ENVIRONMENTAL IMPACT ASSESSMENT REPORT FOR THE PROPOSED 390 MW SAN KRAAL WIND ENERGY FACILITY AND GRID CONNECTION, NORTHERN AND EASTERN CAPE PROVINCES

On behalf of

SAN KRAAL WIND POWER (PTY) LTD

January 2018

FOR PUBLIC COMMENT

DEA REFERENCE NUMBER:
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PROJECT DETAILS

DEA Reference Number:	14/12/16/3/3/2/1029
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Project Applicant:	San Kraal Wind Power (Pty) Ltd
Report Status:	Draft Environmental Impact Report
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EXECUTIVE SUMMARY

Introduction

San Kraal Wind Power (Pty) Ltd are applying for environmental authorisation to construct the San Kraal 390 MW wind energy facility (WEF) and its associated infrastructure, including a 132 kV grid connection (the proposed San Kraal WEF). Arcus Consultancy Services South Africa (Pty) Ltd ('Arcus') has been appointed by San Kraal Wind Power (Pty) Ltd to conduct the Environmental Impact Assessment (EIA) process as required by the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA), as amended.

The proposed San Kraal WEF aims to generate and distribute electricity from renewable wind energy sources into the national grid by connecting the on-site switching station with 132 kV power lines to the proposed 132/400 kV Umsobomvu Substation to be located approximately 25 km west from the on-site switching station.

In accordance with the Department of Energy's Renewable Energy Independent Power Producer Procurement Program's ('REIPPPP') bid requirements, InnoWind (Pty) Ltd has established San Kraal Wind Power (Pty) Ltd as a Special Purpose Vehicle (SPV) that will be used to own all the authorisations, contracts, permits and licenses required to lawfully build and operate the proposed San Kraal WEF. The project is applying for an operational lifespan of 20 years through the REIPPPP.

InnoWind is a South African based integrated renewable energy company that develops, finances, builds, owns and operates commercial wind-powered generation facilities to supply energy into the national power grid. InnoWind's technical expertise in project management and operations emanates from its French-based parent company, EDF Energies Nouvelles, a global leader in renewable energy operations with an asset base of approximately 10 GW across 18 countries worldwide.

Arcus is a specialist environmental consultancy providing environmental services to the renewable energy market. Arcus has advised on over 150 renewable energy projects in the United Kingdom and South Africa with environmental management and in-house specialist services.

Site Location and Proposed Development Description

The proposed development site is located approximately six kilometres south east of the town of Noupoort in the Umsobomvu Local Municipality (ULM) which forms part of the Pixley ka Seme District in the Northern Cape Province. A small portion of the development site falls within the Inxuba Yethemba Local Municipality, within the Chris Hani District of the Eastern Cape Province. The town of Middelburg and Colesberg are located approximately 25 km and 58 km to the south and north east of the site respectively.

The proposed San Kraal WEF will comprise of up to 78 wind turbine generators (WTG), each with a hub height of up to 150 m, blade length of up to 75 m and a rotor diameter of up to 150 m. An on-site switching station will be constructed as part of the San Kraal WEF, which will transfer the electricity generated by the WEF to the proposed Umsobomvu 132/400 kV substation, to be located approximately 25 km west of the on-site switching station, via a 132 kV double or single string transmission line.

The grid connection alternatives run in a south-westerly direction from the development site on the plateau, down the escarpment through plains, with the last section crossing areas consisting of steep slopes, mountain ridges and koppies. On the plains below the escarpment, the vegetation type is classified as Eastern Upper Karoo. On the steep slopes, mountain ridges and koppies, Besemkaree Koppies Shrubland is found.

A Final Scoping Report was submitted to the Department of Environmental Affairs and accepted in November 2017. The Final Scoping report presented and assessed an initial proposed wind turbine layout and associated infrastructure. The results of the specialists' assessments were taken into consideration and a revised preferred layout alternative was produced, which is presented and assessed in this Environmental Impact Assessment Report (EIAR). Following these specialists' assessments and their proposed mitigation measures a final mitigated layout was produced for approval.

Environmental Legislative Requirements

The EIA Regulations 2014 published in Government Notice (GN) No. R. 982, provide for the control of certain Listed Activities. These activities are listed in GN No. R. 983 (Listing Notice 1 – Basic Assessment), R. 984 (Listing Notice 2 – Scoping & EIA Process) and R. 985 (Listing Notice 3 – Basic Assessment) of 4 December, and are prohibited to proceed until environmental authorisation has been obtained from the competent authority, in this case, the Department of Environmental Affairs (DEA).

On 7 April 2017 in Government Gazette 40772 the Minister of Environmental Affairs published amendments to the Environmental Impact Assessment (EIA) Regulations of 2014 (in Notice Number 326), Listing Notice 1 (in Notice Number 327), Listing Notice 2 (in Notice Number 325) and Listing Notice 3 (in Notice Number 324). The table below indicates the listing notices, as amended in 2017.

Listed Activities applicable to this proposed project are presented in the table below. All potential impacts associated with these Listed Activities are considered and assessed in this EIA.

As this proposed San Kraal WEF development triggers Listed Activities in Listing Notices 1 – 3, a full Scoping and EIA process is followed for this application.

Applicable Listed Activities in terms of the NEMA

LISTING NOTICE	ACTIVITIES
LN 1 GN R327[1]	11(i); 14, 19 (i); 24 (ii); 24, 56 (ii)
LN 2 GN R325[2]	1; 6; 9; 15.
LN 3 GN R324[3]	4 (a)(i)(bb) & (g)(bb)(ee); 12(g)(ii); 18 (a)(i)(bb)

Depending on the final design of the San Kraal WEF, there may be a requirement for the following additional permits/ authorisations:

- Waste Management License/s as required by the NEMA, Waste Act, 2008 (Act No. 59 of 2008);
- Mining Permits as required by the Minerals and Petroleum Resources Development Act, 2002 (MPRDA) (Act No. 28 of 2002)(MPRDA); and
- Water Use Licenses as required by the National Water Act, 1998 (Act No. 36 of 1998) (NWA). A water use licence application has been submitted to the Department of Water Affairs. Proof of submission is included in Appendix D.

These permits will be applied for should the project be authorised and be selected as a preferred bidder.

[1] "Listing Notice 1 of the EIA Regulations, promulgated under Government Notice R983 of 4 December 2014, as amended by Government Notice R327 of 7 April 2017."
[2] "Listing Notice 2 of the EIA Regulations, promulgated under Government Notice R984 of 4 December 2014, as amended by Government Notice R325 of 7 April 2017."
[3] "Listing Notice 3 of the EIA Regulations, promulgated under Government Notice R985 of 4 December 2014, as amended by Government Notice R324 of 7 April 2017."

Results of Specialist Investigations

Aquatic

It is anticipated the no impacts on the aquatic environment will occur based on the proposed grid connection alignments and the alternatives. This is based on the assumption that during the final design process all transmission line towers will be located outside of the delineated water courses and the 32m buffer.

The only recommendation being that should any of the towers be located on steep slopes adequate erosion protection should be installed to prevent any surface water run-off from eroding these areas.

It is however recommended that a walk down of the final tower positions is conducted by an aquatic specialist prior to construction. This will allow for critical comment on the tower positions and allow for any adjustments to avoid any impacts by shifting tower positions where required.

The proposed turbine layout and proposed transmission lines would seem to have limited impact on the aquatic environment as the proposed structures can avoid the delineated watercourses except for two water course crossings. As such a water use licence application is being submitted for the two crossings. Use of any existing roads will support this. Thus, based on the findings of this study no objection to the authorisation of any of the proposed activities for within the WEF site and that the preferred transmission route alignment is used (middle).

No aquatic protected or species of special concern (flora) were observed during the site visit. Therefore, based on the site visit the significance of the impacts assessed for the aquatic systems after mitigation would be low.

Ecology

The fauna of the area is considered to be composed of widespread species, with very few species of conservation concern likely to be present at the site. The most important areas for fauna at the site are the drainage systems and well-vegetated slopes which are largely outside of the development footprint and would not be significantly affected. The major impact on fauna would be habitat loss associated largely with the high-elevation plateau habitat of the site. As there are no species of high conservation concern prevalent in the area, impacts on terrestrial fauna are likely to be relatively low and of local significance only.

A small portion of the San Kraal WEF is located within a CBA which raises the potential for negative impact on the affected CBA and associated biodiversity due to the development. The CBAs in the area are related to the maintenance of ecosystem processes and not biodiversity pattern and the approximate 15ha footprint within the CBA represents a small proportion of the affected CBAs and is not likely to significantly disrupt or alter the ecological functioning or ability of the landscape to provide ecosystem services. Consequently, the development of a wind farm partly within a CBA is not seen as a critical flaw associated with the project and the predicted impacts on the affected CBAs would be of a local nature only.

The San Kraal Grid Connection and associated infrastructure is likely to generate low impacts on fauna and flora after mitigation. No high impacts that cannot be avoided were observed and from a flora and terrestrial fauna perspective, there are no ecological reasons to oppose the development of the grid connection and associated infrastructure.

Avifauna

Collisions of priority species with the turbines in the operational phase are likely to be a medium negative impact and it could be reduced to a low negative level through the application of mitigation measures. Species most likely to be at risk of collision with the turbines are Lesser Kestrel, Martial Eagle, Verreaux's Eagle and Jackal Buzzard. The impact is likely to persist for the operational life-time of the project. Implementation of the proposed mitigation measures should reduce the probability and severity of the impact on priority species to such an extent that the overall significance should be reduced to low.

Mortality of priority species with the grid connection and internal medium voltage network due to collisions in the operational phase is likely to be of medium significance, and will remain as such after the implementation of mitigation measures. Several of the priority species which occur or potentially occur in the study area are power line sensitive from a collision perspective. These include Ludwig's Bustard, Blue Crane, Northern Black Korhaan, Karoo Korhaan, Blue Korhaan, Secretarybird, White Stork and Greater Flamingo. All of these species, but particularly Ludwig's Bustard and Blue Crane, could be impacted by the proposed grid connection and the internal medium voltage lines (where they are above ground) through collision. The application of BFDs should reduce the probability and severity of the collision impact, but it is likely to remain at the medium level, as the application of BFD's will reduce, but not eliminate the risk.

Mortality due to electrocutions with the overhead sections of the medium voltage internal network is likely to be a medium impact, but it can be reduced to low through the use of bird-friendly pole designs, which must be approved by the avifaunal specialist. The poles could potentially be lethal for species such as Jackal Buzzard, Verreaux's Eagle, Martial Eagle, Cape Eagle-Owl, Spotted Eagle-Owl, Steppe Buzzard and African Harrier-hawk. The electrocution risk will persist as long as the lines are up, but it can be completely eliminated at the onset if bird-friendly structures are used.

From a cumulative impact perspective, the greatest potential concern in the 35km radius around San Kraal WEF is for the large raptor species, particularly the Red Listed Verreaux's Eagle and Martial Eagle, due to their relatively low numbers and vulnerability to turbine collisions (Ralston – Patton et al. 2017). Another concern is the potential impact of the powerline grid connections on large terrestrial species, particularly Blue Crane, Ludwig's Bustard and Secretarybird. The combined cumulative impact of renewable developments on priority species, and particularly wind energy developments on Verreaux's Eagle and Martial Eagle, within the 35km radius around the San Kraal WEF, is potentially significant at a local scale, and require the strict application of mitigation measures such as buffer zones around nests, and the establishment of mortality thresholds and subsequent curtailment of turbines, if thresholds are exceeded. The impact should be less severe at a regional and national level, due to the large distribution ranges of the species, but should nonetheless be carefully monitored. If all the mitigation measures proposed for the various renewable projects are strictly implemented, the cumulative impacts of these developments, including the proposed San Kraal WEF, should be reduced to low.

Bats

Five bat species were detected by the passive monitoring systems, namely, *Eptesicus hottentotus, Miniopterus natalensis, Neoromicia capensis, Rhinolophus clivosus* and *Tadarida aegyptiaca*. *Tadarida aegyptiaca* and *Neoromicia capensis* are the most abundant bat species recorded by all systems. Common and abundant species, such as *Neoromicia capensis, Tadarida aegyptiaca* and *Miniopterus natalensis*, are of a larger value to the local ecosystems as they provide a greater contribution to most ecological services than the rarer species due to their higher numbers.

Miniopterus natalensis is the only migratory species detected on site. The results of the full 12 months have been analysed for the presence of a migratory event. *Miniopterus natalensis* had low activity across the monitoring period near all the monitoring systems, therefore no migratory event was detected by the three passive monitoring systems.

The Met Mast East, Short Mast 3 and Short Mast 4 monitoring systems show the general trend of increased bat activity during spring and summer, and lowered bat activity over the winter months from June. All monitoring systems display a relatively sustained level of activity throughout the months of September 2015 to April 2016, with Met Mast East and Short Mast 3 having highest activity during March and Short Mast 4 indicating highest activity in December 2015.

A sensitivity map was drawn up indicating potential roosting and foraging habitat. The Moderate bat sensitivity areas and associated buffer zones must be prioritised during operational monitoring and preferably be avoided during turbine placement, if another feasible option is available. The High Bat Sensitivity areas are expected to have elevated levels of bat activity and support greater bat diversity. High Bat Sensitivity areas and their buffers are 'no – go' areas due to the expected elevated rates of bat fatalities due to wind turbines. No turbines are allowed to be placed in High Bat Sensitivity areas and their associated buffers. The Final Mitigated Layout avoids all High and Moderate bat sensitivities and their buffers, and is therefore acceptable. The proposed grid connection was not assessed during the study, as according to the best knowledge of the specialist, grid infrastructure does not pose a significant threat to bat conservation in South Africa if the site is not located in an area abundant with bat caves.

It is recommended that curtailment be applied from the start of operation at Level 3 on all turbines for every night of the year from dusk until dawn.

Noise

The proposed layout will result in increased noises, but the noise levels will be low and are highly unlikely to impact on the quality of living for the surrounding receptors. In terms of acoustics, there is no benefit to the surrounding environment (closest receptors). The potential noise impacts are very low and the significance will be low.

Visual

The visual impacts identified in this VIA are not significant enough to prevent the project from proceeding and that EA should be granted. From a visual impact perspective, only two (2) visually sensitive receptors with tourism significance have been identified within the study area, namely VR 28 – The Dairy BnB and VR 36 – Carlton Heights Lodge. A total number of twenty-one (21) potentially sensitive visual receptors were however identified. These included scattered farmsteads / homesteads which house the local farmers as well as their farm workers. These dwellings are regarded as potentially sensitive visual receptors as they are located within a mostly rural setting and the proposed development will likely alter natural vistas experienced from these dwellings. In addition, the proposed development is expected to alter the largely natural / scenic character of the study area and contrast moderately with the typical land use and/or pattern and form of human elements present as the study area is largely natural / scenic and untransformed. This is however not true for the areas within close proximity of the town of Noupoort and the operational Noupoort Wind Farm. These areas have seen a significant amount of transformation / disturbance over the years and are considered to have an urban / built up / industrial visual character. The visual impact of the proposed development on the sensitive visual receptor locations identified (namely VR 28 and VR 36) was rated as being moderate. In addition, the proposed San Kraal WEF would have a moderate visual impact on five (5) of the potentially sensitive visual receptor locations and a low visual impact on twelve (12) of the potentially sensitive visual receptors. The proposed development would however result in a negligible visual impact on four (4) of the potentially sensitive receptors. Additionally, the proposed development is not expected to result in a high visual impact for any of the sensitive or potentially sensitive visual receptor locations. In light of the above, the impacts associated with the construction and operation phases can be mitigated to acceptable levels provided the recommended mitigation measures are implemented.

Heritage

- Archaeology. The physical remnants of human activity were identified and assessed through physical site inspection, mapped and assigned field grades. The comprehensive survey of the project area, associated infrastructure and power lines has revealed that Stone Age archaeological sites are sparse in the high *suurveld* areas and that not very many sites will be physically impacted. Mitigation of 1 archaeological site (Stone Age) close to grid connection option 2 requires that the site be avoided or mitigated through systematic collection.
- Palaeontology. The palaeontological assessment by Dr John Almond has revealed that while the geology is potentially sensitive, fossil finds on site are confined to mostly fragmented river-washed bone fragments. He noted the presence of a number of fossilised vertebrate burrows in a river bed close to the convergence of the grid connection alternatives and has suggested that care must be taken to ensure that infrastructure is kept clear of the river bed.
- Landscape and setting. The landscape is largely rural, and apart from being used for small stock keeping is quite wild and un-altered. The slopes of the Kikvorsberge support *suurveld* grazing which is not optimal for domestic stock. Hence the area which has good scenic qualities, is very isolated and seldom visited.
- Accumulative impacts. The types of heritage material found on San Kraal, are very similar to those found in other projects within a 35 km radius. Almost all of this is grade 3 or ungraded – historic kraals and stock posts and Stone Age open scatters of moderate heritage significance. This material is all well represented in the eastern Karoo region therefore the accumulative impact is expected to be low. There is a concern that the compounded effect of renewable energy facilities will result in an aesthetic impact and change of character of the landscape, however this is difficult to quantify.

Transportation and Traffic

As per the request of DEA Traffic Impact Assessment was commissioned by the applicant to determine the potential impact the proposed San Kraal WEF will have to the existing traffic. In 2016 a route assessment report was compiled for the proposed Umsobomvu WEF (this WEF neighbours San Kraal, and is also an InnoWind development). For purposes of Traffic Impact Assessment Report, the main route as identified by the route determination report as being suitable will be the transportation route for the San Kraal WEF. From Middleburg the vehicles will make use of the N9 heading north towards Noupoort and turn R389 towards the San Kraal Access.

One access point was identified to serve San Kraal WEF. A site visit was conducted on the 11th of January 2018 to access the access point to site for its suitability to serve the WEF. The San Kraal WEF must be accessible to Passengers cars, buses, trucks and multi vehicle combinations which will be delivering WT components. Access to site needs to be safe and practical to minimise risk of pedestrian and vehicle accidents with sufficient traffic control, clear visibility through sufficient stopping site distances, clear markings and warnings signs.

The base year and forecast year road capacity has indicated that the proposed development will have no significant impact on the existing road network capacity

Based on the site visit, the proposed San Kraal access, is sufficient to meet visibility, accessibility and safety requirements.

It is recommended that Access point E be stop controlled and widened to allow for dedicated right turn and left turn lanes off the main road that will incorporate the turning circles of the expected abnormal vehicles.

In addition, allowance must be made for public transport vehicle lay byes on both sides of the access along the main road as well as safe pedestrian crossings on all 3 approaches of the access.

Wake Effect Analysis

As per the request of the DEA, the applicant engaged with Mainstream Renewable Energy with regards to the wake effect the proposed development could have on the nearby Mainstream Noupoort WEF. Through consultation with the DEA it was determined that a letter of no objection from Mainstream would be sufficient. As Mainstream did not provide such letter, a wake effect study was commissioned by the applicant, to determine the wake impact of the San Kraal WEF on the existing Noupoort WEF. A single wind farm configuration was considered by the specialist, as per the proposed development plan and project description. 29.8 months of data from a 120 m measurement mast installed at the site was considered. The configuration of the measurement device complies with best practice, but these measurements may not adequately represent wind conditions at all wind turbine locations. After data processing and analysis, the two year period 14 September 2015 – 13 September 2017 was selected for being the representative of the short term wind regime at the site. Short term measurements were then correlated to long term reference data to compensate for seasonal and annual wind variations. ERA-Interim S31.22 E25.308 data and the linear regression method were selected. The terrain at the site was modelled (elevation, roughness and obstacles to the wind flow) and the wind flow model WAsP was used to extrapolate the wind regime tot eh location and hub height of each wind turbine. The preliminary study indicated that the impact to the Noupoort Wind Farm's production is minimal with an estimated loss of 0,96% of its production, based on the current San Kraal wind turbine layout as depicted in the Draft EIR and the Vestas V150 turbine model.

Social

The findings of the SIA indicate that the development of the proposed San Kraal WEF will create employment and business opportunities for locals during both the construction and operational phase of the project. The establishment of a Community Trust will also benefit the local community. The potential negative social impacts can also be effectively mitigated.

The proposed development also represents an investment in clean, renewable energy infrastructure, which, given the negative environmental and socio-economic impacts associated a coal based energy economy and the challenges created by climate change, represents a significant positive social benefit for society as a whole. The findings of the SIA also indicate that the Renewable Energy Independent Power Producers Procurement Programme (REIPPPP) has resulted in significant socio-economic benefits, both at a national level and at a local, community level. These benefits are linked to foreign Direct Investment, local employment and procurement and investment in local community initiatives.

