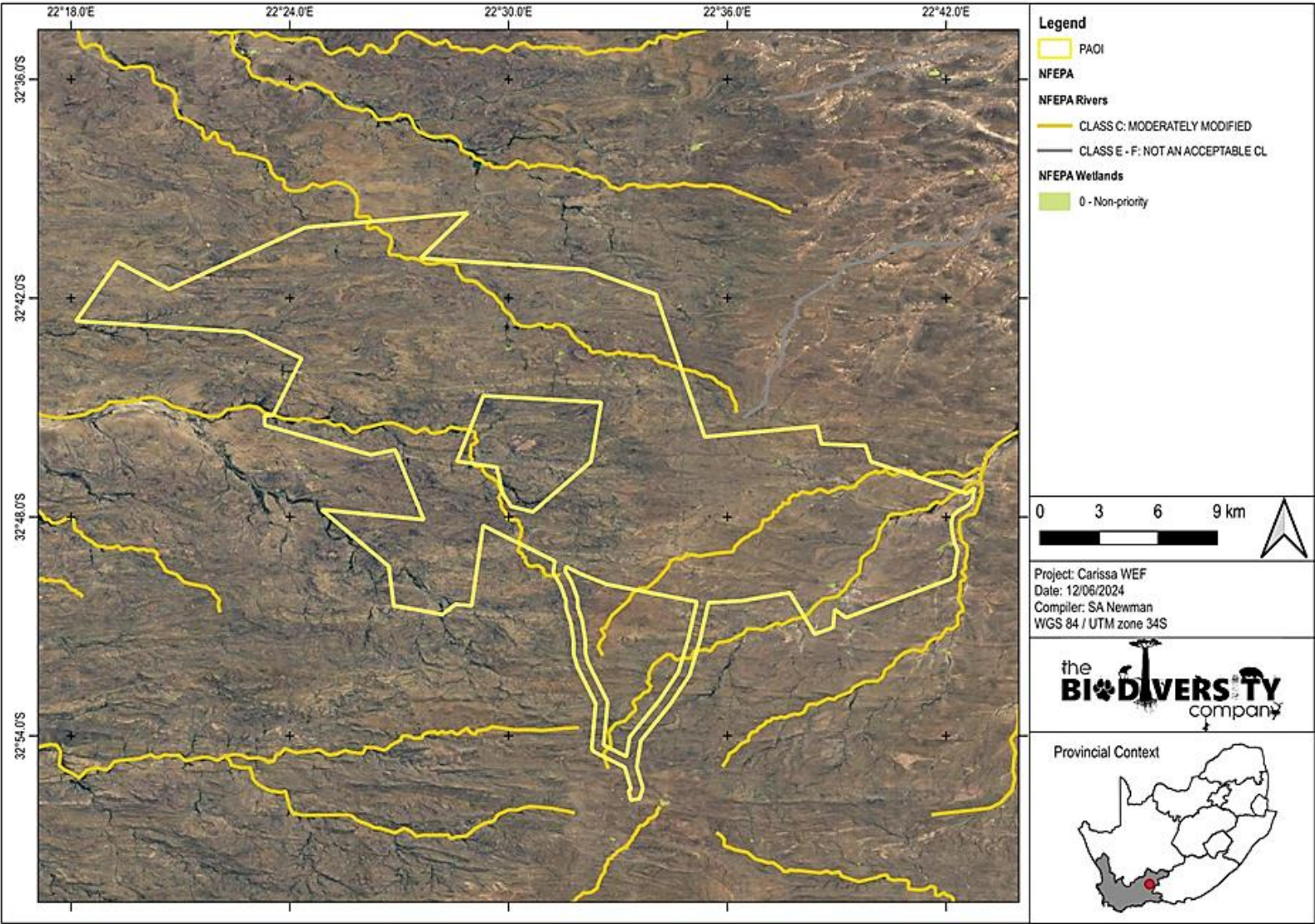


Figure 7.20: Map Illustrating the PAOI in Relation to the National Freshwater Ecosystem Priority Area Dataset

7.5.10 Vegetation Types

The dominant vegetation is a grassy, dwarf shrubland. Grasses tend to be more common in depressions and on sandy soils, and less abundant on clayey soils. Grazing rapidly increases the relative abundance of shrubs. Most of the grasses are of the C4 type and, like the shrubs, are deciduous in response to rainfall events (SANBI, 2019).

The PAOI is situated in the Gamka Karoo vegetation type according to SANBI (2018) which is a member of the Lower Karoo Bioregion.

Gamka Karoo

The Gamka Karoo vegetation type is comprised of extremely irregular to slightly undulating plains covered by dwarf spiny shrubland dominated by Karoo dwarf shrubs (e.g., *Chrysocoma ciliata*, *Eriocephalus ericoides*, etc.) (Mucina & Rutherford, 2006). Trees are rare but occur sporadically (e.g., *Euclea undulata*). Dense stands of drought resistant grasses (*Stipagrostis* sp. and *Aristida* sp.) cover the broad sandy bottomlands, especially after the occurrence of rain.

This vegetation type is one of the most arid of the Nama-Karoo Biome, experiencing autumn and summer rainfall, peaking in March. The mean annual precipitation ranges from about 100 mm to about 240 mm, depending on the region (Mucina & Rutherford, 2006).

Important plant taxa are those species that have a high abundance, a frequent occurrence or are prominent in the landscape within a particular vegetation type (Mucina & Rutherford, 2006).

According to Mucina and Rutherford (2006) this vegetation type is classified as least threatened. It has a conservation target of 16%, with about 2% statutorily conserved in the Karoo National Park, and some in private reserves, such as Steenbokkie Private Reserve (near Beaufort West). Only a small portion of this vegetation unit has undergone transformation. The alien plant, *Salsola kali*, poses a serious risk of infestations locally (Mucina & Rutherford, 2006).

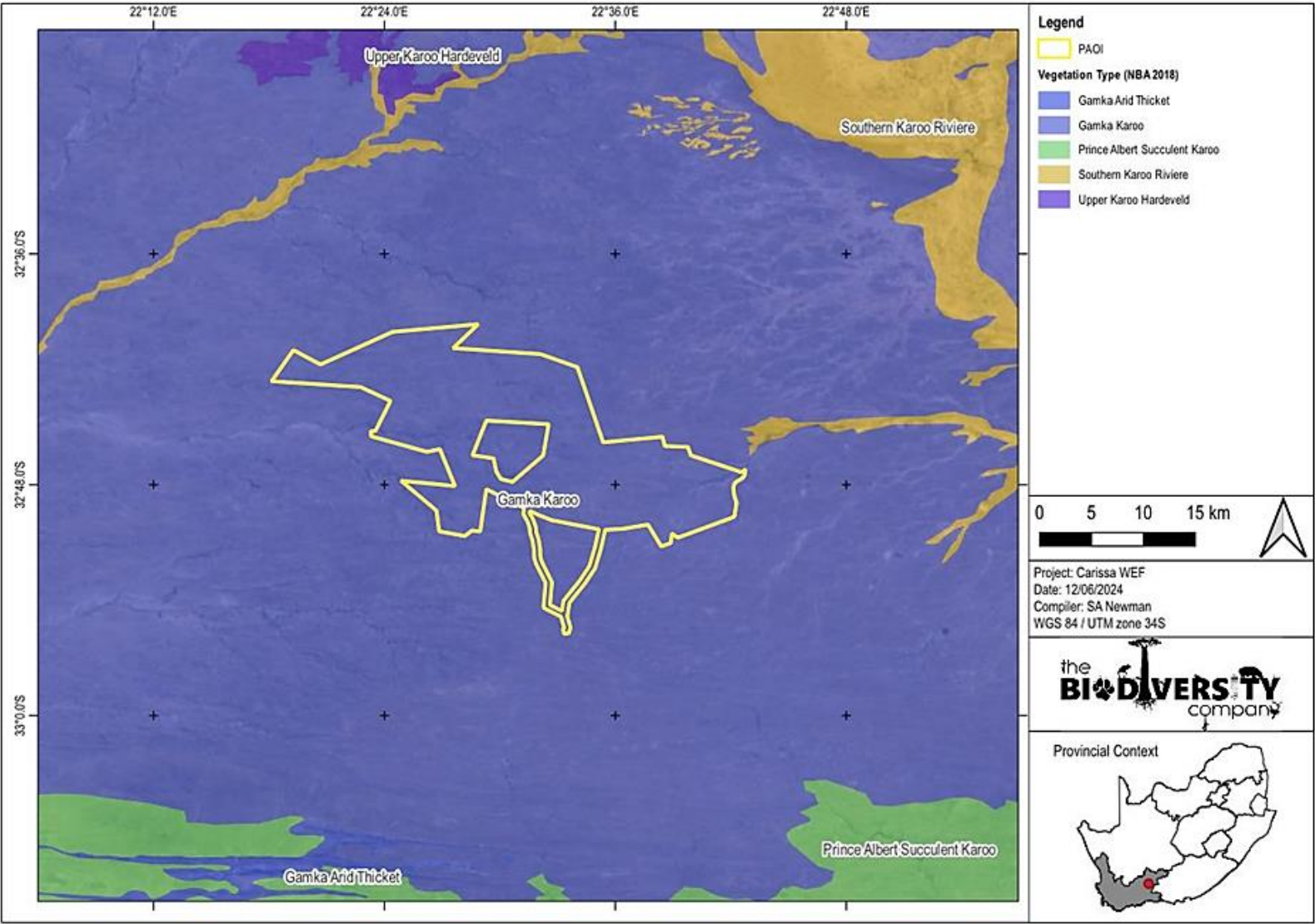


Figure 7.21: Map Illustrating the Vegetation Types Associated with the PAOI

7.5.11 Habitat Types

The main habitat types identified across the PAOI were initially identified largely based on aerial imagery. These main habitat types were refined based on the field coverage and data collected during the survey. Emphasis was placed on limiting timed meander searches within the natural habitats and therefore habitats with a higher potential of hosting SCC. Six (06) habitats were identified in the PAOI, which includes water resources, each of the habitats identified and descriptions of the habitat units can be found in Table 7.2 below.

Table 7.2: Table Providing Descriptions of the Habitat Types Delineated for the PAOI

Habitat	Description and Condition	Ecosystem Processes and Services
Karoo Shrubland	Semi-natural portions of Shrubland (Central Gamka Karoo and Karoo vegetation types) was recorded across the majority of the PAOI. The habitat is associated with slopes and broad ridges of low mountains and small escarpments, with low shrubland dominated by suites of karoo shrubs with a rich geophytic flora in the undergrowth. The habitat has in some instances been exposed to the grazing by livestock, mismanagement and also human infringement. The current ecological condition of this habitat with regard to the main driving forces, is intact, which is evident in the amount of, and importance of, the species recorded in the flora and faunal assessment, and also to the high species diversity and number of plant species recorded. Current human infringement still occurs throughout, especially in areas close to roads. SCC flora and fauna were confirmed in this habitat unit. This habitat includes areas that are stony and rocky ridges with varying slopes, bedrock protruding from the soil layer with the associated small boulders and rocks that occur within the shrubland habitat. The habitat is used by faunal species as fine-scale habitats and is important to consider for mitigation actions when an area is cleared for placement of the infrastructure. These habitats can be considered as ecological hotspots being an important habitat for fauna and flora, especially plants as well as reptiles. The habitat has been infringed upon by livestock, which has had an impact on this habitat, although minor. This habitat type has undergone impacts associated with human activity especially due to the use of the area for grazing.	<p>Ecosystem that contributes to valuable conservation targets and flora and fauna habitats.</p> <p>Provides refuge, grazing and foraging resources for indigenous fauna and livestock. Aids in the filtration of water permeating through the soil into the river areas. Corridor for fauna dispersion within the landscape and important foraging and nesting habitat. Habitat is used by faunal species as and is important for several life stages.</p> <p>The ridge and mountain habitat forms part of a unique landscape within the region and provides refugia, food and a more natural environment.</p>
Rocky Outcrops	Similar to some rocky areas of the Shrubland habitat, however different in regard to elevation, presence of large boulders and rocks. Slopes and ridges including sandstone sills with rocky hills/outcrops which are connected to the Rocky Hills and outcrops in certain areas and may also include plateaus.	Provides refuge, grazing and foraging resources for indigenous fauna and livestock. Aids in the filtration of water permeating through the soil into the drainage areas. Important corridor for fauna dispersion within the landscape. The areas may be used as a movement corridor. Habitat is used by faunal species and is

Habitat	Description and Condition	Ecosystem Processes and Services
		important for several life stages and may support several SCC.
Karoo Shrub Grassland	<p>Semi-natural portions of Karoo Shrub Grassland were recorded across sections of the PAOI. This habitat is characterised by flat landscapes with mostly sandy type soils and is found in lower waly areas. Prominent among the vegetation are dominant grass species such as <i>Aristida congesta</i>, <i>Stipagrostis ciliata</i>, <i>Aristida diffusa</i>, and <i>Eragrostis obtuse</i> with some small succulent shrub's present characteristic to the Gamka Karoo. All of which play key roles in defining the habitat's character and ecological functions. In some instances, the habitat has been exposed to grazing by livestock, mismanagement, and human infringement.</p> <p>The current ecological condition of this habitat, with regard to the main driving forces, remains largely intact. This is evident from the diverse and significant species recorded in the flora and faunal assessments, as well as the high species diversity and number of plant species documented. However, human infringement still occurs throughout, particularly in areas close to roads. No Species of Conservation Concern (SCC) flora and fauna were confirmed in this habitat unit. Faunal species use this habitat as fine-scale habitats, which are important to consider for mitigation actions when an area is cleared for infrastructure development. Despite some infringement by livestock, the impact on this habitat has been minor. Nonetheless, the Karoo Shrub Grassland has experienced impacts associated with human activity, particularly due to the use of the area for grazing.</p>	Provides refuge, grazing and foraging resources for indigenous fauna and livestock. Aids in the filtration of water permeating through the soil into the drainage areas. Important corridor for fauna dispersion within the landscape. The areas may be used as a movement corridor. Habitat is used by faunal species and is important for several life stages and may support several SCC.
Drainage area	Channels through which surface water naturally collates and flows. Perennial or ephemeral systems were both considered for this habitat type. The Southern Karoo River habitat is associated with non-perennial riverine areas dominated by shrub and tree species such as <i>Vachellia karroo</i> , <i>Searsia burchelli</i> and <i>Lycium cinereum</i> . The Southern Karoo River habitat provide a vital movement corridor for the majority of the faunal species in the area. As such the ecological integrity, importance and	Act as a vital water resource for faunal species in the area. Provides refuge, grazing and foraging resources for indigenous fauna and livestock. Important corridor for fauna dispersion within the landscape. Habitat is used by faunal species and is important for several life stages. Provides surface water within the landscape.

Habitat	Description and Condition	Ecosystem Processes and Services
	functioning of these areas play a crucial role as a water resource system and an important habitat for various fauna and flora in the area.	Aids in trapping sediment and nutrients derived from land runoff.
Water Resources	Channels and manmade dams through which surface water naturally collates and flows. Perennial and ephemeral systems were both considered for this habitat type. All the prominent features were identified, as there are numerous inconspicuous drainage features throughout the PAOI.	Water Paths, functions as important water resources. Provides refuge and grazing areas, especially during the dry seasons. Provides surface water within the landscape. Aids in trapping sediment and nutrients derived from land runoff and form part of the fluvial system, and therefore contribute to nutrient cycling, water filtration and water security, particularly in this water scarce and arid ecosystem.
Modified (~19 ha)	This habitat unit includes all areas that maintain little to no native vegetation and/or where anthropogenic activity has substantially modified an area's primary ecological functions and species composition. This habitat unit no longer maintains its functional integrity and does not contribute significantly to ecosystem services. This habitat unit is predominantly made up of gravel roads and some infrastructure to support livestock (kraals, reservoirs, shading, etc.).	The ecological services provided by this habitat are limited due to the extent of land transformation and the large amount of bare ground.

7.5.12 Site Ecological Importance

The different habitat types within the PAOI were delineated and identified based on observations during the field assessment, and available satellite imagery. These habitat types were assigned Ecological Importance (EI) categories based on their ecological integrity, conservation value, the presence of SCCs and their ecosystem processes. As per the terms of reference for the project, GIS sensitivity maps are required in order to identify sensitive features in terms of the relevant specialist discipline/s within the PAOI. Based on the criteria applied, all habitats within the PAOI were assigned a sensitivity category, i.e., an SEI category. Refer to Table 7.3 below.

Site Ecological Importance (SEI) is a function of the Biodiversity Importance (BI) of the receptor (e.g., SCC, the vegetation/fauna community or habitat type present in the PAOI) and Receptor Resilience (RR) (its resilience to impacts). BI is a function of Conservation Importance (CI) and the Functional Integrity (FI) of the receptor.

Refer to Figure 7.22 below for the map illustrating the SEI for the Carissa WEF.

Table 7.3: Summary of Habitat Types Delineated within Field Assessment Area

Habitat	Conservation Importance	Functional Integrity	Biodiversity Importance ³¹	Project Component in relation to habitat type	Receptor Resilience	Site Ecological Importance ³²
Rocky Outcrops	Medium	Very High	High	Turbines, roads and other infrastructure roads.	Low	High
	Confirmed or highly likely occurrence of populations of Near Threatened (NT) species, > 50% of receptor contains natural habitat with potential to support SCC.	Very large intact area for any conservation status of ecosystem type. Good habitat connectivity, with potentially functional ecological corridors and a regularly used road network between intact habitat patches.			Will recover slowly (~ more than 10 years) to restore > 75% of the original species composition and functionality of the receptor	
Karoo Shrub Grassland	Medium	Very High	High	Turbines, roads and other infrastructure roads mitigated.	High	Medium
	Confirmed or highly likely occurrence of populations of Near Threatened (NT) species, > 50% of receptor contains natural habitat with potential to support SCC.	Very large intact area for any conservation status of ecosystem type. Good habitat connectivity, with potentially functional ecological corridors and a regularly used road network between intact habitat patches.			Habitat that can recover relatively quickly (~ 5–10 years) to restore > 75% of the original species composition and functionality of the receptor functionality	

³¹ Considered as the 'sensitivity'³² Considered as the sensitivity in relation to the project component.

Habitat	Conservation Importance	Functional Integrity	Biodiversity Importance ³¹	Project Component in relation to habitat type	Receptor Resilience	Site Ecological Importance ³²
Karoo Shrubland	Medium	Very High	High	Turbines, roads and other infrastructure roads.	High	Medium
	Confirmed or highly likely occurrence of populations of Near Threatened (NT) species, > 50% of receptor contains natural habitat with potential to support SCC.	Very large intact area for any conservation status of ecosystem type. Good habitat connectivity, with potentially functional ecological corridors and a regularly used road network between intact habitat patches.			Habitat that can recover relatively quickly (~ 5–10 years) to restore > 75% of the original species composition and functionality of the receptor functionality	
Water resources/Drainage area	Medium	High	High	Impeding Water resources or their buffer areas.	Low	High
	Confirmed or highly likely occurrence of populations of Near Threatened (NT) species, > 50% of receptor contains natural habitat with potential to support SCC.	Mostly minor current negative ecological impacts			Habitat that is unlikely to be able to recover fully after a relatively long period: > 15 years required to restore ~ less than 50% of the original species composition and functionality of the receptor	
Modified	Low	Very Low	Very Low	N/A	High	Very Low
	< 50% of receptor contains natural habitat with limited potential to support SCC.	Several major current negative ecological impacts.			Habitat that can recover relatively quickly	

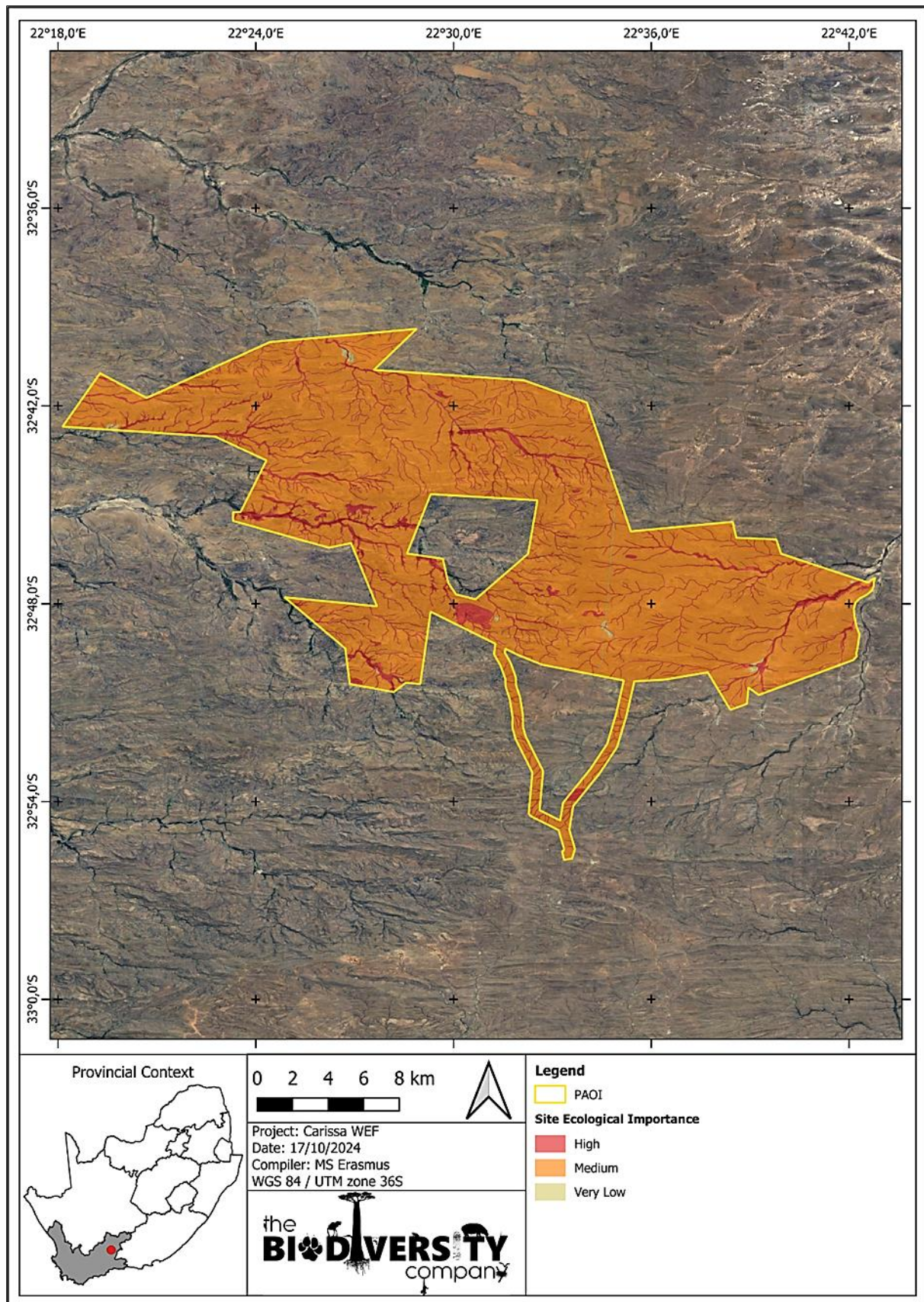


Figure 7.22: The SEI for the Carissa WEF

7.5.13 Fauna Assessment

7.5.13.1 Amphibians

Based on the FrogMap database, provided by the Animal Demography Unit (Fitzpatrick Institute of African Ornithology, 2023), five (05) amphibian species are expected for the PAOI. One (01) amphibian SCC is expected to occur within the PAOI. No species were listed by the Screening Tool. Refer to Table 7.4 below.

Table 7.4: List of Amphibian Species of Conservation Concern that may occur in the PAOI. NT = Near Threatened

Scientific Name	Common Name	Screening Tool Designation	Conservation Status		Likelihood of Occurrence
			SANBI	IUCN	
<i>Pyxicephalus adspersus</i>	Giant Bull Frog	-	NT	LC	Low

7.5.13.2 Reptiles

Based on the ReptileMap database, provided by the Animal Demography Unit (Fitzpatrick Institute of African Ornithology, 2023), 23 reptile species are expected for the PAOI. Four (04) reptile SCC are expected to occur within the PAOI. One (01) species was listed by the Screening Tool. Refer to Table 7.5 below.

Table 7.5: List of Reptile Species of Conservation Concern that may occur in the PAOI. LC = Least Concern, NT = Near Threatened, VU = Vulnerable

Scientific Name	Common Name	Screening Tool Designation	Conservation Status		Likelihood of Occurrence
			SANBI	IUCN	
<i>Chersobius boulengeri</i>	Karoo Padloper	Medium	NT	EN	Medium
<i>Psammobates tentorius</i>	Tent Tortoise	-	NT	NT	Medium
<i>Psammobates tentorius tentorius</i>	Karoo Tent Tortoise	-	NT	NT	Confirmed
<i>Psammobates tentorius verroxii</i>	Verrox's Tent Tortoise	-	NT	NT	Medium

7.5.13.3 Mammals

The MammalMap database provided by the Animal Demography Unit (Fitzpatrick Institute of African Ornithology, 2023) lists 38 mammal species that could be expected to occur within the PAOI. Species

generally restricted to protected areas such as game reserves were not expected to occur in PAOI and were removed from the list but those identified by the Screening Tool are retained. Two (02) mammal SCC are expected to occur within the PAOI. One (01) mammal species were listed by the Screening Tool. Refer to Table 7.6 below.

Table 7.6: List of Mammal Species of Conservation Concern that may occur in the PAOI. CR – Critically Endangered, EN = Endangered, LC = Least Concern, NT = Near Threatened, VU = Vulnerable

Scientific Name	Common Name	Screening Tool Designation	Conservation Status		Likelihood of Occurrence
			SANBI	IUCN	
<i>Bunolagus monticularis</i>	Riverine Rabbit	Medium	CR	CR	Low
<i>Parotomys littledalei</i>	Littledale's Whistling Rat	-	NT	LC	Medium

The layout design has been informed by the specialist findings and corresponding sensitivities. It is the opinion of the specialist that the revised layout is acceptable and may be considered favourably for approval by the Competent Authority.

7.6 Avifauna Assessment

The Project Area of Influence for avian species was determined as an area of up to 7 km from the proposed turbine positions, and 2 km from proposed overhead power line corridors, in line with Best Practice for areas in which large resident breeding raptors occur. A specialist site inspection, reconnaissance survey and survey set up was conducted over three days on 21, 22 and 23 March 2023, during which the locations of vantage points, walked and driven transects were confirmed. A control site was selected approximately 5 km from the WEF site, which matched the WEF site as closely as possible.

A site inspection/reconnaissance survey followed by six avifaunal monitoring surveys were conducted approximately every two months over a 13-month period. The first survey was conducted from 13 – 24 April 2023 (autumn) in line with the Best Practice Guidelines (Jenkins, et al., 2015). Thereafter the Pre-application Monitoring Plan was amended to increase sampling effort in line with Verreaux's Eagle and Black Harrier Guidelines. The second survey was conducted from 16 – 27 June 2023 (winter), the third survey was conducted from 12 – 21 September 2023 (spring), the fourth survey was conducted from 7 – 16 November 2023 (early summer), the fifth survey was conducted from 22 January – 31 January 2024 (summer) and the sixth survey was conducted from 3 – 8 April 2024 (Autumn) and 21 – 24 May 2024 (early winter), in line with the applicable Best Practice Guidelines.

7.6.1 Important Bird Areas

The closest Important Bird Area (IBA) is the Karoo National Park located outside of Beaufort West, approximately 30 km north of the study area, which is known to support the Species of Conservation Concern (SCC) Blue Crane, Ludwig's Bustard, Martial Eagle, Black Harrier, Secretarybird, Kori Bustard, Verreaux's Eagle, Black Stork, Lanner Falcon, Karoo Korhaan and African Rock Pipit.

Approximately half of the development site lies within the Eastern Gamka Karoo Key Biodiversity Area (KBA), which is a 440 500 ha large terrestrial unprotected site consisting of 99% shrubland (Key Biodiversity Areas Partnership, 2024). The site has been designated a KBA as it meets thresholds for three (03) KBA criteria. The biodiversity trigger for KBA criteria is the presence of significant populations of three (03) threatened species, including the Karoo Dwarf Tortoise the site regularly holding 2 individual geographically restricted species and being 100% irreplaceable for the global persistence of three (02) species. KBA trigger species include birds, plants, and reptiles.

7.6.2 Avifauna Habitats

Four (04) avifaunal habitat types were identified on the proposed development footprint. These are as follows:

Karoo scrub

The majority of the proposed development site consist of a relatively uniform habitat in terms of plant species composition and abundance and dominated by a small number of grass and fern species (Karoo scrub). This type of habitat supports several Species of Conservation Concern (SCC), including the SCC recorded in the study area Black Harrier (Endangered), Black Stork (Vulnerable), Blue Crane (Near-Threatened), Greater Flamingo (Near Threatened), Karoo Korhaan (Near Threatened), Kori Bustard (Near Threatened), Lanner Falcon (Vulnerable), Ludwig's Bustard (Endangered), Martial Eagle (Endangered), Secretarybird (Endangered), Southern Black Korhaan (Vulnerable), Tawny Eagle (Endangered) and Verreaux's Eagle (Vulnerable). Several endemic and near-endemic passerine species also occur here, such as Fairy Flycatcher, Fiscal Flycatcher, Grey Tit, Jackal Buzzard, Karoo Eremomela, Karoo Lark, Karoo Prinia, Karoo Thrush, Large-billed Lark, Layard's Warbler and Pied Starling.

Drainage lines and watercourses

Drainage lines and watercourses are characterised by taller riparian vegetation with small trees, than the surrounding karoo scrub areas, and generally support a higher avifaunal abundance and diversity than the surrounding areas. The SCC listed above for karoo scrub habitat may also occur here occasionally, but this habitat is more likely to be frequented by smaller passerine species. Endemic and near-endemic species recorded in the PAOI that prefer this habitat include Cape Weaver, Cape White-eye, Fiscal Flycatcher, Layard's Warbler, Namaqua Warbler, Pied Starling, Sickle-winged Chat, and Southern Double-collared Sunbird.

Farm dams

The PAOI includes several artificial NFEPA wetlands (farm dams), which when full can attract a variety of waterfowl and water-associated birds including the SCC Blue Crane (Vulnerable) that prefers to breed and roost near waterbodies. Water-associated species recorded in larger numbers in the PAOI were South African Shelduck, Egyptian Goose, Red-knobbed Coot which typically favour waterbodies for foraging and breeding.

Alien trees and buildings

The PAOI contains several stands of alien trees such as conifer, eucalyptus, poplar and willow trees that provide a suitable roosting and nesting substrate for a variety of avian species, including raptors such as Common Buzzard, Cape Eagle-Owl, Barn Owl, Jackal Buzzard, Spotted Eagle Owl, Booted Eagle, Brown Snake Eagle and Black-chested Snake Eagle, Martial Eagle (Endangered) and Verreaux's Eagle (Vulnerable), otherwise unavailable in the area.

7.6.3 Site Ecological Importance

As per the Species Assessment guidelines (SANBI, 2022) the Site Ecological Importance (SEI) is a function of the Biodiversity Importance (BI) of the Impact Receptor (i.e., SCC or habitat of the SCC) and its resilience to impacts (Receptor Resilience, RR). Biodiversity importance in turn is a function of Conservation Importance (CI) and Functional Integrity (FI). The SEI calculation is presented in Table 7.7 below.

Table 7.7: Calculation of Site Ecological Importance

Habitat	Conservation Importance	Functional Integrity	Biodiversity Importance	Receptor resilience	Site Ecological Importance
Karoo scrub	Medium	High	Medium	Medium	Medium
Drainage lines & watercourses	Medium	High	Medium	Medium	Medium
Farm dams	Low	Low	Low	Very high	Very low
Alien trees & buildings	Low	Low	Low	Medium	Low

The results included in the table above can be interpreted as follows:

- The Conservation Importance (CI) for karoo scrub, drainage lines and watercourses were determined as medium due to more than 50% of the receptor containing natural habitat with potential to support SCC. Dams and alien trees and buildings were rated as low CI as no confirmed or highly likely populations of SCC occurring, and <50% of the receptor containing natural habitat that can support SCC.
- The Functional Integrity of karoo scrub, and drainage lines and watercourses, has been rated as high as the vegetation is semi-intact and has been utilised for sheep grazing for decades, but there is high habitat connectivity, limited road networks, and no signs of major past disturbance such as ploughing apparent. Farm dams, and alien trees and buildings were rated as low due to their small size or low rehabilitation potential.
- The Receptor Resilience of the karoo scrub, drainage line and rocky ridges habitat has been rated as medium as a recovery to restore >75% of functionality is assumed to be slow, but possible with rehabilitation, over more than 10 years. It was rated as very high for farm dams, as this artificial habitat can be restored readily, and it was rated as medium for alien trees and buildings as large alien trees take more than 10 years to regrow.
- The resulting Site Ecological Importance (SEI) rating was determined as medium for karoo scrub, and drainage lines and watercourses, which means with minimisation and restoration mitigation development activities with medium impact are acceptable if followed by appropriate restoration activities. The SEI for dams was determined as very low, and the SEI for alien trees and buildings was determined as low.

SAPAP2 has recorded a total of 307 species in the project area, of which 158 were recorded as present on the WEF site. Of those recorded on the WEF, 21 are endemic or near-endemic, 13 are regional Red List species (Taylor et al. 2015) and 22 are priority species for wind energy developments (Retief et al. 2014). The 22 observed Priority species recorded included four species listed as Endangered (i.e., Ludwig's Bustard, Martial Eagle, Black Harrier and Tawny Eagle), six species listed as Vulnerable (i.e.,

Secretarybird, Verreaux's Eagle, Lanner Falcon, Blue Crane, Black Stork and Southern Black Korhaan) and two species listed as Near-Threatened (i.e., Karoo Korhaan and Kori Bustard). Priority species were recorded with an average passage rate of 0.746 birds per hour and an average passage rate of 0.413 of birds per hour passing through risk height. The most abundant walked transects were WT14 and WT7 where more than 100 birds per kilometre sampled were recorded (115.01 – 175.78 birds/km) and where an average of 40 species were recorded, the most abundant of these including Lark-like Bunting, Karoo Chat, Rufous-eared Warbler, Karoo Long-billed Lark and Yellow Canary.

7.6.4 Avifaunal Constraints

Avifaunal constraints were identified based on the results of pre-application monitoring and provided as shapefiles to inform the design of the scoping phase project layout. The following constraints were recommended for the Carissa WEF site. All constraints are complied with in the proposed scoping layout:

Table 7.8: Avifaunal Constraints

Constraint area	Constraint	Scoping Layout Compliance
Within 1.5 km of Martial Eagle nests	No development activities are supported.	Full. No development activities are proposed
Within 1 km of Secretarybird nests	No development activities are supported.	Full. No development activities are proposed
Within 200 m of Jackal Buzzard nests	No development activities are supported.	Full. No development activities are proposed
Within 6 km of Martial Eagle nests	No turbines are supported. Some minimised overhead power lines and other associated infrastructure is acceptable with mitigation.	Full. No turbine positions are proposed. The proposed minimised infrastructure is acceptable.
Within 2 km of active Secretarybird nests	No spinning turbines or overhead power lines are supported. Construction activities should be minimised when breeding.	Full. No turbines or overhead power lines are proposed.
Within 1 km of active Jackal Buzzard nests	No spinning turbines or overhead power lines are supported. Construction activities should be minimised when breeding.	Exceeded. No development activities are proposed.
Within 500 m of active Pale Chanting Goshawk nests	No spinning turbines or overhead power lines are supported.	Exceeded. No development activities are proposed.
Within 200 m of NFEPA Rivers and Wetlands:	No turbines are supported. Some minimised infrastructure such as roads and overhead power lines may be acceptable if unavoidable with pylons placed as far as possible on the outside of the buffers and mitigations such as bird flight diverters installed along the entire line.	Full. No turbines are proposed. Minimised infrastructure proposed is acceptable.
Within Critical Biodiversity Areas	Should be avoided by development, as far as possible. Minimised unavoidable linear activities may be acceptable with mitigation.	Full. Minimised proposed linear infrastructure is acceptable.

Constraint area	Constraint	Scoping Layout Compliance
Areas of identified higher flight activity (medium) by priority species	Should be avoided by turbine placement and overhead power lines as far as possible. Minimised development may be acceptable with mitigation, with a higher risk of adaptive mitigation measures being required, such as Shut-down-on demand (SDOD) or curtailment.	Acceptable. 11 turbines are proposed within these areas.

Refer to Figure 7.23 below for the Avifaunal Constraints Map.

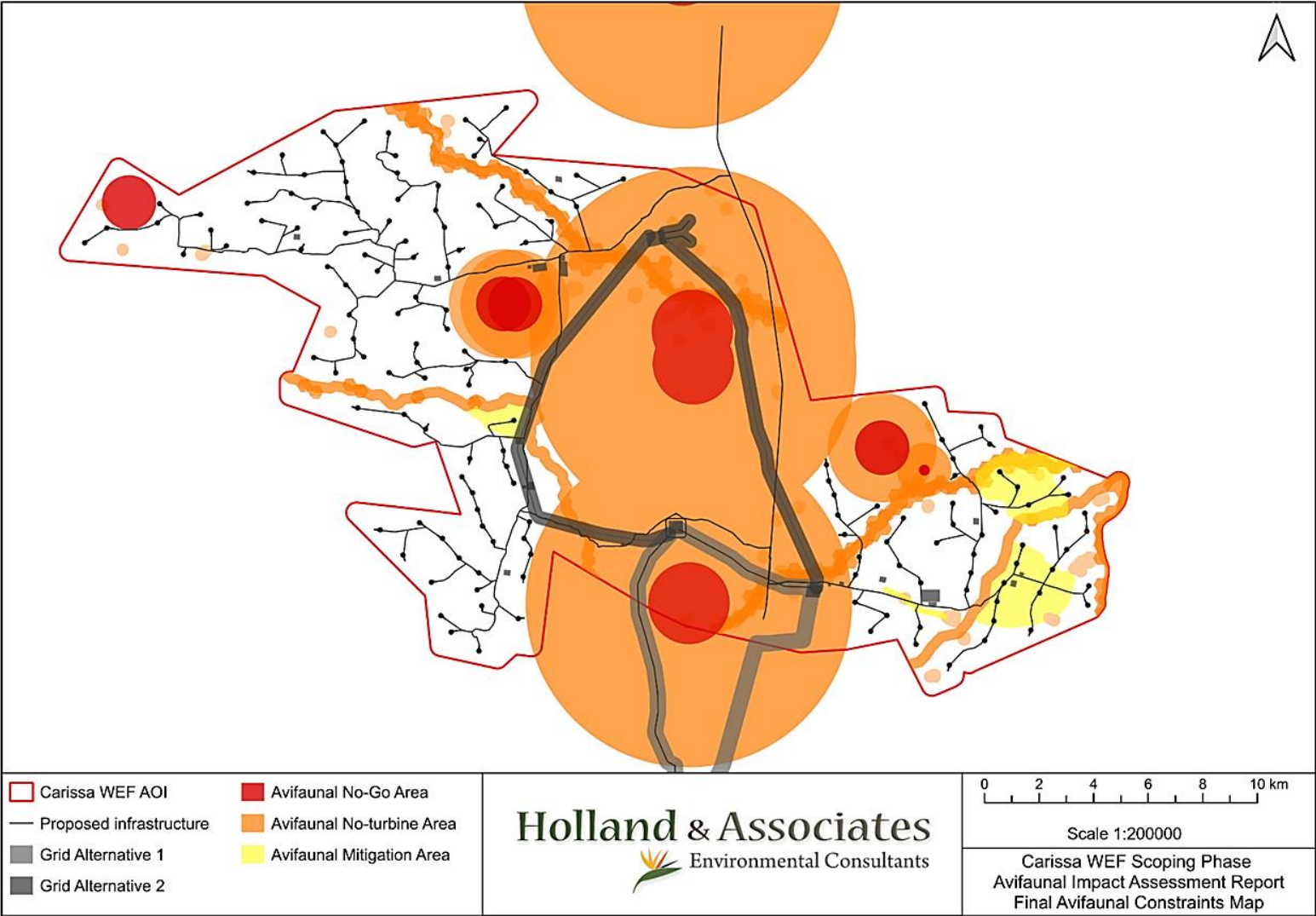


Figure 7.23: Final Avifaunal Constraints Map

7.6.5 Avifauna Site Sensitivity Verification

The Screening Tool identified the PAOI as of low sensitivity under the vulture and avifauna (wind) theme. It must be noted that the Screening Tool does not contain reliable data for the avian theme.

The Screening Tool Report generated for the Carissa WEF original study area (the area proposed for turbine development) identifies the site as of high sensitivity under the animal species theme (likely presence of SCC) for three avian species of conservation concern listed as Endangered: Black Harrier (*Circus maurus*), Ludwig's Bustard (*Neotis ludwigii*), and Martial Eagle (*Polemaetus bellicosus*); and of medium sensitivity for four SCC: Southern Black Korhaan (Vulnerable), Black Harrier (Endangered), Ludwig's Bustard (Endangered) and Verreaux's Eagle (Vulnerable).

The specialist site inspection and pre-application avifaunal monitoring confirmed the presence of 13 SCC, including those identified by the Screening Tool (Appendix B). Five of the confirmed SCC are red-listed as Endangered (Black Harrier, Ludwig's Bustard, Martial Eagle, Secretarybird and Tawny Eagle), five are red-listed as Vulnerable (Black Stork, Blue Crane, Lanner Falcon, Southern Black Korhaan, and Verreaux's Eagle) and three are red-listed as Near Threatened.

Therefore, the results of the Screening Tool under the animal species theme are confirmed as of high sensitivity and an Avian Species Specialist Assessment must be conducted as per the animal species protocol (GN 1150) by a specialist registered with SACNASP within a field of practice relevant to the taxonomic group (in this case Aves – Birds), for which this assessment is being undertaken. The assessment must be undertaken in accordance with the Species Environmental Assessment Guideline (SANBI, 2022).

The specialist site sensitivity verification disputes the results of the Screening Tool under the avian theme of low sensitivity – (Areas that possibly do not support priority populations of threatened species that are susceptible to impacts from wind energy facilities) due to the confirmed presence of 30 priority species for wind energy facilities (as defined by Retief, et al., 2014), including 13 SCC. The sensitivity in terms of the avifauna (wind) theme is determined as high (Includes habitat likely to be of importance to priority bird species sensitive to wind energy developments, Critically Endangered, Endangered bird species and/or Vulnerable bird species; and habitat likely to be of importance to endemic and/or range-restricted bird species that are susceptible to impacts from wind energy facilities). An Avifaunal Specialist Assessment as per the avifauna (wind) protocol (GN320) is to be undertaken in line with the latest version of the Bird and Wind Energy Best-Practice Guidelines.

The Screening Tool results for the vulture theme were confirmed as of low sensitivity, with no vultures recorded during pre-application monitoring or by SABAP2 in the area. As no vulture protocol for the vulture theme has been gazetted to date, there is no legal requirement for this theme and assessments would be conducted in line with Appendix 6 of the NEMA EIA Regulations, 2014, as amended. The potential presence of far-ranging vultures during the lifetime of the facility was considered as possible.

The proposed development of the Carissa WEF (Scoping phase layout) is acceptable from an avifaunal perspective and supported, if all recommended mitigations are included in the project-specific Environmental Management Programme and implemented accordingly.

7.7 Bat Assessment

The site was evaluated by considering the number of man-made structures, dense tree clumps and surface rock (possible roosting space), topography (influencing surface rock in most cases), vegetation (possible roosting spaces and foraging sites), climate (can influence insect numbers and availability of fruit), and presence of surface water and drainage areas (influences insects and acts as a source of drinking water)

to identify bat species that may be impacted by wind turbines. These considerations principally involved studying the literature, available satellite imagery and vegetation descriptions of each site. Several site visits were conducted to provide an understanding of the environmental setting of the site.

Bat activity was monitored using passive bat monitoring techniques. Passive detection has been completed at Carissa WEF by means of 15 bat detection systems which were installed in August 2023. These bat monitoring systems were installed on four Meteorological Masts (referred to as Met Mast 1 – Met Mast 4) and three Short Masts (referred to as ShM1 – ShM3) located on site.

Table 7.9: Equipment Setup and Site Visit Information

Met Mast passive bat detection systems	Quantity on site	4
	Coordinates	Met Mast 1: -32.711479° 22.381557°
		Met Mast 2: -32.804182° 22.471099°
		Met Mast 3: -32.717866° 22.496215°
		Met Mast 4: -32.797665° 22.631666°
Short Mast passive bat detection systems	Microphone heights	7 m, 60 m, & 120 m (MM1); 7 m, 75 m, & 150 m (MM2 - 4)
	Quantity on site	3
	Coordinates	ShM1: -32.694350° 22.467509°
		ShM2: -32.830251° 22.606556°
		ShM3: -32.803464° 22.678855°
	Microphone height	7 m
Site visits:		
19 – 25 August 2023 (Installation of monitoring systems): The microphones were mounted such that they pointed approximately 30 degrees downward to avoid excessive water damage. The bat detectors were installed with a solar power setup each to enable a 12-month deployment.		
12 – 14 November 2023: Equipment and systems checked. Most systems working well; top microphone at MM3 not functioning, replaced on 20 November. All data retrieved and downloaded.		
28 February – 1 March 2024: Equipment and systems checked. Most systems working well; the system at ShM1 was off on arrival due to poor contact between connector plug and solar panel, the connection was changed to another outlet and issue was fixed. All data retrieved and downloaded.		
17 – 21 June 2024: Equipment and systems checked. MM2 – Access prevented due to padlock. Padlock was cut and replaced. Top microphone was not operating, most likely due to lightning. MM4 – top microphone was not operating most likely due to lightning. All other systems were operating well. All systems updated to 2.4.9 firmware. All data retrieved and downloaded.		
21 – 24 August 2024: All systems were decommissioned and data retrieved. MM3 – Top and middle system functioning, lowest system had no power as power cable was not attached to the solar panel – possibly due to birds sitting on the cable. MM4 – Top microphone was not responsive and SD cards were empty, MM2 top microphone were faulty from April onwards. ShM1 – system was off on arrival, solar panel was found on the ground at the bottom of the mast, but data were recorded until 21 August 2024. All other systems working well. The site terrain was observed for seasonal differences and habitat sensitivities. The results from data analysis are presented in this document.		
Type of passive bat detector		SM4BAT

Recording schedule	The bat detectors were set to operate in continuous trigger mode from dusk each evening until dawn (times were automatically adjusted in relation to latitude, longitude and season).
Trigger threshold	>16KHz, -18dB
Trigger window (time of recording after trigger ceased)	1 second
Microphone gain setting	12dB
Other methods	During the site visits mentioned above, terrain was investigated during the day for bat habitat observations.

The predominant land use of the wind farm site and surrounding properties is livestock farming (grazing). Vegetation units and geology are of great importance to a study such as this, as these may serve as suitable sites for the roosting of bats and support of their foraging habits (Monadjem et al. 2020). Houses and buildings may also serve as suitable roosting spaces (Taylor 2000; Monadjem et al. 2020). The importance of the vegetation units and associated geomorphology serving as potential roosting and foraging sites are described in Table 7.10 below.

Table 7.10: Potential of the Vegetation Units to Serve as Suitable Roosting and Foraging Spaces for Bats, According Specifically to the Terrain and Habitat Found in the Area

Vegetation Unit	Foraging Potential	Comments	Roosting Potential	Comments
Gamka Karoo	Medium	Foraging will mostly be focused on drainage lines and associated riparian vegetation.	Low (Natural environment) Medium to High (Man-made)	Exposed rocky cliffs and trees are limited Man-made structures such as houses and buildings can offer an abundance of roosting habitat for certain species on site.
Southern Karoo Riviere	Medium - High	Foraging will mostly be focused on drainage lines and associated riparian vegetation, and will be greater when these areas are filled with water.	Medium (Natural environment) Medium-High (Man-made)	Roosting opportunities are limited to tree hollows. Man-made structures such as houses and buildings can offer an abundance of roosting habitat for certain species on site.

7.7.1 Protected Areas, Known Sensitivities and Caves/Roosts within 30 km and 100 km from the Site

There are no protected or conserved areas within a 30 km radius of the proposed Carissa WEF. The Gouritz Cluster Biosphere Reserve is a conserved area located approximately 31 km south and south-west of the proposed WEF. Henry Kruger Private Nature Reserve, Karoo National Park and Steenbokkie Private Nature Reserve are the closest protected areas and are situated 31 km west, 31 km north and 36 km north of the proposed WEF, respectively. None of the protected areas are well-known hotspots for bat activity or bat roosts that may influence the site, although the presence of natural vegetation may promote bat diversity and activity levels.

The Strategic Environmental Assessment (SEA; Department of Environment Forestry and Fisheries 2019) for the REDZ assigns a minimum buffer of 500 m to all known bat roosts. Maximum buffers vary depending on the size of roost and the type of bats. Maximum buffers are assigned in accordance with the buffers designated in the South African Best Practice Guidelines for Pre-construction Monitoring of Bats at Wind Energy Facilities (MacEwan et al. 2020). Therefore, any possible cave/roost locations may be assigned a No-go buffer of up to 20 km if they are found to be supporting large enough bat colonies. A larger radius, up to 100 km, has been considered in this study to account for migration paths from roosts to foraging areas. There are six known roosts within a 100 km radius of the proposed Carissa WEF, including roosts in three known caves, the closest of which are situated approximately 60 km south-south-west of Carissa WEF according to databases from Bats KZN, SABAA and when considering museum records of cave bats in the area (ACR, 2020). However, these six roosts have no bearing on the site with regards to the no-go buffer zone. There are currently no known caves supporting bat roosts on site, however, due to the difficulty in pinpointing these features, it is still possible that such colonies may still be found, although unlikely. Refer to Table 7.11 below and Figure 7.24 below.

Table 7.11: Known Bat Roosts and Caves within a 100 km Radius of the Proposed Carissa WEF (SABAA and Bats KZN Databases)

Map ID	Roost Name	Additional information	No-go radial buffer distance
Cave	Skelton Cave	None	20 km maximum (may reduce with verification)
Cave	Spies Cave	None	20 km maximum (may reduce with verification)
Cave	Skeleton Cave	<i>Rousettus aegyptiacus</i> identified at this site	20 km maximum (may reduce with verification)
1	Abrie	None	20 km maximum (may reduce with verification)
2	Grahamstown	None	20 km maximum (may reduce with verification)
3	Marcus Mud Crawl	None	20 km maximum (may reduce with verification)

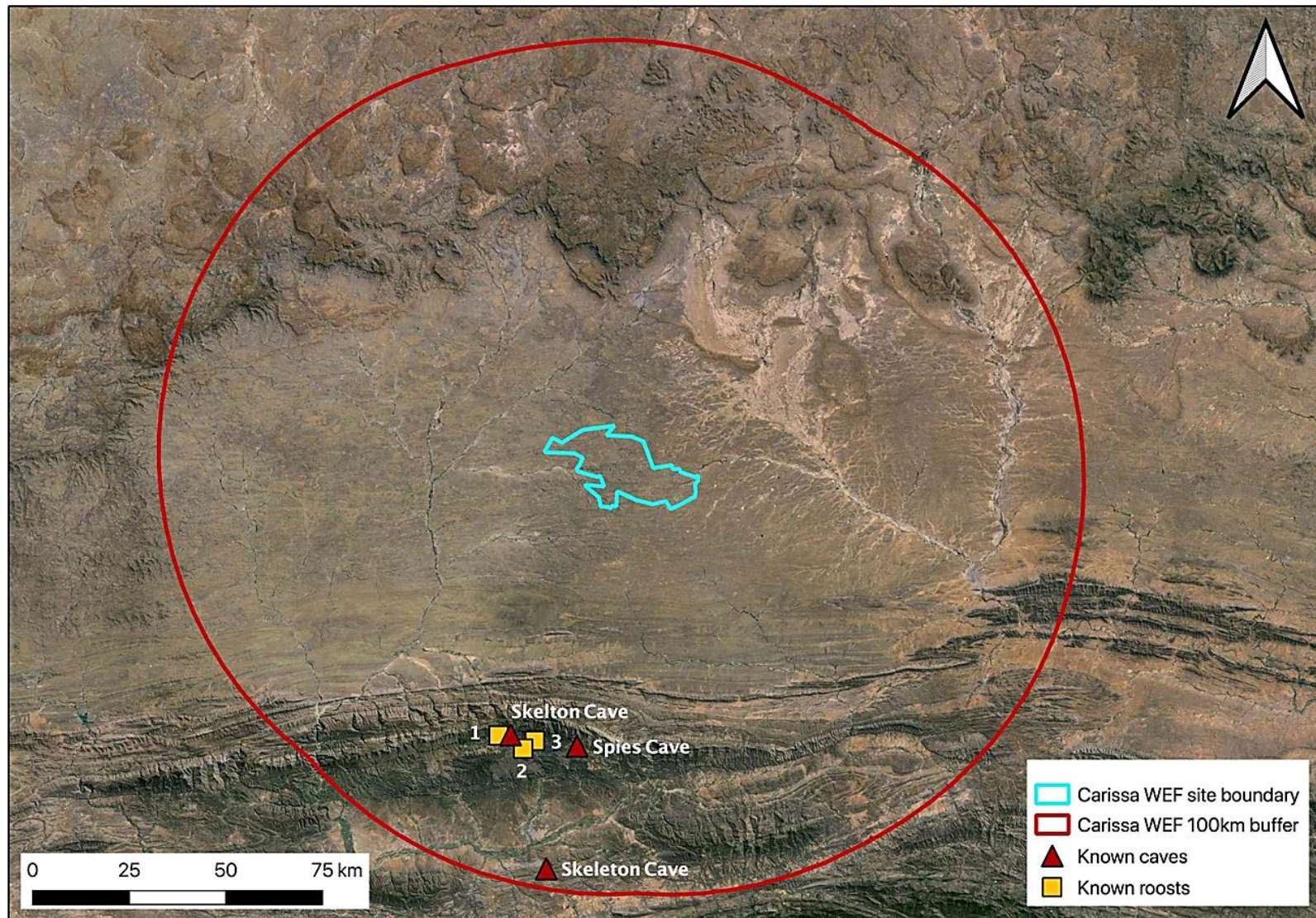


Figure 7.24: Known Caves and Roosts within a 100 km Radius (Red Line) of the Proposed Carissa WEF (SABAA and Bats KZN Databases)

7.7.2 Currently Confirmed, Previously Recorded as Well as Literature-Based Species Probability of Occurrence

“Probability of Occurrence” is assigned based on consideration of the presence of roosting sites and foraging habitats on the site, compared to literature described preferences, species records from nearby and adjacent wind farms, and species currently confirmed on site. Refer to Table 7.12 of species that are currently confirmed on site, and/or have been previously recorded in the area and may be occurring based on literature. The probability of occurrence is also influenced by the likelihood of encountering the bat species on site (e.g., its scarcity in general, or if the distribution is marginal to the site location).

The column of “Likely risk of impact” describes the likelihood of risk of fatality from direct collision or barotrauma with wind turbine blades for each bat species. The risk was assigned by MacEwan et al. (2020) based on species distributions, altitudes at which they fly and distances they traverse; and assumes a 100 % probability of occurrence.

Table 7.12: Table of Species that are Currently Confirmed on Site, and/or Have Been Previously Recorded in the Area and may be Occurring Based on Literature. Roosting or Foraging in the Study Area, the Possible Site-Specific Roosts, and their Probability of Occurrence Based on Literature as well as Recordings and Observations in the Surrounding Area, is also Briefly Described (Monadjem Et Al. 2020)

Species	Common name	Occurrence in area	Conservation status (2016 Regional Listing)	Possible roosting habitat on or near site	Possible foraging habitat utilised on or near site	Likelihood of risk of fatality (MacEwan <i>et al.</i> 2020)
<i>Tadarida aegyptiaca</i>	Egyptian free-tailed bat	Confirmed on site	Least Concern	Roosts in rock crevices, hollows in trees, and behind the bark of dead trees. Exposed rocky cliffs. The species has also taken to roosting in roofs of buildings.	It forages over a wide range of habitats; its preferences of foraging habitat seem independent of vegetation. It seems to forage in all types of natural and urbanised habitats.	High
<i>Laephotis capensis</i>	Cape serotine	Confirmed on site	Least Concern	Roosts in the roofs of houses and buildings, and also under the bark of trees.	It appears to tolerate a wide range of environmental conditions from arid semi-desert areas to montane grasslands, forests, and savannahs. But is predominantly a medium height clutter edge forager.	Medium
<i>Miniopterus natalensis</i>	Natal long-fingered bat	Confirmed on site	Near Threatened (2004 National Listing)	Cave and hollow dependent, closest known caves are over 50km from site. Will also roost in small groups or individually in culverts and other hollows.	Clutter-edge forager. May forage in more open terrain during suitable weather.	Medium – High
<i>Sauromys petrophilus</i>	Roberts's flat-headed bat	Confirmed on site	Least Concern	It is a crevice dweller roosting in rock crevices, as well as other crevices in buildings. Exposed rocky cliffs.	Open air forager.	High
<i>Eptesicus hottentotus</i>	Long-tailed serotine	Confirmed on site	Least Concern	It is a crevice dweller roosting in rock crevices, as well as other crevices in buildings. Exposed rocky cliffs.	It generally seems to prefer foraging on the clutter edge of vegetation, such as the vegetated drainage areas and also over open water sources such as farm dams.	Medium
<i>Rhinolophus spp.</i>		Confirmed on site	Least Concern	Roosts in caves and mine adits, closest known caves are over 50km from site. May utilise man-made hollows, Aardvark burrows or hollows formed by rocky boulder koppies.	It is associated with a variety of habitats including thickets that may be found in the vegetated drainage areas.	Low
<i>Nycteris thebaica</i>	Egyptian slit-faced bat	Confirmed within 100km of site	Least Concern	Roosts in rocky hollows, aardvark burrows, culverts under roads and the trunks of dead trees.	Occurs in moist and dry savannah, ranging into riparian strips, but avoids open grasslands. Requires tree cover.	Low

Species	Common name	Occurrence in area	Conservation status (2016 Regional Listing)	Possible roosting habitat on or near site	Possible foraging habitat utilised on or near site	Likelihood of risk of fatality (MacEwan <i>et al.</i> 2020)
<i>Myotis tricolor</i>	Temmink's myotis	Confirmed within 100km of site	Near Threatened (2004 National Listing)	Usually roosts gregariously in caves, closest known caves are over 50km from site. Sometimes culverts or other hollows.	Clutter-edge forager. May forage in more open terrain during suitable weather.	Medium – High
<i>Rhinolophus clivosus</i>	Geoffroy's horseshoe bat	Confirmed within 100km of site	Least Concern (2016 Regional Listing)	Caves present in the larger area.	Vegetation clutter forager, clumps of trees in the larger area.	Low
<i>Epomophorus wahlbergi</i>	Wahlberg's epauletted fruit bat	Confirmed within 100km of site	Least Concern (2016 Regional Listing)	Roosts in dense foliage of large, leafy trees in the larger area, and may travel several kilometres each night to reach fruiting trees.	Feeds on fruit, nectar, pollen and flowers.	High
<i>Rousettus aegyptiacus</i>	Egyptian fruit bat	Confirmed within 100km of site	Least Concern (2016 Regional Listing)	Roost in natural caverns, irrigation tunnels, ruins, mines and open wells.	Feeds on fruit, nectar, pollen and flowers.	High
<i>Cistugo lesueuri</i>	Lesueur's hairy bat	Confirmed within 100km of site	Near Threatened (2004 National Listing)	Roosts in rock crevices, usually near water. Exposed rocky cliffs and tors.	Areas with available drinking water. Clutter edge forager. May forage in more open terrain during suitable weather.	Medium
<i>Rhinolophus capensis</i>	Cape horseshoe bat	Confirmed within 100km of site	Least Concern (2016 Regional Listing) Near Threatened (2004 National Listing)	Caves and disused mine tunnels present in the larger area.	Clutter-edge foragers. Forage in and close to the canopy of trees.	Low

Bat activity was divided into categories according to the risk of being impacted on by wind turbines, as well as other important ecological significance (as is the case with cave bats).

Table 7.13: The Categories Used for Grouping and Presenting Bat Activity in the Passive Bat Activity Graphs³³. “Risk” Represents the Likelihood of Fatality to Turbine Collision

Graph category and abbreviation	Motivation of graph category	Species detected in graph category
High risk (H)	<ul style="list-style-type: none"> Open-air foragers High flying in rotor swept zone 	<i>Tadarida aegyptiaca</i> <i>Sauromys petrophilus</i>
High – Medium risk (HM)	<ul style="list-style-type: none"> Migrant bats, can influence multiple ecologies Cave bats, may possibly indicate presence of undiscovered bat cave roosts Can also roost in non-cave hollows Forages on the edges of vegetation clutter (clutter-edge foragers) Medium height foraging, overlapping with lower rotor swept zone 	<i>Miniopterus natalensis</i> <i>Myotis tricolor</i>
Medium risk (M)	<ul style="list-style-type: none"> Forages on the edges of vegetation clutter (clutter-edge foragers) Medium height foraging, overlapping with lower rotor swept zone 	<i>Eptesicus hottentotus</i> <i>Laephotis capensis</i>
Low risk (L)	<ul style="list-style-type: none"> Non-migrant cave and hollow dwelling bats, but may possibly indicate presence of caves, therefore presented in graphs Forages in dense vegetation clutter (clutter foragers) Low height foraging outside rotor swept zone 	<i>Rhinolophus</i> spp.

The bat species detected on site thus far are: *Tadarida aegyptiaca*, *Sauromys petrophilus*, *Miniopterus natalensis*, *Laephotis capensis*, *Myotis tricolor*, and *Eptesicus hottentotus*. Additionally, there is likely at least one member of the Rhinolophidae family present on site.

The temporal data displays the spread of bat activity over each night and may indicate abrupt peaks in activity. Bat activity was generally less during the winter. This trend mirrors known insect activity decreases during the colder nights and is in keeping with the expectations for the site.

Considering the Met Mast (MM) systems, overall bat activity peaked on 12 October 2023 at all four Met Masts, although peaks of activity were also observed in August 2024 (MM1), November 2023 (MM2), November 2023 and January 2024 (MM3), and December 2023 and August 2024 (MM4). Bat activity for the High-risk species was notably greatest of all the risk categories across the entire monitoring period, followed by the Medium-risk group, albeit at lower levels. The other risk groups showed much lower activity throughout the entire monitoring period.

Considering the Short Mast (ShM) systems, overall bat activity peaked on 8 September at ShM1, and on 17 November at ShM2 and ShM3. Overall, the High-risk group was the most active risk group at ShM1,

³³ Detailed graphs presented in the Bat Impact Assessment under Appendix E4

while the High-risk and Medium-risk groups were both dominant at ShM2 and ShM3. The other risk groups showed much lower activity throughout the entire monitoring period.

7.7.3 Bat Sensitivity Analysis

Table 7.14 below presents the features identified to be important for foraging and roosting of the species that most commonly occur on site. Table 7.15 below describes the implications of the sensitivity criteria.

The round cement dam water reservoirs are demarcated as Conditional No-go sensitivities. They can be closed-up to have no exposed surface water available for bats, this may reduce bat activity around these reservoirs. The dams can remain fully functional for agricultural purposes. The alteration will downgrade this specific Conditional No-go bat sensitivity to a Medium level of bat sensitivity. Closing-up these water reservoirs will lessen water loss by evaporation. In cases where such cement reservoirs are not closed-up, the No-Go sensitivity criteria outlined in Table 7.15 will apply to the relevant infrastructure.

Considering the current layout, and a rotor radius of 100 m, the blade overhang of **Turbine 136** is intruding into no-go bat sensitivity buffers with approximately 5.5 m. This turbine must be micro-sited³⁴ to have its blade overhang outside of the no-go bat sensitivity buffers prior to EA being granted and the Final Site Layout Plan being approved. Additionally, the blade overhang of **Turbine 17** is intruding into high bat sensitivity buffers and mitigation measures must therefore be applied during construction and operation phases for the turbine to remain at this location. Based on the current layout, roads, hardstands, MTS and grid connections, access control security buildings, O and M building areas, construction site camps, laydown areas, batching plants and material handling areas respect the bat sensitivity map.

Figure 7.25 below depicts the sensitive areas of the site. The sensitivity map is based on species ecology and habitat preferences.

³⁴ Note turbine micro-siting is intended to be undertaken during the detailed EIA phase

Table 7.14: Description of Parameters Used in the Construction of the Sensitivity Map

Sensitivity	Sensitivity Feature	Motivation
No-go Sensitivity	Perennial streams and rivers, especially if (but not limited to) associated with riparian vegetation	Available water and moisture will attract insect food, and the riparian vegetation can offer shelter from the wind thereby promoting insect activity and bat foraging.
	Dams and water bodies with exposed surface water.	Bats make use of such features as a source of drinking water. Available water and moisture will attract insect food, thereby promoting insect activity and bat foraging.
	Cliffs and ridges with significant exposed rock, especially if (but not limited to) located in near water sources.	These areas can offer roosting space for crevice dwelling bats and shelter from the wind and increased general biodiversity and available insect food.
	Man-made structures and buildings, especially if part of a farmstead with associated garden vegetation and irrigated croplands.	Such structures can offer roosting space, especially in buildings with ceilings. In combination with garden vegetation and croplands (especially if irrigated), it also offers roosting space with a reliable source of insect food. Fruit bats are also more likely to utilise vegetation at farmsteads if fruit is available seasonally.
Conditional No-go Sensitivity	Man-made cement water reservoirs (round cement dams).	The round cement dam water reservoirs can be closed up to have no exposed surface water available for bats, this may reduce bat activity around these reservoirs. If the reservoirs have exposed surface water, they provide drinking water for bats and available insect prey.
High Sensitivity	Larger non-perennial streams and drainage systems, especially if associated with riparian vegetation	Seasonally available water and moisture may attract insect food.
	Small water features with less to no riparian vegetation, especially if directly connected to no-go aquatic sensitivities.	Bat and insect food activity will therefore be more seasonal compared to perennial open water sources.
	Smaller rocky cliffs and ridges, especially if located in or near water sources.	These areas can offer, to some degree, possible roosting and shelter from the wind and increased general biodiversity and available insect food.
	Non-perennial drainage lines	Some seasonally available moisture may attract insect food.

Sensitivity	Sensitivity Feature	Motivation
Medium Sensitivity	Smaller non-perennial streams and drainage lines	Seasonally available moisture may attract insect food, especially only after sufficient rain.
Low Sensitivity	The remainder of the site not delineated by buffers	

Table 7.15: The Significance of Sensitivity Map Categories for Each Infrastructure Component for the WEF

Sensitivity	Turbines	Buildings (including substation, battery storage facility and construction camp/yards)	Grid lines (transmission)	Roads and underground cables	Internal overhead transmission lines
No-go Sensitivity (including Conditional No-go sensitivity)	These areas are ‘no-go’ zones and turbines may not be placed in these areas. Turbine blades (blade overhang) may not intrude into these areas.	Avoid these areas (no-go areas).	Pylon base areas only: Avoid these areas (no-go areas). Overhead cables: Allowed inside these areas.	Preferably keep to a minimum within these areas where practically feasible.	Allowed inside these areas.
No-go Sensitivity buffer (including Conditional No-go sensitivity buffer)	These areas are ‘no-go’ zones and turbines may not be placed in these areas. Turbine blades (blade overhang) may not intrude into these areas.	Preferably keep to a minimum within these areas where practically feasible.	Pylons and cables: Allowed inside these areas	Allowed inside these areas.	Allowed inside these areas.
High Sensitivity	These areas are ‘no-go’ zones and turbines may not be placed in these areas. Turbine blades (blade overhang) may not intrude into these areas.	Avoid these areas (no-go areas).	Pylon base areas only: Avoid these areas (no-go areas). Overhead cables: Allowed inside these areas.	Preferably keep to a minimum within these areas where practically feasible.	Allowed inside these areas.
High Sensitivity buffer	Turbines may be placed in these areas. Turbine blades (blade overhang) may be inside these areas. Only on condition that operational mitigation measures be applied to these turbines from the onset of operation. These mitigation measures will be detailed in the EIA and EMPr.	Allowed inside these areas.	Pylons and cables: Allowed inside these areas	Allowed inside these areas.	Allowed inside these areas.
Medium Sensitivity and buffers	Turbines may be placed in these areas if no alternatives are available. Alternative locations should be used where available. Turbines within these areas may have a higher likelihood that mitigation measures may need to be applied to them.	Allowed inside these areas.	Pylons and cables: Allowed inside these areas	Allowed inside these areas.	Allowed inside these areas.

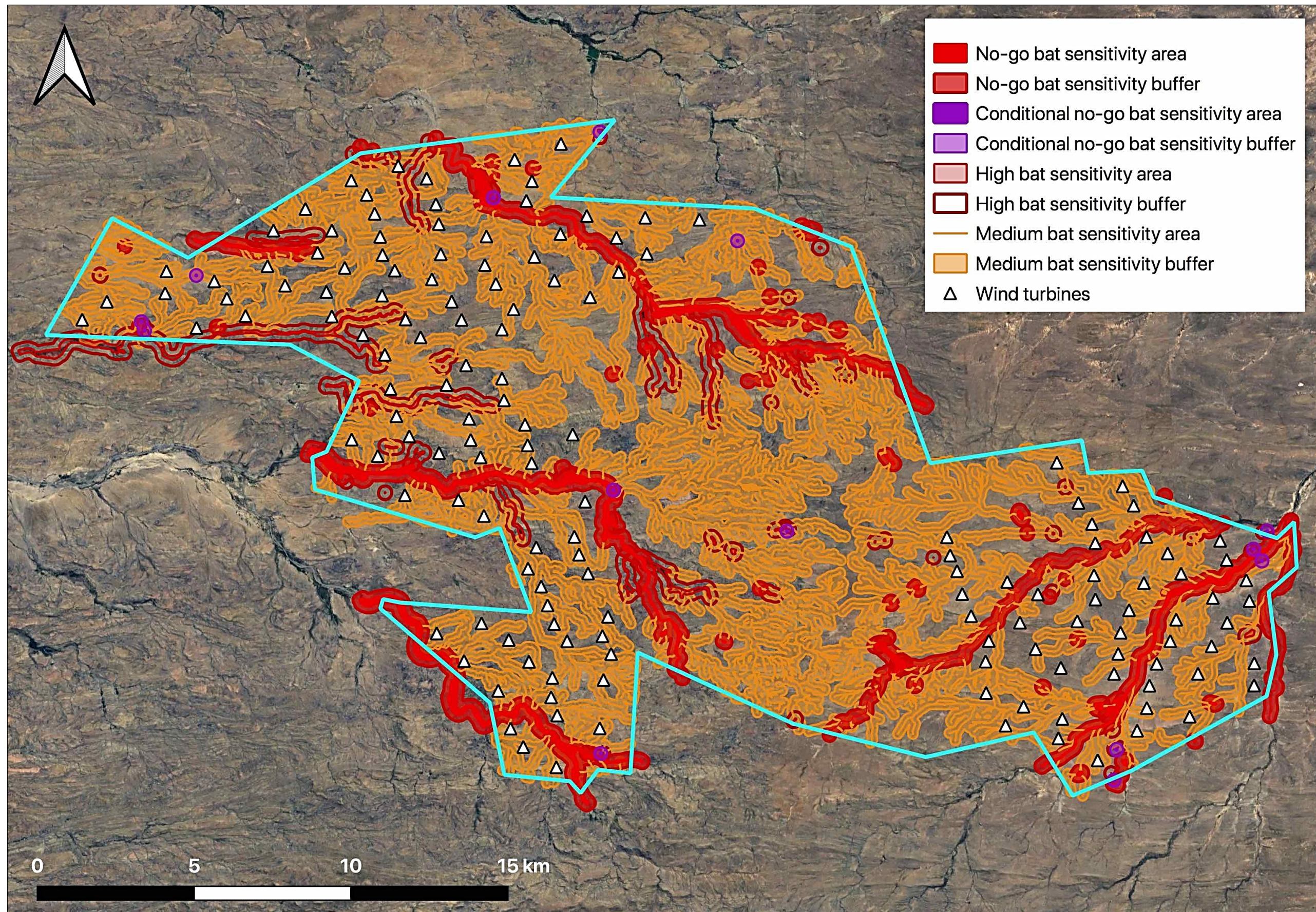


Figure 7.25: Bat Sensitivity Map of the Proposed Carissa WEF, Showing No-Go, Conditional No-Go, High and Medium Sensitivity Zones and their Buffers; also Highlighting the Proposed Wind Turbine Layout

Table 7.16: Specific Details of Features Highlighted in the Sensitivity Map

Sensitivity Category	Buffer Distance
Conditional Sensitivity No-go	Assigned a 200 m buffer
No-go Sensitivity	Assigned a 200 m buffer
High Sensitivity	Assigned a 200 m buffer
Medium sensitivity features	Assigned a 150 m buffer

Table 7.17: Action Required for the Current Wind Turbine Layout When Considering a Rotor Radius of 100 m

Turbine number	Action required	Reason
WTG-136	Turbine must be micro-sited	Blades intrude into no-go buffer with approximately 5.5m
WTG-17	Mitigation required	Turbine base intrudes into high buffer

According to available information consulted during this study and up to date, there are no fatal flaws from a bat sensitivity perspective which should prevent the wind farm from proceeding to the approval phase.

7.8 Aquatic Ecological Assessment

A site assessment was undertaken from the 3rd to the 5th May 2024. It is important to note that at least 90% of the associated freshwater drainage were dry during the site visit, which is typical for the region and the nature of the drainage pattern. It is assumed that rainfall events will occur as flash floods, with water not persisting for extended periods. During these events, drainage lines and rivers will achieve pristine conditions, as there are no significant impacts on these systems. However, these conditions are short-lived due to the characteristic arid nature of the Karoo.