Based on the findings of the SIA the establishment of the proposed San Kraal WEF is supported. In this regard the project will create significant socio-economic opportunities for the area and have limited potential negative social impacts.

SUMMARY OF CONSTRUCTION PHASE IMPACT ASSESSMENTS

Construction Phase	Extent	Duration	Intensity	Status	Significance	Probability	Confidence
Geology, Soils and Agricultural Potential Impact							
Loss of Agricultural land	Low	Low	Low	Negative	**Medium**	High	High
With Mitigation	Low	Low	Low	Neutral	**Medium**	High	High
Increased soil erosion hazard	Low	Medium	Medium	Negative	**Medium**	High	High
With Mitigation	Low	Low	Low	Neutral	**Medium**	High	High
Freshwater and Wetlands							
Loss of riparian systems and water courses during the construction phase of the WEF	Low	Medium	Low	Negative	**Medium**	High	High
With Mitigation	Low	Low	Low	Negative	**Low**	Low	High
Increase in sedimentation and erosion within the development footprint during the construction phase and to a lesser degree the operational phase	Low	Medium	Low	Negative	**Medium**	High	High
With Mitigation	Low	Low	Low	Negative	**Low**	Low	High
Impact on localized surface water quality	Low	Low	Low	Negative	**Medium**	High	High
With Mitigation	Low	Low	Low	Negative	**Low**	Low	High
Flora and Terrestrial Fauna							
Impacts on vegetation and listed or protected plant species resulting from construction activities	Low	High	High	Negative	**High**	High	High
With Mitigation	Low	Medium	Low	Negative	**Medium**	High	High
Faunal impacts due to construction-phase noise and physical disturbance	Low	Medium	High	Negative	**Medium**	High	High
With Mitigation	Low	Medium	Low	Negative	**Medium**	High	Medium
Avifauna							
Displacement of priority species due to construction activities at the wind development area	Low	Low	Medium	Negative	**Medium**	High	Medium
With Mitigation	Low	Low	Low	Negative	**Medium**	Medium	Medium
Bats							

Construction Phase	Extent	Duration	Intensity	Status	Significance	Probability	Confidence
Destruction of bat roosts due to earthworks and blasting	Medium	Low	High	Negative	**Medium**	Medium	High
With Mitigation	Low	Low	Medium	Negative	**Low**	Low	High
Loss of foraging habitat	Low	High	Low	Negative	**Medium**	Medium	High
With Mitigation	Low	Medium	Low	Negative	**Low**	Low	High
Noise							
Daytime construction of the Access Roads	Low	Low	Low	Negative	**Low**	Low	High
With Mitigation	Low	Low	Low	Negative	**Low**	Low	High
Night-time construction of the Access Roads	Low	Low	Low	Negative	**Low**	Low	High
With Mitigation	Low	Low	Low	Negative	**Low**	Low	High
Noise from daytime construction traffic	Low	Low	Low	Negative	**Low**	Low	High
With Mitigation	Low	Low	Low	Negative	**Low**	Low	High
Noise from night-time construction traffic	Low	Low	Low	Negative	**Low**	Low	High
With Mitigation	Low	Low	Low	Negative	**Low**	Low	High
Daytime construction of Wind Turbines	Low	Low	Low	Negative	**Low**	Low	High
With Mitigation	Low	Low	Low	Negative	**Low**	Low	High
Night-time construction of Wind Turbines	Low	Low	Low	Negative	**Low**	Low	High
With Mitigation	Low	Low	Low	Negative	**Low**	Low	High
Visual							
Impact on access roads	Medium	Low	Medium	Negative	**Medium**	Medium	Medium
With Mitigation	Medium	Low	Medium	Negative	**Medium**	Medium	Medium
Impact on cabling	Medium	Low	Medium	Negative	**Medium**	Medium	Medium
With Mitigation	Medium	Low	Medium	Negative	**Medium**	Medium	Medium
Heritage							
Impacts to Archaeological Heritage	Low	High	Low	Negative – Neutral	**Low**	Low	High
With Mitigation	Low	High	Low	Negative – Neutral	**Low**	Low	High
Impacts to Colonial Period Heritage	Low	Low	Low	Negative – Neutral	**Low**	Low	High
With Mitigation	Low	Low	Low	Negative – Neutral	**Low**	Low	High
Impacts to cultural landscape and setting	Low	Medium	Medium	Negative	**Medium**	Medium	High
With Mitigation	Low	Medium	Medium	Negative	**Medium**	Medium	High

Construction Phase	Extent	Duration	Intensity	Status	Significance	Probability	Confidence
Palaeontological Heritage Impact							
Impacts to Palaeontology	Low	High	Medium	Negative	**Medium**	Medium	High
With Mitigation	Low	High	Low	Neutral – Pos	**Low**	Low	High
Social Impacts							
Creation of local employment, training and business opportunities	Medium	Low	Medium	Positive	**Medium**	Medium	High
With Mitigation	High	Low	High	Positive	**High**	High	High
Impact of construction workers on local communities	Medium	Low	Medium	Negative	**Medium**	Medium	High
With Mitigation	Medium	Low	Low	Negative	**Low**	Medium	High
Influx of job seekers	Medium	Low	Low	Negative	**Low**	Medium	Medium
With Mitigation	Medium	Low	Low	Negative	**Low**	Medium	Medium
Risk to safety, livestock, farm infrastructure and farming operations	Medium	Low	Medium	Negative	**Medium**	Medium	High
With Mitigation	Medium	Low	Low	Negative	**Low**	Medium	High
Increased fire risk	Medium	Low	Medium	Negative	**Medium**	Medium	High
With Mitigation	Medium	Low	Low	Negative	**Low**	Medium	High
Impacts associated with construction vehicles	Medium	Low	Medium	Negative	**Medium**	Medium	High
With Mitigation	Medium	Low	Low	Negative	**Low**	Medium	High
Impact associated with loss of farmland	Medium	Low	Low	Negative	**Medium**	Medium	High
With Mitigation	Medium	Low	Low	Negative	**Medium**	Medium	High

SUMMARY OF OPERATIONAL PHASE IMPACT ASSESSMENTS

Operational Phase	Extent	Duration	Intensity	Status	Significance	Probability	Confidence
Geology, Soils and Agricultural Potential Impact							
Loss of Agricultural land	Low	Low	Low	Negative	**Low**	Low	High
With Mitigation	Low	Low	Low	Neutral	**Low**	Low	High
Increased soil erosion hazard	Low	Medium	Medium	Negative	**Medium**	Medium	High
With Mitigation	Low	Low	Low	Neutral	**Low**	Low	High
Freshwater and Wetlands							
Impact on riparian systems through the	Low	Low	Low	Negative	**Medium**	High	High

possible increase in surface water runoff from hard surfaces and or new road crossings on riparian form and function							
With Mitigation	Low	Low	Low	Negative	**Low**	Low	High
Increase in sedimentation and erosion within the development footprint during the construction phase and to a lesser degree the operational phase	Low	Medium	Low	Negative	**Medium**	High	High
With Mitigation	Low	Low	Low	Negative	**Low**	Low	High
Flora and Terrestrial Fauna							
Faunal impacts due to operational activities	Low	Medium	Medium	Negative	**Medium**	High	High
With Mitigation	Low	Medium	Low	Negative	**Low**	Low	Medium
Soil Erosion Risk	Low	High	High	Negative	**High**	High	High
With Mitigation	Low	Low	Low	Negative	**Low**	Low	High
Alien Plant Invasion	Low	High	Medium	Negative	**Medium**	High	High
With Mitigation	Low	Low	Low	Negative	**Low**	Low	High
Impact on Critical Biodiversity Areas and Broad-Scale Ecological Processes	Medium	High	Medium	Negative	**High**	High	High
With Mitigation	Low	High	Medium	Negative	**Medium**	High	High
Avifauna							
Direct mortality of priority species due to electrocution associated with the internal medium voltage MV powerline at the wind development area	Low	Medium	Medium	Negative	**Medium**	High	High
With Mitigation	Low	Medium	Medium	Negative	**Low**	Low	High
Displacement of priority species due to habitat destruction at the wind development site	Low	High	Low	Negative	**Medium**	Medium	Medium
With Mitigation	Low	High	Low	Negative	**Low**	Low	Medium
Direct mortality of priority species due to collisions with the turbines at the wind development area	Low	Medium	Medium	Negative	**Medium**	High	Medium
With Mitigation	Low	Medium	Low	Negative	**Low**	Low	Low
Bats							
Bat mortalities due to direct blade impact or barotrauma during	Low	High	High	Negative	**High**	High	High

foraging activities (not migration)							
With Mitigation	Low	High	Low	Negative	**Medium**	Medium	High
Artificial Lighting	Low	High	Medium	Negative	**Medium**	High	High
With Mitigation	Low	High	Low	Negative	**Low**	Low	High
Noise							
Daytime operation of Wind Turbines	Low	Medium	Low	Negative	**Low**	Low	High
With Mitigation	Low	Medium	Low	Negative	**Low**	Low	High
Night-time operation of Wind Turbines	Medium	Medium	Low	Negative	**Low**	Low	High
With Mitigation	Medium	Medium	Low	Negative	**Low**	Low	High
Visual							
Impact on access roads	Medium	Medium	High	Negative	**Medium**	High	Medium
With Mitigation	Medium	Medium	Medium	Negative	**Medium**	High	Medium
Impact on cabling	Medium	Medium	Medium	Negative	**Medium**	High	Medium
With Mitigation	Medium	Medium	Medium	Negative	**Medium**	High	Medium
Heritage							
Impacts to cultural landscape and setting	Low	Medium	Medium	Negative	**Medium**	Medium	High
With Mitigation	Low	Medium	Medium	Negative	**Medium**	Medium	High
Social Impacts							
Development of renewable energy infrastructure	Medium	High	Medium	Positive	**Medium**	Medium	High
With Mitigation	Medium	High	High	Positive	**High**	High	High
Creation of employment and business opportunities and support for local economic development	Medium	Medium	Low	Positive	**Low**	Medium	High
With Mitigation	Medium	Medium	Medium	Positive	**Medium**	High	High
Benefits associated with the establishment of a Community Trust	Medium	High	Medium	Positive	**Medium**	Medium	High
With Mitigation	Medium	High	High	Positive	**High**	High	High
Generate income for affected landowners	Medium	Medium	Low	Positive	**Low**	Medium	High
With Mitigation	Medium	Medium	Medium	Positive	**Medium**	High	High
Impact on sense of place and rural character of the landscape based on findings of VIA	Medium	Medium	Medium	Negative	**Medium**	Medium	Medium
With Mitigation	Medium	Medium	Medium – Low	Negative	**Medium – Low**	Medium	Medium
Potential impact on	Medium	Medium	Medium	Negative	**Medium**	Medium	Medium

property values							
With Mitigation	Medium	Medium	Low	Negative	**Low**	Medium	Medium
Potential impact on tourism	Medium	Medium	Low	Negative	**Low**	Medium	High
With Mitigation	Medium	Medium	Low	Negative	**Low**	Medium	High

SUMMARY OF DECOMMISSIONING PHASE IMPACT ASSESSMENTS

Decommissioning Phase	**Extent**	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Freshwater and Wetlands							
Impact on riparian systems through the possible increase in surface water runoff from hard surfaces and or new road crossings on riparian form and function	Low	Low	Low	Negative	**Medium**	High	High
With Mitigation	Low	Low	Low	Negative	**Low**	Low	High
Increase in sedimentation and erosion within the development footprint during the construction phase and to a lesser degree the operational phase	Low	Medium	Low	Negative	**Medium**	High	High
Flora and Terrestrial Fauna							
Faunal impacts due to decommissioning phase activities	Medium	Low	High	Negative	**Medium**	High	High
With Mitigation	Low	Low	Low	Negative	**Low**	Medium	High
Following decommissioning, the site will be highly vulnerable to soil erosion	Medium	High	Medium	Negative	**High**	High	High
With Mitigation	Low	Low	Low	Negative	**Low**	Low	High
Faunal impacts due to decommissioning phase activities	Medium	Low	High	Negative	**Medium**	High	High
With Mitigation	Low	Low	Low	Negative	**Low**	Medium	High
Alien Plant Invasion following decommissioning	Medium	High	Medium	Negative	**High**	High	High
With Mitigation	Low	Low	Low	Negative	**Low**	Low	High
Avifauna							
Displacement of priority species due to dismantling activities at the wind development area	Low	Low	Medium	Negative	**Medium**	High	Medium

With Mitigation	Low	Low	Low	Negative	**Medium**	Medium	Medium
Social							
Loss of jobs and associated income	Medium	Medium	Medium	Negative	**Medium**	Medium	High
With Mitigation	Medium	Low	Low	Negative	**Low**	Medium	High

Conclusion

The proposed San Kraal Wind Energy Facility and its associated grid connection has the potential to provide much needed renewable energy to the country's grid. The use of renewable energy to provide power to South Africa is supported at International, National, Provincial and Local Government Levels. Further, given South Africa's need for additional electricity generation and the need to decrease the country's dependency on coal-based power, renewable energy has been identified as a national priority, with wind energy identified as one of the most readily available, technically viable and commercially cost-effective sources of renewable energy.

The potential positive impacts associated with the proposed project is further recognised through the creation of jobs for the local community, and the positive contributions to the socio-economic development of the surrounding areas and local communities.

Should the San Kraal WEF be developed, the actual physical footprint of the wind turbines and associated on-site infrastructure will occupy an area of land of approximately 1.5% of the total project area. Small livestock grazing and other agricultural activities can continue in parallel with the operation of the turbines. The project will have no significant impact in terms of loss of agricultural productivity. Should the mitigation measures identified by specialists and the recommendations of the EMPr be effectively implemented the negative impacts associated with the proposed project will be significantly reduced.

The base year and forecast year road capacity has indicated that the proposed development will have no significant impact on the existing road network capacity.

Operational phase monitoring of birds and bats must be undertaken according to applicable guidelines current at the start of the operational phase. The monitoring should not be undertaken according to those guidelines that are current at the time of the environmental authorisation. The information collected during the operational monitoring must be shared with Bird Life SA and EWT, as well as the South African Bat Association Panel (or any other agency that comes into effect, which centrally collects information to inform the effects of WEF on birds and bats). Monitoring and carcass searching must be undertaken throughout the life span of the development, at an agreed frequency with specialists.

All recommendations and mitigations must be complied with and adhered to.

Taking into consideration the findings of the EIA process for the proposed development and the fact that recommended mitigation measures have been used to inform the project design with turbines located outside of buffer areas, and highly sensitivity areas, as identified by specialists. it is the opinion of the Environmental Assessment Practitioner (EAP) that the majority of negative impacts associated with the implementation of the proposed project have been mitigated to acceptable levels. While the residual impacts of the project will have an impact on the local environment, the extent of the benefits associated with the implementation of the projects will benefit a much larger group of people, in terms of renewable energy supply and positive local and regional economic impact.

A wake effect analysis study was commissioned by InnoWind, to determine, what effect, if any, the proposed San Kraal Development will have on the operational Noupoort Wind Farm. The study concluded that the operation of the San Kraal WEF will potentially result in a 0.96% loss for the Noupoort Wind Farm (under certain wind flow, speed and wind turbine specifications). InnoWind has engaged and will continue to engage, with Mainstream regarding the wake effect that will have a potential impact on the Noupoort Wind Farm's energy production once the San Kraal WEF becomes operational.

InnoWind will agree to provide Noupoort Wind Farm with equitable compensation for its loss of production as a result of the wake effect caused by the San Kraal WEF's operations.

To this end InnoWind will negotiate fair compensation with Mainstream in good faith, when San Kraal WEF reaches preferred bidder status in the REIPPP, or any other renewable energy program, and before San Kraal reaches Financial Close. This negotiation is subject to Mainstream cooperating with InnoWind during this process, in good faith without causing any unreasonable delays or interference.

InnoWind will appoint (at its own cost) with Mainstream's prior written consent, which shall not be unreasonably delayed or withheld, an additional independent third-party specialist study that will quantify the loss of production, the Noupoort Wind Farm will incur as a result of the wake effects caused by the San Kraal WEF based on the final layout and turbine model as submitted to DEA for approval, prior to initiating the construction phase**.**

Based on the above, and the findings of the specialists studies, this EIA study has concluded that there are no negative high residual impacts, or potentially high cumulative impacts associated with the proposed development, and the proposed San Kraal WEF should be authorised with certain conditions.

ABBREVIATIONS, ACRONYMS AND UNITS

AGA	Astronomy Geographic Advantage Act, 2007 (Act No 27 of 2007)
ATNS	Air Traffic and Navigation Services SOC Limited
BGIS	Biodiversity Geographic Information System
BID	Background Information Document
CARA	Conservation of Agricultural Resources, 1983 (Act No. 43 of 1983)
CBA	Critical Biodiversity Area
CCRS	Climate Change Response Strategy
CSP	Concentrated Solar Power
DAFF	Department of Agriculture, Forestry and Fisheries
dB	Decibel
DEA	Department of Environmental Affairs (National)
DENC	Department of Environment and Nature Conservation (Northern Cape)
DENC	Provincial Department of Environmental Affairs and Nature Conservation
DoE	Department Of Energy
DSR	Draft Scoping Report
DWA	Department of Water Affairs
EAP	Environmental Assessment Practitioner
ECA	Environment Conservation Act, 1989 No. 73 of 1989)
EIA	Environmental Impact Assessment
EIR	Environmental Impact Report
EMPr	Environmental Management Programme
ESA	Ecological Support Area
ESA	Early Stone Age
Eskom	Eskom Holdings SOC Limited
EWT	Endangered Wildlife Trust
FEPA	Freshwater Ecosystem Priority Area
FSR	Final Scoping Report
GHG	Greenhouse Gas
GIS	Geographical Information Systems
GNR	Government Notice Regulation
GPS	Global Positioning System
GWh	Gigawatt hour
HDI	Historically Disadvantaged Individuals
HIA	Heritage Impact Assessment
HV	High Voltage
Hz	Hertz
I&AP	Interested and Affected Party
IDP	Integrated Development Plan
IEM	Integrated Environmental Management
IPP	Independent Power Producer
IRP	Integrated Resource Plan
kV	Kilovolt
kWh	Kilowatt Hours
LSA	Late Stone Age
mamsl	Meters above mean sea level
MSA	Middle Stone Age
MW	Megawatt
NCR	Noise Control Regulations
NDP	National Development Plan
NEMA	National Environmental Management Act, 1998 (Act No. 107 of 1998)
NFEPA	National Freshwater Ecosystem Priority Area
NHRA	National Heritage Resources Act, 1999 (Act No. 25 of 1999)
NSD	Noise-sensitive Developments
NWA	National Water Act, 1998 (Act No. 36 of 1998)
PES	Present Ecological State
PGDS	Provincial Growth and Development Strategy
PICC	Presidential Infrastructure Coordinating Committee
PPA	Power Purchase Agreement
PPP	Public Participation Process
PSDF	Provincial Spatial Development Framework
PSEIA	Plan of Study for EIA
PV	Solar photovoltaic
RBS	Revised Balanced Scenario
RE	Renewable Energy
REIPPPP	Renewable Energy Independent Power Producer Procurement Programme
RSH	Rotor Swept Height

SABAAP	South African Bat Assessment Advisory Panel
SABIF	South African Biodiversity Information Facility
SABS	South African Bureau of Standards
SAHRA	South African Heritage Resources Agency
SAHRIS	South African Heritage Resources Information System
SALT	Southern African Large Telescope
SANBI	South African National Biodiversity Institute
SANRAL	South African National Roads Agency Limited
SANS	South African National Standards
SCADA	Supervisory Control and Data Acquisition
SDF	Spatial Development Framework
SDIP	Sustainable Development Implementation Plan
SEA	Strategic Environmental Assessment
SES	Sustainable Energy Strategy
SHEQ	Safety Health Environment and Quality
SIA	Social Impact Assessment
SIPS	Strategic Integrated Projects
SKA	Square Kilometre Array Project
SODAR	Sonic Detection and Ranging
SPV	Special Project Vehicle
TWI	Total Wetness Index
WEF	Wind Energy Facility
WHO	World Health Organisation
WTG	Wind Turbine Generator
WULA	Water Use License Application

GLOSSARY OF TERMS

'Do nothing' alternative or 'no-go option'	The 'do nothing' alternative, or 'no go' option is the option of not undertaking the proposed activity or any of its alternatives. The 'do nothing' alternative also provides the baseline against which the impacts of other alternatives should be compared.
Ambient noise	The all-encompassing sound at a point being composed of sounds from many sources both near and far. It includes the noise from the noise source under investigation.
Ambient sound level	The level of the ambient sound indicated on a sound level meter in the absence of the sound under investigation (e.g. sound from a particular noise source or sound generated for test purposes). Ambient sound level as per Noise Control Regulations.
Amplitude modulated sound	A sound that noticeably fluctuates in loudness over time.
Archaeology	Remains resulting from human activity which are in a state of disuse and are in or on land and which are older than 100 years, including artefacts, human and hominid remains and artificial features and structures.
Attenuation	Term used to indicate reduction of noise or vibration, by whatever method necessary, usually expressed in decibels.
Broadband noise	Spectrum consisting of a large number of frequency components, none of which is individually dominant.
Calcrete	A soft sandy calcium carbonate rock related to limestone which often forms in arid areas.
Cultural landscape	The combined works of people and natural processes as manifested in the form of a landscape
Cumulative impacts	Impacts that result from the incremental impact of the proposed activity on a common resource when added to the impacts of other past, present or reasonably foreseeable future activities
Cut-in speed	The minimum wind speed at which the wind turbine will generate usable power.
Cut-out speed	The wind speed at which shut down occurs.
Early Stone Age	The archaeology of the Stone Age between 700 000 and 2500 000 years ago.
Environmental management programme (EMPr)	An operational programme that organises and co-ordinates mitigation, rehabilitation and monitoring measures in order to guide the implementation of a proposal and its ongoing maintenance after implementation.
Fossil:	Mineralised bones of animals, shellfish, plants and marine animals. A trace fossil is the track or footprint of a fossil animal that is preserved in stone or consolidated sediment.
Generator	The generator is what converts the turning motion of a wind turbine's blades into electricity
Heritage	That which is inherited and forms part of the National Estate (Historical places, objects, fossils as defined by the National Heritage Resources Act 25 of 1999.
Holocene	The most recent geological time period which commenced 10 000 years ago.
Late Stone Age	The archaeology of the last 20 000 years associated with fully modern people.
Midden	A pile of debris, normally shellfish and bone that have accumulated as a result of human activity.
Middle Stone Age	The archaeology of the Stone Age between 20-300 000 years ago associated with early modern humans.
Miocene	A geological time period (of 23 million - 5 million years ago).
Nacelle	The nacelle contains the generator, control equipment, gearbox and anemometer for monitoring the wind speed and direction.
Palaeontology	Any fossilised remains or fossil trace of animals or plants which lived in the geological past, other than fossil fuels or fossiliferous rock intended for industrial use, and any site which contains such fossilised remains or trace.
Palaeosole	An ancient land surface.
Pleistocene	A geological time period (of 3 million – 20 000 years ago).
Pliocene	A geological time period (of 5 million – 3 million years ago).

Rotor	The portion of the wind turbine that collects energy from the wind is called the rotor. The rotor converts the energy in the wind into rotational energy to turn the generator. The rotor has three blades that rotate at a constant speed of about 15 to 28 revolutions per minute (rpm).
Structure (historic)	Any building, works, device or other facility made by people and which is fixed to land, and includes any fixtures, fittings and equipment associated therewith. Protected structures are those which are over 60 years old.
Tower	The tower supports the rotor, and is constructed from tubular steel and/or concrete. The nacelle and the rotor are attached to the top of the tower. The tower raises the wind turbine so that its blades safely clear the ground in order to reach the stronger winds at higher elevations. Large modern wind turbines are usually mounted on towers ranging from 80 to 130 m tall. The tower must be strong enough to support the wind turbine and to sustain vibration, wind loading and the overall weather elements for the lifetime of the wind turbine.
Wind rose	The diagrammatic representation of joint wind speed and direction distribution at a particular location. The length of time that the wind comes from a particular sector is shown by the length of the spoke, and the speed is shown by the thickness of the spoke.

DEPARTMENT OF ENVIRONMENTAL AFFAIRS INFORMATION REQUIREMENTS FOR WIND FARM APPLICATIONS

The Department of Environmental Affairs' requirements for information for all applications for Wind Energy Facilities (WEFs) is included in this section of the report. Where this information is not provided in the tables below, the location of where it can be found in the report is indicated.

Table A: DEA Information Requirements – WEF and Grid Connection General Site Information

Description	Report Reference
Descriptions of all affected farm portions	Section 3
21 digit Surveyor General codes of all affected farm portions	Section 3
Copies of deeds of all affected farm portions	Landowner consent forms and title deeds were submitted to the DEA with the application form.
Photos of areas that give a visual perspective of all parts of the site	Section 7 Volume II: Visual Specialist Report
Photographs from sensitive visual receptors (tourism routes, tourism facilities, etc.)	Section 8 Volume II: Visual Specialist Report
Wind plant design specifications including:	
Type of technology	Wind turbine electricity generators
Structure height (Tip Height)	225 m (Hub height of 150 m with blade length of 75 m)
Surface area to be covered (including associated infrastructure such as roads)	150 ha
Structure orientation	Vertical turbines to be spread across the site, as well as ancillary infrastructure, such as the substation and overhead power lines.
Laydown area dimensions (Construction period and Operation)	Approximately 7500 m² per turbine.
Generation capacity of the facility as a whole at delivery points	390 MW

Table B: DEA Information Requirements – WEF Technical Details

Component	Description/Dimensions
Location of the site	South East of the town of Noupoort within the Umsobomvu Local Municipality in the Northern Cape Province and the Inxuba Yethemba Local Municipality in the Eastern Cape Province
Facility Area	10 511.51 ha (Site Boundary)
Number of Turbines	Up to 78
Hub Height	150 m
Blade Length	75 m
Rotor Diameter	150 m

Component	Description/Dimensions
Area occupied by inverter transformer stations/substations	10 000 m^2 switching station + 180 000 m^2 on-site substation & OMS complex
Capacity of on-site substation	2 x 80 MVA
Area occupied by both permanent and construction laydown areas	up to 675 000 m^2
Operations and maintenance buildings (O&M building) with parking area	180 000 m^2 (includes on-site substation)
Length of internal roads	53 km
Width of internal roads	During the construction of the WEF up to 14 m wide internal roads will be required to allow large delivery vehicles and cranes to turn. These internal roads will be rehabilitated to 8 m roads for use during the operational phase of the WEF.
Proximity to grid connection	Approximately 25 km to proposed Umsobomvu Substation
Height of fencing	Up to 3 m around switching stations and offices
Type of fencing	Palisade and/or diamond mesh

Table C: DEA Information Requirements – Grid Connection Technical Details

Component	Description/Dimensions
Height of pylons	Up to 30 m
Length of transmission line	25 km
Type of poles used	Concrete monopoles
Area occupied by pylon servitude	34 m in width
Transmission capacity	132 kV
Area occupied by both permanent and construction laydown areas	600 m x 600 m
Area occupied by buildings	Not applicable
Length of service road	25 km
Width of service road	4 m
Proximity to grid connection	25 km
Height of fencing	Not applicable
Type of fencing	Not applicable

Table D: DEA Information Requirements - Site Maps and GIS Information

Site Maps and GIS Information	Section of this Report
All maps/information layers must also be provided in ESRI Shapefile format.	
All affected farm portions must be indicated.	Figure 6.1 Proposed Site Development Plan
The exact site of the application must be indicated (the areas that will be occupied by the application).	Figure 1.1 Site Location Figure 6.1 Proposed Site Development Plan
A *status quo* map/layer must be provided that includes the following: Current use of land on the site including:	
Buildings and other structures	Figure 8.11 Potential Noise-sensitive Developments
Agricultural fields	Figure 8.3 Land Cover and Land Use
Grazing areas	Figure 8.3 Land Cover and Land Use
Natural vegetation areas (natural veld not cultivated for the preceding 10 years) with an indication of the vegetation quality as well as fine scale mapping in respect of Critical Biodiversity Areas and Ecological Support Areas	Figure 8.6 Vegetation Types and NCPAES AReas Figure 8.7 Critical Biodiversity Areas
Critically endangered and endangered vegetation areas that occur on the site	Figure 8.8 Ecological Sensitivity
Bare areas which may be susceptible to soil erosion	No specific bare areas have been identified. During construction phase, vegetation removal will be confined to the smallest possible footprint, runoff will be controlled and site-specific measures will be devised for any potentially high risk areas.
Cultural historical sites and elements	Figure 11.1 Environmental Sensitivity
Rivers, streams and water courses	Figure 8.5 Watercourses in the Proposed Development Site
Ridgelines and 20 m continuous contours with height references in the GIS database	Figure 7.4 Slope Analysis Map
Fountains, boreholes, dams (in-stream as well as off-stream) and reservoirs	Figure 8.4 Quaternary Catchments and Mainstem Rivers within the Region Figure 8.5 Watercourses in the Proposed Development Site

Site Maps and GIS Information	**Section of this Report**
High potential agricultural areas as defined by the Department of Agriculture, Forestry and Fisheries	No high potential agricultural areas within the proposed development site. Figure 8.3 Land Cover and Land Use
Buffer zones (also where it is dictated by elements outside the site): **500 m from any irrigated agricultural land** **1 km from residential areas**	Figure 11.1 Environmental Sensitivity
Indicate isolated residential, tourism facilities on or within 1 km of the site	Figure 8.3 Land Cover and Land Use Figure 8.11 Potential Noise Sensitive Receptors Figure 8.13 Sensitive and Potentially Sensitive Visual receptors
A slope analysis map/layer that include the following slope ranges: **Less than 8% slope (preferred areas for turbines and infrastructure)** **Between 8% and 12% slope (potentially sensitive to turbines and infrastructure) Between 12%and 14% slope (highly sensitive to turbines and infrastructure)** **Steeper than 18% slope (unsuitable for turbines and infrastructure)**	Figure 7.4 Slope Analysis Map
A map/layer that indicate locations of birds and bats including roosting and foraging areas	Figure 8.9 Avifaunal Sensitivity Map Figure 8.10 Bat Sensitivity Map
A site development proposal map(s)/layer(s) that indicate: **Turbine positions** **Foundation footprint** **Permanent laydown area footprint** **Construction period laydown footprint** **Internal roads indicating width (construction period width and operation period width) and with numbered sections between the other site elements which they serve (to make commenting on sections possible).**	Figure 6.1 Proposed Site Development Plan
River, stream and water crossing of roads and cables indicating the type of bridging structures that will be used.	Figure 6.1 Proposed Site Development Plan
Substation(s) and/or transformer(s) sites including their entire footprint.	Figure 6.1 Proposed Site Development Plan

Site Maps and GIS Information	Section of this Report
Cable routes and trench dimensions (where they are not along internal roads) Connection routes to the distribution/transmission network (the connection must form part of the EIA even if the construction and maintenance thereof will be done by another entity such as ESKOM).	Figure 6.1 Proposed Site Development Plan Figure 7.1 Grid Connection Route Alternative and Land Parcels
Cut and fill areas at turbine sites along roads and at substation/transformer sites indicating the expected volume of each cut and fill	Figure 6.1 Proposed Site Development Plan
Borrow pits	No borrow pits on site. Licenced borrow pits will be used to source material.
Spoil heaps (temporary for topsoil and subsoil and permanently for excess material) Buildings including accommodation	Temporary and permanent spoil heaps will be kept within demarcated construction areas, and monitored by the ECO during the construction phase.

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1 INTRODUCTION

Arcus Consultancy Services South Africa (Pty) Ltd has been appointed by San Kraal Wind Power (Pty) Ltd to conduct the Environmental Impact Assessment (EIA) process as required by the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA), as amended, for the proposed development of the San Kraal 390 MW Wind Energy Facility (WEF) and its associated infrastructure, including its grid connection.

The proposed development aims to generate and produce electricity from renewable wind energy sources in order to supply electricity into the national grid by connecting the proposed WEF and its electrical infrastructure to the proposed Umsobomvu 132/400kV Substation, which also forms part of Eskom's Transmission Development Plan 2016-2025.

The WEF would deliver electricity into the existing Eskom electricity grid via a high voltage grid connection. The proposed development site is situated approximately 58 km south of Colesberg and 6 km south east of the town of Noupoort in the Northern Cape Province, bordering the Eastern Cape Province (Figure 1.1).

InnoWind (Pty) Ltd has established San Kraal Wind Power (Pty) Ltd, a Special Purpose Vehicle (SPV), in order to obtain an Environmental Authorisation and preferred bidder status for the proposed development. The proposed development will apply for an operational lifespan of twenty years through the REIPPPP.

1.1 Aims and Purpose of this Report

The purpose of this EIA Report is to present the environmental impact assessment undertaken on the preferred alternative for the proposed development. The preferred, site, layout, and technical specifications, were assessed by the specialists and their findings and assessment are collated in this EIA report. This EIA report will provide sufficient information for the competent authority to make an informed decision on the proposed development. The report further addresses comment received during the public participation process.

1.2 Overview of the EIA Process

The National Environment Management Act, 1998 (Act No 107 of 1998) (NEMA) promotes the use of scoping and EIA in order to ensure the integrated environmental management of activities.

Section 24(1) of NEMA states:

"In order to give effect to the general objectives of integrated environmental management laid down in this Chapter, the potential impact on the environment of listed activities must be considered, investigated, assessed and reported to the competent authority charged by this Act with granting the relevant environmental authorisation."

EIA is ultimately a decision-making process with the specific aim of selecting an option that will provide the most benefit, and cause the least impact. The EIA process should identify activities which may have a detrimental effect on the environment, and which would therefore require Environmental Authorisation prior to commencement.

The EIA process commences with formally notifying the DEA (the competent authority for renewable energy developments) of the proposed development by the submission of application forms. Following the notification, the EAP, along with the team of technical specialists, will commence the scoping phase, in order to inform decisions of the appropriate "scope" of the EIA process. This involves establishing the existing environmental baseline of the site proposed for development, considering the type of development and its potential impacts on the existing environment, and therefore determining what potential impacts should be assessed and how, within the EIA process. The EAP therefore compiles a Draft Scoping Report which is made available for public and stakeholder comment for a prescribed consultation period. All comments received in response to the DSR was be considered and as appropriate incorporated into the FSR and PSEIA.

The FSR and PSEIA has been submitted to the DEA, as the competent authority, for approval. Interested and Affected Parties (I&APs) were able to comment on the FSR and PSEIA by submitting their comments directly to the DEA.

The DEA accepted the FSR on 10 November 2017. This marks the formal end of the scoping phase, after which the EAP undertakes the EIA and compiles the Draft EIA Report (DEIAR) which is then, like the Draft Scoping Report, made available for public and stakeholder comment for a period of 30 days (this document). Any comments will then be considered and incorporated as applicable into a Final EIA Report (FEIAR). I&APs will then be notified of the availability of the FEIAR and advised that should they like to comment on the report, they must submit their comments directly to the DEA (contact details of the DEA will be included in the notification documents).

Once a FEIAR has been submitted, the competent authority (the DEA) will make a decision on whether to grant or refuse Environmental Authorisation.

1.3 DEA Requirements

In November 2017, the DEA accepted the final scoping report for the proposed development, included in the acceptance letter was a list of requirements to be undertaken for the EIA phase.

Table 1.1 below summarises the comments received from the DEA on the final scoping report. This table further indicates where in this report the comments have been addressed.

Table 1.1: Comments Received from DEA on Final Scoping Report

No.	Comment from DEA	EAP Response	Section in Report
1	All comments and recommendations made by all stakeholders and Interested and Affected Parties (I&APs) in the draft SR and submitted as part of the final SR must be taken into consideration when preparing an Environmental Impact Assessment report (EIAr).	All comments and recommendations by stakeholders and I&APs have been addressed and considered and form part of the Issues Trail	App C: Comments & Response Report Table 4.1: Issue Trail
2	All mitigation measures and recommendations in the specialist studies are addressed and included in the final EIAr and Environmental Management Programme (EMPr).	All mitigation measures have been included in the EIAr impact tables and the EMPr	Section 10 Assessment of Potential Impacts App B: EMPr
3	Ensure that comments from all relevant stakeholders are submitted to the Department with the final EIAr.	Copies of all comments received are included in the Issues Trail	App C: Comments & Response Report
4	Address all issues raised by Organs of State and I&APs prior to the submission of the EIAr to the Department.	All issues raised have been collated in the issues trail and responded to. Copies of all correspondence is included in the Comments & Response Report	Table 4.1 Issues Trail App C: Comments & Response Report
5	Proof of correspondence with the various stakeholders must be included in the EIAr. Should you be unable to obtain comments, proof should be submitted to the Department of the attempts that were made to obtain comments.	Proof of all correspondence including sent emails, delivery notifications and read receipts as well as registered mail are included.	App C: Comments & Response Report
6	The EAP must, in order to give effect to Regulation 8, give registered I&APs access to, and an opportunity to comment on the report in writing within 30 days before submitting the final EIAr to the Department.	All I&APs will be given an opportunity to comment on the EIA report for a period of 30 days. All comments received will be included and responded to prior to submission to the DEA.	Table 4.1 Issues Trail App C: Comments & Response Report Table
7	The EIAr must provide an assessment of the impacts and mitigation measures for each of the listed activities applied for.	All specialists have assessed the proposed project in relation to the listed activities applied for and provided mitigation measures.	Section 10: Assessment of Potential Impacts Volume II: Specialist Reports
8	The listed activities represented in the EIAr and the application form must be the same and correct.	The correct listed activities are supplied in the EIAr and amended application form submitted with the EIAr.	Section 2, Table 2.1: Listed activities applied for Application Form

9	The correct sub-listed activity of Activity 56 of Listing Notice 1 must be provide for and assessed.	The sub-listed activity 56 has been corrected to (ii).	Section 2, Table 2.1: Listed activities applied for Application Form
10	Address relevance of Activity 6 of Listing Notice 2.	This activity is relevant as applicant would need to construct bridges over rivers and streams as part of the roads. This could result in the pollution, albeit temporary, of rivers/streams on site. All crossings of rivers would require a Water Use License in terms of the National Water Act, 1998 (Act No. 36 of 1998). These river crossings have been identified by the freshwater ecologist in this EIR.	Section 8.4 Freshwater and Wetlands
11	The correct and specific geographical areas for all activities applied for under Listing Notice 3 must be provided for and assessed in the EIAr.	The correct listed activities are supplied in the EIAr and amended application form	Section 2, Table 2.1: Listed activities applied for Application Form
12	Address applicability of Activity 10 of Listing Notice 3. This activity must be adequately assessed and the specific quantities must be provided for.	This listed activity is not applicable. The application form has been amended accordingly.	Section 2, Table 2.1: Listed activities applied for Application Form
13	The correct sub-listed activity of Activity 14 of Listing Notice 3 must be provide for and assessed.	This listed activity is no longer applicable. No bridges exceeding 10 m^2 will be constructed	Section 2, Table 2.1: Listed activities applied for Application Form
14	The EIAr must provide the technical details for the proposed facility in a table format as well as their description and/or dimensions.	Technical details of the proposed facility are presented	Table B & C: DEA Information Requirements WEF and Grid Connection Technical Details page viii-xix
15	The EIAr must provide the four corner coordinate points for the proposed development site.	A list of coordinates of all bend points of the proposed development site is presented.	Figure 7.3 Proposed Development Site Corner Coordinate
16	The EIAr must provide clear indication of the envisioned area for the proposed wind energy facility.	A detailed proposed final mitigated development layout is presented	Figure 6.1 Proposed Site Development Plan

17	The EIAr must provide clear description of all associated infrastructure. This description must include, but is not limited to the following: Powerlines; Internal roads infrastructure; all supporting on-site infrastructure such as laydown area, guard house and control room etc.; and all necessary details regarding all possible locations and sizes of the proposed satellite substation and the main substation.	A detailed description of the proposed development is presented the project description and proposed site development map	Section 7 The Preferred Alternative Figure 6.1 Proposed Site Development Plan
18	EIAr must also include a comments and response report.	A C&RR is presented	Volume I, App C: Comments & Response Report
19	The Comments and Responses Report must not include comments for the adjacent proposed Phezukomoya WEF.	All comments relating only to the adjacent proposed Phezukomoya WEF have been removed.	Volume I, App C: Comments & Response Report
20	The EIAr must include the detail inclusive of the PPP in accordance with Regulation 41 of the EIA Regulations as amended.	The PPP has been conducted in accordance with regulation 41, with evidence supplied	Volume I, App C: Comments & Response Report
21	Details of the future plans for the site and infrastructure after decommissioning in 20-30 years and the possibility of upgrading the proposed infrastructure to more advanced technologies.	San Kraal Wind Power will either operate the facility for 20 years (duration of PPA with Eskom) and then decommission the plant and rehabilitate the site. Should San Kraal Wind Power manage to secure a new PPA, the project will be repowered to continue its operation for a further 10 to 20 years. It is impossible at this stage to anticipate the kind of advanced wind technology that will be available in the distant future. In the event that the technology changes significantly, San Kraal Wind Power will engage with DEA to understand what additional requirements might need to be fulfilled in order to be authorised to use more advanced technology on the site.	Section 7 The Preferred Alternative
22	All specialist studies must be undertaken in the most appropriate time, and detailed reasons must be provided for why the study was undertaken during the said period.	All specialist studies include a statement on the timing of the study.	Volume II: Specialist Studies