Given the extensive size of the project area, the aquatic assessment was undertaken and divided into East and West sections with the N12 National Road serving as the dividing line and the findings of the assessment will be presented as such. Table 7.18 below provides the characteristics of the aquatic features within the proposed development area.

Table 7.18: Regional Characteristics of the Project Area

ATTRIBUTE	PROJECT DETAILS	
	EAST	WEST
Water User	Carissa WEF Facility	
Water Management Area	9 – Mzimvuba_Tsitsikamma	8 – Breede_Gouritz
Sub-water Management Area	Gamtoos	Gamka
Primary Catchment Region	Region L	Region J
Quaternary Drainage Region	L12A	J21C; J21E & J21D

ATTRIBUTE	PROJECT DETAILS	
	EAST	WEST
Level 1 Eco-region	21 – Great Karoo	
Level 2 Eco-region	21.05 Level	21.04 Level
Main River in Catchment and Site Specific	Soutfontein se; Amos River; and Swartbakens	Plaatjies River; Veldmans River; and LammerskraalSpruit
Main River PES	Class C Moderately Impaired	
River EIS	Very High	
Site Specific River Condition	Soutfontein se Rivcon = AB; Amos Rivcon = CDEFZ Swartbakens Rivcon = AB	All rivers = Rivcon of AB
DWS RQO Catchment PESC	Class C – Moderately Impaired	
Best Attainable Management Class	Class C – Moderately Impaired	
Default Ecological Management Class	Class C – Moderately Impaired	
Catchment EISC	Moderate	
SANBI NFEPA Status	Moderate	
Protected Areas	Henry Kruger Private Nature reserve – West Steenbokkie Private Nature Reserve – North Karoo National Park – North	
Conservation Areas	Gouritz Cluster Biosphere Reserve Swart Berge	
Fish Sanctuaries	No Fish Sanctuaries within proximity to the development area	
Aquatic Sub-catchments	2 – Irreplaceable	

The project area falls within the Great Karoo Biological Band. This biological band are used to determine the Aquatic Invertebrate Community composition and overall, Health Category, although this classification system could not be used due to insufficient water within the entire area.

Freshwater Aquatic Features

The eastern part of the project area falls within the “L” (L1) Drainage Region within the Mzimvuba_Tsitsikamma Water Management Area (WMA) and within the Gamtoos Sub-Water Management Area (Sub-WMA). The western side of the project area falls within the “J” (J2) Drainage Region within the Breede_Gourtiz Water Management Area (WMA) and within the Gamka Sub- Water Management Area (Sub-WMA). The applicable quaternary catchment areas (L12A; J21C; J21E and J21D) ranges between Class B Slightly Impaired categories to Class C Moderately Impaired systems. The Best Attainable Ecological Class is set between Class A to Class C Health categories however it will be difficult to obtain these categories. Refer to Figure 7.26 below for the applicable WMA.

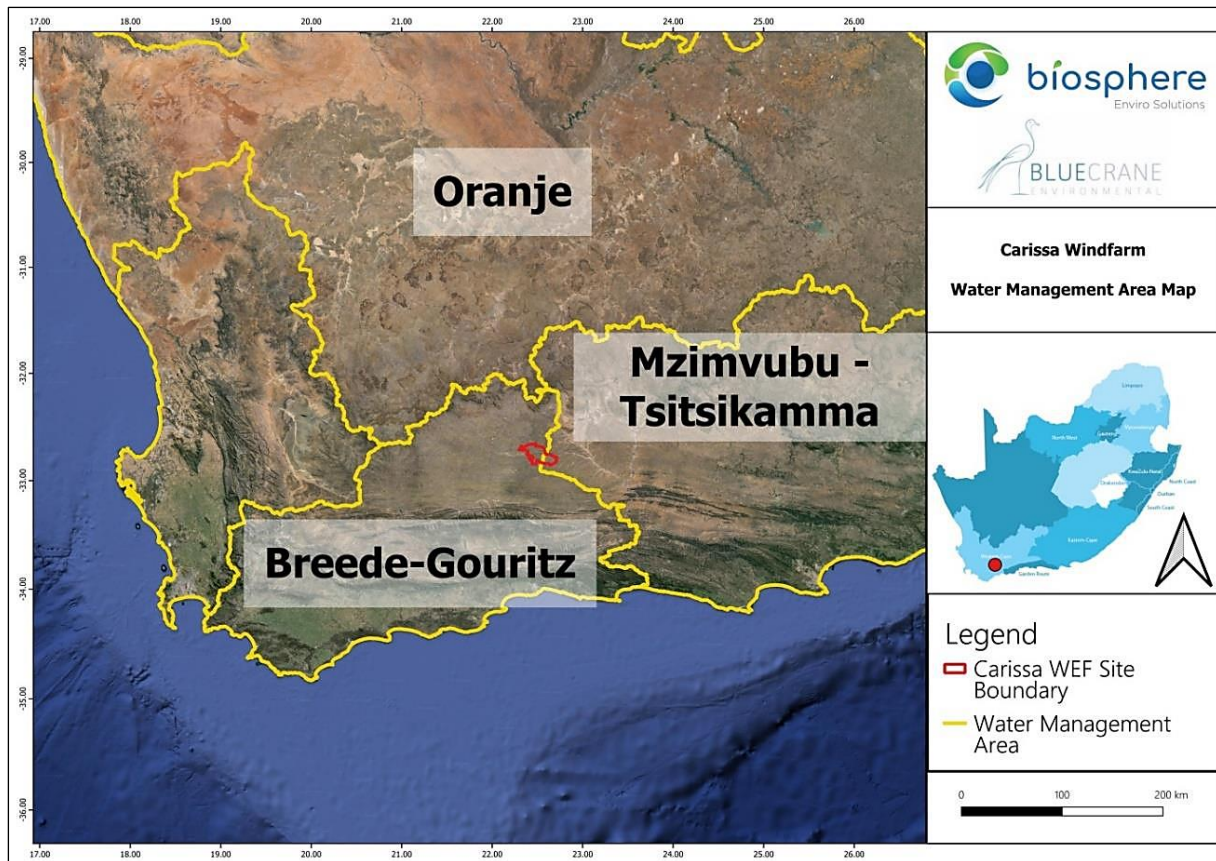


Figure 7.26: Applicable WMA's

The primary National Freshwater Ecosystem Priority Areas (NFEPA) rivers on the eastern side of the development flow eastward from the proposed WEF and eventually converge with the Sout River. The Soutfontein se and Swartbakens rivers merge with the Amos River, serving as the main freshwater system for all non-perennial tributaries in the L12A catchment. These systems fall within the Traka River Management Unit (RMU) and must be maintained continuously.

The NFEPA rivers on the western side of the development flow westward from the WEF and eventually converge with the Gamka River. The primary rivers (Plaatjies, Veldmans, and Lammerskraal Spruit), all within the specified quaternary catchments, serve as the main receptors for all non-perennial tributaries and drainage lines. These systems fall within the Gamka River Management Unit and must be maintained continuously. The assessment focuses on these freshwater systems, along with their associated tributaries and drainage lines. All NFEPA rivers and their associated tributaries are classified as non-perennial systems, experiencing insufficient flow for most of the year and containing water only during rainfall events. With minimal impacts on the receiving environment, these freshwater systems remain in good condition, exhibiting moderate ecological importance and sensitivity.

The proposed site is identified as having "Very High Aquatic Sensitivities" with the project area falling within a CBA1 and ESA1: Aquatic region as well as having a very high river classification of Class B/C. The river conditions, which are classified as a River Con AB, indicate that the Freshwater sources and tributaries are intact and able to contribute towards the aquatic ecosystem biodiversity due to the largely natural state. The Class B Health Category further indicates that a higher diversity of aquatic species is present and expected and that the overall aquatic ecosystem functions are essentially unchanged with the potential of reaching an optimum aquatic community structure during wet season periods.

The Ecological Sensitivity and Importance (EIS) of the Freshwater sources associated with the entire Carissa WEF consists of a median classification of HIGH which correlates with the quaternary catchments. The Traka and Gamka RMU are considered priority catchments with a Class II management class indicating that the catchment must be maintained or improved at all times, as the water resources are of high aquatic ecological value. Sensitive aquatic features or protected areas are identified surrounding the study area although the proposed project will not have a direct impact on these systems.

Aquatic macroinvertebrates commonly found in the 3222DA and 3222BC quaternary degree grid cells predominantly belong to the Odonata Family with a total of 7 species recorded. Although these species have a least concern status their presence indicates the sensitivity of the area.

Table 7.19: Aquatic Macro Invertebrates Found in the 3222DA/BC

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	IUCN STATUS
Aeshnidae	Anax imperator	Blue Emperor	LC
Aeshnidae	Anax Tristis	Black Emperor	LC
Aeshnidae	Zostereschna	Friendly Hawker	LC
Coenagrionidae	Africallagma glaucum	Swamp Bluet	LC
Libellulidae	Crocothemis erythraea	Broad Scarlet	LC
Libellulidae	Trithemis Arteriosa	Red-veined Dropwing	LC
Libellulidae	Trithemis Kirbyi	Orange-winged Dropwing	LC

Rivers:

There are six (06) NFEPA rivers within the project boundary, three (03) of which are situated to the east side of the project area and the remaining three (03) to the west. These rivers are known as:

- Soutfontein River.
- Amos River.
- Swartbakens River.
- Plaatjies River.
- Veldmans River.
- Lammerskraal Spruit.

Wetlands:

When considering SANBI's NFEPA, several wetlands are identified within the assessment area. All of these systems are classified as artificial waterbodies with limited biodiversity importance. The Nama-Karoo Biome within the Gamka (lower) Karoo Bioregion primarily consists of artificial waterbodies that function as farm dams with limited aquatic ecological value. Most of these dams were constructed to capture water for livestock due to the semi-arid climate zone.

The aquatic assessment primarily focuses on the freshwater resources associated with the project area, the NFEPA wetlands will not be discussed in detail due to their low sensitivity and artificial nature. As illustrated in the Figures below the proposed WEF area does not contain any NFEPA features however certain sections along the Plaatjies, Soutfontein se and Swartbakens Rivers does fall within a FEPA Sub-catchment.

The grid area predominantly falls outside delineated wetlands and NFEPA Rivers. Within the project area, there are several small farm dams located in the drainage courses. Although these dams do not have an official classification, they play a crucial role for avifauna and livestock in the region. It is

recommended that these artificial dams be avoided by the proposed WEF area, as avifauna and fauna species rely heavily on these water sources due to the scarcity of water in the area.

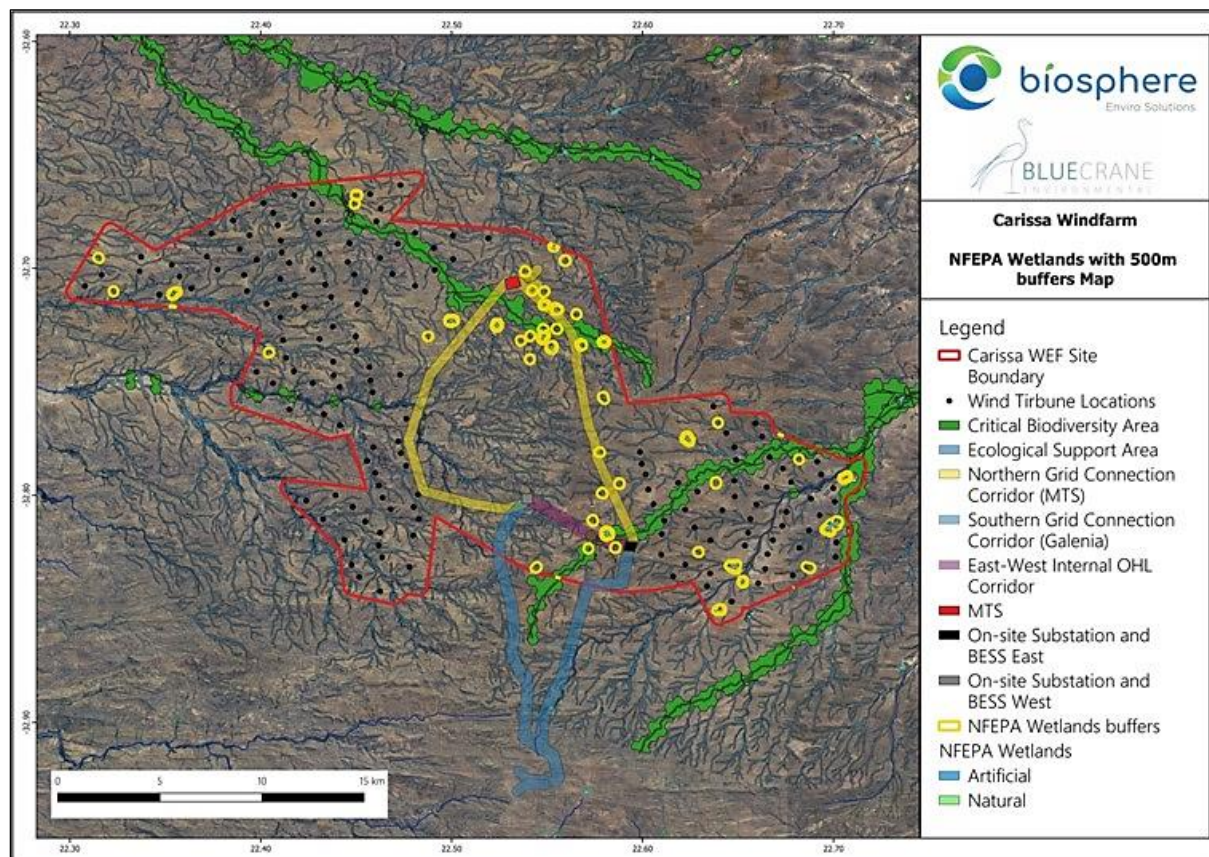


Figure 7.27: NFEPA Wetlands and Associated Buffers (WEF)

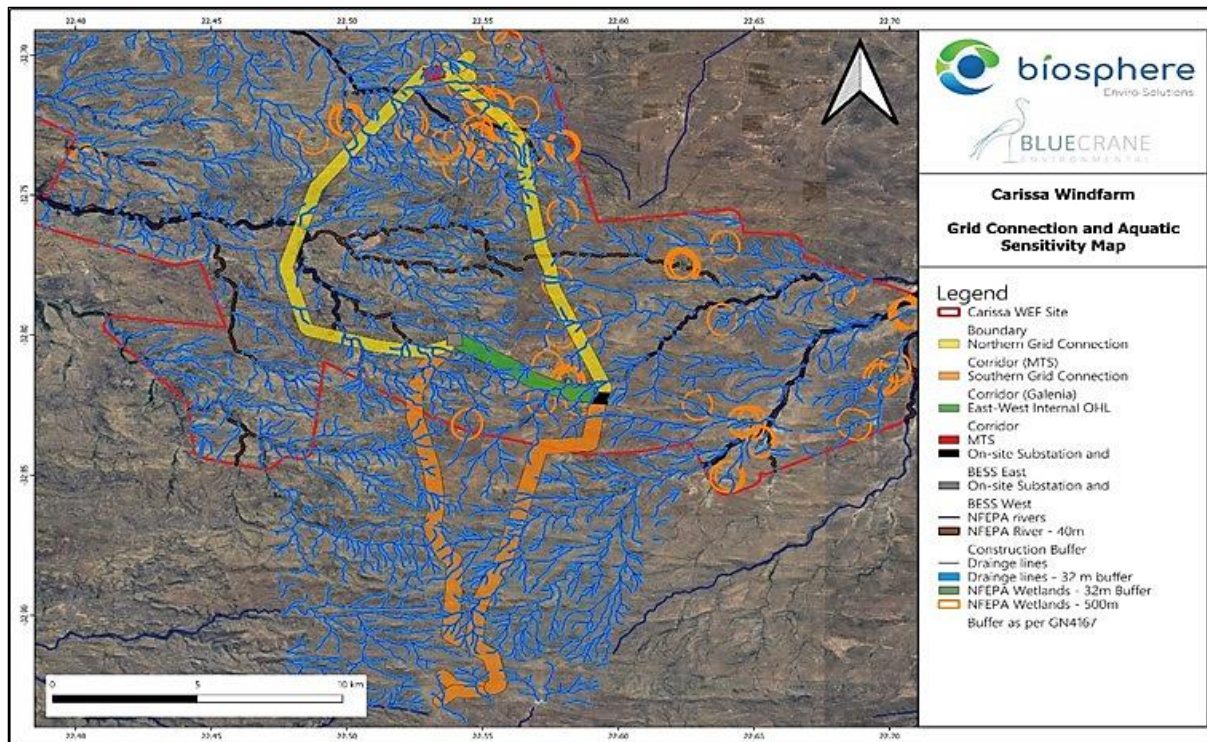




Figure 7.28: NFEPA Wetlands within 500 m of Regulated Area (Gridline)



Site Survey



At the time of the study twelve (12) sites were evaluated in terms of aquatic ecology. These sites are presented in Table 7.20 below and were carefully selected in order to obtain a comprehensive overview of the aquatic characteristics, by assessing upstream sites, midstream sites and downstream sites in the associated aquatic ecosystem.



Table 7.20: Aquatic Monitoring Sites Applicable to the Carissa WEF



IDENTITY	COORDINATES	DESCRIPTION	SITE PHOTOGRAPH
Site 1	32°49'9.47"S 22°34'43.45"E	(East) Site is located upstream of the artificial fam dam and adjacent the N12 Highway. Insufficient water available at the time of study however this section provides a High sensitivity for Avifauna.	
Site 1 Reference (West)	32°41'42.32"S 22°31'54.38"E	(West) This site serves as a main tributary for the Put River and drains away from the proposal Buildable area.	

IDENTITY	COORDINATES	DESCRIPTION	SITE PHOTOGRAPH
Site 2	32°49'21.88"S 22°39'41.95"E	(East) Site is located within the Amos River which serves as the main NFEPA River on the eastern side. The site consisted of stagnant pools with very little water however the natural conditions of the Amos River is in optimal condition.	
Site 2 Reference (Close to Site 13 – Francois Jordaan)	32°43'42.87"S 22°22'53.60"E	(West) This site is located outside of the project area and was assessed close to the Bakovenfontein Farm. This non-perennial tributary confluence with the Veldmans River and does provide important aquatic features along the this stretch of the river.	

IDENTITY	COORDINATES	DESCRIPTION	SITE PHOTOGRAPH
Site 3	32°47'1.14"S 22°42'55.56"E	(East) This site serves as the downstream site in the Amos River at the confluence with the Soutfontein Se and Swartbakens River. This area is considered a CBA area and should be avoided by the WEF at all times.	
Site 4 – (Alternative site selection in river), close to Site 12 (Bantry point)	32°43'33.01"S 22°25'18.10"E	(West) Situated within a non-perennial stream and tributary of the Veldmans River this site is located in the upper reaches of the catchment. The site consists of natural habitat however it is seasonal and is recommended that the buffers be adhered too.	

IDENTITY	COORDINATES	DESCRIPTION	SITE PHOTOGRAPH
Site 6	32°49'53.45"S 22°39'1.11"E	(East) Site is located within the Amos River as well as the main tributary of the Amos River. Agricultural activities are taking place around this point and this area also serve as a low water crossing for local residents.	
Site 8	32°44'46.69"S 22°35'1.04"E	(West) Site is located within the Plaatjies River and acts as a CBA area. This system does provide water and suitable habitat conditions were experienced along the Plaatjies River. However not all sections consisted of water and can be seen as a non-perennial stream.	

IDENTITY	COORDINATES	DESCRIPTION	SITE PHOTOGRAPH
Site 9	32°42'38.55"S 22°30'9.83"E	(West) Site is located in the middle of the Plaatjies River and consisted of the most water available on the entire project area. Aquatic macro invertebrate communities were sampled and indicated that the system does support a diverse aquatic community. The site falls within the CBA area which has already been avoided in terms of infrastructure within the regulated areas. The road could be utilised in terms of access however it is recommended that the necessary authorisation (WULA) be obtained.	
Site 10	32°40'49.57"S 22°27'2.17"E	(West) Situated within the Plaatjies river and main tributary this section of the NFEPA River were dry with no available water at the site.	

IDENTITY	COORDINATES	DESCRIPTION	SITE PHOTOGRAPH
Site 15 & Site 17	32°45'40.04"S 22°27'51.23"E	(West) Situated with the Veldmans River this system acts the main river that eventually confluence with the Gamka River within the catchment region. Although no water was available at the time of the study the Veldmans River must be protected and maintained within the current ecological status.	
Site 18	32°45'55.29"S 22°29'9.61"E	(West) Situated with the Veldmans River as Site 17 this system acts the main river that eventually confluence with the Gamka River within the catchment region. Although no water was available at the time of the study the Veldmans River must be protected and maintained within the current ecological status.	
<p><i>*All sites experienced a lack of water however the natural condition of the stream could provide suitable aquatic biodiversity.</i></p> <p><i>*All biotopes were present at most of the sites however all sites experienced a lack of water.</i></p>			

A visual assessment of the aquatic ecosystems and the surrounding environmental factors is focused on capturing the conditions of the aquatic environment, including water quality, habitat conditions, and the presence of aquatic life. The findings can be noted:

Hydrological Conditions.

- *Water clarity, temperature and flow:* Visual observations indicated the absence of water across most of the site, leading to limited flow conditions. In areas where water was present, the volume was insufficient to allow for standard sampling methods. However, at specific locations, such as the Plaatjies River near the road crossings (Site 9 on table above), stagnant pools were observed, and sampling procedures were conducted where feasible.

Habitat and Vegetation:

- *Aquatic vegetation:* Limited aquatic vegetation was observed, with minimal submerged and emergent plants.
- *Marginal vegetation:* Grasses along the stream banks were observed (however impacted by erosion and sedimentation) which provide habitat for terrestrial species and contribute to the overall aquatic environment.
- *Habitat diversity:* The Karoo area in which the project falls exhibits a range of habitat types. The upper sections of the site feature more densely vegetated aquatic habitats, whereas the lower sections lack both aquatic and marginal vegetation. The limited water present on-site has contributed to a lower habitat diversity score. However, seasonal variations are anticipated to enhance the system's capacity to support a diverse aquatic community during the wet season.

Aquatic Life:

- *Fish populations:* not applicable due to absence of water availability.
- *Aquatic Invertebrates:* The NFEPA Plaatjies River had stagnant pools of water in certain areas with species of Gerridae (Pond Skaters) and other air breathers being observed on the surface.

7.8.1 Buffers Required and No-Go Areas

Recommended buffer zones on all identified hydrological features were determined using the site-based Buffer Zone Tool developed by Macfarlane and Bredin for aquatic impact (2017). Buffer zones outside the boundary of aquatic habitats are required to ensure that the ecotones between aquatic and terrestrial environments are conserved. The buffer tool aims to provide a method for determining appropriate buffer widths for developments associated with aquatic ecosystems. This method takes into account a number of different factors in determining the buffer width including the impact of the proposed activity on the water resource, climatic factors and the sensitivity of the water resource.

The model determined the Desktop Buffer requirement at 100 m from all watercourses. The current proposed development area or buildable area consists of this regulated area and complies with the GN4167 of December 2023 regulations. This buffer has been refined to a more realistic site-based requirement.

The site-based aquatic impact buffers without mitigation measures indicated a 48 m buffer on all non-perennial tributaries and drainage lines, while the NFEPA Rivers indicated an 80 m buffer for the construction phase. The operational phase for all non-perennial tributaries and drainage lines indicated a 25 m buffer while the NFEPA Rivers indicate a 61 m buffer.

With mitigation measures the site-based model determined the buffers for the construction phase for all non-perennial tributaries and drainage lines at 25 m while the NFEPA Rivers obtained a 40 m buffer.

For the operation phase a 15 m buffer will suffice for all non-perennial tributaries and drainage lines while a 32 m buffer for the NFEPA Rivers all from the edge of the riparian zone will suffice.

Therefore, the final calculated buffers indicate that a 15 m buffer for all non-perennial tributaries and drainage lines is appropriate for the protection of the ecosystem services associated with the project area. A 32 m buffer for the NFEPA Rivers is required in order to avoid any potential impacts on the freshwater resources.

The no-go option implies that the status quo within the sites remains the same. This implies that the aquatic features remain in their current biodiversity state and that no significant changes to their desired state will occur. This sensitivity buffer is in accordance with the wetland delineation should be adhered to in order to ensure the protection of the aquatic biodiversity ecosystem.

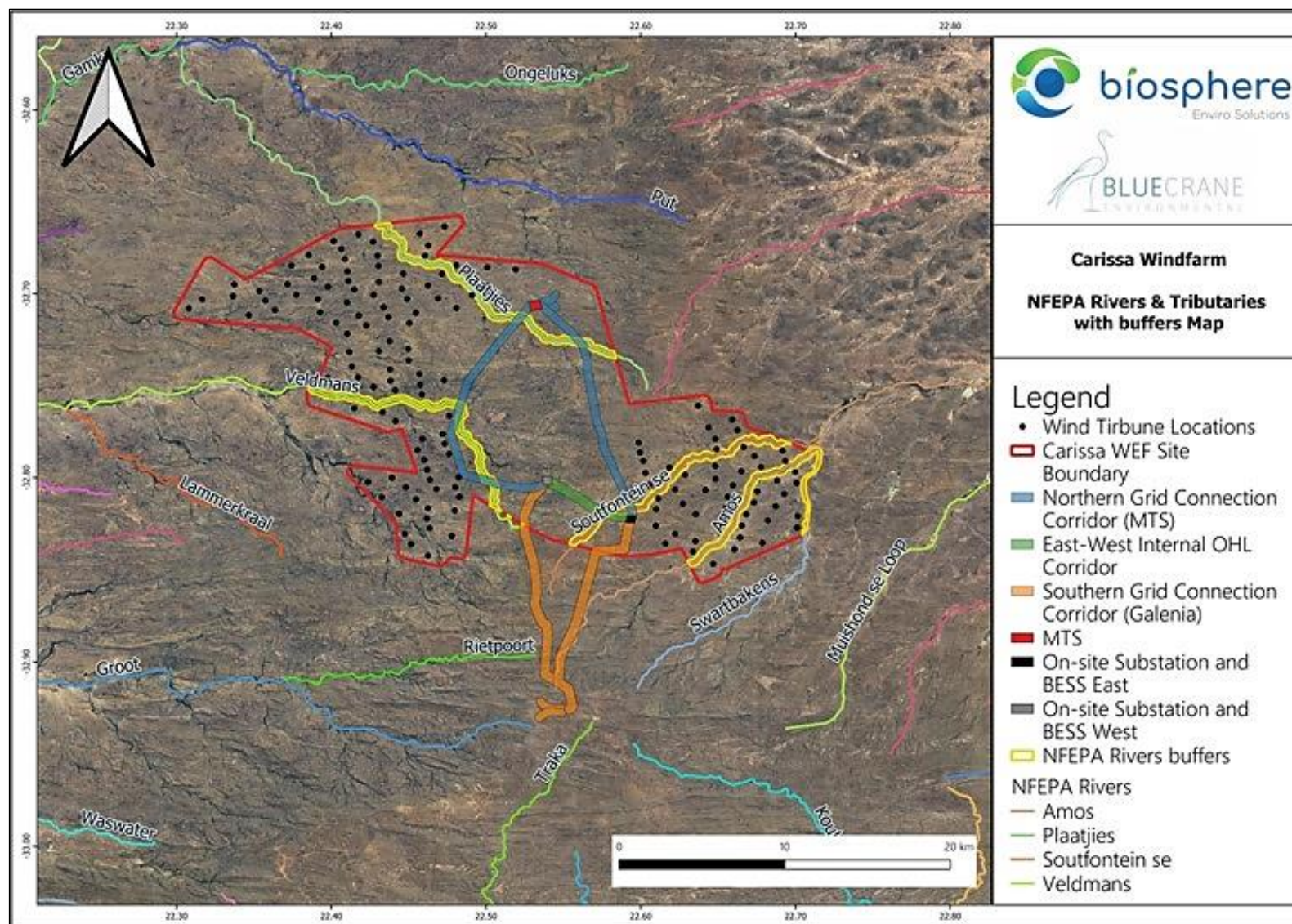


Figure 7.29: NFEPA Rivers and Tributaries with Buffers

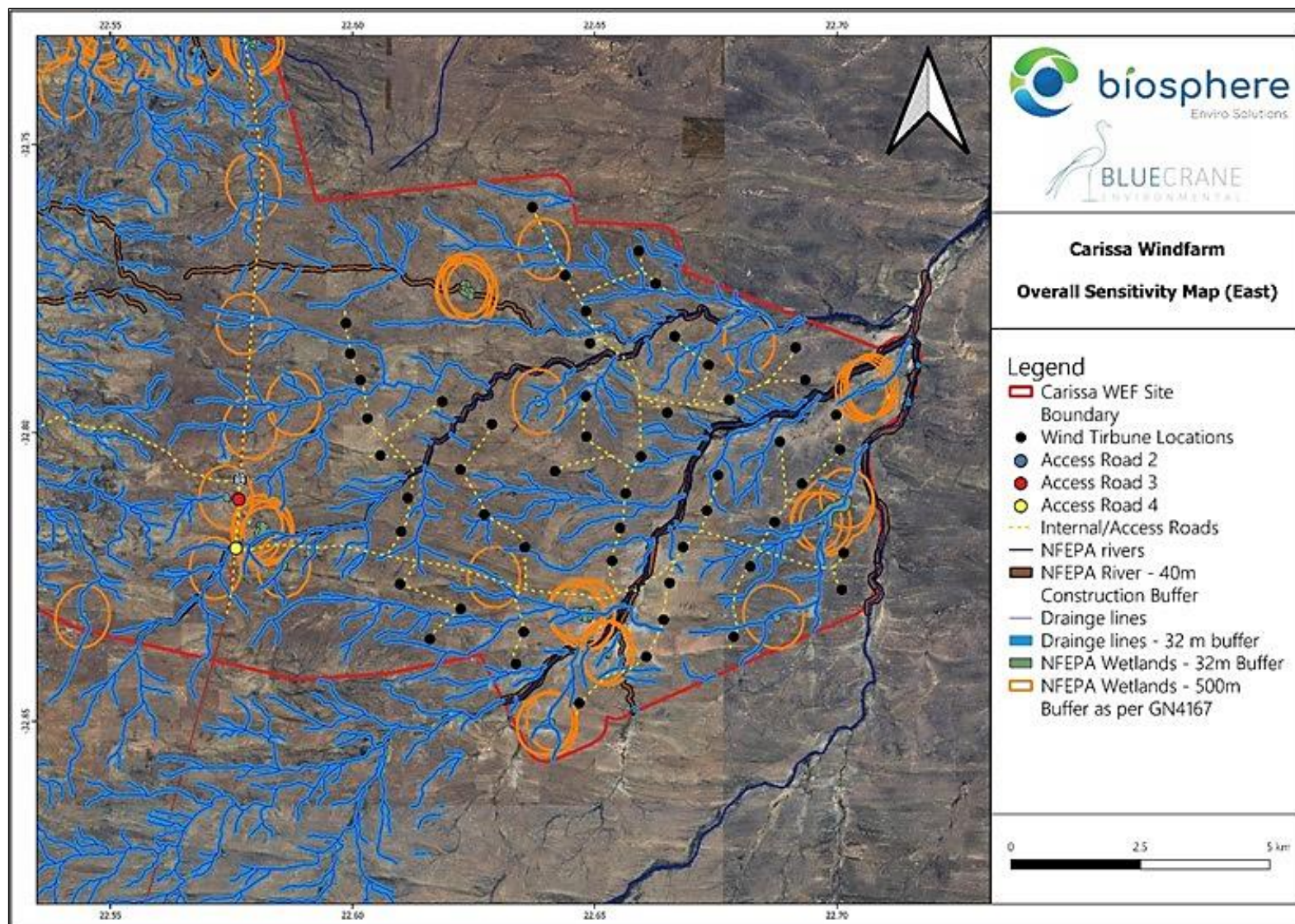


Figure 7.30: WEF East Aquatic Sensitivities Map

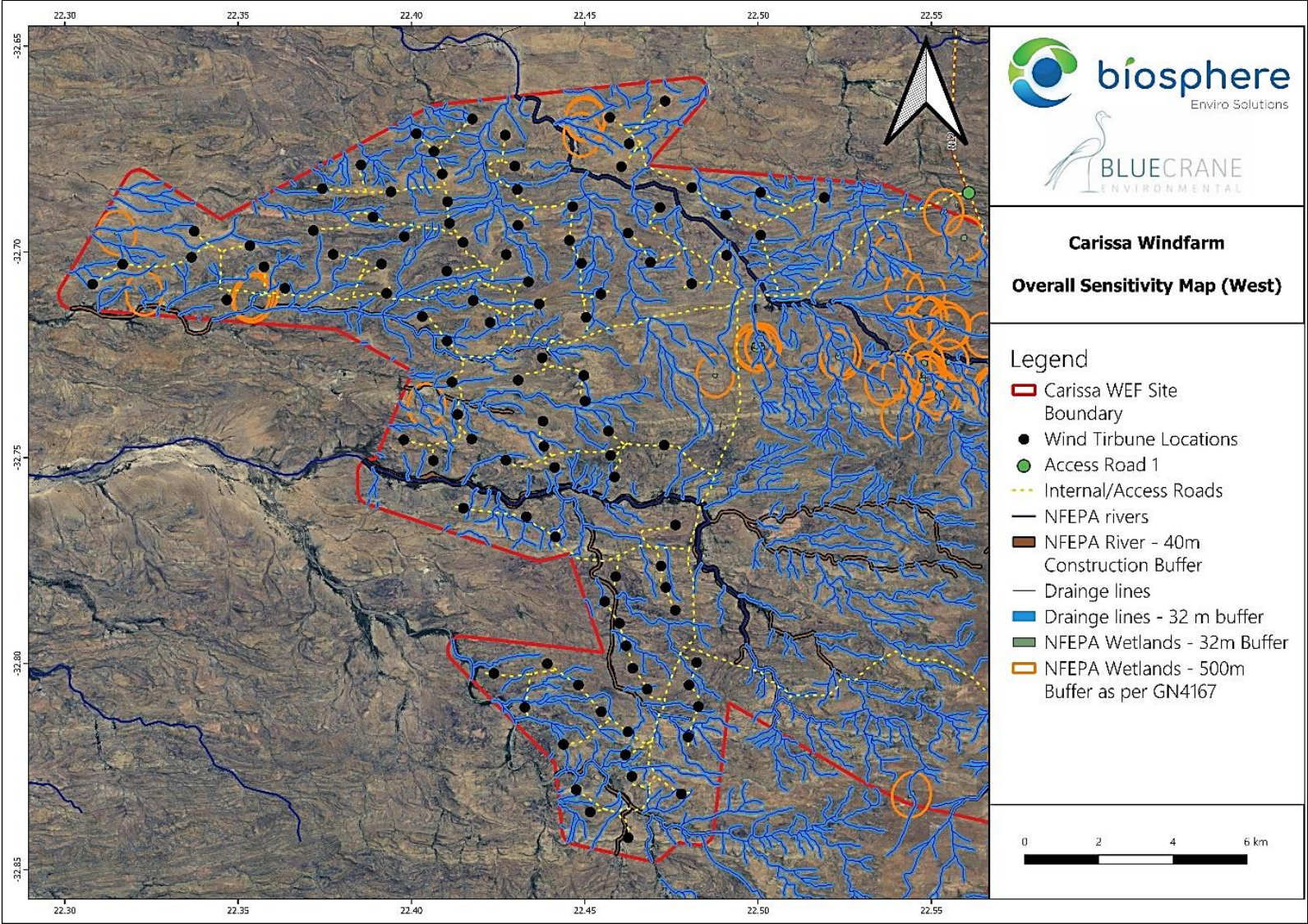


Figure 7.31: WEF West Aquatic Sensitivities Map

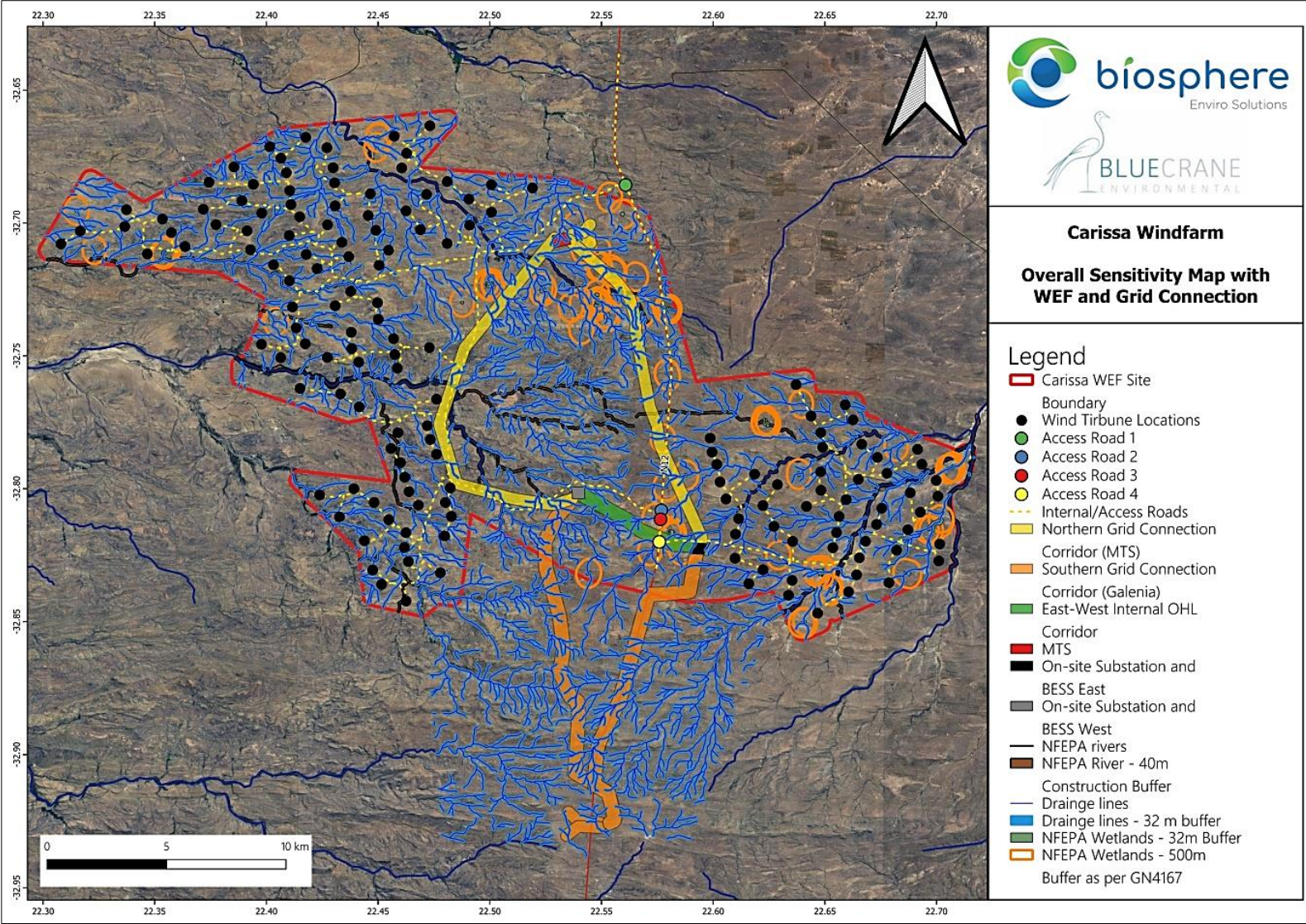


Figure 7.32: Grid and Aquatic Sensitivities Map

Although no-go areas have been identified within the boundary of the proposed site for the project, it is critical that vegetation clearance and construction activities associated with the proposed development are restricted to the delineated boundaries of the development footprint.

It is recommended that the boundaries of the development footprint be clearly demarcated prior to the clearing of vegetation to prevent the encroachment of activities into the surrounding natural areas.

Should the development of the site progress, it is recommended that all application authorisations are obtained and that the viability of the project is subject to the implementation of strict sufficient mitigation measures during the construction phase and to ensure that an approach prioritises responsible environmental stewardship by the developer. The localised nature of the construction and WEF facility will potentially impact the functionality of the identified ESA1 areas. It is recommended to implement strict mitigation strategies to prevent any potential impacts within this freshwater ecosystem, thereby preventing any aggravation of its degradation. It is recommended that all development activities be confined outside of these designated areas.

7.8.2 Layout

The aquatic assessment aimed to investigate the feasibility of the Carissa WEF Project and identifying “no-go” areas within the proposed project area. Two (02) distinct sections of the WEF have been identified within the proposed project area. The East section is situated east of the N12 Highway, while the West section is located northwest of the N12 Highway. The extensive size of the Carissa WEF project boundary allows for strategic placement of wind turbines outside regulated areas. The applicant has demonstrated commendable environmental stewardship by selecting appropriate areas for erecting the wind turbines.

The east section of the WEF layout falls outside of the delineated aquatic buffers and identified CBA1 area. It is recommended that this layout be finalised and incorporated into the application. The west section which is linked by rocky outcrops comprises mainly of degraded natural areas of low sensitivity. As with the east section one CBA1 area has been identified which is related to the Plaatjies River. The layout as presented avoids the regulated areas as well as the CBA1 area and is recommended that this layout be finalised and incorporated into the application.

The proposed gridline infrastructure should not intersect any freshwater regulated buffers, except for the delineated Amos River features. No other NFEPA aquatic features are of concern for the grid connection however it is recommended that mitigation measures are still put in place to ensure no impacts on the freshwater features occur.

7.9 Noise Assessment

The noise assessment describes ambient sound levels (residual noise levels) in the area, potential worst-case noise rating levels and the potential noise impact that the project may have on the surrounding environment.

The Environmental Potential Atlas of South Africa (ENPAT) describes the topography to the west of the N12 as “*extremely irregular plains*” and the area to the east of the N12 as “*plains*”. The proposed WTG will be situated at approximately 740 – 950 m above sea level (mamsl). Due to the height of the WTG, as well as the position where they may be developed, it is unlikely that topographical features will limit the propagation of sound from the WTG.

Minor noise sources are associated with typical household activities and associated subsistence farming. Noise from these sources will not be investigated or considered in the Environmental Noise Impact

Assessment (ENIA). The N12 highway transects the WEF developmental area, though traffic on this road is low and will not influence ambient sound levels within the project area. There are a number of small access roads leading from the N12, mainly to serve the farmers in the area. Traffic volumes on the small access roads are low and will be of no acoustical significance. The impact of traffic noises will not be considered in the ENIA.

For environmental noise, weather plays an important role, the greater the separation distance, the greater the influence of the weather conditions, so, from day to day, a road 1 000 m away can sound very loud or can be completely inaudible. Other, environmental factors that impact on sound propagation includes wind, temperature and humidity. Ambient sound levels are generally less during the colder months (due to less faunal communication) and higher during the warmer months.

7.9.1 Sound Level Measurements

Ambient (background) sound levels were measured over a period of seven (07) nights from 26 June till 3 July 2024 at two (02) locations. Measurements were done 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"*. This resulted in 1 325 daytime measurements and 672 night-time measurements (with each measurement having a duration of 10-minutes). Refer to 7.33 below for the localities where ambient sound levels were measured.

7.9.1.1 Long-term Measurement Location BACLTSL01

The measurement location was selected to be indicative of potential quiet area, away from busy farm dwellings. There were a number of large trees within 20 m from the microphone that would increase wind-induced noises (WIN) during periods with increased winds. There were generally low winds during the measurement period, resulting in relatively low ambient sound levels being measured. There was an operational farm with occasional agricultural activities that would influence daytime ambient sound levels.

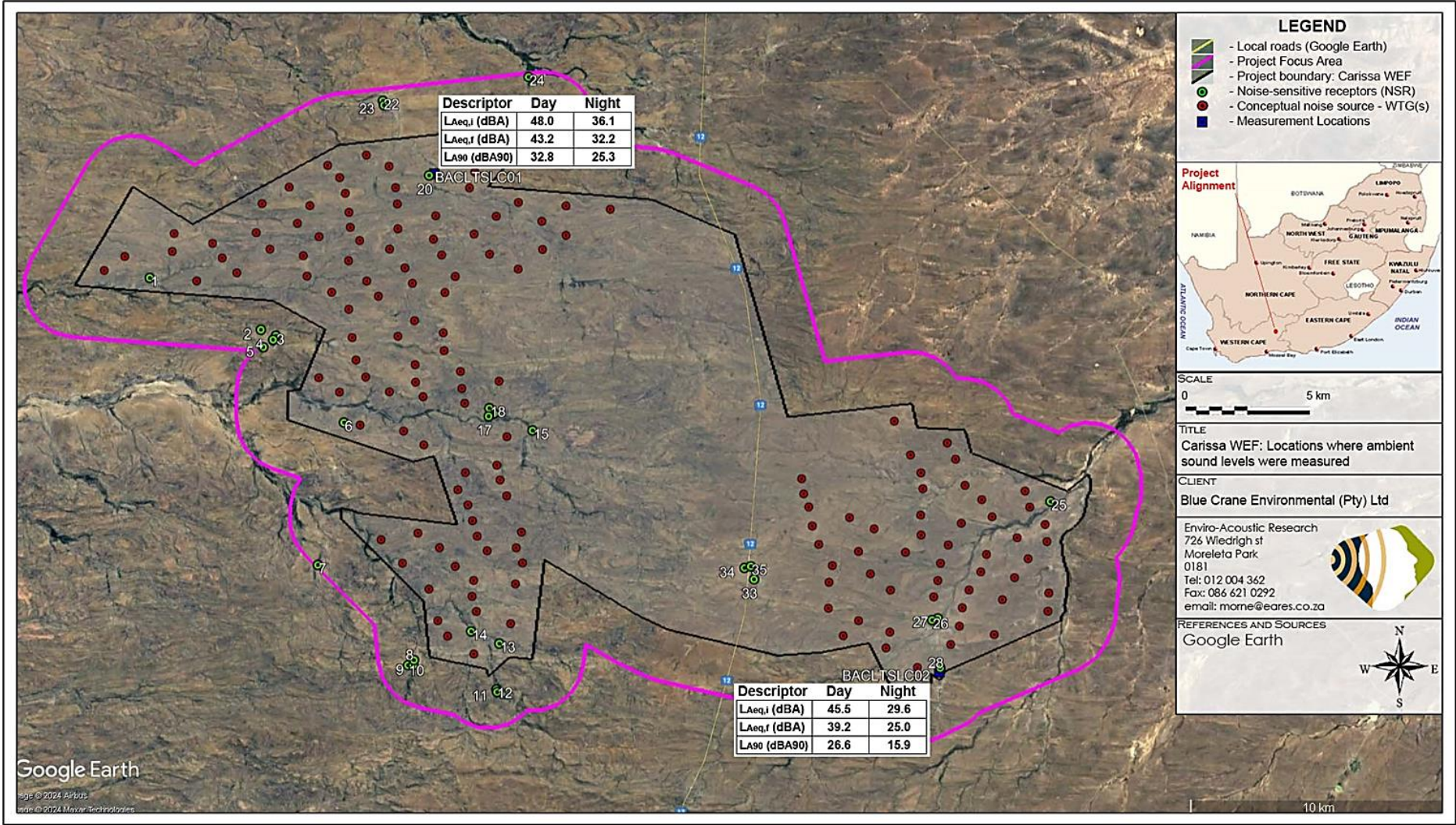


Figure 7.33: Localities where Ambient Sound Levels were Measured

The equipment defined in Table 7.21 below was used for gathering data with Table 7.22 highlighting sounds heard during equipment deployment and collection.

Table 7.21: Equipment Used to Gather Data at SAWFLTSL01

Equipment	Model	Serial no	Calibration Date
Sound Level Meter	Svan 977	34849	January 2023
Pre-amplifier	SV 12L	32395	January 2023
Microphone	ACO 7052E	33077	January 2023
Calibrator	Quest CA-22	J 2080094	July 2024

Table 7.22: Noises/Sounds Heard During Site Visits at BACLTSL01

Noises/sounds heard during onsite investigations		
Magnitude Scale Code: <ul style="list-style-type: none"> • Barely Audible • Audible • Dominating 	During equipment deployment	
	Faunal and Natural	This location was considered to be quiet, with birds clearly audible and dominant. WIN just audible through the trees.
	Sounds associated with the household	Dogs barking significant during barking event. Sheep were audible at times.
	Industrial & transportation	-
	During equipment collection	
	Faunal and Natural	This location was considered to be quiet, with birds clearly audible and dominant. WIN audible.
	Sounds associated with the household	Dogs barking significant during barking event. Sheep were audible at times.
	Industrial & transportation	-

7.9.1.2 Summary of Ambient Sound Levels Measured

Impulse time-weighted equivalent sound levels ($L_{Aeq,10min}$) and fast time-weighted equivalent sound levels ($L_{AFeq,10min}$) are summarised in Table 7.23 below. Fast-weighted equivalent sound levels are included in this report as this is the sound descriptor used in most international countries to define the Ambient Sound Level. The L_{A90} level is presented in this report to define the “background ambient sound level”, or the sound level that can be expected if there were little single events (loud transient noises) that impacts on average sound level. The L_{A90} level is low, typical of a quiet rural environment.

Table 7.23: Various Sound Level Descriptors as Measured at BACLTSL01

	$L_{Amax,i}$ (dBA)	$L_{Aeq,i}$ (dBA)	$L_{Aeq,f}$ (dBA)	$L_{A90,f}$ (dBA90)	$L_{Amin,f}$ (dBA)
Day arithmetic average	-	48.0	43.2	32.8	-
Night arithmetic average	-	36.1	32.2	25.3	-
Day equivalent	-	55.1	50.5	-	-
Night equivalent	-	41.4	38.2	-	-
Day minimum	-	28.0	23.9	-	18.5
Day maximum	89.6	70.2	65.5	-	-
Night minimum	-	22.2	20.0	-	18.3
Night maximum	76.5	58.4	53.5	-	-

Maximum noise levels generally did not exceed 65 dBA at night, with only two events during the first and second night; and one event during the fourth night. If maximum noise levels exceed 65 dBA more than 10 times at night, it may increase the probability where a receptor may be awakened at night, ultimately impacting on the quality of sleep.

7.9.1.3 Long-Term Measurement Location - BACLTSL02

This measurement location was deployed near a residential dwelling, with relatively little vegetation close to the microphone. This location was considered quiet, with only birds influencing the residual noise levels. The equipment defined in Table 7.24 was used for gathering data with Table 7.25 highlighting sounds heard during equipment deployment and collection.

Table 7.24: Equipment Used to Gather Data at BACLTSL02

Equipment	Model	Serial no	Calibration Date
Sound Level Meter	Svan 977	34160	September 2022
Pre-amplifier	SV 12L	32395	September 2022
Microphone	ACO 7052E	54645	September 2022
Calibrator	Quest CA-22	J 2080094	July 2024

Table 7.25: Noises/Sounds Heard During Site Visits at BACLTSL02

Noises/sounds heard during onsite investigations		
Magnitude – Colour Code Used Barely Audible Audible Dominating	During equipment deployment	
	Faunal and Natural	Birds audible and generally dominant.
	Residential	-
	Industrial & transportation	-
	During equipment collection	
	Faunal and Natural	Birds audible and dominant.
	Residential	-
	Industrial & transportation	-

7.9.1.4 Summary of Ambient Sound Levels Measured

The maximum noise levels did exceed 65 dBA 10-, 3-, 1-, 1- and 7-times during night one, two, four, five and seven respectively. The source of this maximum noise events is not defined. If maximum noise levels exceed 65 dBA more than 10 times at night, it may increase the probability where a receptor may be awakened at night, ultimately impacting on the quality of sleep.

Table 7.26: Various Sound Level Descriptors as Measured at BACLTSL02

	L _{Amax,i} (dBA)	L _{Aeq,i} (dBA)	L _{Aeq,f} (dBA)	L _{A90,f} (dBA90)	L _{Amin,f} (dBA)
Day arithmetic average	-	45.5	39.2	26.6	-
Night arithmetic average	-	29.6	25.0	15.9	-
Day Equivalent Levels	-	56.8	49.3	-	-
Night Equivalent Levels	-	56.4	46.8	-	-
Day minimum	-	16.0	14.7	-	13.7
Day maximum	93.7	75.7	69.3	-	-

Night minimum	-	15.6	14.5	-	13.7
Night maximum	101.7	79.6	69.6	-	-

Based on the sound measurements:

- Approximately 1 325 10-minute measurements were collected during the day, with the highest fast-weighted sound level (during the various 10-minute measurements) measured at ± 69 dBA, with the lowest sound level being less than 20 dBA;
- Approximately 672 10-minute measurements were collected during the night-time period, with the highest fast-weighted sound level (during the numerous 10-minute measurements) measured at ± 69 dBA, with the lowest sound level being less than 20 dBA.

The average of the 10-minute sound levels at the two measurement locations were 41.2 dBA for the daytime period and 28.6 dBA for the night-time period (fast-weighted sound levels).

Considering the developmental character, the acceptable zone sound level (rating level) during low and no-wind conditions would be expected to be that of a rural noise district for the day- and night-time periods, e.g.:

- 45 dBA for the daytime period; and,
- 35 dBA for the night-time period.

When evaluating the results of the ambient sound levels as measured, ambient sound levels were typical of a rural environment. To assess the noise impact occurring during the construction phase, this assessment will use the following noise limits:

- 52 dBA for the daytime period; and,
- 42 dBA for the night-time period.

In addition, considering international guidelines, the IFC (projects financed by the World Bank Group) the following upper noise levels should not be exceeded during either the construction and/or operational phase:

- 55 dBA (as recommended by the IFC) for daytime residential use; and
- 45 dBA (as recommended by the IFC) for night-time residential use.

The proposed renewable energy activities (worst-case evaluated) will raise the noise levels at a number of the closest potential NSR. There is no alternative location where the wind farm can be developed as the presence of a viable wind resource determines the viability of a commercial WEF. While the location cannot be moved, the WTG within the WEF can be moved around, although this layout is the result of numerous evaluations and modelling to identify the most economically feasible and environmentally sustainable layout. Refer to Figure 7.34 below.

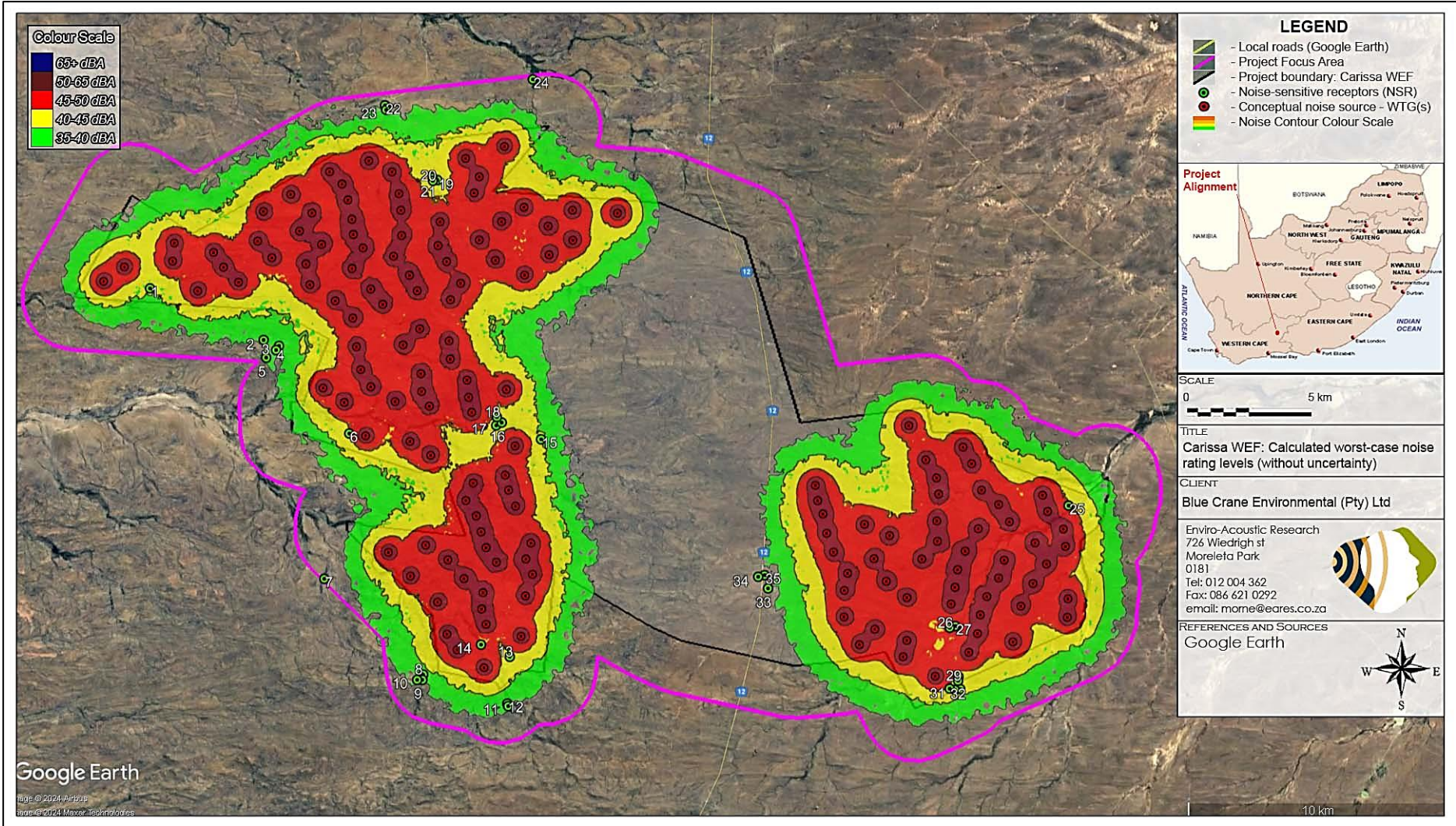


Figure 7.34: Projected Worst-Case Noise Rating Level Contours – Operation of the Carissa WEF (PWL of 110.5 dBA re 1 pW)

During the operational phase, the projected noise rating levels will be higher or similar to the on-site ambient sound levels (the residual noise levels). It is slightly possible that the noise rating levels could exceed the ambient sound levels during certain periods although it is unlikely to impact on the quality of living (at night) for the closest receptors. The closest receptors should not lose the peace or quiet that they are used to.

The project will greatly assist in the provision of energy, which will allow further economic growth and development in South Africa and locally. The project will generate short and long-term employment and other business opportunities and promote renewable energy in South Africa and locally. People in the area that are not directly affected by increased noises generally have a more positive perception of the renewable projects and understand the need and desirability of the project.

7.10 Heritage Assessment

The cultural heritage assessment aims to identify and report any heritage resources that may fall within the development footprint; to determine the impact of the proposed development on any sites, features, or objects of cultural heritage significance; to assess the significance of any identified resources; and to assist the developer in managing the documented heritage resources in an accountable manner, within the framework provided by the National Heritage Resources Act (Act 25 of 1999) (NHRA).

South Africa's heritage resources are rich and widely diverse, encompassing sites from all periods of human history. Resources such as buildings and archaeological artefacts, such as landscapes and living heritage, may be tangible or intangible. Their significance is based on their aesthetic, architectural, historical, scientific, social, spiritual, linguistic, economic or technological values; their representation of a time or group; their rarity; and their sphere of influence.

A team of three archaeologists completed a systematic, purposive survey of the proposed project area to locate, identify, record, photograph, and describe archaeological, historical or cultural interest sites. The archaeological site visit was conducted during mid-winter on the 11th to the 16th of June 2024.

The survey was tracked, and GPS points of identified significant areas were recorded with a handheld GPS and an Android smartphone using a Locus Map application. Photographs of the environment and identified heritage resources were taken, and detailed field notes were taken to describe observations. The layout of the area and plotted GPS points, tracks and coordinates were transferred to Google Earth, and QGIS and maps were created. Refer to Figure 7.35 below for the survey track log.

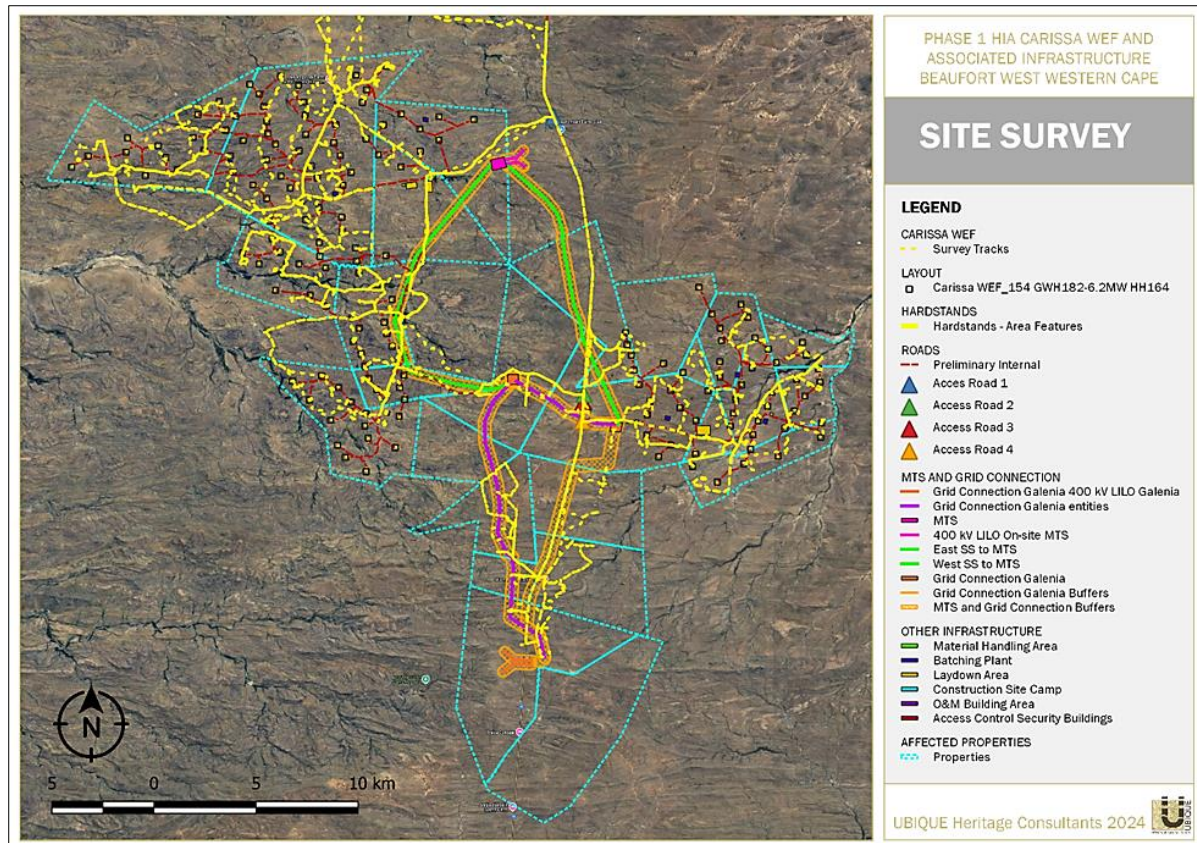


Figure 7.35: Survey Tracks Across the Development Area

7.10.1 Historical and Archaeological Background

South Africa has a long and varied history of human occupation (Deacon & Deacon 1999). This occupation dates to approximately 2 mya (million years ago) (Mitchell 2002). Briefly, the archaeology of South Africa can be divided into three “major” periods: the Stone Age, the Iron Age and the Historical period. In addition, various archaeological and historical sites have been identified and documented throughout South Africa.

7.10.1.1 Stone Age

The history of the Western Cape Province is reflected in a rich archaeological landscape with a wealth of pre-colonial archaeological sites. Numerous sites have been identified and documented across the region, dating to the earlier, middle, and later Stone Ages.

In southern Africa, the Stone Age can be divided into three periods. It is, however, critical to note that dates are relative and only provide a broad framework for interpretation. The division of the Stone Age, according to Lombard et al. (2012), is as follows:

- Earlier Stone Age (ESA): >2 000 000 - >200 000 years ago
- Middle Stone Age (MSA): <300 000 - >20 000 years ago
- Later Stone Age (LSA): <40 000 - until the historical period

In short, the Stone Age refers to humans mainly utilising stone as a technological marker. Each sub-division is formed by industries where the assemblages share attributes or common traditions (Lombard et al. 2012). The ESA is characterised by flakes produced from pebbles, cobbles, percussive tools, and objects created later during this period, such as large hand axes, cleavers, and other bifacial tools (Klein 2000).

The MSA is associated with small flakes, blades and points. The aforementioned is generally suggested to have been made and utilised for hunting activities and had numerous functions (Wurz 2013). Hunter-gatherer lifeways are attested to in the Middle Stone Age record for at least the last 100 000 years (Wadley 2015). Such foraging groups continued to occupy the landscape throughout the Later Stone Age between 40 000 and 20 000 years ago, lasting until a couple of centuries.

About 2 000 years ago, during the final ceramic Later Stone Age, the first evidence of goats/sheep was found in southern Africa, possibly associated with Khoekhoe herding groups (e.g., Sadr 2008). These groups came into being as a combination of the migration of East African pastoralists who mixed with local hunter-gatherers (e.g., Choudhury et al. 2021). However, it is almost impossible to differentiate between the San and Khoekhoe groups based on archaeological or genetic records. Presently, these populations are referred to as Khoisan (Barnard 1992). Furthermore, the LSA is characterised by microlithic stone tools, scrapers and flakes (Binneman 1995; Lombard et al. 2012). The LSA is also associated with rock art. These sites are commonly found on slopes, hilltops, rocky outcrops and occasionally in river beds (Kruger 2018).

7.10.1.2 Iron Age

Archaeologically, the arrival of African farming communities from West Africa about 1 700 years ago and their subsequent settlement, first in the north-eastern parts and later in much of southern Africa, is known as the Iron Age (Huffman 2007). These farmers encountered Khoisan communities (Mitchell 2002). The archaeology of farming communities of southern Africa encompasses three phases. The Early Iron Age, dated 200 – 900 CE, represents the arrival of farmers in southern Africa. The Middle Iron Age (900 – 1 300 CE) is best associated with the onset of state formation in the Limpopo Valley of South Africa. Finally, the Late Iron Age (1 300 – 1 840 CE) marked the arrival and spread of ancestral Nguni- and Sotho-Tswana communities into southern Africa and the development of state-level societies, such as Great Zimbabwe and Mutapa (Huffman 2007; Badenhorst 2010).

The Iron Age (IA) is characterised by the use of metal (Coertze & Coertze 1996: 346). There is some controversy about the periods within the IA. Van der Ryst & Meyer (1999) have suggested that there are two phases within the IA, namely:

- Early Iron Age (EIA) 200 – 1000 A.D
- Late Iron Age (LIA) 1000 – 1850 A.D

However, Huffman (2007) suggests instead that there are three periods within the Iron Age, these periods are:

- Early Iron Age (EIA) 250 – 900 A.D
- Middle Iron Age (MIA) 900 – 1300 A.D
- Late Iron Age (LIA) 1300 – 1840 A.D

Thomas Huffman believes that the Middle Iron Age should be included within this period; his dates have been widely accepted in the IA field of archaeology.

The South African Iron Age is generally characterised by farming communities with domesticated animals, cultivated plants, manufactured and used ceramics and beads, and smelted iron for weapons and manufactured tools (Hall 1987). Iron Age people were often mixed farmers/agropastoralists. These agropastoralists generally lived in areas with sufficient water for domestic use and arable soil that could be cultivated with an iron hoe. Most Iron Age (IA) settlements built by agropastoralists were permanent settlements (with a few exceptions). They comprised houses, raised grain bins, storage pits and animal kraals/byres, contrasting with pastoralists' and hunter-gatherers' temporary camps (Huffman 2007). It is

evident in the archaeological record that IA groups had migrated with their material culture (Huffman 2002).

7.10.1.3 Historical Period

The Historical/Colonial period generally refers to the last 500+ years when European settlers and colonialism entered southern Africa (Binneman et al. 2011). During the colonial frontier period, place names started becoming fixed on maps and farm names, specifically in a cadastral sense. As an archaeological period, the Late Iron Age ended by the 1840s. By then, the ongoing Mfecane caused major socio-political disruptions in southern Africa. During the late 1600s and 1700s, Dutch settlers subjugated the Khoisan and established the Cape Colony. By the 1800s, a culmination of preceding tensions rooted in competition amongst local chiefdoms for trade at Delagoa Bay, increased demand for ivory by European traders, and droughts severely impacted maize-dependent communities. The steady rise of chiefdoms, such as the Mabhudu, Ndwande, Qwabe and Mtethwa, meant rulers expanded their patronage networks by conquering a competitor's land and people. Smaller chiefdoms caught up in the conflict fled and either attacked or merged with neighbouring populations. This political unrest would be followed by a similar uprising, the Mfecane (ca. 1818-1840 CE) (Ross 1999; Bonner 2002; Chewins 2016). European traders, travellers, and missionaries encountered Khoisan and African farmers during this time. Subsequent relations, with negative and positive impacts, continued into the 20th century (e.g., Hall 1987).

The Western Cape was one of the initial destinations for European settlers. They brought enslaved people from Malay to work for them, integrating Malay culture into South Africa's unique heritage. Several structures in Cape Town boast a history of over 300 years (SAHO 2023). The Cape of Good Hope witnessed European settlement in 1652, driven by the Dutch East Indian Company's supply chain. The establishment of this colonial settlement relied on the utilisation of slavery. Throughout the 18th century, slavery emerged as the primary economic pillar of the Western Cape Province. However, in 1795, the Cape Colony fell under British control, leading to the abolition of slavery shortly after that. This marked a significant historic shift for the Western Cape as emancipation was granted to the enslaved population (Overview of Stellenbosch n.d).

The province experienced a comprehensive surge in industrialisation and development in 1945, which attracted numerous workers from prominent townships like Gugulethu and Nyanga. Notably, the Western Cape is home to Robben Island, the site where Nelson Mandela was released from prison in 1990, marking a pivotal moment in South Africa's journey towards becoming a non-racial democracy (Overview of Stellenbosch n.d). Various groups of people have settled in the general area, such as the San, Dutch, Cape Malay, French Huguenots, and British (Overview of Stellenbosch n.d).

7.10.1.4 Local Area

Briefly, prior to the establishment of Beaufort West as a town, the area was prone to conflict and competition over resources. It was not until the British took control of the Cape after 1805 that efforts were made to establish law and order in the remote districts. In 1818, the Governor of the Cape Colony, Lord Charles Somerset, sent Lieutenant John Baird to the northern border areas as the first magistrate, or "landdrost," to maintain order in these frontier districts (Frandsen 2019; Wikipedia_Beaufort_West 2024).

Beaufort West was the first town to be established in the central Karoo. The town was founded in 1818 and named Beaufort after Henry Somerset, the 5th Duke of Beaufort and father of Lord Charles Somerset. It was later renamed Beaufort West to avoid confusion with other locations in the Eastern Cape. The village was established on the farm Hooivlakte, granted in 1760 by Governor Rijk Tulbagh to Godliep

Rudolph Opperman. Commandant Le Clerq, a veteran of the frontier wars, later sold the farm, along with the neighbouring Boesjesmansberg, to the Colonial Government (Frandsen 2019; Wikipedia_Beaufort_West 2024).

In 1825, Reverend Colin Fraser founded the Dutch Reformed Church parish in Beaufort West, serving nomadic Trek Boers. The town's establishment led to the decline of the Bushmen in the area. Beaufort West became South Africa's first municipality in 1837 and had the country's first town hall. A significant development in the district was the introduction of Merino sheep by John Molteno, an Anglo-Italian immigrant who arrived in Cape Town in 1831. Molteno greatly influenced Beaufort West, founding its first bank in 1854 and later becoming the Cape Colony's first Prime Minister. His contributions included advancing South Africa's railways, making Beaufort West a key marshalling yard and locomotive depot when the railroad reached the town in 1880, connecting it to Kimberley's diamond fields and Johannesburg's gold fields. As late as the 1970s, mainline trains would switch from diesel or electric to steam locomotives for the journey between Beaufort West and Kimberley (Frandsen 2019; Wikipedia_Beaufort_West 2024).

In 1849, Sir John Fraser, the son of Reverend Fraser, documented a massive migration of Springbok and other antelope species through Beaufort West, as recounted in Lawrence Green's "Karoo" (Frandsen 2019; Wikipedia_Beaufort_West 2024).

Graves are readily found throughout the landscape. The Beaufort West region has several recorded graves, burial sites, and cemeteries. Some of them are formal graveyards associated with currently occupied farm complexes, other less formal graves associated with farmsteads, and graves found in remote areas far from any structures (Fourie 2021; Halkett 2009; Mann 2022; Nilssen 2010; Orton 2021).

7.10.2 Detailed Survey Findings

The maps provided below provides an indication of the identified heritage resources.