23	Where specialist studies were conducted in-house of by a specialist other than a suitably qualified specialist in the relevant field	No specialist studies were conducted in house and all specialists are suitably qualified in their relevant fields.	Volume II: Specialist Studies: Declarations of Independence & CV's
24	All turbines located in the "not preferred" and •no-go" areas must be relocated or removed from the development.	The final mitigated layout does not include any turbines in the high sensitivity and no go areas.	Fig 6.1 Proposed Site Development Plan
25	The EIAr must adhere to all the comments issued by this Department on the Draft SR dated 19 September 2017	All comments on the DSR have been addressed and responded to.	Table 4.1 Issues Trail
26	Comments received in the initial application which lapsed must still be responded to.	All comments and responses from the lapsed application are included in the Issues Trail and Comments & Response Report and addressed in the EIAr.	App C: Comments & Response Report Table 4.1: Issues Trail
27	A number of neighbouring farmers have raised their concerns regarding the impact of the proposed development on their properties. As such a Property Evaluation Study must be undertaken.	The two parties that commented on property values have retracted their comments, as they were referring to the already authorised Umsobomvu Wind Energy Facility. They have no comment on the San Kraal application. Evidence of this is provided.	App C: Comments & Response Report Table 4.1: Issues Trail
28	The EAP is advised to include all applicable Development Management Plans and provincial legislation for the part of the site located within the Eastern Cape Province.	All information for the Eastern Cape has been added to the EIA report.	Section 2: Environmental Legal Framework Volume II: Social Impact Assessment Specialist Report
29	The Ecological Study indicates that the ecological sensitivity of the different units identified in the mapping procedure was rated according to low, medium, high and very high ratings. However, on the broad-scale ecological sensitivity map, there are medium-low and medium-high ratings which are not defined in the Ecological Study.	The Ecological specialist has amended the Ecological Impact Assessment Specialist Report to define all mapped categories.	Section 3 Methodology: 3.2.3 Flora and Fauna; 3.2.3.3 Sensitivity Mapping & Assessment Volume II: Ecological Impact Assessment Specialist Report
30	An extensive site inspection must be conducted during the areas rainy season (December to March) to determine if there are any sensitive species that will be affected by the development.	The Ecology specialist has confirmed that the site visit was conducted in the rainy season for that area.	Section 3 Methodology: 3.2.3 Flora and Fauna: 3.2.3.2 Site visits Volume II: Ecological Impact Assessment Specialist Report

31	The proposed buffers as depicted on Figure 7 of the avifaunal specialist report locates circular sensitivity buffers in the middle of the development area with no accompanying buffered passage flight path. The avifaunal specialist is required to provide further motivation for this and clearly indicate birds' movement patters within the development area.	The aim of the two circular buffers is to prevent disturbance of the Blue Cranes potentially breeding in the immediate vicinity of the two pans. It is not aimed at preventing collisions. The locality of Blue Crane sightings at the site is shown in Figure 6 of the Avifaunal Impact Assessment Report.	Volume II: Avifaunal Impact Assessment Specialist Report
32	The avifaunal specialist must provide an overview of bird movements along the Southern Great Escarpment and especially discuss the possibility of migration routes in the study area.	No evidence could be found of a well-defined, recognised avifaunal, migratory fly-way along the Southern Great Escarpment, such as for example in the Great Rift valley in East Africa. A 12-months pre-construction monitoring programme was implemented assess the importance of the site for priority avifauna. The presence of migrating birds at the site was recorded and factored into the assessments and mitigation measures. The presence of migratory species at he proposed site is linked to the presence of food, and not topography.	Volume II: Avifaunal Impact Assessment Specialist Report
33	Sensitivity buffers as depicted on Figure 6 of the Bat Specialist Report shows, in some instances, an overlap of the moderate and high sensitivity buffers. The Department is of the view that such overlay areas be designated very high sensitive areas due to the affected areas being important for both foraging and roosting.	Both moderate and high sensitivity is important for both foraging and roosting, the high sensitivity is just more important for foraging and roosting than the moderate sensitivity. So where the overlap the high sensitivity automatically takes priority and such an area is deemed a high sensitivity, but it's more sensitivity than other high sensitivity areas.	Volume II: Bat Impact Assessment Specialist Report

34	The Avifaunal and Bat Specialist assessments must assess and make recommendations at definite measurements for the preferred hub heights and rotor diameter	<u>Avifauna</u> The assumption that a larger rotor-swept area will automatically increase the risk of collision is questionable. While the assumption seems to make intuitive sense, it should be noted that the majority of published scientific studies indicate that an increase in rotor swept area do not automatically translate into a larger collision risk. Turbine dimensions seem to play an insignificant role in the magnitude of the collision risk in general, relative to other factors such as topography, turbine location, morphology and a species' inherent ability to avoid the turbines, and may only be relevant in combination with other factors, particularly wind strength and topography (see Howell 1997, Barrios & Rodriguez 2004; Barclay et al. 2007, Krijgsveld et al. 2009, Smallwood 2013; Everaert 2014). Only two studies found a correlation between turbine hub height and mortality (De Lucas et al. 2008; Loss et al. 2013). It is therefore deemed unnecessary to provide a specific recommendation as far as hub height and rotor diameter is concerned, from avifaunal perspective. <u>Bats</u> The guidelines request measurements at standard heights to cater for change in turbine dimensions later on and also make data sets across sites comparable. it is possible that increased turbine dimensions would increase potential impacts to bats, however based on the low bat activity levels as assessed from pre-construction monitoring data, the specialist has no objection to the proposed hub height and rotor diameter, as assessed in the bat impact assessment report.	The bat specialist and avifaunal specialist have responded to these comments in their reports Volume II: Bat Impact Assessment Specialist Report and Avifaunal Impact Assessment Report

35	A significant amount of materials and equipment will be delivered to the site during the construction phase of the development and will thus have impacts on the environment. The impacts of this activity must be fully identified and assessed. A Traffic Impact Assessment must form part of the EIAr and the terms of reference must include, inter alia the following: Evaluate the impacts of the proposed development on existing road network and traffic volumes. The study must determine the specific traffic needs during the different phases of implementation, namely wind turbine construction and installation, operation and decommissioning; Identify the position and suitability of the preferred access road alternative; Evaluate the roadway capacity of the road network; Confirm the associated clearances required for the necessary equipment to be transported from the point of delivery to the various sites; Confirm freight and transport requirements during construction, operation and maintenance; Propose origins and destinations of equipment; and Determine (Abnormal) Permit requirements if any.	A full Traffic Impact Assessment has been conducted and is included in the EIAr.	Section 7.7 Transportation of Wind Turbine Components to Site Volume II: Specialist Traffic Impact Assessment
36	This Department requires specialist input on cumulative impact of the loss of agricultural land on the site and within the area.	The soil specialist has given a written statement that the cumulative level of impact of the proposed development is very low and the site has poor agricultural potential.	Volume II: Soil Specialist Cumulative Impact Statement
37	Comments from Eastern Cape Parks and the Northern Cape Department of Environment and Nature Conservation must be sought.	These stakeholders are on the I&AP database and they are receiving invitations to comment on this report. All comments received will be included in the Issues Trail	App C: Comments & Response Report: Proof of Registered Mail
38	The EIAr must provide a detailed description of the need and desirability, for clean energy in South Africa of the proposed activity and indicate if the proposed development is needed in the region and if the current proposed location is desirable for the proposed activity compared to other sites. The need and desirability must take into account cumulative impacts of the proposed development in the area.	Need & Desirability is discussed in detail.	Section 5 Need & Desirability

39	All available biodiversity information must be used in the finalisation of the layout map. Existing infrastructure must be used as far as possible e.g. roads. The layout map must indicate the following: Wind turbine positions and its associated infrastructure; Permanent laydown area footprint; Internal roads indicating width (construction period width and operation period width} and with numbered sections between the other site elements which they serve (to make commenting on sections possible}; Wetlands, drainage lines, rivers, stream and water crossing of roads and cables indicating the type of bridging structures that will be used; The location of sensitive environmental features on site e.g. CBAs, heritage sites, wetlands, drainage lines etc. that will be affected by the facility and its associated infrastructure; Substation(s) and/or transformer(s} sites including their entire footprint; Connection routes (including pylon positions) to the distribution / transmission network; All existing infrastructure on the site, especially roads; Buffer areas; Buildings, including accommodation; and All "no-go" areas.	All available biodiversity information and requested has been included and used in the finalisation of the layout map.	Figures 6.1; 7.1; 7.3; 8.4; 8.5; 8.6; 8.7; 11.1
40	An environmental sensitivity map indicating environmental sensitive areas and features identified during the EIA process.	A sensitivity map has been produced and included in this EIA report.	Figure 11.1 & 11.2
41	A map combining the final layout map superimposed (overlain) on the environmental sensitivity map.	A map combining the final layout overlain on the sites environmental sensitivity is included in this EIA report.	Figure 11.1 & 11.2
42	A shapefile of the preferred development layout/footprint must be submitted to this Department.	A shapefile is being submitted to the department via a CD with the FEIAr	Electronic copy included to DEA.
43	The EMPr to be submitted as part of the EIAr	EMPr is included and will be submitted with the FEIAr.	App B: EMPr

1.4 The Applicant

InnoWind is a South African registered company dedicated to the development of wind energy projects which develops, finances, builds, owns and operates commercial wind-powered generation facilities to supply energy into the national power grid.

To date, InnoWind has been awarded four wind energy projects under the renewable energy independent power producer procurement (REIPPP) programme of the Department of Energy (DoE) amounting to 139 MW. These include the Chaba (Komga), Waainek (Grahamstown), Grassridge (Port Elizabeth) and Riverbank (Wesley-Ciskei) wind power projects, all located in the Eastern Cape.

In accordance with the REIPPPP bid requirements, InnoWind established San Kraal Wind Power (Pty) Ltd as a Special Purpose Vehicle (SPV) that will be used to own all the authorisations, contracts, permits and licenses required to lawfully build and operate the Proposed San Kraal WEF.

1.5 The Environmental Assessment Practitioner

The co-ordination and management of this EIA process is being conducted by Arcus Consultancy Services South Africa (Pty) Ltd ('Arcus') with the lead EAP being Ashlin Bodasing. Refer to Appendix A for the EAP's Declaration of Interest and *Curriculum Vita*.

Ashlin Bodasing

Qualifications	Bachelor of Social Science (Geography and Environmental Management)
Experience in Years	11 years
Experience	Ashlin Bodasing is the Team Leader at Arcus Consulting, located in Cape Town. Having obtained her Bachelor of Social Science Degree from the University of Kwa-Zulu Natal; she has over 10 years' experience in the environmental consulting industry in southern Africa. She has gained extensive experience in the field of Integrated Environmental Management, environmental impact assessments and public participation. She has also been actively involved in a number of industrial and infrastructural projects, including electricity power lines and substations; road and water infrastructure upgrades and the installation of telecommunication equipment and as well green field coal mines, as well as renewable energy facilities, both wind and solar. Ashlin has major project experience in the development of Environmental Impact Assessments, Environmental Management Plans and the monitoring of construction activities. Her areas of expertise include project management, environmental scoping and impact assessments, environmental management plans, environmental compliance monitoring and environmental feasibility studies. Experience also includes International Finance Corporation Performance Standards and World Bank Environmental Guidelines environmental reviews. She has worked in Mozambique, Botswana, Lesotho and Zimbabwe.

Anja Albertyn

Qualifications	Master of Science (Zoology)
Experience in Years	8 years
Experience	Anja Albertyn has worked at Arcus Consultancy Services since November 2013. She is registered with SACNASP as a professional natural scientist in the field of ecological science. She has five years of experience as an environmental consultant, and eight years of work experience in ornithology. She has worked on over 24 renewable energy development projects, including acting as avifaunal specialist on many of these. Anja also functions as Arcus' GIS specialist in Cape Town. As an EAP she has contributed to 6 large scale wind energy facility applications to date. Anja started her professional career as an environmental consultant in 2009 after graduating with a Master of

Science in Zoology (Ornithology) from the Percy FitzPatrick Institute of African Ornithology at the University of Cape Town. She oversaw a large-scale ballast water treatment testing project for an environmental consultancy for over two years. Thereafter she worked as an avifaunal observer on a variety of projects for over two years with the majority being pre-construction avifaunal monitoring projects on proposed wind energy developments. She is currently in the position of Avifauna Specialist and Environmental Assessment Practitioner.

Arcus is a specialist environmental consultancy providing environmental services to the renewable energy market. Arcus has advised on over 150 renewable energy projects in the United Kingdom and South Africa, with environmental management and in-house specialist services.

1.5.1 The Specialists

The EAPs have assembled a team of technical specialists to undertake studies for the proposed San Kraal WEF.

The specialists' fields of investigation are listed in Table 1.2 below. The areas of investigation have been identified as relevant to the proposed development as per the experience of the EAP, consultation with the listed specialists who are familiar with the locality and nature of development. Should further topics be identified in the scoping process through consultation, these will be considered for inclusion in the scope of the EIA.

These specialists have been selected based on their experience in the field of EIA and of renewable energy projects, and the locality of the proposed development.

Table 1.2: EIA Project Team

Name	Organisation	Role
Ashlin Bodasing	Arcus Consultancy Services	Project Leader (Environmental Assessment Practitioner)
Anja Albertyn	Arcus Consultancy Services	Environmental Assessment Practitioner
Chris Van Rooyen	Chris van Rooyen Consulting	Bird Impact Assessment and Monitoring
Werner Marais	Animalia	Bat Impact Assessment and Monitoring
Simon Todd	Simon Todd Consulting	Terrestrial Ecological Impact Assessment (Flora and Fauna)
Dr Tim Hart	ACO Associates	Cultural Heritage and Archaeology Impact Assessment
Dr John Almond	via ACO Associates	Palaeontology Impact Assessment
Dr Brian Colloty	Scherman Colloty and Associates	Freshwater and Wetlands Impact Assessment
Morné de Jager	Enviro-Acoustic Research	Noise Impact Assessment
Andrea Gibb	SiVest Environmental	Landscape and Visual Impact Assessment
Garry Patterson	Agricultural Research Council	Geology, Soils and Agriculture Impact Assessment
Tony Barbour	Tony Barbour Environmental Consulting and Research	Socio-Economic Impact Assessment
Xhobiso, Charlotte & Gerna van Jaarsveld	SMEC	Transportation Management Plan
Olgu Yimdirimilar	3E	Wake Effect Analysis

1.6 Structure of this Report

The EIA Report is set out in two volumes:

- Volume 1: EIA Report; and
- Volume 2: Specialists' Studies.

Table 1.3: Structure of this Report

Section	Title	Containing
1	Introduction	Aims and Purpose of the EIA Report, Overview of the EIA process, the requirements of the DEA, the details of the applicant, details of the EAP and the assumptions and limitations of the study.
2	Environmental Legal Framework	National Environmental Legislation, International Conventions and Treaties, Policies and Guidelines.
3	EIA Plan of Study and Methodology	Environmental Impact Assessment Methodology, Specialists Studies Methodology. Public Participation Methodology.
4	Public Participation	Details of Public Participation Conducted to Date.
5	Need and Desirability	Description of the Need and Desirability of the Proposed Development.
6	Assessment of Alternatives	A Comparative Analysis of Site, Technology, Location, Design and the No-Go Alternatives.
7	The Preferred Alternative	Description of the Proposed Development
8	Description of the Baseline Environment	A Detailed Description of the Affected Environment, including Freshwater and Wetlands, Flora, Fauna, Avifauna, Bat, Ambient Noise, Visual, Heritage and Social.
9	Wind Energy Related Impacts	A Discussion of Issues / Impacts typically associated with the Establishment of Wind Energy Facilities
10	Assessment of Potential Impacts	A Detailed Assessment of the Potential Impacts During the Construction, Operational and Decommissioning Phases, including Cumulative Impacts.
11	Summary of Findings	A summary of the Finding of the Impact Assessment and The Impact Statement
Appendix A	EAP Declaration of Independence and CV	Commissioner of Oaths
Appendix B	Environmental Management Programme	The Draft Environmental Management Programme, detailing the Proposed Mitigation Measures, and the Roles and Responsibility of Management during the Construction, Operation and Decommissioning of the Proposed Development.
Appendix	Public Participation Process	Comments & Response Report

Section	Title	Containing
C		
Appendix D	Water Use Licence Application Process	Proof of Application Process Initiation

1.7 Assumptions and Limitations

The following assumptions and limitations are noted for the EIA Report and the specialist studies conducted as part of the EIA process for the proposed development.

- The assumption is made that the information on which this report is based (baseline studies and project information, as well as existing information) is accurate and correct.

1.7.1 Geology

- Only the general dominance of the soils in the landscape is given, and not the actual areas of occurrence within a specific land type;
- Other soils that were not identified due to the scale of the survey may also occur; and
- The site was not visited during the course of this study, and so the detailed soil composition of the specific land types has not been groundtruthed. However, this is not seen as a limiting factor for the intent of the soil study, due to the prevailing shallow soils and steep terrain, which is restricting regarding agricultural activities.

1.7.2 Freshwater and Wetlands

- In order to obtain a comprehensive understanding of the dynamics of both the flora and fauna of both the aquatic communities within a study site, as well as the status of endemic, rare or threatened species in any area, assessments should always consider investigations at different time scales (across seasons/years) and through replication. However, due to time constraints these long-term studies are not feasible and are mostly based on instantaneous sampling. This site was assessed after a period of spring rainfall, while the adjacent farms have been visited during other years and seasons. This provides the aquatic specialist with an adequate understanding of the region and the aquatic environment.
- It is assumed that any existing roads and tracks within the proposed development site will be upgraded, while the new roads and associated transmission lines can avoid or span the observed water courses.
- It is assumed that water will be sourced from a licensed resource and not illegally abstracted from any surrounding water courses, particularly if dust suppression is required.
- It should be emphasised that information, as presented in this document, only has reference to the study area as indicated on the accompanying maps. Therefore, this information cannot be applied to any other area without detailed investigation.

1.7.3 Flora and Terrestrial Fauna

The current study is based on extensive and detailed site visits as well as a desktop study of the available information. As the vegetation was in a good condition for sampling at the time, there are few limitations with regards to the vegetation sampling and the species lists obtained for the site are considered comprehensive. The study also relies to some extent on existing information as available in the various spatial databases and coverages. In many cases, these databases are not intended for fine-scale use and the reliability and adequacy of these data sources relies heavily on the extent to which the area has been sampled in the past. Many remote areas have not been well sampled with the result that the species lists for an area do not always adequately reflect the actual fauna and flora present at the site. In order to counter the likelihood that the area has not been well sampled in the past and in order ensure a conservative approach, the species lists derived for the site from the literature were obtained from an area significantly larger (quarter and half) degree squares (3125A, 3124B) than the study area and are likely to include a much wider array of species than actually occur at the site. This is a cautious and conservative approach which takes the study limitations into account.