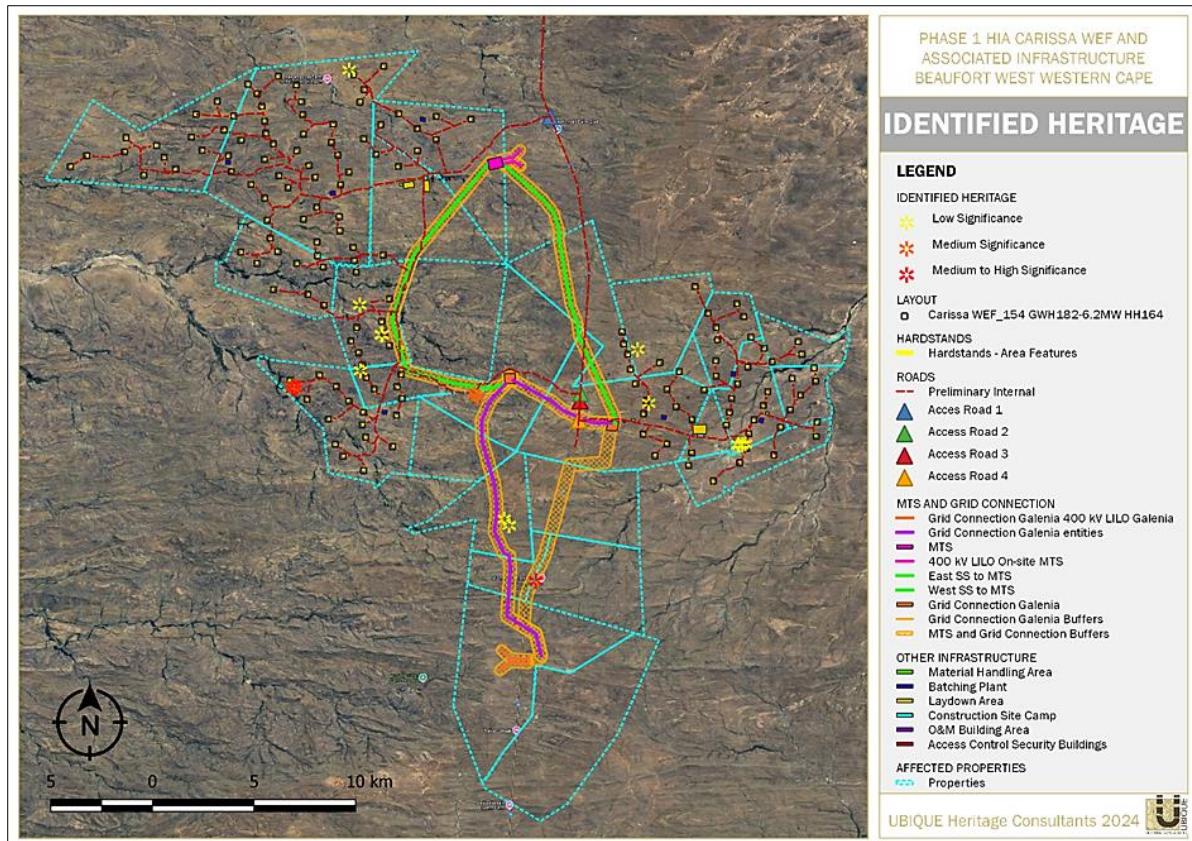


Figure 7.36: Identified Heritage Resources Across the Development Area

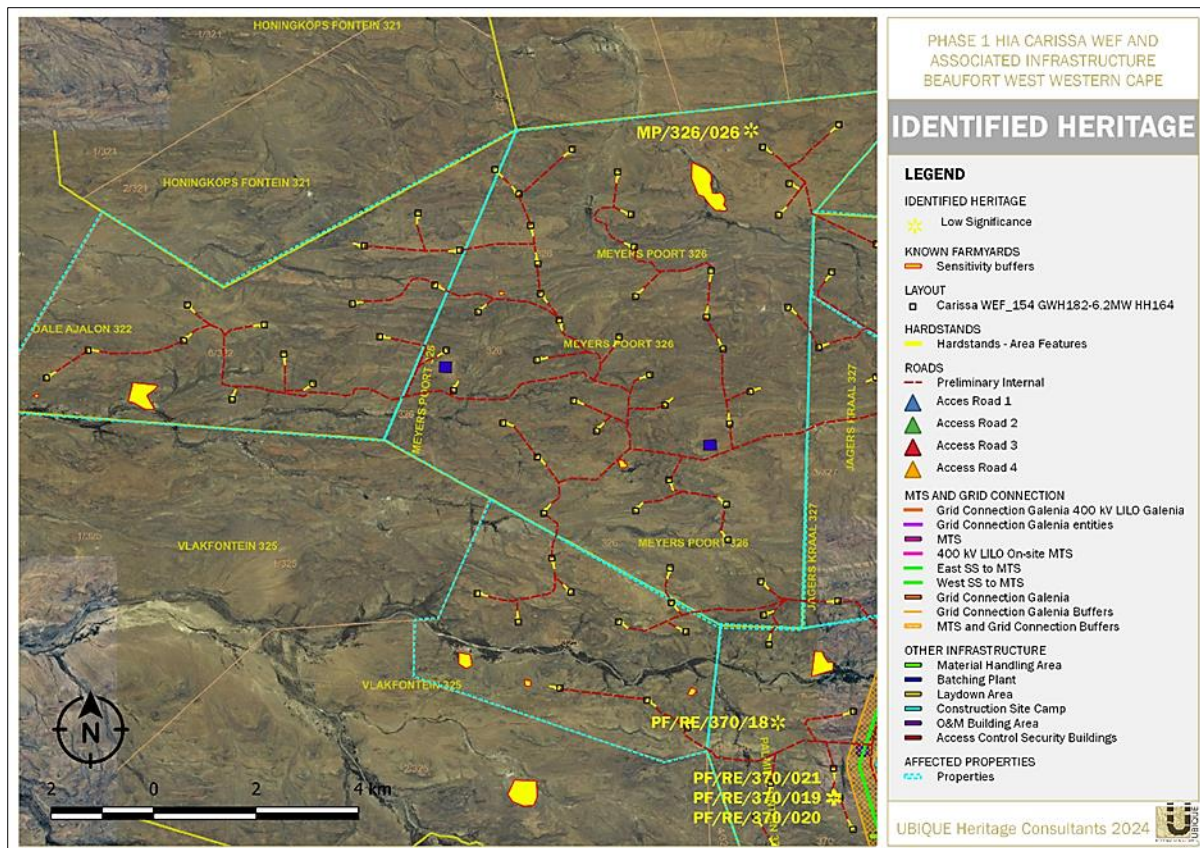


Figure 7.37: Detail 1: Identified Heritage Resources Across the Development Area

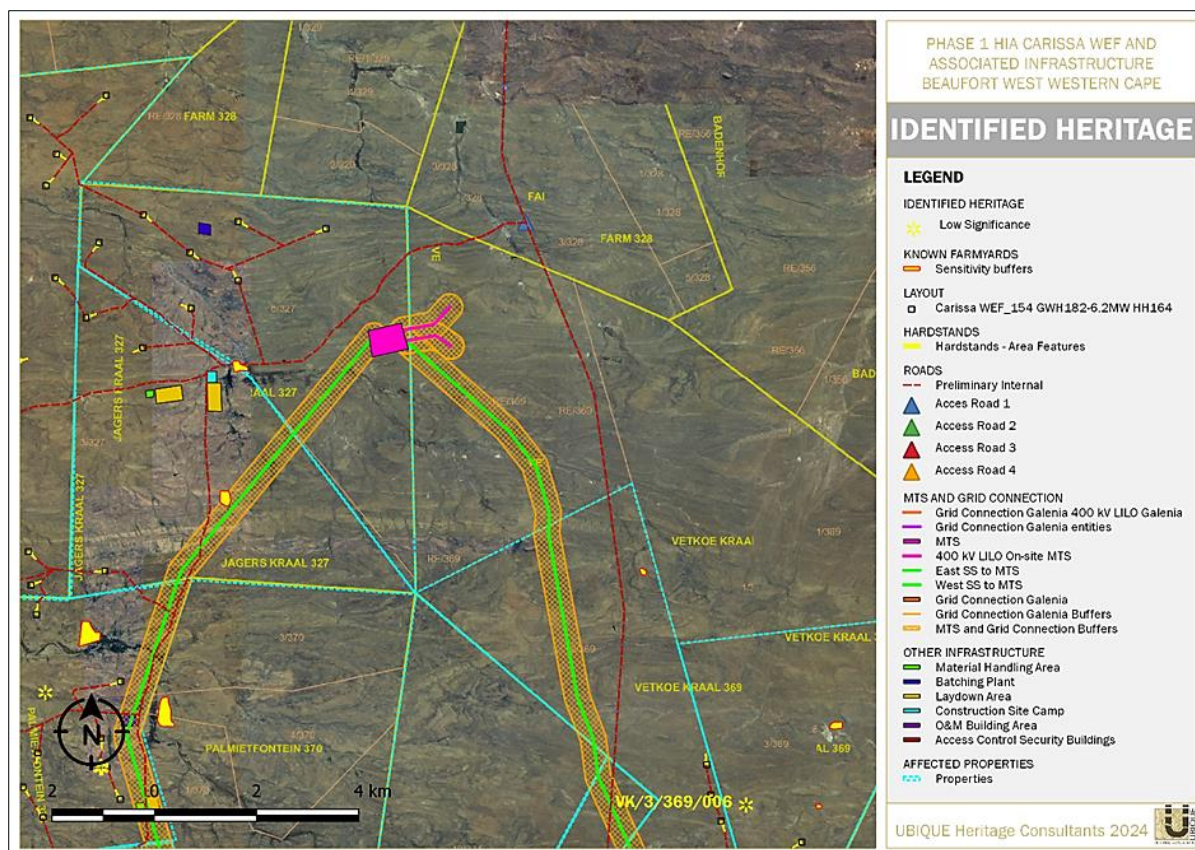


Figure 7.38: Detail 2: Identified Heritage Resources Across the Development Area

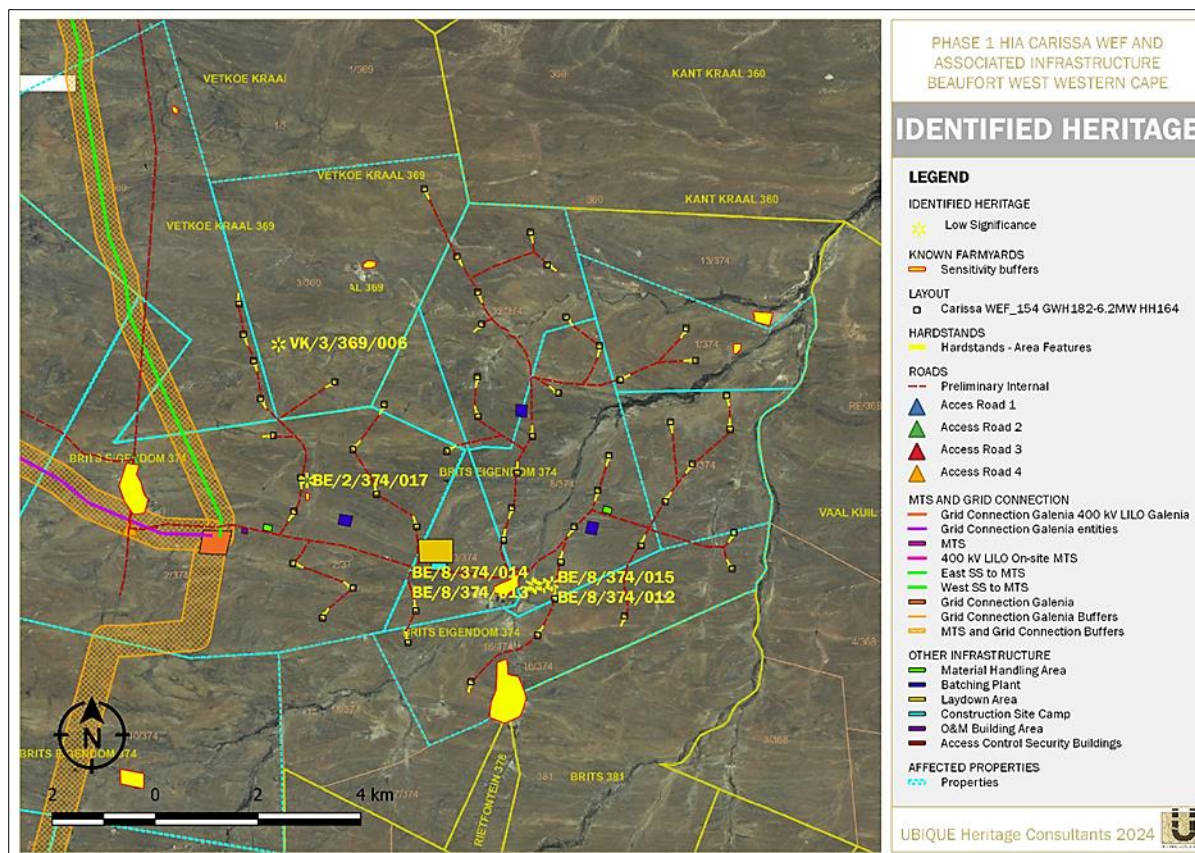


Figure 7.39: Detail 3: Identified Heritage Resources Across the Development Area

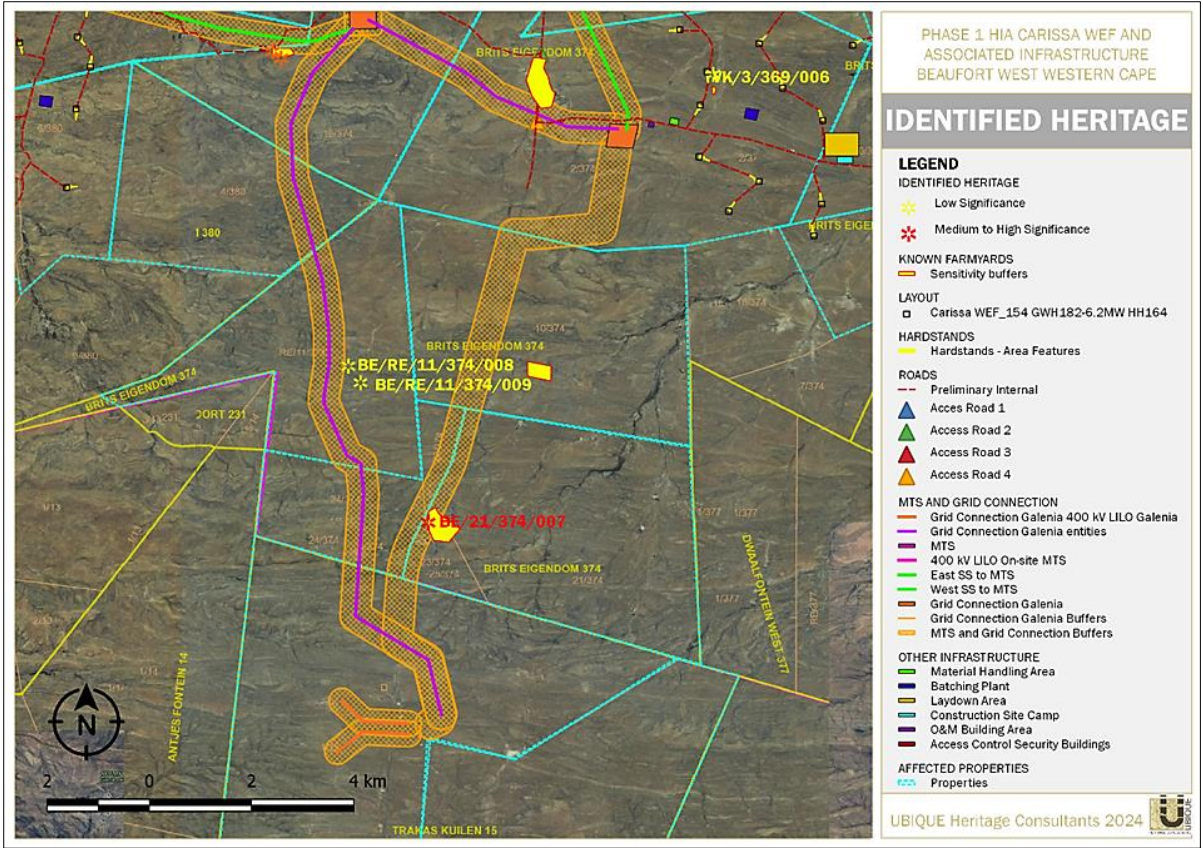


Figure 7.40: Detail 4: Identified Heritage Resources Across the Development Area

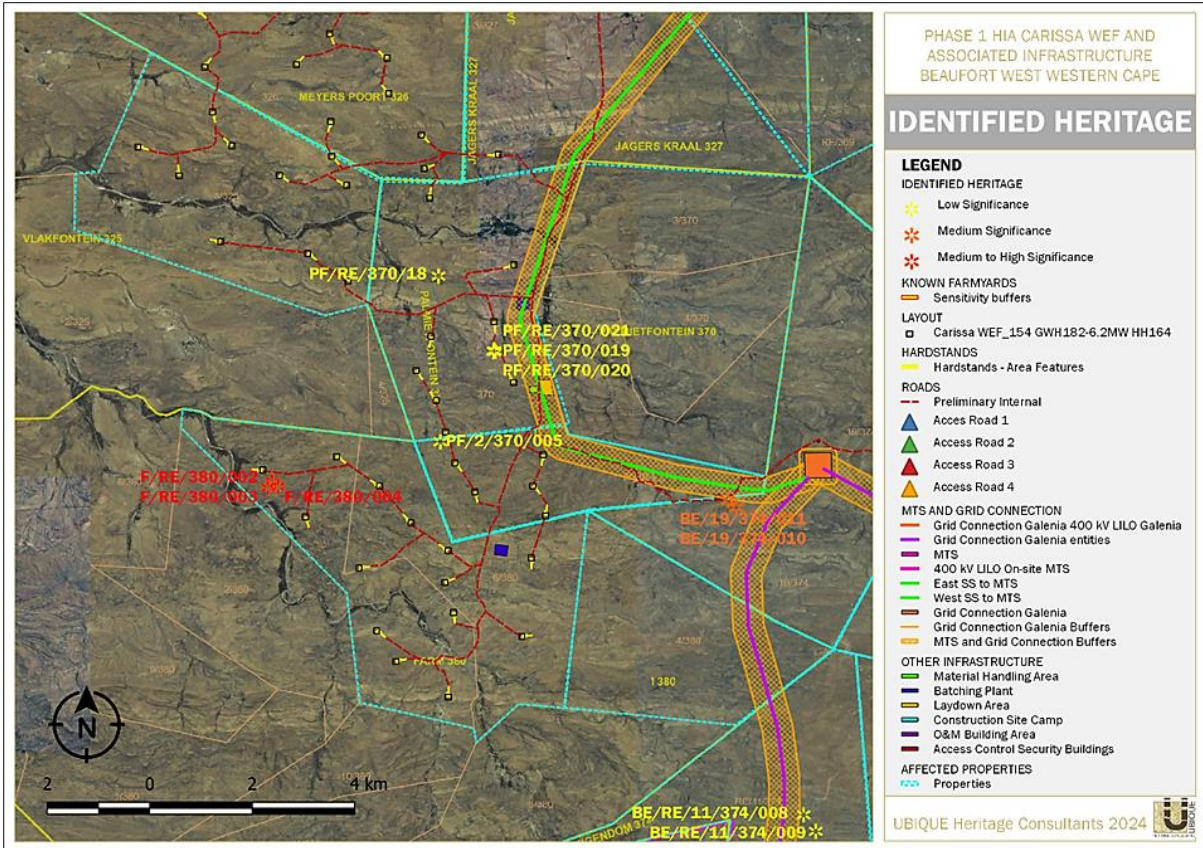


Figure 7.41: Detail 5: Identified Heritage Resources Across the Development Area

Table 7.27: Stone Age Resources on Farm RE/380

STONE AGE PERIOD RESOURCES IDENTIFIED					
SITE ID #	DESCRIPTION		PERIOD	LOCATION	FIELD RATING/ SIGNIFICANCE/ RECOMMENDED MITIGATION
F/RE/380/002	Type lithic/s	Knapping site	LSA	32°48'14.09"S 22°25'32.77"E Farm RE/380	Field Rating IVA Medium/high significance No mitigation
	Raw material	CCS and Dolerite			
	N in m ²	>25/50m ²			
	Context	An open LSA knapping site/workshop			
	Additional	Open scatters of LSA debris throughout the area			
F/RE/380/003	Type lithic/s	Knapping site	MSA/L SA	32°48'18.05"S 22°25'29.39"E Farm RE/380	Field Rating IVA Medium/high significance No mitigation
	Raw material	CCS and Dolerite			
	N in m ²	>31/50m ²			
	Context	An open LSA knapping site/workshop			
	Additional	Open scatters of LSA debris throughout the area			
F/RE/380/004	Type lithic/s	Knapping site	LSA	32°48'17.32"S 22°25'37.10"E Farm RE/380	Field Rating IVA Medium/high significance No mitigation
	Raw material	CCS and Dolerite			
	N in m ²	>8/20m ²			
	Context	An open LSA knapping site/workshop			
	Additional	Open scatters of LSA debris throughout the area			

An LSA knapping site (F/RE/380/002, 003, 004) of high significance was identified on the Remaining Extent of Farm 380, southeast of the current position of wind turbine WTG86. A high density of lithic material was recorded. The knapping site's lithic assemblage includes knapping debitage, bladelets and scrapers. This site is given a 'General' Protection A (Field Rating IVA). This resource is of medium/high significance; thus, any impact would be negative. Since the turbine's location has been adjusted post-survey, the site now falls outside the WTG86 footprint, so it will likely not be impacted. Thus, no further mitigation is recommended.

However, since the survey of the area was purposive and targeted, more knapping or settlement sites could be present in the koppies between the turbine footprints, and this went unrecorded. It should be noted that recent changes were made to the locations of the turbines, and several areas were not accessed. A final heritage walkthrough must be completed before construction.

Table 7.28: Stone Age Resources at Brits Eigendom 2/374

STONE AGE PERIOD RESOURCES IDENTIFIED					
SITE ID #	DESCRIPTION		PERIOD	LOCATION	FIELD RATING/ SIGNIFICANCE/ RECOMMENDED MITIGATION
BE/2/374/017	Type lithic/s	Flake	LSA	32°48'40.59"S 22°36'45.84"E Brits Eigendom 2/374	Field Rating IVC Low significance No Mitigation
	Raw material	Dolerite			
	N in m ²	1/20m ²			
	Context	Isolated occurrence			
	Additional	N/A			

An isolated stone flake was recorded west of wind turbine WTG-112 on Portion 2 of the Farm Brits Eigendom 374. It is without substantial archaeological context or matrix and, therefore, deemed of minor scientific importance and not conservation-worthy (NCW). The material is given a 'General' Protection C (Field Rating IV C). This means that it has been sufficiently recorded (in Phase 1). It requires no further action.

Table 7.29: Stone Age Resources on Palmietfontein RE/370

STONE AGE PERIOD RESOURCES IDENTIFIED					
SITE ID #	DESCRIPTION		PERIOD	LOCATION	FIELD RATING/ SIGNIFICANCE/ RECOMMENDED MITIGATION
PF/RE/370/018	Type lithic/s	Flakes and possible bladelet	LSA	32°46'4.29"S 22°27'37.60"E Palmietfontein RE/370	Field Rating IVC Low significance No Mitigation
	Raw material	Dolerite			
	N in m ²	3/20m ²			
	Context				
	Additional	N/A			
PF/RE/370/019	Type lithic/s	Possible Bladelet	LSA	32°46'51.74"S 22°28'18.86"E Palmietfontein RE/370	Field Rating IVC Low significance No Mitigation
	Raw material	Dolerite			
	N in m ²	1/20m ²			
	Context	Isolated occurrence			
	Additional	N/A			
PF/RE/370/021	Type lithic/s	Low-fired ceramics, scraper, bladelet and a flake	LSA	32°46'51.72"S 22°28'20.22"E Palmietfontein RE/370	Field Rating IVC Low significance No Mitigation
	Raw material	Low-fired ceramics, CCS/Dolerite			
	N in m ²	>60/20m ²			
	Context	Isolated open scatter			
	Additional	The ceramics appear to belong to the same pot.			

Isolated occurrences of low-significant Later Stone Age (LSA) lithic material and thin-walled low-fired ceramics were recorded on the Remaining Extent of the Farm Palmietfontein 370. PF/RE/370/021 is not situated near any of the proposed turbines, while PF/RE/370/18 and 19 were identified approximately 85 m north and northeast of wind turbine WTG-83. They are without substantial archaeological context

or matrix and are therefore deemed of minor scientific importance and not conservation-worthy (NCW). The material is given a 'General' Protection C (Field Rating IV C). This means that it has been sufficiently recorded (in Phase 1). It requires no further action.

Table 7.30: Stone Age Resources on Meyerspoort 326

STONE AGE PERIOD RESOURCES IDENTIFIED					
SITE ID #	DESCRIPTION		PERIOD	LOCATION	FIELD RATING/ SIGNIFICANCE/ RECOMMENDED MITIGATION
MP/326/026	Type lithic/s	Flakes	LSA	32°39'50.04"S 22°27'17.55"E Meyerspoort 326	Field Rating IVC
	Raw material	CCS/Dolerite			Low significance
	N in m ²	4/20m ²			No Mitigation
	Context	Random open scatter.			
	Additional	N/A			

An isolated occurrence of Later Stone Age (LSA) low-density flakes scatter of low significance was identified on the Farm Meyerspoort 326. These flakes are not situated near any of the proposed turbines. They are without substantial archaeological context or matrix and are therefore deemed of minor scientific importance and not conservation-worthy (NCW). The material is given a 'General' Protection C (Field Rating IV C). This means that it has been sufficiently recorded (in Phase 1). It requires no further action.

Table 7.31: Historical Period Resources on Palmietfontein 2/370

HISTORICAL PERIOD RESOURCES IDENTIFIED					
SITE ID #	DESCRIPTION		PERIOD	LOCATION	FIELD RATING/ SIGNIFICANCE/ RECOMMENDED MITIGATION
PF/2/370/005	Type of feature	Ceramic occurrence	Mid-late 1800s	32°47'49.06"S 22°27'39.02"E Palmietfontein 2/370	Field Rating IVC
	Material	Blue-banded Spongware ceramic fragments			Low significance
	N in m ² .	3/20m ²			No Mitigation
	Context	No additional context, isolated occurrence			
	Additional	N/A			

An isolated occurrence of three blue-banded spongware ceramic fragments, dating to the mid to late 1800s, was identified on Portion 2 of the Farm Palmietfontein 370, northwest of wind turbine WTG-100. This occurrence is without substantial archaeological context or matrix and is, therefore, deemed of minor scientific importance and not conservation-worthy (NCW). The material is given a 'General' Protection C (Field Rating IV C). This means that it has been sufficiently recorded (in Phase 1). It requires no further action.

Table 7.32: Historical Period Resources on Vetkoe Kraal 3/369

HISTORICAL PERIOD RESOURCES IDENTIFIED					
SITE ID #	DESCRIPTION		PERIOD	LOCATION	FIELD RATING/ SIGNIFICANCE/ RECOMMENDED MITIGATION
VK/3/369/ 006	Type of feature	Isolated fragment	Ca. Mid- late 1800s- early 1900s	32°47'15.28"S 22°36'24.67"E Vetkoe Kraal 3/369	Field Rating IVC Low significance No Mitigation
	Material	Asian stoneware			
	N in m ² .	1/20m ²			
	Context	No additional context, isolated occurrence			
	Additional	N/A			

An isolated fragment of UID Asian stoneware was identified on Portion 3 of the Farm Vetkoe Kraal 369. However, due to the updated WEF layout, it is not located near any of the proposed turbines. This occurrence is without substantial archaeological context or matrix and is therefore deemed of minor scientific importance and not conservation-worthy (NCW). The material is given a 'General' Protection C (Field Rating IV C). This means that it has been sufficiently recorded (in Phase 1). It requires no further action.

Table 7.33: Historical Period Resources on Brits Eigendom RE/11/374

HISTORICAL PERIOD RESOURCES IDENTIFIED					
SITE ID #	DESCRIPTION		PERIOD	LOCATION	FIELD RATING/ SIGNIFICANCE/ RECOMMENDED MITIGATION
BE/RE/11/3 74/008	Type of feature	Isolated metal cup	Ca. late 1800s- mid- 1900s	32°51'44.78"S 22°32'11.79"E Brits Eigendom RE/11/374	Field Rating IVC Low significance No Mitigation
	Material	Metal			
	N in m ² .	1/20m ²			
	Context	No additional context			
	Additional	N/A			
BE/RE/11/3 74/009	Type of feature	Stone Foundation	Ca. late 1800s- mid- 1900s	32°51'55.20"S 22°32'20.90"E Brits Eigendom RE/11/374	Field Rating IVC Low significance No Mitigation
	Material	Stone			
	N in m ² .	N/A			
	Context	The remains of a square stone foundation, no diagnostic cultural material was found in relation to the foundation.			
	Additional	N/A			

The remains of a stone foundation (BE/RE/11/374/009) were recorded on the Remaining Extent of Portion 11 of Farm Brits Eigendom No. 374, east of the grid corridor, as well as an isolated metal cup. These resources are without substantial archaeological context or matrix and are, therefore, deemed of minor scientific importance and not conservation-worthy (NCW). The material is given a 'General' Protection C (Field Rating IV C). This means that it has been sufficiently recorded (in Phase 1). It requires no further action.

Table 7.34: Historical Period Resources on Brits Eigendom 19/374

HISTORICAL PERIOD RESOURCES IDENTIFIED					
SITE ID #	DESCRIPTION		PERIOD	LOCATION	FIELD RATING/ SIGNIFICANCE/ RECOMMENDED MITIGATION
BE/19/374 /010	Type of feature	Farmstead	>60 years	32°48'30.53 "S 22°31'21.20 "E Brits Eigendom 19/374	Field Rating IVB Medium significance No mitigation
	Material	Brick, cement, stone			
	N in m².	N/A			
	Context	Old farmhouse and associated features, such as outbuildings and threshing floor.			
	Additional	N/A			
BE/19/374 /011	Type of feature	Kraal and associated features	>60 years	32°48'26.10 "S 22°31'15.08 "E Brits Eigendom 19/374	Field Rating IVB Medium significance 100 m Buffer/safety No-Go Zone
	Material	Stone			
	N in m².	N/A			
	Context	Associated with Farmstead			
	Additional	N/A			

A farmstead older than 60 years with associated features such as outbuildings, a possible threshing floor, a kraal, and a water canal/storage was identified near the proposed grid corridor on Portion 19 of the Farm Brits Eigendom 374. The farmhouse is outside the corridor; however, the kraal is within the corridor. These resources are given a 'General' Protection B (Field Rating IVB) and are of medium significance. Since the farmhouse is outside of the grid corridor, it will not be impacted by development. Thus, no further mitigation is recommended. However, a 100 m buffer/safety zone is recommended to negate the negative impact on the kraal and associated features, as this resource is located within the grid corridor.

Table 7.35: Historical Period Structures on Jagerskraal 3/327

HISTORICAL PERIOD RESOURCES IDENTIFIED					
SITE ID #	DESCRIPTION		PERIOD	LOCATION	FIELD RATING/ SIGNIFICANCE/ RECOMMENDED MITIGATION
JK/2/374/ 27	Type of feature	Remains of structural features, and what appears to be a Kraal	>60 years	32°44'2.95"S 22°29'52.99"E 2/374	Possible Field Rating IVB Medium significance 100m A Buffer/safety No-Go zone
	Material	Unknown			
	N in m².	N/A			
	Context	Situated inside the updated corridor			
	Additional	the proposed updated corridor			

A Historical period structural feature was originally noted; however, this resource was not surveyed, it initially did not fall within the proposed grid. This resource is, however, older than 60 years. Due to the recent changes that were made to the corridor locations, it will now be impacted by development. It is given a 'General' Protection B (Field Rating IVB) and are of medium significance. A 100 m buffer/safety zone is recommended to negate the negative impact on the kraal and associated features, as these resources are located within and near the grid corridor.

Table 7.36: Historical Period Structures on Brits Eigendom 2/374, 25/374, 21/374, 4/374

HISTORICAL PERIOD RESOURCES IDENTIFIED					
SITE ID #	DESCRIPTION		PERIOD	LOCATION	FIELD RATING/ SIGNIFICANCE/ RECOMMENDED MITIGATION
BE/374/028	Type of feature	Farmstead and associated features,	>60 years	32°53'30.81"S 22°33'22.09"E 25/374, 21/374, 4/374	Possible Field Rating IVB
	Material	Stone, brick			Medium significance 100m A Buffer/safety No-Go zone
	N in m².	N/A			
	Context	It is still currently in use as the Silver Karoo Guesthouse. The Silver Karoo Padstal is also located nearby. The graveyard at BE/21/374/007 is located nearby.			
	Additional	Situated just outside of the proposed updated corridor			

A Historical period structural feature was originally noted; however, this resource was not surveyed, it initially did not fall within the proposed grid. This resource is, however, older than 60 years. Due to the recent changes that were made to the corridor locations, it will now be impacted by development. It is given a 'General' Protection B (Field Rating IVB) and are of medium significance. A 100 m buffer/safety zone is recommended to negate the negative impact on the kraal and associated features, as these resources are located within and near the grid corridor.

Table 7.37: Historical Period Resources on Brits Eigendom 8/374

HISTORICAL PERIOD RESOURCES IDENTIFIED					
SITE ID #	DESCRIPTION		PERIOD	LOCATION	FIELD RATING/ SIGNIFICANCE/ RECOMMENDED MITIGATION
BE/8/374/012	Type of feature	Isolated fragment	>60 years	32°49'46.39"S 22°39'35.01"E Brits Eigendom 8/374	Field Rating IVC
	Material	European ceramic			Low significance No Mitigation
	N in m².	1/20m²			
	Context	Isolated occurrence			
	Additional	N/A			
BE/8/374/013	Type of feature	Isolated glass fragment	Ca. late-1800s	32°49'47.15"S 22°39'36.83"E	Field Rating IVC
	Material	Glass			Low significance

HISTORICAL PERIOD RESOURCES IDENTIFIED					
SITE ID #	DESCRIPTION		PERIOD	LOCATION	FIELD RATING/ SIGNIFICANCE/ RECOMMENDED MITIGATION
BE/8/374/ 014	N in m ² .	1/20m ²	to early- 1900s	Brits Eigendom 8/374	No Mitigation
	Context	Isolated occurrence			
	Additional	N/A			
	Type of feature	Isolated glass fragment	Ca. late- 1800s to early- 1900s	32°49'46.61"S 22°39'43.09"E Brits Eigendom 8/374	Field Rating IVC Low significance No Mitigation
	Material	Glass			
	N in m ² .	2/20m ²			
	Context	Isolated occurrence			
	Additional	N/A			
BE/8/374/ 015	Type of feature	Broken Horse Shoe	>60 years	32°49'45.50"S 22°39'48.96"E Brits Eigendom 8/374	Field Rating IVC Low significance No Mitigation
	Material	Metal			
	N in m ² .	1/20m ²			
	Context	Isolated occurrence			
	Additional	N/A			

On Portion 8 of the Farm Brits Eigendom 374, four isolated occurrences of low-significant Historical period material such as glass, ceramic and a broken horseshoe were recorded. However, due to the updated WEF layout, these resources are not located near the proposed turbines. They are without substantial archaeological context or matrix and are therefore deemed of minor scientific importance and not conservation-worthy (NCW). The material is given a 'General' Protection C (Field Rating IV C). This means that it has been sufficiently recorded (in Phase 1). It requires no further action.

Table 7.38: Historical Period Resources on Palmietfontein RE/370

HISTORICAL PERIOD RESOURCES IDENTIFIED					
SITE ID #	DESCRIPTION		PERIOD	LOCATION	FIELD RATING/ SIGNIFICANCE/ RECOMMENDED MITIGATION
PF/RE/370/ 020	Type of feature	Isolated occurrence	Ca. early 1900s	32°46'51.67"S 22°28'19.12"E Palmietfontein RE/370	Field Rating IVC Low significance No Mitigation
	Material	Glass			
	N in m ² .	3/20m ²			
	Context	Isolated occurrence, identified on the hill near the low-fired ceramics and stone tools (PF/RE/370/021)			
	Additional	N/A			

An Isolated random occurrence of three glass fragments was identified on the hill, close to the low-fired ceramics and LSA lithic material (PF/RE/370/021) on the Remaining Extent of the Farm Palmietfontein 370. This occurrence is without substantial archaeological context or matrix and is, therefore, deemed of minor scientific importance and not conservation-worthy (NCW). The material is given a 'General' Protection C (Field Rating IV C). This means that it has been sufficiently recorded (in Phase 1). It requires no further action.

Table 7.39: Graves on Brits Eigendom 21/374

GRAVE RESOURCES IDENTIFIED					
SITE ID #	DESCRIPTION		PERIOD	LOCATION	FIELD RATING/ SIGNIFICANCE/ RECOMMENDED MITIGATION
BE/21/374/007	Grave markers	Stones, Headstones	Ca. mid-1900s to early-2000s	32°53'23.50"S 22°33'11.73"E Brits Eigendom 21/374	Field Rating IIIA High significance 50m Buffer/No-Go Safety Zone
	Inscription	Various			
	Graves' Orientation	East-West			
	Dimensions/Extent	43 visible graves			
	Additional	N/A			

One graveyard was recorded within the corridor footprint on Portion 21 of the Farm Brits Eigendom 374. There are approximately 43 visible graves. The graves consist of stone-packed graves as well as graves with headstones. Most of the marked graves date from the mid-1900s to the early-2000s. This grave site has been given a Field Rating of IIIA (High – medium significance) and should thus be mitigated. It is recommended that a buffer/safety zone of 50 m should be implemented around the graves.

Apart from marked graves that are chiefly located around the farmsteads, unmarked graves can also be present within the landscape. According to anecdotal narrative (pers. Comm. Mrs Zettie van Eck), there are unmarked graves somewhere on the farm Amosvlei (Farm Brits Eigendom No. 374 Portions 1, 8, 12, 14 and 16) of a group of Khoi people who Dutch governmental officials killed during the 1600s. The location of their graves is unknown.

Due to time constraints, the expansive terrain and the large extent of the development footprint, the survey had to be purposive and concentrated on the preliminary development layout as received by the client prior to our survey. Therefore, to consider all specialist sensitivities, the adjusted project layout includes areas that were not comprehensively surveyed. The post-survey adjusted project layout includes infrastructure, internal roads, and new placements of the wind turbines. It is recommended that a final heritage walkthrough must be completed before construction to identify any additional areas that may be impacted by development. Note this is not considered a post EA study.

Therefore, UBIQUE Heritage Consultants recommend that the proposed Carissa Wind Energy Facility (WEF) and Associated Infrastructure near Beaufort West in the Beaufort West and Prince Albert Local Municipalities, Central Karoo District Municipality, Western Cape, may continue, provided the recommendations stipulated within this report and the subsequent HWC decision are followed.

7.11 Paleontological Assessment

As the development area is highly fossiliferous a six-day comprehensive site-specific field survey of the development footprint for the project was conducted on foot and motor vehicle by Banzai Environmental (16 June to 21 June 2024; autumn). Please note that the season in which the site investigation was conducted does not influence the Palaeontology of the site.

The proposed Carissa Wind Energy Facility and Associated Infrastructure, near Beaufort West, in the Western Cape Province is depicted on the 1:250 000 Beaufort West 3222 (1979) Geological map (Council of Geoscience, Pretoria) indicating that the study area is underlain by Quaternary alluvium

(yellow, single bird figure) (in the south and west) while the majority of the development is underlain by Permian aged sediments of the Teekloof (Pt, dark green) and the Abrahamskraal (Pa, green) Formations (Beaufort Group, Karoo Supergroup; Figure 7.42).

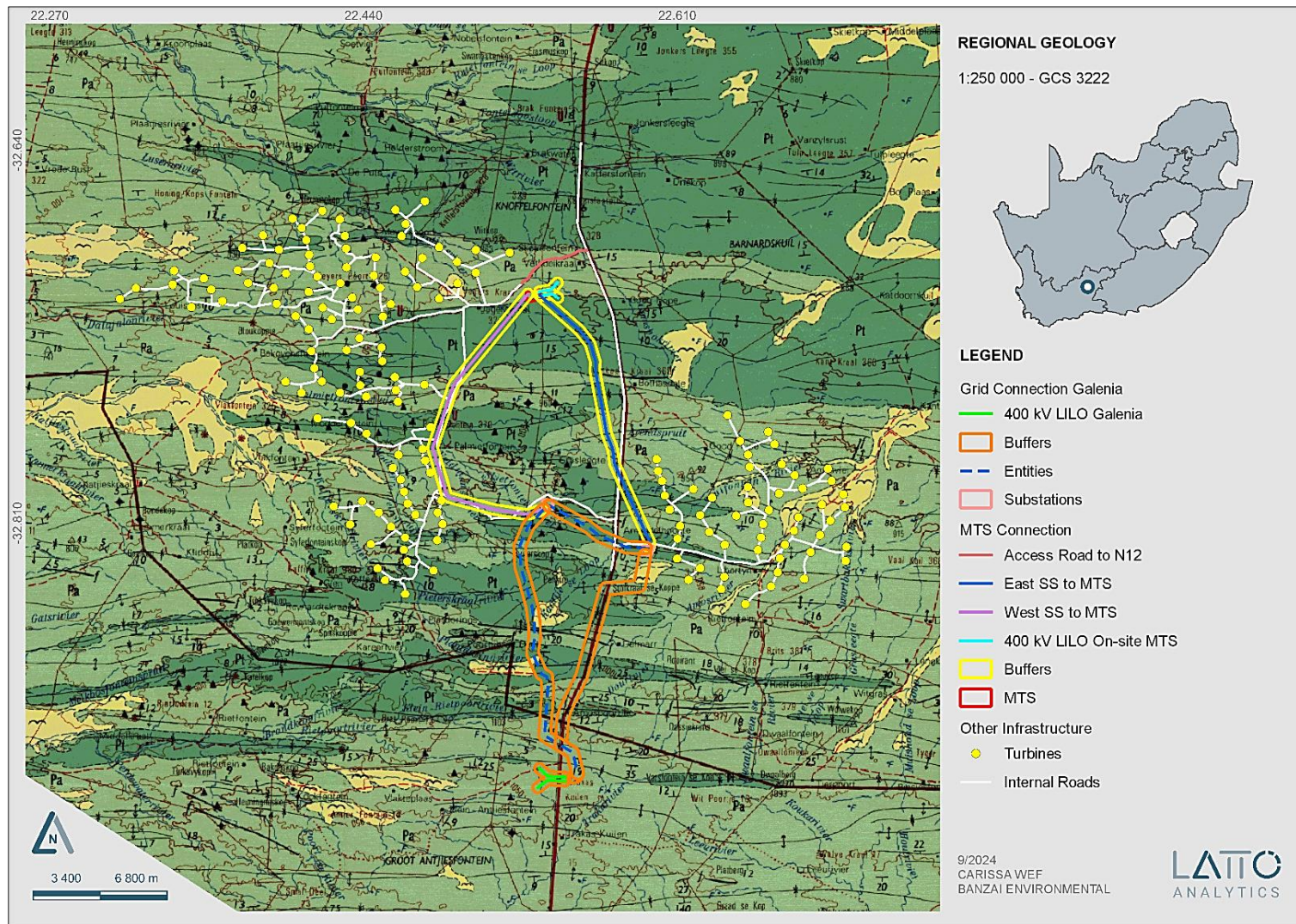


Figure 7.42: Extract of the Beaufort West 3222 (1979) Geological Map (Council Of Geoscience, Pretoria) Indicating that the Study Area is Underlain by Quaternary Alluvium (Yellow, Single Bird Figure) (In The West) While the Majority of the Development is Underlain by Permian Aged Sediments of the Teekloof (Pt, Dark Green) and the Abrahamskraal (Pa, Green) Formations (Beaufort Group, Karoo Supergroup)

Updated geology (2014) produced by the Council of Geosciences (Pretoria; Figure 7.43) indicates that the proposed development is underlain by the Middelton (Pm) and Abrahamskraal (Pa) Formations of the of the Beaufort Group (Karoo Supergroup). The PalaeoMap of the South African Heritage Resources Information System (SAHRIS) indicates that the Palaeontological Sensitivity of Quaternary alluvium in this region is Low (blue) while that of the Middelton and Abrahamskraal Formations is Very High (red) (Figure 7.44, Table 7.40).

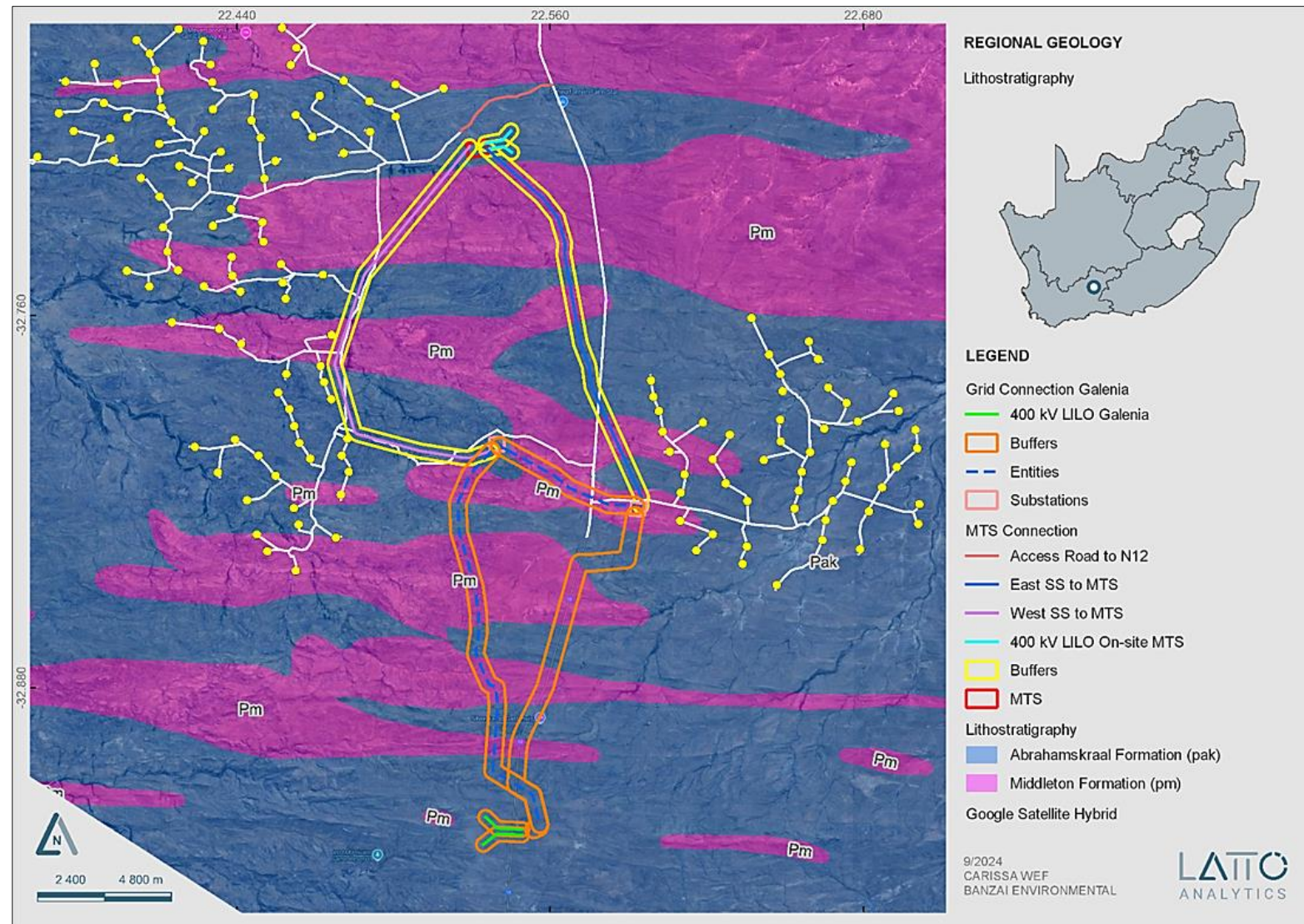


Figure 7.43: Updated Geology (2014, Council of Geosciences, Pretoria) Indicates that the Proposed Development near Beaufort West in the Western Cape is Underlain by the Middleton (Pm) and Abrahamskraal (Pa) Formations of the Beaufort Group (Karoo Supergroup)

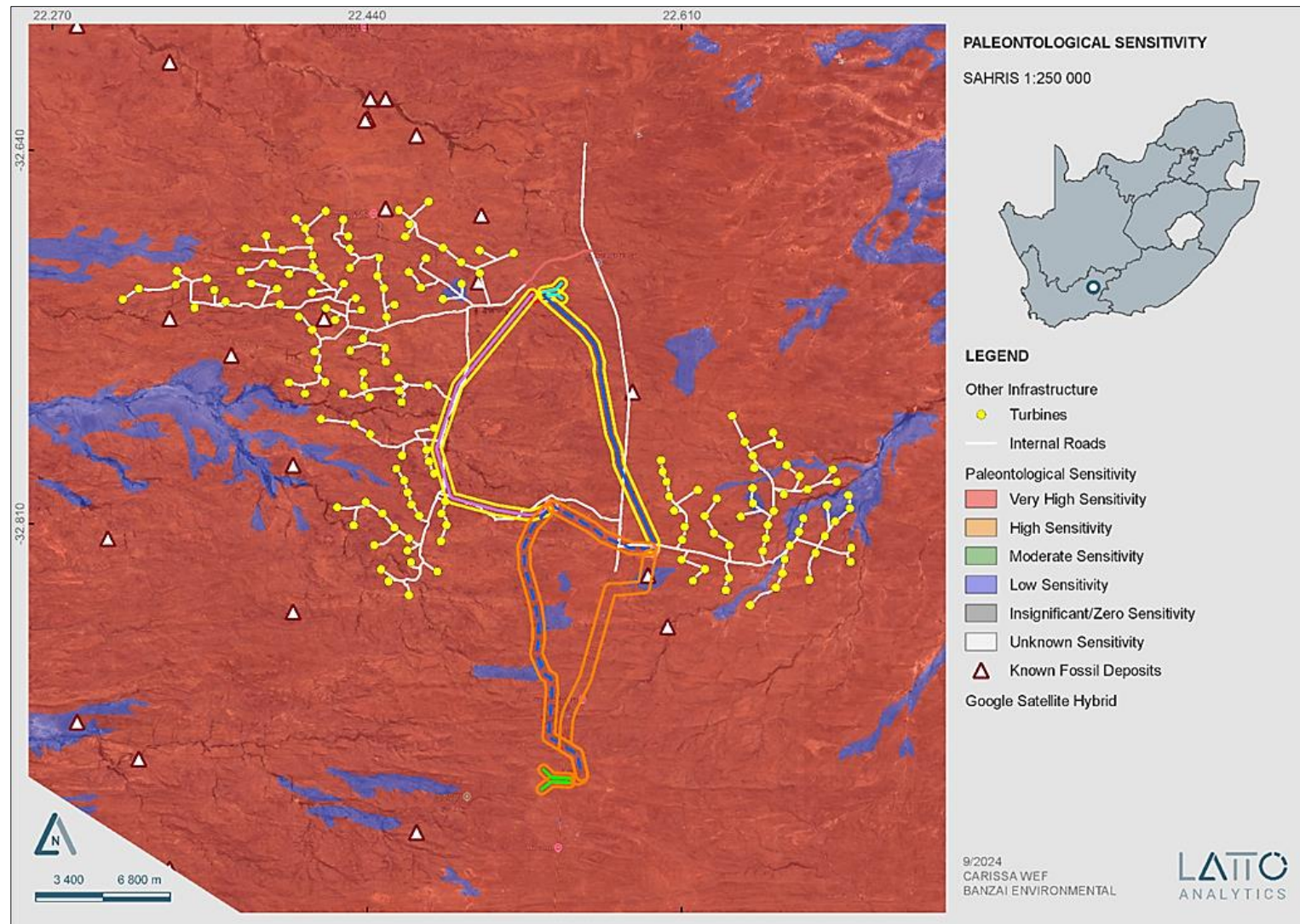


Figure 7.44: Extract of the SAHRIS PalaeoMap map (Council of Geosciences) indicates the **Very High (red)** and **Low (blue)** Palaeontological Sensitivity of the Carissa WEF Development in the Western Cape Province. Fossil finds on the National Palaeontological Database indicates that fossils are found in the development footprint (indicated by white triangle with red border)

Table 7.40: Palaeontological Sensitivity According to the SAHRIS PalaeoMap (Almond et al, 2013; SAHRIS website)

Colour	Sensitivity	Required Action
RED	VERY HIGH	Field assessment and protocol for finds is required
ORANGE/YELLOW	HIGH	Desktop study is required and based on the outcome of the desktop study; a field assessment is likely
GREEN	MODERATE	Desktop study is required
BLUE	LOW	No paleontological studies are required however a protocol for finds is required
GREY	INSIGNIFICANT/ZERO	No paleontological studies are required
WHITE/CLEAR	UNKNOWN	These areas will require a minimum of a desktop study. As more information comes to light, SAHRA will continue to populate the map.

The study area is underlain by sediments with a **Very High (red)** and **Low (blue)** Palaeontological Sensitivity. The National Palaeontological Database is a combined database of all fossils collected by the different research institutions in South Africa. A few fossils were recovered from the north, west and south of Carissa WEF study area as indicated by the white triangles with red outlines in Figure 7.45 below. These fossils were collected and are housed in museum and university collections.

Various fossiliferous outcrops were identified during this site visit. New fossil sites were identified that was not indicated on the National Palaeontological Database (containing all fossils collected by the Museums and Universities of Southern Africa). The presence of fossiliferous outcrops on the ground surface was confirmed with high certainty.

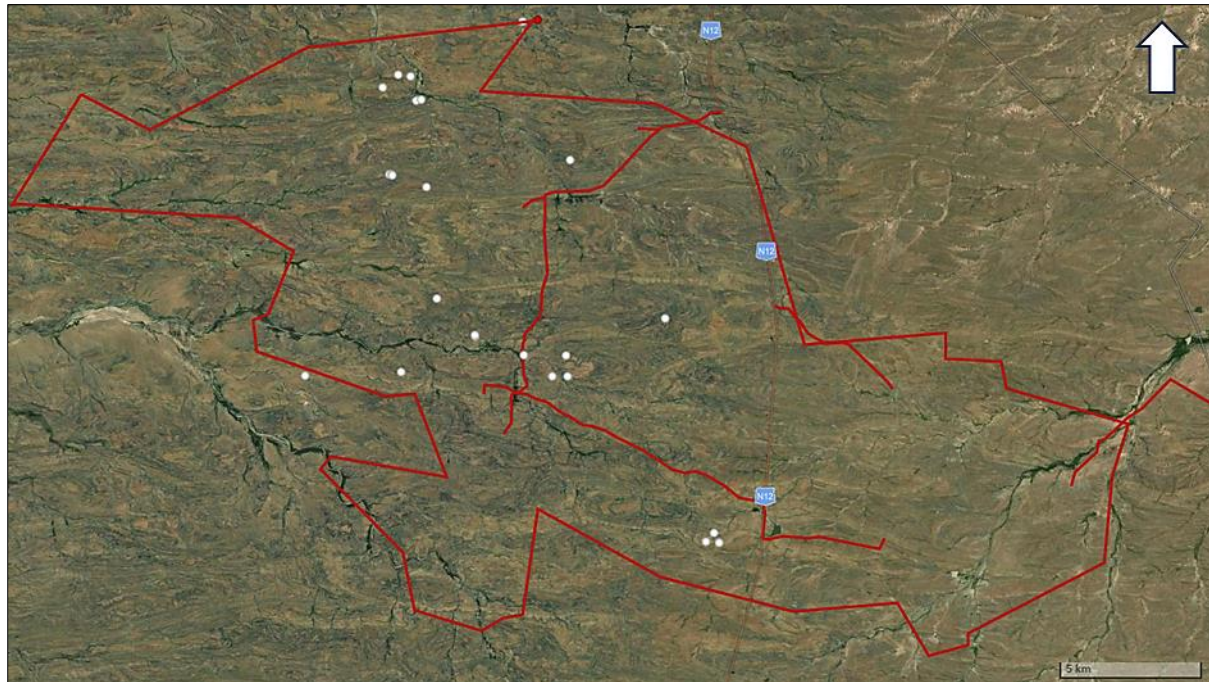


Figure 7.45: Fossil Finds During the Site Investigation (Loose and in Situ)

Two grid corridors have been proposed and assessed for this project. The geology of these routes is identical, hence there is no preference between them.

The Carissa WEF Project is vast and although care was taken to identify all fossil sites during the site investigation, time was a limitation. It is thus recommended that a Palaeontological Walkdown is conducted, by a professional Palaeontologist, for the Carissa WEF and associated infrastructure when the final layouts are established, before vegetation clearance and construction takes place. This is considered a pre-construction requirement.

7.12 Visual and Shadow Flicker Assessment

Visual impacts occur when changes in the landscape are noticeable to viewers looking at the landscape from their homes or from parks and conservation areas, highways and travel routes, and important cultural features and historic sites.

Visual impacts therefore relate to the changes that arise in the composition of views as a result of:

- Changes to the landscape;
- People's response to those changes; and
- The overall negative effect with respect to the scenic beauty of that landscape, which can be subjective.

Visual impact is therefore measured as the change or contrast to the existing visual environment and the extent to which that change compromises (negative impact) or enhances (positive impact) or maintains the visual quality of the landscape.

Visual impacts can be seen as an issue because it reduces the public's enjoyment and appreciation of the landscape and impair the character or quality of such a place as well as the aesthetic quality of the landscape if it is considered to be a national resource.

A site inspection was conducted on the 17th and 18th of April 2024. Most of the visual receptors were determined by using ZTV and geographical imagery within a 25 km radius before the site inspection.

7.12.1 Zone of Theoretical Visibility (ZTV)

The ZTV maps, generated through ArcMap, reflects the exposure in term of proximity of viewers to the proposed development within a 25 km PAOI for the WEF and within a 10 km PAOI for grid connection infrastructure. Table 7.41 below is used for Visual Exposure rating within the different radii as per the visual exposure set out in Table 7.42 below.

Table 7.41: Exposure Rating for the WEF

Distance (km)	Exposure Rating
0-2	Very High Exposure with possible Shadow Flicker
2-5	Very High Exposure
5-10	High Exposure
10-15	Moderate Exposure
15-25	Low Exposure

Table 7.42: Exposure Rating for Grid Connection Infrastructure

Distance (km)	Exposure Rating
0-1	High Exposure
1-3	Moderate High Exposure
3-5	Moderate Exposure
5-10	Low Exposure

These distances were calculated using satellite imagery, but the Exposure Rating was determined by using previous experiences, assumptions and opinions, it is therefore theoretical. The ZTV maps will give a clearer understanding of areas susceptible to line of sight within a 25 km and 10 km PAOI which means, an imaginary line from the eye to a perceived object. The ZTV did not consider existing screening such as buildings and vegetation cover but rather the terrain's Above Mean Sea Level (AMSL) which indicates line of sight. The receptors which were identified were subject to an impact assessment.

7.12.2 Visual Features and Sensitive Receptors

The study area is characterised by some landscape features that possess a visual or scenic value. These natural elements along with potential sensitive visual receptors serve as a visual baseline for assessing the surroundings. The following landscape features and potential sensitive visual receptors can be observed:

Table 7.43: Visual Features and Sensitive Receptors

Scenic Resource	Landscape Features within the 25 km PAOI (Assessment Radius)
Topographic Features	A diverse array of landforms, including kopjes, ridges, plains, and undulating hills.
Water Features	Within the 25 km PAOI, there are several water features that add to visual quality, but none of the water features add to visual quality to such an extent to specifically attract visitors or tourists. Most water features are seasonal and episodic.
Vegetation Features	The area surrounding the proposed development consist mostly out of Karoo shrubland vegetation that adds to visual quality.
Cultural Landscapes	Some farmsteads within the landscape do exhibit the typical Karoo architecture. There is a clear European influence in the architecture of these establishments, with many of the typical Karoo houses being very simplified versions of the popular Regency, Late Georgian, Victorian and Edwardian styles of the time. Typical characteristics include a facade and a flat roof and quite often a prominent covered veranda (stoep) as protection against the harsh sun. These houses in the Karoo were built of local materials such as stone and handmade bricks and plastered with a breathable mud plaster.
Sensitive Receptors	Potential Sensitive Receptors within the 25 km PAOI

Nature reserves and national parks	No nature reserves are located within the 25 km PAOI.
Human settlements and farmsteads	A number of farmsteads and some lodging facilities are located within the 25 km PAOI, but sparsely scattered. Two farmstalls (padstal) are located within the 25 km PAOI. Farmstalls are very popular tourist stops where one can stretch legs, buy something to eat or drink, and usually offer some interesting visual features.
Scenic routes and arterial roads	<p>Arterial roads include the following:</p> <ul style="list-style-type: none"> • National Route 1 • National Route 12 <p>No specific scenic roads within the 25 km PAOI, but all these roads can be seen as scenic in some way as they traverse a beautiful Karoo landscape. The two above mentioned routes are very popular with tourists travelling to other areas within the Western Cape Province, especially during peak holiday periods.</p>
Cultural and heritage sites	These form part of the heritage study. A development might have a visual impact on cultural or heritage sites only if these sites are visited frequently by tourists or interested parties.
Tourism facilities / sites	Only eight lodging facilities within the 25 km PAOI catering to tourists for overnight accommodation and for tourists visiting the area to experience the serene Karoo landscape. No specific tourism sites attracting a large number of tourists.

The visual impact assessment criteria and site sensitivity verification is presented in Table 7.44 below.

Table 7.44: Visual Impact Assessment Criteria - Assessed

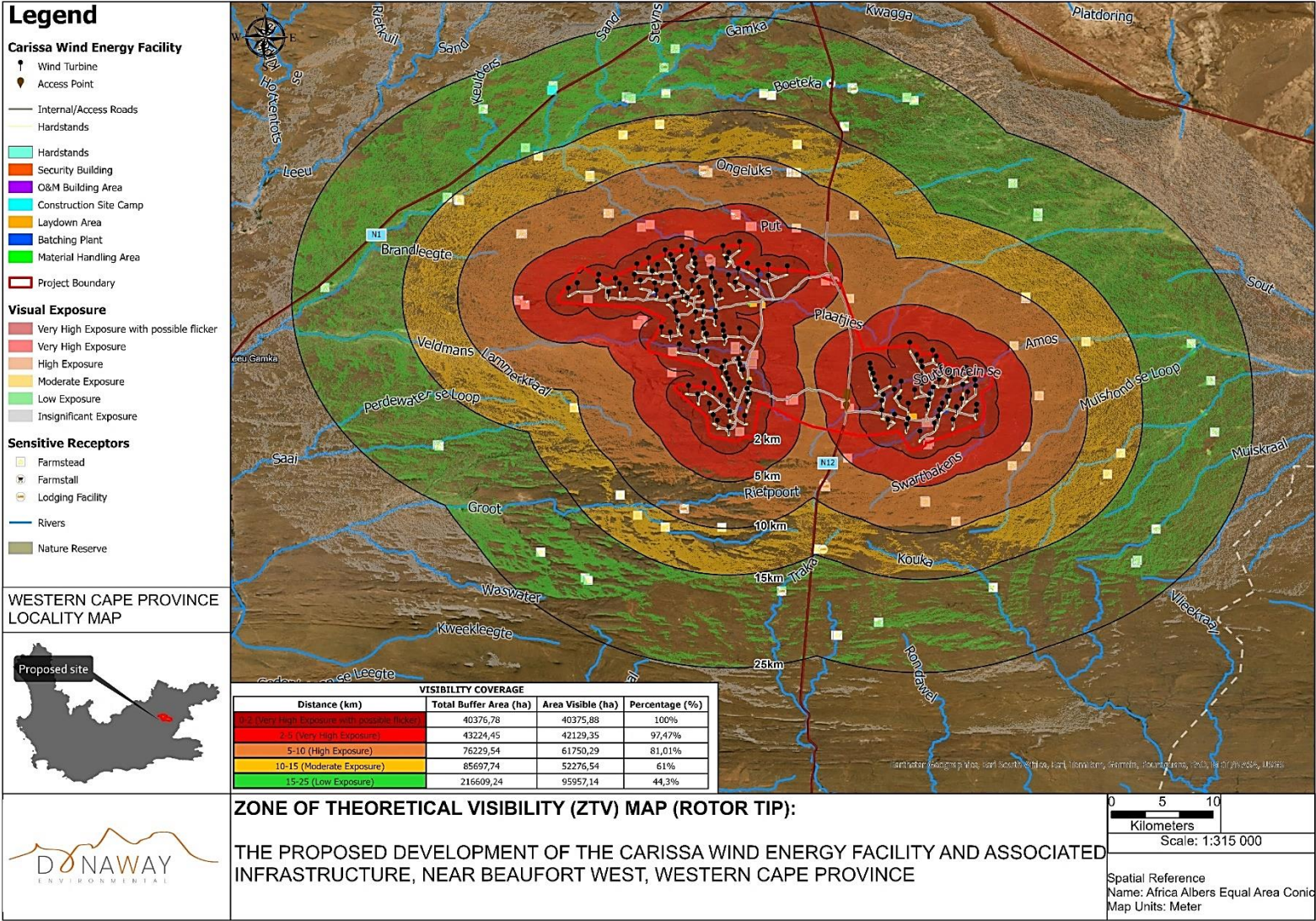
Specific Criteria for Visual Impact Assessments	
VISIBILITY OF THE PROJECT	<p>HIGH VISIBILITY</p> <p>The rating is solely based on the size of the Zone of Theoretical Visibility (ZTV) and serves as an indicator of the potential visual impacts of the development on the surrounding region according to topography, excluding vegetation and infrastructure screening. A high visibility does not necessarily imply a significant visual impact or exposure, although it may have one if the region has a dense population of sensitive visual receptors together with sparse vegetation and infrastructure screening.</p> <p>The ZTV maps below indicates a “High Visibility”, according to the Specific Criteria for Visual Impact Assessment (Oberholzer, B. 2005), for the entire PAOI. Visibility within the PAOI covers thousands of hectares for all infrastructure. A more notable decline in visibility for the WTGs can be observed beyond 10 km and beyond 3 km for both grid connection options. Please refer to the ZTV maps below.</p> <p>Furthermore, air quality and atmospheric conditions play a crucial role in determining visibility levels. Poor air quality, characterised by high levels of pollutants and particulate matter, can significantly reduce visibility by scattering and absorbing light. Fine particulate matter, such as smoke, haze, and smog, can absorb and scatter sunlight, creating a hazy or foggy appearance. Similarly, pollutants like sulphur dioxide and nitrogen dioxide can react with other compounds in the atmosphere to form smog, which further impairs visibility. Atmospheric conditions, such as humidity and temperature inversions, also affect visibility. High humidity levels can lead to the formation of fog and mist, reducing visibility to mere meters. Temperature inversions occur when a layer of warm air traps cooler air near the ground, causing pollutants and particulate matter to be trapped closer to the surface and reducing visibility. In summary, air quality and atmospheric conditions are closely linked to visibility, with poor air quality and specific weather phenomena significantly impacting the clarity of our surroundings.</p>
VISUAL EXPOSURE	<p>As mentioned above, the exposure rating is based on the ZTV (line of site influenced solely by topography) and not existing visual screening such as vegetation cover and / or other infrastructure. The receptors discussed below are exclusively those that have the potential to visually observe or perceive the project. Visual exposure diminishes exponentially with distance.</p> <p>WTGs³⁵</p>

³⁵ Data available on request.

Specific Criteria for Visual Impact Assessments					
	Distance radii	Number of Receptors (Total of 127 Receptors excluding the N1 and N12)	Number of Receptors Exposed	Average number of WTGs visible from exposed receptors	Average percentage of at least one (1) WTG visible from exposed receptors
	0-2 km with flicker.	15	15 (all 15 exposed to flicker as well)	65	99.05%
	2-5 km	21	21	66	81.29%
	5-10 km	28	25	70	75.71%
	10-15 km	18	17	42	58.82%
	15-25 km	41	20	62	68.21%
	<p>Further to the above WTG table, the N12 is exposed in all radii, with a very small section exposed within 2 km. The N1 is only exposed within the 15-25 km radius.</p> <p>Grid Connection Options</p> <p>Both grid connection options show similar exposure with all receptors exposed up to 3 km. Exposure beyond the 3 km radius starts to diminish very slightly. The majority of receptors are exposed within the entire 10 km radius.</p>				
VISUAL SENSITIVITY OF THE AREA	<p>MODERATE VISUAL SENSITIVITY</p> <p>The assessment of visual sensitivity in the area reveals a moderate impact, primarily attributed to an area with no specific scenic quality. The exception does exist due to some landforms and the Karoo landscape, but no features exist with such scenic quality to specifically attract tourists.</p>				
VISUAL SENSITIVITY	<p>HIGH RECEPTOR SENSITIVITY</p>				

Specific Criteria for Visual Impact Assessments	
OF RECEPTORS	Please refer to the ZTV maps below for an indication of sensitive visual receptors in the area. Receptors mainly encompass farmers and their employees, lodging facilities and the N12.
VISUAL ABSORPTION CAPACITY (VAC)	<div>LOW VAC</div> <p>The area surrounding the proposed development boasts a low Visual Absorption Capacity (VAC) in terms of its sparse / low vegetation and topographical landscape features. The area is characterised by sparse vegetation of the Karoo. Topographical features limit visibility of the WTGs more beyond a 15 km radius, primarily due to the height of the turbines. Topographical features are more effective for screening of the grid connection infrastructure, seeing a sharp decline in visibility beyond the 3 km radius.</p>
VISUAL INTRUSION	<div>HIGH VISUAL INTRUSION</div> <p>The visual intrusion of the project in an area characterised by open fields poses an interesting juxtaposition of modern technology and the natural landscape. The WTGs, though efficient and eco-friendly, may alter the visual harmony, drawing attention away from the rhythmic patterns of grazing fields, and the more scenic resource the Karoo landscape provides.</p>

ZTV maps provided below.



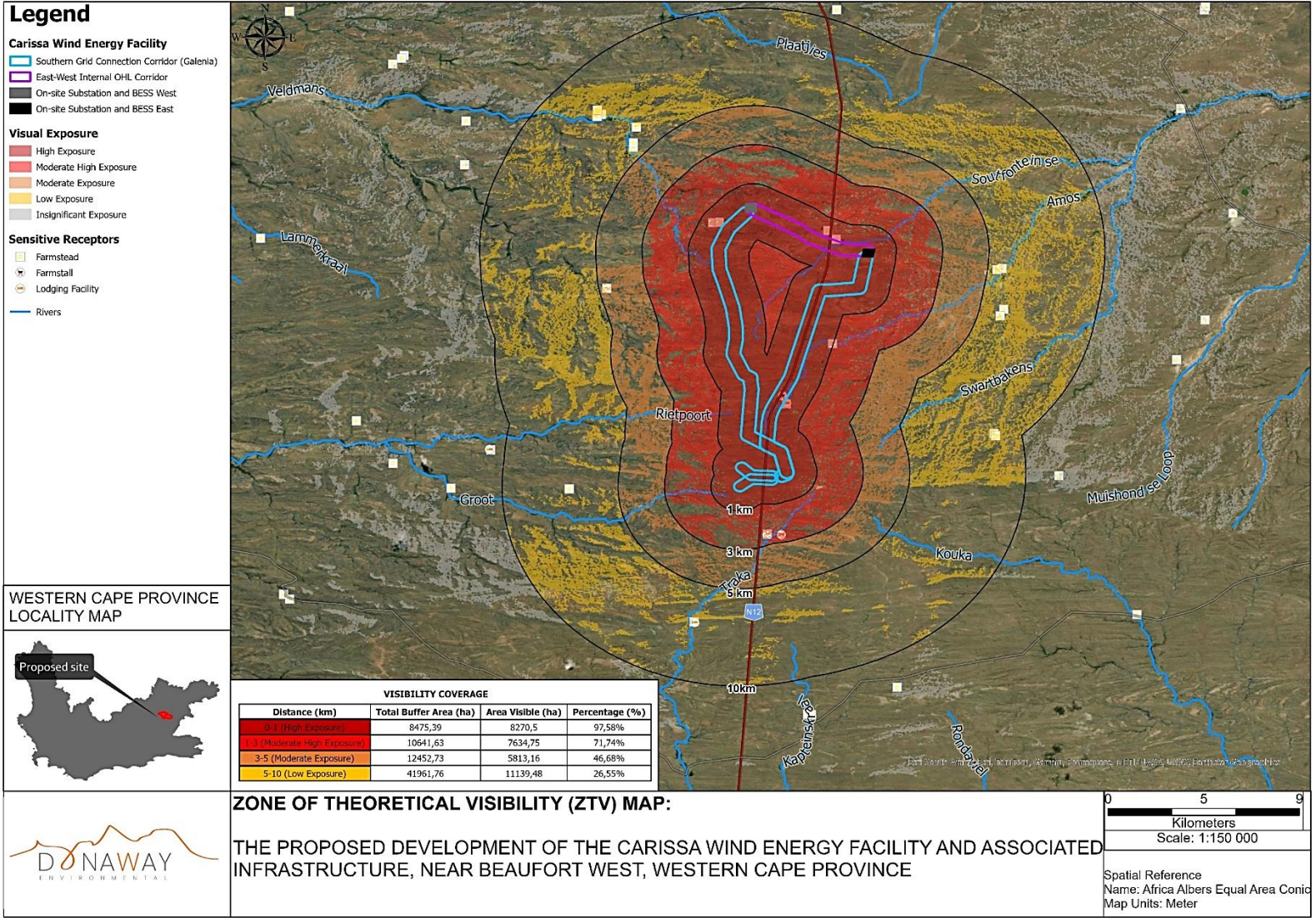


Figure 7.47: ZTV Map: Grid Connection – Option 1: Preferred

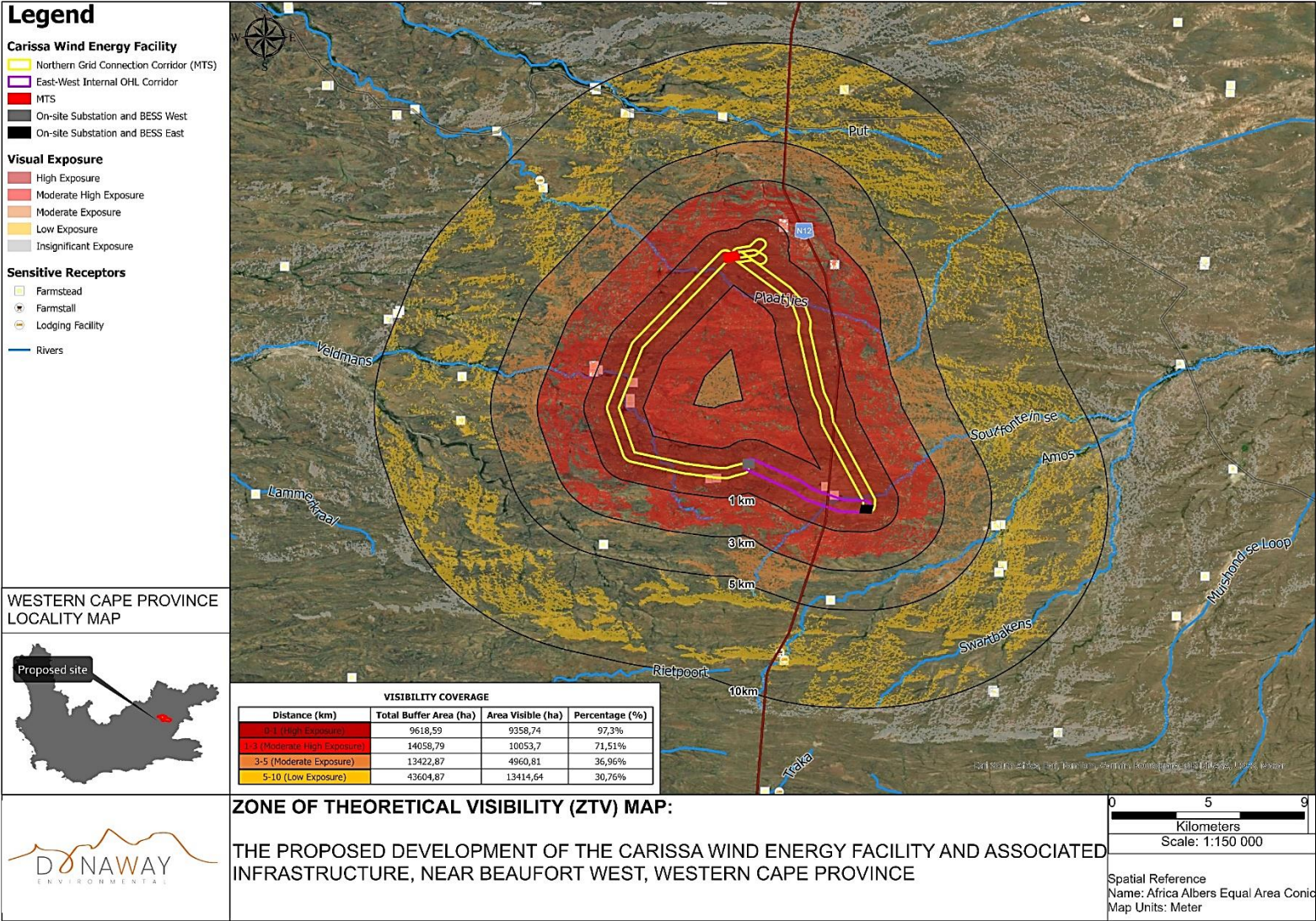


Figure 7.48: ZTV Map: Grid Connection – Option 2

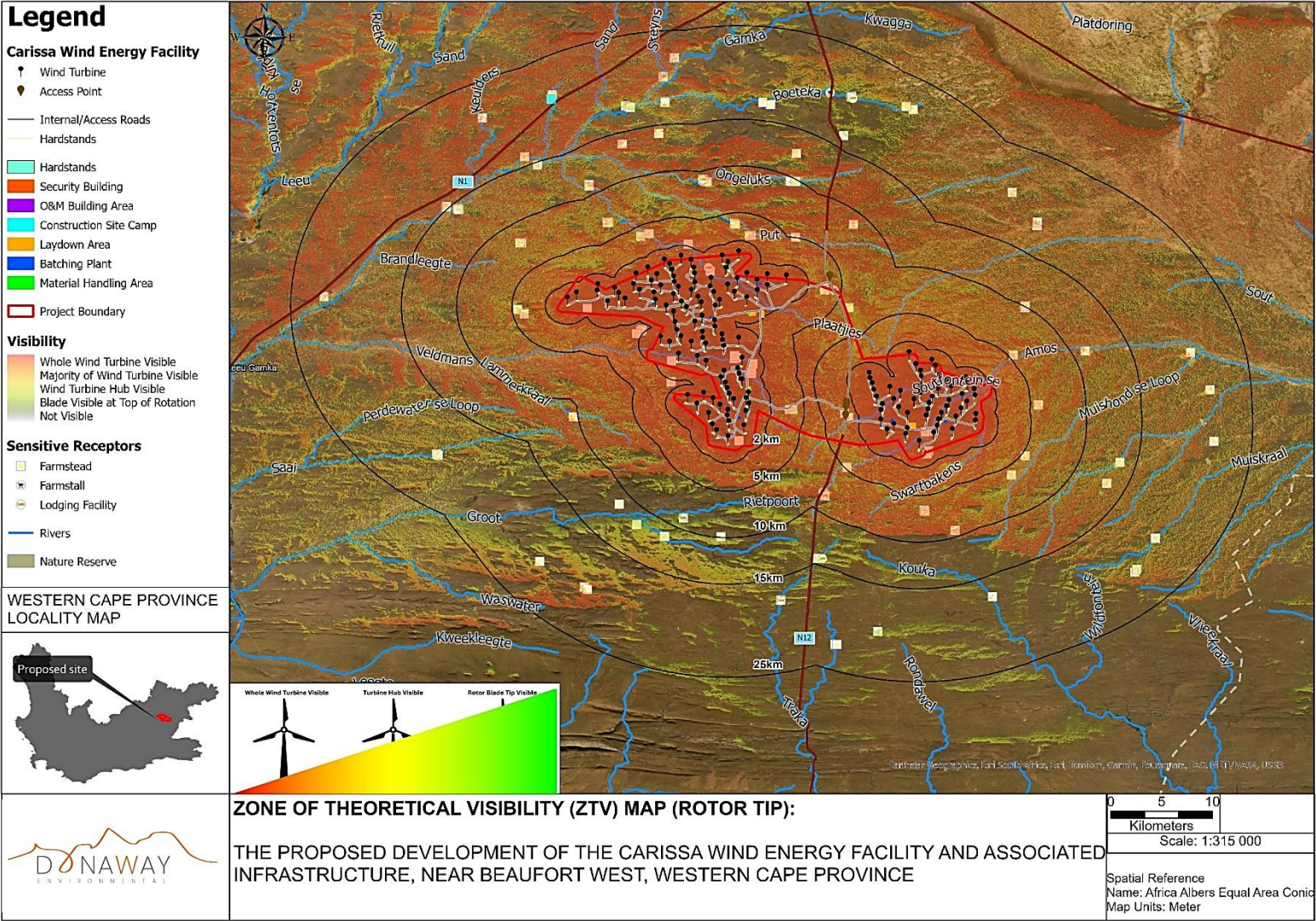


Figure 7.49: ZTV Map: Visibility of WTG Structure

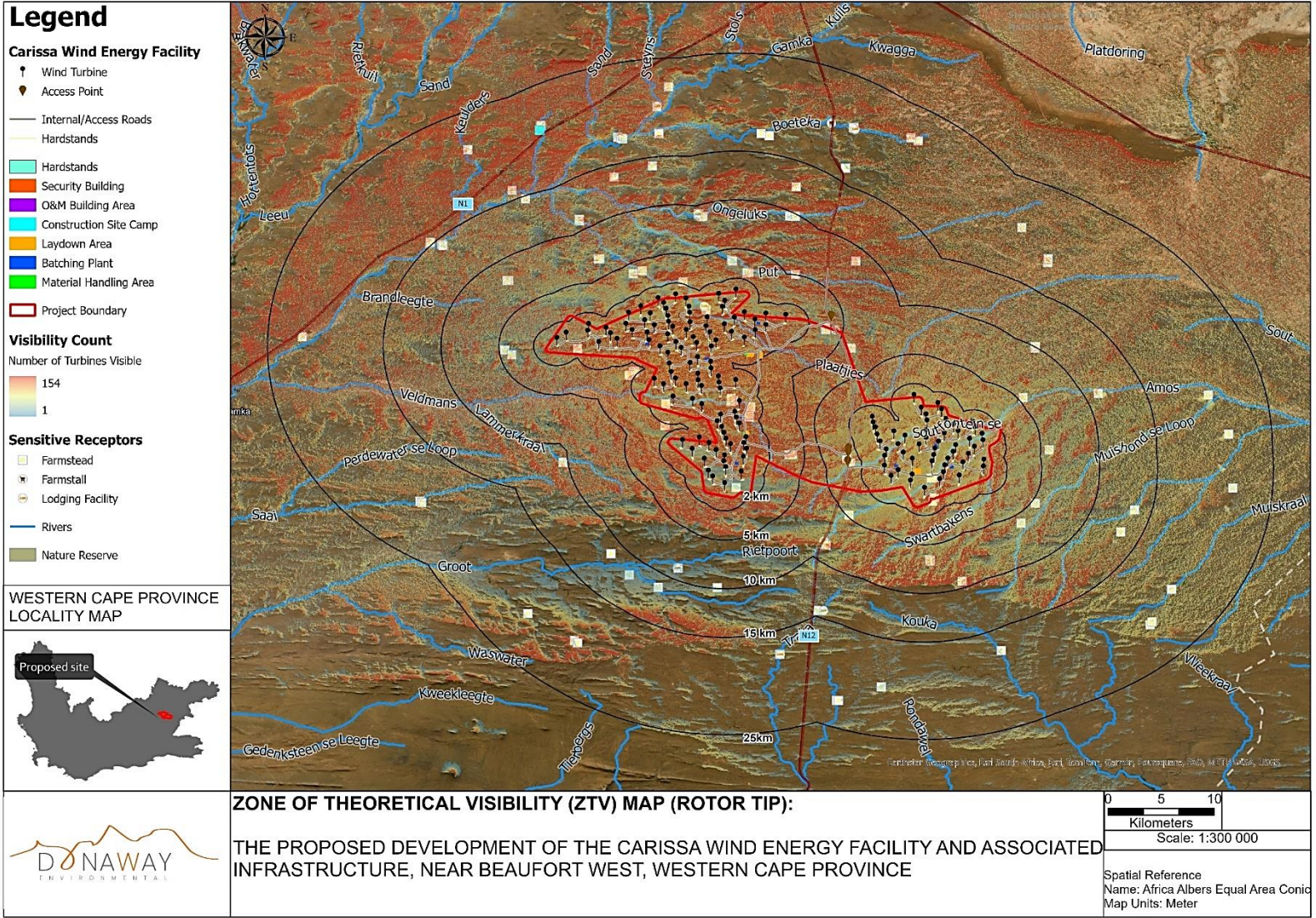


Figure 7.50: ZTV Map: Number of WTGs Visible

7.12.3 Shadow Flicker

Shadow flicker (SF) is a phenomenon resulting from the sun's position, typically when it's low on the horizon, causing its rays to pass through the rotating blades of a wind turbine. This interplay results in the projection of a dynamic, moving shadow.

This occurrence becomes a matter of concern for communities and rural residents situated in the vicinity of wind turbines when the intermittent shadow from the revolving blades extends over buildings or homes. The outcome is the perception of a recurring pattern of alternating light and dark sequences, visible through windows or in areas near buildings or homes that are used for purposes like relaxation or recreation.

Given the specific solar angles necessary for this effect to manifest, shadow flicker is relatively infrequent, only occurring in select geographic locations and during a few hours each year. However, when it does materialise, it has the potential to be a source of irritation for homeowners residing in close proximity to these turbines.

The influence of shadow flicker is generally noteworthy within a proximity of approximately 10 rotor diameters from a wind turbine. For modern wind turbines, characterised by rotor diameters ranging from 80 m to 140 m, this equates to a possible SF range of about 800 m to 1 400 m. In this case for the Carissa WEF, the rotor diameter is set to 200 m, equating to a SF range of about 2 000 meters.

SF were calculated using specific software, namely WindPro 4.0. SF receptors were identified during the site visits and using Google Earth Pro, within 2 000 m from a Wind Turbine Generator (WTG). The SF worst case and predicted scenarios, with cloud cover, were evaluated using a custom WTG model, featuring a hub height of 180 meters and a rotor diameter of 200 meters.

7.12.4 Shadow Flicker Data Results

The results do not account for rotor orientation, the presence of vegetation or other shielding factors around each sensitive receptor, nor does it consider turbine shutdown. Therefore, the adjusted shadow flicker durations presented in these results should still be viewed as a worst-case estimate.

There are 15 shadow flicker receptors within 2 000 meters of a WTG, where all 15 are likely to experience shadow flicker. The majority are located on affected properties. 13 of the receptors might experience shadow flicker above the 30 hours per annum threshold worst case with three receptors not included as affected or participating properties, while 14 receptors might experience shadow flicker above the 30 minutes per day threshold worst case with three receptors not included as affected or participating property. Additionally, it is not feasible to predict long-term weather conditions, such as wind direction and other atmospheric conditions. As a result, the actual flicker impacts may be significantly lower than those presented in this report.

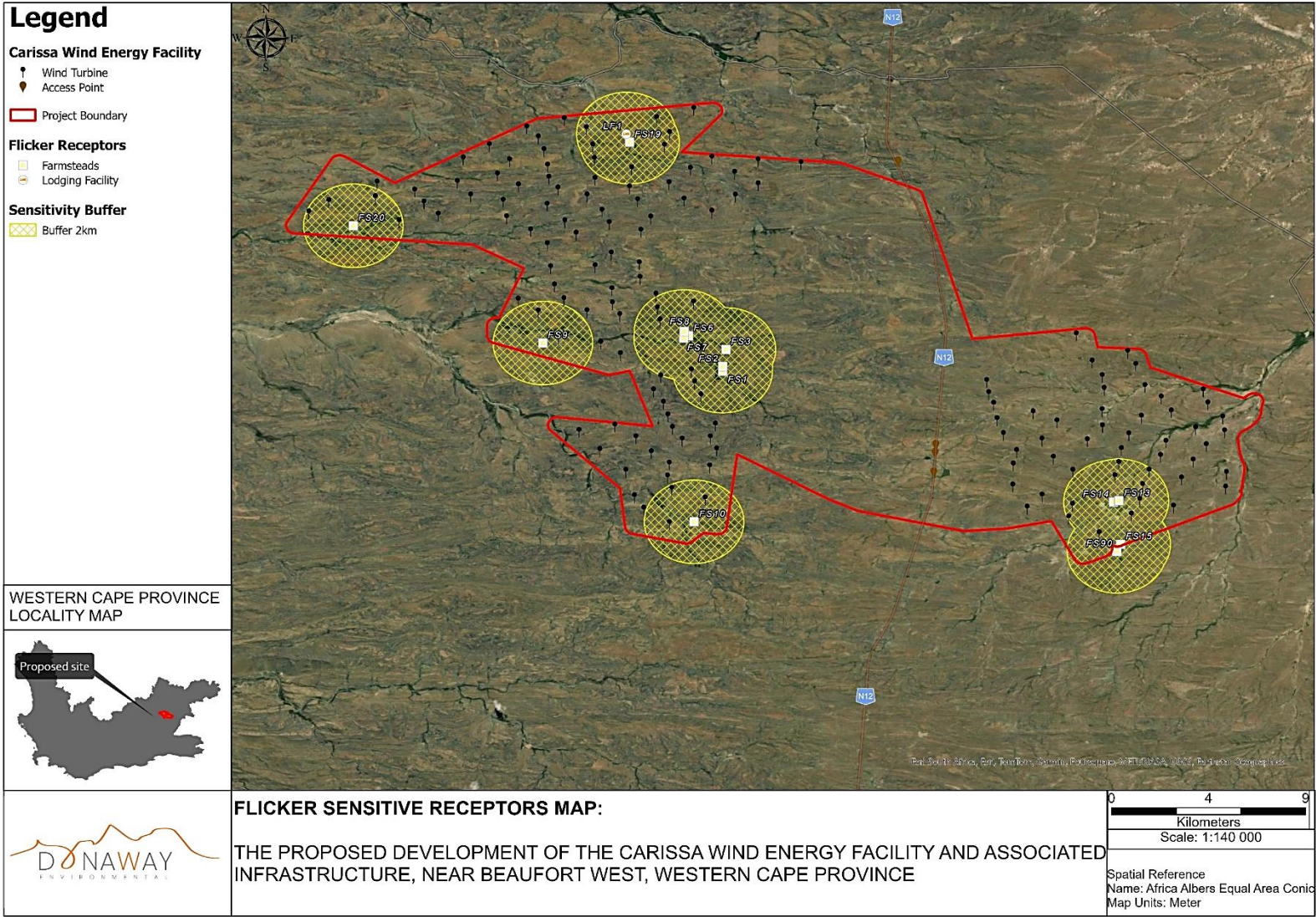


Figure 7.51: Shadow Flicker: Sensitivity Map

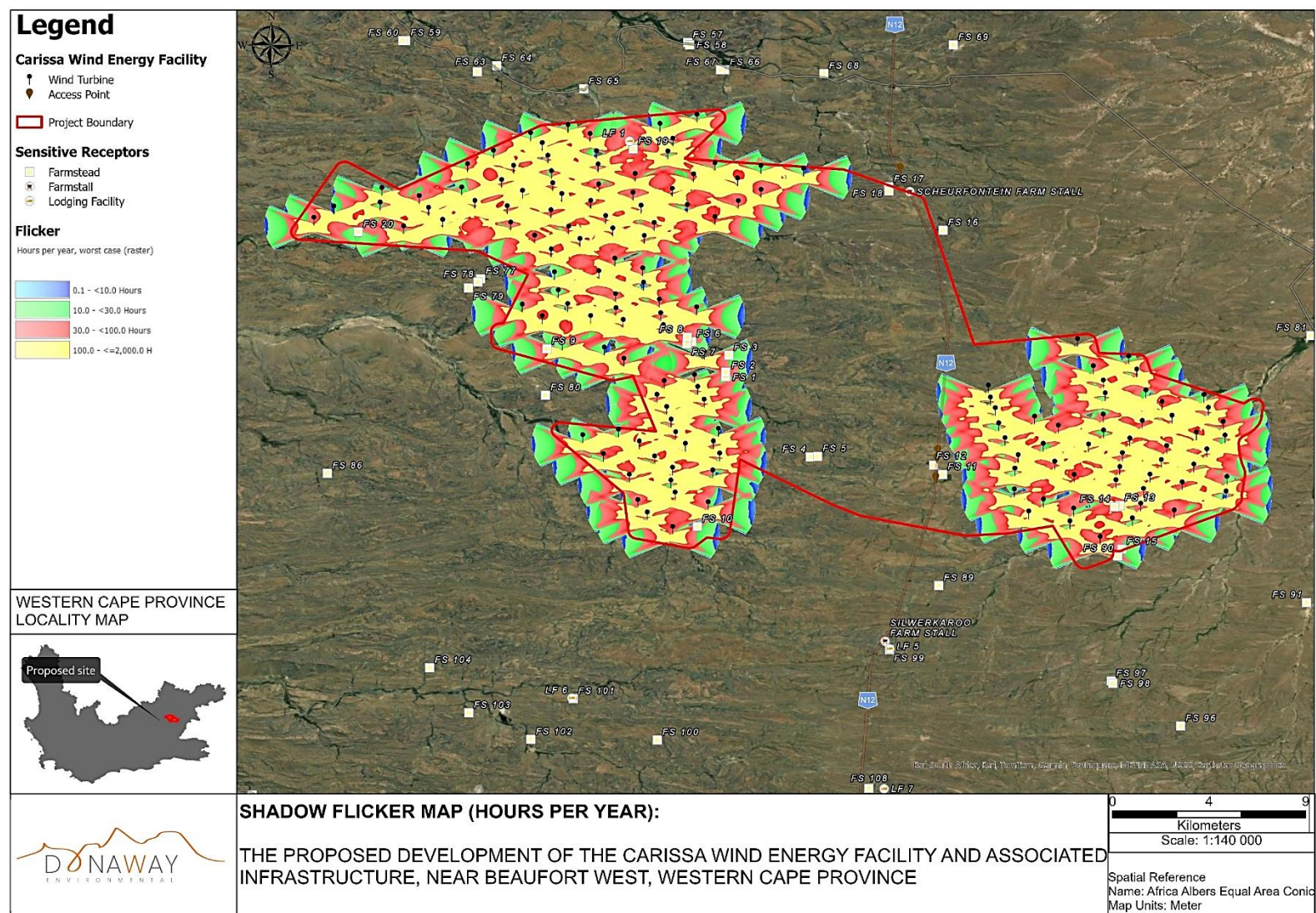


Figure 7.52: Shadow Flicker: Hours per year

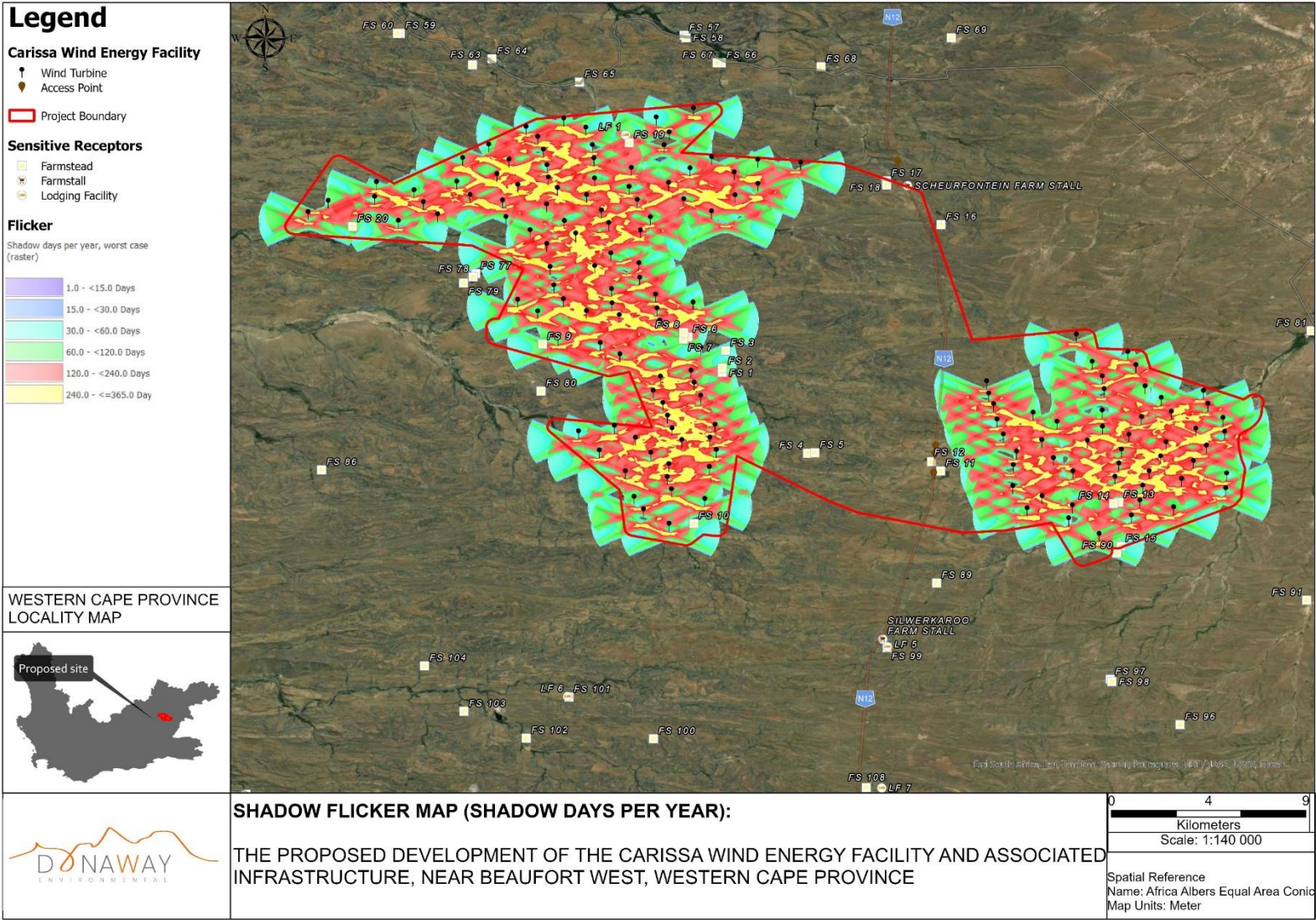


Figure 7.53: Shadow Flicker: Shadow Days Per Year

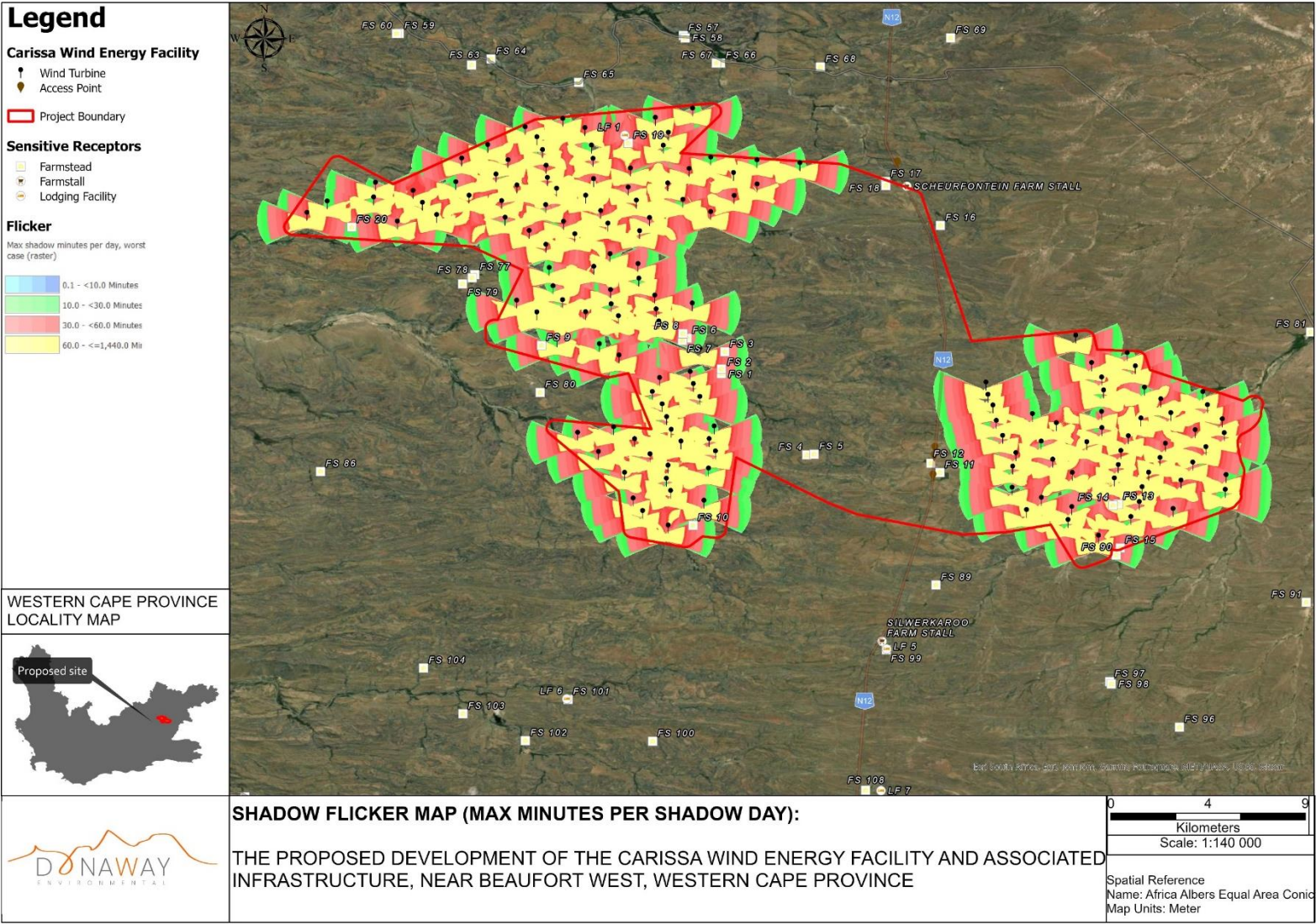


Figure 7.54: Shadow Flicker: Max Minutes Per Shadow Day

It is believed that renewable energy resources are essential to the environmental well-being of the country and planet (WESSA, 2012). Aesthetic characteristics are subjective, and some people find renewable energy facilities and their associated infrastructure pleasant and optimistic while others may find it visually invasive. Wind farms are mostly perceived as symbols of energy independence, and local prosperity.

Despite being situated in the visually sensitive and tranquil Karoo landscape, the specific area within the 25 km PAOI does not attract significant tourist attention due to its aesthetically pleasing yet unremarkable scenery. Most tourists pass through the region during peak holiday seasons, en route to more popular destinations in the Western Cape Province.

Considering all positive factors of such a development including economic factors, social factors and sustainability factors, especially in a semi-arid country, the visual impact of this proposed development might not outweigh the positive impacts, and it is suggested that the development commence, from a visual impact point of view. The impact is deemed acceptable despite the high impact. Any or both of the grid connection options can be approved.

7.13 Traffic Assessment

The existing external road network, in the vicinity of the Carissa WEF consists of the: N1 national road, N12 national road, DR02304, DR02301, DR01728 and MR00372.

Table 7.45 below provides description of the existing external road network, and Figure 7.55 provides an illustration of the network present.

Table 7.45: Existing External Road Network Description

Road Name	Road Class	Description
National Route 1 (N1)	Class R1 – Rural principal arterial	The N1 is a national route in South Africa that runs from Cape Town through Bloemfontein, Johannesburg, Pretoria, and Polokwane to Beit Bridge on the border with Zimbabwe. It should be noted that the N12 connects to this roadway to the north of the proposed Carissa WEF site. This roadway, in the vicinity of the proposed development, is a single carriageway with one lane per direction and has surfaced shoulders (and additional unsurfaced shoulder section) of either side of the road.
National Route 12 (N12)	Class R2 – Rural major arterial / rural highway	The N12 is a national route in South Africa and connects the city of George in the Western Cape (to the south) to the city of eMalalheni in Mpumalanga (to the north). It should be noted that this road runs between the eastern and western portions of the proposed Carissa WEF and connects to Beaufort West, just to the north of the facility. The roadway is surfaced, two-lane facility in the vicinity of the proposed Carissa WEF with

Road Name	Road Class	Description
		gravel shoulders provided on either side of the road.
DR01728	Class R3 – Rural minor arterial	The DR01728 is gravel road with on lane per direction. The road connects the N12 at the intersection with the DR01728, south of the proposed Carissa WEF to the town of Willowmore (to the east).
DR02304	Class R4 – Rural collector roads	DR02304 is a gravel road with one lane per direction. This roadway is located to the north, adjacent to the Carissa WEF site and serves to connect the N1 to the N12 as well as areas to the east of the N12.
DR02301		DR02301 is a gravel road with one lane per direction. This roadway is located to the south, adjacent to the Carissa WEF site and serves to connect the R353 (to the west of the proposed site) to the N7 as well as areas to the east of the N12.
MR00372		MR00372 is a gravel road that connects the town of Prince Albert, west of the proposed Carissa WEF to the N12 at the intersection with the DR01728.



There project is still at a preliminary planning stage, and as such, there is some uncertainty regarding the transportation routes that will be used by the developers for the various components that will comprise the Carissa WEF. Due to the nature of the development, it is anticipated that the WEF and large electrical components will be imported and arrive at ports of entry via ship.

Two (02) possible ports of entry have been identified from where the wind panel technology and large electrical components will be transported, namely: Cape Town and Gqeberha. The distance from Cape Town to the Carissa WEF, via road, is approximately 499 km via the N1 and N12 and from Gqeberha to the Carissa WEF is approximately 463 km via the N2 and N12.

7.14 Concluding Statement

From an environmental perspective the proposed site / development area is considered desirable despite some environmental sensitivities present. The area proposed for development exclusively consists of natural grazing. Further investigation will be undertaken to inform the detailed EIA phase of the project, as well as the facility layout / development footprint to be put forward for approval.

7.15 Legal Requirements Complied with in Section 7 as per the Requirements of the EIA Regulations, 2014 (as amended)

This section of the report includes the following information required in terms of Appendix 2: Content of the scoping report:

Requirement	Relevant Section
2(g) a full description of the process followed to reach the proposed preferred activity, site and location of the development footprint, including (iv) the environmental attributes associated with the alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects.	This chapter provides a description of the environment that may be affected by the proposed Carissa WEF. The information is provided in order to assist the reader in understanding the receiving environment within which the project is proposed, and features of the biophysical, social, and economic environment that could be directly or indirectly affected by, or alternatively could impact on, the proposed development. This chapter was supplemented by research of existing available information; information gathered from on-site investigations and as received from various specialist investigations. Copies of the specialist assessment reports are attached as Appendix E.

8 IMPACT ASSESSMENT OF POTENTIAL ISSUES

The development of Carissa WEF has the potential to impact on the affected environment within which the project is proposed. This section of the final Scoping Report identifies and explores the potential impacts and issues that may arise due to the development.

To appropriately identify, assess and, as far as possible, avoid or mitigate potential impacts and risks that may be associated with the construction, operation and decommissioning of the Carissa WEF, Blue Crane Environmental commissioned a team of independent specialists with relevant knowledge and expertise in the biophysical (i.e., biotic and abiotic) and socio-economic environments. Input was sought from the following specialist fields through the provision of independent specialist reports:

- Appendix E1: Terrestrial Biodiversity Impact Assessment
- Appendix E2: Aquatic Biodiversity Impact Assessment
- Appendix E3: Avifaunal Impact Assessment
- Appendix E4: Bat Assessment
- Appendix E5: Soil and Agricultural Impact Assessment
- Appendix E6: Visual Impact Assessment
- Appendix E7: Social Impact Assessment
- Appendix E8: Noise Impact Assessment
- Appendix E9: Heritage Impact Assessment
- Appendix E10: Paleontological Impact Assessment
- Appendix E11: Traffic Impact Assessment
- Appendix E12: Geotechnical Assessment
- Appendix E13: Risk Assessment

Construction activities lead to temporary air emissions (dust and vehicle emissions), noise related to excavation, construction and vehicle transit, solid waste generation and wastewater generation from temporary building sites and worker accommodation. In addition, Occupational Health and Safety (OHS) is an issue that needs to be effectively managed during construction in order to minimise the risk of preventable accidents leading to injuries and / or fatalities. Proper OHS risk identification and management measures should be incorporated in every project's management plan and standard Engineering, Procurement and Construction (EPC) contractual clauses.

The impacts identified by the independent specialists for the Carissa WEF are discussed in the sections below. Impacts are identified for the construction, operation and decommissioning phases as relevant. It must be noted that the impacts are assessed in terms of the development area proposed by the Applicant.

8.1 Assessment of Impacts and Issues

The impacts and issues are discussed per specialist field.

8.1.1 Potential Impacts Relating to the Geological Environment

Based on pre-liminary assessments of the geology and geotechnical nature of the site, the following negative direct impacts were identified and assessed:

Soil and/or bedrock degradation

Soil degradation is the negative alteration of the natural soil profile, usually directly or indirectly related to human activity, including erosion, excavation/removal, loosening, mixing, compaction and contamination/pollution or chemical alteration. Soil degradation negatively affects soil formation, natural weathering processes, moisture levels and soil stability. This could, in time, have a significant effect on agricultural potential and biodiversity. Soil erosion induced or increased by human activity is termed accelerated erosion and is an integral element of global soil degradation. Accelerated soil erosion is generally considered the most important impact in any development due to its potential impact on a local and regional scale (i.e., on and off site) and as a potential threat to global biodiversity. Soil erodibility – the susceptibility of soil to erosion – is a complex variable, not only because it depends on soil chemistry, texture, and characteristics, but because it varies with time and other variables, such as mode of transport (i.e., wind or water). Erosion of soil due to water run-off is generally considered as being more important due to the magnitude of the potential impact over a relatively short period of time, which can be very difficult to control or reverse. Erosion potential is typically increased in areas where soil is loosened and vegetation cover is stripped (such is the case on most construction sites). Removal of vegetation (ground cover) may increase the risk of soil erosion, making the soil less fertile and less able to support the regeneration of vegetation in future. Generally speaking, unconsolidated or partly consolidated, fine-grained soils of low plasticity occurring along or near drainage lines, on moderate to steep slopes or at the base of steep slopes are most vulnerable to severe levels of erosion due to water run-off. Areas where these factors occur are typically classified as “highly erosion-sensitive” areas. To combat erosion, special engineering measures may be required, and this may have further knock-on impacts due to additional earthworks, soil loosening, etc.

The following negative indirect impacts were also identified on the site:

- Dust pollution.
- Siltation of watercourses adjacent to or away from the site or activity areas.

Negative impacts are dominantly related to the construction phase with insignificant additional impacts in the post construction and decommissioning phases, as explained below.

Construction Phase - The construction phase typically takes 1-2 years and includes the following activities:

- Site clearing and grubbing (with the exception of protected vegetation and sensitive areas).
- Construction of site camps, access roads and construction areas.
- Electrical reticulation (trenching, cabling and/or overhead lines).
- Construction of foundations and structures.
- Construction of substation(s) and operational buildings.

Operation Phase - The following activities were envisaged during the operational phase:

- Infrastructure maintenance (mechanical & electrical).
- Road maintenance (surfacing and drainage). This could be a significant factor along roads that cross drainage lines or low-lying areas subject to flooding.
- Environmental maintenance (erosion control, etc).

Decommissioning Phase - The following activities were envisaged during the decommissioning phase:

- Disassembling structures.
- Removing equipment and infrastructure from site.

- Rehabilitating soil, vegetation and surrounds.

The proposed development also presented potential positive impacts on the geological environment (either directly or indirectly) during the operational phase, such as a reduced demand for non-renewable energy sources (such as coal, uranium) and an improvement in the status quo in terms of erosion due to improved storm water and roads engineering on the site (more specifically on highly degraded sites).

The most significant potential negative impacts on the geological environment that were identified on the site was that of soil degradation and erosion. However, all the identified impacts were assessed to have a low significance and if these impacts were successfully mitigated, the proposed activity would have a negligible impact on the environment. The proposed activity also carried a highly significant positive potential impact in the reduction for demand in non-renewable geological/fossil fuel sources.

The proposed development is supported in principle, but micro-siting may be required based on outcome of further studies.

Negative impacts can be mitigated to a large degree by the implementation of an appropriate and effective EMPr. The following generic guidelines relate specifically to the earthworks contract.

Earthworks

- Earthworks should be undertaken in accordance with the requirements set out in the EMPr.
- All earthworks shall be undertaken in such a manner to minimise the extent of any impacts caused by such activities.
- Defined access routes to and from the area of operations as well as around the area of operation shall be adhered to.
- No equipment associated with the activity shall be allowed outside of these areas unless expressly permitted by the Environmental Control Officer (ECO).
- Mechanical methods of rock breaking, including Montabehr-type breakers and jackhammers, have noise and dust impacts, and must be addressed in the EMPr.
- Residents shall be notified at least one week prior to these activities commencing, and their concerns addressed.
- Chemical breaking shall require a method statement approved by the Engineer's Representative (ER).

Topsoil

- Prior to construction, the topsoil areas to be disturbed should be stripped to a depth to be confirmed by the ER and set aside for spreading to all areas to be reinstated after the construction. Temporary topsoil stockpiles must be covered with net, shade cloth or straw bales to protect them.
- Once all grades have been finalised and prepared, topsoil should be spread evenly to all affected areas to be re-vegetated.

Erosion and Sedimentation Control

- During construction, the contractor shall protect areas susceptible to erosion by installing necessary temporary and permanent drainage works as soon as possible and by taking other measures necessary to prevent the surface water from being concentrated in streams and from scouring the slopes, banks or other areas.

- A method statement shall be developed and submitted to the ER to deal with erosion issues prior to bulk earthworks operations commencing.
- Any erosion channels developed during the construction period or during the vegetation establishment period shall be backfilled and compacted and the areas restored to a proper condition.
- Stabilisation of cleared areas to prevent and control erosion shall be actively managed. The method of stabilisation shall determine in consultation with the ECO. Consideration and provision shall be made for the following methods (or combination):
 - Brush cut packing
 - Mulch or chip cover
 - Straw stabilising
 - Watering
 - Planting/sodding
 - Hand seed-sowing
 - Hydroseeding
 - Soil binders and anti-erosion compounds
 - Gabion bolsters and mattresses for flow attenuation
 - Geofabric
 - Hessian cover
 - Log/ pole fencing
- Traffic and movement over stabilised areas shall be restricted and controlled and damage to stabilised areas shall be repaired and maintained to the satisfaction of the ECO.
- Anti-erosion compounds shall consist of all organic or inorganic material to bind soil particles together and shall be a proven product able to suppress dust and erosion. The application rate shall conform to the manufacturer's recommendations. The material used shall be approved by the ECO.

Drilling and Jack-Hammering

- The contractor shall submit a method statement detailing his proposals to prevent pollution during drilling operations. This shall be approved by the site manager prior to the onset of any drilling operations.
- The contractor shall take all reasonable measures to limit dust generation as a result of drilling operations.
- Noise and dust nuisances shall comply with the applicable standards according to the Occupational Health and safety (Act No. 85 of 1993).
- The Contractor shall ensure that no pollution results from drilling operations, either as a result of oil and fuel drips, or from drilling fluid.
- All affected parties shall be informed at least one week prior to the onset of the proposed drilling/jackhammering operations, and their concerns addressed.
- Drill coring with water or coolant lubricants shall require a method statement approved by the Site Manager.
- Any areas or structures damaged by the drilling and associated activities shall be rehabilitated by the contractor to the satisfaction of the site manager.

Trenching

- Trenching shall be kept to a minimum using single trenches for multiple service provision.
- The planning and selection of trench routes shall be undertaken in liaison with the ER and cognisance shall be given to minimising the potential for soil erosion.

- Trench routes with permitted working areas shall be clearly defined and marked with painted stakes prior to excavation.
- The stripping and separation of topsoil shall occur as stipulated by the ER. Soil shall be stockpiled for use as backfilling as directed by the ER.
- Trench lengths shall be kept as short as practically possible before backfilling and compacting.
- Trenches shall be backfilled to the same level as (or slightly higher to allow for settlement) the surrounding land surface to minimise erosion. Excess soil shall be stockpiled in an area approved by the engineer.
- Immediately after backfilling, trenches and associated disturbed working areas shall be planted with a suitable plant species and regularly watered. Where there is a particularly high erosion risk, a fabric such as Geojute (biodegradable) shall be used in addition to planting.

Dust

- The contractor shall be solely responsible for the control of dust arising from the contractor's operations and for any costs against the employer for damages resulting from dust.
- The contractor shall take all reasonable measures to minimise the generation of dust as a result of construction activities to the satisfaction of the site manager.
- Removal of vegetation shall be avoided until such time as soil stripping is required and similarly exposed surfaces shall be re-vegetated or stabilised as soon as is practically possible.
- Excavation, handling and transport of erodible materials shall be avoided under high wind conditions or when a visible dust plume is present.
- During high wind conditions the site manager will evaluate the situation and make recommendations as to whether dust damping measures are adequate, or whether working will cease altogether until the wind speed drops to an acceptable level.
- Where possible, soil stockpiles shall be located in sheltered areas where they are not exposed to the erosive effects of the wind. Where erosion of stockpiles becomes a problem, erosion control measures shall be implemented at the discretion of the site manager.
- Vehicle speeds shall not exceed 40 km/h along dust roads or 20 km/h when traversing unconsolidated and non-vegetated areas.
- Appropriate dust suppression measures shall be used when dust generation is unavoidable, e.g., dampening with water, particularly during prolonged periods of dry weather in summer. Such measures shall also include the use of temporary stabilising measures (e.g., chemical soil binders, straw, brush packs, clipping etc.)
- Straw stabilisation shall be applied at a rate of one bale/ 10 m² and harrowed into the top 100 mm of top material for all completed earthworks.

Imported Materials and Stockpiles

- Imported materials shall be free of weeds, litter and contaminants.
- Sources of imported material shall be listed and approved by the ER on site.
- The contractor shall provide samples to the ER for approval.
- Stockpile areas shall be approved by the ER before any stockpiling commences.

Tables 8.1 to 8.16 below provides the geotechnical impact assessment and mitigation measures of the potential impacts associated with the Carissa WEF.

Table 8.1: Soil Degradation by Disturbance During the Construction Phase

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated?	Is the impact acceptable?
Soil degradation by disturbance, removal, mixing, compaction, etc due to the construction of infrastructure	Before mitigation	Negative	1	4	2	2	1	1	2	22	Low (6-28)	Yes	Yes
	After mitigation	Negative	1	4	2	2	1	1	1	11	Low (6-28)		
Mitigation: <ul style="list-style-type: none">Minimise excavations and disturbance areas.Rehabilitate topsoil and vegetation around site a construction.													

Table 8.2: Soil Degradation Due to Pollution During the Construction Phase

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated?	Is the impact acceptable?
Soil degradation due to pollution by contaminants used on site during construction (fuel, oil, chemicals, cement)	Before mitigation	Negative	1	3	2	2	1	1	2	20	Low (6-28)	Yes	Yes
	After mitigation	Negative	1	3	2	2	1	1	1	10	Low (6-28)		
Mitigation: <ul style="list-style-type: none">• Provide contamination prevention systems on site.• Control use and disposal of potential contaminants or hazardous materials.• Remove contaminants and contaminated topsoil, reinstate ground levels and replace topsoil in affected areas.													

Table 8.3: Erosion by Wind and/or Water of Loosened Soil During the Construction Phase

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated?	Is the impact acceptable?
Erosion by wind and/or water of loosened soil in construction areas	Before mitigation	Negative	1	3	3	2	2	2	2	26	Low (6-28)	Yes	Yes
	After mitigation	Negative	1	3	3	2	1	1	1	11	Low (6-28)		
Mitigation: <ul style="list-style-type: none">Minimise size of the construction footprint.Avoid work in or near watercourses where possible.													

Table 8.4: Degradation of Watercourses During the Construction Phase

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated?	Is the impact acceptable?
Degradation of watercourses due to siltation (silt-loading) due to erosion from denuded construction areas	Before mitigation	Negative	2	3	3	2	2	2	2	28	Low (6-28)	Yes	Yes
	After mitigation	Negative	1	2	3	2	1	1	1	10	Low (6-28)		
Mitigation:													
<ul style="list-style-type: none">• Install anti-erosion measures such as silt fences, geosynthetic erosion protection, and/or flow attenuation along watercourses below construction sites.• Strictly control activity near water courses/natural drainage lines as sediment transport is higher in these areas (avoid construction activity in or near water- courses where possible).• Minimise increased run-off from hard surfaces by channelising and capturing rainwater for re-use (rainwater harvesting) where feasible.													

Table 8.5: Dust Pollution During the Construction Phase

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated?	Is the impact acceptable?
Dust pollution due to wind erosion from denuded construction areas	Before mitigation	Negative	2	3	3	2	2	2	1	14	Low (6-28)	Yes	Yes
	After mitigation	Negative	1	2	3	2	1	1	1	10	Low (6-28)		
Mitigation:													
<ul style="list-style-type: none">Apply dust control measures such as straw bales or dampen dusty denuded areas.													

Table 8.6: Soil Degradation by Disturbance During the Operational Phase

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated?	Is the impact acceptable?
Soil degradation by disturbance, removal, mixing, compaction, etc due to the construction of infrastructure	Before mitigation	Negative	1	4	2	2	1	1	1	11	Low (6-28)	Yes	Yes
	After mitigation	Negative	1	4	2	2	1	1	1	11	Low (6-28)		
Mitigation: <ul style="list-style-type: none">Minimise excavations and disturbance areas.Rehabilitate topsoil and vegetation around site a construction.													

Table 8.7: Soil Degradation Due to Pollution During the Construction Phase

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated?	Is the impact acceptable?
Soil degradation due to pollution by contaminants	Before mitigation	Negative	1	3	2	2	1	1	2	20	Low (6-28)	Yes	Yes

used on site during construction (fuel, oil, chemicals, cement)	After mitigation	Negative	1	3	2	2	1	1	1	10	Low (6-28)		
Mitigation: <ul style="list-style-type: none"> Provide contamination prevention systems on site. Control use and disposal of potential contaminants or hazardous materials. 													

Table 8.8: Erosion by Wind and/or Water of Loosened Soil During the Operational Phase

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated?	Is the impact acceptable?
Erosion by wind and/or water of loosened soil in construction areas	Before mitigation	Negative	1	3	3	2	2	2	1	13	Low (6-28)	Yes	Yes
	After mitigation	Negative	1	3	3	2	1	1	1	11	Low (6-28)		
Mitigation: <ul style="list-style-type: none">Minimise size of the construction footprint.Avoid work in or near watercourses where possible.Restrict activity outside of construction footprint.													

Table 8.9: Degradation of Watercourses During the Operational Phase

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated?	Is the impact acceptable?
Degradation of watercourses due to siltation (silt-loading) due to erosion from denuded construction areas	Before mitigation	Negative	2	3	3	2	2	2	1	14	Low (6-28)	Yes	Yes
	After mitigation	Negative	1	2	3	1	1	1	1	10	Low (6-28)		
Mitigation:													
● Install anti-erosion measures such as silt fences, geosynthetic erosion protection, and/or flow attenuation along watercourses below construction sites.													

Table 8.10: Dust Pollution During the Operational Phase

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated?	Is the impact acceptable?
Dust pollution due to wind erosion from denuded construction areas	Before mitigation	Negative	1	2	3	2	1	1	1	10	Low (6-28)	Yes	Yes
	After mitigation	Negative	2	3	3	2	2	2	1	14	Low (6-28)		
Mitigation:													
<ul style="list-style-type: none">Apply dust control measures such as straw bales or dampen dusty denuded areas.													

- Minimise number of disturbance areas at any one time.

Table 8.11: Reduction in the Extraction of Non-Renewable Energy Sources During the Operational Phase

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated?	Is the impact acceptable?
A reduction in the extraction of non-renewable energy sources, such as coal, uranium, etc due to the provision of	Before mitigation	Positive	4	4	1	1	3	4	3	51	High (51-73)	N/A	Yes
	After mitigation										N/A		
Mitigation:													
<ul style="list-style-type: none">• Apply dust control measures such as straw bales or dampen dusty denuded areas.• Minimise number of disturbance areas at any one time.													

Table 8.12: Soil Degradation by Disturbance During the Decommissioning Phase

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated?	Is the impact acceptable?
Soil degradation by disturbance, removal, mixing, compaction, etc due to the construction of infrastructure	Before mitigation	Negative	1	4	2	2	1	1	2	22	Low (6-28)	Yes	Yes
	After mitigation	Negative	1	4	2	2	1	1	1	11	Low (6-28)		
Mitigation:													
<ul style="list-style-type: none">• Minimise excavations and disturbance areas.• Rehabilitate topsoil and vegetation around site a construction.													

Table 8.13: Soil Degradation Due to Pollution During the Decommissioning Phase

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated?	Is the impact acceptable?
Soil degradation due to pollution by contaminants used on site during construction (fuel, oil, chemicals, cement)	Before mitigation	Negative	1	3	2	2	1	1	2	20	Low (6-28)	Yes	Yes
	After mitigation	Negative	1	3	2	2	1	1	1	10	Low (6-28)		
Mitigation:													
<ul style="list-style-type: none">• Provide contamination prevention systems on site.• Control use and disposal of potential contaminants or hazardous materials.													

Table 8.14: Erosion by Wind and/or Water of Loosened Soil During the Decommissioning Phase

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated?	Is the impact acceptable?
Erosion by wind and/or water of loosened soil in construction areas	Before mitigation	Negative	1	3	3	2	2	2	2	26	Low (6-28)	Yes	Yes
	After mitigation	Negative	1	3	3	2	1	1	1	11	Low (6-28)		
Mitigation:													
<ul style="list-style-type: none">Minimise size of the construction footprint.Avoid work in or near watercourses where possible.Restrict activity outside of construction.													

Table 8.15: Degradation of Watercourses During the Decommissioning Phase

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated?	Is the impact acceptable?
Degradation of watercourses due to siltation (silt-loading) due to erosion from denuded construction areas	Before mitigation	Negative	2	3	3	2	2	2	2	28	Low (6-28)	Yes	Yes
	After mitigation	Negative	1	2	3	1	1	1	1	10	Low (6-28)		
Mitigation:													
<ul style="list-style-type: none">Install anti-erosion measures such as silt fences, geosynthetic erosion protection, and/or flow attenuation along watercourses below construction sites.													

Table 8.16: Dust Pollution During the Decommissioning Phase

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated?	Is the impact acceptable?
Dust pollution due to wind erosion from denuded construction areas	Before mitigation	Negative	2	3	3	2	2	2	1	14	Low (6-28)	Yes	Yes
	After mitigation	Negative	1	2	3	2	1	1	1	10	Low (6-28)		
Mitigation: <ul style="list-style-type: none">• Apply dust control measures such as straw bales or dampen dusty denuded areas.• Minimise number of disturbance areas at any one time.													

8.1.2 Potential Agricultural Impacts

There is only ever a single agricultural impact of any development, and it is a net change to the future agricultural production potential of land. It occurs as a result of different mechanisms, some of which decrease production potential and some of which increase it. In most developments, the decrease in production potential is primarily caused by the exclusion of agriculture from the footprint of the development. Soil erosion and degradation may also contribute to loss of agricultural production potential, but these can be managed so as not to cause impact. The significance of a loss of agricultural production potential is a direct function of the following three factors:

1. the size of the footprint of land from which agriculture will be excluded (or the footprint that will have its potential decreased);
2. the baseline production potential (particularly cropping potential) of that land; and
3. the length of time for which agriculture will be excluded (or for which potential will be decreased).

In the case of wind farms, the first factor, size of footprint, is so small that the total extent of the loss of future agricultural production potential is insignificantly small, regardless of how much production potential the land has. This is because the required spacing between turbines means that the amount of land excluded from agricultural use is extremely small in relation to the surface area over which a wind farm is distributed. Wind farm infrastructure (including all associated infrastructure and roads) typically occupies less than 2% of the surface area, according to the typical surface area requirements of wind farms in South Africa (DEA, 2015). Most wind energy facilities, for which I have recently done assessments, occupy less than 1% of the surface area. During construction there is some disturbance to agricultural activities. Thereafter, all agricultural activities can continue unaffectedly on all parts of the farmland other than this small footprint, from which agriculture is excluded, and the actual loss of production potential is therefore insignificant.

Furthermore, the entire area impacted by the wind farm is not viable for cropping and is therefore below the threshold of needing to be conserved as agricultural production land. At the farm level, the development will provide a positive economic impact because the lease of the land to the energy facility will generate additional income without compromising agricultural production. This is likely to increase cash flow and financial security and may improve farming operations and productivity through increased investment into farming.

Due to the fact that the proposed development will not occupy scarce, viable cropland, and that its negative impact is offset by economic and other benefits to farming, the overall negative agricultural impact of the development (loss of future agricultural production potential) is assessed as being of low significance and as acceptable.

The agricultural protocol requires an indication of the potential losses in production and employment from the change of the agricultural use of the land as a result of the proposed development. As this assessment has shown, the agricultural use of the land will be integrated with the renewable energy facility, and it will continue with no discernible change in terms of production. The expected losses in production and employment will therefore be zero.

The proposed overhead power line has negligible agricultural impact, regardless of the agricultural potential and sensitivity of the land it crosses. The agricultural impact of a power line is negligible in almost all environments but is even more so where agricultural land use is predominantly grazing, which it is in the environment that is the subject of this assessment. All possible agricultural activities can continue entirely unhindered underneath the power line. The direct, permanent, physical footprint that has any potential to interfere with agriculture is confined to pylon bases and a servitude track and is therefore

insignificantly small. The only potential source of impact of the power line is minimal disturbance to the land (erosion and topsoil loss) during construction (and decommissioning). This impact can be completely prevented with standard, generic mitigation measures that are all inherent in the project engineering and/or are standard, best-practice for construction sites, and are included in the generic EMPr developed by DFFE. The power line will result in negligible loss of future agricultural production potential and its agricultural impact is therefore assessed as being of very low significance and as acceptable.

An Agricultural Agro-Ecosystem Specialist Assessment is required by the protocol to identify the extent of the impact of the proposed development on agricultural resources. The assessment of impacts in an environmental impact assessment is done according to a prescribed, semi-quantitative rating methodology that is supposed to cover all specialist disciplines and allow comparison of the impacts across them. However, the system was designed for biological components of the ecosystem such as plants and animals and does not rate agricultural impacts in a sensible or particularly useful way. As has been discussed above, the significance of the agricultural impact is simply the degree to which the future agricultural production potential of the site will be changed and that is predominantly a function of the size of the area of land that is impacted and the production potential of that impacted land. The dominant factor in this case is the insignificant size of the area of land that is impacted. The prescribed methodology complicates and obscures what is actually a simple and straight forward assessment. Aspects of the prescribed methodology, such as probability, do not make sense and tend to skew the calculation of significance. Other aspects of agricultural impact, such as compliance with the prescribed allowable development limits, are much more important and relevant for determining the significance of the agricultural impact.

The most important and effective mitigation of agricultural impacts for any development is avoidance of viable, potential cropland. This development has already applied this mitigation by locating the facility where it avoids all viable, potential cropland in the area.

There are no additional mitigation measures required, over and above what has already been included in the *Generic Environmental Management Programme (EMPr) For The Development And Expansion For Overhead Electricity Transmission And Distribution Infrastructure and the Generic Environmental Management Programme (EMPr) For Substation Infrastructure For The Transmission And Distribution Of Electricity*, as per Government Notice 435, which was published in Government Gazette 42323 on 22 March 2019.

Generic mitigation measures that are effective in preventing soil degradation are all inherent in the engineering of such a project and/or are standard, best-practice for construction sites. These include:

- A system of storm water management, which will prevent erosion on and downstream of the site, will be an inherent part of the engineering design on site. Any occurrences of erosion must be attended to immediately and the integrity of the erosion control system at that point must be amended to prevent further erosion from occurring there.
- Any excavations done during the construction phase, in areas that will be re-vegetated at the end of the construction phase, must separate the upper 20 cm of topsoil from the rest of the excavation spoils and store it in a separate stockpile. When the excavation is back-filled, the topsoil must be back-filled last, so that it is at the surface. Topsoil should only be stripped in areas that are excavated. Across the majority of the site, including construction lay down areas, it will be much more effective for rehabilitation, to retain the topsoil in place. If levelling requires significant cutting, topsoil should be temporarily stockpiled and then re-spread after cutting, so that there is a covering of topsoil over the entire cut surface.

The inputs to the EMPr are detailed in the tables below for each development phase.

Table 8.17: Management Plan for the Planning and Design Phase

Impact	Mitigation / management objectives and outcomes	Mitigation / management actions	Monitoring		
			Methodology	Frequency	Responsibility
Aspect: Protection of soil resources					
Erosion	That disturbance and existence of hard surfaces causes no erosion on or downstream of the site.	Design an effective system of storm water run-off control, where it is required - that is at any points where run-off water might accumulate. The system must effectively collect and safely disseminate any run-off water from all accumulation points, and it must prevent any potential down slope erosion.	Ensure that the storm water run-off control is included in the engineering design.	Once-off during the design phase.	Holder of the EA

Table 8.18: Management Plan for the Construction Phase

Impact	Mitigation / management objectives and outcomes	Mitigation / management actions	Monitoring		
			Methodology	Frequency	Responsibility
Aspect: Protection of soil resources					
Erosion	That disturbance and existence of hard surfaces causes no erosion on or downstream of the site.	Implement an effective system of storm water run-off control, where it is required - that is at any points where run-off water might accumulate. The system must effectively collect and safely disseminate any run-off water from all accumulation points and it must prevent any potential down slope erosion.	Undertake a periodic site inspection to verify and inspect the effectiveness and integrity of the storm water run-off control system and to specifically record the occurrence of any erosion on site or downstream. Corrective action must be implemented to	Monthly during construction phase	Environmental Control Officer (ECO)

Impact	Mitigation / management objectives and outcomes	Mitigation / management actions	Monitoring		
			Methodology	Frequency	Responsibility
			the run-off control system in the event of any erosion occurring. Photo evidence required.		
Erosion	That vegetation clearing does not pose a high erosion risk.	Maintain where possible all vegetation cover and facilitate re-vegetation of denuded areas throughout the site, to stabilise disturbed soil against erosion.	Undertake a periodic site inspection to record the occurrence of and re-vegetation progress of all areas that require re-vegetation. Photo evidence required.	Every 4 months during the construction phase	ECO
Topsoil loss	That topsoil loss is minimised	If an activity will mechanically disturb the soil below surface in any way, then any available topsoil should first be stripped from the entire surface to be disturbed and stockpiled for re-spreading during rehabilitation. During rehabilitation, the stockpiled topsoil must be evenly spread over the entire disturbed surface.	Record GPS positions of all occurrences of below-surface soil disturbance (e.g., excavations). Record the date of topsoil stripping and replacement. Check that topsoil covers the entire disturbed area. Photo evidence required.	As required, whenever areas are disturbed.	ECO

Table 8.19: Management Plan for the Operational Phase

Impact	Mitigation / management objectives and outcomes	Mitigation / management actions	Monitoring		
			Methodology	Frequency	Responsibility
Aspect: Protection of soil resources					
Erosion	The existence of hard surfaces causes no erosion on or downstream of the site.	Maintain the storm water run-off control system. Monitor erosion and remedy the storm water control system in the event of any erosion occurring.	Undertake a periodic site inspection to verify and inspect the effectiveness and integrity of the storm water run-off control system and to specifically record the occurrence of any erosion on site or downstream. Corrective action must be implemented to the run-off control system in the event of any erosion occurring. Photo evidence is required.	Once per month during the dry season and after any rain events during the dry season. Weekly during the wet season.	Facility Environmental Manager , onsite ECO
Erosion	That denuded areas are re-vegetated to stabilise soil against erosion	Facilitate re-vegetation of denuded areas throughout the site	Undertake a periodic site inspection to record the progress of all areas that require re-vegetation. Photo evidence is required.	Bi-annually	Facility Environmental Manager , onsite ECO

Table 8.20: Management Plan for the Decommissioning Phase

Impact	Mitigation / management objectives and outcomes	Mitigation / management actions	Monitoring		
			Methodology	Frequency	Responsibility
Aspect: Protection of soil resources					
Erosion	That disturbance and existence of hard surfaces causes no erosion on or downstream of the site.	Implement an effective system of storm water run-off control, where it is required - that is at any points where run-off water might accumulate. The system must effectively collect and safely disseminate any run-off water from all accumulation points, and it must prevent any potential down slope erosion.	Undertake a periodic site inspection to verify and inspect the effectiveness and integrity of the storm water run-off control system and to specifically record the occurrence of any erosion on site or downstream. Corrective action must be implemented to the run-off control system in the event of any erosion occurring.	Every 2 months during the decommissioning phase, and then every 6 months after completion of decommissioning, until final sign-off is achieved.	ECO
Erosion	That vegetation clearing does not pose a high erosion risk.	Maintain where possible all vegetation cover and facilitate re-vegetation of denuded areas throughout the site, to stabilise disturbed soil against erosion.	Undertake a periodic site inspection to record the occurrence of and re-vegetation progress of all areas that require re-vegetation.	Every 4 months during the decommissioning phase, and then every 6 months after completion of decommissioning, until final sign-off is achieved.	ECO
Topsoil loss	That topsoil loss is minimised	If an activity will mechanically disturb the soil below surface in any way, then any available topsoil should first be stripped from the entire surface to be disturbed and stockpiled for re-	Record GPS positions of all occurrences of below-surface soil disturbance (e.g., excavations). Record the date of topsoil stripping and	As required, whenever areas are disturbed.	ECO

Impact	Mitigation / management objectives and outcomes	Mitigation / management actions	Monitoring		
			Methodology	Frequency	Responsibility
		spreading during rehabilitation. During rehabilitation, the stockpiled topsoil must be evenly spread over the entire disturbed surface.	replacement. Check that topsoil covers the entire disturbed area.		

8.1.3 Potential Impacts on Terrestrial Biodiversity

Anthropogenic activities drive habitat destruction causing displacement of fauna and flora and possibly direct mortality. Land clearing destroys local wildlife habitat and can lead to the loss of local breeding grounds, nesting sites and wildlife movement corridors such as rivers, streams and drainage lines, or other locally important features. The removal of natural vegetation may reduce the habitat available for fauna species and may reduce animal populations and species compositions within the area.

The development of the area could result in the loss or degradation of the habitat, ecosystem and vegetation which is expected to support a number of flora and fauna SCC species. The construction of the WEF could also lead to the displacement/mortalities of the fauna and more specifically SCC fauna species. The operation of the facility could result in the disruption of ecological life cycles. This could be as a result of a number of things, but mainly due to dust, noise, light pollution and collisions. The disturbance of the soil/vegetation layer will allow for the establishment of flora alien invasive species. In turn, the new infrastructure could provide refuge for invasive/feral fauna species. Erosion is another possible impact that could result from the disturbance of the topsoil and vegetation cover. A number of machines, vehicles and equipment will be required, aided by chemicals and concrete mixes for the project. Leaks, spillages or breakages from any of these could result in contamination of the receiving water resources. Contaminated water resources are likely to have an effect on the associated biota. The significance of these impacts will be determined during the detailed EIA phase.

8.1.4 Potential Impacts on Avifauna

The following potential avifaunal impacts are identified.

8.1.4.1 *Displacement through disturbance*

Disturbance during the construction, operational and decommissioning phases can negatively affect all avifauna on an individual or population level by increasing stress, decreasing food and habitat availability, causing displacement into potentially less suitable neighbouring environments, and ultimately potentially decreasing reproductive success (Bennun, et al., 2021; Jenkins, et al., 2017; Madders & Whitfield, 2006; Marques, et al., 2021). An avoidance of the WEF at a macro scale (barrier effect), can lead to displacement, but can also lead to no response (if the bird avoiding the WEF area does not alter its habitat use otherwise) (Laranjeiro, et al., 2018; May, 2015).

In a review of 71 peer-reviewed studies on displacement in Europe and North America (Marques, et al., 2021) about half of these studies found no effects of displacement, 40.6% found displacement effects and 7.7% found attraction effects, i.e., an increased abundance at the site during operation against pre-application results. A study on long-established wind farms in India indicates that certain bird species avoided wind-turbine dominated sites, affecting their distribution pattern (Kumara, et al., 2022). Displacements effects have been reported for large raptors in other countries, but the studies are often inconclusive due to lack of baseline and collision data.

Five of eight wind farms in a study in South Africa in 2017 (Ralston-Paton, 2017) reported an increase in the total number of species on site after construction, even though this difference was not statistically significant.

Different species vary in their susceptibility to disturbance. The risk of displacement from disturbance is higher for shy, secretive species not habituated to human activities. For this project, disturbance is of particular concern due to the confirmed occurrence of SCC in the area which are locally breeding resident species, such as Secretarybird (Endangered), Martial Eagle (Endangered), Verreaux's Eagle

(Vulnerable), Karoo Korhaan (Near-Threatened) and Blue Crane (Near-Threatened). One case study suggests Martial Eagle are not sensitive to displacement by operation (Simmons & Martins, 2024). Blue Crane and Jackal Buzzard also do not appear to be sensitive to displacement by disturbance as successful breeding was recorded at an operational WEF, and Jackal Buzzard has the highest mortality rate across WEFs in South Africa (Ralston-Paton, 2023; Perold, et al., 2020). There is no consistent evidence that Verreaux's Eagle avoid operational wind farms with some sites recording increased flight activity after construction, while other sights recorded decreased flight activity (Ralston-Paton & Murgatroyd, 2021).

To date too little evidence has been gathered and published to determine the impact of disturbance for the Priority Species that occur at this site, and a precautionary approach must be taken.

The impact of disturbance on avifauna is rated as negative. Without mitigation the impact is definite to occur and could affect avian species beyond the site boundary at a local scale during all phases. Due to the potential impact on the breeding success of SCC this could lead to a marginal irreplaceable loss which could be only partially reversible. The impact would last for the duration of each phase and is potentially of high magnitude for breeding SCC. According to the impact assessment methodology this would result in an impact of medium negative significance.

Mitigation

Disturbance can be managed and mitigated most effectively at the design stage by avoiding important nesting, roosting and foraging areas of sensitive species during site selection and layout design, which has been achieved for the proposed development (avoidance). The disturbance footprint can be minimised by restricting activities to the smallest possible footprint and demarcating this area, with outside areas declared no-go areas during all phases. A pre-construction avifaunal walkthrough conducted within the month prior to commencement of construction can mitigate residual impacts by identifying areas that require additional mitigation during construction and limit negative impacts on sensitive species.

With the above avoidance, minimisation and mitigation the extent of the impact can be restricted to the site, the probability can be reduced to possible, with no irreplaceable resources lost. As no breeding SCC would be affected the magnitude of the impact would likely be low.

The impact of disturbance on avifauna is rated as of medium negative significance without mitigation which can be reduced to a low negative impact significance with mitigation.

8.1.4.2 Displacement through habitat loss

The construction of the proposed development will require the transformation of indigenous vegetation. Any transformation of vegetation leads to habitat loss for avian species utilising that vegetation, causing displacement into areas which are potentially less suitable or already occupied by competing individuals or species (Frid & Dill, 2002; Percival, 2005; Dwyer, et al., 2018). Once constructed, the development infrastructure, and any available perches within the facility may be used as nesting and roosting substrate by some less-sensitive species and create new habitat, which would be lost during decommissioning.

Many bird species will persist within the operational WEF site, due to the relatively small footprint, compared to the size of the development area of 41 699 ha, however, avian species sensitive to disturbance will be displaced from the area. Habitat loss would have the greatest impact on sensitive terrestrial species such as Ludwig's Bustard, Karoo Korhaan, Southern Black Korhaan.

The impact of habitat loss on avifauna is negative and would affect the site directly and surrounding areas indirectly through displacement. Therefore, the spatial extent of the impact is rated as local. Habitat loss is definite to occur and may impact SCC. Reversibility is partly possible with rehabilitation and the loss of irreplaceable resources could be significant for certain breeding SCC, but if these areas are avoided the loss of irreplaceable resources would be potentially marginal. The impact will persist for the lifetime of the facility and is therefore rated as long-term with and without mitigation measures. The operational phase of the development has therefore not been rated, as the impact will persist from the construction phase. The magnitude of habitat loss for the construction phase is potentially high if habitat loss occurs within SCC breeding areas. For the decommissioning phase the magnitude is potentially medium if SCC are breeding within the facility. This can be mitigated to a low magnitude.

Mitigation

Mitigation of habitat loss from construction of the facility is mainly achieved through site selection and the avoidance of sensitive areas, as was achieved for this project. Following site selection (avoidance), minimisation is only marginally possible by retaining as much of the indigenous vegetation as possible, minimising the footprint of all associated infrastructure, including buildings, electrical infrastructure and the width and length of roads. Residual impacts can be mitigated by rehabilitating as many disturbed areas as possible following construction. Before construction and decommissioning an avifaunal walkthrough can identify any active nesting and breeding sites, which must be protected until the breeding has concluded. Installed infrastructure should be of a bird-friendly design with anti-perching structures installed and electricity pylons that do not offer nesting opportunities.

The impact of displacement from habitat loss on avifauna is rated as of potentially high negative significance without mitigation which can be reduced to a medium negative impact significance with mitigation.

8.1.4.3 Mortality from collisions with turbines

Bird collisions with wind turbine blades has been well documented worldwide and can be devastating to avian populations in certain locations (Drewitt & Langston, 2006; Dwyer, et al., 2018; Laranjeiro, et al., 2018). Birds can collide with wind turbines and the monopoles if they do not avoid them (Kunz, et al., 2007), and their ability to avoid turbines can be site-, species- and weather- and turbine-specific (Cook et al. 2014, Drewitt & Langston 2006, Marques et al. 2014). Mortalities from collisions with turbines can vary greatly between sites (Sovacool, 2009) and the effect of mortalities on the species population can vary greatly depending on the species resilience, with large-bodies, long-living species with a low reproductive rate and slow maturation rates being disproportionately affected. In addition to being more prone to collisions due to body size, even low fatality rates can have population-level effects, particularly for already heavily impacted upon SCC (Carrete, et al., 2009; Drewitt & Langston, 2006; Marques, et al., 2014).

A high number of species is affected in South Africa with 130 species from 46 families having been recorded as turbine collision mortalities (Perold, et al., 2020). The same study suggests that some 42% of species recorded during pre-application monitoring will be affected during the lifetime of the facility. Diurnal raptors were most affected making up 36% of carcasses with 23 species recorded, followed by passerines (30%, 49 species), waterbirds (11%, 24 species), swifts (9%, six species), large terrestrial birds 5%, 10 species), pigeons and other near passerines (5%, 13 species) (Perold, et al., 2020)

Monitoring at operational wind farms in South Africa has recorded fatalities of priority species that occur at the proposed WEF, including African Fish Eagle, African Harrier-hawk, Amur Falcon, Blue Crane (Vulnerable), Black-chested Snake Eagle, Black-shouldered Kite, Booted Eagle, Common Buzzard, Jackal

Buzzard, Lanner Falcon (Vulnerable), Ludwig's Bustard (Endangered), Martial Eagle (Endangered), Pale Chanting Goshawk, Rock Kestrel, Secretarybird (Endangered), Southern Black Korhaan (Vulnerable), Spotted Eagle-Owl, Tawny Eagle (Endangered), and Verreaux's Eagle (Vulnerable) (Ralston-Paton, 2023). It must however be assumed that all priority species potentially occurring and confirmed in the area are potentially affected.