1.7.4 Avifauna

- Conclusions in this study are based on experience of these and similar species in different parts of South Africa. Bird behaviour can never be entirely reduced to formulas that will be valid under all circumstances, especially for a relatively new field such as wind energy. However, power line and substation impacts can be predicted with a fair amount of certainty, based on a robust body of research stretching back over thirty years;
- To date no peer-reviewed scientific papers are available on the impacts of wind farms on birds in South Africa. The precautionary principle was therefore applied throughout. The World Charter for Nature, which was adopted by the UN General Assembly in 1982, was the first international endorsement of the precautionary principle. The principle was implemented in an international treaty as early as the 1987 Montreal Protocol and, among other international treaties and declarations, is reflected in the 1992 Rio Declaration on Environment and Development. Principle 15 of the 1992 Rio Declaration states that: "in order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall be not used as a reason for postponing cost-effective measures to prevent environmental degradation."
- Predicted mortality rates are often inaccurate, indicating that this is still a fledgling science in many respects, even in developed countries like Spain with an established wind industry[4]. Mortality data from post-construction monitoring programmes currently implemented at wind farms in South Africa was used to assist with the priority species risk assessments.[5]

1.7.5 Bats

- Distribution maps of South African bat species still require further refinement such that the bat species proposed to occur on the site (that were not detected) are assumed accurate. If a species has a distribution marginal to the site it was assumed to occur in the area. The literature based table of species probability of occurrence may include a higher number of bat species than actually present.
- The migratory paths of bats are largely unknown, thus limiting the ability to determine if the wind farm will have a large scale effect on migratory species. Attempts to overcome this limitation, however, will be made during this long-term sensitivity assessment.
- Species identification with the use of bat detection and echolocation is less accurate when compared to morphological identification, nevertheless it is a very certain and

[4] FERRER, M., DE LUCAS, M., JANSS, G.F.E., CASADO, E., MUNOZ, A.R., BECHARD, M.J., CALABUIG, C.P. 2012. Weak relationship between risk assessment studies and recorded mortality on wind farms. Journal of Applied Ecology. 49. p38-46.

[5] RALSTON-PATON, S., SMALLIE, J., PEARSON, A.J., RAMALHO, R. 2017. Wind Energy Impacts on Birds in South Africa: A Preliminary review of the results of operational monitoring at the first wind farms of the Renewable Energy Independent Power Producer Procurement Programme in South Africa. BLSA. Occasional Report Series: 2.

accurate indication of bat activity and their presence with no harmful effects on bats being surveyed.
- It is not possible to determine actual individual bat numbers from acoustic bat activity data, whether gathered with transects or the passive monitoring systems. However, bat passes per night are internationally used and recognized as a comparative unit for indicating levels of bat activity in an area as well as a measure of relative abundance.
- Spatial distribution of bats over the study area cannot be accurately determined by means of transects, although the passive systems can provide comparative data for different areas of the site. Transects may still possibly uncover high activity in areas where it is not necessarily expected and thereby increase insight into the site.
- Exact foraging distances from bat roosts or exact commuting pathways cannot be determined by the current methodology. Radio telemetry tracking of tagged bats is required to provide such information if needed.
- Costly radar technology is required to provide more quantitative data on actual bat numbers as well as spatial distribution of multiple bats.

1.7.6 Noise

- Ambient sound levels are the cumulative effect of innumerable sounds generated at various instances both far and near. High measurements may not necessarily mean that noise levels in the area are high. Similarly, a low sound level measurement will not necessarily mean that the area is always quiet, as sound levels will vary over seasons, time of the day, faunal characteristics, vegetation in the area and meteorological conditions (especially wind). This is excluding the potential effect of sounds from anthropogenic origin. It is impossible to quantify and identify the numerous sources that influenced one 10-minute measurement using the reading result at the end of the measurement. Therefore trying to define ambient sound levels using the result of one 10-minute measurement will be very inaccurate (very low confidence level in the results) for the reasons mentioned above. The more measurements that can be collected at a location the higher the confidence levels in the ambient sound level determined. The more complex the sound environment, the longer the required measurement. It is assumed that the measurement locations represent other residential dwellings in the area (similar environment), yet, in practice this can be highly erroneous as there are numerous factors that can impact on ambient sound levels, including;
- the distance to closest trees, number and type of trees as well as the height of trees;
- available habitat and food for birds and other animals;
- distance to residential dwelling, type of equipment used at dwelling (compressors, air-cons);
- general maintenance condition of house (especially during windy conditions); and
- a number and type of animals kept in the vicinity of the measurement locations.
- Measurement locations for this project were selected to be in a relative quiet area, away from the residential dwelling to minimize the potential of extraneous noises impacting on the ambient sound levels,
- Exact location of a sound level meter in an area in relation to structures, infrastructure, vegetation and external noise sources will influence measurements. It may determine whether one is measuring anthropogenic sounds from a receptors dwelling, or environmental ambient soundscape contributors of significance (faunal, roads traffic, railway line movement etc.). At times there are extraneous noises that cannot be heard during deployment, or not operational, that can significantly impact on readings (such as water pumps, transformers, faunal communication, etc.);
- Determination of existing road traffic and other noise sources of significance are important (traffic counts etc.) – when close to any busy or significant roads. Traffic however is highly dependent on the time of day as well as general agricultural

activities taking place during the site investigation. Traffic noise is one of the major components in urban areas and could be a significant source of noise during busy periods. This study found that traffic in the area was very low, yet it cannot be assumed that it is always low.

- Measurements over wind speeds of 3 m/s could provide data influenced by wind-induced noises. While the windshields used limit the effect of fluctuating pressure across the microphone diaphragm, the effect of wind-induced noises in the trees in the vicinity of the microphone did impact on the ambient sound levels. The site visit unfortunately coincided with a relatively windy period;
- Ambient sound levels are dependent not only time of day and meteorological conditions, but also change due to seasonal differences. Ambient sound levels are generally higher in summer months when faunal activity is higher and lower during the winter due to reduced faunal activity. Winter months unfortunately also coincide with lower temperatures and very stable atmospheric conditions, ideal conditions for propagation of noise. Many faunal species are more active during warmer periods than colder periods. Certain cicada species can generate noise levels up to 120 dB for mating or distress purposes, sometimes singing in synchronisation magnifying noise levels they produce from their ymbals[6];
- Ambient sound levels recorded near rivers, streams, wetlands, trees and bushy areas can be high. This is due to faunal activity which can dominate the sound levels around the measurement location. This generally is still considered naturally quiet and understood and accepted as features of the natural soundscape, and in various cases sought after and pleasing;
- Considering one or more sound descriptor or equivalent can improve an acoustical assessment. Parameters such as L_{AMin}, L_{AIeq}, L_{AFeq}, L_{Ceq}, L_{AMax}, L_{A10}, L_{A90} and spectral analysis forms part of the many variables that can be considered; and
- As a residential area develops the presence of people will result in increased sounds. These are generally a combination of traffic noise, voices, animals and equipment (incl. TV's and Radios). The result is that ambient sound levels will increase as an area matures.

Please see Section 6 of the Noise Specialist Report (Volume II) for further assumptions related to the Noise Impact Assessment.

Noise experienced at a certain location is the cumulative result of innumerable sounds emitted and generated both far and close, each in a different time domain, each having a different spectral character at a different sound level. Each of these sounds are also impacted differently by surrounding vegetation, structures and meteorological conditions that result in a total cumulative noise level represented by a few numbers on a sound level meter.

It is not the purpose of noise modelling to accurately determine a likely noise level at a certain receptor, but to calculate a noise rating level that is used to identify potential issues of concern.

1.7.7 Visual

- The identification of visual receptors has been based on a combination of desktop assessment as well as field-based observation. Initially Google Earth imagery was used to identify potential receptors within the study area. Thereafter a site visit was undertaken from the 11th to the 14th of September 2017 in order to verify the sensitive visual receptors within the study area and assess the visual impact of the development from these receptor locations. Due to the extensive area covered by the

[6] Clyne, D. *"Cicadas: Sound of the Australian Summer, Australian Geographic"* Oct/Dec Vol 56. 1999.

study area, a number of broad assumptions have been made in terms of the sensitivity of the receptors to the proposed development. It should be noted that not all receptor locations would necessarily perceive the proposed development in a negative way. This is usually dependent on the use of the facility and the economic dependency on the scenic quality of views from the facility. Sensitive receptor locations typically include sites that are likely to be adversely affected by the visual intrusion of the proposed development. They include; tourism facilities and scenic locations within natural settings. The presence of a receptor in an area potentially affected by the proposed development does not thus necessarily mean that a visual impact will be experienced.

- Wind turbines are very large structures by nature and could impact on receptors that are located relatively far away, particularly in areas with very flat terrain. Given the nature of the receiving environment and the height of the proposed wind turbines, the study area or visual assessment zone is assumed to encompass a zone of 8km from the proposed WEF – i.e. an area of 8km (not factoring the curvature of the earth's surface) from the proposed turbine locations. This 8km limit on the visual assessment zone was applied because distance is a critical factor when assessing visual impacts and although the WEF may still be visible beyond 8km, the degree of visual impact would diminish considerably. As such, the need to assess the impact on potential receptors beyond this distance would not be warranted.
- In assessing the potential visual impacts for the proposed 132kV power line, the study area or visual assessment zone is assumed to encompass a zone of 5km from the proposed development – i.e. all areas within a 5km radius of the power line alternatives.
- During the site visit, it was observed that a few of the farmsteads / residential dwellings identified via desktop means (i.e. Google Earth) during the scoping phase of this study have been abandoned. No further assessment was therefore undertaken from these abandoned farmsteads / residential dwellings and they were eliminated from the list of potentially sensitive receptor locations for the purpose of this EIA phase study.
- Some receptors identified during the scoping phase of this study were found to be farmsteads on properties which form part of the proposed development and the owners of these properties would benefit financially from the proposed development. These farmsteads would therefore not be visually sensitive to the proposed WEF and were eliminated from the list of potentially sensitive receptor locations for the purpose of this EIA phase study. It should however be noted that some of these farmsteads were not eliminated from the list of potentially sensitive receptor locations as they are still currently occupied (either by the owners or tenants) and according to the socio-economic specialist, could still perceive the proposed WEF in a negative light. In addition, these farmsteads could become potentially sensitive receptor locations in the future (Barbour, T and van der Merwe, S., September 2017). These receptors are thus still regarded as potentially sensitive visual receptor locations.

- All sensitive visual receptor locations which were identified were visited and investigated from a visual perspective during the time of the site visit. However, due to access limitations and time constraints during the site visit, not all of the identified potentially sensitive visual receptor locations (such as farmsteads and/or residential dwellings) could be visited and investigated further and therefore the impact rating assessment of the proposed development on these receptor locations was undertaken primarily via desktop means. Although the use of all of these farmsteads / residential dwellings could not be established during the field investigation, they were still regarded as being potentially sensitive to the visual impacts associated with the proposed wind farm and were assessed as part of the VIA.

- A matrix has been developed to assist in the assessment of the potential visual impact at each receptor location. The limitations of quantitatively assessing a largely subjective or qualitative type of impact should be noted. The matrix is relatively simplistic in considering five (5) main parameters relating to visual impact, but provides a reasonably accurate indicative assessment of the degree of visual impact likely to be exerted on each receptor location by the proposed wind energy facility. The matrix should therefore be seen as a representation of the likely visual impact at a receptor location. The results of the matrix should be viewed in conjunction with the visualisation modelling to gain a full understanding of the likely visual impacts associated with the proposed development.
- Due to the varying scales and sources of information as well as the fact that only 20m contours were available to establish the Digital Terrain Model (DTM); maps and visual models may have minor inaccuracies. As such, only large scale topographical variations have been taken into account and minor topographical features or small undulations in the landscape may not be depicted on the DTM.
- A viewshed analysis was undertaken for the proposed WEF based on the layout available at the time of undertaking the EIA phase visual study. The viewshed analysis was undertaken from each turbine location. The worst-case scenario, in which the wind turbines would have a maximum height of 225m was assumed when undertaking the analysis. The other infrastructure associated with the proposed wind farm was not factored into the viewshed analysis. In addition, screening provided by any existing infrastructure and tall wooded vegetation were not factored into the analysis. It should be noted that detailed topographic data was not available for the entire study area and as such, the viewshed analysis does not take into account any localised topographic variations which may constrain views. The viewshed analysis should therefore be seen as a conceptual representation or a worst-case scenario which rates the geographical area from where the proposed wind farm could be visible from.
- A visual sensitivity analysis was undertaken for the proposed WEF based purely on topographic data available for the broader study area. Localised topographic variations, existing infrastructure and / or vegetation which may constrain views were not factored into the analysis. In addition, the analysis does not take into account differing perceptions of the viewer which largely determine the degree of visual impact being experienced. This sensitivity analysis should therefore be seen as a conceptual representation or a worst-case scenario which rates the visibility of the site in relation to potentially sensitive receptors.
- Operational and security lighting will be required for the proposed WEF and the associated infrastructure proposed within the development footprint. At the time of undertaking the visual study no information was available regarding the type and intensity of lighting required and therefore the potential impact of lighting at night has not been assessed at a detailed level. As such, the night-time environment in the study area was not characterised. General measures to mitigate the impact of additional light sources on the ambiance of the nightscape have however been provided.
- The assessment of receptor-based impacts has been based on the turbine layout provided by the proponent. It is however recognised that this layout is subject to changes based on a number of potential factors, including the findings of the EIA studies. The turbine locations may thus move, which may result in greater or lesser visual impacts on receptor locations.
- A cumulative impact assessment has been undertaken to provide a representation of the number of proposed renewable energy facilities likely to be visible from each sensitive and potentially sensitive receptor location, if they were all constructed. Factors affecting visibility, such as localised screening from trees or topographical undulations have not been factored into the cumulative impact assessment.

- The layout information that could be sourced for the proposed renewable energy facilities which are planning in close proximity to the proposed San Kraal WEF includes that for the proposed Phezukomoya WEF only. The distance of the potentially sensitive receptor locations from the actual layout could therefore not be utilised to determine whether the receptor is likely to be visually exposed to the development. As such, the distance from the farm on which each development is proposed was used to calculate the cumulative visual impact.
- A literature review of visual impact assessments / studies which were undertaken for the other renewable energy developments (both solar and wind) proposed within a 35km radius of the proposed San Kraal WEF was undertaken to ascertain any additional cumulative impacts that should be taken into consideration. Some of the project sites are at a very advanced stage, and the initial studies were undertaken in 2012 and are therefore no longer publicly available. In addition, visual impact assessments / studies could not be sourced for all of the other nearby renewable energy developments proposed nearby and thus some visual studies were omitted from the literature review. The literature review was also based on the information which was available at the time and as such, all renewable energy facilities may not be included. Additionally, there could be minor inaccuracies in terms of property information / status etc.
- Visualisation modelling was undertaken for the proposed WEF, although not from all potential receptor locations. An indicative range of locations was selected for modelling purposes to provide an indication of the possible impacts from different locations within the study area. It should be noted that this modelling is specific to the location, and that even sites in close proximity to one another may be affected in different ways by the proposed WEF. The visual models represent a visual environment that assumes all vegetation cleared during construction will be restored to its current state after the construction phase. This is however, an improbable scenario as some trees and shrubs may be removed which may reduce the accuracy of the models generated. At the time of this study the proposed project was still in its early planning stages. Therefore, the turbine layouts, as provided by Innowind, may change and the infrastructure associated with the facility has not be included in the models.
- Visualisation modelling has not been undertaken for the proposed 132kV power lines. Should the need for visualisation modelling be proven by stakeholders / I&AP feedback, then this will be incorporated into this assessment.
- Most rainfall within the area occurs from February to March, during the late summer months. It should be noted that the fieldwork was undertaken in September 2017, during early spring time when the surrounding vegetation is expected to provide less potential screening than in the late summer months and the clear conditions would make the wind turbines appear to contrast more from the surrounding environment than they would on a cloudy overcast day.

1.7.8 Heritage and Palaeontology

Access to the site was mostly good (apart from one area) and the survey team was able to check to majority of turbine positions and infrastructure alignment in the project area. While it was not possible to cover the entire landscape of the project area, overall coverage was good and there is reasonable confidence in the findings. There is an underlying assumption in all the work and findings that the regional archaeological sequence as determined by the nearby Zeekoei Valley Archaeological Project applies.

The accuracy and reliability of palaeontological specialist studies as components of heritage impact assessments are generally limited by the following constraints:

- Inadequate database for fossil heritage for much of the RSA, given the large size of the country and the small number of professional palaeontologists carrying out fieldwork here. Most development study areas have never been surveyed by a palaeontologist.
- Variable accuracy of geological maps which underpin these desktop studies. For large areas of terrain these maps are largely based on aerial photographs alone, without ground-truthing. The maps generally depict only significant ("mappable") bedrock units as well as major areas of superficial "drift" deposits (alluvium, colluvium) but for most regions give little or no idea of the level of bedrock outcrop, depth of superficial cover (soil *etc*), degree of bedrock weathering or levels of small-scale tectonic deformation, such as cleavage. All of these factors may have a major influence on the impact significance of a given development on fossil heritage and can only be reliably assessed in the field.
- Inadequate sheet explanations for geological maps, with little or no attention paid to palaeontological issues in many cases, including poor locality information.
- The extensive relevant palaeontological "grey literature" - in the form of unpublished university theses, impact studies and other reports (*e.g.* of commercial mining companies) - that is not readily available for desktop studies.
- Absence of a comprehensive computerized database of fossil collections in major RSA institutions which can be consulted for impact studies. A Karoo fossil vertebrate database is now accessible for impact study work.

In the case of palaeontological desktop studies without supporting Phase 1 field assessments these limitations may variously lead to either:

(a) *underestimation* of the palaeontological significance of a given study area due to ignorance of significant recorded or unrecorded fossils preserved there, or

(b) *overestimation* of the palaeontological sensitivity of a study area, for example when originally rich fossil assemblages inferred from geological maps have in fact been destroyed by tectonism or weathering, or are buried beneath a thick mantle of unfossiliferous "drift" (soil, alluvium *etc*).

Since most areas of the RSA have not been studied palaeontologically, a palaeontological desktop study usually entails *inferring* the presence of buried fossil heritage within the study area from relevant fossil data collected from similar or the same rock units elsewhere, sometimes at localities far away. Where substantial exposures of bedrocks or potentially fossiliferous superficial sediments are present in the study area, the reliability of a palaeontological impact assessment may be significantly enhanced through field assessment by a professional palaeontologist.

In the case of the San Kraal WEF study area near Noupoort in the Northern and Eastern Cape preservation of potentially fossiliferous bedrocks is favoured by the semi-arid climate and sparse vegetation but bedrock exposure is very limited by extensive superficial deposits (sandy soils, scree), especially in areas of low relief such as the plateau areas where the majority of the WEF infrastructure will be placed. Vehicle access to most of the upland plateau areas is currently challenging and very limited.

In practice, approximately two thirds of the fieldwork time was spent traversing the core WEF project area on the Katberg sandstone plateau – uniformly regarded as palaeontologically uninformative due to superficial sediment cover - and perhaps some 10% of time in the powerline project area. However, it is considered that sufficient bedrock and cover sediment exposures were examined during the course of this study to assess the broader palaeontological heritage sensitivity of the study area. Comparatively few academic palaeontological studies or field-based fossil heritage impact studies have been carried out in the region, so any new data from impact studies here are of scientific interest.

1.7.9 Social

- It is assumed that the development site represents a technically suitable site for the establishment of a wind energy facility.
- The strategic importance of promoting wind energy is supported by the national and provincial energy policies. However, this does not mean that site related issues can be ignored or overlooked.
- Legislation and policies reflect societal norms and values. The legislative and policy context therefore plays an important role in identifying and assessing the potential social impacts associated with a proposed development.
- A key component of the SIA process is to assess the proposed development in terms of its fit with key planning and policy documents. As such, if the findings of the study indicate that the proposed development in its current format does not conform to the spatial principles and guidelines contained in the relevant legislation and planning documents, and there are no significant or unique opportunities created by the development, the development cannot be supported. However, the study recognises the strategic importance of wind energy and the technical, spatial and land use constraints required for wind energy facilities.
- The information contained in some key policy and land use planning documents, such as Integrated Development Plans etc., may not contain data from the 2011 Census. However, where required this data has been up-dated with the relevant 2011 Census data.

1.7.10 Traffic Study

The following assumptions were made in order to calculate trips generated during the construction phase:

- It is estimated that the construction period will last approximately 2 years with a 5 day working week. Resulting in 480 working days over 24 months.
- The WEF will most likely be constructed from components that will need to be shipped to South Africa via the Port Elizabeth port and be transported to site via road transport using heavy and abnormal load vehicles. It is also assumed that that the turbine component delivery period will be over a course of a conservative 9 months.
- Different abnormal vehicle options, similar to the ones as found in the TRH11 (2009), may be selected depending on the service provider used to transport WT components. The remainder of the facility components and construction equipment will use standard transport vehicles and therefore will not require abnormal vehicles.
- Average "component per turbine" rate of 8 will be used (sum of abnormal components), therefore over the course of the turbine component delivery period, approximately 624 abnormal vehicle loads to construct 78 WT, will be delivered to the project site.
- Route used to transport most of the heavy and abnormal loads will be from Coega up to interchange N9/N10 south of Middleburg. From Middleburg the vehicles will make use of the N9 heading north towards Noupoort, thereafter turning right onto R389 to enter site at the San Kraal Intersection.
- Water for construction purposes (e.g. mass earthworks, dust suppression and roads) will be transferred from the source to the point of use on the site via tanker. Assuming the 1 tanker will make one round trip per day at the start and end of the day.
- Some of the aggregate required for the construction of the on-site tracks may be sourced from cut and fill operations within the site with additional material be obtained from borrow pits or imported from quarries as required.