Collisions with wind turbines is a negative operational phase impact. The impact is rated as long-term for the lifetime of the facility with potential effects on national populations. It is deemed probable that collisions of priority species with turbines will occur without mitigation and the magnitude of the impact occurring is high and could lead to a significant loss of SCC, which is partly reversible, resulting in a high negative impact significance without mitigation.

Mitigation

The main mitigation measure for the avoidance of collisions is the placement of turbines outside of areas likely to be frequented by collision-prone bird species. Therefore, a raptor nest survey (conducted previously by a different specialist), a specialist site inspection and one year of avifaunal pre-construction monitoring in line with all applicable Best Practice Guidelines, were completed prior to the selection of the facility site and recommendations were made in the Final Monitoring Report to inform the design of the turbine layout for this project.

The proposed turbine layout avoids all areas identified as no-turbine areas. The risk of collisions is deemed to be slightly higher in the areas identified as medium sensitivity areas, where increased flight activity by a number of priority species was recorded, and it is recommended to avoid or minimise development in these areas. The proposed layout largely avoids the identified areas with 11 turbines proposed within these areas. While this is deemed acceptable, the risk of adaptive mitigation being required for these turbines is higher than for the remaining 143 turbines.

Proactive minimising mitigation measures include habitat management measures, such as removing artificial rock piles used by eagle prey, minimising perching and nesting opportunities within the facility, blade painting and implementing post-construction monitoring. The painting of one turbine blade in a different colour has shown to lower collisions by raptors successfully (May et al. 2020), and this is currently being implemented retrospectively (in-situ) at one WEF in South Africa. As this mitigation is potentially highly effective, proactively painting the blades turbines prior to construction, at a fraction of the cost of a reactive approach is highly recommended.

Post-construction and operational phase monitoring according to Best Practice Guidelines applicable at the time of commencement of construction is required, in order to determine what mortalities are occurring, and if any additional adaptive (reactive) management mitigation measures are required, such as curtailment of certain turbines (shutting down during certain times/seasons/conditions) or SDOD when flight activity by SCC is observed by observers or automated devices.

Pale Chanting Goshawk was the species flying at risk height for the longest duration and the species likely occurs across the WEF site. Records often involved more than one individual. Pale Chanting Goshawk appears to be prone to collisions with turbine blades, with fatalities recorded (Ralston-Paton, 2023), but is a common and widespread species, and not red-listed. Nevertheless, the cumulative impact of wind energy facilities on this species could become a concern in the future.

Greater Kestrel was recorded with the second longest duration at risk height, but with a relatively low passage rate. This was due to continuous flight of a pair over a duration of several hours. Greater Kestrel

is a common and widespread species that is not of conservation concern, for which no fatalities at wind energy facilities have been published (Perold, et al., 2020; Ralston-Paton, 2023).

Long durations of flight at risk height were also recorded for Jackal Buzzard which is deemed the most at-risk species for collisions at the proposed WEF site, as it appears to be particularly prone to collisions and occurs across the WEF site (Perold et al. 2020). This may be a function of their relatively high abundance in South Africa in relation to other larger raptors and their flight behaviour. While not a threatened species (yet), Jackal Buzzard are endemic to southern Africa and some mortalities at the proposed WEF are expected to occur, despite the implementation of a 1 km nest buffer surrounding a Jackal Buzzard nest, and with blade painting. Mortalities from the proposed development layout are unlikely to have an unacceptable impact at a population or regional level to this widespread species with a population of tens of thousands and are deemed acceptable. However, cumulative national and regional impacts (which are beyond the scope of this assessment) to this species are a growing concern, which highlights the importance of submitting all post-construction reporting to Birdlife South Africa and the Department of Forestry, Fisheries and the Environment (DFFE). Adaptive mitigation may be required should mortalities occur above a threshold determined by avifaunal specialists in consultation with Birdlife SA, the EWT, and the DFFE.

Ludwig's Bustard (Endangered) was the most frequently recorded species flying at risk height with a passage rate of 0.183 birds per hour. Despite bustards being known to be highly prone to collisions with overhead power lines (Shaw, et al., 2021; Silva, et al., 2022), Ludwig's Bustard does not appear to be as susceptible to collisions with turbine blades, with 6 collisions with turbine blades recorded to date at 7 of 33 wind energy facilities with a total of 1 416 turbines over eight years of data collected (Ralston-Paton, 2023). While the actual number of fatalities from collisions is likely to be higher, this is a relatively small number for a large-bodies species whose carcass is easy to detect and likely occurs across the country at the majority of the 33 facilities included in the dataset.

Secretarybird (Endangered) was recorded breeding on site with 4 nests identified and a recorded passage rate at risk height of 0.019 birds per hour. Most of these flights were within 2 km of the identified nests. Secretarybird is a terrestrial foraging species but holds large territories through which they fly from and between feeding areas to roost or nesting areas. Secretarybirds typically utilise a nest for approximately up to 5 years, after which the nest usually collapses, and another site is chosen (Dean & Simmons, 2005). It is assumed that breeding sites are located within good foraging habitat and may be reused in the future (Brink, 2022), and development should therefore also exclude inactive nest sites. According to BirdLife SA's guidance (Brink, 2022) a 1 km no-go buffer around breeding sites was therefore recommended to reduce disturbance and displacement and to protect suitable breeding habitat, and no active turbines or overhead powerlines should be located within 2 km of active breeding sites. Construction activities during the breeding season should also be minimised within 2 – 3 km of active nests (BirdLife SA 2022). Therefore, a minimum 1 km no-go buffer was recommended for all Secretarybird nests to protect the breeding habitat, and a maximum 2 km high sensitivity buffer (no turbines and no overhead power lines) was recommended for the active nests. As the locations of nests will again change, the facility will require continuous monitoring for Secretarybird nest activity for the lifetime of the facility, and strict mitigation measures will need to be applied to turbines within 2 km of active nests, such as curtailment during certain times of day during the breeding season, or observer-based or technology-based SDOD. The proposed development layout completely avoids all areas within 2 km of Secretarybird nests and is therefore deemed acceptable for this species. It is however unknown if the avoidance, blade painting and post-construction monitoring mitigations recommended will be sufficient and additional adaptive mitigation measures such as SDOD may be required based on the results of operational phase monitoring.

Black Harrier (Endangered) was recorded singly during setup, the first and second survey (March, April and June), which is before their breeding season. This indicates that one or more individuals were moving through the area on their migratory route from their eastern non-breeding areas to their south-western breeding grounds. Black Harrier breed mainly in south-western South Africa and start moving eastwards relatively quickly to Lesotho and the Eastern Cape following their breeding season (around mid - November to mid-December) and return to their breeding grounds, often at a slower and meandering pace around May to July, with the timing being weather dependant (Simmons, et al., 2020). Therefore, it is likely that the observed individual(s) were passing through and could be the same or different individuals. Of 21 Black Harrier flights recorded during 1007 hours of Vantage Point surveys, 7 flights went through risk height for a duration of 26m 15s, and the majority of these occurred within identified no-turbine areas. Therefore, the risk of the proposed turbine layout to Black Harrier is deemed acceptable. It is unknown if the avoidance mitigation, minimisation in higher risk areas, blade painting mitigation and habitat management mitigation will be sufficient to protect any migrating Black Harrier, and adaptive mitigation measures may be required based on the results of pre-construction monitoring. The threshold for adaptive mitigation measures being required is one (1) recorded fatality for this Endangered species.

Four Martial Eagle (Endangered) nests were located within the development site during a nest survey completed prior to the commencement of pre-application monitoring. These nests were excluded from the survey area prior to the commencement of pre-application monitoring, by implementing a 6 km no-turbine area, based on peer-reviewed research (Eeden, et al., 2017) and recommendations from the Endangered Wildlife Trust (G. Tate, pers. comm.). The results of avifaunal monitoring indicate that this buffer area is sufficient to protect the birds that were recorded actively breeding at two of these nests. Martial Eagle use alternate nests, and do not breed every year. Therefore, all Martial Eagle nests are deemed potentially active in perpetuity, once identified, irrespective of their status, the presence of birds, or the destruction of the nest.

By implementing the preferred layout and the recommended mitigation strategy the extent of the impact can be reduced to local and the probability of the impact can be lowered from probable to possible, with a marginal loss of resources, resulting in a medium negative impact significance.

The impact of collisions with wind turbines on avifauna is rated as of potentially high negative significance without mitigation which can be reduced to a medium negative impact significance with mitigation.

8.1.4.4 *Mortality from collisions with power lines*

Collisions with power lines is a well-known and increasing threat for many bird species worldwide (Bernardino, et al., 2018; Jenkins, et al., 2015; Loss, et al., 2014). In South Africa, a number of endemic and threatened species are known to be significantly affected by collisions (Taylor, et al., 2015), including SCC's that were recorded in the area such as Ludwig's Bustard, Blue Crane, Secretarybird and Black Stork (Shaw, et al., 2021). Ludwig's Bustard is particularly prone to collisions and made up 69% of carcasses found under power lines in a two-year study in the Karoo (Shaw, et al., 2018). Karoo Korhaan is also affected, but does not collide as frequently as Ludwig's Bustard, possibly due to their sedentary nature making them familiar with their area and their smaller size increasing their maneuverability (Shaw, et al., 2018).

For raptors, collisions appear to be a less frequent source of mortality compared to electrocutions (Loss, et al., 2014; Slater, et al., 2020). This is likely due to a combination of their good eyesight, high aspect-ratio wings, and often high flight altitude while engaged in thermal soaring (Bevanger, 1998; Martin & Shaw, 2010; Janss, 2000; Slater, et al., 2020). However, power line collisions increase when lines intersect with home ranges or if lines span regularly used flight paths between nesting and foraging

grounds (Rollan, et al., 2010; Slater, et al., 2020). For some raptor species collisions with power lines are a major conservation concern, such as the Bonelli's Eagle in Spain (Rollan, et al., 2010).

The impact is long-term, potentially regional, probable to occur and rated as of high magnitude. At a local population level, the impact is potentially barely reversible in a worst-case scenario and could leave to a significant irreplaceable loss of resources if endangered species are affected. The impact significance rating without mitigation is high negative.

Mitigation

The impact can be completely avoided by burying overhead power lines (OHPL). However, it is understood that the proposed up to 132 kV and 400 kV grid connection power line options, as well as the 132 kV power line between the on-site substations/switching stations may result in unacceptable ecological impacts if they were to be buried, and burying these 132 kV lines would also be technically and financially not feasible. The below assessment therefore assumes that all internal power lines between turbines and the on-site substation are buried, with the exception of the 132 kV grid connection lines to the MTS and between the two substations. Any deviation in the final as built layout must be signed off by an avifaunal specialist as acceptable, as every meter of OHPL potentially significantly increases the probability of collisions resulting and could result in an unacceptable impact significance rating.

To minimise collisions with overhead power lines, the length of power lines should be the minimum distance that avoids identified no-overhead power line buffers. Both grid connection options achieve this. However, Option 1 is further away from Martial Eagle nests, with approximately 1/3 of the line more than 6 km from an active nest, and therefore preferred, however, the difference does not affect the impact significance rating.

To mitigate residual impacts line markers such as dynamic and static bird flight diverters (BFDs) are being widely used with some success, and dynamic models are believed to be more likely to increase visibility for a range of species (Silva, et al., 2022). One recent study (Shaw, et al., 2021) demonstrated a 51% reduction in mortality for all large birds, while reducing collision rates effectively for some species (92% for Blue Crane) and having no effect on others (Ludwig's Bustard). 100% of all OHPL therefore must be marked with the largest, dynamic BFD available, placed as close to each other as possible, as per the Eskom Technical Standard, and must be regularly monitored and replaced if required over the lifetime of the infrastructure.

Power lines should be placed parallel to existing infrastructure as far as practically possible, with wires as low and thick as the current Eskom Technical Standard allows (Silva, et al., 2022). Some evidence has emerged that suggests that the staggering of pylons could reduce bustard mortality. In one study in Namibia and South Africa of 134 bustard collisions 87.3% were confirmed as having occurred away from towers, in the intermediate and mid-span sections of the powerline (Pallett, et al., 2022). Therefore, the 132 kV power line pylons should be staggered against existing or other proposed pylons to increase the power line visibility, where technically possible.

All pylons must be of a bird-friendly design as per Eskom Technical Standards with anti-perching devices installed. A single monopole pylon that does not allow nest-building should be used where technically possible.

The impact of collisions with wind turbines on avifauna is rated as of potentially high negative significance without mitigation which can be reduced to a medium negative impact significance with mitigation.

8.1.4.5 Mortality from electrocutions on electrical infrastructure

Normally, energised components on overhead power lines are not insulated but are elevated to place them safely out of people's reach, which elevates energised wires into places that are also attractive perches for birds (Dwyer, et al., 2017). Large birds can be electrocuted or incur electric shock injuries when simultaneously contacting two uninsulated energised components of differing electric potential (phase-to-phase electrocution), or when contacting an uninsulated energised component and a path to ground (phase-to-ground - electrocution) (Dwyer, 2006; APLIC, 2006). Because electrocutions result from birds bridging airgaps, larger birds with larger wingspans, such as Martial Eagle, are disproportionately affected (Slater, et al., 2020). Most bird electrocutions occur at relatively low and medium voltage distribution systems, rather than with transmission systems where the separations created by longer insulators and wider airgaps around wires are larger (APLIC, 2006; Bennun, et al., 2021; Slater, et al., 2020).

The impact can affect susceptible species such as Martial Eagle (Endangered) potentially on a regional level, and is deemed probable if unmitigated, barely reversible, and could result in a significant irreplaceable loss of resources for the lifetime of the facility. The magnitude of the impact is high, and its cumulative effect potentially medium.

Mitigation

Bird electrocutions can be easily avoided by burying overhead power lines, and by creating separation between conductors of differing electrical potential at substations and electrical infrastructure, and by placing insulation over conductors, or by redirecting birds to perch or nest away from conductors (APLIC, 2006; Dwyer, et al., 2017).

If all internal power lines between turbines and substations/switching stations are buried, and the grid connection 132 kV power lines between the substations and the MTS, and the 400kV OHPL between the MTS and the existing line are of a bird-friendly design, in line with the latest Eskom Technical Standards, with a phase-phase and phase-earth clearance of at least 1.8 m, with any exposed electrical infrastructure within the substations also of a bird-friendly insulated design, and with bird perches installed on monopole pylons, the impact can be completely avoided. The below assessment assumes all mitigation measures are implementable. If it is technically not possible or feasible to achieve this, a reassessment will be required in the EIA Phase.

The impact of mortality from electrocutions with overhead power lines and electrical infrastructure on avifauna is rated as of potentially high negative significance without mitigation which can be reduced to a low negative impact significance with mitigation.

Refer to the impact tables below.

Table 8.21: Displacement from Disturbance During Construction

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated?	Is the impact acceptable?
Displacement from Disturbance	Before mitigation	Negative	2	4	2	2	1	2	3	39	Medium (29-50)	Yes	Yes
	After mitigation	Negative	1	2	1	1	1	1	1	7	Low (6-28)		
Mitigation: <ul style="list-style-type: none">Minimise and demarcate disturbance area footprint.Layout avoids all no-go areas and adheres to identified development constraints.Conduct an avifaunal pre-construction walkthrough.													

Table 8.22: Displacement from Habitat Loss During Construction

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated?	Is the impact acceptable?
Displacement from Habitat Loss	Before mitigation	Negative	2	4	2	3	4	2	3	51	High (51-73)	Yes	Yes
	After mitigation	Negative	2	4	2	2	3	2	2	30	Medium (29-50)		
Mitigation:													
<ul style="list-style-type: none">Minimise and demarcate development footprint.Layout avoids all no-go areas and adheres to identified development constraints.													

Table 8.23: Displacement from Disturbance During Operation

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated?	Is the impact acceptable?
Displacement from Disturbance	Before mitigation	Negative	2	4	2	2	3	2	3	45	Medium (29-50)	Yes	Yes
	After mitigation	Negative	1	2	1	1	3	1	1	9	Low (6-28)		
Mitigation: <ul style="list-style-type: none">Minimise and demarcate disturbance area footprint.Layout avoids all no-go areas and adheres to identified development constraints.Conduct an avifaunal pre-construction walkthrough.													

Table 8.24: Mortality from Collisions with Wind Turbines During Operation

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated?	Is the impact acceptable?
Mortality from collisions with wind turbines	Before mitigation	Negative	4	3	2	3	3	3	3	54	High (51-73)	Yes	Yes
	After mitigation	Negative	2	2	2	2	3	3	3	42	Medium (29-50)		
Mitigation:													
<ul style="list-style-type: none">• Turbine layout avoids all identified no-turbine areas.• Painting of one turbine blade per turbine in line with the latest BirdLife SA Guidelines and CAA approval• Implement Habitat Management Plan.• Implement an Operational Monitoring Plan for the lifetime of the facility in line with current Best Practice Guidelines, including repeating avifaunal pre-application monitoring, carcass searching, searcher efficiency trials, and determination of fatality thresholds and adaptive mitigation requirements.													

Table 8.25: Mortality from Collisions with Overhead Power Lines During Operation

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated?	Is the impact acceptable?
Mortality from collisions with overhead power lines	Before mitigation	Negative	3	3	3	3	3	3	3	54	High (51-73)	Yes	Yes
	After mitigation	Negative	2	2	2	2	3	3	3	42	Medium (29-50)		
Mitigation: <ul style="list-style-type: none">All internal power lines between turbines and the substations are buried.Overhead power line alignment avoids all identified no-overhead-power line areas.Alignment is minimised within sensitive areas as far as possible.Alignment runs parallel to existing infrastructure where possible.Alignment is minimised to the shortest route possible after taking the above into account.Large, dynamic BFDs are installed at maximum allowed density across 100% of all OHPL.Cables as thick and low as permissible by Eskom Technical Standards.All pylons are of a bird-friendly design with anti-perching devices fitted in line with Eskom Technical Standards.Stagger pylons of parallel OHPL if technically possibly.													

Table 8.26: Mortality from Electrocutions on Electrical Infrastructure During Operation

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated?	Is the impact acceptable?
Mortality from electrocutions on electrical infrastructure	Before mitigation	Negative	3	3	3	3	3	3	3	54	High (51-73)	Yes	Yes
	After mitigation	Negative	1	1	2	1	3	1	1	9	Low (6-28)		

Mitigation:

- All internal power lines between turbines and the substations are buried.
- All electrical infrastructure must be of a bird-friendly design with a phase-phase and phase-earth clearance of at least 1.8 m, with any exposed electrical infrastructure within the substations also of a bird-friendly insulated design, and with bird perches installed on monopole pylons.

Table 8.27: Displacement from Disturbance During Decommissioning

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated?	Is the impact acceptable?
Displacement from Disturbance	Before mitigation	Negative	2	4	2	2	1	2	3	39	Medium (29-50)	Yes	Yes
	After mitigation	Negative	1	2	1	1	1	1	1	7	Low (6-28)		

Mitigation:

- Minimise and demarcate disturbance area footprint.
- Layout avoids all no-go areas and adheres to identified development constraints.
- Conduct an avifaunal pre-construction walkthrough.
- Implement environmental management plan with standard measures that must include noise control, dust control, no off-road driving, and restricted access.

Table 8.28: Displacement from Habitat Loss During Decommissioning

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated?	Is the impact acceptable?
Displacement from Habitat Loss	Before mitigation	Negative	2	4	3	3	4	3	2	38	High (51-73)	Yes	Yes
	After mitigation	Negative	1	4	3	2	3	2	1	15	Low (6-28)		

Mitigation:

- Minimise and demarcate development footprint.
- Layout avoids all no-go areas and adheres to identified development constraints.

8.1.5 Potential Impacts on Bats

An outline of the potential impacts the WEF development may have on bats is provided below. Four (04) impacts have been identified and assessed for the construction and operational phases. No impacts have been identified for the decommissioning phase.

8.1.5.1 *Destruction of bat roosts during construction*

Probable roosting spaces on site are mostly in the form of man-made structures such as houses and farm buildings, as well as some limited roosting potential offered by trees with hollows, fissures and loose bark. During construction, these may be permanently lost.

8.1.5.2 *Foraging habitat loss*

Some foraging habitat will be permanently lost by the construction of turbines and access roads. Temporary foraging habitat loss will occur during construction due to storage areas and movement of heavy vehicles.

8.1.5.3 *Bat mortalities due to direct blade impact or barotrauma during foraging (not migration)*

Bat mortalities of resident bat species due to moving blades can have significant impacts on bat populations since the impact can persist over the lifetime of the facility. It is critical that this impact is sufficiently managed and mitigated. The first level of mitigation by avoidance is already achieved by adhering to the sensitivity map. Creation of artificial foraging habitat: During the operational phase strong artificial lights will attract insects and therefore also bats. If such lights are located near turbines, it will significantly increase the probability of bats being killed by moving turbine blades. Similarly, the creation of artificial wetlands/open water sources near turbines by means of stormwater runoff can increase the presence of bats in that area and significantly increase the probability of bats being killed by moving turbine blades. During the operational phase, artificial bat roosting habitat may be present on site that were created unintentionally by the wind farm infrastructure. If such artificial bat roosting habitat are located near turbines it will significantly increase the probability of bats being killed by moving turbine blades.

8.1.5.4 *Bat mortalities due to direct blade impact or barotrauma during migration*

Cave dwelling bats play a critical role in cave ecology by being the major source of energy input into the cave ecosystems by means of bat guano, since sunlight is lacking in the dark zones of caves. In most cases an entire cave ecosystem and food web can be based on the input of bat guano into a cave. If bats migrating from one cave to another are killed during their migration, both cave ecosystems will be severely impacted and will likely collapse. Cave ecosystems are isolated and tend to be unique, and therefore may contain unique and specialised species of biota. Migratory routes in the region are completely unknown, and there is no knowledge of whether any such migrations exist. Thus far the passive bat activity data does not indicate any clear signs of migration routes existing on site.

Table 8.29: Destruction of Bat Roosts During Construction

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated?	Is the impact acceptable?
Destruction of bat roosts during construction	Before mitigation	Negative	1	3	4	3	1	3	3	45	Medium (29-50)	Yes	Yes
	After mitigation	Negative	1	1	4	3	1	2	1	12	Low (6-28)		
Mitigation:													
<ul style="list-style-type: none">Adhering to the bat sensitivity map as a mitigation to be outlined in the EMPr, is adequate.Additionally, if undiscovered bat roosts are encountered during construction, the Environmental Compliance Officer (ECO) on site must be notified immediately and a bat specialist consulted to advise the appropriate action.													

Table 8.30: Foraging Habitat Loss During Construction

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated?	Is the impact acceptable?
Foraging habitat loss	Before mitigation	Negative	1	3	4	3	1	3	2	30	Medium (29-50)	Yes	Yes
	After mitigation	Negative	1	2	4	3	1	2	1	13	Low (6-28)		
Mitigation:													
<ul style="list-style-type: none">Adhering to the bat sensitivity map as a mitigation to be outlined in the EMPr, is adequate.Additionally, keep to designated areas when storing building materials, resources, turbine components and/or construction vehicles and keep to designated roads with all construction vehicles. Damaged areas should be rehabilitated by an experienced vegetation succession specialist after construction.													

Table 8.31: Bat Mortalities Due to Direct Blade Impact or Barotrauma During Foraging (Not Migration) During Operation

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated?	Is the impact acceptable?
Bat mortalities due to direct blade impact or barotrauma during foraging (not migration)	Before mitigation	Negative	2	4	2	3	3	4	3	54	High (51-73)	Yes	Yes
	After mitigation	Negative	2	2	2	2	3	3	2	28	Low (6-28)		
Mitigation:													
<ul style="list-style-type: none">Implement the Action Plan included in section 9 of the Bat Impact Assessment – to be included in the EMPr during the detailed EIA phase.													

Table 8.32: Bat Mortalities Due to Direct Blade Impact or Barotrauma During Migration in the Operational Phase

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated?	Is the impact acceptable?
Bat mortalities due to direct blade impact or barotrauma during migration	Before mitigation	Negative	3	2	2	3	3	3	3	48	Medium (29-50)	Yes	Yes
	After mitigation	Negative	3	1	2	2	3	2	2	26	Low (6-28)		
Mitigation:													
<ul style="list-style-type: none">Based on peak bat activity periods that will be presented by the 12-month pre-construction study for migratory bat species, curtailment must be applied to all turbines by ninety-degree feathering of blades below the manufacturer’s cut-in speed, so they are exactly parallel to the wind direction thereby minimising freewheeling blade rotation as much as possible without locking the blades. This applies to the lifetime of the facility and can significantly lower probability of bat mortalities. Influence on productivity is minimal since no power is generated below the manufacture’s cut-in speed. Additional mitigation (only if required): Additional curtailment or bat deterrent mitigation parameters based on climatic conditions may be presented when all bat activity data are gathered, and will be detailed in the EMPr. Such additional curtailment or bat deterrent mitigation will only be required if bat mortalities of migratory species exceed sustainable thresholds for the region, and will be limited to the applicable turbines causing the highest fatalities.													

8.1.5.5 Mitigation Measures for the EMPr

The following must be considered to minimise bat mortalities. A mitigation Action Plan will be included as a part of the EMPr.

Avoidance of creating artificial foraging and roosting habitat

Artificial foraging habitat can unintentionally be created by the presence of outside lights attracting insects and artificial wetlands/water sources created by stormwater. Artificial roosting habitat can unintentionally be created by the roof structures of new buildings on site, as well as construction of culverts. In both the presence of artificial foraging and roosting habitat, the likelihood of bats being killed by moving turbine blades increases significantly when they are attracted to their proximity, when such areas have become improved foraging airspaces due to the presence of artificial light, water sources or roosts.

For artificial foraging habitat:

A mitigation to apply in the design of the WEF is to keep artificial lighting to a minimum on the infrastructure (O&M buildings and on wind turbines), while still adhering to safety and security requirements. For example, this can be achieved by having floodlights down-hooded, installing passive motion sensors onto lights around buildings and possibly utilising lights with lighting colours (also referred to as lighting temperatures) that attract fewer insects. Such lights generally are "warm white", yellow or amber and have a colour temperature below 4 000 K (Kelvin).

Stormwater management should also avoid creating artificial wetlands and open water sources in the turbine zones (closer than 300 m from any turbine base), as this will increase insect and bat activity around turbines.

For artificial roosting habitat:

During the construction phase, the creation of such roosting habitat must be avoided, to minimise this operational phase impact. Buildings: The roofs of all new buildings on site must be constructed and designed in such a way to be sealed off well, especially everywhere at a roof and wall joining. If corrugated iron is used as a roofing material, it must be sealed off with a durable and flexible sealant (not with cement), this is because corrugated iron sheets have some movement in wind which loosens the rigid cement sealing the roof off where it meets with a sidewall. Thatched roofs must be avoided entirely. Avoid using any bargeboards/sideboards if mounted against a sidewall, if this is unavoidable these bargeboards must also be sealed off with a flexible sealant. Culverts: Where new culverts are constructed, designs must be avoided that cause elevated ceiling hollows inside the culvert, similarly avoid using designs with holes and hollows extending upwards inside the culvert from the roof/ceiling of the culvert. If such designs are unavoidable, these holes and hollows must be filled to be flush with the ceiling of the culvert. Eviction and inspection: During the operational monitoring and mortality auditing of the facility, the infrastructure on the WEF must be inspected by a bat specialist for the presence of artificial bat roosts. If any such roosts are found, an eviction must be attempted by a qualified bat specialist during the appropriate season when the species inhabiting the roost does not have pups, since the pups may not be evicted successfully which will result in them dying off.

Curtailement to prevent freewheeling

Freewheeling occurs when the turbine blades are rotating in wind speeds below the generator cut-in speed (also called the manufacturer's cut-in speed), thus no electricity is being produced and only some blade momentum is maintained.

Since bat activity tends to be negatively correlated with wind speed, it means that high numbers of bats are likely to be flying and impacted on in low wind speeds where freewheeling may occur. If turbine blades are feathered below the generator cut-in speed to prevent freewheeling, it can result in a very significant reduction of bat mortalities with minimal energy production loss.

Curtailment that increases the cut-in speed

The activity levels of South African bats generally decrease in weather conditions with increased wind speeds. However, in scenarios where above sustainable numbers of bats are being killed, and these bats fly in wind speeds above the turbine manufacturer's cut-in speed, the turbine's computer control system (referred to as the Supervisory Control and Data Acquisitions or SCADA system) can be programmed to a cut-in speed higher than the manufacturer's set speed. The new cut-in speed will then be referred to as the mitigation cut-in speed and can be determined from studying the relationship between long term (12-month) bat activity patterns on site and wind speed. This sustainable threshold of bat mortalities will be calculated according to the South African Bat Fatality Threshold Guidelines (MacEwan, et al., Edition 3, April 2020).

Turbines are curtailed in this manner by means of blade feathering, to render the blades motionless in wind speeds below the mitigation cut-in speed.

Acoustic bat deterrents

This technology is developed well enough to be tested on site and may be recommended during operational monitoring, if mortality data indicate bat mortalities above the sustainable threshold for the wind farm. This threshold will be calculated according to the South African Bat Fatality Threshold Guidelines (MacEwan, et al., Edition 3, April 2020). Initial experiments with this technology on wind farms in South Africa are yielding positive results that may indicate the effectiveness of the devices in the correct scenarios.

Current data on the South African trials is still limited to a small sample set, and the technology will not necessarily be effective in all mitigation scenarios and for all bat species. Therefore, it should be considered and tested on a case-by-case basis if possible, and it is highly recommended that adequate monitoring continues concurrently, to assess the effectiveness of the devices in reducing bat mortalities.

Should the mitigation options be followed as per the Mitigation Action Plan outlined in the Bat Impact Assessment report, negative impacts should be effectively reduced to at least a Low negative significance. Cumulatively, however, even with mitigation, it is likely that residual impacts will be slightly higher but still at a Low negative significance for bat mortalities due to turbine collisions. If the proposed wind farm receives EA, a minimum of two years of operational bat mortality monitoring should be conducted from no later than the facility's commercial operation date (COD).

8.1.6 Potential Impacts on the Aquatic Ecosystems

The current driving forces and impacts overserved on site can be attributed to the following factors:

- Agricultural practices/ farming activities in the region, such as livestock grazing and crop cultivation, has led to the runoff of agrochemicals, sediment, trampling of stream banks and subsequent nutrients filtration into the water bodies.
- Instream dams alter the natural flow of water run-off and attribute to sediment transport, affecting the stream's geomorphology and hydrology.

The specific impacts included in the risk impact assessment matrix are tailored to the project and activities being assessed, providing a clear indication of the relevant aquatic impacts:

- *Water quality*: This includes changes in the physical, chemical, and biological properties of water, such as temperature, pH, dissolved oxygen, and nutrient levels.
- *Habitat alteration*: This includes changes in the physical structure of the aquatic environment, such as the depth, flow, and substrate of a stream or river. Construction activities can lead to the loss or degradation of riparian areas. This impact should be carefully monitored once activities are done in close proximity to the NFEPA Features.
- *Species diversity*: This includes changes in the number and types of species present in an aquatic ecosystem that are influenced by disturbed migration routes.
- *Eutrophication*: This is the excessive growth of algae and other aquatic plants, which can lead to oxygen depletion and the death of other organisms.
- *Pollution*: This includes the introduction of harmful substances, such as chemicals, heavy metals, and oil, into an aquatic ecosystem.
- *Physical disturbance*: This includes activities that physically damage aquatic habitats, such as construction and clearance of vegetation.
- *Physical disturbance*: This includes any activities within drainage lines, tributaries and rivers such as vehicle and construction machinery crossing the aquatic features.

Recommendations to consider:

- Keep aquatic features natural, with no further loss of riparian habitat where possible. Degraded areas should be rehabilitated along with access road crossings that would be utilised. Only low-impact, biodiversity-sensitive land-uses are appropriate.
- Maintain all NFEPA features in a functional, near-natural state. Some aquatic habitat loss is acceptable, provided the underlying biodiversity objectives and ecological functioning are not compromised.
- Freshwater CBAs should be maintained in good ecological condition, and those that are degraded such as the widening or upgrading of access roads should ideally be rehabilitated to a good condition.
- Minimise habitat and species loss to ensure ecosystem functionality through strategic landscape planning.
- It is recommended that highly sensitive areas be avoided for development. Existing road infrastructure should be prioritised for use to minimise new road development.
- Road infrastructure crossing drainage lines must be free-draining, non-erosive in nature and bank stability must be maintained.
- The environmental authorisation process should include the following:
 - Maintenance and monitoring plans to be approved by the relevant regulatory authorities. These should relate to requirements of water use licencing, alien invasive control and NEMA.
 - It is recommended that strict mitigatory measures are implemented and considered, where appropriate; for the planning and layout determination for the project should it progress further.
- It is recommended that a follow up aquatic assessment be done once during the construction phase and a final assessment after completion of the construction phase.
- Fish and Macro-invertebrate assessments as mentioned above should be done during the mentioned timeframes as well as bi-annually after the completion of construction activities. This will ensure a comprehensive database is obtained to detect and identify any impacts that could have occurred.

- The project area is classified as an Important Sub-catchment ESA and is therefore recommended that the scientific buffer outlined in this report is maintained to ensure no detrimental impacts occur that could result in a loss of aquatic biodiversity.
- The monitoring programme and mitigation measures outlined in this report must be adhered to during construction and operation phases to ensure no significant impacts occur in the system causing it to deteriorate to a lower aquatic health category.
- It is recommended that the mitigation measures outlined in this report are implemented to ensure stability of the stream banks and to ensure no further degradation occurs.
- It is recommended that the boundaries of the development footprint be clearly demarcated prior to the clearing of vegetation to prevent the encroachment of activities into the surrounding natural areas.
- It is recommended that sanitation facilities should be located at least outside of the calculated scientific buffers as outlined in this report and away from the watercourse during the construction phase.
- Short term monitoring must take place of the AIP until the site establishment has been completed. It is recommended that a minimum period of 12 months is implemented. The clearing of indigenous vegetation should not take place within the aquatic features and the recommended buffers, unless authorised under a Water Use License. It is anticipated that minor works including clearing of indigenous vegetation at selected access road crossings will occur with a low impact rating. These areas should be rehabilitated as soon as possible after activities have been completed.
- It is recommended that once the project reaches closure phase a Risk Assessment is done separately for this phase. As the project does not intend to close within the next 20 years a decommissioning phase aquatic impact assessment with a Risk Assessment is not necessary at this stage.

The following table provides an overview of a typical monitoring programme associated with a WEF Facility. It should be noted that the current assessment constitutes as the 1st bi-annual assessment.

Table 8.33: Recommended Aquatic Monitoring Programme

PROJECT PHASE	MONITORING REQUIREMENTS	SITES TO BE MONITORED	MONITORING FREQUENCY
During Construction phase	Biomonitoring (SASS5 & FRAI)	All six NFEPA Rivers, with specific aim to the Soutfontein Se River due to the CBA Area associated with it.	Bi-annual Biomonitoring
	Surface Water Monitoring		Monthly Surface Water monitoring
Post Construction phase	IHAS & IHA1	Main non-perennial tributaries	Bi-annual Biomonitoring
			Quarterly Surface Water monitoring

Tables 8.34 to 8.52 below provides the aquatic impact assessment and mitigation measures of the potential impacts associated with the Carissa WEF.

Table 8.34: Potential Changes in Water Flow and Quality During Construction Phase

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated?	Is the impact acceptable?
Infrastructure Design: Potential changes in water flow and quality	Before mitigation	Negative	3	3	3	3	1	4	3	51	High (51-73)	Yes	Yes
	After mitigation	Negative	2	2	1	2	1	2	2	20	Low (6-28)		
Mitigation:													
<ul style="list-style-type: none">• Incorporate buffer or regulated zones around the freshwater bodies.• Design infrastructure to minimise runoff and water contamination.													

Table 8.35 Disturbance to Aquatic Habitats Due to Site Surveys During the Construction Phase

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated?	Is the impact acceptable?
Site Selection: Disturbance to aquatic habitats due to site surveys	Before mitigation	Negative	2	2	1	1	1	2	2	18	Low (6-28)	Yes	Yes
	After mitigation	Negative	1	1	1	1	1	1	1	6	Low (6-28)		
Mitigation:													
<ul style="list-style-type: none">Conduct construction during non-sensitive periods (dry season) for aquatic life.Use non-invasive survey/construction methods wherever possible.													

Table 8.36: Sedimentation in Water Bodies from Soil Erosion During the Construction Phase

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated?	Is the impact acceptable?
Land clearing and Excavation: Sedimentation in water bodies from soil erosion	Before mitigation	Negative	2	3	3	3	2	3	3	48	Medium (29-50)	Yes	Yes
	After mitigation	Negative	1	2	1	2	1	2	2	18	Low (6-28)		
Mitigation: <ul style="list-style-type: none">Implement erosion control measures such as silt fences and sediment traps.Schedule construction of off-stream developments during dry seasons to reduce runoff, and avoid activities directly after rainfall events within the regulated areas.Flow dissipators and stormwater management practices must be implemented for any infrastructure located within drainage courses.													

Table 8.37: Risk of Fuel and Oil Spills Contaminating Freshwater Sources During the Construction Phase

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated?	Is the impact acceptable?
Use of heavy machinery: Risk of fuel and oil spills contaminating freshwater sources	Before mitigation	Negative	2	3	2	4	1	3	2	30	Medium (29-50)	Yes	No
	After mitigation	Negative	1	1	1	2	1	1	1	7	Low (6-28)		
Mitigation: <ul style="list-style-type: none">• Maintain machinery to prevent leaks.• Have spill response kits on site and train workers in their use.• Drip trays must be placed under standing vehicles.													

Table 8.38: Alteration of Natural Water Flow Patterns During the Construction Phase

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated?	Is the impact acceptable?
Building of Access Roads: Alteration of natural water flow patterns	Before mitigation	Negative	3	4	3	3	3	3	4	76	Very High (74-96)	Yes	No
	After mitigation	Negative	2	2	2	2	2	2	2	24	Low (6-28)		
Mitigation: <ul style="list-style-type: none">Design roads to avoid crossing water bodies, where possible.Use culverts and bridges to maintain natural flow patterns.Use existing water crossings to avoid additional impacts.													

Table 8.39: Changes to Fluvial Geomorphology and Hydrology During the Construction Phase

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated?	Is the impact acceptable?
Site Development: Changes to fluvial geomorphology & Hydrology	Before mitigation	Negative	2	3	2	3	2	2	2	28	Low (6-28)	Yes	Yes
	After mitigation	Negative	1	2	1	1	1	1	1	7	Low (6-28)		
Mitigation:													
<ul style="list-style-type: none">• Damage to stream banks must be reshaped to its original state.• No material, sediment or debris from access roads must be left to allow for build-up in water bodies – continuous routine site inspection must be done on a weekly basis.													

Table 8.40: Sanitation Services and Water Quality Pollution During the Construction Phase

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated?	Is the impact acceptable?
Site Development: Sanitation Services and water quality pollution	Before mitigation	Negative	2	2	2	2	1	3	2	24	Low (6-28)	Yes	Yes
	After mitigation	Negative	1	1	1	1	1	1	1	6	Low (6-28)		
Mitigation:													
<ul style="list-style-type: none">• Use of potential environmental pollutants (Chemicals, pesticides etc) must be properly stored and controlled.• Sanitary facilities must be made available to personnel and must be placed outside the regulated buffer areas.													

Table 8.41 Potential for Accidental Spills and Leaks from Vehicles and Wind Turbines During the Operational Phase

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated?	Is the impact acceptable?
Maintenance Activities: Potential for accidental spills and leaks from vehicles and wind turbines	Before mitigation	Negative	2	3	2	3	3	3	2	32	Medium (29-50)	Yes	Yes
	After mitigation	Negative	1	1	1	2	2	2	1	9	Low (6-28)		
Mitigation:													
<ul style="list-style-type: none">Develop and implement a maintenance schedule.Regularly inspect and maintain equipment and wind turbines to prevent leaks.													

Table 8.42: Potential Impact on Water Quality from Operational By-Products During the Operational Phase

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated?	Is the impact acceptable?
Wind Turbine Operation: Potential impact on water quality from operational by-products	Before mitigation	Negative	2	3	2	2	3	3	2	30	Medium (29-50)	Yes	Yes
	After mitigation	Negative	1	1	1	1	2	2	1	8	Low (6-28)		
Mitigation: <ul style="list-style-type: none">Monitor water quality regularly (monthly).Implement operational protocols to minimise contamination.													

Table 8.43: Potential Disturbance to Aquatic Fauna During the Operational Phase

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated?	Is the impact acceptable?
Noise and vibration: Potential disturbance to aquatic fauna	Before mitigation	Negative	3	3	2	2	3	4	3	51	High (51-73)	Yes	No
	After mitigation	Negative	2	2	1	1	1	2	2	18	Low (6-28)		
Mitigation:													
<ul style="list-style-type: none">Implement noise reduction measures.Conduct regular monitoring of aquatic fauna.													

Table 8.44: Increase Runoff During the Operational Phase

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated?	Is the impact acceptable?
Stormwater Runoff Systems: Increase runoff from cleared surface and hard areas resulting in erosion and increase siltation	Before mitigation	Negative	3	3	2	2	3	3	2	32	Medium (29-50)	Yes	Yes
	After mitigation	Negative	2	2	1	1	2	2	1	10	Low (6-28)		
Mitigation:													
<ul style="list-style-type: none">Implement berms, soil traps, gabions and runoff diversion away from susceptible areas.Water controlled structures should be maintained throughout the project life time.													

Table 8.45: Alien Invasive Plant Species During the Operational Phase

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated?	Is the impact acceptable?
Alien Invasive Plant Species: Proliferation of aquatic species may alter the drainage lines and important CBA Areas	Before mitigation	Negative	3	3	2	2	3	3	2	32	Medium (29-50)	Yes	Yes
	After mitigation	Negative	1	1	1	1	2	2	1	8	Low (6-28)		
Mitigation:													
<ul style="list-style-type: none">Implement alien vegetation control plan with particular focus on natural aquatic habitats.AIP programme must be followed to control and remove alien species throughout project lifecycle.													

Table 8.46: Ongoing Edge Effects During the Operational Phase

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated?	Is the impact acceptable?
Operation of WEF: Ongoing edge effects from activities that negatively impact on natural aquatic habitats	Before mitigation	Negative	3	3	2	3	3	3	2	34	Medium (29-50)	Yes	Yes
	After mitigation	Negative	2	1	1	1	2	1	2	16	Low (6-28)		
Mitigation: <ul style="list-style-type: none">Keep disturbance inside the development footprint.New access roads must be inspected on a monthly basis for erosion etc. maintained.All infrastructure within or close to drainage lines must be inspected on a regular basis to ensure no significant impacts occur on the aquatic habitats.													

Table 8.47: Disturbance and Sedimentation During Decommissioning Phase

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated?	Is the impact acceptable?
Dismantling of Infrastructure: Disturbance and sedimentation similar to contraction phase	Before mitigation	Negative	2	3	2	3	1	2	2	26	Low (6-28)	Yes	Yes
	After mitigation	Negative	1	1	1	1	1	1	1	6	Low (6-28)		
Mitigation:													
<ul style="list-style-type: none">• Reuse existing roads and tracks to minimise new disturbances.• Implement erosion and sediment control measures.													

Table 8.48: Restoration and Reinstatement of Natural Aquatic Habitats During Decommissioning Phase

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated?	Is the impact acceptable?
Site Rehabilitation: Restoration and reinstatement of natural aquatic habitats	Before mitigation	Positive	2	2	3	2	2	3	3	42	Medium (29-50)	Yes	Yes
	After mitigation	Positive	2	2	3	2	2	3	3	42	Medium (29-50)		
Mitigation: <ul style="list-style-type: none">Develop and implement a site rehabilitation plan.Use native vegetation for replanting and habitat restoration.Reinstate stream banks and crossings to its original state and reinforce stream bank stability.Monitor rehabilitation efforts after site has been cleared for a minimum of at least three months.													

Table 8.49: Removal of Turbines and Laydown Infrastructure During Decommissioning Phase

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated?	Is the impact acceptable?
Removal of turbines and laydown infrastructure in close proximity to aquatic features	Before mitigation	Negative	2	3	2	2	1	2	2	24	Low (6-28)	Yes	Yes
	After mitigation	Negative	1	1	1	1	1	2	1	7	Low (6-28)		
Mitigation:													
<ul style="list-style-type: none">• Use controlled dismantling methods to minimise soil disturbance.• Implement erosion and sediment control measures during dismantling of turbines.													

Table 8.50: Potential Erosion During the Removal of Road Infrastructure During Decommissioning Phase

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated?	Is the impact acceptable?
Restoration of Access Roads: Potential erosion during the removal of road infrastructure	Before mitigation	Negative	3	2	2	2	2	2	2	26	Low (6-28)	Yes	Yes
	After mitigation	Negative	1	1	1	1	1	1	1	6	Low (6-28)		
Mitigation:													
<ul style="list-style-type: none">Gradually decommission roads to prevent rapid erosion.Restore natural drainage patterns and stabilise the soil with native vegetation.													

Table 8.51: Potential Contamination from Residual Chemicals and Materials During Decommissioning Phase

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated?	Is the impact acceptable?
Site clean-up and contaminant removal: Potential contamination from residual chemicals and materials	Before mitigation	Negative	3	3	2	2	1	2	2	26	Low (6-28)	Yes	Yes
	After mitigation	Negative	1	2	1	1	1	1	1	7	Low (6-28)		
Mitigation:													
<ul style="list-style-type: none">Conduct a thorough site assessment to identify and remove all contaminants.Use appropriate remediation techniques for any residual contamination.													

Table 8.52: Monitoring Post Decommissioning

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated?	Is the impact acceptable?
Monitoring Post Decommissioning: Ensuring the recovery of natural aquatic environments (Natural and Artificial)	Before mitigation	Positive	3	2	2	2	1	2	1	12	Low (6-28)	Yes	Yes
	After mitigation	Positive	2	1	1	1	1	2	1	8	Low (6-28)		
Mitigation:													
<ul style="list-style-type: none">Establish a long-term monitoring programme to assess environmental recovery.Implement corrective actions if recovery is not progressing as expected.Continue with site inspection and freshwater monitoring for at least a minimum of three months after decommissioning phase.													

8.1.7 Potential Impacts on the Social Environment

The social specialist has undertaken a detailed investigation and impact assessment to identify and consider the social impacts that could potentially be realised with the development of the Carissa WEF. Refer to Appendix E7 for the Social Impact Assessment.

This SIA focused on the collection of data to identify and assess social issues and potential social impacts associated with the development of Carissa WEF. Secondary data was collected and presented in a literature review and primary data was collected through consultations with affected and adjacent landowners and key stakeholders. The environmental assessment framework for assessment of impacts and the relevant criteria were applied to evaluate the significance of the potential impacts.

The Beaufort West and surrounding communities are some vulnerable communities within the project area that may be affected by the development of the Carissa WEF and its associated infrastructure. The construction is traditionally associated with the greatest social impact communities, as a result the town of Beaufort West and its surrounding communities may be affected by social impacts. Many of the social impacts are unavoidable and will take place to some extent but can be managed through the careful planning and implementation of appropriate mitigation measures. Several potential positive and negative social impacts have been identified for the project, however an assessment of the potential social impacts indicated that there are no perceived negative impacts that are so significant to allow them to be classified as “fatal flaws”.

The majority of social impacts associated with the project are anticipated to occur during the construction phase of development and are typical of the type of social impacts generally associated with construction activities. Impacts associated with the design and construction phase of a project are usually of a short duration and temporary in nature, but could have long-term effects on the surrounding social environment if not planned or managed appropriately. It is therefore necessary that the design phase be conducted in such a manner so as not to result in permanent impacts associated with the ill placement of project components or associated infrastructure.

Carissa WEF is anticipated to operate between 20 and 25 years. The facility will operate continuously, seven (07) days a week, during daylight hours. While the WEF will be largely self-sufficient, monitoring and periodic maintenance activities will be required. Key elements of the Operation and Management (O&M) Plan include monitoring and reporting the performance of the WEF, conducting preventative and corrective maintenance, receiving visitors, and maintaining security.

Typically, major social impacts associated with the decommissioning phase are linked to the loss of jobs and associated income and will be similar to the impacts during the construction phase. This has implications for the households who are directly affected, the communities within which they live, and the relevant local authorities. However, in the case of Carissa WEF it is anticipated that the proposed facility will be refurbished and upgraded to prolong its life. No decommissioning of the facility is proposed.

The following recommendations are made based on the SIA. The proposed mitigation measures should be implemented to limit the negative impacts and enhance the positive impacts associated with the project. Based on the social assessment, the following recommendations are made:

- The appointment of a CLO to assist with the management of social impacts and to deal with community issues, if feasible.
- It is imperative that local labour be sourced, wherever possible, to ensure that benefits accrue to the local communities. Efforts should be made to involve local businesses during the construction activities.

where possible. Local procurement of labour and services / products would greatly benefit the community during the construction and operational phases of the project.

- Local procurement of services and equipment is required where possible in order to enhance the multiplier effect.
- Involve the community in the process as far as possible (encourage co-operative decision making and partnerships with local entrepreneurs).
- Employ mitigation measures to minimise the dust and noise pollution and damage to existing roads.
- Safety and security risks should be considered during the planning / construction phase of the proposed project. Access control, security and management should be implemented to limit the risk of crime increasing in the area.

The proposed project and associated infrastructure are unlikely to result in permanent damaging social impacts. From a social perspective it is concluded that the project could be developed subject to the implementation of recommended mitigation measures and management actions identified for the project. It is therefore the specialist recommendation that the project, with the associated layout, be approved provided that mitigation measures are implemented.

The proposed Carissa WEF has the potential to generate additional income and employment opportunities for Beaufort West and the surrounding communities. These benefits could be particularly significant to reduce the dependency of job opportunities within the main employment sectors. As a whole, unemployment in South Africa is significantly high and additional job opportunities would not only benefit the region but the overall South African employment ratio. Positive impacts can be associated with the Carissa WEF with regard to additional renewable energy facilities and reducing the current load on existing Eskom power generation facilities.

Tables 8.53 to 8.67 below provides the social impact assessment and mitigation measures of the potential impacts associated with the Carissa WEF.

Table 8.53: Direct and Indirect Employment Opportunities and Skills Development During the Construction Phase

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated?	Is the impact acceptable?
Direct and indirect employment opportunities and skills development	Before mitigation	Positive	2	4	1	1	1	2	3	33	Medium (29-50)	Yes	Yes
	After mitigation	Positive	2	4	1	1	1	4	4	52	High (51-73)		
Enhancement:													
<ul style="list-style-type: none">• A local employment policy should be adopted to maximise opportunities made available to the local labour force.• Labour should be sourced from the local labour pool as far as possible, and only if the necessary skills aren't available should labour be sourced from (in order of preference) the District Municipality, Province, South Africa, or elsewhere.• Where feasible, training and skills development programmes should be initiated prior to the commencement of the construction phase.• As with the labour force, suppliers should also be sourced as far as practically possible.• The recruitment selection process should seek to promote gender equality and the employment of women wherever possible.													

Table 8.54: Economic Multiplier Effect During the Construction Phase

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated?	Is the impact acceptable?
Economic Multiplier effect	Before mitigation	Positive	2	2	1	1	1	2	2	18	Low (6-28)	Yes	Yes
	After mitigation	Positive	3	3	1	1	1	3	3	36	Medium (29-50)		
Enhancement:													
<ul style="list-style-type: none">It is recommended that a local procurement policy is adopted to maximise the benefit to the local economy.A database of local companies, specifically Historically Disadvantaged Individuals (HDIs) which qualify as potential service providers (e.g., construction companies, security companies, catering companies, waste collection companies, transportation companies etc.) should be created (or sourced from the local Municipality, where available) and companies listed thereon should be invited to bid for project-related work where applicable.Local procurement is encouraged along with engagement with local authorities and business organisations to investigate the possibility of procurement of construction materials, goods and products from local suppliers where feasible.													

Table 8.55: Potential Loss of Productive Farmland During the Construction Phase

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated?	Is the impact acceptable?
Potential loss of productive farmland	Before mitigation	Negative	1	3	3	2	1	2	2	24	Low (6-28)	Yes	Yes
	After mitigation	Negative	1	2	2	2	1	2	2	20	Low (6-28)		
Mitigation:													
<ul style="list-style-type: none">• The proposed site for the development, construction footprint, needs to be marked out prior to the construction phase and all construction related activities should be confined in the construction footprint.• Livestock grazing on the proposed development footprint area may need to be relocated from the construction footprint in consultation with the landowner.													

- The Environmental Control Officer (ECO) will continuously monitor that all construction activities occurring within the project boundary, in the case of construction activities occurring outside the project boundary determined by the ECO, the required remediation procedures will be implemented.
- Implement, manage and monitor a grievance mechanism for the recording and management of social issues and complaints.
- Mitigation measures from the Agricultural and Soil Report, should also be implemented.

Table 8.56: Influx of Jobseekers and Change in Population During the Construction Phase

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated?	Is the impact acceptable?
Influx of jobseekers and change in population	Before mitigation	Negative	2	3	4	3	4	3	2	38	Medium (29-50)	Yes	Yes
	After mitigation	Negative	2	2	4	3	3	2	1	16	Low (6-28)		
Mitigation:													
<ul style="list-style-type: none">• Develop and implement a local procurement policy which prioritises “locals first”, as far as possible to prevent the movement of people into the area in search of work.• Engage with local community representatives prior to construction to facilitate the adoption of the locals first procurement policy.• Provide transportation for workers to ensure workers can easily access their place of employment and do not need to move closer to the project site.• As far as possible, working hours should be kept between daylight hours during the construction phase, and / or as any deviation that is approved by the relevant authorities.• Compile and implement a grievance mechanism.• Appoint a Community Liaison Officer (CLO) to assist with the procurement of local labour.• Prevent the recruitment of workers at the project site.• Implement, manage and monitor a grievance mechanism for the recording and management of social issues and complaints.• Establish clear rules and regulations for access to the proposed site.• Where feasible, a security company should be appointed to implement appropriate security procedures to ensure that workers do not remain onsite after working hours, as far as possible.• Inform local community organisations and policing forums of construction times and the duration of the construction phase.• Establish procedures for the control and removal of loiterers from the construction site.													

Table 8.57: Safety and Security Impacts During the Construction Phase

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated?	Is the impact acceptable?
Safety and security impacts	Before mitigation	Negative	2	3	1	1	1	4	4	48	Medium (29-50)	Yes	Yes
	After mitigation	Negative	2	1	1	1	1	2	3	24	Low (6-28)		
Mitigation:													
<ul style="list-style-type: none">Working hours should be kept within daylight hours during the construction phase and / or as any deviation that is approved by the relevant authorities.Provide transportation for workers to prevent loitering within or near the project site outside of working hours.The perimeter of the construction site should be appropriately secured to prevent any unauthorised access to the site. Access control to the site should be maintained throughout the construction period.The appointed EPC Contractor must appoint a security company to ensure appropriate security procedures and measures are implemented, including controlling access in and out of the construction site.A CLO should be appointed as a grievance mechanism. A method of communication should be implemented whereby procedures to lodge complaints are set out for the local community to express any complaints or grievances with the construction process.													

- The EPC Contractor should implement a stakeholder management plan to address neighbouring farmer concerns regarding safety and security.
- The project proposed must prepare and implement a Fire Management Plan; this must be done in conjunction with surrounding landowners, particularly the EPC Contractor must prepare a Method Statement which deals with fire prevention and management.

Table 8.58: Impacts on Daily Living and Movement Patterns During the Construction Phase

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated?	Is the impact acceptable?
Impacts on daily living and movement patterns	Before mitigation	Negative	3	4	2	2	1	2	3	42	Medium (29-50)	Yes	Yes
	After mitigation	Negative	3	3	2	1	1	2	2	24	Low (6-28)		
Mitigation:													
<ul style="list-style-type: none">• All vehicles must be road worthy, and drivers must be qualified, obey traffic rules, follow speed limits and be made aware of the potential road safety issues.• Heavy vehicles should be inspected regularly to ensure their road worthiness.• Provision of adequate and strategically placed traffic warning signs, that have to be maintained for the duration of the construction phase, and control measures along the road to warn road users of the construction activities taking place for the duration of the construction phase. Warning signs must be always visible, especially at night.• Implement penalties for reckless driving to enforce compliance to traffic rules.• As far as possible, avoid heavy vehicle activity during “peak” hours (when children are taken to school, or people are driving to work).• The developer and EPC Contractor must ensure that all fencing along access roads is maintained in the present condition or repaired if disturbed due to construction activities.• The developer and EPC Contractor must ensure that the roads utilised for construction activities are either maintained in the present condition or upgraded if disturbed due to construction activities.• The EPC Contractor must ensure that damage / wear and tear caused by construction related traffic to the access roads is repaired before the completion of the construction phase.• A method of communication must be implemented whereby procedures to lodge complaints are set out for the local community to express any complaints or grievances with the construction process.													

Table 8.59: Nuisance Impacts (Noise and Dust) During the Construction Phase

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated?	Is the impact acceptable?
Nuisance impacts (noise and dust)	Before mitigation	Negative	2	4	1	1	1	3	3	36	Medium (29-50)	Yes	Yes
	After mitigation	Negative	2	3	1	1	1	2	2	20	Low (6-28)		
Mitigation:													
<ul style="list-style-type: none">• The movement of heavy vehicles associated with the construction phase should be timed to avoid weekends, public holidays, and holiday periods where feasible.• Dust suppression measures must be implemented for heavy vehicles such as wetting of gravel roads on a regular basis and ensuring that vehicles used to transport sand and building materials are fitted with tarpaulins or covers where necessary.• Ensure all vehicles are road worthy, drivers are qualified and are made aware of the potential noise and dust issues.• A CLO should be appointed, and a grievance mechanism implemented.													

Table 8.60: Increased Risk of Potential Veld Fires During the Construction Phase

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated?	Is the impact acceptable?
Increased risk of potential veld fires	Before mitigation	Negative	2	3	2	3	1	1	4	48	Medium (29-50)	Yes	Yes
	After mitigation	Negative	1	2	1	2	1	1	3	24	Low (6-28)		
Mitigation:													
<ul style="list-style-type: none">A firebreak should be implemented during the construction phase where necessary.Adequate fire-fighting equipment should be provided and readily available on site and all staff should be trained in firefighting and how to use the fire-fighting equipment.No staff (except security) should be accommodated overnight on site and the contractor should ensure that no open fires are allowed on site. The use of cooking or heating implements should only be used in designated areas.Contractors need to ensure that any construction related activities that might pose potential fire risks, are done in the designated areas where it is also managed properly.Precautionary measures need to be taken during high wind conditions or during the winter months when the fields are dry.The project will adhere to the National Forest and Veld Fires Act and the fire management plan. It is recommended that the project proponent join the local fire association or implement their own third-party insurance.													

Table 8.61: Visual and Sense of Place Impacts During the Construction Phase

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated?	Is the impact acceptable?
Visual and sense of place impacts	Before mitigation	Negative	2	4	3	1	1	2	4	52	High (51-73)	Yes	Yes
	After mitigation	Negative	2	4	1	1	1	2	3	33	Medium (29-50)		
Mitigation:													
<ul style="list-style-type: none">Implement mitigation measures identified in the Visual Impact Assessment (VIA) prepared for the project.To the extent possible, limit noise generating activities to normal daylight working hours and avoid weekends and public holidays.The movement of heavy vehicles associated with the construction phase should be timed to avoid weekends, public holidays, and holiday periods where feasible.Dust suppression measures must be implemented for heavy vehicles such as wetting of gravel roads on a regular basis and ensuring that vehicles used to transport sand and building materials are fitted with tarpaulins or covers where necessary.All vehicles must be road-worthy, and drivers must be qualified and made aware of the potential road safety issues and need for strict speed limits.Communication, complaints, and grievance channels must be implemented and contact details of the CLO must be provided to the local community in the study area.													

Table 8.62: Direct and Indirect Employment Opportunities and Skills Development During the Operational Phase

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated?	Is the impact acceptable?
Direct and Indirect employment opportunities and skills development	Before mitigation	Positive	2	3	3	1	3	2	2	28	Low (6-28)	Yes	Yes
	After mitigation	Positive	2	4	4	1	3	2	3	48	Medium (29-50)		

Enhancement:
<ul style="list-style-type: none"> It is recommended that local employment policy is adopted to maximise the opportunities made available to the local community. The recruitment selection process should seek to promote gender equality and the employment of women wherever possible. Vocational training programs could be established to promote the development of skills, or other investments in local skills development, education and/or local enterprise development initiatives.

Table 8.63: Development of Non-Polluting, Renewable Energy Infrastructure During the Operational Phase

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated?	Is the impact acceptable?
Development of non-polluting, renewable energy infrastructure	Before mitigation	Positive	4	4	1	2	4	3	2	36	Medium (29-50)	No	Yes
	After mitigation	Positive	4	4	1	2	4	3	2	36	Medium (29-50)		
Enhancement/Mitigation:													
• None identified													

Table 8.64: Potential Loss of Agricultural Land During the Operational Phase

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated?	Is the impact acceptable?
Potential loss of agricultural land	Before mitigation	Negative	1	3	2	3	3	3	2	30	Medium (29-50)	Yes	Yes
	After mitigation	Negative	1	2	1	2	3	1	1	10	Low (6-28)		
Mitigation:													
<ul style="list-style-type: none">The proposed mitigation measures for the construction phase should have been implemented at this stage.Mitigation measures from the Agricultural and Soil Report, should also be implemented.													

Table 8.65: Contribution to Local Economic Development (LED) and Social Upliftment During the Operational Phase

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated?	Is the impact acceptable?
Contribution to Local Economic Development (LED) and social upliftment	Before mitigation	Positive	4	4	2	1	3	2	3	48	Medium (29-50)	Yes	Yes
	After mitigation	Positive	4	4	3	1	3	3	4	72	High (51-73)		
Enhancement:													
<ul style="list-style-type: none">A CNA must be conducted as far as practically possible to ensure that the LED and social upliftment programmes proposed by the project are meaningful.Ongoing communication and reporting are required to ensure that maximum benefit is obtained from the programmes identified, and to prevent the possibility for such programmes to be misused.The programmes should be reviewed on an ongoing basis to ensure that they are best suited to the needs of the community at the time (bearing in mind that these are likely to change over time).													

Table 8.66: Impact on Tourism During the Operational Phase

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated?	Is the impact acceptable?
Impact on tourism	Before mitigation	Positive/ Negative	2	3	1	1	3	2	2	24	Low (6-28)	Yes	Yes
	After mitigation	Positive/ Negative	2	3	1	1	3	2	2	24	Low (6-28)		
Enhancement:													
<ul style="list-style-type: none">Due to the extent of the project no viable mitigation measures can be implemented to eliminate the visual impact of the wind turbines, but the subjectivity towards the wind turbines can be influenced by creating a “Green Energy” awareness campaign, educating the local community and tourists on the benefits of renewable energy. Tourists visiting the area should be made aware of South Africa’s movement towards renewable energy. This might create a positive feeling of a country moving forward in terms of environmental sustainability.													

Table 8.67: Visual and Sense of Place Impacts During the Operational Phase

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated?	Is the impact acceptable?
Visual and sense of place impacts	Before mitigation	Negative	2	4	1	3	3	3	4	64	High (51-73)	Yes	Yes
	After mitigation	Negative	2	3	1	2	3	3	3	42	Medium (29-50)		
Mitigation:													
<ul style="list-style-type: none">To effectively mitigate the visual impact and the impact on sense of place during the operational phase of the proposed development, it is suggested that the recommendations made in the Visual Impact Assessment (specialist study) should be followed in this regard.													

8.1.8 Potential Impacts Based on Noise Levels

Increased noise levels are directly linked with the various activities associated with the construction of the proposed Carissa WEF development and related infrastructure, as well as the operation phase of the activity.

Noises Impact Relating to the Planning and Design Phase

Activities that relate to the planning and design phases are normally limited to surveying and site visits. These activities are normally limited to the daytime period, with the activities normally having temporary noise impacts of a minor consequence. The significance of the noise impact for the planning and design phase will be negative low and will not be considered in this noise assessment.

Construction Activities Relating to the Access Roads

Daytime ambient sound levels could range from less than 20 to more than 70 dBA, averaging at 41.2 dBA (for the two measurement locations as per chapter 7 above). Daytime ambient sound levels are thus typical of a rural noise district. Construction noises might be audible over large distances during quiet periods (during low wind conditions). Road construction activities however will be very temporary, though noise levels could be very high at NSR2 14, 34 and 35.

Road construction activities may exceed the recommended upper noise limit of 52 dBA at NSR 14 and 35; this assessment determined a potential significance of medium for this noise impact. Refer to Figure 8.1 below. While this medium significance may relate to the strict EIA criteria used, the following measures are recommended to note:

- The applicant should discuss the potential noise levels with these NSR, highlighting that the noise will be very temporary;
- The applicant should plan road construction or upgrading activities (when working closer than 120 m from NSR) when NSR are not at home (children at school, adults at work or busy). Ideally work near NSR should be planned to take place between 08:00 and 14:00; and
- Depending on feedback from the NSR, the applicant may consider relocating the access road further than 60 m from the NSR.

Noises Relating to Construction Traffic Passing NSR

Construction traffic noises will not exceed the recommended upper noise limit of 52 dBA with this assessment determined a potential significance of low for this noise impact. Additional mitigation measures are not required or recommended for this activity (construction traffic passing NSR).

Construction Activities at the WEF

Noises from daytime construction activities will not exceed the recommended upper noise limit of 52 dBA with this assessment determined a potential significance of low for daytime construction noises. Additional mitigation measures are not required or recommended for daytime construction activities.

While night-time construction activities are not planned, unforeseen events may require night-time construction activities. Noises from night-time construction activities could exceed the recommended upper noise limit of 42 dBA at NSRs 25, 27 and 28, with this assessment determined a potential significance of medium at NSR 27. Additional mitigation measures are recommended and it is recommended that the applicant should limit night-time construction activities at one WTG location, when working within 2 km

from any NSR. Simultaneous night-time activities can take place at other WTG locations further than 2 km from NSR.

Noise Impact Due to Future Operational Activities

WTG will only operate during period with increased winds, when ambient sound levels could be higher than periods with no or low winds. Ambient sound levels will likely be higher, with this assessment assuming an ambient sound level of 41.5 dBA at a wind speed of 8 m/s. This assessment recommends a daytime upper noise limit of 52 dBA and a night-time upper noise limit of 45 dBA. Numerous WTG of the WEF operating simultaneously will increase ambient sound levels due to air-borne noise from the WTG.

For the layout evaluated, using a WTG with a PWL of 110.5 dBA (re 1 pW), the potential significance for daytime operational activities will be low and additional mitigation are not required or recommended (daytime operational activities). Noises from night-time operation of the WTG could exceed the recommended upper noise limit of 45 dBA at NSRs 6, 14, 18, 25, 26 and 27, with this assessment determined a potential significance of medium at these NSR. Additional mitigation measures are required for any WTG with a PWL exceeding 108.0 dBA (re 1 pW), with potential mitigation measures including:

- *Planning phase* - changing the layout to position WTG further from NSR, or reducing the number of WTG located within 2 500 m from NSR;
- *Planning phase* - the selection of a WTG with a higher power generation capacity, which will allow a reduction in the total number of WTG required for the project (position WTG further from NSR, or reducing the number of WTG located within 2 500 m from NSR);
- *Planning phase* - the applicant can select the use of a WTG with a lower PWL (a quieter turbine);
- *Planning phase* - the applicant can plan to use serrated trailing edges (STE) on the blades of certain wind turbines located up to 2 500 m from receptors, or the design of a noise abatement programme on certain WTG (depending on the desired maximum noise level). Once the final layout and detail of the final WTG are available, noise modelling should re-evaluate the potential noise levels and design an appropriate noise abatement plan (to ensure worst-case noise levels less than 45 dBA at all NSR);
- *Planning phase* - the applicant to design and implement a noise monitoring programme at representative locations (where noise rating levels exceed 42 dBA based on the noise model used in this study);
- *Operational phase* - While planning would likely have managed noise levels below 45 dBA, if noise monitoring indicates noise levels exceeding 45 dBA at NSR, the applicant can retrofit WTG blades with STE; and
- *Operational phase* - If after the retro fitment of STE to the blades of WTG, and noise monitoring still indicate noise levels exceeding the recommended noise limit of 45 dBA, the applicant can design and implement a noise abatement plan that will further reduce the noise emission levels during certain wind speeds, wind directions, time periods or meteorological conditions.

Noise Impact Due to Future Decommissioning Activities

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.

Refer to Tables 8.68 to 8.74 for the noise impact assessment and mitigation measures of the potential impacts associated with the Carissa WEF.

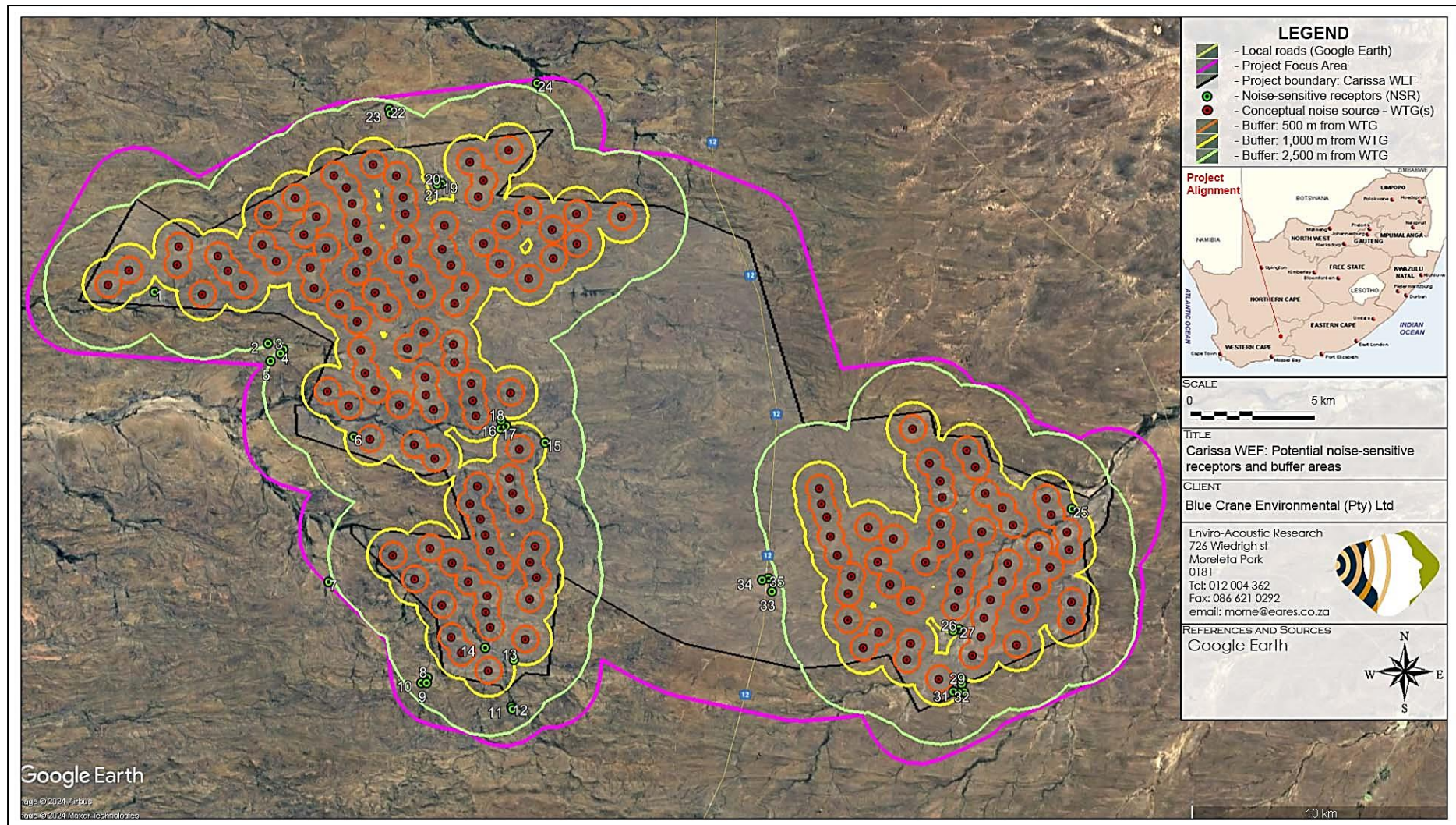


Figure 8.1: Study Area and Potential Noise-Sensitive Receptors Close to Carissa WEF

Table 8.68: Noises Associated with the Construction or Upgrading of Access Roads

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated?	Is the impact acceptable?
Noises associated with the construction or upgrading of access roads	Before mitigation	Negative	1	2	1	2	1	1	4	32	Medium (29-50)	Yes	Yes
	After mitigation	Negative	1	2	1	2	1	1	3	24	Low (6-28)		
Mitigation: <ul style="list-style-type: none">Discuss noise level with NSR.Plan timing of construction activities.Consider relocation of access roads further from NSR.													

Table 8.69: Noises Associated with Construction Traffic Passing Close to NSR

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated?	Is the impact acceptable?
Noises associated with construction traffic passing close to NSR	Before mitigation	Negative	1	4	1	2	1	1	2	20	Low (6-28)	Yes	Yes
	After mitigation	Negative	1	3	1	2	1	1	2	18	Low (6-28)		
Mitigation:													
• Mitigation not required due to low significance of noise impact from construction traffic passing NSR.													

Table 8.70: Noises Associated with the Daytime Construction of Projected Infrastructure

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated?	Is the impact acceptable?
Noises associated with the daytime construction of projected infrastructure	Before mitigation	Negative	1	3	1	2	1	1	2	18	Low (6-28)	Yes	Yes
	After mitigation	Negative	1	3	1	2	1	1	2	18	Low (6-28)		
Mitigation:													
<ul style="list-style-type: none">Mitigation not required due to low significance of noise impact from daytime construction activities passing NSR.													