Another contributor to trips generated to the site will be daily commuters/workers expected during construction. The following assumptions, were made:

- Due to the site being close to the town of Noupoort, the construction labour force will be mostly local.
- It is assumed that approximately 300 workers will be on site.
- Based on the composition it was therefore assumed that 20% of the workers will make use of private or personal vehicles (cars and light duty trucks) travelling from their temporary or permanent place of residence to the site.
- Furthermore, it was assumed that the reminder of the 80% staff will be transported to site on 14 seater buses, whose quantities will fluctuate depending on number of labourers, costs, routes and shuttle hours.
- For assessment purposes, only the morning and afternoon trip generation was assessed.
- Based on the above assumptions the expected AM and PM peak trips comprise of 17 buses and 60 vehicles. A with a majority of them travelling from Noupoort to site in the AM and vice versa in the PM.

1.7.11 Wake Effect Analysis

The results presented in the wake effect analysis report are only valid if the power curves considered in the study are consistent with the ones of the turbine that will ultimately be built on site. As such it is recommended that this study be recommissioned prior to the start of construction once the turbine layout and model have been finalised.

1.8 Deviations from Plan of Study

There are no deviations from the approved plan of study. A transportation management plan is included as part of the specialist studies conducted for the proposed development, as well as a wake effect study. These were commissioned at the request of DEA.

2 ENVIRONMENTAL LEGAL FRAMEWORK

2.1 The National Environment Management Act, 1998 (Act No 107 of 1998)

Section 2 of the National Environment Management Act, 1998 (NEMA) as amended, lists environmental principles that are to be applied by all organs of state regarding proposals that may significantly affect the environment. Included amongst the key principles is the principle that all development must be socially, economically and environmentally sustainable, environmental management must place people and their needs at the forefront of its concern, to serve their physical, psychological, developmental, cultural and social interests equitably.

NEMA also provides for the participation of I&APs and it stipulates that decisions must take the interests, needs and values of all I&APs into account.

Chapter 5 of NEMA outlines the general objectives and implementation of Integrated Environmental Management (IEM), the latter providing a framework for the integration of environmental issues into the planning, design, decision-making and implementation of plans and development proposals. Section 24 provides a framework for the granting of environmental authorisations.

In order to give effect to the general objectives of IEM, the potential impacts on the environment of listed activities must be considered, investigated, assessed and reported to the competent authority. Section 24(4) outlines the minimum requirements for procedures for the investigation, assessment and communication of the potential impact of activities.

On 4 December 2014, the Minister of Environmental Affairs promulgated new regulations in terms of Chapter 5 of the NEMA, *viz*, EIA Regulations 2014 (Government Notices (GN) No. R. 982, R. 983, R. 984 and R. 985 in Government Gazette No. 38282 of 4 December 2014). These regulations came into effect on 8 December 2014.

The EIA Regulations 2014 published in Government Notice (GN) No. R982, provide for the control of certain Listed Activities. These activities are listed in GN No. R983 (Listing Notice 1 – Basic Assessment), R984 (Listing Notice 2 – Scoping & EIA Process) and R985 (Listing Notice 3 – Basic Assessment) of 4 December 2014, and are prohibited to commence until environmental authorisation has been obtained from the competent authority, in this case, the Department of Environmental Affairs (DEA).

Environmental authorisation, which may be granted subject to conditions, will only be considered upon compliance with GNR982, as amended GNR326 of 7 April 2017.

The Listed Activities applicable to this proposed project are presented in Table 2.1 below. All potential impacts associated with these Listed Activities will be considered and adequately assessed in this EIA process.

As this proposal triggers Listed Activities in Listing Notices 1 – 3, a full Scoping and EIA process is to be followed for this application (and the related applications).

Any Environmental Authorisation obtained from the DEA applies only to those specific listed activities for which the application was made. To ensure that all Listed Activities that could potentially be applicable to this proposal are covered by the Environmental Authorisation, a precautionary approach is followed when identifying listed activities, that is, if an activity could potentially be part of the proposed development, it is listed.

On 7 April 2017 in Government Gazette 40772 the Minister of Environmental Affairs published amendments to the Environmental Impact Assessment (EIA) Regulations of 2014 (in Notice Number 326), Listing Notice 1 (in Notice Number 327), Listing Notice 2 (in Notice Number 325) and Listing Notice 3 (in Notice Number 324). The table below indicates, the listing notices, as amended in 2017.

All listed activities which potentially form part of the proposed development, and which require environmental authorisation, are included in the application for Environmental Authorisation prepared and submitted to the DEA.

Any Environmental Authorisation which is obtained from the DEA can cover only those specific listed activities for which applications were made. To ensure that all listed activities that could potentially be required are covered by the Environmental Authorisations, a precautionary approach was followed when identifying listed activities in the application for Environmental Authorisation form, i.e., if an activity could potentially form part of the proposed development, it is listed. Any changes to this list will be notified in writing to the DEA, and I&APs will also be informed accordingly.

Table 2.1 Listed Activities Applied for the Proposed Development

Listing Notices 1 - 3 07 April 2017	***Listed Activity***	**Project Description**
Listing Notice 1 GN R 327 Activity 11	*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 WEF will require transmission lines in order to connect to the grid. Electrical reticulation will be installed to transfer electricity from the turbines to an on-site substation. Cables will be installed underground where feasible.
Listing Notice 1 GN R 327 Activity 14	*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 meters or more but not exceeding 500 cubic meters.*	Estimated Volume of Hazardous Materials Stored on Site for 78 turbines over a construction period of 24 months. Construction Phase 176.64m³; Operational Phase 197.62m³.
Listing Notice 1 GN R 327 Activity 19	*The infilling or depositing of any material of more than 10 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 10 cubic metres from a watercourse;*	The construction of the WEF would likely include the excavation of soil in watercourses/drainage line areas, and infilling/deposition may exceed 5 cubic metres and in some instances may exceed 10 cubic metres. Figure 6.1 shows the location of water crossings. The construction of associated infrastructure, such as access tracks crossing watercourses may require excavation and/or infilling of watercourse areas.
Listing Notice 1 GN R 327 Activity 24	*The development of a road— (ii) with a reserve wider than 13,5 meters, or where no reserve exists where the road is wider than 8 metres;*	Access roads will be required between turbines. These roads will be unsealed and will likely be between 8 - 14 m in width. The roads will be up to 14 m wide during construction, but will be reduced during operation.
Listing Notice 1 GN R 327 Activity 56	*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; excluding where widening*	Existing farm access roads may need to be widened or lengthened. These

Listing Notices 1 - 3 07 April 2017	*Listed Activity*	Project Description
	or lengthening occur inside urban areas.	roads would currently have no road reserve and may be wider than 8 meters in some areas.
Listing Notice 2 GN R 325 Activity 1	*The development of facilities or infrastructure for the generation of electricity from a renewable resource where the electricity output is 20 megawatts or more*	The San Kraal WEF will consist of a number of wind turbines for electricity generation of more than 20 megawatts (up to 390 MW).
Listing Notice 2 GN R 325 Activity 6	*The development of facilities or infrastructure for any process or activity which requires a permit or licence or an amended permit or licence in terms of national or provincial legislation governing the generation or release of emissions, pollution or effluent.*	The construction of the WEF requires a Water Use License in terms of the National Water Act, 1998 (Act No. 36 of 1998).
Listing Notice 2 GN R325 Activity 9	*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.*	The construction of a 132/400kV substation yard at the proposed Umsobomvu substation.
Listing Notice 2 GN R 325 Activity 15	*The clearance of an area of 20 hectares or more of indigenous vegetation, excluding where such clearance of indigenous vegetation is required for-* *(i) the undertaking of a linear activity;* *(ii) maintenance* purposes undertaken in accordance with a maintenance management plan.	The construction of the WEF will require the clearance of approximately 150 hectares of vegetation in total across the site.
Listing Notice 3 GN R 324 Activity 4	*The development of a road wider than 4 metres with a reserve less than 13,5 metres.* *a. Eastern Cape* *i. Outside urban areas:* *(bb) National Protected Area Expansion Strategy Focus areas;* *g. Northern Cape* *Outside urban areas:* *(bb) National Protected Area Expansion Strategy Focus areas;* *(ee) Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans;*	Internal and external access roads will be constructed, which are wider than 4 m. The site falls outside of an urban area and parts of the site fall within a NPAESF in the Eastern Cape and Northern Cape and in a Critical Biodiversity Area in the Northern Cape.
Listing Notice 3 GN R324 Activity 12	*The clearance of an area of 300 square metres or more of indigenous vegetation except where such clearance of indigenous vegetation is required for maintenance purposes undertaken in accordance with a maintenance management plan.*	The proposed development will require the clearance of natural vegetation in excess of 300 m^2 in areas of natural vegetation. A small

Listing Notices 1 - 3 07 April 2017	***Listed Activity***	**Project Description**
	g. Northern Cape *ii. Within critical biodiversity areas identified in bioregional plans;*	portion of the WEF is located within a Critical Biodiversity area.
Listing Notice 3 **GN R324** **Activity 18**	*The widening of a road by more than 4 metres, or the lengthening of a road by more than 1 kilometre.* *a. Eastern Cape* *i. Outside urban areas:* *(bb) National Protected Area Expansion Strategy Focus areas;*	Existing farm roads may need to be widened or lengthened. The site lies outside urban areas, and contains NPAESF areas.

2.2 The National Heritage Resources Act, 1999 (Act No 25 of 1999)

Section 38 (1) of the National Heritage Resources Act, 1999 (NHRA) lists development activities that would require authorisation by the responsible heritage resources authority. Activities considered applicable to the proposed project include the following:

"*(a) The construction of a road, wall, powerline, pipeline, canal or other similar form of linear development or barrier exceeding 300 m in length;*
(c) any development or other activity which will change the character of a site; and
(i) exceeding 5000 m² in extent."

The NHRA requires that a person intending to undertake such an activity must notify the relevant national and provincial heritage authorities at the earliest stages of initiating such a development.

The relevant heritage authority would then in turn, notify the person whether a Heritage Impact Assessment Report should be submitted. According to Section 38(8) of the NHRA, a separate report would not be necessary if an evaluation of the impact of such development on heritage resources is required in terms of the Environment Conservation Act, 1989 (No. 73 of 1989) (ECA) (now replaced by NEMA) or any other applicable legislation. The decision-making authority must ensure that the heritage evaluation fulfils the requirements of the NHRA and take into account any comments and recommendations made by the relevant heritage resources authority. As such, a Heritage Impact Assessment (HIA) will form part of this EIA process.

In South Africa, the law is directed towards the protection of human made heritage, although places and objects of scientific importance are covered. The NHRA also protects intangible heritage such as traditional activities, oral histories and places where significant events happened. Generally protected heritage, which must be considered in any heritage assessment, includes:

- *Any place of cultural significance (described below);*
- *Buildings and structures (greater than 60 years of age);*
- *Archaeological sites (greater than 100 years of age);*
- *Palaeontological sites and specimens;*
- *Shipwrecks and aircraft wrecks; and*
- *Graves and grave yards.*

Section 3(3) of the NHRA defines the cultural significance of a place or objects with regard to the following criteria:

(a) Its importance in the community or pattern of South Africa's history;
(b) Its possession of uncommon, rare or endangered aspects of South Africa's natural or cultural heritage;
(c) Its potential to yield information that will contribute to an understanding of South Africa's natural or cultural heritage;
(d) Its importance in demonstrating the principal characteristics of a particular class of South Africa's natural or cultural places or objects;
(e) Its importance in exhibiting particular aesthetic characteristics valued by a community or cultural group;
(f) Its importance in demonstrating a high degree of creative or technical achievement at a particular period;
(g) Its strong or special association with a particular community or cultural group for social cultural or spiritual reasons;
(h) Its strong or special association with the life or work of a person, group or organisation of importance in the history of South Africa; and
(I) sites of significance relating to the history of slavery in South Africa.

While not specifically mentioned in the NHRA, Scenic Routes are recognised as a category of heritage resources which requires grading as the Act protects area of aesthetic significance (clause "e" above).

During the Scoping Phase of this process, the heritage impact assessment will be submitted to the SAHRA for comment.

2.3 Subdivision of Agricultural Land Act, 1970 (Act No. 70 of 1970)

In terms of the Subdivision of Agricultural Land Act, 1970, any application for change of land use must be approved by the Minister of Agriculture.

2.4 Conservation of Agricultural Resources, 1983 (Act No. 43 of 1983)

The Conservation of Agricultural Resources Act (CARA), 1983 states that no degradation of natural land is permitted. The Act requires the protection of land against soil erosion and the prevention of water logging and salinization of soils by means of suitable soil conservation works to be constructed and maintained. The utilisation of marshes, water sponges and watercourses are also addressed.

2.5 The Environment Conservation Act, 1989 (Act No.73 of 1989), the National Noise Control Regulations: GN R154 of 1992

The Environment Conservation Act, 1989 (ECA) allows the Minister of Environmental Affairs and Tourism ("now the Minister of Environmental Affairs") to make regulations regarding noise, amongst other concerns. The Minister has made noise control regulations under the ECA.

In terms of section 25 of the ECA, the national noise-control regulations (NCR) were promulgated (GN R154 in *Government Gazette* No. 13717 dated 10 January 1992). 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.

Subsequently, in terms of Schedule 5 of the Constitution of South Africa of 1996 legislative responsibility for administering the NCR was devolved to provincial and local authorities.

These regulations define "**disturbing noise**" as:

"*Noise level which exceeds the zone sound level or, if no zone sound level has been designated, a noise level which exceeds the ambient sound level at the same measuring point by 7 dBA or more*".

These Regulations prohibits anyone for causing a disturbing noise.

No provincial noise control regulations have been promulgated in the Northern nor in the Eastern Cape Provinces and thus the National Noise Control Regulations be relevant here.

2.6 National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004)

Section 34 of the Air Quality Act, 2004 (AQA) makes provision for:

(1) The Minister to prescribe essential national noise standards -
  - (a) For the control of noise, either in general or by specified machinery or activities or in specified places or areas; or
  - (b) For determining –
    - (i) a definition of noise; and
    - (ii) The maximum levels of noise.

(2) When controlling noise the provincial and local spheres of government are bound by any prescribed national standards.

This section of the Act is in force, but no such standards have yet been promulgated.

An atmospheric emission license issued in terms of Section 22 may contain conditions in respect of noise. This however will not be relevant to the WEF.

2.6.1 National Dust Control Regulations, 2013

The National Environmental Management: Air Quality Act, 2004 (Act 39 of 2004), makes provision for national dust control regulations. These regulations prescribe dust fall standards for residential and non-residential areas. These Regulations also provide for dust monitoring, control and reporting.

The acceptable dust fall out rates are:

Restriction Area	**Dust Fall (D) (mg/m^2/day, 30 day average)**	**Permitted Frequency of exceedance**
Residential	D<600	Two within a year, not sequential months
Non- Residential	600 <D< 1200	Two within a year, not sequential months

2.7 National Water Act, 1998 (Act No. 36 of 1998)

The National Water Act, 1998 (NWA) provides for constitutional requirements including pollution prevention, ecological and resource conservation and sustainable utilisation. In terms of this Act, all water resources are the property of the State.

A water resource includes any watercourse, surface water, estuary or aquifer, and, where relevant, its bed and banks. A watercourse is interpreted as a river or spring; a natural channel in which water flows regularly or intermittently; a wetland lake or dam into which or from which water flows; and any collection of water that the Minister may declare to be a watercourse.

Relevant water uses for the proposed construction of WEF, which will require access roads over watercourses and drainage channels, in terms of Section 21 of the Act include, but are not limited to, the following:

Section 21(c): Impeding or diverting the flow of water in a watercourse; and
Section 21(i): Altering the bed, banks, course or characteristics of a watercourse.

GN 1199 of 18 December 2009 grants general authorisation for the above water uses based on certain conditions. It is also stipulates that these water uses must be registered with the responsible authority.

Pollution of river water is a contravention of the NWA. Chapter 3, Part 4 of the NWA deals with pollution prevention and in particular the situation where pollution of a water resource occurs or might occur as a result of activities on land. The person who owns, controls, occupies or uses the land in question is responsible for taking measures to prevent pollution of water resources.

Chapter 3, Part 5 of the NWA deals with pollution of water resources following an emergency incident, such as an accident involving the spilling of a harmful substance that finds or may find its way into a water resource. The responsibility for remedying the situation rests with the person responsible for the incident or the substance involved.

The EIA Phase has determined that there will be two water crossings. San Kraal Wind Power is applying for a Water Use License, and proof of the initiation of the application process is provided in Appendix D.

2.8 National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) – Threatened or Protected Species List

Amendments to the Threatened or Protected Species (TOPS) list were published on 31 March 2015 in Government Gazette No. 38600 and Notice 256 of 2015. Certain bird species that occur on the site may be threatened or protected.

2.8.1 Alien and Invasive Species Regulations, 2014

The Act and Regulations set out various degrees of Invasive species (Plants, Insects, Birds, Animals, Fish and Water Plants) and requires that certain of those invasive species are documented and, in some cases, removed from properties in South Africa. This must happen before a property may be sold.

The Regulations list 4 categories of invasive species that must be managed, controlled or eradicated from areas where they may cause harm to the environment, or that are prohibited to be brought into South Africa.

2.9 The Nature and Environmental Conservation Ordinance No. 19 of 1974; and Northern Cape Nature Conservation Act, 2009 (Act No. 9 of 2009)

These were developed to protect both animal and plant species within the various provinces of the country which warrant protection. These may be species which are under threat or which are already considered to be endangered and species are listed in the relevant documents. The provincial environmental authorities are responsible for the issuing of permits in terms of this legislation.

2.10 Additional Relevant Legislation

The applicant must also comply with the provisions of other relevant national legislation. Additional relevant legislation that has informed the scope and content of this EIA Report includes the following:

- *Constitution of the Republic of South Africa, 1996 (Act No. 108, 1996);*
- *Aviation Act, 1962 (Act No. 74, 1962);*
- *National Environmental Management: Waste Act, 2008 (Act No. 59, 2008);*
- *National Forest Act, 1998 (Act No. 84, 1998);*
- *National Environmental Management: Protected Areas Act, 2003(Act No. 57, 2003);*
- *National Roads Act, 1998 (Act No. 7, 1998)*
- *Occupational Health and Safety Act, 1993 (Act No. 85 of 1993);*
- *National Veld and Forest Fire Bill of 10 July 1998;*
- *Fertiliser, Farm Feeds, Agricultural Remedies and Stock Remedies Act, 1947 (Act No. 36 of 1947;*
- *Astronomy Geographic Advantage Act, 2007 (Act No. 21 of 2007);*
- *Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002); and*
- *Independent Communications Authority of South Africa Act, 2000 (Act No. 13 of 2000; as amended).*

2.11 Conventions and Treaties

2.11.1 The Convention on Biological Diversity (CBD) (1993)

This is a multilateral treaty for the international conservation of biodiversity, the sustainable use of its components and fair and equitable sharing of benefits arising from natural resources. Signatories have the sovereign right to exploit their own resources pursuant to their own environmental policies, and the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States or of areas beyond the limits of national jurisdiction.

The convention prescribes that signatories identify components of biological diversity important or conservation and monitor these components in light of any activities that have been identified which are likely to have adverse impacts on biodiversity. The CBD is based on the precautionary principle which states that where there is a threat of significant reduction or loss of biological diversity, lack of full scientific certainty should not be used as a reason for postponing measures to avoid or minimize such a threat and that in the absence of scientific consensus the burden of proof that the action or policy is not harmful falls on those proposing or taking the action.

2.11.2 The Ramsar Convention (1971)

The Convention on Wetlands, called the Ramsar Convention, as it was adopted in the Iranian city of Ramsar in 1971 and came into force in 1975, is an intergovernmental treaty that provides the framework for the conservation and wise use of wetlands and their resources. Under the three pillars ofthe convention the Contracting Parties commit to 10 work towards the wise use of all their wetlands through national plans, policies and legislation, management actions and public education; 20 designate suitable wetlands for thei list of Wetlands of International Importance (the "Ramsar List") and ensure their effective management; and 30 Cooperate internationally on transboundary wetlands, sahred wetland systems, shared species, and development projects that may affect wetlands.

2.11.3 The Convention on the Conservation of Migratory Species of Wild Animals (CMS or Bonn Convention) (1983)

An intergovernmental treaty, concluded under the sponsorship of the United Nations Environment Programme, concerned with the conservation of wildlife and habitats on a global scale. The fundamental principles listed in Article II of this treaty state that signatories acknowledge the importance of migratory species being conserved and agree to take action to this end "*whenever possible and appropriate*", "*paying special attention to migratory species the conservation status of which is unfavourable and taking individually or in cooperation appropriate and necessary steps to conserve such species and their habitat*".

2.11.4 The Agreement on the Conservation of African-Eurasian Migratory Waterbirds (AEWA) (1999)

An intergovernmental treaty developed under the framework of the Convention on Migratory Species (CMS), concerned the coordinated conservation and management of migratory waterbirds throughout their entire migratory range. Signatories of the Agreement have expressed their commitment to work towards the conservation and sustainable management of migratory waterbirds, paying special attention to endangered species as well as to those with an unfavourable conservation status. The assessment of the ecology and identification of sites and habitats for migratory waterbirds is required to coordinate efforts that ensure that networks of suitable habitats are maintained and investigate problems likely posed by human activities.

2.12 Policies and Guidelines

2.12.1 Environmental Impact Assessment Guidelines

Relevant guidelines and policies as applicable to the management of the EIA process and to this application have also been taken into account, as indicated below:

- *Integrated Environmental Management (IEM) Guideline Series (Series 2): Scoping in the EIA process (2002);*
- *IEM Guideline Series (Series 3): Stakeholder engagement (2002);*
- *IEM Guideline Series (Series 4): Specialist studies (2002);*
- *IEM Guideline Series (Series 5): Impact Significance (2002);*
- *IEM Guideline Series (Guideline 5): Companion to the EIA Regulations 2010 (October 2012);*
- *IEM Guideline Series (Series 7): Cumulative Effects Assessment (2002);*
- *IEM Guideline Series (Guideline 7): Public Participation in the EIA process (October 2012);*
- *IEM Guideline Series (Series 7): Alternatives in the EIA process (2002);*
- *IEM Guideline Series (Guideline 9): Draft guideline on need and desirability in terms of the EIA Regulations 2010 (October 2012);*
- DEA (2017) Guideline on Need and Desirability, Department of Environmental Affairs (DEA) Pretoria, South Africa;
- *IEM Guideline Series (Series 12): Environmental Management Plans (EMP) (2002); and*
- *IEM Guideline Series (Series 15): Environmental impact reporting (2002).*

2.12.2 Noise Standards

National

Four South African Bureau of Standards (SABS) scientific standards are considered relevant to noises from a Wind Energy Facility. They are:

- *SANS 10103:2008. 'The measurement and rating of environmental noise with respect to annoyance and to speech communication';*
- *SANS 10210:2004. 'Calculating and predicting road traffic noise';*
- *SANS 10328:2008. 'Methods for environmental noise impact assessments'; and*
- *SANS 10357:2004. 'The calculation of sound propagation by the Concave method'.*

The relevant standards use the equivalent continuous rating level as a basis for determining what is acceptable. The levels may take single event noise into account, but single event noise by itself does not determine whether noise levels are acceptable for land use purposes. The recommendations that the standards make are likely to inform decisions by authorities, but non-compliance with the standards will not necessarily render an activity unlawful *per se.*

International

There exists a number of international guidelines and the three described below are selected as they are used by different countries in the subject of environmental noise management, with the last two documents specifically focussing on the noises associated by wind energy facilities. Due to the lack of local regulations specifically relevant to wind energy facilities, these guidelines will also be considered during the determination of the significance of noise impacts.

2.12.2.1.1 Guidelines for Community Noise (Word Health Organisation, 1999)

The World Health Organization's (WHO) document on the Guidelines for Community Noise is the outcome of the WHO- expert task force meeting held in London, United Kingdom, in April 1999. It is based on the document entitled "Community Noise" that was prepared for the World Health Organization and published in 1995 by the Stockholm University and Karolinska Institute.

The scope of the WHO's effort to derive guidelines for community noise is to consolidate actual scientific knowledge on the health impacts of community noise and to provide guidance to environmental health authorities and professionals trying to protect people from the harmful effects of noise in non-industrial environments.

Guidance on the health effects of noise exposure of the population has already been given in an early publication of the series of Environmental Health Criteria. The health risk to humans from exposure to environmental noise was evaluated and guidelines values derived. The issue of noise control and health protection was briefly addressed.

The document uses the LAeq and LA,max descriptors to define noise levels with the instrument likely using the "Fast"-time weighting. This document was important in the development of the SANS 10103 standard.

2.12.2.1.2 The Assessment and Rating of Noise from Wind Farms (1997)

This report describes the findings of a Working Group on Wind Turbine Noise, facilitated by the United Kingdom Department of Trade and Industry. It was developed as an Energy Technology Support Unit[7] (ETSU) project. The aim of the project was to provide information and advice to developers and planners on noise from wind turbines. The report represents the consensus view of a number of experts (experienced in assessing and controlling the environmental impact of noise from wind farms). Their findings can be summarised as follows:

1. Absolute noise limits applied at all wind speeds are not suited to wind farms; limits set relative to the background noise (including wind) are more appropriate.
2. $L_{A90,10mins}$ is a much more accurate descriptor when monitoring ambient and turbine noise levels.
3. The effects of other wind turbines in a given area should be added to the effect of any proposed wind energy facility, to calculate the cumulative effect.
4. Noise from a wind energy facility should be restricted to no more than 5 dBA above the current ambient noise level at a NSD. Ambient noise levels are measured on-site in terms of the $L_{A90,10min}$ descriptor for a period sufficiently long enough for a set period.
5. Wind farms should be limited to within the range of 35 dBA to 40 dBA (day-time) in a low noise environment. A fixed limit of 43 dBA should be implemented during all night time noise environments. This should increase to 45 dBA (day and night) if the NSD has financial investments in the wind energy facility.
6. A penalty system should be implemented for wind turbine/s that operates with a tonal characteristic.

This is likely the guideline used in the most international countries to estimate the potential noise impact stemming from the operation of a wind energy facility. It also recommends an improved methodology (compared to a fixed upper noise level) on determining ambient sound levels in periods of higher wind speeds, critical for the development of a wind energy facility. Because of its international importance, the methodologies used in the ETSU R97 document will be recommended in this Scoping

[7] ETSU was set up in 1974 as an agency by the United Kingdom Atomic Energy Authority to manage research programmes on renewable energy and energy conservation. The majority of projects managed by ETSU were carried out by external organizations in academia and industry. In 1996, ETSU became part of AEA Technology plc which was separated from the UKAEA by privatisation.

Report for implementation during the Environmental Noise Impact Assessment phase should projected noise levels (from the proposed WEF at PSRs) exceed the zone sound levels as recommended by SANS 10103:2008.

2.12.2.1.3 The document uses the $L_{Aeq,f}$ and L_{A90} descriptors to define noise levels using the "Fast"-time weighting. Noise Guidelines for Wind Farms (MoE, 2008)[8]

This document establishes the sound level limits for land-based wind power generation facilities and describes the information required for noise assessments and submissions under the Environmental Assessment Act and the Environmental Protection Act, Canada (Table 2.2).

The document defines:

- *Sound Level Limits for different areas (similar to rural and urban areas), defining limits for different wind speeds at 10 m height; and*
- *The Noise Assessment Report, including:*
  - Information that must be part of the report;
  - Full description of noise sources;
  - Adjustments, such as due to the wind speed profile (wind shear);
  - The identification and defining of potential sensitive receptors;
  - Prediction methods to be used (ISO 9613-2);
  - Cumulative impact assessment requirements;
  - It also defines specific model input parameters;
  - Methods on how the results must be presented; and
  - Assessment of Compliance (defining magnitude of noise levels).

Table 2.2: Summary of Sound Level Limits for Wind Farms (MoE)

Wind speed (m/s) at 10 m height	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Wind Turbine Sound Level Limits, Class 3 Area, dBA	40	40	40	43	45	49	51
Wind Turbine Sound Level Limits, Class 1 & 2 Areas, dBA	45	45	45	45	45	49	51

The document used the $L_{Aeq,1h}$ noise descriptor to define noise levels. It is not clear whether the instrument must be set to the "Fast" or "Impulse" time weighing setting, but, as the "Fast" setting is used in most international countries it is assumed that the instrument will be set to the "Fast" setting.

It should be noted that these Sound Level Limits are included for the reader to illustrate the criteria used internationally. Due to the lack of local regulations specifically relevant to wind energy facilities these criteria will also be considered during the determination of the significance of the noise impact.

2.12.2.1.4 The Equator Principles (EPs) III, 2013

The principles applicable to the project are likely to include:

- *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;*

[8] Noise Guidelines for Wind Farms Interpretation for Applying MOE NPC Publications to Wind Power Generation Facilities Ministry of the Environment, Ontario, October 2008.

- *Principle 7: Independent Review;*
- *Principle 8: Covenants;*
- *Principle 9: Independent Monitoring and Reporting; and*
- *Principle 10: Reporting and Transparency.*

These principles, among various requirements, include a requirement for an assessment process and an Environmental and Social Management Plan (ESMP) to be prepared by the client to address issues raised in the assessment process and incorporate actions required to comply with the applicable standards, and the appointment of an independent environmental expert to verify monitoring information.

2.12.3 South African Wind Energy Facility Guidelines

The following guidelines are relevant to the proposed WEF and the potential impacts they may have on bats/avifauna and habitat that support bats/avifauna:

- *South African Good Practise Guidelines for Surveying Bats in Wind Energy Facility Developments – Pre-Construction. Fourth Edition: 2016;*
- *South African Good Practise Guidelines for Operational Monitoring for Bats at Wind Energy Facilities (2014); and*
- *Birds and Wind-Energy Best-Practice Guidelines: Best-Practice Guidelines for assessing and monitoring the impact of wind-energy facilities on birds in southern Africa. Third Edition, 2015 (previous versions 2011 and 2012).*

2.13 Impact Assessment and Reporting

The primary objective of the environmental impact assessment and reporting phase (EIA phase) is to present sufficient information to the competent authority (CA) and interested and affected parties (I&APs) on predicted impacts and associated mitigation measures required to avoid or mitigate negative impacts, as well as to improve or maximise the benefits of the project.

This must include addressing issues raised in the scoping phase, an assessment of alternatives to the proposed development in a comparative manner, an assessment of identified impacts and a determination of their significance, as well as a formulation of mitigation measures.

In terms of legal requirements, NEMA EIA Regulations regulate and prescribe the content of the EIA Report and specify the type of supporting information that must accompany the submission of the report to the authorities. Table 2.3 shows how and where the legal requirements are addressed in this EIA Report. Appendix C of this EIA Report contains the PPP undertaken to date. As the comments are received on the Draft EIA Report these will be collated and included in the issues and response report.

The EIA Report presents a summary of the findings and recommendations of all specialists.

The EIA Phase must be undertaken in line with the approved plan of study for environmental impact assessment. The environmental impacts, mitigation and closure outcomes as well as the residual risks of the proposed activity must be set out in the EIR.

As per the EIA Regulations 2014, as amended, "the objective of the environmental impact assessment process is to, through a consultative process -

(a) determine the policy and legislative context within which the activity is located and document how the proposed activity complies with and responds to the policy and legislative context;

(b) describe the need and desirability of the proposed activity, including the need and desirability of the activity in the context of the preferred location;

(c) identify the location of the development footprint within the preferred site based on an impact and risk assessment process inclusive of cumulative impacts and a ranking process of all the identified development footprint alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects of the environment;
(d) determine the:
(i) nature, significance, consequence, extent, duration and probability of the impacts occurring to inform identified preferred alternatives; and
(ii) degree to which these impacts –
(aa) can be reversed;
(bb) may cause irreplaceable loss of resources, and
(cc) can be avoided, managed or mitigated;
(e) identify the most ideal location for the activity within the preferred site based on the lowest level of environmental sensitivity identified during the assessment;
(f) identify, assess, and rank the impacts the activity will impose on the preferred location through the life of the activity;
(g) identify suitable measures to avoid, manage or mitigate identified impacts; and
(h) identify residual risks that need to be managed and monitored".

The above activities are completed through consultation with:

- The lead authorities involved in the decision-making for the EIA application (in this case, the DEA);
- The public, I&APs and other relevant organisations to ensure that local issues are well understood; and
- The EIA specialist team to ensure that technical issues are identified.

The existing environment within which a proposed development is to be located is investigated, through a review of relevant background literature and ground-truthing.

A primary objective during this phase is to present key stakeholders with the findings of the assessments, obtain and document feedback and address all issues raised.

Table 2.3: Legislative Requirements for Content of EIA Report

Appendix 3 Requirements NEMA, 1998 (Act No. 107 of 1998	**Location in EIR**
2 (a) details of- *(i) the EAP who prepared the report; and* *(ii) the expertise of the EAP, including a curriculum vitae;*	Section 1 and Appendix A
(b) the location of the activity, including- *(i) the 21 digit Surveyor 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 co-ordinates of the boundary of the property or properties;*	Section 7 Figure 1.1 Figure 6.1 Figure 7.1 Figure 7.3
(c) a plan which locates the proposed activity or activities applied for as well as the associated structures and infrastructure at an appropriate scale, or, if it is- *(i) a linear activity, a description and coordinates of the corridor in which the proposed activity or activities is to be undertaken; or* *(ii) on land where the property has not been defined, the coordinates within which the activity is to be undertaken;*	Figure 6.1 Figure 7.1 Figure 7.3
(d) a description of the scope of the proposed activity, including- *(i) all listed and specified activities triggered and being applied for; and* *(ii) a description of the associated structures and infrastructure related to the development;*	Section 2 Section 7

Appendix 3 Requirements NEMA, 1998 (Act No. 107 of 1998	**Location in EIR**
(e) a description of the policy and legislative context within which the development is located and an explanation of how the proposed development complies with and responds to the legislation and policy context;	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;	Section 5
(g) a motivation for the preferred development footprint within the approved site;	Section 6
(h) a full description of the process followed to reach the proposed development footprint within the approved site, including- *(i) details of the development footprint alternatives considered;*	Section 6
(ii) details of the public participation process undertaken in terms of regulation 41 of the Regulations, including copies of the supporting documents and inputs;	Section 4 and Appendix C
(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;	Section 4 and Appendix C
(iv) the environmental attributes associated with the development footprint alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects;	Section 8
(v) the impacts and risks identified, including the nature, significance, consequence, extent, duration and probability of the impacts, including the degree to which these impacts- *(aa) can be reversed;* *(bb) may cause irreplaceable loss of resources; and* *(cc) can be avoided, managed or mitigated;*	Section 10
(vi) the methodology used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks;	Section 3
(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;	Section 10
(viii) the possible mitigation measures that could be applied and level of residual risk;	Section 10
(ix) if no alternative development locations for the activity were investigated the motivation for not considering such;	N/A
(x) a concluding statement indicating the preferred alternative development location within the approved site;	Section 6
(xi) a full description of the process undertaken to identify, assess and rank the impacts the activity and associated structures and infrastructure will impose on the preferred location through the life of the activity, including - *(i) a description of all environmental issues and risks that were identified during the environmental impact assessment process; and* *(ii) an assessment of the significance of each issue and risk and an indication of the extent to which the issue and risk could be avoided or addressed by the adoption of mitigation measures;*	Section 10
(j) an assessment of each identified potentially significant impact and risk, including- *(i) cumulative impacts;*	Section 10

Appendix 3 Requirements NEMA, 1998 (Act No. 107 of 1998	**Location in EIR**
(ii) the nature, significance and consequences of the impact and risk; *(iii) the extent and duration of the impact and risk;* *(iv) the probability of the impact and risk occurring;* *(v) the degree to which the impact and risk can be reversed;* *(vi)the degree to which the impact and risk may cause irreplaceable loss of resources; and* *(vii) the degree to which the impact and risk can be mitigated;*	
(k) where applicable, a summary of the findings and recommendations of any specialist report complying with Appendix 6 to these Regulations and an indication as to how these findings and recommendations have been included in the final assessment report;	Section 11
(l) an environmental impact statement which contains- *(i) a summary of the key findings of the environmental impact assessment:* *(ii) a map at an appropriate scale which superimposes the proposed activity and its associated structures and infrastructure on the environmental sensitivities of the preferred site indicating any areas that should be avoided, including buffers; and* *(iii) a summary of the positive and negative impacts and risks of the proposed activity and identified alternatives;*	Section 11
(m) based on the assessment, and where applicable, recommendations from specialist reports, the recording of proposed impact management objectives, and the impact management outcomes for the development for inclusion in the EMPr as well as for inclusion as conditions of authorisation;	Section 11
(n) the final proposed alternatives which respond to the impact management measures, avoidance, and mitigation measures identified through the assessment;	Section 11
(o) any aspects which were conditional to the findings of the assessment either by the EAP or specialist which are to be included as conditions of authorisation	Section 11
(p) a description of any assumptions, uncertainties and gaps in knowledge which relate to the assessment and mitigation measures proposed;	Section 1
(q) a reasoned opinion as to whether the proposed activity should or should not be authorised, and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation;	Section 11
(r) where the proposed activity does not include operational aspects, the period for which the environmental authorisation is required and the date on which the activity will be concluded and the post construction monitoring requirements finalised;	Section 11
(s) 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;* *(iii) the inclusion of inputs and recommendations from the specialist reports where relevant; 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;*	Appendix A
(t) where applicable, details of any financial provisions for the rehabilitation, closure, and ongoing post decommissioning management of negative environmental impacts;	N/A
(u) an indication of any deviation from the approved scoping report, including	Section 1

Appendix 3 Requirements NEMA, 1998 (Act No. 107 of 1998	Location in EIR
the plan of study, including: *(i) any deviation from the methodology used in determining the significance of potential environmental impacts and risks; and* *(ii) a motivation for the deviation;*	
(v) any specific information that may be required by the competent authority; and	No other specific information is required for the CA to make an informed decision
(w) any other matters required in terms of section 24(4)(a) and (b) of the Act.	Noted

3 METHODOLOGY

3.1 Assessment Techniques for the EIA

Each of the specialist assessments follows a systematic approach to the assessment of impacts, with the principal steps being:

- Description of existing environment/baseline conditions;
- Prediction of likely potential impacts, including cumulative impacts (both positive and negative);
- Assessment of likely potential impacts (positive and negative);
- Identification of appropriate mitigation measures; and
- Assessment of residual (potential) environmental impacts.

3.2 Baseline Description

In order to evaluate the potential environmental impacts, information relating to the existing environmental conditions were collected through field and desktop research; this is known as the baseline. Climate change is expected to affect the proposed development site over the lifetime of the proposed development; however, the nature, scale and severity of climate change effects are uncertain. Given this uncertainty, the existing environment is assumed to remain constant throughout the lifetime of the proposed development, and forms the current and future baseline for the impact assessments.

The baseline was used to determine the sensitivity of receptors on and near the proposed grid connection site and what changes may take place during the construction, operation and decommissioning of the proposed grid connection and the impacts, if any, that these changes may have on these receptors.

Within each specialist assessment, the methods of data collection have been discussed with the relevant I&APs and is presented below. Data was collected from public records and other archive sources and where appropriate field surveys were also carried out as detailed.

3.2.1 Geology

Existing information was obtained from the map sheet 3124 Middelburg from the national Land Type Survey. A land type is defined as an area with a uniform terrain type, macroclimate and broad soil pattern. The soils are classified according to MacVicar *et al.* (1977)[9]. A site visit was not deemed necessary due to the prevailing shallow soils and steep terrain which is restricting regarding agricultural activities.

3.2.2 Freshwater and Wetlands

A desktop survey was conducted to identify which portions of the proposed development could have the greatest impact on the wetlands and associated habitats. Following this, site visits were conducted in March 2016 for the purpose of the Scoping Report and in September 2017 for this report. The surveys coincided with summer and early spring cycles, both following some degree of rainfall, and totalling 6 full days in the field. In addition the site has previously been visited by the specialist during the 2012-2014 period when heavy rainfalls had occurred. Thus the specialist has an understanding of the area during summer and winter and during flooding and drought events.

[9] MacVicar, C.N., de Villiers, J.M., Loxton, R.F, Verster, E., Lambrechts, J.J.N., Merryweather, F.R., le Roux, J., van Rooyen, T.H. & Harmse, H.J. von M., 1977. Soil classification. A binomial system for South Africa. ARC-Institute for Soil, Climate & Water, Pretoria.