Table 8.71: Noises Associated with the Night-Time Construction of Projected Infrastructure

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated?	Is the impact acceptable?
Noises associated with the night-time construction of projected infrastructure	Before mitigation	Negative	2	4	1	3	1	1	3	36	Medium (29-50)	Yes	Yes
	After mitigation	Negative	2	3	1	3	1	1	2	22	Low (6-28)		
Mitigation:													
• Applicant to limit simultaneous night-time construction activities at more than one WTG location closer than 2 km from NSR.													

Table 8.72 Noises Associated with Daytime Operation

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated?	Is the impact acceptable?
Noises associated with daytime operation of wind turbines	Before mitigation	Negative	1	2	1	2	3	3	2	24	Low (6-28)	Yes	Yes
	After mitigation	Negative	1	2	1	2	3	3	2	24	Low (6-28)		
Mitigation:													
<ul style="list-style-type: none">Applicant to limit simultaneous night-time construction activities at more than one WTG location closer than 2 km from NSR.													

Table 8.73: Noises Associated with Night-Time Operation of Wind Turbines

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated?	Is the impact acceptable?
Noises associated with night-time operation of wind turbines	Before mitigation	Negative	1	4	1	2	3	3	3	42	Medium (29-50)	Yes	Yes
	After mitigation	Negative	1	2	1	2	3	3	2	24	Low (6-28)		
Mitigation: <ul style="list-style-type: none">Planning Phase: Change layout, locate WTG further from NSR.Planning Phase: Reduce number of WTG within 2.5 km from NSR.Planning Phase: Selection of WTG with a lower PWL.Planning Phase: Design noise abatement plan (use of STE and / or reduced noise emission mode).Operational phase: Implement STE or noise abatement plan.													

Table 8.74: Noises Associated with a Future Decommissioning of the Project Infrastructure

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated?	Is the impact acceptable?
Noises associated with a future decommissioning of the project infrastructure	Before mitigation	Negative	1	3	1	2	1	1	2	18	Low (6-28)	Yes	Yes
	After mitigation	Negative	1	3	1	2	1	1	2	18	Low (6-28)		
Mitigation:													
• Mitigation not required due to low significance of noise impact from decommissioning activities.													

Mitigation Options Available to Reduce Noise Impact During the Construction Phase:

The significance of the noise impact associated with future construction activities would have a medium significance, with the impact associated with potential road upgrading or construction activities (when these activities take place closer than 60 m from NSR). While this medium significance may relate to the strict EIA criteria used, the following measures are recommended for the applicant to note:

- The applicant should discuss the potential noise levels with the NSR, highlighting that the noise will be very temporary;
- The applicant should plan road construction or upgrading activities (when working closer than 120 m from NSR) when NSR are not at home (children at school, adults at work or busy). Ideally work near NSR should be planned to take place between 08:00 and 14:00; and
- Depending on feedback from the NSR, the applicant may consider relocating the access road further than 60 m from the NSR.

It is also recommended that the developer consider the following to ensure that annoyance with the project is minimised:

- Night-time construction activities within 2 000 m from all NSR: Warning NSR when construction activities may take place at night; and
- Night-time construction activities within 2 000 m from all NSR: Minimise active equipment at night, planning the completion of noisiest activities (such a pile driving, rock breaking and excavation) during the daytime period.

Mitigation Options Available to Reduce Noise Impact During Operation:

The significance of the noise impact during the operation phase is projected to be low for daytime operational activities, but of a medium significance for night-time operational activities. Additional mitigation measures could be required for any WTG with a PWL exceeding 108.0 dBA (re 1 pW), with noise monitoring required for any WTG with a PWL higher than 105.0 dBA (re 1 pW).

Potential mitigation measures could be:

- *Planning phase* - changing the layout to position WTG further from NSR, or reducing the number of WTG located within 2 500 m from NSR;
- *Planning phase* - the selection of a WTG with a higher power generation capacity, which will allow a reduction in the total number of WTG required for the project (position WTG further from NSR, or reducing the number of WTG located within 2 500 m from NSR);
- *Planning phase* - the applicant can select the use of a WTG with a lower PWL (a quieter turbine);
- *Planning phase* - the applicant can plan to use serrated trailing edges (STE) on the blades of certain wind turbines located up to 2 500 m from receptors, or the design of a noise abatement programme on certain WTG (depending on the desired maximum noise level). Once the final layout and detail of the final WTG are available, noise modelling should re-evaluate the potential noise levels and design an appropriate noise abatement plan (to ensure worst-case noise levels less than 45 dBA at all NSR);
- *Planning phase* - the applicant to design and implement a noise monitoring programme at representative locations (where noise rating levels exceed 42 dBA based on the noise model used in this study);

- *Operational phase* - While planning would likely have managed noise levels below 45 dBA, if noise monitoring indicates noise levels exceeding 45 dBA at NSR, the applicant can retrofit WTG blades with STE;
- *Operational phase* - If after the retro fitment of STE to the blades of WTG, and noise monitoring still indicate noise levels exceeding the recommended noise limit of 45 dBA, the applicant can design and implement a noise abatement plan that will further reduce the noise emission levels during certain wind speeds, wind directions, time periods or meteorological conditions.

Mitigation Options Available to Reduce Noise Impact During Decommissioning:

The potential significance of the noise impact would be similar as the construction phase (low significance) and no further mitigation is recommended or required for the decommissioning phase.

Mitigation and Management Conditions to be Included in the EMPr:

It is recommended that the project applicant:

1. The applicant remodel the potential noise rating levels once the WTG specifications are finalised and the selected WTG have a maximum PWL exceeding 108.0 dBA (re 1 pW);
2. If the modelled worst-case noise rating levels, after the evaluation of the final selected WTG (and final layout) are higher than 45 dBA at any NSR, the applicant must use STE on certain WTGs, or design a noise abatement programme that will ensure that worst-case modelled noise levels are less than 45 dBA at all verified NSR. The noise abatement plan should identify WTG that require STE and/or additional noise emission reduction modes;
3. The applicant re-evaluate the noise impact should the layout be revised where any WTG, located within 2 500 m from a confirmed NSR, are moved closer to the NSR;
4. The applicant re-evaluate the noise impact should the layout be revised where any new WTG are introduced within 2 500 m from an NSR;
5. The applicant re-evaluate the noise impact should the layout be revised where the number of WTG within 2 500 m from an NSR are increased;
6. The applicant plan and design a noise monitoring program at representative NSR locations where the modelled worst-case noise rating levels exceed 42 dBA. This should include the measurement of ambient sound levels prior to the development of the WEF, followed by noise measurements once the WEF is operational to confirm that noise levels are less than 45 dBA;
7. The applicant to ensure that trucks and other construction equipment are well maintained and fitted with the correct and appropriate noise abatement measures. Engine bay covers over heavy equipment could be pre-fitted with sound absorbing material. Heavy equipment that fully encloses the engine bay should be considered, ensuring that the seam gap between the hood and vehicle body is minimised;
8. The applicant to include a component covering environmental noise in the Health and Safety Induction to sensitize all employees and contractors about the potential impact from noise, especially those employees and contractors that have to travel past receptors at night, or might be required to do work close (within 1 500 m) to NSRs at night. This should include issues such as minimising the use of vehicle horns;
9. The applicant to notify NSR (and/or land owner(s)) before night-time construction activities are to take place within 1 500 m from an NSR (if the structures are used for residential activities during the proposed construction period);
10. Where practicable, mobile equipment should be fitted with broadband (white-noise generators/alarms), rather than tonal reverse alarms;

11. The applicant to investigate any reasonable and valid noise complaint if registered by a receptor staying within 2 000 m from the location where construction activities are taking place, or where an operational WTG are located; and
12. The applicant to keep a complaint register, registering a full record of any noise complaint.

Environmental Monitoring Plan

Environmental Noise Monitoring can be divided into two distinct categories, namely:

- Passive monitoring – the registering of any complaints (reasonable and valid from NSR living within 2 500 m from any WTG of the Carissa WEF) regarding noise; and
- Active monitoring – the measurement of noise levels at identified locations.

Worst-case scenario modelling undertaken for this assessment indicates that noise levels could exceed 45 dBA at six locations (seven locations within the PFA for the cumulative scenario).

Worst-case noise levels are projected to be higher than 42 dBA (more than 7 dBA of the night-time rating level of a rural noise district) and active noise monitoring is recommended and required. Noise monitoring may be required for any WTG with a PWL exceeding 105.0 dBA (re 1 pW) (for the current layout). In addition, should a reasonable and valid noise complaint be registered, the applicant should investigate the noise complaint.

○ Measurement Localities and Frequency

It is recommended that ambient sound levels be measured at representative NSR locations before the development of the WEF where the worst-case noise levels could exceed 42 dBA, with the measurements repeated after the first year of operation.

In addition, should there be a valid and reasonable noise complaint, 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.

○ Measurement Procedures

Noise level measurements should be collected considering the requirements of SANS 10103:2008 (or an international recognized method such as IEC 61400-11, ETSU-R97 or ISO 1996). While potential construction noises could be measured using the SANS 10103:2008 procedure, an international recognized protocol is recommended to measure operational noises from the WEF.

○ Environmental Management

When a noise complaint is being investigated, measurements should be collected during a period or in conditions similar to when the receptor experienced the disturbing noise.

Environmental Management Objectives are difficult to be defined for noise because ambient sound levels would slowly increase as developmental pressures increase in the area. This is due to increased traffic associated with increased development, human habitation, agriculture and even eco-tourism. While these increases in ambient sound levels may be low (and insignificant) it has the effect of cumulatively increasing the ambient sound levels over time.

The moment the WEF stops operation, ambient sound levels will drop to levels similar to the pre-WEF levels, or to new levels (typical of other areas with a similar developmental character) if other developments have occurred in the interim.

For the purpose of this report potential environmental management objectives would be:

- That the development (construction and operational phase) of the WEF project does not result in noise levels exceeding 52 dBA (when measured over a period of at least 1 hour) during the day at NSRs; and
- That the development (construction and operational phase) of the WEF project should not result in noise levels exceeding 45 dBA (when measured over a period of at least 1 hour) at night at NSRs.

As potential noise levels will be low during both the construction and operational phases, Environmental Management is mainly focusing on the night-time period as summarised in:

- Planning phase (to ensure that noise levels are with the acceptable limits during the future operational phase;
- Night-time activities during the construction phase; and
- The operation of the WTGs.

Table 8.75: Environmental Management for Planning Phase

Objective: Calculated noise rating levels less than 7 dBA from the appropriate rating level		
Project Components:	Future construction and operational activities of WTG of the Carissa WEF	
Potential Impact:	Noise levels impacting on the quality of living of NSR	
Activity/Risk source	Future construction and operational activities	
Mitigation: Target	Daytime noise levels less than 52 dBA, night-time noise levels less than 42 dBA at locations used for residential purposes	
Mitigation: Action / Control	Responsibility	Timeframe
The applicant to remodel the potential noise rating levels once the WTG specifications are finalised and the selected WTG have a maximum PWL exceeding 108.0 dBA (re 1 pW).	Applicant	Planning phase, before development of WEF
If the modelled worst-case noise rating levels, after the evaluation of the final selected WTG (and final layout) are higher than 45 dBA at any NSR, the applicant can use STE on certain WTG, or design a noise abatement programme that will ensure that worst-case modelled noise levels are less than 45 dBA at all verified NSR. The noise abatement plan should identify WTG that require STE and/or additional noise emission reduction modes.	Applicant	Planning phase, before development of WEF
The applicant to re-evaluate the noise impact should the layout be revised where any WTG, located within 2 500 m from a confirmed NSR, are moved closer to the NSR.	Applicant	Planning phase, before development of WEF
The applicant to re-evaluate the noise impact should the layout be revised where any new WTG are introduced within 2 500 m from an NSR	Applicant	Planning phase, before development of WEF
The applicant to re-evaluate the noise impact should the layout be revised where the number of WTG within 2 500 m from an NSR are increased	Applicant	Planning phase, before development of WEF
The applicant to plan and design a noise monitoring program at representative NSR locations where the worst-case noise rating levels exceed 42 dBA. This should include the measurement of	Applicant	Planning phase, before development of WEF

ambient sound levels prior to the development of the WEF, followed by noise measurements once the WEF is operational.		
Performance Indicator	Calculated daytime noise levels should be less than 52 dBA, with night-time noise levels being less than 42 dBA at structures used residential purposes	
Monitoring	No monitoring required during planning phase	

Table 8.76: Environmental Management for Night-Time Construction Activities

Objective: Construction activities not to result in noise levels exceeding 52 dBA during the day-time period at NSRs Construction activities not to result in noise levels exceeding 42 dBA during the night-time period at NSRs		
Project Components:	Construction activities and construction equipment generating disturbing and nuisance noises	
Potential Impact:	Night-time noise levels impacting on the quality of living of NSR	
Activity/Risk source	Construction activities	
Mitigation: Target	Daytime noise levels less than 52 dBA, night-time noise levels less than 42 dBA at locations used for residential purposes	
Mitigation: Action / Control	Responsibility	Timeframe
The applicant to ensure that trucks and other construction equipment are well maintained and fitted with the correct and appropriate noise abatement measures. Engine bay covers over heavy equipment could be pre-fitted with sound absorbing material. Heavy equipment that fully encloses the engine bay should be considered, ensuring that the seam gap between the hood and vehicle body is minimised.	Contractor / Applicant	Ongoing during construction phase
The applicant to include a component covering environmental noise in the Health and Safety Induction to sensitize all employees and contractors about the potential impact from noise, especially those employees and contractors that have to travel past receptors at night, or might be required to do work close (within 1 500m) to NSRs at night. This should include issues such as minimising the use of vehicle horns.	Contractor / Applicant	Ongoing during construction phase
The applicant to notify NSR (and/or land owner(s)) before night-time construction activities are to take place within 1 500 m from an NSR (if the structures are used for residential activities during the proposed construction period).	Contractor / Applicant	Construction activities within 1 000 m from NSR, if NSR is used for residential purposes
Where practicable, mobile equipment should be fitted with broadband (white-noise generators/alarms), rather than tonal reverse alarms.	Contractor / Applicant	Construction phase
Performance Indicator	Daytime noise levels from construction activities less than 52 dBA at NSR Night-time noise levels from construction activities less than 42 dBA at NSR	
Monitoring	Inspection of equipment by Contractor or Environmental Control Officer (ECO). Measurement of noise levels at dwellings of NSR after noise complaints.	

Table 8.77: Environmental Management for Night-Time Operational Period

Objective: Operational activities not to result in noise levels exceeding 52 dBA during the day-time period at NSRs Operational activities not to result in noise levels exceeding 45 dBA during the night-time period at NSRs	
Project Components:	Operation of WTG within 2 500 m from structure used for residential purposes

Potential Impact:	Noises from WTG impacting on the quality of living of NSR		
Activity/Risk source	Operation of WTG		
Mitigation: Target	Daytime noise levels from operational activities less than 52 dBA at NSR Night-time noise levels from operational activities less than 45 dBA at NSR		
Mitigation: Action / Control		Responsibility	Timeframe
The applicant to investigate any reasonable and valid noise complaint if registered by a receptor staying within 2 000 m from the location where construction activities are taking place, or where an operational WTG are located.		EO / Applicant	Within 2 months after a noise complaint is registered
The applicant to keep a complaint register, registering a full record of the complaint.		EO / Applicant	Ongoing during the operational phase.
The applicant to conduct operational noise monitoring to confirm that noise levels associated with operating WTG are less than 45 dBA at all NSR locations (measurements at representative NSR locations where the worst-case modelled noise levels exceeded 42 dBA).		EO / Applicant	During the first year once the project is operational. Noise specialist to confirm need for future measurements.
Performance Indicator	Measurement of noise levels using an appropriate and suitable measurement protocol (such as IEC 61400-11 or ETSU-R97).		

8.1.9 Potential Impacts on Cultural Heritage

The following impacts are identified on cultural heritage resources.

8.1.9.1 Impact - Field Rating IIIA (BE/21/374/007)

The graveyard (BE/21/374/007) identified at Portion 21 of Brits Eigendom 374, is situated within the proposed Grid Corridor and will be negatively impacted by development. All graves are of high significance and should be protected. The impact of the graveyard would be NEGATIVE HIGH before mitigation and NEGATIVE LOW after mitigation during the Construction and Decommissioning phases, and NEGATIVE MEDIUM before mitigation and NEGATIVE LOW after mitigation during the Operational phase.

Mitigation:

It is recommended that a Buffer/Safety No-Go zone of 50 m should be implemented around the graves. The buffer/safety zone implemented should be clearly demarcated during the construction and decommissioning phases of the project and completely avoided by personnel and equipment.

8.1.9.2 Impact - Field Rating IVA (F/RE/380/002; F/RE/380/003; F/RE/380/004)

Since the Knapping site (F/RE/380/002; F/RE/380/003; F/RE/380/004) is situated outside of the proposed development on Farm RE/380, it will not be impacted. However, in the unlikely event that impact occurs, it will be negative. The impact on these resources would be NEGATIVE LOW before and after mitigation, NEGATIVE LOW during the construction and decommissioning phases and NEGATIVE LOW before and after mitigation during the operational phases.

Mitigation:

Since the turbine's location has been adjusted post-survey, the site now falls outside the WTG86 footprint, so it will likely not be impacted. Thus, no further mitigation is recommended.

8.1.9.3 Impact - Field rating IVB (BE/19/374/010; BE/19/374/011)

A farmstead older than 60 years with associated features such as outbuildings, a possible threshing floor, a kraal, and a water canal/storage was identified near the proposed grid corridor on Portion 19 of the Farm Brits Eigendom 374. The farmhouse is outside the corridor; however, the kraal is within the corridor. The impact of these resources would be NEGATIVE MEDIUM before mitigation and NEGATIVE LOW after mitigation during the Construction and Decommissioning phases, and NEGATIVE LOW before and after mitigation during the Operational phase.

Mitigation:

Since the farmhouse is outside of the grid corridor, it will not be impacted by development. Thus, no further mitigation is recommended. However, a 100 m buffer/safety zone is recommended to negate the negative impact on the kraal and associated features, as this resource is located within the grid corridor.

8.1.9.4 Impact - Field rating IVB (JK/2/374/27; BE/374/028)

The historical period structures on Jagerskraal 2/374 (JK/2/374/27) and Portions 25, 21, and 4 of Brits Eigendom 374 (BE/374/028) are older than 60 years. Due to the recent changes that were made to the corridor locations, it will now be impacted by development. Any impact on these resources would be negative. The impact of these resources would be NEGATIVE HIGH before mitigation and NEGATIVE LOW after mitigation during the Construction phase, and NEGATIVE MEDIUM before mitigation and NEGATIVE LOW after mitigation during the Decommissioning phase, and NEGATIVE LOW before and after mitigation during the Operational phase.

Mitigation:

A 100 m buffer/safety zone is recommended to negate the negative impact on these resources.

8.1.9.5 Impact - Field Rating IVC (BE/2/374/017; PF/RE/370/018; PF/RE/370/019; PF/RE/370/019; MP/326/026; PF/2/370/005; VK/3/369/006; BE/RE/11/374/008; BE/RE/11/374/009; BE/8/374/012; BE/8/374/013; BE/8/374/014; BE/8/374/015; PF/RE/370/020)

The isolated occurrences of LSA period lithics (BE/2/374/017; PF/RE/370/018; PF/RE/370/019; PF/RE/370/019; MP/326/026) identified at Brits Eigendom 2/374, Palmietfontein RE/370, and Meyerspoort 326, as well as the Historical Period resources (PF/2/370/005; VK/3/369/006; BE/RE/11/374/008; BE/RE/11/374/009; BE/8/374/012; BE/8/374/013; BE/8/374/014; BE/8/374/015; PF/RE/370/020) identified at Palmietfontein 2/370, RE/370 Vetkoe Kraal 3/369, Brits Eigendom RE/11/374, 8/374 are considered to be of low significance (Field rating IVC) as they are without substantial archaeological context or matrix and are therefore deemed of minor scientific importance and not conservation-worthy (NCW). The impact on these resources would be NEGATIVE LOW before and after mitigation during the construction and operational phases. The impact is negligible.

Mitigation:

No mitigation measures are recommended.

8.1.9.6 *Visual Impact of Industrial Operational Infrastructure on Sensitive Visual Receptors, Landscape and Scenic Resources. Change in the Sense of Place of the Local Area*

The majority of visual impacts associated with the project are anticipated to occur during the operational phase of the development. Impacts during the construction phase of the project are typical of the type of visual impact generally associated with construction activities. Impacts associated with the design and construction phase of a project are usually of short duration and temporary in nature. Still, they could have long-term effects on the surrounding visual environment if not planned or managed appropriately. It is, therefore, necessary that the design phase be conducted in such a manner so as not to result in permanent impacts associated with the ill placement of project components or associated infrastructure. The project is anticipated to operate permanently. The development will operate continuously, seven days a week. Key elements of the Operation and Management (O&M) Plan include monitoring and reporting the performance of the project, conducting preventative and corrective maintenance, receiving visitors, and maintaining security. The decommissioning phase of the project will result in the same visual impacts experienced during the construction phase of the project. However, the proposed development is anticipated to be refurbished and upgraded to prolong its life. No decommissioning of the development is proposed at this stage (Donaway Environmental 2024, Appendix C).

Mitigation:

The following mitigation is recommended:

Construction Phase

- An Environmental Control Officer should be appointed during the construction and decommissioning phase to oversee environmental compliance.
- Ensure that vegetation is not unnecessarily cleared or removed during the construction period.
- Reduce the construction period through careful logistical planning and productive implementation of resources.
- Plan the placement of lay-down areas and potential temporary construction camps in order to minimise vegetation clearing (i.e., in already disturbed areas) where possible.
- Restrict the activities and movement of construction workers and vehicles to the immediate construction site and existing access roads.
- Implement good housekeeping through the removal of rubble, litter, and construction material. If it is not removed daily from a registered landfill site, then it should be stored appropriately until removal can take place.
- Dust suppression should be implemented during construction, especially near roads where dust may cause reduced visibility. Due to water scarcity in most parts of South Africa, contractors could source alternative ways to implement dust suppression. One such way could be the use of fine gravel stone on roads with heavy traffic.
- Restrict construction activities to daylight hours to negate or reduce the visual impact of lighting.
- Rehabilitate all disturbed areas outside the construction footprint immediately after the completion of construction works.

Operational Phase

- Maintenance and good housekeeping of the development.
- Roads must be maintained to eliminate erosion and suppress dust.
- Rehabilitated areas must be monitored for rehabilitation failure, and remedial action must then be implemented as and when required.

- Retain/re-establish and maintain natural vegetation immediately adjacent to the development footprint.
- It is not feasible to add vegetation for screening purposes due to the water scarcity in the Karoo. Furthermore, due to the height of the WTGs, screening might not have the desired effect, but screening will be added where required.
- Use low-intensity, aviation-safe lighting that is only visible when necessary, such as using lights that activate only when aircraft are nearby. This mitigation measure is subject to SACAA regulations and technical feasibility.

Shadow Flicker Phenomenon

- Involve landowners at an early stage to explain the phenomenon of shadow flicker and present the relevant data.
- Involving the landowner might have the following outcomes (each landowner might have a different outcome, and they should be approached individually):
- Installation of screening structures and/or planting of trees to block shadows flicker by the turbines.
- Use of turbine control strategies which shut down turbines when shadow flicker is likely to occur.
- If a landowner does not object to shadow flicker, no mitigation is required, and the landowner should sign a waiver.

Table 8.78: All Construction Phase Activities SITE(S): Field Rating IIIA (BE/21/374/007)

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated?	Is the impact acceptable?
All construction phase activities SITE(S): Field Rating IIIA (BE/21/374/007)	Before mitigation	Negative	2	4	3	3	3	3	3	54	High (51-73)	Yes	No
	After mitigation	Negative	1	1	1	1	1	1	1	6	Low (6-28)		
Mitigation:													
<ul style="list-style-type: none">It is recommended that a Buffer/Safety No-Go zone of 50 m should be implemented around the graves. The buffer/safety zone implemented should be clearly demarcated during the construction and decommissioning phases of the project and completely avoided by personnel and equipment.													

Table 8.79: All Construction Phase Activities SITE(S): Field Rating IVA (F/RE/380/002; F/RE/380/003; F/RE/380/004)

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated?	Is the impact acceptable?
All construction phase activities SITE(S): Field IVA Rating (F/RE/380/002; F/RE/380/003; F/RE/380/004)	Before mitigation	Negative	2	2	2	2	2	2	2	24	Low (6-28)	Yes	No
	After mitigation	Negative	1	1	1	1	1	1	1	6	Low (6-28)		
Mitigation:													
<ul style="list-style-type: none">Since the turbine’s location has been adjusted post-survey, the site now falls outside the WTG86 footprint, so it will likely not be impacted. Thus, no further mitigation is recommended.													

Table 8.80: All Construction Phase Activities SITE(S): Field rating IVB (BE/19/374/010; BE/19/374/011)

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated?	Is the impact acceptable?
All construction phase activities SITE(S): Field rating IVB (BE/19/374/010; BE/19/374/011)	Before mitigation	Negative	1	3	3	3	3	3	3	48	Medium (29-50)	Yes	No
	After mitigation	Negative	1	1	1	1	1	1	1	6	Low (6-28)		
Mitigation:													
<ul style="list-style-type: none">Since the farmhouse is outside of the grid corridor, it will not be impacted by development. Thus, no further mitigation is recommended. However, a 100 m buffer/safety zone is recommended to negate the negative impact on the kraal and associated features, as this resource is located within the grid corridor.													

Table 8.81: All Construction Phase Activities SITE(S): Field rating IVB (JK/2/374/27; BE/374/028)

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated?	Is the impact acceptable?
All construction phase activities SITE(S): Field	Before mitigation	Negative	1	3	3	3	3	3	3	48	Medium (29-50)	Yes	No

rating IVB (JK/2/374/27; BE/374/028)	After mitigation	Negative	1	1	1	1	1	1	1	6	Low (6-28)		
Mitigation:													
<ul style="list-style-type: none"> A 100 m buffer/safety zone is recommended to negate the negative impact on these resources. 													

Table 8.82: All Construction Phase Activities SITE(S): Field Rating IVC (BE/2/374/017; PF/RE/370/018; PF/RE/370/019; PF/RE/370/019; MP/326/026; PF/2/370/005; VK/3/369/006; BE/RE/11/374/008; BE/RE/11/374/009; BE/8/374/012; BE/8/374/013; BE/8/374/014; BE/8/374/015; PF/RE/370/020)

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated?	Is the impact acceptable?
All construction phase activities SITE(S): Field Rating IVC (BE/2/374/017; PF/RE/370/018; PF/RE/370/019; PF/RE/370/019; MP/326/026; PF/2/370/005; VK/3/369/006; BE/RE/11/374/008; BE/RE/11/374/009; BE/8/374/012; BE/8/374/013; BE/8/374/014; BE/8/374/015; PF/RE/370/020)	Before mitigation	Negative	1	2	1	1	1	1	1	7	Low (6-28)	Yes	Yes
	After mitigation	Negative	1	1	1	1	1	1	1	6	Low (6-28)		
Mitigation:													
● A 100 m buffer/safety zone is recommended to negate the negative impact on these resources.													

Table 8.83: All Operation Phase Activities SITE(S): Field Rating IIIA (BE/21/374/007)

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated?	Is the impact acceptable?
All operation phase activities SITE(S): Field IIIA Rating (BE/21/374/007)	Before mitigation	Negative	2	2	3	3	3	3	3	48	Medium (29-50)	Yes	No
	After mitigation	Negative	1	1	1	1	1	1	1	6	Low (6-28)		
Mitigation:													
<ul style="list-style-type: none">It is recommended that a Buffer/Safety No-Go zone of 50 m should be implemented around the graves. The buffer/safety zone implemented should be clearly demarcated during the construction and decommissioning phases of the project and completely avoided by personnel and equipment.													

Table 8.84: All Operation Phase Activities SITE(S): Field Rating IVA (F/RE/380/002; F/RE/380/003; F/RE/380/004)

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated?	Is the impact acceptable?
All operation phase activities SITE(S): Field Rating IVA (F/RE/380/002; F/RE/380/003; F/RE/380/004)	Before mitigation	Negative	2	2	3	3	3	3	3	48	Medium (29-50)	Yes	No
	After mitigation	Negative	1	1	1	1	1	1	1	6	Low (6-28)		
Mitigation:													
<ul style="list-style-type: none">Since the turbine’s location has been adjusted post-survey, the site now falls outside the WTG86 footprint, so it will likely not be impacted. Thus, no further mitigation is recommended.													

Table 8.85: All Operation Phase Activities SITE(S): Field rating IVB (BE/19/374/010; BE/19/374/011)

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated?	Is the impact acceptable?
All operation phase activities SITE(S): Field rating IVB (BE/19/374/010; BE/19/374/011)	Before mitigation	Negative	2	2	3	3	3	3	3	48	Medium (29-50)	Yes	No
	After mitigation	Negative	1	1	1	1	1	1	1	6	Low (6-28)		
Mitigation:													
<ul style="list-style-type: none">Since the farmhouse is outside of the grid corridor, it will not be impacted by development. Thus, no further mitigation is recommended. However, a 100 m buffer/safety zone is recommended to negate the negative impact on the kraal and associated features, as this resource is located within the grid corridor.													

Table 8.86: All Operation Phase Activities SITE(S): Field rating IVB (JK/2/374/27; BE/374/028)

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated?	Is the impact acceptable?
All operation phase activities SITE(S): Field rating IVB (JK/2/374/27; BE/374/028)	Before mitigation	Negative	1	2	1	1	1	2	1	8	Low (6-28)	Yes	No
	After mitigation	Negative	1	1	1	1	1	1	1	6	Low (6-28)		
Mitigation:													
<ul style="list-style-type: none">A 100 m buffer/safety zone is recommended to negate the negative impact on these resources.													

Table 8.87: All Operation Phase Activities SITE(S): Field Rating IVC (BE/2/374/017; PF/RE/370/018; PF/RE/370/019; PF/RE/370/019; MP/326/026; PF/2/370/005; VK/3/369/006; BE/RE/11/374/008; BE/RE/11/374/009; BE/8/374/012; BE/8/374/013; BE/8/374/014; BE/8/374/015; PF/RE/370/020)

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated?	Is the impact acceptable?
All operation phase activities SITE(S): Field Rating IVC (BE/2/374/017; PF/RE/370/018; PF/RE/370/019; PF/RE/370/019; MP/326/026; PF/2/370/005; VK/3/369/006; BE/RE/11/374/008; BE/RE/11/374/009; BE/8/374/012; BE/8/374/013; BE/8/374/014; BE/8/374/015; PF/RE/370/020)	Before mitigation	Negative	1	1	1	1	1	1	1	6	Low (6-28)	Yes	Yes
	After mitigation	Negative	1	1	1	1	1	1	1	6	Low (6-28)		
Mitigation:													
• No mitigation measures are recommended.													

Table 8.88: All Decommissioning Phase Activities SITE(S): Field Rating IIIA (BE/21/374/007)

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated?	Is the impact acceptable?
All decommissioning phase activities SITE(S): Field Rating IIIA (BE/21/374/007)	Before mitigation	Negative	2	4	3	3	3	3	3	54	High (51-73)	Yes	No
	After mitigation	Negative	1	1	1	1	1	1	1	6	Low (6-28)		
Mitigation:													
<ul style="list-style-type: none">It is recommended that a Buffer/Safety No-Go zone of 50 m should be implemented around the graves. The buffer/safety zone implemented should be clearly demarcated during the construction and decommissioning phases of the project and completely avoided by personnel and equipment.													

Table 8.89: All Decommissioning Phase Activities SITE(S): Field Rating IVA (F/RE/380/002; F/RE/380/003; F/RE/380/004)

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated?	Is the impact acceptable?
All decommissioning phase activities SITE(S): Field Rating IVA (F/RE/380/002; F/RE/380/003; F/RE/380/004)	Before mitigation	Negative	2	2	2	2	2	2	2	24	Low (6-28)	Yes	No
	After mitigation	Negative	1	1	1	1	1	1	1	6	Low (6-28)		

Mitigation:

- Since the turbine's location has been adjusted post-survey, the site now falls outside the WTG86 footprint, so it will likely not be impacted. Thus, no further mitigation is recommended.

Table 8.90: All Decommissioning Phase Activities SITE(S): Field rating IVB (BE/19/374/010; BE/19/374/011)

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated?	Is the impact acceptable?
All decommissioning phase activities SITE(S): Field rating IVB (BE/19/374/010; BE/19/374/011)	Before mitigation	Negative	1	3	3	3	3	3	3	48	Medium (29-50)	Yes	No
	After mitigation	Negative	1	1	1	1	1	1	1	6	Low (6-28)		
Mitigation:													
<ul style="list-style-type: none">Since the farmhouse is outside of the grid corridor, it will not be impacted by development. Thus, no further mitigation is recommended. However, a 100 m buffer/safety zone is recommended to negate the negative impact on the kraal and associated features, as this resource is located within the grid corridor.													

Table 8.91: All Decommissioning Phase Activities SITE(S): Field rating IVB (JK/2/374/27; BE/374/028)

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated?	Is the impact acceptable?
All decommissioning phase activities SITE(S): Field rating IVB (JK/2/374/27; BE/374/028)	Before mitigation	Negative	1	3	3	3	3	3	3	48	Medium (29-50)	Yes	No
	After mitigation	Negative	1	1	1	1	1	1	1	6	Low (6-28)		
Mitigation:													
<ul style="list-style-type: none">A 100 m buffer/safety zone is recommended to negate the negative impact on these resources.													

Table 8.92: All Decommissioning Phase Activities SITE(S): Field Rating IVC (BE/2/374/017; PF/RE/370/018; PF/RE/370/019; PF/RE/370/019; MP/326/026; PF/2/370/005; VK/3/369/006; BE/RE/11/374/008; BE/RE/11/374/009; BE/8/374/012; BE/8/374/013; BE/8/374/014; BE/8/374/015; PF/RE/370/020)

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated?	Is the impact acceptable?
All decommissioning phase activities SITE(S): Field Rating IVC (BE/2/374/017; PF/RE/370/018; PF/RE/370/019; PF/RE/370/019; MP/326/026;	Before mitigation	Positive	1	1	1	1	1	1	1	6	Low (6-28)	Yes	Yes

PF/2/370/005; VK/3/369/006; BE/RE/11/374/008; BE/RE/11/374/009; BE/8/374/012; BE/8/374/013; BE/8/374/014; BE/8/374/015; PF/RE/370/020)	After mitigation	Positive	1	1	1	1	1	1	1	6	Low (6-28)		
Mitigation: <ul style="list-style-type: none">A 100 m buffer/safety zone is recommended to negate the negative impact on these resources.													

8.1.10 Potential Paleontological Impacts

Based on the site investigation and desktop research it is concluded that fossil heritage of scientific and conservational interest is present in the Carissa WEF development footprint. This is in agreement with the Very High Sensitivity allocated to the development area by the SAHRIS Paleo-sensitivity Map and DFFE Screening Tool. A High Palaeontological Significance has been allocated for the construction phase of the Carissa WEF and associated infrastructure pre-mitigation and a Medium significance post-mitigation. The construction phase will be the only development phase impacting Palaeontological Heritage, and no significant impacts are expected to impact the Operational and Decommissioning phases. As the No-Go Alternative considers the option of 'doing nothing' and maintaining the status quo, it will have a Neutral impact on the Palaeontological Heritage of the development. The Cumulative impacts of the development near Beaufort West are considered to be Medium pre-mitigation and Low, post-mitigation and fall within the acceptable limits for the project.

The Carissa WEF Project is vast and although care was taken to identify all fossil sites during the site investigation time was a limitation.

It is thus recommended that a Palaeontological Walkdown is conducted, by a professional Palaeontologist, for the Carissa WEF and associated infrastructure when the final layouts are established, before vegetation clearance and construction takes place. This is considered a pre-construction requirement.

Table 8.93: Loss of Fossil Heritage During Construction

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated?	Is the impact acceptable?
Loss of Fossil Heritage by Destruction, Movement or Sealing in of Fossil Heritage in or Below the Earth's Surface	Before mitigation	Negative	1	3	4	4	4	2	4	72	High (51 to 73)	No	Yes
	After mitigation	Negative	1	3	4	2	4	1	4	42	Medium (29-50)		
Mitigation:													
<ul style="list-style-type: none">• A 30 m Buffer is recommended around the in situ Therapsid vertebrate column and ribs (-32.700773; 22.503574).• It is further recommended that a Palaeontological Walkdown is conducted by a professional Palaeontologist for the Carissa WEF and associated infrastructure when the final layouts are established but before vegetation clearance and construction take place.• A Chance Find Protocol must be implemented if fossil remains are discovered prior to the Palaeontological Walkdown.													

8.1.11 Potential Impacts on the Visual Landscape

The design and construction phase are expected to take up to 24 months to complete. The majority of visual impacts associated with the project are anticipated to occur during the operational phase of the development. Impacts during the construction phase of the project are typical of the type of visual impacts generally associated with construction activities. Impacts associated with the design and construction phase of a project are usually of a short duration and temporary in nature but could have long-term effects on the surrounding visual environment if not planned or managed appropriately. It is therefore necessary that the design phase be conducted in such a manner so as not to result in permanent impacts associated with the ill placement of project components or associated infrastructure.

The project is anticipated to operate permanently. The development will operate continuously, 7 days a week. Key elements of the Operation and Management (O&M) Plan include monitoring and reporting the performance of the project, conducting preventative and corrective maintenance, receiving visitors, and maintaining security.

The decommissioning phase of the project will result in the same visual impacts experienced during the construction phase of the project. However, it is anticipated that the proposed development will be refurbished and upgraded to prolong its life. No decommissioning of the development is proposed at this stage.

Refer to Tables 8.94 to 8.97 below for the visual impact.

Table 8.94: Visual Impact – Construction Phase: WEF

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated?	Is the impact acceptable?
Visual impact of construction activities on sensitive visual receptors and a rural landscape.	Before mitigation	Negative	2	4	1	3	1	4	4	60	High (51-73)	Yes	Yes
	After mitigation	Negative	2	3	1	3	1	4	4	56	High (51-73)		
Mitigation: Planning													
<ul style="list-style-type: none">Retain and maintain natural vegetation immediately adjacent to the development footprint.													
Mitigation: Construction													
<ul style="list-style-type: none">Ensure that vegetation is not unnecessarily removed during the construction phase.Plan the placement of laydown areas and temporary construction equipment camps to minimise vegetation clearing (i.e., in already disturbed areas) where possible.Restrict the activities and movement of construction workers and vehicles to the immediate construction site and existing access roads.Ensure that rubble, litter, etc. are appropriately stored (if it can't be removed daily) and then disposed of regularly at a licenced waste site.Reduce and control dust during construction by utilising dust suppression measures.Limit construction activities between 07:00 and 18:00, where possible, to reduce the impacts of construction lighting.Rehabilitate all disturbed areas immediately after the completion of construction work and maintain good housekeeping.													

Table 8.95: Visual Impact – Construction Phase: Grid Connection³⁶

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated?	Is the impact acceptable?
Visual impact of construction activities on sensitive visual receptors and a rural landscape.	Before mitigation	Negative	2	3	3	3	1	4	2	32	Medium (29-50)	Yes	Yes
	After mitigation	Negative	2	3	2	2	1	3	2	26	Low (6-28)		
Mitigation: Planning													
<ul style="list-style-type: none">Retain and maintain natural vegetation immediately adjacent to the development footprint.													
Mitigation: Construction													
<ul style="list-style-type: none">Ensure that vegetation is not unnecessarily removed during the construction phase.Plan the placement of laydown areas and temporary construction equipment camps to minimise vegetation clearing (i.e., in already disturbed areas) where possible.Restrict the activities and movement of construction workers and vehicles to the immediate construction site and existing access roads.Ensure that rubble, litter, etc. are appropriately stored (if it can't be removed daily) and then disposed of regularly at a licenced waste site.Reduce and control dust during construction by utilising dust suppression measures.Limit construction activities between 07:00 and 18:00, where possible, to reduce the impacts of construction lighting.Rehabilitate all disturbed areas immediately after the completion of construction work and maintain good housekeeping.													

³⁶ Both grid connection options reflect a small difference in potential impacts. It is expected that they will have negligible difference in visual impact and will be assessed collectively.

Table 8.96: Visual Impact – Operational Phase: WEF

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated?	Is the impact acceptable?
Visual impact of industrial operational infrastructure on sensitive visual receptors, landscape and scenic resources. Change in the sense of place of the local area.	Before mitigation	Negative	2	4	4	3	3	4	3	60	High (51-73)	Yes, but only partially	Yes
	After mitigation	Negative	2	4	3	3	3	4	3	57	High (51-73)		
Mitigation: Planning													
<ul style="list-style-type: none">Retain/re-establish and maintain natural vegetation immediately adjacent to the development footprint.It is not feasible to add vegetation for screening purposes due to the water scarcity in the Karoo. Furthermore, due to the height of the WTGs, screening might not have the desired effect, but screening will be added where required.Use low-intensity, aviation-safe lighting that is only visible when necessary, such as using lights that activate only when aircraft are nearby. This mitigation measure is subject to SACAA regulations and technical feasibility.													

Table 8.97: Visual Impact – Operational Phase: Grid Connection³⁷

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated?	Is the impact acceptable?
Visual impact of industrial operational infrastructure on sensitive visual receptors, landscape and scenic resources. Change in the sense of place of the local area.	Before mitigation	Negative	2	4	3	2	3	4	2	36	Medium (29-50)	Yes, but only partially	Yes
	After mitigation	Negative	2	3	2	2	3	4	2	32	Medium (29-50)		
Mitigation: Planning													
<ul style="list-style-type: none">Retain/re-establish and maintain natural vegetation immediately adjacent to the development footprint.Maintain general appearance of the grid connection infrastructure.													

³⁷ Both grid connection options reflect a small difference in potential impacts. It is expected that they will have negligible difference in visual impact and will be assessed collectively.

Shadow flicker must be assessed on an individual receptor basis rather than as a whole. While shadow flicker exceeding the threshold may have a significant impact on each affected receptor, it is not expected to pose a health risk and should not be considered a reason to relocate or remove the WTG from the layout. The flicker may cause nuisance or irritation to the receptor, but it is important to note that excluding a WTG from the layout could reduce income for the affected property. In some cases, landowners may prefer to tolerate shadow flicker rather than forgo income from leases or power generation, especially if their income is tied to a percentage of the generation revenue. Most flicker receptors are located on affected / participating properties. Mitigation measures can eliminate the impacts of shadow flicker entirely by using the shadow flicker data to manage the effect on specific receptors. Additionally, it is not feasible to predict long-term weather conditions, such as wind direction and other atmospheric conditions. As a result, the actual flicker impacts may be significantly lower than those presented in this report.

Some mitigation during planning and operation include:

- As far as practically possible:
 - Involve landowners at an early stage to explain the phenomenon of shadow flicker and present the relevant data.
- Involving the landowner might have the following outcomes (each landowner might have a different outcome, and they should be approached individually):
 - Installation of screening structures and/ or planting of trees to block shadows flicker by the turbines.
 - Use of turbine control strategies which shut down turbines when shadow flicker is likely to occur.
 - Relocating WTGs.

If an impacted landowner does not have an objection to shadow flicker, no mitigation is required, and the landowner should sign a waiver.

8.1.12 Potential Traffic Impacts

The expected effects of traffic that would be generated by the proposed Carissa WEF were analysed as follows:

- The background traffic volumes were determined for the study network near the site, as well as the transportation routes;
- The future traffic volumes for the years 2025 and 2026 (construction years) were predicted and is based on a trendline analysis. The future traffic volumes for the operation and decommissioning years were also based on a similar approach;
- Construction, operation, and decommissioning phase traffic (site generated trips) were estimated for the proposed wind energy facility;
- The WEF traffic was compared to the background traffic volumes to determine the total traffic conditions with the WEF in place; and
- An impact rating system was used to determine the significance of impact of the Carissa WEF during the construction, operation, and decommissioning phases.

Refer to Tables 8.98 to 8.100 below.

Table 8.98: Traffic Impacts Relating to the Construction Phase of the Carissa WEF

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated?	Is the impact acceptable?
During the construction phase (24 months), the road network leading to the Carissa WEF will include national and regional roads from either Gqeberha or Cape Town. There will be an increase in traffic volumes, for both light and heavy vehicles, influencing traffic congestion and road safety.	Before mitigation	Negative	3	3	1	1	2	2	2	24	Low (6-28)	N/A	N/A
	After mitigation	N/A											
Mitigation: <ul style="list-style-type: none">All construction vehicles must be roadworthy, and drivers must have the relevant licenses for the type of vehicles they are operating.All vehicle drivers need to strictly adhere to the rules of the road.													

Table 8.99: Traffic Impacts Relating to the Operation Phase of the Carissa WEF

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated?	Is the impact acceptable?
The road network, surrounding the Carissa WEF, will be affected. There will be an increase in traffic influencing traffic congestion and road safety. However, vehicles used for the operations and maintenance phase will be light vehicles. The extent of the road network that will be affected is small, as staff will be living in neighbouring towns, such as Beaufort West. The operations and maintenance phase traffic will only be temporary, and no major impact is anticipated on the road network.	Before mitigation	Negative	2	3	1	1	3	1	1	11	Low (6-28)	N/A	N/A
	After mitigation	N/A											

Mitigation:												
<ul style="list-style-type: none">All construction vehicles must be roadworthy, and drivers must have the relevant licenses for the type of vehicles they are operating.All vehicle drivers need to strictly adhere to the rules of the road.												

Table 8.100: Traffic Impacts Relating to the Decommissioning Phase of the Carissa WEF

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated?	Is the impact acceptable?
The road network, surrounding the Carissa WEF, will be affected. There will be an increase in traffic influencing traffic congestion and road safety. However, the extent of the impact will be very small and local of nature. The traffic during the decommissioning phase will only be temporarily and have an insignificant impact on the road network.	Before mitigation	Negative	2	2	1	1	1	1	1	8	Low (6-28)	N/A	N/A
	After mitigation	N/A											
Mitigation:													
<ul style="list-style-type: none">All decommissioning vehicles must be roadworthy, and drivers must have the relevant licenses for the type of vehicles they are operating.All vehicle drivers need to strictly adhere to the rules of the road.													

8.1.13 Safety, Health and Environmental Risk Assessment for the Development of Battery Energy Storage Systems

A SHE Risk Assessment is focussed on hazards arising from the construction, operation and decommissioning of a facility and their impact on humans, either employees or members of the public outside the site. By definition, the nature of the chemical and machine hazards is negative, i.e., adverse impact on health and safety. Some of the impacts are immediate and direct such as effects of fires and explosions or exposure to high concentrations of chemicals (in health and safety we refer to these as acute impacts). Other impacts are longer term such as repeated exposure to low concentrations of harmful chemicals, noise, etc., (in health and safety this is referred to as chronic impacts).

Risk is made up of two components:

- The probability of a certain hazardous event or incident occurring.
- The severity of the consequences of that hazardous event / incident.

Therefore, the assessment of risk comprises:

- Identification of the likely hazards and hazardous events related to the operation of the installation.
- Estimation of the likelihood/probability of these hazardous events occurring.
- Estimation of the consequences of these hazardous events.
- Estimation of the risk and comparison against certain acceptability criteria.

For the purpose of this high-level Risk Assessment a desktop study of the available information, proposed BESS locations, reports of related incidents and various literature sources was undertaken. Based on this information the facility and the project were divided into the following phases:

- construction;
- operation; and
- decommissioning (end of life).

An analysis was undertaken to identify the failure events, their causes, consequences, as well as the preventative and mitigative measures in place on the proposed installation for all three phases of a typical project. Refer to Tables 8.101 to 8.106 below.

The Risk Assessment below shows that provided the preventative and mitigative measures are incorporated, the construction phase of the project does not present any high risks nor any fatal flaws.

Table 8.101: Solid State Lithium-Ion Battery Energy Storage Systems – Construction Phase (Excluding commissioning which is part of the operational phase)

Impact number	Receptor	Description	Stage	Character	Preventative and Mitigative Measures	Ease of Mitigation	(M+	E+	R+	D)x	P=	S	(M+	E+	R+	D)x	P=	S
							Raw Risk						Residual Risk					
Impact 1:	Human Health - chronic exposure to toxic chemical or biological agents	Causes - Construction materials such as cement, paints, solvents, welding fumes, truck fumes, etc. Consequences - Employee / contractor illness.	Construction	Negative	The construction phase will be managed according to all the requirements of the Occupational Health and Safety Act 85 of 1993 specifically the Construction Regulations. Safety, Health, Environment and Quality (SHEQ) policy in place. A detailed construction Risk Assessment prior to work. SHE procedure in place. PPE to be specified. SHE appointees in place. Contractor's safety files in place and up to date. All necessary health controls/ practices to be in place, e.g., ventilation of welding and painting areas. SHE monitoring and reporting programs in place. Emergency response plan to be in place prior to beginning construction and to include aspects such as appointment of emergency controller, provision of first aid, first responder contact numbers.	Moderate	3	1	3	4	4	44	1	1	3	4	2	18
Significance							N3 - Moderate						N2 - Low					
Impact 2:	Human Health - exposure to noise	Causes - Drilling, piling, generators, air compressors. Consequences - Adverse impact on hearing of workers. Possible nuisance factor in near-by areas.	Construction	Negative	Health Risk Assessment to determine if equipment noise exceeds 85dB at workstation and 61dB at boundary of the site. OHS Act Noise Induced hearing Loss Regulations. Employees to be provided with hearing protection if working near equipment that exceeds the noise limits.	Easy	3	1	5	5	4	56	2	1	5	5	2	26
Significance							N3 - Moderate						N2 - Low					
Impact 3:	Human Health - exposure to temperature extremes and/or humidity	Causes - Heat during the day. Cold in winter. Consequence - Heat stroke. Hypothermia.	Construction	Negative	Construction site facilities to comply with Occupational Health and Safety Act 85 of 1993 specifically the thermal, humidity, lighting and ventilation requirements of the Environmental Regulations for Workplaces. Adequate potable water for employees to be provided during all phases of the project. Borehole, bowser and tank or small water treatment plant may be required to provide potable water for the BESS installation staff during all phases of the project.	Easy	3	2	3	1	2	18	2	2	3	1	1	8
Significance							N2 - Low						N1 - Very Low					
Impact 4:	Human Health - exposure to psychological stress	Causes - Large projects bring many contractor workers into a small, isolated community. Consequences – Lack	Construction	Negative	Refer to Social Specialist Study for this project.	Easy	2	3	3	2	2	20	2	3	3	2	2	20

Impact number	Receptor	Description	Stage	Character	Preventative and Mitigative Measures	Ease of Mitigation	(M+	E+	R+	D)x	P=	S	(M+	E+	R+	D)x	P=	S
							Raw Risk						Residual Risk					
		of sufficient accommodation, entertainment, etc. Increase in alcohol abuse, violence																
Significance							N2 - Low						N2 - Low					
Impact 5:	Human Health - exposure to ergonomic stress	Causes - Lifting heavy equipment. Awkward angles during construction. Consequences - Back and other injuries.	Construction	Negative	Training in lifting techniques. Ensure that despite the isolated location all the necessary equipment is available (and well maintained) during construction. Otherwise, employees may revert to unsafe practices. Isolated location, maintenance of construction equipment to ensure safe operation is critical. Ensure this is in place prior to project beginning. First aid provision on site.	Moderate	4	1	3	2	3	30	4	1	3	2	2	20
Significance							N2 - Low						N2 - Low					
Impact 6a:	Human and Equipment Safety - exposure to fire radiation	Causes – Involvement in an external fire. Fire involving fuels used in construction vehicles or vehicles themselves (e.g., tyre fire). Fire due to uncontrolled welding or other hot-work Consequences - Injuries due to radiation especially amongst first responders and bystanders. Fatalities unlikely from the heat radiation as not highly flammable nor massive fire.	Construction	Negative	Fuels stored on site in dedicated, demarcated and bunded areas. Suitable fire-fighting equipment on site near source of fuel, e.g., diesel tank, generators, mess, workshops, etc. The company responsible for the facility at this particular development stage is to have: 1. Emergency plan to be in place prior to commencement of construction. 2. Fuel spill containment procedures and equipment to be in place. 3. Hot-work permit and management system to be in place.	Complex	4	2	3	5	4	56	4	2	3	5	2	28
Significance							N3 - Moderate						N2 - Low					

Impact number	Receptor	Description	Stage	Character	Preventative and Mitigative Measures	Ease of Mitigation	(M+	E+	R+	D)x	P=	S	(M+	E+	R+	D)x	P=	S
							Raw Risk						Residual Risk					
Impact 6b:	Human and Equipment Safety - exposure to fire radiation	<p>Causes - Solid state battery containers damaged on route, e.g., dropped in port (drops do happen about 1/2000 containers) and importing possibly < 2*2000 containers for the site. With this it is possible, although unlikely, that one will be dropped, traffic accident on-route. Involvement in an external fire, e.g., at the port or on route. Data indicates installed facility events are 0.001/year. Transport of 2*2000 units per installation assumed to take 4 weeks each so f= 0.30 - once in 3 years so likelihood is high.</p> <p>Consequences – Injuries due to radiation especially amongst first responders and bystanders. Fatalities unlikely from the heat radiation as not highly flammable nor massive fire (refer to noxious smoke in APPENDIX A below for the major impact).</p>	Construction	Negative	<p>Solid state battery design includes abuse tests such as drop test, impact, rapid discharge, etc. Propagation tests for systems, e.g., heat insulating materials between cells/modules. Factory acceptance test prior to leaving manufacture. Batteries are usually stored at 50% charge to prolong life but may be shipped fully discharged. This level of detail should be understood so as to assess the risk during transport and storage.</p> <p>The company responsible for the battery installation should ensure suitably competent transport companies are appointed. The company responsible for transportation should ensure:</p> <ul style="list-style-type: none"> - Compliance with National Road Traffic Act, 1996 (Act 93 of 1996) as amended (NRT Act) regulation 8 – dangerous goods. - Port Authorities should be alerted to the overall project and the hazardous nature of the contents of battery containers being imported. Note. If, as per one of the typical suppliers (Tesla) indications, the containers are classified as International Marine Dangerous Good (IMDG) Class 9 – the containers will not receive any special care in the ports and may be stored next to flammables. Port emergency response in particular need training on mitigating battery hazards. Prior to bringing any containers into the country, the company responsible for the battery installation (possibly via appointed contractors) should ensure that an Emergency response plan is in place for the full route from the ship to the site. Drivers trained in the hazards of containerized batteries. The Emergency plan must determine and address: <ul style="list-style-type: none"> - What gases would be released in a fire and are there inhalation hazards. - Extinguishing has two important elements, put out fire and to provide cooling. Different approaches may be needed for small fire, e.g., put out, and for large fires, e.g., cool with copious quantities of water. Note inert gases and foam may put out the initial fire but fail to control thermal runaway or to cool the batteries resulting in reignition. <ul style="list-style-type: none"> - What initial fire extinguishing medium should be used. - Whether there are any secondary gases or residues from use of extinguishers. - If water is appropriate, determine if the system needs outside connections to sprinklers inside the container. - First responders need to know what media to use, especially if water is totally unsuitable and if there are no connection points for water, etc. <ul style="list-style-type: none"> - Must the container be left unopened or opened. - PPE to be specified including possible exposure to chemicals and fumes as well as radiate heat. 	Complex	5	2	5	5	4	68	5	2	5	5	1	17

Impact number	Receptor	Description	Stage	Character	Preventative and Mitigative Measures	Ease of Mitigation	(M+	E+	R+	D)x	P=	S	(M+	E+	R+	D)x	P=	S
							Raw Risk						Residual Risk					
					- Containment of residues/water/damaged equipment. - Suitable safe making and disposal plan for after the event, i.e., how do responders deal with partially charged damage units, contaminated surfaces (e.g., HF residues).													
Significance							N4 - High						N2 - Low					
Impact 7:	Human and Equipment Safety - exposure to explosion over pressures	Causes - With solid state lithium containers, flammable gases generated by thermal run away reach explosive limits. Ignition on hot surfaces, static. Consequences - Potential fatalities amongst first responders. Damage to container, transport truck or other nearby items, e.g., other container in the port.	Construction	Negative	During transport this is only likely to happen due to possible inappropriate emergency response, e.g., opening containers when they may be the type that should be left to burn out. For simplicity one transport route would be preferable. The route needs to be assessed in terms of responding local services, rest places for drivers, refuelling if required, break down services available, etc. Once an import route has been chosen, e.g., Richards Bay or Durban and along N2/N3/N11, etc., then the appointed transport company should ensure key emergency services on route could be given awareness training in battery fire/accident response. Emergency response planning and training referred to above may be important for key locations such as the mountain passes / tunnels.	N/A	5	4	5	5	3	57	5	4	5	5	1	19
Significance							N3 - Moderate						N2 - Low					
Impact 8a:	Human and Equipment Safety - exposure to acute toxic chemical and biological agents	Causes Human pathogens and diseases, sewage, food waste. Snakes, insects, wild and domesticated animals and harmful plants. Consequences - Illness and at worst without mitigation, possibly extending to fatalities. Effects can vary from discomfort to fatalities	Construction	Negative	All necessary good hygiene practices to be in place, e.g., provision of toilets, eating areas, infectious disease controls. Policies and practice for dealing with known vectors of disease such as AIDS, TB, COVID 19 and others. Awareness training for persons on site, safety induction to include animal hazards. First aid and emergency response to consider the necessary anti-venom, anti-histamines, topical medicines, etc.	Complex	4	2	3	2	3	33	3	2	3	2	2	20

Impact number	Receptor	Description	Stage	Character	Preventative and Mitigative Measures	Ease of Mitigation	(M+	E+	R+	D)x	P=	S	(M+	E+	R+	D)x	P=	S
							Raw Risk						Residual Risk					
		for venomous snakes or bee swarms, etc.																
Significance							N3 - Moderate						N2 - Low					
Impact 8b:	Human and Equipment Safety - exposure to acute toxic chemical and biological agents	<p>Causes - Damaged solid-state batteries release fumes, leak electrolyte, are completely broken exposing hazardous chemicals. Thermal runaway and hazardous fumes released.</p> <p>Consequences - Impacts can vary from mild skin irritation from exposure to small leaks to serious corrosive burns or lung damage.</p>	Construction	Negative	<p>Appointed transport company to ensure transport in accordance with Regulation 8 of the National Road Traffic Act 93 of 1996, Dangerous Goods. Not permitted to transport prescribed goods in manner not consistent with the prescriptions, e.g., consignor and consignee responsibilities. Prescription found in SANS 10228/29 and international codes for battery transport, etc.</p> <p>Transport in sealed packages that are kept upright, protected from movement damage, etc.</p> <p>Also packaged to ensure no short-circuiting during transport. Transport to prevent excessive vibration considerations as battery internal may be damaged leading to thermal run-away during commissioning.</p> <p>Pre-assembled containers will most likely be supplied. These will be fitted with the necessary protective measures by the supplier considering marine and road transport as well as lifting, setting down, etc.</p> <p>Route selection to consider possible incidents along the way and suitable response, e.g., satellite tracking, mobile communication, 24/7 helpline response.</p> <p>Standard dangerous goods requirements for HAZMAT labels, TREM cards, driver trained in the hazards of the load.</p> <p>Likelihood similar to fire above.</p>	Complex	4	3	3	5	3	45	4	3	3	5	2	30
Significance							N3 - Moderate						N2 - Low					

Impact number	Receptor	Description	Stage	Character	Preventative and Mitigative Measures	Ease of Mitigation	(M+	E+	R+	D)x	P=	S	(M+	E+	R+	D)x	P=	S
							Raw Risk						Residual Risk					
Impact 9:	Human and Equipment Safety - exposure to violent release of kinetic or potential energy	Causes - Construction moving equipment, heavy loaded, elevated loads, working at heights Consequences - Injury or possibly fatality. Damage to equipment. Delays in starting the project, financial losses.	Construction	Negative	<p>The construction phase will be managed according to all the requirements of the Occupational Health and Safety Act 85 of 1993 specifically the Construction Regulations.</p> <p>SHEQ policy in place.</p> <p>A detailed construction Risk Assessment prior to work.</p> <p>SHE procedures in place.</p> <p>PPE to be specified.</p> <p>SHE appointees in place.</p> <p>Contractors safety files in place and up to date.</p> <p>SHE monitoring and reporting programs in place.</p> <p>Standard construction site rules regarding traffic, reversing sirens, rigging controls, cordoning off excavations, etc.</p> <p>Civil and building structures to National Building Regulations and Building Standards Act 103 of 1977 (NBRBS Act) as amended, SANS 10400 and other relevant codes.</p> <p>Other constructions such as roads, sewers, etc., also to relevant SANS standards.</p> <p>All normal procedures for working at heights, hot work permits, confined space entry, cordon off excavations, etc., to be in place before the relevant construction task begins.</p> <p>Emergency response plan to be in place before construction begins.</p>	Complex	5	1	5	5	4	64	5	1	5	5	1	16
							N4 - High						N2 - Low					
Impact 10:	Human and Equipment Safety - exposure to electromagnetic waves	Causes - Use of electrical machines, generators, etc. Hot dry area static generation is highly likely. Lightning strike. Consequences - Electrocution. Ignition and burns. Injury and death. Damage electrical equipment.	Construction	Negative	<p>Standard maintenance of condition of electrical equipment and safe operating instructions.</p> <p>Ability to shut off power to systems in use on site.</p> <p>If persons are decanting fuels or dealing with other highly flammable materials care should be taken regarding possible static discharge, installations to be suitably designed and maintained.</p> <p>Lightning strike rate in the study area is low.</p> <p>At-risk outside work must be stopped during thunderstorms.</p> <p>Lightning conductors may be required for the final installation, to be confirmed during design phase.</p>	Complex	5	2	5	5	3	51	5	2	5	5	1	17
							Significance N3 - Moderate						N2 - Low					
Impact 11:	Environment - emissions to air	Causes - Dust from construction and generally hot dry area. Consequences - Adverse impact on employee health.	Construction	Negative	<p>May need to use dampening on roads, etc., as per normal construction practices.</p> <p>May need PPE (dust masks) for specific construction workers.</p>	Easy	3	2	1	1	4	28	2	2	1	1	2	12
							Significance N2 - Low						N1 - Very Low					

Impact number	Receptor	Description	Stage	Character	Preventative and Mitigative Measures	Ease of Mitigation	(M+	E+	R+	D)x	P=	S	(M+	E+	R+	D)x	P=	S
							Raw Risk						Residual Risk					
Impact 12:	Environment - emissions to water	Causes - Diesel for equipment, paints and solvents. Transformer oil spills. Sewage and kitchen/mess area wastewater. Consequences - Environmental damage, particularly to the surface and underground water in the area.	Construction	Negative	Normal construction site practices for preventing and containing fuels/paint/oil, etc., spills. Bunding under any temporary tanks, curbing under truck offloading areas and sealed surfaces (e.g., concrete) under truck parking area where reasonably practicable is particularly important. Spill clean-up procedures to be in place before commencing construction. Sewage and any kitchen liquids - containment and suitable treatment/disposal	Moderate	2	2	3	2	3	27	2	2	3	2	2	18
Significance							N2 - Low						N2 - Low					
Impact 13:	Environment - emissions to earth	Causes - Mess area and other solid waste. Consequences - Environmental damage.	Construction	Negative	There will be packaging materials that will need to be disposed of after the entire system is connected and commissioned as well as after regular maintenance. There will need to be waste segregation (e.g., electronic equipment, chemicals) and management on the site.	Easy	2	2	3	3	3	30	1	2	3	3	2	18
Significance							N2 - Low						N2 - Low					
Impact 14:	Environment - waste of resources, e.g., water, power, etc.	Causes - Water usage not controlled. Battery containers damaged. Consequences - Delays.	Construction	Negative	Water usage to be monitored on site during construction. Handling protocols to be provided by battery supplier. End of Life plan needs to be in place before any battery containers enter the country as there may be damaged battery unit from day 1. Water management plan and spill containment plans to be in place.	Easy	1	1	1	2	4	20	1	1	1	2	2	10
							N2 - Low						N1 - Very Low					
Impact 15:	Public - Aesthetics	Causes - Bright surfaces reflecting light. Tall structures in a flat area. Consequences - Irritation.	Construction	Negative	Refer to visual impact assessment.	Moderate	2	2	3	3	3	30	2	2	3	3	3	30
Significance							N2 - Low						N2 - Low					
Impact 16:	Investors - Financial	Causes - Defective technology. Extreme project delays. Consequences - Financial loss	Construction	Negative	Design by experienced contractors using internationally recognized and proven technology. Project management with deviation monitoring.	Moderate	5	1	3	4	3	39	3	1	3	4	2	22
Significance							N3 - Moderate						N2 - Low					

Impact number	Receptor	Description	Stage	Character	Preventative and Mitigative Measures	Ease of Mitigation	(M+	E+	R+	D)x	P=	S	(M+	E+	R+	D)x	P=	S
							Raw Risk						Residual Risk					
Impact 17:	Employees and investors - Security	Causes - On route, potential hi-jacking of valuable but hazardous load. On site, theft of construction equipment and battery installation facilities. Civil unrest or violent strike by employees. Consequences - Theft. Injury to burglars. Damage to equipment possibly setting off thermal runaway.	Construction	Negative	Fencing around electrical infrastructure to SANS standard and Eskom Holdings SOC Limited (ESKOM) Guidelines. The hazardous nature of the electrical and battery equipment should be clearly indicated, e.g., Skull and Cross Bones or other signs. Isolated location both helps and hinders security. Night lighting to be provided both indoors and outdoors where necessary.	Complex	4	1	3	2	4	40	3	1	3	2	3	27
Significance							N3 - Moderate						N2 - Low					
Impact 18:	Emergencies	Causes - Fires, explosions, toxic smoke, large spills, traffic accidents, equipment/structural collapse. Inadequate emergency response to small event leads to escalation. Consequences - Injuries turn to fatalities, small losses become extended down time.	Construction	Negative	Emergency procedures need to be practiced prior to commencement of construction. If batteries are stored at 50% charge, thermal run away can happen while in storage on site waiting for installation. In addition, if involved in an external fire thermal run away can happen even with uncharged batteries. Except during shipping, ideally the units should not be stored any closer to each other than they would be in the final installation so that propagation is prevented, i.e., laydown area needs to be considered. The company in charge of the containers at each stage in the transport process needs to be very clear so that responsibility for the integrity of the load and protection of the persons involved in transfer and coordination of emergency response on-route. E.g., if purchased from Tesla, where does hand over occur to the South African contractor / owner, at the factory door in USA, at the port in South Africa, at the site fence. For example, who will be accountable if there's thermal runaway event on a truck with a container that stops in a small town for driver refreshments.	Complex	4	2	3	5	4	56	4	2	3	5	2	28
Significance							N3 - Moderate						N2 - Low					
Impact 19:	Investors - Legal	Causes - Battery field is evolving quickly with new guides, codes and regulations happening at the same time as evolving technology. Consequences - Unknown hazards manifest due to using	Construction	Negative	Use only internationally reputable battery suppliers who comply with all known regulations/guidelines at the time of purchasing. Ensure only state of the art battery systems are used and not old technologies prone to fires/explosions, etc.	Moderate	3	1	3	3	4	40	2	1	3	3	2	18

Impact number	Receptor	Description	Stage	Character	Preventative and Mitigative Measures	Ease of Mitigation	(M+	E+	R+	D)x	P=	S	(M+	E+	R+	D)x	P=	S
							Raw Risk						Residual Risk					
		"cheaper supplier or less developed technology".																
Significance							N3 - Moderate						N2 - Low					

From the details of accidents that have happened both with BESS installations and chemical plants in general, it is clear that many potential problems manifest during the commissioning phase when units are first powered up to test functionality. This phase is critical and all controls, procedures, mitigation measures, etc., that would be in place for full operation should be in place before commissioning commences. Refer to Table 8.102 below for the Operational Risk.

The below Risk Assessment shows that, provided the preventative and mitigative measures are incorporated, the operational phase of the project does not present any high risks nor any fatal flaws.

Table 8.102: Operational Phase (Including Commissioning)

Impact number	Receptor	Description	Stage	Character	Preventative and Mitigative Measures	Ease of Mitigation	(M+	E+	R+	D)x	P=	S	(M+	E+	R+	D)x	P=	S
							Raw Risk						Residual Risk					
Impact 1a:	Human Health - chronic exposure to toxic chemical or biological agents	Causes - Operation and maintenance materials, spare parts, paints, solvents, welding fumes, transformers oils, lubricating oils and greases, etc. Consequences - Occupational illness.	Operation	Negative	The operation and maintenance phase will be managed according to all the requirements of the Occupational Health and Safety Act 85 of 1993. SHEQ policy in place. A detailed Risk Assessment of all normal operating and maintenance activities on site to be compiled, and form the basis of operating instructions, prior to commencing commissioning. SHE procedure in place, e.g., PPE specified, management of change, integrity monitoring. SHE appointees in place. Training of staff in general hazards on site. All necessary health controls/ practices to be in place, e.g., ventilation of confined areas, occupational health monitoring if required and reporting programs in place. Emergency response plan for full operation and maintenance phase to be in place prior to beginning commissioning and to include aspects such as: - appointment of emergency controller, - emergency isolation systems for electricity, - emergency isolation and containment systems for electrolyte, - provision of PPE for hazardous materials response, - provision of emergency facilities for staff at the main office building, - provision of first aid facilities, - first responder contact numbers, etc.	Easy	2	1	3	4	5	50	1	1	3	4	2	18
Significance							N3 - Moderate						N2 - Low					
Impact 1b:	Human Health - chronic exposure to toxic chemical or biological agents	Causes - Compromised battery compartments vapours accumulate in the containers, solids/liquids on	Operation	Negative	Solid state batteries sealed, individual batteries in modules which are also sealed, pre-packed in the container. Maintenance procedures will be in place should equipment need to be opened, e.g., pumps drained and decontaminated prior to repair in workshop, etc. PPE will be specified for handling battery parts and other equipment on site.	Complex	3	1	3	5	4	48	1	1	3	5	2	20

Impact number	Receptor	Description	Stage	Character	Preventative and Mitigative Measures	Ease of Mitigation	(M +	E+	R+	D) x	P=	S	(M +	E+	R+	D) x	P=	S
							Raw Risk						Residual Risk					
		surfaces. Maintenance of battery components, corrosive and mildly toxic liquid on surfaces. Consequences - Dermatitis, skin /eye/lung irritation.			<p>Training of staff in hazards of chemicals on site.</p> <p>Possible detectors with local alarms if regulated occupational exposure limits are exceeded, etc., prior to entry for inspection of battery containers.</p> <p>Labelling of all equipment.</p> <p>Confined space entry procedures if entering tanks.</p> <p>There needs to be careful thought given to procedures to be adopted before entering into the BESS or a container particularly after a BMS shut down where there may be flammable or toxic gases present, a fire, etc.</p> <p>Safety Data Sheets (SDSs) to be available on site.</p> <p>Operating manuals to be provided including start-up, shut-down, steady state, monitoring requirements.</p> <p>Maintenance manuals with make safe, decontamination and repair procedures.</p> <p>Proposed maintenance schedules, e.g., checklists for weekly, monthly, annually, etc.</p> <p>Provided portable equipment for calibration and for testing/verification of defective equipment, e.g., volt/current meters, infrared camera</p>													
Significance							N3 - Moderate						N2 - Low					
Impact 2:	Human Health - exposure to noise	Causes - Moving parts inside containers, buildings, pumps, compressors, cooling systems, etc. Consequences - Adverse impact on hearing of workers. Nuisance factor at near -by residences or other activities.	Operation	Negative	<p>Design to ensure continuous noise does not exceed 85dB within the facilities or at any other location on site or 61 dB at the site boundary, e.g., emergency generator, air compressor, etc., OHS Act Noise Induced Hearing Loss Regulations.</p> <p>Employees to be provided with hearing protection if working near equipment that exceeds the noise limits.</p>	Easy	2	1	5	5	4	52	2	1	5	5	2	26
Significance							N3 - Moderate						N2 - Low					
Impact 3:	Human Health - exposure to temperature extremes and/or humidity	Causes - Heat during the day. Batteries generate heat within enclosed building / containers. Cold in winter. Night work requires lighting. Consequences - Heat stroke. Hypothermia.	Operation	Negative	<p>Building and container facilities to comply with Occupational Health and Safety Act 85 of 1993 specifically the thermal, humidity, lighting and ventilation requirements of the Environmental Regulations for Workplaces. Ensure containers are temperature controlled as required to remain within the optimal battery operating temperature range.</p> <p>Lighting to be provided inside any buildings, inside the containers, possibly linked to the door opening and outdoors where necessary.</p> <p>Adequate potable water to be provided during all phases of the project.</p> <p>Suitable lighting to be provided including emergency lighting for safe building exit in the event of power failure.</p> <p>PPE for operations and maintenance staff to be suitable for the weather conditions.</p>	Easy	4	2	3	1	2	20	3	2	3	1	1	9
Significance							N2 - Low						N1 - Very Low					

Impact number	Receptor	Description	Stage	Character	Preventative and Mitigative Measures	Ease of Mitigation	(M +	E+	R+	D) x	P=	S	(M +	E+	R+	D) x	P=	S
							Raw Risk						Residual Risk					
Impact 4:	Human Health - exposure to psychological stress	Causes - Isolated workstation and monotonous repetitive work. Consequences - Low performance, system productivity suffers.	Operation	Negative	Staff rotation to other activities within the site may be necessary. Performance monitoring of inspections / maintenance tasks in particular will be necessary.	Easy	2	3	3	2	2	20	1	3	3	2	1	9
Significance							N2 - Low						N1 - Very Low					
Impact 5:	Human Health - exposure to ergonomic stress	Causes - Lifting heavy equipment. Awkward angles during maintenance, stretching reaching to high level and bending to low level. Working at height if equipment located on top of roofs or elevated electrical equipment (e.g., pylons). Consequences - Back and other injuries.	Operation	Negative	Training in lifting techniques. Training in working at heights. If equipment is at height (see OHS Act General Safety Regulation 6), ensure suitable safe (electrically and physically) ladders / harnesses, etc., are available. Working at height procedure to be in place.	Easy	5	1	3	2	3	33	4	1	3	2	2	20
Significance							N3 - Moderate						N2 - Low					
Impact 6a:	Human and Equipment Safety - exposure to fire radiation	Causes – Involvement in an external fire, e.g., veld fire, maintenance vehicle fire, electrical systems fire. Manufacturing defects or damage to battery leading to shorting and heating. High humidity condensation of water or ingress of water or flooding leading to shorting. Dust accumulation on electrical parts leading to	Operation	Negative	Grass cutting and fire breaks around the BESS installations to prevent veld fires. No combustible materials to be stored in or near the batteries or electrical infrastructure. Separation of site diesel tank, transformers from BESS and vice versa. There are BESS design codes from the USA and standards of practice that can be used, e.g., UL9540, NFPA 855 and DNV GL RP 43. Detailed FMEA/HAZOP/Bowtie to be done during design at the component level and system levels. Safety integrity level rating of equipment (failure probably) with suitable redundancy if required. Site Acceptance Testing as part of commissioning of each unit and the overall system. Abuse tests conducted by supplier. BMS should be checking individual cell voltage as well as stack, module, container, system voltages/current, etc. BMS tripping the cell and possibly the stack/ building unit or module/rack/container, if variations in voltage. Diagnostics easily accessible. Diagnostics able to distinguish cell from stack or cell from module faults. Protective systems are only as good as their reliability and functionality testing is important, e.g., testing that all battery trips actually work. Fire resistant barrier between the batteries and the PCS side if in the same container, or separate containers.	Complex	5	1	5	5	4	64	5	1	5	5	1	16

Impact number	Receptor	Description	Stage	Character	Preventative and Mitigative Measures	Ease of Mitigation	(M +	E+	R+	D) x	P=	S	(M +	E+	R+	D) x	P=	S
							Raw Risk						Residual Risk					
		overheating. Excessive electrical loads - surges Operator abuse BMS failure or software failure. Incorrect extinguishing medium, escalate the fire. Consequences - Contaminated run off. Radiation burns unlikely to be severe as no highly flammable materials on site. Damaged equipment. Fire spreads to other units or offsite if grass/vegetation not controlled. Data indicates an event frequency of 0.001 per installation and with 2*2000 units this would mean an event once a year, i.e., a high probability event.			Suitable ingress protection level provided for electrical equipment, e.g., IP55 - 66. If air cooling into container, suitable dust filters to be provided. Smoke detectors linked to BMS and alerts in control room. Effects of battery aging to be considered. Solid state battery life starts to be impacted above 40 deg C and significant impacts above 50 deg C with thermal run away starting at 65-70 deg C. BMS trips system at 50 deg C. Temperature monitoring to be in place. Regular infrared scanning. Data needs to be stored for trend analysis. Most events will be small not resulting in injuries, but this is possible if the event is not controlled, hence prior to commencement of cold commissioning, emergency plan from transport and construction phase to be extended to operational phase and to include the hazards of the electrically live system. Procedure to address solid state container fires - extinguishing, ventilating, entering as appropriate or not. PPE for container firefighting include fire retardant, chemically resistant, nitrile gloves, antistatic acid resistant boots, full face shields, Breathing Apparatus (BA) sets. A planned fire response to prevent escalation to an explosion or an environmental event. Suitable supply of fire extinguishing medium and cooling medium. Consider fire water for cooling adjacent equipment – BESS units. Can use fogging nozzles to direct smoke. Ensure procedures in place for clean up after event Lingering HF and other toxic residues in the soil and on adjacent structures. Procedures to be in place for IR scanning (or other suitable method) to determine if batteries are still smouldering / are sufficient cooled to handle as batteries may still be active some weeks after an event. Smoke or gas detector systems that are not part of the original battery container package, need to be linked to the main control panel for the entire system so that issues can be detected and responded to rapidly.													
Significance							N4 - High						N2 - Low					
Impact 6b:	Human and Equipment Safety - exposure to fire radiation	Causes - Power Conversion System (PCS) i.e., DC to AC, cooling failure electrical fire. Consequences - Fire starts in PCS or another section or room and spreads to battery area.	Operation	Negative	Modern lithium container design put the PCS in another part of the container with a fire rated wall separating it from the battery. Alternately the PCS is another container altogether.	Moderate	5	2	5	5	4	68	5	2	5	5	1	17
Significance							N4 - High						N2 - Low					

Impact number	Receptor	Description	Stage	Character	Preventative and Mitigative Measures	Ease of Mitigation	(M +	E+	R+	D) x	P=	S	(M +	E+	R+	D) x	P=	S
							Raw Risk						Residual Risk					
Impact 7:	Human and Equipment Safety - exposure to explosion over pressures	Cause 1 - Transformer shorting / overheating / explosion. Cause 2 - Flammable gases generated by thermal run away reach explosive limits. Ignition on hot surfaces, static. Lithium Cobalt Oxide generates O ₂ during decomposition – escalation. Consequences - Potential fatalities amongst first responders. Damage to container or other nearby items, e.g., other container.	Operation	Negative	Electrical equipment will be specified to suit application. Emergency response plan and employee training referred to above is to be in place. This is only really likely to happen due to possible inappropriate emergency response, e.g., opening containers when they may be the type that should be left to burn out. Modern state of the art containers have ventilation systems for vapours. Undertake a hazardous area classification of the inside of the container to confirm the rating of electrical equipment, due to possible leaks of electrolyte or generation of flammable gases under thermal run away. Emergency response plan and employee training referred to above is critical. Suitable training of selected emergency responders who may be called out to the facilities is critical. NOTE. Refer to Appendix A for an initial approximation of worst-case possible explosion impact zones.	Moderate	5	1	5	5	2	32	5	1	5	5	1	16
Significance							N3 - Moderate						N2 - Low					
Impact 8a:	Human and Equipment Safety - exposure to acute toxic chemical and biological agents	Causes Human pathogens and diseases, sewage, food waste. Snakes, insects, wild and domesticated animals and harmful plants. Consequences - Illness and at worst without mitigation, possibly extending to fatalities. Effects can vary from discomfort to fatalities for venomous snakes or bee swarms, etc.	Operation	Negative	All necessary good hygiene practices to be in place, e.g., provision of toilets, eating areas, infectious disease controls. Policies and practice for dealing with known vectors of disease such as AIDS, TB, COVID 19 and others. Awareness training for persons on site, safety induction to include animal hazards. First aid and emergency response to consider the necessary anti-venom, anti-histamines, topical medicines, etc.	Moderate	4	1	3	2	3	30	3	1	2	2	2	16
Significance							N2 - Low						N2 - Low					

Impact number	Receptor	Description	Stage	Character	Preventative and Mitigative Measures	Ease of Mitigation	(M +	E+	R+	D) x	P=	S	(M +	E+	R+	D) x	P=	S
							Raw Risk						Residual Risk					
Impact 8b:	Human and Equipment Safety - exposure to acute toxic chemical and biological agents	<p>Causes - Damaged batteries components, leak electrolyte, are completely broken exposing hazardous chemicals. Hazardous fumes released on thermal run away see fire above.</p> <p>Consequences - Impacts can vary from mild skin irritation from exposure to small leaks to serious corrosive burns for large exposure.</p> <p>In the case of toxic fumes, serious lung damage.</p>	Operation	Negative	<p>Acid resistant PPE (e.g., overalls, gloves, eyeglasses) to be specified for all operations in electrolyte areas.</p> <p>PPE to be increased (e.g., full-face shield, aprons, chemical suits) for operations that involve opening equipment and potential exposure, e.g., sampling, maintenance.</p> <p>All operators/maintenance staff trained in the hazards of chemicals on site.</p> <p>Batteries contained, modules contained and all inside a container that acts as bund.</p> <p>Refer to fire above as all the protective measures apply to prevent toxic smoke.</p> <p>Refer to fire above as all the measures apply to mitigate toxic smoke. 24/7 helpline response.</p> <p>Standard dangerous goods requirements for HAZMAT labels.</p> <p>All operators/maintenance staff trained in the hazards.</p> <p>NOTE Refer to Appendix A for an initial approximation of worst case possible noxious smoke impact zones.</p>	Moderate	4	3	3	5	3	45	3	3	3	5	2	28
Significance							N3 - Moderate						N2 - Low					
Impact 9:	Human and Equipment Safety - exposure to violent release of kinetic or potential energy	<p>Causes - Moving equipment, pumps, heavy equipment at elevation, nip points, working at heights. Traffic accidents. Earthquake / tremor.</p> <p>Consequences - Injury. Fatality in unlikely worst case, e.g., traffic accidents or fall from heights. Damage to equipment, spills, environment pollution</p>	Operation	Negative	<p>Apart from pumps, no major moving parts during operation. Maintenance equipment to be serviced and personnel suitably trained in the use thereof.</p> <p>Normally just small vehicles on site, bakkies, grass cutting, cherry-pickers, etc. Possibly large cranes if large equipment or elevated structure removed/replaced.</p> <p>Traffic signs, rules, etc., in place on site.</p> <p>All normal working at heights, hot work permits, confined space entry, cordon off unsafe areas/works, etc., to be in place.</p> <p>Emergency response plan.</p> <p>Civil design to take seismic activity into account.</p>	Moderate	5	1	5	5	3	48	5	1	5	5	1	16
N3 - Moderate							N2 - Low											
Impact 10:	Human and Equipment	Causes - Use of electrical machines,	Operation	Negative	<p>Codes and guidelines for electrical insulation.</p> <p>Suitable PPE to be specified.</p>	Complex	5	2	5	5	3	51	5	2	5	5	1	17

Impact number	Receptor	Description	Stage	Character	Preventative and Mitigative Measures	Ease of Mitigation	(M +	E+	R+	D) x	P=	S	(M +	E+	R+	D) x	P=	S
							Raw Risk						Residual Risk					
	Safety - exposure to electromagnetic waves	generators, etc. Hot dry area static generation is highly likely. Lightning strike. Consequences - Electrocution. Ignition and burns. Injury and death. Damage electrical equipment.			Low voltage equipment (e.g., batteries) separated from high voltage (e.g., transmission to grid). Ensure trained personnel and refer to guideline – IEEE 1657 – 2018. Ensure compliance with Eskom Operating Regulations for high voltage systems including access control, permit to work, safe work procedures, live work, abnormal and emergency situations, keeping records. Electromagnetic fields, impact on other equipment, e.g., testing devices, mobile phones – malfunction, permanent damage. Software also need to be kept as update to date as reasonably practicable. Consider suitably located Emergency stop buttons for the facility and the other equipment on site. PPE to consider static accumulation for entering the facility, and particularly the battery containers especially after a high temperature shut down where there could possibly be flammable materials. The procedures for responding to alarm and auto shut down on containers, needs to consider that there may be a dangerous environment inside and how to protect personnel who may enter to respond. Lightning strike rate in proposed development area is low. All at-risk outside work must be stopped during thunder storms. Lightning conductors may be required for the installation, to be confirmed during design phase.													
Significance							N3 - Moderate						N2 - Low					
Impact 11:	Environment - emissions to air	Not expected on a normal basis. Refrigerant may be an asphyxiant if accidentally released indoors it can accumulate and displace oxygen.	Operation	Negative	Especially after any warning alarms have gone off, but possibly even normally the container could be treated as entering a confined space and similar procedures could be in place, e.g., do not enter alone, gas testing prior to entering, ensure adequate ventilation	Easy	3	1	1	1	3	18	3	1	1	1	1	6
Significance							N2 - Low						N1 - Very Low					
Impact 12:	Environment - emissions to water	Causes - Cooling water blow-down. Laboratory waste (if included in the design). Maintenance waste, e.g., oils. Spills from batteries, coolant system, diesel trucks, transformers. Parked vehicles – oil drips. Fire water runoff	Operation	Negative	Bunding under any outdoors tanks, curbing under truck offloading areas and sealed surfaces (e.g., concrete) under truck parking area where reasonably practicable is particularly important. Sewage and any kitchen liquids - containment and suitable treatment/disposal. Procedures for dealing with damaged/leaking equipment as well as clean-up of spills. Normal site practices for preventing and containing diesel/paint, etc., spills. Waste management plan to be in place, e.g., liquid waste treatment or suitable removal and disposal will be provided. Spill clean-up procedures to be in place before bringing container on site, including spill kits – non-combustible materials, HAZMAT disposal.	Moderate	2	2	3	2	3	27	2	2	3	2	2	18

Impact number	Receptor	Description	Stage	Character	Preventative and Mitigative Measures	Ease of Mitigation	(M +	E+	R+	D) x	P=	S	(M +	E+	R+	D) x	P=	S
							Raw Risk						Residual Risk					
		control. Kitchen waste and sewage. Refrigerant release. Consequences - Pollution if not contained. Excessive disposal costs if emissions not limited.			The National Environment Management Act (NEMA) has a list of substances with Reportable spill Quantities, ensure compliance with this.													
Significance							N2 - Low						N2 - Low					
Impact 13:	Environment - emissions to earth	Causes - Mess area and other solid waste. Disposal of solid-state batteries. Consequences - Environmental damage.	Operation	Negative	Implement waste segregation (e.g., electronic equipment, chemicals, domestic) and management on the site.	Easy	2	2	3	3	3	30	2	2	3	3	1	10
Significance							N2 - Low						N1 - Very Low					
Impact 14:	Environment - waste of resources, e.g., water, power, etc.	Causes - Similar to construction phase. Disposal of batteries or components. Disposal of containers. Water usage not controlled. Consequences - Delays. Excessive costs and disposal of large volumes of hazardous waste.	Operation	Negative	Water usage to be monitored on site. Handling protocols to be provided by supplier of batteries. Water management plan and spill containment plans to be in place. Investigate end of Life plan for solid state batteries - reuse / recovery / reconditioning. Similarly, for decommissioned containers – reuse / recovery / repurpose.	Easy	1	1	1	2	4	20	1	1	1	2	2	10
							N2 - Low						N1 - Very Low					
Impact 15:	Public - Aesthetics	Causes - Bright surfaces reflecting light. Tall structures in a flat area. Consequences - Irritation.	Operation	Negative	Refer to Visual Impact Assessment which includes the BESS installation.	Easy	1	2	4	4	2	22	1	2	4	4	2	22

Impact number	Receptor	Description	Stage	Character	Preventative and Mitigative Measures	Ease of Mitigation	(M +	E+	R+	D) x	P=	S	(M +	E+	R+	D) x	P=	S
							Raw Risk						Residual Risk					
Significance							N2 - Low						N2 - Low					
Impact 16:	Investors - Financial	Causes - Defective technology. Extreme project delays. Consequences - Financial loss	Operation	Negative	Design by experienced contractors using internationally recognized and proven technology. Project management with deviation monitoring.	Easy	5	1	3	4	3	39	3	1	3	4	2	22
Significance							N3 - Moderate						N2 - Low					
Impact 17a:	Employees and investors - Security	Causes - On route, potential hi-jacking of valuable but hazardous load. On site, theft of construction equipment and battery installation facilities. Civil unrest or violent strike by employees. Consequences - Theft. Injury to burglars. Damage to equipment possibly setting off thermal runaway.	Operation	Negative	Fencing around electrical infrastructure to SANS standard and Eskom Guidelines. Consider motion detection lights and CCTV. The hazardous nature of the electrical and battery equipment should be clearly indicated, e.g., Skull and Cross Bones or other signs. Isolated location both helps and hinders security. Night lighting to be provided both indoors and outdoors where necessary.	Moderate	3	1	3	2	4	36	3	1	3	2	2	18
Significance							N3 - Moderate						N2 - Low					
Impact 17b:	Employees and investors - Security	Causes - Cyber security attacks aimed at the National Electricity Grid. Consequences - Ransom of the National Electricity Grid.	Operation	Negative	Cyber security needs monitoring. Remote access to system needs to be negotiated and controlled. Password controls, levels of authority, etc. Protection of the National Electricity Grid from Cyber-attacks accessing through the BESS. Cyber emergency procedures – should be in place prior to commissioning.	Complex	4	4	3	1	4	48	4	4	3	1	2	24
Significance							N3 - Moderate						N2 - Low					
Impact 18:	Emergencies	Causes - Fires, explosions, toxic smoke, large spills, traffic accidents, equipment/structural collapse. Inadequate emergency	Operation	Negative	Emergency procedures need to be practiced prior to commencement of operations. Escape doors should swing open outwards and not into the container. Doors should be able to be hooked open when persons are inside the container, i.e., they should not be automatically self-closing. More than one exit from buildings. Storage of spare batteries (e.g., in stores on site or elsewhere) also needs to consider possible thermal run away.	Complex	4	2	3	4	3	39	4	2	3	4	2	26

Impact number	Receptor	Description	Stage	Character	Preventative and Mitigative Measures	Ease of Mitigation	(M +	E+	R+	D) x	P=	S	(M +	E+	R+	D) x	P=	S
							Raw Risk						Residual Risk					
		response to small event leads to escalation. Consequences - Injuries turn to fatalities, small losses become extended down time.																
Significance							N3 - Moderate						N2 - Low					
Impact 19:	Investors - Legal	Causes Battery field is evolving quickly with new guides, codes and regulations happening at the same time as evolving technology. Consequences - Unknown hazards manifest due to using “cheaper supplier or less developed technology”.	Operation	Negative	Use only internationally reputable battery suppliers who comply with all known regulations/guideline at the time of purchasing. Ensure only state of the art battery systems are used and not old technologies prone to fires/explosions, etc.	Moderate	3	1	3	3	4	40	3	1	3	3	2	20
Significance							N3 - Moderate						N2 - Low					

Battery components may have a limited lifespan, there are damaged equipment, etc. There could already be “waste” on the first day of commissioning and plans should be in place to deal with this. Ideally an End-of-Life plan needs to be in place before the first container / equipment is brought on site. All decommissioning activities must comply with the relevant regulations at the time. Decommissioning will ultimately need to be informed by the regulatory requirements at the time, which may be different to present requirements. The Risk Assessment below shows that, provided the preventative and mitigative measures are incorporated, the de-commissioning phase of the project does not present any high risks nor any fatal flaws.

Table 8.103: Decommissioning Phase

Impact number	Receptor	Description	Stage	Character	Preventative and Mitigative Measures	Ease of Mitigation	(M +	E+	R+	D) x	P=	S	(M +	E+	R+	D) x	P=	S
							Raw Risk						Residual Risk					
Impact 1:	Human Health - chronic exposure to toxic chemical or biological agents	Similar to the construction and operational phases - no new hazards.	De-commission	Negative	As per construction and operational phases.	Easy	1	1	1	1	1	4	1	1	1	1	1	4
Significance							As for Construction and Operation						As for Construction and Operation					

Impact number	Receptor	Description	Stage	Character	Preventative and Mitigative Measures	Ease of Mitigation	(M +	E+	R+	D) x	P=	S	(M +	E+	R+	D) x	P=	S
							Raw Risk						Residual Risk					
Impact 2:	Human Health - exposure to noise	Similar to the construction and operational phases - no new hazards.	De-commission	Negative	As per construction and operational phases.	Easy	1	1	1	1	1	4	1	1	1	1	1	4
							Significance						As for Construction and Operation					
Impact 3:	Human Health - exposure to temperature extremes and/or humidity	Similar to the construction and operational phases - no new hazards.	De-commission	Negative	As per construction and operational phases.	Easy	1	1	1	1	1	4	1	1	1	1	1	4
							Significance						As for Construction and Operation					
Impact 4:	Human Health - exposure to psychological stress	Similar to the construction and operational phases - no new hazards.	De-commission	Negative	As per construction and operational phases.	Easy	1	1	1	1	1	4	1	1	1	1	1	4
							Significance						As for Construction and Operation					
Impact 5:	Human Health - exposure to ergonomic stress	Similar to the construction and operational phases - no new hazards.	De-commission	Negative	As per construction and operational phases.	Easy	1	1	1	1	1	4	1	1	1	1	1	4
							Significance						As for Construction and Operation					
Impact 6:	Human and Equipment Safety - exposure to fire radiation	Similar to the construction and operational phases - no new hazards.	De-commission	Negative	As per construction and operational phases.	Easy	1	1	1	1	1	4	1	1	1	1	1	4
							Significance						As for Construction and Operation					
Impact 7:	Human and Equipment Safety - exposure to explosion over pressures	Similar to the construction and operational phases - no new hazards.	De-commission	Negative	As per construction and operational phases.	Easy	1	1	1	1	1	4	1	1	1	1	1	4
							Significance						As for Construction and Operation					
Impact 8:	Human and Equipment Safety - exposure to acute toxic chemical and	Similar to the construction and operational phases - no new hazards.	De-commission	Negative	As per construction and operational phases.	Easy	1	1	1	1	1	4	1	1	1	1	1	4

Impact number	Receptor	Description	Stage	Character	Preventative and Mitigative Measures	Ease of Mitigation	(M +	E+	R+	D) x	P=	S	(M +	E+	R+	D) x	P=	S
							Raw Risk						Residual Risk					
	biological agents																	
Significance							As for Construction and Operation						As for Construction and Operation					
Impact 9:	Human and Equipment Safety - exposure to violent release of kinetic or potential energy	Similar to the construction and operational phases - no new hazards.	De-commission	Negative	As per construction and operational phases.	Easy	1	1	1	1	1	4	1	1	1	1	1	4
Significance							As for Construction and Operation						As for Construction and Operation					
Impact 10:	Human and Equipment Safety - exposure to electromagnetic waves	Similar to the construction and operational phases - no new hazards.	De-commission	Negative	As per construction and operational phases.	Easy	1	1	1	1	1	4	1	1	1	1	1	4
Significance							As for Construction and Operation						As for Construction and Operation					
Impact 11:	Environment - emissions to air	Similar to the construction and operational phases - no new hazards.	De-commission	Negative	As per construction and operational phases.	Easy	1	1	1	1	1	4	1	1	1	1	1	4
Significance							As for Construction and Operation						As for Construction and Operation					
Impact 12:	Environment - emissions to water	Similar to the construction and operational phases - no new hazards.	De-commission	Negative	As per construction and operational phases.	Easy	1	1	1	1	1	4	1	1	1	1	1	4
Significance							As for Construction and Operation						As for Construction and Operation					
Impact 13:	Environment - emissions to earth	Causes - Batteries / equipment reached end of life and may leak. Consequences - Environment damage from heavy metal ions.	De-commission	Negative	End of Life shutdown procedure including a Risk Assessment of the specific activities involved. Where possible re-purpose the solid-state batteries / containers and equipment with associated environmental impact considered. Disposal according to local regulations and other directives such as the European Batteries Directive. End of life, which is affected by temperature and time, cycles, etc., should be predefined and the monitoring should be in place to determine if it has been reached.	Complex	4	3	3	5	4	60	4	3	3	5	2	30
Significance							N3 - Moderate						N2 - Low					

Impact number	Receptor	Description	Stage	Character	Preventative and Mitigative Measures	Ease of Mitigation	(M +	E+	R+	D) x	P=	S	(M +	E+	R+	D) x	P=	S
							Raw Risk						Residual Risk					
Impact 14:	Environment - waste of resources, e.g., water, power, etc.	Similar to the construction and operational phases - no new hazards.	De-commission	Negative	As per construction and operational phases.	Easy	1	1	1	1	1	4	1	1	1	1	1	4
							Significance						As for Construction and Operation					
Impact 15:	Public - Aesthetics	Similar to the construction and operational phases - no new hazards.	De-commission	Negative	As per construction and operational phases.	Easy	1	1	1	1	1	4	1	1	1	1	1	4
							Significance						As for Construction and Operation					
Impact 16:	Investors - Financial	Similar to the construction n and operational phases - no new hazards.	De-commission	Negative	As per construction and operational phases.	Easy	1	1	1	1	1	4	1	1	1	1	1	4
							Significance						As for Construction and Operation					
Impact 17:	Employees and investors - Security	Similar to the construction and operational phases - no new hazards.	De-commission	Negative	As per construction and operational phases.	Easy	1	1	1	1	1	4	1	1	1	1	1	4
							Significance						As for Construction and Operation					
Impact 18:	Emergencies	Similar to the construction and operational phases - no new hazards.	De-commission	Negative	As per construction and operational phases.	Easy	1	1	1	1	1	4	1	1	1	1	1	4
							Significance						As for Construction and Operation					
Impact 19:	Investors - Legal	Disposal of hazardous “waste” is rife with difficulties and numerous regulations that need to be complied with.	De-commission	Negative	Applicants should seek the opinion from a waste consultant on how to correctly dispose of hazardous waste.	Complex	3	1	3	3	4	40	3	1	3	3	3	30
							Significance						N3 - Moderate					
													N2 - Low					

The Risk Assessment below shows that provided the preventative and mitigative measures are incorporated, the construction phase of the project does not present any high risks nor any fatal flaws

Table 8.104: Vanadium Redox Flow and Zinc Hybrid Ion Battery Energy Storage Systems - Construction Phase (Excluding commissioning which is part of the operational phase)

Impact number	Receptor	Description	Stage	Character	Preventative and Mitigative Measures	Ease of Mitigation	(M +	E+	R+	(D) x	P=	S	(M +	E+	R+	(D) x	P=	S
							Raw Risk						Residual Risk					
Impact 1:	Human Health - chronic exposure to toxic chemical or biological agents	Causes - Construction materials such as cement, paints, solvents, welding fumes, truck fumes, etc. Consequences - Employee / contractor illness.	Construction	Negative	The construction phase will be managed according to all the requirements of the Occupational Health and Safety Act 85 of 1993 specifically the Construction Regulations. SHEQ policy in place. A detailed construction Risk Assessment prior to work. SHE procedure in place. PPE to be specified. SHE appointees in place. Contractor's safety files in place and up to date. All necessary health controls/ practices to be in place, e.g., ventilation of welding and painting areas. SHE monitoring and reporting programs in place. Emergency response plan to be in place prior to beginning construction and to include aspects such as appointment of emergency controller, provision of first aid, first responder contact numbers.	Moderate		1	3	4	4	44	1	1	3	4	2	18
Significance							N3 - Moderate						N2 - Low					
Impact 2:	Human Health - exposure to noise	Causes - Drilling, piling, generators, air compressors. Consequences - Adverse impact on hearing of workers. Possible nuisance factor in near-by areas.	Construction	Negative	Health Risk Assessment to determine if equipment noise exceeds 85dB at workstation and 61dB at boundary of the site. OHS Act Noise Induced Hearing Loss Regulations. Employees to be provided with hearing protection if working near equipment that exceeds the noise limits.	Easy	3	1	5	5	4	56	2	1	5	5	2	26
Significance							N3 - Moderate						N2 - Low					
Impact 3:	Human Health - exposure to temperature extremes and/or humidity	Causes - Heat during the day. Cold in winter. Consequence - Heat stroke. Hypothermia.	Construction	Negative	Construction site facilities to comply with Occupational Health and Safety Act 85 of 1993 specifically the thermal, humidity, lighting and ventilation requirements of the Environmental Regulations for Workplaces. Adequate potable water to be provided during all phases of the project. Borehole, bowser and tank or small water treatment plant may be required to provide potable water for the employees during all phases of the project.	Easy	3	2	3	1	2	18	2	2	3	1	1	8
Significance							N2 - Low						N1 - Very Low					
Impact 4:	Human Health - exposure to psychological stress	Causes - Large projects bring many contractor workers into a small, isolated community. Consequences – Lack of sufficient	Construction	Negative	Refer to Social Specialist Studies for this project.	Easy	2	3	3	2	2	20	2	3	3	2	2	20

Impact number	Receptor	Description	Stage	Character	Preventative and Mitigative Measures	Ease of Mitigation	(M +	E+	R+	D) x	P=	S	(M +	E+	R+	D) x	P=	S
							Raw Risk						Residual Risk					
		accommodation, entertainment, etc. Increase in alcohol abuse, violence.																
Significance							N2 - Low						N2 - Low					
Impact 5:	Human Health - exposure to ergonomic stress	Causes - Lifting heavy equipment. Awkward angles during construction. Consequences - Back and other injuries.	Construction	Negative	<p>Training in lifting techniques.</p> <p>Ensure that despite the isolated location all the necessary equipment is available (and well maintained) during construction. Otherwise employees may revert to unsafe practices. Isolated location, maintenance of construction equipment to ensure safe operation is critical. Utilization of local service providers where possible. Ensure this is in place prior to project beginning.</p> <p>First aid provision on site.</p>	Moderate	4	1	3	2	3	30	4	1	3	2	2	20
Significance							N2 - Low						N2 - Low					
Impact 6:	Human and Equipment Safety - exposure to fire radiation	<p>Causes - Involvement in an external fire. Fire involving fuels used in construction vehicles or vehicles themselves (e.g., tyre fire).</p> <p>Fire due to uncontrolled welding or other hot-work</p> <p>Consequences - Injuries due to radiation especially amongst first responders and bystanders. Fatalities unlikely from the heat radiation as not highly flammable nor massive fire.</p>	Construction	Negative	<p>Fuels stored on site in dedicated, demarcated and bunded areas. Suitable fire-fighting equipment on site near source of fuel, e.g., diesel tank, generators, mess, workshops, etc.</p> <p>The company responsible for the facility at this stage is to have:</p> <ol style="list-style-type: none"> 1. Emergency plan to be in place prior to commencement of construction. 2. Fuel spill containment procedures and equipment to be in place. 3. Hot-work permit and management system to be in place. 	Complex	4	2	3	5	4	56	4	2	3	5	2	28
Significance							N3 - Moderate						N2 - Low					

Impact number	Receptor	Description	Stage	Character	Preventative and Mitigative Measures	Ease of Mitigation	(M +	E+	R+	D) x	P=	S	(M +	E+	R+	D) x	P=	S
							Raw Risk						Residual Risk					
Impact 7:	Human and Equipment Safety - exposure to explosion over pressures	No credible causes	Construction	Negative	No credible causes, hence, no mitigation necessary.	N/A	1	1	1	1	1	4	1	1	1	1	1	4
Significance							#N/A						#N/A					
Impact 8a:	Human and Equipment Safety - exposure to acute toxic chemical and biological agents	Causes Human pathogens and diseases, sewage, food waste. Snakes, insects, wild and domesticated animals and harmful plants. Consequences - Illness and at worst without mitigation, possibly extending to fatalities. Effects can vary from discomfort to fatalities for venomous snakes or bee swarms, etc.	Construction	Negative	All necessary good hygiene practices to be in place, e.g., provision of toilets, eating areas, infectious disease controls. Policies and practice for dealing with known vectors of disease such as AIDS, TB, COVID 19 and others. Awareness training for persons on site, safety induction to include animal hazards. First aid and emergency response to consider the necessary anti-venom, anti-histamines, topical medicines, etc.	Complex	4	2	3	2	3	33	3	2	3	2	2	20
Significance							N3 - Moderate						N2 - Low					
Impact 9:	Human and Equipment Safety - exposure to violent release of kinetic or potential energy	Causes - Construction moving equipment, heavy loaded, elevated loads, working at heights. Consequences - Injury or possibly fatality. Damage to equipment. Delays in starting the project, financial losses	Construction	Negative	The construction phase will be managed according to all the requirements of the Occupational Health and Safety Act 85 of 1993 specifically the Construction Regulations. SHEQ policy in place. A detailed construction Risk Assessment prior to work. SHE procedure in place. PPE to be specified. SHE appointees in place. Contractors safety files in place and up to date. SHE monitoring and reporting programs in place. Standard construction site rules regarding traffic, reversing sirens, rigging controls, cordoning off excavations, etc. Civil and building structures to National Building Regulations and building Standards Act 103 of 1977 SANS 10400 and other relevant codes. Other constructions such as roads, sewers, etc., also to relevant SANS	Complex	5	1	5	5	4	64	5	1	5	5	1	16

Impact number	Receptor	Description	Stage	Character	Preventative and Mitigative Measures	Ease of Mitigation	(M +	E+	R+	D) x	P=	S	(M +	E+	R+	D) x	P=	S
							Raw Risk						Residual Risk					
					standards. All normal procedures for working at heights, hot work permits, confined space entry, cordon off excavations, etc., to be in place before relevant construction task begins. Emergency response plan to be in place before construction begins.													
Significance							N4 - High						N2 - Low					
Impact 10:	Human and Equipment Safety - exposure to electromagnetic waves	Causes - Use of electrical machines, generators, etc. Hot dry area static generation is highly likely. Lightning strike. Consequences - Electrocutation. Ignition and burns. Injury and death. Damage electrical equipment.	Construction	Negative	Standard maintenance of condition of electrical equipment and safe operating instructions. Ability to shut off power to systems in use on site. If persons are decanting fuels or dealing with other highly flammable materials care should be taken regarding possible static discharge, installations to be suitably designed and maintained. Lightning strike rate in the study area is low. All at-risk outside work must be stopped during thunderstorms. Lightning conductors may be required for the final installation, to be confirmed during design phase.	Complex	5	2	5	5	3	51	5	2	5	5	1	17
Significance							N3 - Moderate						N2 - Low					
Impact 11:	Environment - emissions to air	Causes - Dust from construction and generally hot dry area. Consequences - Adverse impact on employee health.	Construction	Negative	May need to use dampening on roads, etc., as per normal construction practices. May need PPE (dust masks) for specific construction workers.	Easy	3	2	1	1	4	28	2	2	1	1	2	12
Significance							N2 - Low						N1 - Very Low					
Impact 12:	Environment - emissions to water	Causes - Diesel for equipment, paints and solvents. Transformer oil spills. Sewage and kitchen/mess area wastewater. Consequences - Environmental damage, particularly to the surface and	Construction	Negative	Normal construction site practices for preventing and containing fuels/paint/oil, etc., spills. Bunding under any temporary tanks, curbing under truck offloading areas and sealed surfaces (e.g., concrete) under truck parking area where reasonably practicable is particularly important. Spill clean-up procedures to be in place before commencing construction. Sewage and any kitchen liquids - containment and suitable treatment/disposal.	Moderate	2	2	3	2	3	27	2	2	3	2	2	18

Impact number	Receptor	Description	Stage	Character	Preventative and Mitigative Measures	Ease of Mitigation	(M +	E+	R+	D) x	P=	S	(M +	E+	R+	D) x	P=	S
							Raw Risk						Residual Risk					
		underground water in the area.																
Significance							N2 - Low						N2 - Low					
Impact 13:	Environment - emissions to earth	Causes - Mess area and other solid waste. Consequences - Environmental damage.	Construction	Negative	There will be packaging materials that will need to be disposed of after the entire system is connected and commissioned as well as after regular maintenance. There will need to be waste segregation (e.g., electronic equipment, chemicals) and management on the site.	Easy	2	2	3	3	3	30	1	2	3	3	2	18
Significance							N2 - Low						N2 - Low					
Impact 14:	Environment - waste of resources, e.g., water, power, etc.	Causes - Water usage not controlled. Battery equipment damaged. Consequences - Delays.	Construction	Negative	Water usage to be monitored on site during construction. Handling protocols to be provided by battery supplier. Water management plan and spill containment plans to be in place.	Easy	1	1	1	2	4	20	1	1	1	2	2	10
Significance							N2 - Low						N1 - Very Low					
Impact 15:	Public Aesthetics	Causes - Bright surfaces reflecting light. Tall structures in a flat area. Consequences - Irritation.	Construction	Negative	Visual impact assessment to include BESS installation. Confirm any height limitations for VRFB/ZHB BESS building (if utility scale)	Moderate	3	2	3	4	4	48	1	2	3	4	2	20
Significance							N3 - Moderate						N2 - Low					
Impact 16:	Investors Financial	Causes - Defective technology. Extreme project delays. Consequences - Financial loss	Construction	Negative	Design by experienced contractors using internationally recognized and proven technology. Project management with deviation monitoring.	Moderate	5	1	3	4	3	39	3	1	3	4	2	22
Significance							N3 - Moderate						N2 - Low					

Impact number	Receptor	Description	Stage	Character	Preventative and Mitigative Measures	Ease of Mitigation	(M +	E+	R+	D) x	P=	S	(M +	E+	R+	D) x	P=	S
							Raw Risk						Residual Risk					
Impact 17:	Employees and investors - Security	Causes - On route, potential hi-jacking of valuable but hazardous load. On site, theft of construction equipment and battery installation facilities. Civil unrest or violent strike by employees. Consequences - Theft. Injury to burglars. Damage to equipment possibly setting off thermal runaway.	Construction	Negative	Fencing around electrical infrastructure to SANS standard and Eskom Guidelines. The hazardous nature of the electrical and battery equipment should be clearly indicated, e.g., Skull and Cross Bones or other signs. Isolated location both helps and hinders security. Night lighting to be provided both indoors and outdoors where necessary.	Complex	4	1	3	2	4	40	3	1	3	2	3	27
Significance							N3 - Moderate						N2 - Low					
Impact 18:	Emergencies	Causes - Fires, explosions, toxic smoke, large spills, traffic accidents, equipment/structural collapse. Inadequate emergency response to small event leads to escalation. Consequences - Injuries turn to fatalities, small losses become extended down time.	Construction	Negative	Emergency procedures need to be practiced prior to commencement of construction.	Complex	4	2	3	4	3	39	4	2	3	4	2	26
Significance							N3 - Moderate						N2 - Low					
Impact 19:	Investors - Legal	Causes Battery field is evolving quickly with new guides, codes and regulations happening at the	Construction	Negative	Use only internationally reputable battery suppliers who comply with all known regulations/guideline at the time of purchasing. Ensure only state of the art battery systems are used and not old technologies prone to fires/explosions, etc.	Moderate	3	1	3	3	4	40	2	1	3	3	2	18

Impact number	Receptor	Description	Stage	Character	Preventative and Mitigative Measures	Ease of Mitigation	(M +	E+	R+	D) x	P=	S	(M +	E+	R+	D) x	P=	S
							Raw Risk						Residual Risk					
		same time as evolving technology. Consequences - Unknown hazards manifest due to using "cheaper supplier or less developed technology".																
Significance							N3 - Moderate						N2 - Low					

From the details of accidents that have happened both with BESS installations and chemical plants in general, it is clear that many potential problems manifest during the commissioning phase when units are first powered up to test functionality. This phase is critical and all controls, procedures, mitigation measures, etc., that would be in place for full operation should be in place before commissioning commences. The Risk Assessment below shows that, provided the preventative and mitigative measures are incorporated, the operational phase of the project does not present any high risks nor any fatal flaws.

Table 8.105: Operational Phase (Including Commissioning)

Impact number	Receptor	Description	Stage	Character	Preventative and Mitigative Measures	Ease of Mitigation	(M +	E+	R+	D) x	P=	S	(M +	E+	R+	D) x	P=	S
							Raw Risk						Residual Risk					
Impact 1a:	Human Health - chronic exposure to toxic chemical or biological agents	Causes - Operation and maintenance materials, spare parts, paints, solvents, welding fumes, transformers oils, lubricating oils and greases, etc. Consequences - Occupational illness.	Operation	Negative	The operation and maintenance phase will be managed according to all the requirements of the Occupational Health and Safety Act 85 of 1993. SHEQ policy in place. A detailed Risk Assessment of all normal operating and maintenance activities on site to be compiled, and form the basis of operating instructions, prior to commencing commissioning. SHE procedure in place, e.g., PPE specified, management of change, integrity monitoring. SHE appointees in place. Training of staff in general hazards on site. All necessary health controls/ practices to be in place, e.g., ventilation of confined areas, occupational health monitoring if required and reporting programs in place. Emergency response plan for full operation and maintenance phase to be in place prior to beginning commissioning and to include aspects such as: - appointment of emergency controller, - emergency isolation systems for electricity, - -emergency isolation and containment systems for electrolyte, - provision of PPE for hazardous materials response, - provision of emergency facilities for staff at the main office building, - provision of first aid facilities, - first responder contact numbers, etc.	Easy	2	1	3	4	5	50	1	1	3	4	2	18
Significance							N3 - Moderate						N2 - Low					

Impact number	Receptor	Description	Stage	Character	Preventative and Mitigative Measures	Ease of Mitigation	(M +	E+	R+	D) x	P=	S	(M +	E+	R+	D) x	P=	S
							Raw Risk						Residual Risk					
Impact 1b:	Human Health - chronic exposure to toxic chemical or biological agents	Causes - Compromised battery compartments vapours accumulate in the containers, solids/liquids on surfaces. Maintenance of battery components, corrosive and mildly toxic liquid on surfaces. Consequences - Dermatitis, skin /eye/lung irritation.	Operation	Negative	VRFB and ZHB facilities can be within buildings but may be containerized. Maintenance procedures will be in place should equipment need to be opened, e.g., pumps drained and decontaminated prior to repair in workshop, etc. PPE will be specified for handling battery parts and other equipment on site. Training of staff in hazards of chemicals on site. Labelling of all equipment. Confined space entry procedures if entering tanks. Safety Data Sheets (SDSs) to be available on site. Operating manuals to be provided including start-up, shut-down, steady state, monitoring requirements. Maintenance manuals with make safe, decontamination and repair procedures. Proposed maintenance schedules, e.g., checklists for weekly, monthly, annually, etc. Provided portable equipment for calibration and for testing/verification of defective equipment, e.g., volt/current meters, infrared camera	Complex	2	1	3	5	4	44	1	1	3	5	2	20
Significance							N3 - Moderate						N2 - Low					
Impact 2:	Human Health - exposure to noise	Causes - Moving parts inside containers, buildings, pumps, compressors, cooling systems, etc. Consequences - Adverse impact on hearing of workers. Nuisance factor at near -by residences or other activities.	Operation	Negative	Design to ensure continuous noise does not exceed 85dB within the facilities or at any other location on site or 61 dB at the site boundary, e.g., emergency generator, air compressor, etc., OHS Act Noise Induced Hearing Loss Regulations. Employees to be provided with hearing protection if working near equipment that exceeds the noise limits.	Easy	2	1	5	5	4	52	2	1	5	5	2	26
Significance							N3 - Moderate						N2 - Low					
Impact 3:	Human Health - exposure to temperature extremes and/or humidity	Causes - Heat during the day. Batteries generate heat within enclosed building / containers. Cold in winter. Night work requires lighting. Consequences - Heat stroke. Hypothermia.	Operation	Negative	Building and container facilities to comply with Occupational Health and Safety Act 85 of 1993 specifically the thermal, humidity, lighting and ventilation requirements of the Environmental Regulations for Workplaces. Night work is likely for VRFB/ZHB if utility scale building type are used. Suitable lighting to be provided including emergency lighting for safe building exit in the event of power failure. PPE for operations and maintenance staff to be suitable for the weather conditions. Adequate potable water to be provided during all phases of the project. PPE for operations and maintenance staff to be suitable for the weather conditions.	Easy	4	2	3	1	2	20	3	2	3	1	1	9
Significance							N2 - Low						N1 - Very Low					

Impact number	Receptor	Description	Stage	Character	Preventative and Mitigative Measures	Ease of Mitigation	(M +	E+	R+	(D) x	P=	S	(M +	E+	R+	(D) x	P=	S
							Raw Risk						Residual Risk					
Impact 4:	Human Health - exposure to psychological stress	Causes - Isolated workstation and monotonous repetitive work. Consequences - Low performance, system productivity suffers.	Operation	Negative	Staff rotation to other activities within the site may be necessary. Performance monitoring of inspections / maintenance tasks in particular will be necessary.	Easy	2	3	3	2	2	20	1	3	3	2	1	9
							Significance						N2 - Low					
Impact 5:	Human Health - exposure to ergonomic stress	Causes - Lifting heavy equipment. Awkward angles during maintenance, stretching reaching to high level and bending to low level. Working ta height if equipment located on top of electrolyte tanks, roofs or elevated electrical equipment (e.g., pylons). Consequences - Back and other injuries.	Operation	Negative	Training in lifting techniques. Training in working at heights. If equipment is at height (see OHS Act General Safety Regulation 6), ensure suitable safe (electrically and physically) ladders / harnesses, etc., are available. Working at height procedure to be in place.	Easy	5	1	3	2	3	33	4	1	3	2	2	20
							Significance						N3 - Moderate					
													N1 - Very Low					
													N2 - Low					

Impact number	Receptor	Description	Stage	Character	Preventative and Mitigative Measures	Ease of Mitigation	(M +	E+	R+	D) x	P=	S	(M +	E+	R+	D) x	P=	S
							Raw Risk						Residual Risk					
Impact 6a:	Human and Equipment Safety - exposure to fire radiation	Causes – Involvement in an external fire e.g., veld fire, maintenance vehicle fire, electrical systems fire. Manufacturing defects or damage to battery leading to shorting and heating. High humidity condensation of water or ingress of water or flooding leading to shorting. Dust accumulation on electrical parts leading to overheating. Excessive electrical loads - surges Operator abuse BMS failure or software failure. Incorrect extinguishing medium, escalate the fire. Consequences - Contaminated run off. Radiation burns. No affected bystanders. Damaged equipment. Fire spreads to other units or offsite if grass/vegetation not controlled.	Operation	Negative	Grass cutting and fire breaks around the BESS installations. No combustible materials to be stored in or near the batteries or electrical infrastructure, e.g., separation of site diesel tank. Fire resistant barrier between the batteries and the PCS side if in the same container. Design codes from USA and standards of practice UL9540, NFPA 855 and DNV GL RP 43. Detailed FMEA/HAZOP/Bowtie to done during design at the component level and system levels. Safety integrity level rating of equipment (failure probably) with suitable redundancy if required. Site Acceptance Testing as part of commissioning of each unit and the overall system. BMS should be checking individual cell voltage as well as stack, module, container, system voltages/current, etc., BMS tripping the cell and possibly the stack/ building unit or module/rack/container, if variations in voltage. Diagnostics easily accessible. Diagnostics able to distinguish cell from stack or cell from module faults. As per SANS Standards, suitable ingress protection (IP) level provided for electrical equipment, e.g., IP55 - 66. If air cooling into container / building, suitable dust filters to be provided if needed. Smoke detectors may be needed linked to BMS and alerts in the main control room. Effects of battery aging to be considered. Temperature monitoring, regular infrared scanning. Data stored for trend analysis. Protective systems functionality testing. Prior to commencement of cold commissioning, emergency plan from transport and construction phase to extended to operational phase and to include the hazards of the electrically live system. Procedure to address suitable extinguishing media, ventilating, entering container as appropriate or not. PPE for firefighting may need to include fire retardant, chemically resistant, nitrile gloves, antistatic acid resistant boots, fill face shields, BA sets. A planned fire response to prevent escalation to an environmental event is critical. Suitable fire extinguishing medium, cooling medium and adequate supply of both is critical, e.g., cooling adjacent equipment and can use fogging nozzles to direct smoke. Ensure procedures in place to clean up after event. Lingering toxic residues in the soil and on adjacent structures.	Complex	5	1	5	5	3	48	5	1	5	5	1	16
Significance							N3 - Moderate						N2 - Low					
Impact 6b:	Human and Equipment Safety -	Causes - Power Conversion System (PCS – DC to AC) cooling failure	Operation	Negative	VRFB/ZHB building systems PCS in another area separating it from the batteries and other equipment.	Moderate	5	2	5	5	3	51	5	2	5	5	1	17

Impact number	Receptor	Description	Stage	Character	Preventative and Mitigative Measures	Ease of Mitigation	(M +	E+	R+	D) x	P=	S	(M +	E+	R+	D) x	P=	S
							Raw Risk						Residual Risk					
	exposure to fire radiation	electrical fire. Consequences - Fire starts in PCS or another section or room and spreads to battery area.																
Significance							N3 - Moderate						N2 - Low					
Impact 7:	Human and Equipment Safety - exposure to explosion over pressures	Transformer shorting / overheating / explosion. Consequences - Potential fatalities, e.g., amongst first responders. Damage to nearby equipment.	Operation	Negative	Electrical equipment will be specified to suit application. Emergency response plan and employee training referred to above is to be in place.	Moderate	5	1	5	5	2	32	5	1	5	5	1	16
Significance							N3 - Moderate						N2 - Low					
Impact 8a:	Human and Equipment Safety - exposure to acute toxic chemical and biological agents	Causes Human pathogens and diseases, sewage, food waste. Snakes, insects, wild and domesticated animals and harmful plants. Consequences - Illness and at worst without mitigation, possibly extending to fatalities. Effects can vary from discomfort to fatalities for venomous snakes or bee swarms, etc.	Operation	Negative	All necessary good hygiene practices to be in place, e.g., provision of toilets, eating areas, infectious disease controls. Policies and practice for dealing with known vectors of disease such as AIDS, TB, COVID 19 and others. Awareness training for persons on site, safety induction to include animal hazards. First aid and emergency response to consider the necessary anti-venom, anti-histamines, topical medicines, etc.	Moderate	4	1	3	2	3	30	3	1	2	2	2	16
Significance							N2 - Low						N2 - Low					

Impact number	Receptor	Description	Stage	Character	Preventative and Mitigative Measures	Ease of Mitigation	(M +	E+	R+	D) x	P=	S	(M +	E+	R+	D) x	P=	S
							Raw Risk						Residual Risk					
Impact 8b:	Human and Equipment Safety - exposure to acute toxic chemical and biological agents	Causes - Damaged batteries components, leak electrolyte, are completely broken exposing hazardous chemicals. Consequences - Impacts can vary from mild skin irritation from exposure to small leaks to serious corrosive burns for large exposure.	Operation	Negative	Corrosion resistant PPE (e.g., overalls, gloves, eyeglasses) to be specified for all operations in electrolyte areas. PPE to be increased (e.g., full-face shield, aprons, chemical suits) for operations that involve opening equipment and potential exposure, e.g., sampling, maintenance. All operators/maintenance staff trained in the hazards of chemicals on site. Electrolyte contained, modules contained inside a building that is bunded. 24/7 helpline response. Standard dangerous goods requirements for Hazmat labels. All operators/maintenance staff trained in the hazards.	Moderate	4	3	3	5	3	45	3	3	3	5	2	28
Significance							N3 - Moderate						N2 - Low					
Impact 9:	Human and Equipment Safety - exposure to violent release of kinetic or potential energy	Causes - Moving equipment, pumps, heavy equipment at elevation, nip points, working at heights. Traffic accidents. Earthquake / tremor. Consequences - Injury. Fatality in unlikely worst case, e.g., traffic accidents or fall from heights. Damage to equipment, spills, environment pollution	Operation	Negative	Apart from pumps, no major moving parts during operation. Maintenance equipment to be serviced and personnel suitably trained in the use thereof. Normally just small vehicles on site, bakkies, grass cutting, cherry-pickers, etc. Possibly large cranes if large equipment or elevated structure removed/replaced. Traffic signs, rules, etc., in place on site. All normal working at heights, hot work permits, confined space entry, cordon off unsafe areas/works, etc., to be in place. Emergency response plan. Civil design to take seismic activity into account.	Moderate	5	1	5	5	3	48	5	1	5	5	1	16
Significance							N3 - Moderate						N2 - Low					
Impact 10:	Human and Equipment Safety - exposure to electromagnetic waves	Causes - Use of electrical machines, generators, etc. Hot dry area static generation is highly likely. Lightning strike. Consequences - Electrocution. Ignition and burns.	Operation	Negative	Codes and guidelines for electrical insulation. PPE to suit. Low voltage equipment (e.g., batteries) separated from high voltage (e.g., transmission to grid). Ensure trained personnel and refer to guideline – IEEE 1657 – 2018. Ensure compliance with Eskom Operating Regulations for high voltage systems including access control, permit to work, safe work procedures, live work, abnormal and emergency situations, keeping records. Electromagnetic fields, impact on other equipment, e.g., testing devices, mobile phones – malfunction, permanent damage.	Complex	5	2	5	5	3	51	5	2	5	5	1	17

Impact number	Receptor	Description	Stage	Character	Preventative and Mitigative Measures	Ease of Mitigation	(M +	E+	R+	D) x	P=	S	(M +	E+	R+	D) x	P=	S
							Raw Risk						Residual Risk					
		Injury and death. Damage electrical equipment.			<p>Software also need to be kept as update to date as reasonably practicable.</p> <p>Consider suitably located Emergency stop buttons for the facility and the other equipment on site.</p> <p>PPE to consider static accumulation for entering the facilities, and particularly the battery containers especially after a high temperature shut down where there could possibly be flammable materials.</p> <p>The procedures for responding to alarm and auto shut down on containers, needs to consider that there may be a dangerous environment inside and how to protect personnel who may enter to respond.</p> <p>Lightning strike rate in proposed development area is low.</p> <p>All at-risk outside work must be stopped during thunder storms.</p> <p>Lightning conductors may be required for the installation, to be confirmed during design</p>													
Significance							N3 - Moderate						N2 - Low					
Impact 11:	Environment - emissions to air	Continuous small emission of hydrogen. Refrigerant may be an asphyxiant if accidentally released indoors it can accumulate and displace oxygen.	Operation	Negative	<p>Hydrogen vents elevated above the battery for good dispersion.</p> <p>Flashback arrestors in the hydrogen vents in areas with high level of lightning in summer. During commissioning confirmation that levels of hydrogen at the equipment and human activity area of the facility are suitably low.</p> <p>Especially after any warning alarms have gone off, but possibly even normally the container could be treated as entering a confined space and similar procedures could be in place, e.g., do not enter alone, gas testing prior to entering, ensure adequate ventilation</p>	Easy	3	1	1	1	3	18	3	1	1	1	1	6
Significance							N2 - Low						N1 - Very Low					
Impact 12:	Environment - emissions to water	Causes - Cooling water blow-down. Laboratory waste (if included in the design). Maintenance waste, e.g., oils. Spills from batteries, coolant system, diesel trucks, transformers. Parked vehicles – oil drips. Fire water runoff control. Kitchen waste and sewage. Refrigerant release. VRFB/ZHB electrolyte purging.	Operation	Negative	<p>Electrolyte areas fully bunded to 110% of largest tank, or more.</p> <p>Bunding under any outdoors tanks, curbing under truck offloading areas and sealed surfaces (e.g., concrete) under truck parking area where reasonably practicable is particularly important.</p> <p>Sewage and any kitchen liquids - containment and suitable treatment/disposal.</p> <p>Procedures for dealing with damaged/leaking equipment as well as clean-up of spills.</p> <p>Normal site practices for preventing and containing diesel/paint, etc., spills.</p> <p>Waste management plan to be in place, e.g., liquid waste treatment or suitable removal and disposal will be provided.</p> <p>Spill clean-up procedures to be in place before bringing container on site, including spill kits – non-combustible materials, HAZMAT disposal.</p> <p>The National Environment Management Act (NEMA) has a list of substances with Reportable spill Quantities, ensure compliance with this.</p> <p>Process controls in place to prevent contamination and deterioration of electrolyte leading to excessive purging.</p> <p>Ensure proposed locations of the BESS facilities are a suitable distance from the closest watercourse. In the event of a major spill if this is too</p>	Moderate	3	2	3	2	3	30	3	2	3	2	2	20

Impact number	Receptor	Description	Stage	Character	Preventative and Mitigative Measures	Ease of Mitigation	(M +	E+	R+	D) x	P=	S	(M +	E+	R+	D) x	P=	S
							Raw Risk						Residual Risk					
		Consequences - Pollution if not contained. Excessive disposal costs if emissions not limited.			close it may not allow time for mitigation to be taken. Adequate secondary and possibly tertiary containment systems may then be needed on site.													
Significance							N2 - Low						N2 - Low					
Impact 13:	Environment - emissions to earth	Causes - Mess area and other solid waste. Disposal of battery components. Consequences - Environmental damage.	Operation	Negative	Implement waste segregation (e.g., electronic equipment, chemicals, domestic) and management on the site.	Easy	2	2	3	3	3	30	2	2	3	3	1	10
Significance							N2 - Low						N1 - Very Low					
Impact 14:	Environment - waste of resources, e.g., water, power, etc.	Causes - Similar to construction phase. Disposal of batteries or components. Disposal of containers. Water usage not controlled. Excessive purging of deteriorated or contaminated electrolyte. Consequences - Delays. Excessive costs and disposal of large volumes of hazardous waste.	Operation	Negative	Water usage to be monitored on site. Handling protocols to be provided by supplier of electrolyte. Water management plan and spill containment plans to be in place. Investigate End of Life plan for electrolyte - reuse / recovery / reconditioning. Similarly, for decommissioned containers / equipment – reuse / recovery / repurpose	Easy	2	1	1	2	4	24	2	1	1	2	2	12
Significance							N2 - Low						N1 - Very Low					

Impact number	Receptor	Description	Stage	Character	Preventative and Mitigative Measures	Ease of Mitigation	(M +	E+	R+	D) x	P=	S	(M +	E+	R+	D) x	P=	S
							Raw Risk						Residual Risk					
Impact 15:	Public - Aesthetics	Causes - Bright surfaces reflecting light. Tall structures in a flat area. Consequences - Irritation.	Construction	Negative	Visual impact assessment includes BESS installation. Confirm any height limitations for VRFB/ZHB BESS building (if utility scale)	Moderate	3	2	3	4	4	48	1	2	3	4	2	20
Significance							N3 - Moderate						N2 - Low					
Impact 16:	Investors - Financial	Causes - Defective technology. Extreme project delays. Consequences - Financial loss	Operation	Negative	Design by experienced contractors using internationally recognized and proven technology. Project management with deviation monitoring.	Easy	5	1	3	4	3	39	3	1	3	4	2	22
Significance							N3 - Moderate						N2 - Low					
Impact 17a:	Employees and investors - Security	Causes - On route, potential hi-jacking of valuable but hazardous load. On site, theft of construction equipment and battery installation facilities. Civil unrest or violent strike by employees. Consequences - Theft. Injury to burglars. Damage to equipment possibly setting off thermal runaway.	Operation	Negative	Fencing around electrical infrastructure to SANS standard and Eskom Guidelines. Consider motion detection lights and CCTV. The hazardous nature of the electrical and battery equipment should be clearly indicated, e.g., Skull and Cross Bones or other signs. Isolated location both helps and hinders security. Night lighting to be provided both indoors and outdoors where necessary.	Moderate	3	1	3	2	4	36	3	1	3	2	2	18
Significance							N3 - Moderate						N2 - Low					
Impact 17b:	Employees and investors - Security	Causes - Cyber security attacks aimed at the National Electricity Grid. Consequences - Ransom of the National Electricity Grid.	Operation	Negative	Cyber security needs monitoring. Remote access to system needs to be negotiated and controlled. Password controls, levels of authority, etc. Protection of the National Electricity Grid from Cyber-attacks accessing through the BESS. Cyber emergency procedures – should be in place prior to commissioning.	Complex	4	4	3	1	4	48	4	4	3	1	2	24
Significance							N3 - Moderate						N2 - Low					

Impact number	Receptor	Description	Stage	Character	Preventative and Mitigative Measures	Ease of Mitigation	(M +	E+	R+	(D) x	P=	S	(M +	E+	R+	(D) x	P=	S
							Raw Risk						Residual Risk					
Impact 18:	Emergencies	Causes - Fires, explosions, toxic smoke, large spills, traffic accidents, equipment/structural collapse. Inadequate emergency response to small event leads to escalation. Consequences - Injuries turn to fatalities, small losses become extended down time.	Operation	Negative	Emergency procedures need to be practiced prior to commencement of operations. Escape doors should swing open outwards and not into the building/container. More than one exit from buildings.	Complex	4	2	3	4	3	39	4	2	3	4	2	26
Significance							N3 - Moderate						N2 - Low					
Impact 19:	Investors - Legal	Causes Battery field is evolving quickly with new guides, codes and regulations happening at the same time as evolving technology. Consequences - Unknown hazards manifest due to using “cheaper supplier or less developed technology”.	Operation	Negative	Use only internationally reputable battery suppliers who comply with all known regulations/guideline at the time of purchasing. Ensure only state of the art battery systems are used and not old technologies prone to fires/explosions, etc.	Moderate	3	1	3	3	4	40	3	1	3	3	2	20
Significance							N3 - Moderate						N2 - Low					

Battery components may have a limited lifespan, there are damaged equipment, waste electrolyte, etc. There could already be “waste” on the first day of commissioning and plans should be in place to deal with this. Ideally an End-of-Life plan needs to be in place before the first electrolyte / container / equipment is brought on site. All decommissioning activities must comply with the relevant regulations at the time. Decommissioning will ultimately need to be informed by the regulatory requirements at the time, which may be different to present requirements. The Risk Assessment below shows that, provided the preventative and mitigative measures are incorporated, the de-commissioning phase of the project does not present any high risks nor any fatal flaws.

Table 8.106: Decommissioning Phase

Impact number	Receptor	Description	Stage	Character	Preventative and Mitigative Measures	Ease of Mitigation	(M +	E+	R+	(D) x	P=	S	(M +	E+	R+	(D) x	P=	S
							Raw Risk						Residual Risk					
Impact 1:	Human Health - chronic exposure to toxic chemical or biological agents	Similar to the construction and operational phases - no new hazards.	De-commission	Negative	As per construction and operational phases.	Easy	1	1	1	1	1	4	1	1	1	1	1	4
Significance							As for Construction and Operation						As for Construction and Operation					
Impact 2:	Human Health - exposure to noise	Similar to the construction and operational phases - no new hazards.	De-commission	Negative	As per construction and operational phases.	Easy	1	1	1	1	1	4	1	1	1	1	1	4
Significance							As for Construction and Operation						As for Construction and Operation					
Impact 3:	Human Health - exposure to temperature extremes and/or humidity	Similar to the construction and operational phases - no new hazards.	De-commission	Negative	As per construction and operational phases.	Easy	1	1	1	1	1	4	1	1	1	1	1	4
Significance							As for Construction and Operation						As for Construction and Operation					
Impact 4:	Human Health - exposure to psychological stress	Similar to the construction and operational phases - no new hazards.	De-commission	Negative	As per construction and operational phases.	Easy	1	1	1	1	1	4	1	1	1	1	1	4
Significance							As for Construction and Operation						As for Construction and Operation					
Impact 5:	Human Health - exposure to ergonomic stress	Similar to the construction and operational phases - no new hazards.	De-commission	Negative	As per construction and operational phases.	Easy	1	1	1	1	1	4	1	1	1	1	1	4
Significance							As for Construction and Operation						As for Construction and Operation					
Impact 6:	Human and Equipment Safety - exposure to fire radiation	Similar to the construction and operational phases - no new hazards.	De-commission	Negative	As per construction and operational phases.	Easy	1	1	1	1	1	4	1	1	1	1	1	4
Significance							As for Construction and Operation						As for Construction and Operation					
Impact 7:	Human and Equipment Safety - exposure to	Similar to the construction and operational phases - no new hazards.	De-commission	Negative	As per construction and operational phases.	Easy	1	1	1	1	1	4	1	1	1	1	1	4

Impact number	Receptor	Description	Stage	Character	Preventative and Mitigative Measures	Ease of Mitigation	(M +	E+	R+	(D) x	P=	S	(M +	E+	R+	(D) x	P=	S
							Raw Risk						Residual Risk					
	explosion over pressures																	
Significance							As for Construction and Operation						As for Construction and Operation					
Impact 8:	Human and Equipment Safety - exposure to acute toxic chemical and biological agents	Similar to the Construction and operational phases - no new hazards.	De-commission	Negative	As per construction and operational phases.	Easy	1	1	1	1	1	4	1	1	1	1	1	4
Significance							As for Construction and Operation						As for Construction and Operation					
Impact 9:	Human and Equipment Safety - exposure to violent release of kinetic or potential energy	Similar to the Construction and operational phases - no new hazards.	De-commission	Negative	As per construction and operational phases.	Easy	1	1	1	1	1	4	1	1	1	1	1	4
							As for Construction and Operation						As for Construction and Operation					
Impact 10:	Human and Equipment Safety - exposure to electromagnetic waves	Similar to the Construction and operational phases - no new hazards.	De-commission	Negative	As per construction and operational phases.	Easy	1	1	1	1	1	4	1	1	1	1	1	4
Significance							As for Construction and Operation						As for Construction and Operation					
Impact 11:	Environment - emissions to air	Similar to the Construction and operational phases - no new hazards.	De-commission	Negative	As per construction and operational phases.	Easy	1	1	1	1	1	4	1	1	1	1	1	4
Significance							As for Construction and Operation						As for Construction and Operation					
Impact 12:	Environment - emissions to water	Similar to the Construction and operational phases - no new hazards.	De-commission	Negative	As per construction and operational phases.	Easy	1	1	1	1	1	4	1	1	1	1	1	4
Significance							As for Construction and Operation						As for Construction and Operation					

Impact number	Receptor	Description	Stage	Character	Preventative and Mitigative Measures	Ease of Mitigation	(M +	E+	R+	D) x	P=	S	(M +	E+	R+	D) x	P=	S
							Raw Risk						Residual Risk					
Impact 13:	Environment - emissions to earth	Causes - Batteries / electrolyte / equipment reached end of life and may leak. Consequences - Environment damage from heavy metal ions.	Construction	Negative	End of Life shutdown procedure including a Risk Assessment of the specific activities involved. Where possible re-purpose the electrolyte / containers and equipment with associated Environmental impact considered. Disposal according to local regulations and other directives such as the European Batteries Directive. End of life, which is affected by temperature and time, cycles, etc., should be predefined and the monitoring should be in place to determine if it has been reached.	Complex	4	3	3	5	4	60	4	3	3	5	2	30
Significance							N3 - Moderate						N2 - Low					
Impact 14:	Environment - waste of resources, e.g., water, power, etc.	Similar to the Construction and operational phases - no new hazards.	De-commission	Negative	As per construction and operational phases.	Easy	1	1	1	1	1	4	1	1	1	1	1	4
Significance							As for Construction and Operation						As for Construction and Operation					
Impact 15:	Public - Aesthetics	Similar to the Construction and operational phases - no new hazards.	De-commission	Negative	As per construction and operational phases.	Easy	1	1	1	1	1	4	1	1	1	1	1	4
Significance							As for Construction and Operation						As for Construction and Operation					
Impact 16:	Investors - Financial	Similar to the Construction and operational phases - no new hazards.	De-commission	Negative	As per construction and operational phases.	Easy	1	1	1	1	1	4	1	1	1	1	1	4
Significance							As for Construction and Operation						As for Construction and Operation					
Impact 17:	Employees and investors - Security	Similar to the Construction and operational phases - no new hazards.	De-commission	Negative	As per construction and operational phases.	Easy	1	1	1	1	1	4	1	1	1	1	1	4
Significance							As for Construction and Operation						As for Construction and Operation					
Impact 18:	Emergencies	Similar to the Construction and operational phases - no new hazards.	De-commission	Negative	As per construction and operational phases.	Easy	1	1	1	1	1	4	1	1	1	1	1	4
Significance							As for Construction and Operation						As for Construction and Operation					
Impact 19:	Investors - Legal	Disposal of hazardous “waste” is rife with difficulties and numerous regulations that	De-commission	Negative	Applicants should seek the opinion from a waste consultant on how to correctly dispose of hazardous waste.	Complex	3	1	3	3	4	40	3	1	3	3	3	30

Impact number	Receptor	Description	Stage	Character	Preventative and Mitigative Measures	Ease of Mitigation	(M +	E+	R+	D) x	P=	S	(M +	E+	R+	D) x	P=	S	
							Raw Risk						Residual Risk						
		need to be complied with.																	
							Significance	N3 - Moderate						N2 - Low					

The following recommendations have been made:

- There are numerous different battery technologies but using one consistent battery technology system for the BESS installations associated with the Carissa Wind Energy Facility would allow for ease of training, maintenance, emergency response and could significantly reduce risks.
- Where reasonably practicable, state-of-the-art battery technology should be used with all the necessary protective features, e.g., draining of cells during shutdown and standby-mode, full BMS with deviation monitoring and trips, leak detection systems.
- The risk assessment tables above contain technical and systems suggestions for managing and reducing risks. Ensure the items listed in these tables under preventative and mitigative measures are included in the design.
- There are no fatal flaws associated with either of the three technology types for the proposed BESS installations, and there is no specific preference for a type of technology.
- Under certain weather conditions, the noxious smoke from a fire in a lithium battery container could travel some distance from the unit. The smoke will most likely be acrid and could cause irritation, coughing, distress, etc. Close to the source of the smoke, the concentration of toxic gases may be high enough to cause irreversible harmful effects. Location of the facilities needs to ensure a suitable separation distance from public facilities/residences, etc. Based on the current proposed layout, there are no occupied facilities within 500 m of either BESS location and therefore the risks posed by these installations are low.
- The site layout and spacing between SSLB containers should be such that it mitigates the risk of a fire or explosion event spreading from one container to another.
- In order to limit the possibility of domino failures the BESS should be separated from substations by at least 20 m.
- In order to limit on-site risks, any office and maintenance buildings should be located at least 20 m, although preferably 50 m, from the BESS.
- Where there is a choice of alternative locations for the BESS, those that are further from watercourses would be preferred. VRFB and ZHB hazards are mostly related to possible loss of containment of electrolyte and solid-state systems may experience fires that may result in loss of containment of liquids or the use of large amounts of fire water which could be contaminated. One would not want these run-offs to enter water courses directly and currently there are water drainage lines through the substation site. The buffer distance between water bodies and the facilities containing chemicals should be set in consultation with a water specialist and the exact BESS location would need to be optimized to ensure suitable separation.
- The overall design should be subject to a full HAZOP prior to finalisation of the design phase.
- For the VRFB and ZHB systems an end of life (and for possible periodic purging requirements) solution for the possible large quantities of hazardous electrolyte should be investigated, e.g., can it be returned to the supplier for re-conditioning.
- Prior to bringing any solid-state battery containers into the country, the contractor should ensure that:
 - An Emergency Response Plan is in place that would be applicable for the full route from the ship to the site. This plan would include details of the most appropriate emergency response to fires both while the units are in transit and once, they are installed and operating.
 - An End-of-Life plan is in place for the handling, repurposing or disposal of dysfunctional, severely damaged batteries, modules and containers.
- Finally, it is suggested once the technology has been chosen and more details of the actual design are available, all risk assessments required under the OHS Act should be in place.

8.2 Concluding Statement on the Impact Assessment

When considering the impact assessment undertaken for the Carissa WEF, it is confirmed, through the consideration of the results that no unacceptable impacts are expected to occur with the implementation of the recommended mitigation measures provided for by the independent specialists.

Majority of the negative impacts have been identified as being of a high to medium significance before the implementation of recommended mitigation measures and can in most instances be reduced to a low impact significance. No fatal flaws were identified.

The impact assessment will be further refined as part of the EIA Phase and draft EIA Report should Acceptance of Scoping be received. The facility layout provided by the Applicant, based on the results of the Scoping Report will be assessed in detail as part of the EIA Phase and optimisation of the layout will take place where changes are required to ensure that an environmentally appropriate layout can be put forward for decision-making on the Application for Environmental Authorisation.

8.3 Legal Requirements Complied with in Section 8 as per the Requirements of the EIA Regulations, 2014 (as amended)

This section of the report includes the following information required in terms of Appendix 2: Scope of assessment and content of the environmental impact assessment reports:

Requirement	Relevant Section
2(g) a full description of the process followed to reach the proposed preferred activity, site and location of the development footprint, including (v) the impacts and risks which have informed each alternative, including the nature, significance, consequence extent, duration and probability of such identified 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 potential impacts and risks identified to be associated with the development of the Carissa WEF is considered in section 8.1.
2(g)(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 potential positive and negative impacts and risks identified to be associated with the development of the Carissa WEF is considered in section 8.1. These impacts have been identified from the inputs provided by the various independent specialist reports included in Appendix E.
2(g)(viii) the possible mitigation measures that could be applied and the level of residual risk.	Preliminary mitigation measures and recommendations for the management of the potential impacts and environmental sensitivities have been included in section 8.1.

9 CUMULATIVE IMPACT ASSESSMENT OF POTENTIAL ISSUES

The EIA Regulations, 2014 (as amended) determine that cumulative impacts, “in relation to an activity, means the past, current and reasonably foreseeable future impact of an activity, considered together with the impact of activities associated with that activity, that in itself may not be significant, but may become significant when added to the existing and reasonably foreseeable impacts eventuating from similar or diverse activities.”

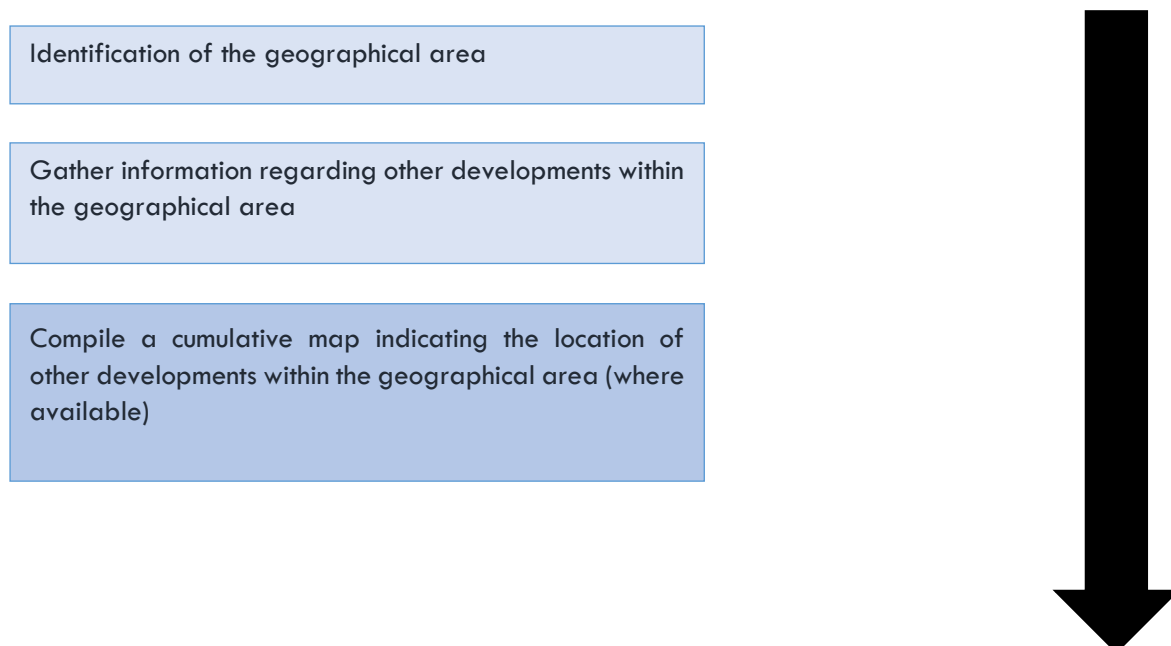
A geographic area must be determined within which the effects of the potential cumulative impacts will be relevant and experienced, and therefore the spatial boundary within which the cumulative impact assessment will be undertaken. The spatial boundary evaluated in this cumulative assessment generally includes an area of a 30 km radius surrounding the proposed development.

Within the geographic area under consideration (i.e., 30 km radius) other known approved renewable energy projects / developments are present. It is unclear whether other projects not related to renewable energy is or has been or will be constructed in this area. In general, development activity in the area is focused on agriculture, natural grazing, game farming and some mining activity.

9.1 Process Followed for the Identification and Assessment of Cumulative Impacts

Available information regarding the geographical area under consideration in terms of the cumulative impact assessment was gathered through the use of existing databases, on-ground information collected by the EAP and the Applicant and general information to the area as provided by the independent specialists.

Figure 9.1 below provides an indication of the flow of information to the specialists and how the information has been attributed to the cumulative impact assessment discussed in this section.



Provide the terms of reference to the specialists in terms of the information available for the cumulative assessment, inclusive of an assessment methodology

Consider the findings of the specialist cumulative impact assessment as part of the Impact Assessment Report
Provide the terms of reference to the specialists in terms of the information available for the cumulative assessment

Draw conclusions from the results of the specialists cumulative impact assessment on the appropriateness of the development within the landscape

Figure 9.1: Process Flow Indicating the Process Followed for the Assessment of Cumulative Impacts

9.2 Other Developments within the Area

A process to identify related projects that may have a cumulative impact, in a 30 km radius of the development area was undertaken. The National Department of Forestry, Fisheries and the Environment (DFFE) website was consulted as well as knowledge from the Applicant on other developments present within the surrounding area of the Carissa WEF. Table 9.1 below provides a summary of related projects that may have a cumulative impact, in a 30 km radius of the development area.

Table 9.1: Renewable Energy Developments Located within a 30 km Radius of the Carissa WEF³⁸

Project name	Distance from study area	Proposed generating capacity (MW)	DFFE reference	EIA process	Project status
Projects included in the REEA database					
Proposed renewable energy facility at Beaufort West	8 km	170	12/12/20/1784	Scoping EIA	Approved
Proposed Construction of 19MW Photovoltaic Solar Facility Proposed By Lurama 214 Pty Ltd On Portion 1 Of The Farm Steenrotsfontein 168, Beaufort West, Western Cape Province	29 km	19	12/12/20/2133	BAR	Approved
The Construction Of The 10mw Roma Energy Leeu Gamka Solar Plant On Portion 40 Of The Farm Kruidfontein No 33, Western Cape Province	29 km	10	12/12/20/2685	BAR	Approved
The development of the 120km up to 400KV Nuweveld gridline west of the town Beaufort	29 km	0	14/12/16/3/3/1/233 6	IEM-REDZ	Approved

³⁸ Note that Amendment applications have been excluded from the Table 9.1. to avoid the duplication of project details. Amendment applications should not be considered as an entirely “new” and separate project.

Project name	Distance from study area	Proposed generating capacity (MW)	DFFE reference	EIA process	Project status
West within the Beaufort West local municipality, Western Cape Province					
Proposed Construction and Operation of the Eskom 132kV1 switching Substation and 132kV Powerline, near Beaufort West in the Prince Albert Local Municipality, within the Central Karoo District in the Western Cape Province.	8 km	0	14/12/16/3/3/1/246 5	BAR	Approved
The proposed 220MW Jessa m wind energy facility (WEF) and associated infrastructure near Beaufort west in the Western Cape Province	17 km	220	14/12/16/3/3/1/249 4	BAR	Approved
The proposed 220MW jessa z wind energy facility (WEF) and associated infrastructure, near Beaufort West in the Western Cape Province	17 km	220	14/12/16/3/3/1/249 6	BAR	Approved

Project name	Distance from study area	Proposed generating capacity (MW)	DFFE reference	EIA process	Project status
Proposed 203,5 MW Jessa s wind energy facility (WEF) and associated infrastructure, near Beaufort West in the Western Cape Province	12 km	204	14/12/16/3/3/1/249 7	BAR	Approved
The proposed development of the On-site Switching Substation / Collector Substation and associated 132kV Power Line for the Koup 2 Wind Energy Facility (WEF), near Beaufort West in the Western Cape Province	<1 km	0	14/12/16/3/3/1/253 7	BAR	Approved
The proposed development of the On-site Switching Substation / Collector Substation and associated 132kV Power Line for the Koup 1 Wind Energy Facility (WEF), near Beaufort West in the Western Cape Province	<1 km	0	14/12/16/3/3/1/253 8	BAR	Approved

Project name	Distance from study area	Proposed generating capacity (MW)	DFFE reference	EIA process	Project status
The proposed Jessa S grid connection and associated near Beaufort West in the Western Cape	18 km	0	14/12/16/3/3/1/257 1	IEM-REDZ	Approved
The proposed construction of a 132 kV Overhead Powerline between the proposed Beaufort West 132kV-400kV Linking Station and the proposed Eskom 132 kV Switching Substation, near Beaufort West in the Western Cape Province (i.e., Kwagga EGI Section 1)	8 km	0	14/12/16/3/3/1/257 8	BAR	Approved
The proposed construction of a 132 kV Overhead Powerline between the proposed Kwagga Wind Energy Facility 1 and the proposed Kwagga Wind Energy Facility 2, near Beaufort West in the Western Cape	4 km	0	14/12/16/3/3/1/258 2	BAR	Approved

Project name	Distance from study area	Proposed generating capacity (MW)	DFFE reference	EIA process	Project status
Province (i.e., Kwagga EGI Section 5)					
Basic Assessment for the proposed construction of a 132 kV Overhead Powerline between the proposed Kwagga Wind Energy Facility 1 and the proposed Kwagga Wind Energy Facility 3, near Beaufort West in the Western Cape Province (i.e., Kwagga EGI Section	8 km	0	14/12/16/3/3/1/258 3	BAR	Approved
The proposed construction of a 132 kV Overhead Powerline between the proposed Kwagga Wind Energy Facility 2 and the proposed Kwagga Wind Energy Facility 3, near Beaufort West in the Western Cape Province (i.e., Kwagga EGI Section 7)	11 km	0	14/12/16/3/3/1/258 4	BAR	Approved
The proposed development of the	29 km	415	14/12/16/3/3/1/267 3	IEM-REDZ	Approved

Project name	Distance from study area	Proposed generating capacity (MW)	DFFE reference	EIA process	Project status
Beaufort West Solar Renewable Energy Facility (SEF) and the associated infrastructure near Beaufort West Local Municipality in the Western Cape Province.					
The proposed development of the 279MW Kwagga wind energy facility 1 (Kwagga WEF 1), near Beaufort West, Western Cape Province	4 km	279	14/12/16/3/3/2/207 0	Scoping EIA	Approved
The Proposed Development of the 341 MW Kwagga Wind Energy Facility (i.e. Kwagga WEF 2), near Beaufort West, Western Cape Province.	8 km	341	14/12/16/3/3/2/207 1	Scoping EIA	Approved
The proposed development of the 204,6 MW Kwagga wind energy facility 3 (Kwagga WEF 3) near Beaufort West, Western Cape Province	13 km	205	14/12/16/3/3/2/207 2	Scoping EIA	Approved

Project name	Distance from study area	Proposed generating capacity (MW)	DFFE reference	EIA process	Project status
The proposed development of the Koups 1 wind energy facility (WEF) and associated infrastructure near Beaufort in the Western Cape Province	<1 km	184	14/12/16/3/3/2/212 0	Scoping EIA	Approved
The Koups 2 WEF and its associated infrastructure near Beaufort West, Western Cape Province	<1 km	211	14/12/16/3/3/2/212 1	Scoping EIA	Approved
The proposed development of up to 240MWac Heuweltjies Wind Energy Facility (WEF), Battery Energy Storage System (BESS), 11-33kV portion / yard of the shared 11-33kV/132kV onsite substation Prince Albert Local Municipality, Western Cape Province.	15 km	240	14/12/16/3/3/2/226 3	Scoping EIA	Approved
Proposed development of up to 240MWac Kraaltjies Wind Energy Facility (WEF), Battery Energy Storage System	< 1 km	240	14/12/16/3/3/2/226 4	Scoping EIA	Approved

Project name	Distance from study area	Proposed generating capacity (MW)	DFFE reference	EIA process	Project status
(BESS), 11-33kV portion / yard of the shared 11-33kV/132kV onsite substation & associated infrastructure, Beaufort West, Western Cape Province.					
Proposed establishment of the Beaufort West Solar Power Plant Site 1, Western Cape Province	29 km	90	14/12/16/3/3/2/772	Scoping EIA	Approved
Proposed Establishment of the Beaufort West Solar Power Plant Site 2, Western Cape Province	29 km	90	14/12/16/3/3/2/773	Scoping EIA	Approved
Proposed Beaufort West Solar power plant site 3 near Beaufort West, Western Cape Province	29 km	90	14/12/16/3/3/2/774	Scoping EIA	Approved
The proposed construction of a 132kv-400kv linking station, two 132kv Power lines and two onsite 132kv substations for the	8 km	0	14/12/16/3/3/2/925	Scoping EIA	Approved

Project name	Distance from study area	Proposed generating capacity (MW)	DFFE reference	EIA process	Project status
mainstream wind energy facilities, near Beaufort West in the Western Cape Province					
Projects not included in the REEA database					
ABO Wind renewable energies (Pty) Ltd – Grid Connection Infrastructure	TBC	-	14/12/16/3/3/1/257 8	-	Approved
ABO Wind renewable energies (Pty) Ltd – Grid Connection Infrastructure	TBC	-	14/12/16/3/3/1/258 2	-	Approved
ABO Wind renewable energies (Pty) Ltd – Grid Connection Infrastructure	TBC	-	14/12/16/3/3/1/258 3	-	Approved
ABO Wind renewable energies (Pty) Ltd – Grid Connection Infrastructure	TBC	-	14/12/16/3/3/1/258 4	-	Approved
ABO Wind renewable energies (Pty) Ltd – Grid Connection Infrastructure	TBC	-	14/12/16/3/3/1/272 5	-	Approved
ABO Wind renewable energies (Pty) Ltd – Grid	TBC	-	14/12/16/3/3/1/272 6	-	Approved

Project name	Distance from study area	Proposed generating capacity (MW)	DFFE reference	EIA process	Project status
Connection Infrastructure					
ABO Wind renewable energies (Pty) Ltd – Grid Connection Infrastructure	TBC	-	14/12/16/3/3/1/272 8	-	Approved
Proposed Development of the 132kv Eskom Portion of the Shared On-site Substation and Associated 132kv Powerline for the up to 240MW Kraatljies Wind Energy Facility	TBC	132 kV	14/12/16/3/3/1/300 7	-	Approved

The Impact of WEF's on landscape connectivity is considered likely to be a key issue in certain parts of South Africa where there is a growing number of renewable energy facility applications. Cumulative impacts are expected to be associated with the following:

- Loss of vegetation and species of conservation concern;
- Impacts on faunal habitats and sensitive faunal species, including avifauna and bats;
- Impacts on soil resources, land use, and agricultural potential;
- Impacts on CBAs as defined by the Western Cape provincial authorities and broad-scale Ecological processes;
- Loss of heritage resources (including archaeological and palaeontological resources);
- Visual impacts; and
- Impacts on the social environment (both positive and negative).

In addition to cumulative impacts associated with the proposed development and other similar developments in the area, cumulative impacts are also to be considered at a site level. The potential direct cumulative impacts associated with the development is expected to be associated predominantly with the potential ecological impact (including plants, animals, avifauna, bats, etc), potential soil impacts, and potential impacts on visual and social aspects and features in the surrounding areas.

The above-mentioned impacts are considered to be probable, although it is anticipated that the extent, duration, and magnitude of these impacts can be minimised to levels where this impact can be regarded as having low or acceptable significance through the implementation of appropriate mitigation measures. The impact associated with the proposed development is expected to be local, affecting mainly the immediate environment and surrounding areas, as well as other renewable energy facilities within the vicinity.

The operational lifespan of the project and other similar energy facilities within the surrounding areas is expected to be long-term (i.e., a minimum of 20 - 25 years) and subsequently the impact is also expected to be long-term.

Cumulative impacts have been assessed and considered in the scoping phase and will be refined during the detailed EIA phase. Each independent specialist report has considered and assessed the cumulative impacts of proposed, approved and authorised renewable energy projects in the area.

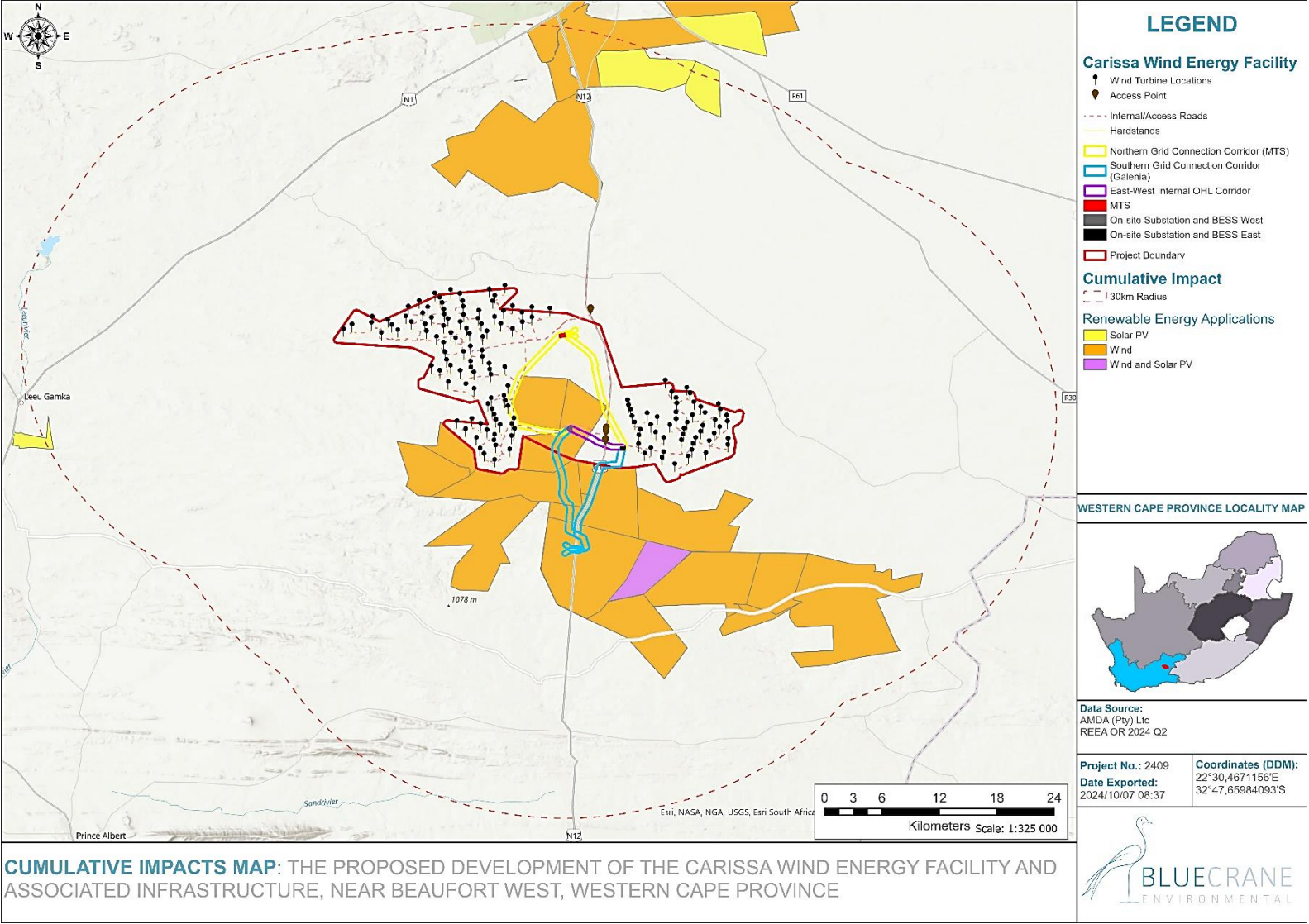


Figure 9.2: Cumulative Map of the Carissa WEF

9.3 Specialist Input

The following input and assessments have been provided by the independent specialists for the development of the Carissa WEF.

9.3.1 Cumulative Impacts to the Geological Environment

The geographic area of evaluation is the spatial boundary in which the cumulative effects analysis was undertaken. The spatial boundary evaluated in these cumulative effects analysis generally includes the area within a 30 km radius surrounding the proposed development. Within this radius, and within the timeframe of the life of the proposed project, there are several other known wind and solar energy facilities and other electrical infrastructure projects that are being planned, the details of which are available in the Scoping Report. Refer to Tables 9.2 to 9.6 below.

Table 9.2: Soil Degradation by Disturbance

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated?	Is the impact acceptable?
Soil degradation by disturbance, removal, mixing, compaction, etc due to the construction of infrastructure	Before mitigation	Negative	1	4	2	2	1	1	3	33	Medium (29-50)	Yes	Yes
	After mitigation	Negative	1	4	2	2	1	1	1	11	Low (6-28)		
Mitigation: <ul style="list-style-type: none">Minimise excavations and disturbance areas.Rehabilitate topsoil and vegetation around site a construction.													

Table 9.3: Soil Degradation Due to Pollution

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated?	Is the impact acceptable?
Soil degradation due to pollution by contaminants used on site during construction (fuel, oil, chemicals, cement)	Before mitigation	Negative	1	3	2	2	1	1	3	30	Medium (29-50)	Yes	Yes
	After mitigation	Negative	1	3	2	2	1	1	1	10	Low (6-28)		
Mitigation: <ul style="list-style-type: none">• Provide contamination prevention systems on site.• Control use and disposal of potential contaminants or hazardous materials.													

Table 9.4: Erosion by Wind and/or Water of Loosened Soil

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated?	Is the impact acceptable?
Erosion by wind and/or water of loosened soil in construction areas	Before mitigation	Negative	1	3	3	2	2	2	3	39	Medium (29-50)	Yes	Yes
	After mitigation	Negative	1	3	3	2	1	1	1	11	Low (6-28)		
Mitigation: <ul style="list-style-type: none">Minimise size of the construction footprint.Avoid work in or near watercourses where possible.Restrict activity outside of construction.													

Table 9.5: Degradation of Watercourses During

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated?	Is the impact acceptable?
Degradation of watercourses due to siltation (silt-loading) due to erosion from denuded construction areas	Before mitigation	Negative	2	3	3	2	2	2	3	42	Medium (29-50)	Yes	Yes
	After mitigation	Negative	1	2	3	2	1	1	1	10	Low (6-28)		
Mitigation:													
● Install anti-erosion measures such as silt fences, geosynthetic erosion protection, and/or flow attenuation along watercourses below construction sites.													

Table 9.6: Dust Pollution During the Construction Phase

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated?	Is the impact acceptable?
Dust pollution due to wind erosion from denuded construction areas	Before mitigation	Negative	2	3	3	2	2	2	2	28	Low (6-28)	Yes	Yes
	After mitigation	Negative	1	2	3	2	1	1	1	10	Low (6-28)		
Mitigation:													
<ul style="list-style-type: none">• Apply dust control measures such as straw bales or dampen dusty denuded areas.• Minimise number of disturbance areas at any one time.													

Table 9.7: Reduction in the Extraction of Non-Renewable Energy Sources

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated?	Is the impact acceptable?
A reduction in the extraction of non-renewable energy sources, such as coal, uranium, etc	Before mitigation	Positive	4	4	1	1	3	4	4	68	High (51-73)	Yes	Yes
	After mitigation												
Mitigation:													
• N/A													

9.3.2 Cumulative Impact on Agriculture

Specialist assessments for environmental authorisation are required to assess cumulative impacts. The cumulative impact of a development is the impact that development will have when its impact is added to the incremental impacts of other past, present, or reasonably foreseeable future activities that will affect the same environment.

The most important concept related to a cumulative impact is that of an acceptable level of change to an environment. A cumulative impact only becomes relevant when the impact of the proposed development will lead directly to the sum of impacts of all developments causing an acceptable level of change to be exceeded in the surrounding area. If the impact of the development being assessed does not cause that level to be exceeded, then the cumulative impact associated with that development is not significant.

The potential cumulative agricultural impact of importance is a regional loss (including by degradation) of future agricultural production potential. The defining question for assessing the cumulative agricultural impact is this: *What loss of future agricultural production potential is acceptable in the area, and will the loss associated with the proposed development, when considered in the context of all past, present or reasonably foreseeable future impacts, cause that level in the area to be exceeded?*

The Department of Forestry, Fisheries and the Environment (DFFE) requires compliance with a specified methodology for the assessment of cumulative impacts. This is positive in that it ensures engagement with the important issue of cumulative impacts. However, the required compliance has some limitations and can, result in an over-focus on methodological compliance, while missing the more important task of effectively answering the above defining question.

This cumulative impact assessment determines the quantitative loss of agricultural land if all renewable energy project applications within a 30 km radius become operational. These projects are listed in Table 9.1 above. Note that electrical grid infrastructure projects do not contribute to a loss of agricultural land and are not therefore included in this calculation of cumulative land loss. The area of land taken out of agricultural use as a result of all the projects listed in Table 9.1 (total generation capacity of 4 228 MW) will amount to a total of approximately 2 839 hectares. This is calculated using the industry standards of 2.5 and 0.3 hectares per megawatt for solar and wind energy generation respectively, as per the Department of Environmental Affairs (DEA) Phase 1 Wind and Solar Strategic Environmental Assessment (SEA) (2015). As a proportion of the total area within a 30 km radius (approximately 282,700 ha), this amounts to only 1% of the surface area. This is well within an acceptable limit in terms of loss of agricultural land, much of which is only suitable for grazing.

All the projects contributing to cumulative impact for this assessment have the same agricultural impacts in a very similar agricultural environment, and therefore the same mitigation measures apply to all.

Specialist assessments for environmental authorisation are required, if the associated grid infrastructure is being applied for separately, to include it as part of the cumulative assessment for the facility. However, due to their negligible agricultural impact, power lines do not contribute to the cumulative impact of the facility. Given the small footprint of the substations, their contribution will also not be significant. Inclusion of the impact of the grid connection of the facility does not therefore change the significance of the cumulative impact of the facility.

The loss of agricultural potential by soil degradation can effectively be prevented for renewable energy developments by generic mitigation measures that are all inherent in the project engineering and/or are

standard, best-practice for construction sites. Soil degradation does not therefore pose a cumulative impact risk.

Due to all the considerations discussed above, the cumulative impact of loss of future agricultural production potential is assessed as low. It will not have an unacceptable negative impact on the agricultural production capability of the area, and it is therefore recommended, from a cumulative agricultural impact perspective, that the development be approved.

9.3.3 Cumulative Avifauna Impacts

A total of 2 294 MW of wind energy, 714 MW of solar energy and 367 km of overhead power lines have been approved within a 30 km radius of the proposed development site.

The impacts of the cumulative projects will be negative by making a larger area of avifaunal karoo scrub habitat unavailable and of higher risk for SCC flying in or through the area.

There is also a potential for an increased barrier effect being created by the combination of these projects, which would be a negative, regional, long-term impact. As these projects are not located on any major flyways, the probability of this occurring is however unlikely.

The contribution of the Carissa WEF to the cumulative impact in a 30 km radius is considered to be relatively high since with up to 1 000 MW the Carissa WEF would contribute to the total approved MW by renewable energy for the area by 25%. However, avifaunal reports were not obtainable for all cumulative projects at this stage, and the number of turbines per MW is likely to be higher for other projects per MW for older technologies, with higher potential collision risks, and the higher footprint per MW of solar facilities is not accounted for. The contribution of the Carissa WEF to the impacts associated with overhead power lines would be relatively low, as the Carissa OHPLs would contribute less than 10% of the total approved OHPL length in the cumulative impact zone.

The only real mitigation possible in order to minimise cumulative impacts, beyond minimising impacts for each project separately during the EIA process, is for the Competent Authority to ensure only projects that are practically mitigatable to an acceptable level are authorised, and that do not lead to unacceptable negative impacts, including cumulative impacts, and to ensure the correct implementation of authorised Environmental Management Programmes through compliance audits and enforcement.

Table 9.8: Cumulative Avifauna Impacts

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated / enhanced?	Is the impact acceptable?
Displacement from Disturbance; Displacement from Habitat Loss; Mortality from Collisions with wind turbines; Mortality from Collisions with overhead power lines; Mortality from Electrocutions on overhead power lines and electrical infrastructure	Impact in isolation	Negative	1	3	2	2	3	4	3	45	Medium (29-50)	Yes	Yes
	Cumulative impact	Negative	3	3	2	2	3	3	3	48	Medium (29-50)		
Mitigation:													
• Competent Authority to ensure only projects are authorised that are practically mitigatable to an acceptable level, and that do not lead to unacceptable negative impacts, including cumulative impacts, and to ensure the correct implementation of authorised Environmental Management Programmes through compliance audits and enforcement.													

9.3.4 Cumulative Bat Impacts

Four (04) cumulative impacts have been identified for the construction and operational phases; these are summarised below. No cumulative impacts have been identified for the decommissioning phase.

9.3.4.1 *Destruction of bat roosts during construction*

Probably roosting spaces on site and in the larger area are mostly in the form of man-made structures such as house and farm buildings, as well as some limited roosting potential offered by trees with hollows, fissures and loose bark. During construction, these may be permanently lost. There are numerous approved renewable energy facilities within 30 km of the proposed Carissa WEF. If this impact is cumulatively combined on several wind farms and/or PV facilities, it will result in a larger area with fewer bat roosts. Since bats generally forage more regularly closer to their roosts, the centre region of such an area within fewer roosts may experience significantly less bat foraging activity which may result in increased insect numbers in these areas. It's likely that such insects may include pest species.

9.3.4.2 *Foraging habitat loss during construction*

Some foraging habitat will be permanently lost by the construction of turbines and access roads. Temporary foraging habitat loss will occur during construction due to storage areas and movement of heavy vehicles. If this impact is cumulatively combined on several windfarms, it will result in a large area with destroyed foraging habitat. However, these areas are scattered and even the combined area of these impacts are relatively small in comparison to the entire cumulative envelope.

9.3.4.3 *Bat mortalities due to direct blade impact or barotrauma during foraging (not migration) during operation*

Bat mortalities of resident bat species due to moving blades can have significant impacts on bat populations since the impact can persist over the lifetime of the facility. It is critical that this impact is sufficiently managed and mitigated. The first level of mitigation by avoidance is already achieved by adhering to the sensitivity map. If this impact is cumulatively combined on several windfarms, it will result in a larger area with consistent bat mortalities. This will increase the number and diversity of bat populations being impacted and therefore increase the overall significance of the impact. It may also result in increased insect numbers in the central area of the combined windfarms. It's possible that such insects may include pest species. The approved PV facilities have no bearing on this impact since there is no substantial evidence of PV facilities causing bat mortalities during operation.

9.3.4.4 *Bat mortalities due to direct blade impact or barotrauma during migration in operation*

Cave dwelling bats play a critical role in cave ecology by being the major source of energy input into the cave ecosystems by means of bat guano, since sunlight is lacking in the dark zones of caves. In most cases an entire cave ecosystem and food web can be based on the input of bat guano into a cave. If bats migrating from one cave to another are killed during their migration, both cave ecosystems will be severely impacted and will likely collapse. Cave ecosystems are isolated and tend to be unique, and therefore may contain unique and specialised species of biota. Migratory routes in the region are completely unknown, and there is no knowledge of whether any such migrations exist. The passive bat activity data does not indicate any clear signs of migration routes existing on site. If this impact is cumulatively combined on several windfarms, it will increase the probability of a bat migration path being intercepted by wind turbines thereby increasing the likelihood of migrating bats being killed. The approved PV facilities have no bearing on this impact since there is no substantial evidence of PV facilities causing bat mortalities during operation.

Table 9.9: Destruction of Bat Roosts During Construction Pre-Mitigation

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated / enhanced?	Is the impact acceptable?
Destruction of bat roosts during construction pre mitigation	Impact in isolation	Negative	1	3	4	3	1	3	3	45	Medium (29-50)	Yes	Yes
	Cumulative impact	Negative	2	3	4	3	1	3	3	48	Medium (29-50)		
Mitigation:													
<ul style="list-style-type: none">Adhering to the bat sensitivity map as a mitigation to be outlined in the EMPr, is adequate.Additionally, if undiscovered bat roosts are encountered during construction, the Environmental Compliance Officer (ECO) on site must be notified immediately and a bat specialist consulted to advise the appropriate action.													

Table 9.10: Destruction of Bat Roosts During Construction Post Mitigation

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated / enhanced?	Is the impact acceptable?
Destruction of bat roosts during construction post mitigation	Impact in isolation	Negative	1	1	4	3	1	2	1	12	Low (6-28)	Yes	Yes
	Cumulative impact	Negative	2	1	4	3	1	2	1	13	Low (6-28)		
Mitigation:													
<ul style="list-style-type: none">Adhering to the bat sensitivity map as a mitigation to be outlined in the EMPr, is adequate.Additionally, if undiscovered bat roosts are encountered during construction, the Environmental Compliance Officer (ECO) on site must be notified immediately and a bat specialist consulted to advise the appropriate action.													

Table 9.11: Foraging Habitat Loss During Construction Pre-Mitigation

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated / enhanced?	Is the impact acceptable?
Foraging habitat loss during construction pre mitigation	Impact in isolation	Negative	1	3	4	3	1	3	2	30	Medium (29-50)	Yes	Yes
	Cumulative impact	Negative	2	3	4	3	1	3	2	32	Medium (29-50)		
Mitigation:													
• Adhering to the bat sensitivity map as a mitigation to be outlined in the EMPr, is adequate.													

- Additionally, keep to designated areas when storing building materials, resources, turbine components and/or construction vehicles and keep to designated roads with all construction vehicles. Damaged areas should be rehabilitated by an experienced vegetation succession specialist after construction.

Table 9.12: Foraging Habitat Loss During Construction Post Mitigation

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated / enhanced?	Is the impact acceptable?
Foraging habitat loss during construction post mitigation	Impact in isolation	Negative	1	2	4	3	1	2	1	13	Low (6-28)	Yes	Yes
	Cumulative impact	Negative	2	2	4	3	1	2	1	14	Low (6-28)		
Mitigation:													
<ul style="list-style-type: none">Adhering to the bat sensitivity map as a mitigation to be outlined in the EMP, is adequate.Additionally, keep to designated areas when storing building materials, resources, turbine components and/or construction vehicles and keep to designated roads with all construction vehicles. Damaged areas should be rehabilitated by an experienced vegetation succession specialist after construction.													

Table 9.13: Bat Mortalities Due to Direct Blade Impact or Barotrauma During Foraging (Not Migration) During Operation Pre-Mitigation

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated / enhanced?	Is the impact acceptable?
Bat mortalities due to direct blade impact or barotrauma during foraging (not migration) during operation pre mitigation	Impact in isolation	Negative	2	4	2	3	3	4	3	54	High (51-73)	Yes	Yes
	Cumulative impact	Negative	2	4	2	3	3	4	3	54	High (51-73)		
Mitigation:													
• Implement the Action Plan included in section 9 of the Bat Impact Assessment. The Action Plan will be included in the EMPr during the EIA phase.													

Table 9.14: Bat Mortalities Due to Direct Blade Impact or Barotrauma During Foraging (Not Migration) During Operation Post Mitigation

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated / enhanced?	Is the impact acceptable?
Bat mortalities due to direct blade impact or barotrauma during foraging (not migration) during operation post mitigation	Impact in isolation	Negative	2	2	2	2	3	3	2	28	Low (6-28)	Yes	Yes
	Cumulative impact	Negative	2	2	2	2	3	3	2	28	Low (6-28)		

Mitigation:

- Implement the Action Plan included in section 9 of the Bat Impact Assessment. The Action Plan will be included in the EMPr during the EIA phase.

Table 9.15: Bat Mortalities Due to Direct Blade Impact or Barotrauma During Migration Pre-Mitigation

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated / enhanced?	Is the impact acceptable?
Bat mortalities due to direct blade impact or barotrauma during migration pre mitigation	Impact in isolation	Negative	3	2	2	3	3	3	3	48	Medium (29-50)	Yes	Yes
	Cumulative impact	Negative	3	2	2	3	3	3	3	48	Medium (29-50)		

Mitigation:

- Based on peak bat activity periods that will be presented by the 12-month pre-construction study for migratory bat species, curtailment must be applied to all turbines by ninety-degree feathering of blades below the manufacturer's cut-in speed, so they are exactly parallel to the wind direction thereby minimising freewheeling blade rotation as much as possible without locking the blades. This applies to the lifetime of the facility and can significantly lower probability of bat mortalities. Influence on productivity is minimal since no power is generated below the manufacture's cut-in speed.
- Additional mitigation (only if required): Additional curtailment or bat deterrent mitigation parameters based on climatic conditions may be presented when all bat activity data are gathered, and will be detailed in the EMPr. Such additional curtailment or bat deterrent mitigation will only be required if bat mortalities of migratory species exceed sustainable thresholds for the region, and will be limited to the applicable turbines causing the highest fatalities.

Table 9.16: Bat Mortalities Due to Direct Blade Impact or Barotrauma During Migration Post Mitigation

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated / enhanced?	Is the impact acceptable?
Bat mortalities due to direct blade impact or barotrauma during migration post mitigation	Impact in isolation	Negative	3	1	2	2	3	2	2	26	Low (6-28)	Yes	Yes
	Cumulative impact	Negative	3	1	2	2	3	2	2	26	Low (6-28)		

Mitigation:

- Based on peak bat activity periods that will be presented by the 12-month pre-construction study for migratory bat species, curtailment must be applied to all turbines by ninety-degree feathering of blades below the manufacturer's cut-in speed, so they are exactly parallel to the wind direction thereby minimising freewheeling blade rotation as much as possible without locking the blades. This applies to the lifetime of the facility and can significantly lower probability of bat mortalities. Influence on productivity is minimal since no power is generated below the manufacture's cut-in speed.
- Additional mitigation (only if required): Additional curtailment or bat deterrent mitigation parameters based on climatic conditions may be presented when all bat activity data are gathered, and will be detailed in the EMPr. Such additional curtailment or bat deterrent mitigation will only be required if bat mortalities of migratory species exceed sustainable thresholds for the region, and will be limited to the applicable turbines causing the highest fatalities.

9.3.5 Cumulative Impacts on the Aquatic Ecosystems

The cumulative impacts associated with the project will include the following:

- Loss of aquatic communities at a regional scale could be exacerbated;
- Increase in downgradient sedimentation as well as water quality;
- Invasion of alien plant species in riparian areas may be exacerbated;
- Habitat Fragmentation and disruption of ecosystem function and process may be exacerbated.

The cumulative impact associated with the construction and operation of the WEF is likely to be of moderate significance prior to the implementation of mitigation measures and of low significance after implementation of mitigation measures, provided the WEF and associated infrastructure avoid areas of high sensitivity. To limit the significance of any adverse impacts on the surrounding aquatic environment, it is important that an Alien Invasive Management and Monitoring Plan and Rehabilitation Plan are implemented, existing roads are used where feasible, and the mitigation measures mentioned in this report are implemented.

Refer to Tables 9.17 to 9.20 below for the cumulative impact significance.

Table 9.17: Habitat Fragmentation

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated / enhanced?	Is the impact acceptable?
Habitat Fragmentation: Fragmentation of aquatic habitats due to multiple infrastructure projects in the region (Roads, transmission lines, other PV and WEF Projects)	Impact in isolation	Negative	1	1	1	1	3	2	1	9	Low (6-28)	Yes	Yes
	Cumulative impact	Negative	3	2	2	2	3	4	3	48	Medium (29-50)		
Mitigation:													
<ul style="list-style-type: none">Establish aquatic fauna corridors to maintain connectivity between habitats.Collaborate with other project developers to coordinate aquatic habitat protection buffers.													

Table 9.18: Increased Sedimentation

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated / enhanced?	Is the impact acceptable?
Increase Sedimentation: Combined sedimentation effects from construction activities in the area leading to degraded flow patterns and water quality	Impact in isolation	Negative	1	2	2	2	3	2	2	24	Low (6-28)	Yes	Yes
	Cumulative impact	Negative	3	3	3	3	3	3	3	54	High (51-73)		
Mitigation:													
<ul style="list-style-type: none">Implement region wide sediment control strategies.Collaborate with local authorities and other developers to reduce cumulative sediment load in the water bodies.Monitor sediment levels and adjust mitigation measures as needed.													

Table 9.19: Disturbance to Aquatic Fauna

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated / enhanced?	Is the impact acceptable?
Disturbance to Aquatic Fauna: Cumulative Noise& vibration from WEF and infrastructure affecting aquatic species behaviour and reproduction	Impact in isolation	Negative	1	2	2	2	3	2	2	24	Low (6-28)	Yes	Yes
	Cumulative impact	Negative	3	3	3	4	3	3	3	57	High (51-73)		
Mitigation:													
• Implement noise reduction measures across all projects.													

- Schedule activities to avoid critical periods (breeding season) for aquatic species.
- Monitor aquatic fauna and species activities in the greater area.

Table 9.20: Beneficial Habitat Restoration

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated / enhanced?	Is the impact acceptable?
Beneficial Habitat Restoration: Opportunities for coordinated natural habitat restoration efforts across multiple decommissioned sites, leading to improved aquatic ecosystem health	Impact in isolation	Positive	2	3	2	2	2	3	3	42	Medium (29-50)	Yes	Yes
	Cumulative impact	Positive	3	2	3	2	2	4	4	64	High (51-73)		
Enhancement: <ul style="list-style-type: none">• Collaborate with other stakeholders to create a regional aquatic habitat restoration plan.• Monitor the success of restoration efforts and share best practices with other stakeholders.• Leverage combined resources for more extensive and effective restoration projects.													

9.3.6 Cumulative Social Impacts

According to the Social Impact Assessment (Appendix E7), the potential for cumulative impacts to occur as a result of the projects is likely. Potential cumulative impacts identified for the project include positive impacts on the economy, business development, and employment, as well as negative impacts such as an influx of jobseekers and change in the area's sense of place.

The geographic spread of renewable projects, administrative boundaries and any environmental features (the nature of the landscape) were considered when determining the geographic area of investigation. It was argued that a radius of 30 km would generally confine the potential for cumulative effects within this particular environmental landscape. A larger geographic area may be used to analyse cumulative impacts based on the specific temporal or spatial impacts of a resource. For example, the socioeconomic cumulative analysis may include a larger area, as the construction workforce may draw from a much wider area. The geographic area of analysis is specified in the discussion of the cumulative impacts for that resource where it differs from the general area of evaluation described above.

The following cumulative impacts are associated with the proposed Carissa WEF:

- *Cumulative impact from employment, skills and business opportunities* - Carissa WEF and the establishment of other renewable energy projects within the area has the potential to result in significant positive cumulative impacts, specifically with regards to the creation of a number of socio-economic opportunities for the region, which in turn, can result in positive social benefits. The positive cumulative impacts include creation of employment, skills development and training opportunities, and downstream business opportunities. The cumulative benefits to the local, regional, and national economy through employment and procurement of services are more considerable than that of Carissa WEF alone.
- *Cumulative impact with large scale in-migration of people* - While the development of a wind power project may not result in a major influx of people into an area, the development of several projects (wind, solar, etc.) may have a cumulative impact on the in-migration and movement of people. In addition, the fact that the project is proposed within an area characterised by good levels of solar irradiation or average suitable wind speed, the suitability of developing commercial solar or wind energy facilities implies that the surrounding area is likely to be subject to considerable future applications for solar or wind energy facilities. Levels of unemployment, and the low level of earning potential may attract individuals to the area in search of better employment opportunities and higher standards of living. It is exceedingly difficult to control an influx of people into an area, especially in a country where unemployment rates are high. It is therefore important that the project proponent implement and maintain strict adherence with a local employment policy in order to reduce the potential of such an impact occurring.

Refer to Tables 9.21 to 9.22 below for the cumulative impact significance.

Table 9.21: Cumulative Impact from Employment, Skills and Business Opportunities

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated / enhanced?	Is the impact acceptable?
Cumulative impact from employment, skills and business opportunities	Impact in isolation	Positive	2	2	1	1	3	2	3	33	Medium (29-50)	Yes	Yes
	Cumulative impact	Positive	3	4	1	1	3	2	4	56	High (51-73) 50		
Enhancement: <ul style="list-style-type: none">The establishment of several renewable power projects in the area has the potential to have a positive cumulative impact on the area in the form of employment opportunities, skills development and business opportunities. The positive benefits will be enhanced if local employment policies are adopted, and local services providers are utilised by the developers to maximise the project opportunities available to the local community.													

Table 9.22: Cumulative Impact with Large Scale In-Migration of People

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated / enhanced?	Is the impact acceptable?
Cumulative impact with large scale in-migration of people	Impact in isolation	Negative	2	2	1	1	2	3	2	22	Low (6-28)	Yes	Yes
	Cumulative impact	Negative	2	3	1	1	3	4	4	56	High (51-73)		
Mitigation: <ul style="list-style-type: none">Develop a recruitment policy / process (to be implemented by contractors), which will source labour locally.Work together with government agencies to ensure service provision is in line with the development needs of the local area.Form joint ventures with community organisations, through Trusts, which can provide local communities with benefits, such as employment opportunities and services.													

9.3.7 Cumulative Noise Impacts

The potential effect of cumulative noises during the construction phase was considered, evaluating the impact from numerous simultaneous activities taking place at all locations where WTG will be developed. The only WEFs proposed within the potential area of influence are the Koup 1, Koup 2 and Kwagga 1 WEFs, with the WTG of other authorised or proposed WEFs being too far to contribute to the cumulative noise levels within the project focus area of the Carissa WEF. The possible significance of the cumulative noise impact summarised in the Table below (focusing only on the night-time period). The cumulative effects are generally low, though there is a potential that cumulative noise effects will result in noise levels exceeding 45 dBA at NSR13, in addition to NSRs 6, 14, 18, 25, 26 and 27. Mitigation as proposed for the operational phase will be sufficient to ensure noise levels less than 45 dBA at these NSR. The applicant should also co-operate with the developer of the Koup 1 and Koup 2 WEF to ensure that worst-case noise levels less than 45 dBA at NSR located between, or within the potential area of influence of these WEFs (NSRs 8, 9, 10, 11, 12, 13 and 14).

Table 9.23: Cumulative Noise Impact

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated / enhanced?	Is the impact acceptable?
Cumulative noise impact (night-time operation of wind turbines)	Impact in isolation	Negative	1	4	1	2	3	3	3	42	Medium (29-50)	Yes	Yes
	Cumulative impact	Negative	1	2	1	2	3	3	2	24	Low (6-28)		
Mitigation:													
<ul style="list-style-type: none">As per operational mitigation measures.Applicant to discuss and co-ordinate with the developer of the Koup 1 and Koup 2 WEFs.													

9.3.8 Cumulative Impact on Cultural Heritage and Palaeontology

The desktop research shows heritage resources predominantly dating to settlements from the Stone Age and the Historical Period. Graded II and IIIB sites are situated around Beaufort West town. Heritage resources recorded during our assessment add to the understanding of the broader archaeological, historical, or cultural landscape. Graves and burial grounds can be expected anywhere within the Southern African landscape. However, the impact on graves would be site-specific, and if mitigation recommendations are followed for identified graves, no cumulative impact is expected. Therefore, the proposed development will have a MEDIUM NEGATIVE cumulative impact before mitigation and LOW NEGATIVE after mitigation.

The general Palaeontological Sensitivity of the area is Low and Very High. The cumulative impacts of the development near Beaufort West are considered to be MEDIUM pre-mitigation and LOW post-mitigation, and they fall within the acceptable limits for the project.

The anticipated cumulative visual impact for the proposed project is expected to include the change in sense of place. The project's construction and operation in the area will likely have a VERY HIGH negative impact. The project's visual impact will remain if it's not decommissioned and dismantled after the end of its operational life.

Table 9.24: Heritage Impact All Phases Activities

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated / enhanced?	Is the impact acceptable?
Heritage Impact all phases activities	Impact in isolation	Negative	2	3	4	4	3	1	2	34	Medium (29-50)	Yes	Yes
	Cumulative impact	Negative	2	2	2	2	3	1	2	24	Medium (29-50)		
Mitigation: <ul style="list-style-type: none">• Demarcate areas to be developed.• Avoid all sensitive environmental features.													

9.3.9 Cumulative Impact on Visual Landscape

The anticipated cumulative visual impact for the proposed project is expected to include the change in sense of place. The construction and operation of the project in the area is likely to have a negative visual impact.

Table 9.25: Visual Impact – Cumulative

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated / enhanced?	Is the impact acceptable?
Cumulative visual impacts of proposed projects.	Impact in isolation	Negative	2	4	4	3	3	4	3	60	High (51-73)	Yes	Yes
	Cumulative impact	Negative	3	4	4	4	3	4	4	84	Very High (74-96)		
Mitigation:													
• Retain/re-establish and maintain natural vegetation immediately adjacent to the development.													

9.3.10 Cumulative Traffic Impacts

Depending on the timing of the other nearby renewable energy projects, where construction could overlap, traffic impact will increase accordingly. It should be noted that the volume of traffic is related to the specific development stage, logistics planning and development size.

The construction period for other renewable energy projects is relatively short (between 12 and 24 months), where traffic flow will vary during the construction period. It is assumed that 50% of these projects' construction periods would likely coincide with the Carissa WEF construction period. This additional traffic, however, will be widely dispersed and easily accommodated on the surrounding road network. In addition, the traffic impact of the operational and maintenance periods will be low/negligible, and it is also unlikely that the decommissioning of these projects will coincide with each other.

In conclusion, the cumulative impact and significance of the various nearby renewable energy projects are considered to have a low/negligible impact and therefore no corrective measures will be required.

Table 9.26: Cumulative Impacts Associated with the Development of the Carissa WEF

Nature of the Impact	Status		Extent	Probability	Reversibility	Irreplaceability	Duration	Cumulative Effect	Magnitude	Impact Significance	Impact Rating	Can impact be mitigated / enhanced?	Is the impact acceptable?
Overall increase in traffic during the lifetime of the different renewable energy facilities, located within a 30 km radius from the Carissa Wind Energy Facility.	Impact in isolation	Negative	2	3	1	1	3	1	1	11	Low (6-28)	Yes	Yes
	Cumulative impact	Negative	3	3	1	1	3	2	1	13	Low (6-28)		
Mitigation:													
<ul style="list-style-type: none">• All vehicles must be roadworthy, and drivers must have the relevant licenses for the type of vehicles they are operating.• All vehicle drivers need to strictly adhere to the rules of the road and all renewable energy facilities need to adhere to specific mitigation measures set out in terms of road safety and traffic.													

9.4 Concluding Statement

When considering the location of the Carissa WEF and the 30 km geographical surrounding area the project is characterised by agricultural activities and linear disturbances such as national and regional roads and transmission and distribution overhead power lines.

The cumulative impacts identified above were found to vary between low to high significance depending on the type of impact under consideration. However, considering the location and current disturbance / sensitivities within the landscape, it is foreseen that these impacts are of an acceptable level. No fatal flaws were identified by the independent specialists. Appropriate mitigation measures have been recommended by the independent specialists for the management and mitigation of the cumulative impacts.

What must be considered and taken into consideration as part of the cumulative assessment is that not all renewable energy developments that are awarded Environmental Authorisation will be constructed and ultimately operated which is based on various technical aspects such as grid capacity to evacuate the power into the national grid as well as obtaining preferred bidder status under the REIPPP Programme or securing a private off-taker.

The cumulative impact associated with Carissa WEF is therefore considered to be acceptable within the landscape.

9.5 Legal Requirements Complied with in Section 9 as per the Requirements of the EIA Regulations, 2014 (as amended)

This section of the report includes the following information required in terms of Appendix 2: Scope of assessment and content of the environmental impact assessment reports:

Requirement	Relevant Section
2(g) a full description of the process followed to reach the proposed preferred activity, site and location of the development footprint, including (v) the impacts and risks which have informed each alternative, including the nature, significance, consequence extent, duration and probability of such identified 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 potential impacts and risks identified to be associated with the development of Carissa WEF is considered in section 9.3.
2(g)(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 potential positive and negative impacts and risks identified to be associated with the development of Carissa WEF is considered in section 9.3. These impacts have been identified from the inputs provided by the various independent specialist reports included in Appendix E.

Requirement	Relevant Section
2(g)(viii) the possible mitigation measures that could be applied and the level of residual risk.	Preliminary mitigation measures and recommendations for the management of the potential impacts and environmental sensitivities have been included in section 9.3.

10 EIA PLAN OF STUDY

The Plan of Study for the EIA Phase provides a description of how the EIA Phase will proceed and includes the details of the independent specialist studies.

One of the key objectives of the Scoping Phase is to determine the level of assessment required for the EIA Phase of the process, including the methodology to be applied, the expertise required as well as the extent of further consultation to be undertaken to determine the impacts and risks a particular activity will impose on a preferred site through the life of the activity, including the nature, significance, consequence, extent, duration and probability of the impacts to inform the location of the development footprint within the preferred site.

10.1 Description of the Aspects to be Assessed

The EIA Report will be drafted with the objective of assessing the direct, indirect and cumulative environmental impacts and benefits associated with each phase of development including design, construction, operation, and decommissioning. The EIA Report will further provide the competent authority (in this case the Department of Forestry, Fisheries and the Environment (DFFE)) with detailed and sufficient information to make an informed decision on the Application for Environmental Authorisation.

The sections below provide an indication of the aspects to be assessed for the Carissa WEF.

10.1.1 Aspects of the Development

A draft (optimised) facility layout will be provided by the Applicant for assessment as part of the EIA Phase which considers the identified environmental sensitivities included in this Scoping Report. The draft layout will be assessed by Blue Crane Environmental and a range of independent specialists. The draft layout will illustrate the proposed locations of all infrastructure associated with the development of the Carissa WEF, including the associated grid connection infrastructure.

10.1.2 Consideration of Alternatives

The following project alternatives will be investigated in the EIA Phase:

Alternatives considered	Description of the Alternative relating to the development
Site Specific and Layout Alternatives	<p>One preferred site / development area has been identified for the development of the Carissa WEF based on specific site characteristics. The development area of up to 41 699 ha is considered to be sufficient for the development of a WEF with a contracted capacity of up to 1 000 MW.</p> <p>Prior to the initiation of the S&EIA process, alternative properties / sites were considered and pre-screened by the Applicant to determine the preferred location for the proposed development area. The selection of a potential wind farm site includes several key aspects including wind resource, grid connection suitability, existing infrastructure as well as environmental and social constraints, topography and access. This proposed project site was selected based on the above criteria ahead</p>

Alternatives considered	Description of the Alternative relating to the development
	<p>of other regional properties / sites due to the cumulative assessment and consideration of all criteria. This process takes several months to complete and ensures that the least environmentally sensitive site is selected in the specific region for further development.</p> <p>Based on the reasons above no site or development area alternatives have been put forward or assessed further during the S&EIA process for this proposed development. The placement of wind energy facilities is dependent on the factors discussed above, all of which are favourable at the proposed site location.</p> <p>The facility layout / development footprint of the infrastructure will be optimised throughout the EIA process to ensure that the relevant environmental constraints are considered and avoided, thereby resulting in a facility layout which can be considered as being environmentally appropriate for development.</p>
Activity Alternatives	Only the development of a renewable energy facility is considered by AMDA Oscar (Pty) Ltd. Due to the location of the site / development area and the suitability of the wind resource, only the development of a wind energy facility is considered feasible considering the natural resources available to the area and the current land-use activities undertaken within the site (i.e., agricultural activities).
Technology Alternatives	<p>Only the development of a WEF is considered due to the characteristics of the site, including the natural resources available. The technology proposed to be utilised is therefore wind turbines.</p> <p>For the development of the Battery Energy Storage System (BESS) three alternatives are under consideration:</p> <ul style="list-style-type: none"> • Li-Ion battery (Technically Preferred - Alternative 1) • Vanadium Redox Flow Battery (Alternative 2) • Zinc-hybrid Ion Battery (Alternative 3)
'Do-nothing' Alternative	The option to not construct the Carissa WEF. No impacts (positive or negative) are expected to occur on the social and environmental sensitive features or aspects located within the surrounding areas of the site. The opportunities associated with the development of the facility for the Beaufort West and Prince Albert areas/towns will not be made available.

10.1.3 Aspects to be Assessed by the Independent Specialists

Specialists in their field of expertise will consider baseline data and identify and assess impacts based on the results of the completed fieldwork. Specialists will also recommend essential ways in which to mitigate negative impacts and enhance positive impacts. Further, specialists will, where possible, take into consideration the cumulative effects associated with this and other projects which are either

developed or in the process of being developed in the local area. The specialist is reminded to follow the latest DFFE protocols.

Specialists' reports must comply with Appendix 6 of GN.R. 326 published under sections 24(5), and 44 of the National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended, where the DFFE protocols are not relevant to be complied with.

The following specialist studies will be undertaken as part of the EIA Phase:

- **Terrestrial Impact Assessment** - which includes ecology, wetlands, fauna and flora and assesses the potential impact and the associated disturbance of vegetation on the ecology and biodiversity (including critical biodiversity areas and broad-scale processes).
- **Aquatic Impact Assessment** - which assess the impacts on the surrounding water resources and the present ecological state of water resources present.
- **Avifauna Impact Assessment** - which includes seasonal surveys and monitoring and assesses the impact on avifaunal habitats and sensitive species, as well as mortality of avifauna and collisions and electrocutions of birds with the project infrastructure.
- **Bat Impact Assessment** - which includes seasonal surveys and monitoring and assesses the impact on habitats and sensitive species, as well as mortality of bats and barotrauma.
- **Soils and agricultural potential** - which assesses the significance of loss of agricultural land and soil degradation and/or erosion.
- **Cultural Heritage and Paleontological Impact Assessment** - which includes archaeology and palaeontology and assesses the potential of disturbance to or destruction of heritage sites and fossils during the construction phase. The cultural landscape associated with the development and the potential impacts will also be considered.
- **Visual Impact Assessment** - which includes the visual quality of the area and assesses the impact of the proposed renewable energy facilities on the aesthetics of the area. The impact of flicker from the turbines will also be considered.
- **Socio-economic Impact Assessment** - consideration of the current social environment and the impact of the proposed developments on the existing social aspects of the area.
- **Noise Impact Assessment** - assessment of the impact of noise, specifically during the operation of wind turbines.
- **Traffic Impact Assessment** - which includes the consideration of the increase in traffic on the surrounding road network and transport routes for project components.
- **Geotechnical Assessment** - consideration of the geotechnical aspects and characteristics of the site that may impact on the development of the WEF.
- **Quantitative Risk** - a risk assessment will be undertaken to consider the potential risks associated with the development of the Battery Energy Storage System.

The results of the specialist studies will further inform the facility layout that will be put forward for environmental authorisation for the Carissa WEF.

Table 10.1 below provides a summary of the aspects that will be assessed in detail in the EIA Report. The aspects are also linked to specialist information obtained.

Table 10.1: Aspects to be Assessed by the Independent Specialists

Aspects	Potential impacts	Specialist studies / technical information
Construction of the wind energy facility	Impacts on the flora and fauna, including impacts on avifauna and bats	Terrestrial Biodiversity, Plant and Animal Species Assessment; Avifauna Impact Assessment; and Bat Assessment
	Impacts on important water resources	Aquatic Impact Assessment
	Impacts on existing services infrastructure	Confirmation from the Local Municipality
	Temporary employment, impacts on health and safety	Social Impact Assessment; and Health, Safety and Environmental Risk Assessment
	Impacts on heritage resources and fossils	Heritage Impact Assessment; and Paleontological Impact Assessment
	Visual Impact	Visual Impact Assessment
	Impacts of loss of agricultural land and soil degradation and/or erosion.	Soils and agricultural potential
	Consideration of the increase in traffic on the surrounding road network and transport routes for project components	Traffic Impact Assessment
Operation of the wind energy facility	Impacts on the flora and fauna, including impacts on avifauna and bats	Terrestrial Biodiversity, Plant and Animal Species Assessment; Avifauna Impact Assessment; and Bat Assessment
	Increased consumption of water	Confirmed volumes to be provided by the Applicant
	Visual Impact and shadow flicker	Visual and flicker Impact Assessment
	Provision of employment and generation of income for the local community	Social Impact Assessment
	Socio-economic impacts (loss of employment)	Social Impact Assessment
	Noise impacts stemming from the operation of the turbines	Noise Impact Assessment

Aspects	Potential impacts	Specialist studies / technical information
	Consideration of the increase in traffic on the surrounding road network and transport routes for project components	Traffic Impact Assessment
Cumulative Impacts	Cumulative biophysical impacts resulting from similar developments in close proximity to the proposed activity.	All independent specialist studies results are to be analysed by the EAP to consider the impact of the project in isolation and the combined cumulative impact significance

10.2 Methodology to be Utilised for the Impact Assessment

Impact assessment must take account of the nature, scale, and duration of impacts on the environment whether such impacts are positive or negative. Each impact is also assessed according to the project phases:

- planning
- construction
- operation
- decommissioning

Table 10.2 provides the impact rating system to be applied in the draft EIA Report.

Table 10.2: Impact Rating Methodology for the Impact Assessment

NATURE		
Include a brief description of the impact of the environmental parameter being assessed in the context of the project. This criterion includes a brief written statement of the environmental aspect being impacted by a particular action or activity.		
GEOGRAPHICAL EXTENT		
This is defined as the area over which the impact will be experienced.		
1	Site	The impact will only affect the site.
2	Local/district	Will affect the local area or district.
3	Province/region	Will affect the entire province or region.
4	International and National	Will affect the entire country.
PROBABILITY		
This describes the chance of occurrence of an impact.		

1	Unlikely	The chance of the impact occurring is extremely low (Less than a 25% chance of occurrence).
2	Possible	The impact may occur (Between a 25% to 50% chance of occurrence).
3	Probable	The impact will likely occur (Between a 50% to 75% chance of occurrence).
4	Definite	Impact will certainly occur (Greater than a 75% chance of occurrence).
DURATION		
This describes the duration of the impacts. Duration indicates the lifetime of the impact as a result of the proposed activity.		
1	Short term	The impact will either disappear with mitigation or will be mitigated through natural processes in a span shorter than the construction phase (0 – 1 years), or the impact will last for the period of a relatively short construction period and a limited recovery time after construction, thereafter it will be entirely negated (0 – 2 years).
2	Medium term	The impact will continue or last for some time after the construction phase but will be mitigated by direct human action or by natural processes thereafter (2 – 10 years).
3	Long term	The impact and its effects will continue or last for the entire operational life of the development but will be mitigated by direct human action or by natural processes thereafter (10 – 30 years).
4	Permanent	The only class of impact that will be non-transitory. Mitigation either by man or natural process will not occur in such a way or such a time span that the impact can be considered indefinite.
INTENSITY/ MAGNITUDE		
Describes the severity of an impact.		
1	Low	Impact affects the quality, use and integrity of the system/component in a way that is barely perceptible.
2	Medium	Impact alters the quality, use and integrity of the system/component but system/component still continues to function in a moderately modified way and maintains general integrity (some impact on integrity).

3	High	Impact affects the continued viability of the system/component, and the quality, use, integrity and functionality of the system or component is severely impaired and may temporarily cease. High costs of rehabilitation and remediation.
4	Very high	Impact affects the continued viability of the system/component, and the quality, use, integrity and functionality of the system or component permanently ceases and is irreversibly impaired. Rehabilitation and remediation often impossible. If possible, rehabilitation and remediation often unfeasible due to extremely high costs of rehabilitation and remediation.
REVERSIBILITY		
This describes the degree to which an impact can be successfully reversed upon completion of the proposed activity.		
1	Completely reversible	The impact is reversible with implementation of minor mitigation measures.
2	Partly reversible	The impact is partly reversible but more intense mitigation measures are required.
3	Barely reversible	The impact is unlikely to be reversed even with intense mitigation measures.
4	Irreversible	The impact is irreversible, and no mitigation measures exist.
IRREPLACEABLE LOSS OF RESOURCES		
This describes the degree to which resources will be irreplaceably lost as a result of a proposed activity.		
1	No loss of resource	The impact will not result in the loss of any resources.
2	Marginal loss of resource	The impact will result in marginal loss of resources.
3	Significant loss of resources	The impact will result in significant loss of resources.
4	Complete loss of resources	The impact is result in a complete loss of all resources.
CUMULATIVE EFFECT		
This describes the cumulative effect of the impacts. A cumulative impact is an effect which in itself may not be significant but may become significant if added to other existing or potential impacts emanating from other similar or diverse activities as a result of the project activity in question.		

1	Negligible cumulative impact	The impact would result in negligible to no cumulative effects.
2	Low cumulative impact	The impact would result in insignificant cumulative effects.
3	Medium cumulative impact	The impact would result in minor cumulative effects.
4	High cumulative impact	The impact would result in significant cumulative effects
SIGNIFICANCE		
<p>Significance is determined through a synthesis of impact characteristics. Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. The calculation of the significance of an impact uses the following formula: (Extent + probability + reversibility + irreplaceability + duration + cumulative effect) x magnitude/intensity.</p> <p>The summation of the different criteria will produce a non-weighted value. By multiplying this value with the magnitude/intensity, the resultant value acquires a weighted characteristic which can be measured and assigned a significance rating.</p>		
Points	Impact significance rating	Description
6 to 28	Negative low impact	The anticipated impact will have negligible negative effects and will require little to no mitigation.
6 to 28	Positive low impact	The anticipated impact will have minor positive effects.
29 to 50	Negative medium impact	The anticipated impact will have moderate negative effects and will require moderate mitigation measures.
29 to 50	Positive medium impact	The anticipated impact will have moderate positive effects.
51 to 73	Negative high impact	The anticipated impact will have significant effects and will require significant mitigation measures to achieve an acceptable level of impact.
51 to 73	Positive high impact	The anticipated impact will have significant positive effects.
74 to 96	Negative very high impact	The anticipated impact will have highly significant effects and are unlikely to be able to be mitigated adequately. These impacts could be considered "fatal flaws".
74 to 96	Positive very high impact	The anticipated impact will have highly significant positive effects.

10.3 Consultation with the Competent Authority

Consultation with the regulating authorities (i.e., DFFE, Western Cape DEA&DP and Heritage Western Cape) will be undertaken and will continue throughout the EIA Phase. On-going consultation will include the following:

- Submission of a Final Scoping Report following the 30-day public review period (and consideration of comments received).
- Submission of a draft EIA Report, inclusive of an Environmental Management Programme, for review and comment.
- Submission of a Final EIA Report following a 30-day public review period (and consideration of comments received).
- Consultation with DFFE and Western Cape DEA&DP (if required) in order to discuss the findings and conclusions of the Final EIA Report.
- Follow-up with the DFFE regarding the decision and provide feedback where queries for certainty are required from the Department.

10.4 Public Participation During the EIA Phase

A public participation process will be undertaken during the EIA Phase. Consultation with key stakeholders and I&APs will be on-going and through this consultation process, stakeholders and I&APs will be encouraged to verify that their issues were recorded in the Scoping Phase and to identify additional issues of concern or highlight positive aspects of the proposed project, and to comment on the findings of the EIA Phase. To accommodate the varying needs of stakeholders and I&APs within the study area, as well as capture their inputs, various opportunities will be provided for stakeholders and I&APs to be involved in the EIA Phase of the process, as follows:

- Telephonic consultation sessions where significant comments are raised and the I&APs have a need for discussion and further consultation, outside of written correspondence.
- Written, faxed or e-mail correspondence.
- Public meeting / Open day inviting the public to meet with the EAP and development team to answer any questions and engage in discussion.

A draft EIA Report will be made available for a 30-day review period prior to finalisation and submission to the DFFE for decision-making. All comments received during the public review period will be included within the final report (through the comments and responses report) to be submitted to the DFFE for review and decision-making.

10.5 Legal Requirements Complied with in Section 10 as per the Requirements of the EIA Regulations, 2014 (as amended)

This section of the report includes the following information required in terms of Appendix 2: Content of the scoping report:

Requirement	Relevant Section
2(h) a plan of study for undertaking the environmental impact assessment process to be undertaken, including (i) a description of the alternatives to be considered and assessed within	A description of the alternatives to be considered in the EIA Phase is discussed in section 10.1.2.

Requirement	Relevant Section
the preferred site, including the option of not proceeding with the activity.	
(ii) a description of the aspects to be assessed as part of the environmental impact assessment process.	A description of the development aspects to be assessed in the EIA Phase is included in section 10.1.
(iii) aspects to be assessed by specialists.	A description of the aspects to be assessed by the independent specialists in the EIA Phase is included in section 10.1.3.
(iv) a description of the proposed method of assessing the environmental aspects including aspects to be assessed by specialists.	The method to be applied for assessing the environmental aspects and impacts is included in section 10.2.
(v) a description of the proposed method of assessing the duration and significance.	The method to be applied for assessing the environmental aspects and impacts is included in section 10.2.
(vi) an indication of the stage at which the competent authority will be consulted.	The consultation to be undertaken with the competent authority is described in section 10.3.
(vii) particulars of the public participation process that will be conducted during the environmental impact assessment process.	The particulars of the Public Participation Process to be undertaken is included in section 10.4.
(viii) a description of the tasks that will be undertaken as part of the environmental impact assessment process.	The tasks to be undertaken for the EIA Phase of the EIA process are fully described in section 10.
(ix) identify suitable measures to avoid, reverse, mitigate or manage identified impacts and to determine the extent of the residual risks that need to be managed and monitored.	The independent specialists will identify suitable management and mitigation measures which will be listed in the EIA Report and EMPr.

11 CONCLUSION

The final Scoping Report was undertaken with the main aim of identifying the potential impacts that may occur with the development of the proposed Carissa WEF. The aim of the Scoping Phase has been to scope out the potential impacts that may be associated with the development, which are to be further assessed and refined during the EIA Phase, should Acceptance of the Scoping Phase and Plan of Study be granted by the DFFE.

The development of a wind energy facility on several farm portions located within the Beaufort West and Prince Albert Local Municipalities may potentially result in both negative and positive environmental impacts that may need to be mitigated to ensure that the development is appropriate from an environmental perspective. The entire extent of a 1 699 ha development area, and two (02) grid connection corridor options have been assessed as part of this final Scoping Report.

Key potential environmental impacts have been identified for the development through inputs provided from independent specialists. The impacts and the significance of the impacts listed below is **without** the implementation of the required mitigation measures.

Construction Phase Impacts:

- Soil degradation by 1) disturbance and pollution (- Low), 2) erosion by wind (- Low), 3) degradation of watercourses (- Low).
- Impacts on avifauna including 1) displacement from disturbance (- Medium), 2) habitat loss (- High).
- Impacts on bats include 1) destruction of bat roosts & habitat loss (- Medium).
- Impact on water resources 1) changes in water flow (- High), 2) disturbance of aquatic habitats (- Low), 3) risk of spills (- Medium), 4) alteration of natural water flow (- Very High).
- Impacts on landscape 1) Visual impact during operation of WEF (- High); and visual impact during construction of the grid (- Medium).
- Social impacts including 1) creation of direct and indirect employment opportunities (+ Medium), 2) economic multiplier effect (+ Low); 3) potential loss of productive farmland (- Low); 4) Influx of jobseekers and change in population (- Medium); 5) safety and security impacts (- Medium); 6) impacts on daily and movement patterns (- Medium); 7) nuisance impacts (noise and dust) (- Medium); 8) increased risk of potential veld fires (- Medium); and 9) visual and sense of place impacts (- High).
- Impacts stemming from noise include 1) construction activity (- Medium), 2) construction related traffic at NSR (- Low), 3) daytime construction activity (- Low), 4) night-time construction (- Medium).
- Impact on cultural heritage and paleontological resources 1) construction activity near significant resources (- High), 2) loss of fossils (- High).
- Impact on transport 1) increase in traffic on external road network (- Low).

Operational Phase Impacts:

- Soil degradation by 1) disturbance and pollution (- Low), 2) erosion by wind (- Low), 3) degradation of watercourses (- Low), 4) reduction in non-renewable energy sources (+ High).

- Impacts on avifauna including 1) displacement from disturbance (- Medium), 2) turbine collisions (- High), 3) collision and electrocution with power lines (- High).
- Impacts on bats include 2) bat mortality from direct blade impact (- High).
- Impact on water resources 1) water quality & accidental spills (- Medium), 2) noise and vibration (- High), 3) increased runoff & AIP (- Medium).
- Impacts on landscape 1) visual impact during operation of the solar PV facility (- Medium); visual impact during operation of the grid (- Medium); and visual impact of lighting (- Medium).
- Social impacts including 1) direct and indirect employment opportunities and skills development (+ Low); 2) development of non-polluting, renewable energy infrastructure (+ Medium); 3) potential loss of agricultural land (- Medium); 4) Contribution to Local Economic Development (LED) and social upliftment (+ Medium); 5) impact on tourism (+ Low); and 6) visual and sense of place impacts (- High).
- Impacts stemming from noise include 1) daytime operation (- Low), 2) night-time operation (- Medium).
- Impact on cultural heritage and paleontological resources 1) construction activity near significant resources (- Medium).
- Impact on transport 1) slight increase in traffic (- Low).

Decommissioning Phase Impacts:

- Soil degradation by 1) disturbance and pollution (- Low), 2) erosion by wind (- Low), 3) degradation of watercourses (- Low).
- Impacts on avifauna including 1) displacement from disturbance (- Medium), 2) habitat loss (- High).
- Impact on water resources 1) disturbance and sedimentation (- Low), 2) rehabilitation & restoration (+ Medium), 3) turbine removal (- Low), post-decommissioning monitoring (+ Low).
- Impacts stemming from noise include 1) decommissioning project infrastructure (- Low).
- Impact on cultural heritage and paleontological resources 1) construction activity near significant resources (- High).
- Impact on transport 1) increase in traffic on external road network (- Low).

From the independent specialist studies undertaken specific preliminary environmental sensitivities have been identified within the Development Area that will need to be avoided by the placement of the development footprint / facility layout. The areas not available for development has been confirmed following extensive specialist fieldwork and site surveys. These will however be further analysed and refined during the detailed EIA phase. The most prominent features in the landscape that need to be considered for the design of the layout are:

- The avifaunal no-go areas; and avifaunal no-turbine areas. Avifauna mitigation areas have been identified which allow for development activity to continue with the implementation of stringent mitigation measures.
- The aquatic assessment has identified and delineated several watercourses which must be avoided by the implementation of a 15 m buffer for all non-perennial tributaries and drainage lines and a 32 m buffer for the NFEPA Rivers.
- The bat assessment has identified two (02) turbines that must be micro-sited during the layout optimisation process. The blade overhang of turbine 136 intrudes approximately 5.5 m into the bat no-go sensitivity buffer. The blade overhang of turbine 17 is also intruding into the high bat sensitivity buffer.

- The following cultural heritage resources were identified which must be avoided by implementing the recommended buffers. These include:
 - A farmstead older than 60 years with associated features such as outbuildings, a possible threshing floor, a kraal, and a water canal/storage was identified near the proposed grid corridor on Portion 19 of the Farm Brits Eigendom 374. The farmhouse is outside the corridor; however, the kraal is within the corridor. A 100 m buffer/safety zone is recommended to negate the negative impact on the kraal and associated features, as this resource is located within the grid corridor.
 - A Historical period structural feature was noted on Jagerskraal 3/327. This resource is, however, older than 60 years. A 100 m buffer/safety zone is recommended to negate the negative impact on the kraal and associated features, as these resources are located within and near the grid corridor.
 - A Historical period structural feature was noted on Brits Eigendom 2/374, 25/374, 21/374, 4/374. This resource is older than 60 years. A 200 m buffer/safety zone is recommended to negate the negative impact on the kraal and associated features, as these resources are located within and near the grid corridor.
 - One graveyard was recorded within the corridor footprint on Portion 21 of the Farm Brits Eigendom 374. There are approximately 43 visible graves. It is recommended that a buffer/safety zone of 50 m should be implemented around the graves.

The large extent of the development area (i.e., 41 699 ha) results in an opportunity for the avoidance of the sensitive environmental features and areas through the careful placement of the development footprint and infrastructure layout. The Applicant will consider all environmental sensitivities during the EIA Phase and design an appropriate facility layout that is considered to be acceptable, which will be further considered and assessed by the independent specialists during the EIA Phase. The acceptability of the preferred layout for the development will also be confirmed by the relevant independent specialists as part of the EIA Report, and where required further optimisation of the layout will be undertaken accordingly.

Based on the results of the draft Scoping Report, it is confirmed that no fatal flaws are relevant to the proposed development.

Blue Crane Environmental therefore confirms the suitability of the development within the assessed development area subject to the avoidance of the identified sensitive environmental features through the careful placement of the development footprint. The recommendation is therefore that the Scoping Phase (Scoping Report) and Plan of Study for the EIA Phase be approved by the DFFE, after which the EIA Phase will commence as required in terms of Regulations 23 to 24 of the EIA Regulations, as amended.

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