Assessment of the wetland types was conducted according to the National Wetland Classification System (Ollis *et al.,* 2013), details of which are presented in Appendix 1 of the Aquatic Impact Assessment in Volume II. The Present Ecological State (PES) of the observed wetlands was assessed using a modified Wetland Index of Habitat Integrity model (DWAF, 2007). The aquatic specialist included additional criteria into this model based system to include additional wetland types. Data required for the assessment were generated during the site visits.

Conservation importance of the individual wetlands was based on the following criteria:

- Habitat uniqueness;
- Species of conservation concern;
- Habitat fragmentation with regard ecological corridors; and
- Ecosystem service (social and ecological).

The presence of any or a combination of the above criteria would result in a HIGH conservation rating if the wetland was found in a near natural state (high PES). Should any of the habitats be found modified the conservation importance would rate as MEDIUM, unless a Species of conservation concern was observed (HIGH). Any systems that was highly modified (low PES) or had none of the above criteria, received a LOW conservation importance rating. Wetlands with HIGH and MEDIUM ratings should thus be excluded from development with incorporation into a suitable open space system, with the maximum possible buffer being applied. Wetlands which receive a LOW conservation importance rating could be included into stormwater management features, but should not be developed to retain the function of any ecological corridors.

The Present Ecological State of a river represents the extent to which it has changed from the reference or near pristine condition (Category A) towards a highly impacted system where there has been an extensive loss of natural habit and biota, as well as ecosystem functioning (Category E).

The national Present Ecological Score or PES scores have been revised for the country and based on the new models, aspects of functional importance as well as direct and indirect impacts have been included (DWS, 2014). The new PES system also incorporates EI (Ecological Importance) and ES (Ecological Sensitivity) separately as opposed to EIS (Ecological Importance and Sensitivity) in the old model. Although the new model is still heavily centred on rating rivers using broad fish, invertebrate, riparian vegetation and water quality indicators. The Recommended Ecological Category (REC) is still contained within the new models, with the default REC being B, when little or no information is available to assess the system or when only one of the above-mentioned parameters is assessed or then overall PES is rated between a C or D.

3.2.3 Flora and Terrestrial Fauna

A desktop study was conducted in combination with a site visit in Scoping Phase (April 2016) and a comprehensive 5 day site visit from 5-9 September 2017 in the EIA Phase.

3.2.3.1 Desktop study

Data sources from the literature consulted and used where necessary in the study includes the following:

Vegetation:

- Vegetation types and their conservation status were extracted from the South African National Vegetation Map (Mucina and Rutherford 2006 and Powrie 2012 Update) as well as the National List of Threatened Ecosystems (2011), where relevant.

- Information on plant species recorded for the Quarter or Half Degree Squares (QDS) 3124B and 3125A was extracted from the SABIF/SIBIS and POSA database hosted by SANBI. This is a considerably larger area than the study area, but this is necessary to ensure a conservative approach as well as counter the fact that the site itself has probably not been well sampled in the past.
- The IUCN conservation status of the species in the list was also extracted from the database and is based on the Threatened Species Programme, Red List of South African Plants.

Ecosystem:

- Freshwater and wetland information was extracted from the National Freshwater Ecosystem Priority Areas assessment, NFEPA (Nel et al. 2011). This includes rivers, wetlands and catchments defined under the study.
- Important catchments and protected areas expansion areas were extracted from the National Protected Areas Expansion Strategy 2008 (NPAES).
- Critical Biodiversity Areas were extracted from the Northern Cape Conservation Plan (Oosthuysen & Holness 2016), available from the SANBI BGIS web portal.

Fauna

- Lists of mammals, reptiles and amphibians which are likely to occur at the site were derived based on distribution records from the literature and the ADU databases http://vmus.adu.org.za.
- Literature consulted includes Branch (1988) and Alexander and Marais (2007) for reptiles, Du Preez and Carruthers (2009) for amphibians, Friedmann and Daly (2004) and Skinner and Chimimba (2005) for mammals.
- The faunal species lists provided are based on species which are known to occur in the broad geographical area, as well as a preliminary assessment of the availability and quality of suitable habitat at the site.
- The conservation status of each species is also listed, based on the IUCN Red List Categories and Criteria version 3.1 (2016) and where species have not been assessed under these criteria, the CITES status is reported where possible.

3.2.3.2 Site visits

The main site visit for the EIA phase was conducted over 5 days from the 5th to the 9th of September 2017. During the site visit, the different biodiversity features, habitat, and landscape units present at the site were identified and mapped in the field. Specific features visible on the satellite imagery of the site were also marked for field inspection and were verified and assessed during the site visit. This included features such as pans and rocky outcrops that were not visible from the access roads of the site and might have otherwise been missed. Walk-through-surveys were conducted within representative areas across the different habitat units identified and all plant and animal species observed were recorded. Active searches for reptiles and amphibians were also conducted within habitats likely to harbour or be important for such species such as around wetlands and in the rocky hills. The presence of sensitive habitats such as wetlands or pans and unique edaphic environments such as rocky outcrops or quartz patches were noted in the field if present and recorded on a GPS. The conditions at the time of the site visit were adequate for the field assessment and there are few limitations resulting from the site visit and the plant species lists obtained for the site are considered reliable and comprehensive. Additional information on plant species that were not visible at the time of the site visit was included from the Scoping Phase site visit in April 2016 as well as the adjacent Mainstream wind energy facility for which the consultant sampled in March 2014.

3.2.3.3 Sensitivity Mapping & Assessment

An ecological sensitivity map of the site was produced by integrating the information collected on-site with the available ecological and biodiversity information available in the literature and various spatial databases as described above. Sensitive features such as wetlands, drainage lines and water bodies were mapped and buffered where appropriate to comply with legislative requirements or ecological considerations. Additional sensitive areas were then identified based on the results of the site visit and delineated. Features that were specifically captured in the sensitivity map include drainage features, wetlands and dams, as well as rocky outcrops and steep slopes. The ecological sensitivity of the different units identified in the mapping procedure was rated according to the following scale:

- **Low** – Units with a low sensitivity where there is likely to be a low impact on ecological processes and terrestrial biodiversity. This category represents transformed or natural areas where the impact of development is likely to be local in nature and of low significance with standard mitigation measures.
- **Medium** - Areas of natural or previously transformed land where the impacts are likely to be largely local and the risk of secondary impact such as erosion low. Development within these areas can proceed with relatively little ecological impact provided that appropriate mitigation measures are taken.
- **High** – Areas of natural or transformed land where a high impact is anticipated due to the high biodiversity value, sensitivity or important ecological role of the area. These areas are not no-go areas, however development within these areas is considered to be undesirable and should only proceed with caution as it may not be possible to mitigate all impacts appropriately.
- **Very High** – Critical and unique habitats that serve as habitat for rare/endangered species or perform critical ecological roles. These areas are essentially no-go areas from a developmental perspective and should be avoided as much as possible.
- In some situations, areas were also categorised between the above categories, such as **Medium-High**, where an area appeared to be of intermediate sensitivity with respect to the two defining categories. However, it is important to note that there are no sensitivities that are identified as "Medium to High" or similar ranged categories because this adds uncertainty to the mapping as it is not clear if an area falls at the bottom or top of such a range.

3.2.4 Avifauna

- Bird distribution data from the South African Bird Atlas 2[10] was used to ascertain which species occur within the broader area i.e. within a block consisting of nine pentad grid cells within which the proposed wind facility is situated. The nine pentad grid cells are the following: 3110_2450, 3110_2455, 3110_2500, 3115_2450, 3115_2455, 3115_2500, 3120_2450, 3120_2455 and 3120_2500. A pentad grid cell covers 5 minutes of latitude by 5 minutes of longitude (5'× 5'). Each pentad is approximately 8 × 7.6 km. From 2011 to date, a total of 68 full protocol cards have
- The national threatened status of all priority species was determined from the Red Data Book of Birds of South Africa[11]and the latest authoritative summary of southern African bird biology[12]

[10] ANIMAL DEMOGRAPHY UNIT. The southern African Bird Atlas Project 2. University of Cape Town. http://sabap2.adu.org.za. Accessed 29/09/2017.

[11]TAYLOR, M.R., PEACOCK, F. & WANLESS, R.S. (eds.) 2015. The Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland. Birdlife South Africa, Johannesburg.

[12] HOCKEY P.A.R., DEAN W.R.J., AND RYAN P.G. 2005. Robert's Birds of Southern Africa, seventh edition. Trustees of the John Voelcker Bird Book Fund, Cape Town.

- The global threatened status of all priority species was determined from the IUCN Red List of Threatened Species[13]
- The Important Bird and Biodiversity Areas of South Africa[14] was consulted for information on Important Bird Areas (IBAs)
- Satellite imagery was used in order to view the broader development area on a landscape level and to help identify sensitive bird habitat.
- Priority species were taken from the updated list (2014) of priority species for wind farms compiled for the Avian Wind Farm Sensitivity Map[15].
- A site visit was conducted from 7 – 9 April 2015 to record bird habitat at the site and to identify transects, vantage points and potential focal points for the 12-months pre-construction monitoring which commenced in March 2015.
- The main source of information on avifaunal abundance and species diversity was the 12-months pre-construction monitoring which was conducted from March 2015 to February 2016. See Volume II: Bird Specialist Study: Appendix 2 for a summary of the methodology employed in the pre-construction programme.
- The current South African "Best practice guidelines"[16] are followed for this study.
- The BirdLife SA Verreaux's Eagle guidelines for wind farm developments[17] were released in May 2017, after the completion of the monitoring. However, these guidelines were considered in the delineation of buffer zones.
- Coordinated Avifaunal Roadcount project (CAR) (2003 to 2014) data was consulted for an overview of densities of large terrestrial species[18]
- The avifaunal specialist studies and pre-construction monitoring reports of the Mainstream Noupoort WEF, the Umsobomvu WEF and the Noupoort CSP project were consulted.

3.2.5 Bats

- All methodologies for the preconstruction study were initiated and designed according to the "South African good practice guidelines for surveying bats in wind farm developments (2014, Sowler & Stoffberg)", but also complies with all requirements of the 2016 version of "South African Good Practice Guidelines for Surveying Bats at Wind Energy Facility Developments - Pre-construction: 4th Edition (Sowler, et al.).
- Bat activity was monitored using active and passive bat monitoring techniques. Active monitoring was done through site visits, with transects made throughout the site with a vehicle-mounted bat detector. Passive detection was completed with the mounting of passive bat monitoring systems placed on four monitoring masts on site. Specifically, three short 10m masts and one meteorological mast.
- The monitoring systems consisted of SM2BAT+ time expansion bat detectors that was powered by 18Ah, 12V, sealed lead acid batteries and 20W solar panels which provided recharging power to the batteries. Each system had an 8-amp low voltage protection regulator and SM3PWR step down transformer. Four SD memory cards, class 10 speed, with a capacity of 32GB each were utilized within each SM2BAT+ detector; this was to ensure substantial memory space with high quality recordings even under conditions of multiple false wind triggers.

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[13]http://www.iucnredlist.org

[14]MARNEWICK, M.D., RETIEF E.F., THERON N.T., WRIGHT D.R., ANDERSON T.A. 2015. Important Bird and Biodiversity Areas of South Africa. Johannesburg: Birdlife South Africa.

[15] RETIEF E.F., DIAMOND M, ANDERSON M.D., SMIT, H.A., JENKINS, A & M. BROOKS. 2012. Avian Wind Farm Sensitivity Map. Birdlife South Africahttp://www.birdlife.org.za/conservation/birds-and-wind-energy/windmap.

[16] Jenkins, A.R., Van Rooyen, C.S., Smallie, J.J., Anderson, M.D., & A.H. Smit. 2011, updated 2015. Best practice guidelines for avian monitoring and impact mitigation at proposed wind energy development sites in southern Africa. Endangered Wildlife Trust and Birdlife South Africa.

17 Ralston Paton, S. 2017. Verreaux's Eagle and Wind Farms. Guidelines for Impact Assessment, Monitoring and Mitigation. BirdLIfe South Africa.

[18] http://car.adu.org.za/)

- One weatherproof ultrasound microphone was mounted at a height of 10 meters on the short masts, while two microphones were mounted at 10m and 50m on the meteorological mast. These microphones were then connected to the SM2BAT+ bat detectors.
- Each detector was set to operate in continuous trigger mode from dusk each evening until dawn (times were correlated with latitude and longitude). Trigger mode is the setting for a bat detector in which any frequency which exceeds 16 kHz and -18dB will trigger the detector to record for the duration of the sound and 500ms after the sound has ceased, this latter period is known as a trigger window.
- All signals were recorded in WAC0 lossless compression format. The table below summarizes the above-mentioned equipment setup.

3.2.5.1 Site Visit Information

<table>
<tr><td colspan="2" rowspan="5">Site visit dates</td><td>First Visit</td><td>6 July 2015 – 12 July 2015</td></tr>
<tr><td>Second Visit</td><td>19 October 2015 - 25 October 2015</td></tr>
<tr><td>Third Visit</td><td>25 January 2016 – 30 January 2016</td></tr>
<tr><td>Fourth Visit</td><td>5 April 2016 – 10 April 2016</td></tr>
<tr><td>Fifth Visit</td><td>29 August 2016 – 3 September 2016</td></tr>
<tr><td rowspan="3">Met mast passive bat detection systems</td><td>Amount on site</td><td colspan="2">1</td></tr>
<tr><td>Microphone heights</td><td colspan="2">10m; 50m</td></tr>
<tr><td>Coordinates</td><td colspan="2">Met East: 31°13'37.97"S 25° 2'54.83"E</td></tr>
<tr><td rowspan="3">Short mast passive bat detection systems</td><td>Amount on site</td><td colspan="2">3</td></tr>
<tr><td>Microphone height</td><td colspan="2">9m</td></tr>
<tr><td>Coordinates</td><td colspan="2">SM3: 31°15'25.71"S 25° 3'32.93"E
SM4: 31°13'2.33"S 25° 4'43.53"E
SM5: 31°15'1.08"S 25° 0'53.05"E</td></tr>
<tr><td colspan="4">Replacements/ Repairs/ Comments</td></tr>
<tr><td colspan="2">First Site Visit</td><td colspan="2">The microphones were mounted such that they pointed approximately 30 degrees downward to avoid excessive water damage. Measures were taken for protection against birds, without compromising effectiveness significantly. Crows have been found to peck at microphones and damage them.
The bat detectors were mounted inside weather-proof boxes together with all peripherals, to provide protection against the elements.</td></tr>
<tr><td colspan="2">Second Site Visit</td><td colspan="2">All systems were operational apart from SM5 which was pulled down and bent. All equipment was removed from the box and left in the open and two guy cables were stolen. Data was lost from 6 September 2015 to when the system was repaired on 20 October 2015.</td></tr>
<tr><td colspan="2">Third Site Visit</td><td colspan="2">The monitoring systems were operating normally, except for Short Mast 4 and 5. The bat detector firmware of Short Mast 4 had become corrupt and required reloading, this system recorded until early January 2016 and lost minimal data. It seems as though Short Mast 5 was tampered with by a third party since the system recorded properly until 1 November 2015 and then again from early January 2016. There were no firmware or battery issues.</td></tr>
<tr><td colspan="2">Fourth Site Visit</td><td colspan="2">SM1 had frozen, the AA batteries were replaced and it is operational again. SM3 had fallen over as a result of an anchor failure and had shattered the solar panel. The box had also broken its latch with the fall resulting in the</td></tr>
</table>

	equipment being exposed to the elements. SM5 had been completely stolen with only the bottom 2 segment of the mast and an empty box left behind. All other masts were working fine.
Fifth Site Visit	SM5 was stolen, SM4 had structural issues but was still fully operational and SM3 developed a partial solar charging/battery issue and recorded for one month during this period. The Met Mast East gathered enough data to allow for a full 12 month record of bat activity. All the masts were decommissioned except for the Met Mast system which was left until the microphone removal.
Type of passive bat detector	SM2BAT+, Real Time Expansion (RTE) type.
Recording schedule	Each detector was set to operate in continuous trigger mode from dusk each evening until dawn (times were automatically adjusted with latitude, longitude and season).
Trigger threshold	>16KHz, 18dB
Trigger window (time of recording after trigger ceased)	500ms
Microphone gain setting	36dB
Compression	WAC0
Single memory card size (each systems uses 4 cards)	32GB
Battery size	18Ah; 12V
Solar panel output	20 Watts
Solar charge regulator	8 Amp with low voltage/deep discharge protection
Other methods	Terrain was investigated during the day.

3.2.6 Noise

Ambient sound levels were measured at a number of locations during April 2016. Three class-1 Sound Level Meters as well as a portable weather station was used for measurements. Two instruments were used for semi-continuous, longer measurements (2 night-time periods) with one instrument used for shorter measurements (10 minutes each). The sound level meters would measure "average" sound levels over a time period, save the data and start with a new measurement till the instrument was stopped.

The data indicate that traffic is a major source of the noise in the area, but the road traffic will only influence the sound levels in an area up to 1,000m from the road. Away from the roads (N9 and N10), the area has a high potential to be very quiet during low wind conditions. Birds, faunal and wind-induced noises do influence sound levels and considering the data collected, wind-induced noises significantly influences sound levels as wind speeds increases.

As most of the area was considered naturally quiet, it was selected to assign an acceptable noise rating level of a rural noise district (as per SANS 10103:2008). This allows daytime noise limits of 52 dBA with night-time noise limits of 42 dBA (during lower wind conditions as increased wind speeds would increase ambient sound levels).

The potential noise impact was evaluated using a sound propagation model. Conceptual scenarios were developed for construction and operational phases.

Ambient Sound Measurement Procedure

The measurement of ambient sound levels is defined by the South African National Standard SANS 10103:2008 as: "***The measurement and rating of environmental***

noise with respect to land use, health, annoyance and to speech communication". The standard specifies the acceptable techniques for sound measurements including the type of equipment, minimum duration of measurement, microphone positions, calibration procedures and instrument checks and weather conditions. This includes:

- The calibration of the sound measuring equipment directly before and directly after the measurements was collected.
- The use of a windshield specifically designed for outdoor use during increased wind speeds;
- Areas where measurements were recorded were selected so as to limit the risks of direct impacts by the wind on the microphone;
- Noise data was synchronised with the wind data measured onsite using an anemometer at a 1.5 m height.

Ambient sound levels were measured at a number of locations from 26 to 28 April 2016. Three class-1 Sound Level Meters as well as a portable weather station was used for measurements. Two instruments were used for semi-continuous, longer measurements (2 night-time periods) with one instrument used for shorter measurements (10 minutes each). The sound level meters would measure "average" sound levels over a time period, save the data and start with a new measurement till the instrument was stopped.

Table 3.1: Equipment used to measure sound levels at INWEFLTASL01

Equipment	Model	Serial no	Calibration Date
SLM	Svan 977	34849	May 2015
Microphone	ACO Pacific 7052E	55974	May 2015
Calibrator	Quest CA-22	J 2080094	June 2016

* Microphone fitted with the RION WS-03 outdoor all-weather windshield.

3.2.7 Visual

A desktop study was conducted in combination with a comprehensive 4 day site visit from 11 – 14 September 2017 in the EIA Phase.

Fieldwork and photographic review

A site visit was conducted to:

- Verify the landscape characteristics identified via the desktop study;
- investigate the visual character of the area;
- identify any additional visually sensitive receptor locations within the study area, and
- Take photographs to be used for visual models of the proposed WEF.

It should be noted that the fieldwork was undertaken during early spring time, before the summer rainfall, therefore the surrounding vegetation is expected to provide less potential screening than in the late summer months. As such, the proposed development is expected to be more visible during spring and winter times due to a lack of significant vegetative screening factors. Due to the timing of the fieldwork, the results of this visual impact assessment are considered to be indicative of the worst case scenario with regards to vegetative screening factors.

Physical landscape characteristics

A site visit and digital information from spatial databases such as the National Geo-spatial Information (NGI), the South African National Land Cover dataset (2014) and the South African National Biodiversity Institute (SANBI) were sourced to provide baseline information on the topography, vegetation and land use in the study area. These physical landscape characteristics are important factors which influence the visual character and visual sensitivity of the study area.

Identification of sensitive receptors

During the field investigation, sensitive visual receptor locations, such as guesthouses / guest farms and routes within the study area were identified and assessed in order to determine the impact of the proposed WEF development on each of the identified sensitive receptor locations.

Impact Assessment

A rating matrix was used to objectively evaluate the significance of the visual impacts associated with the proposed development, both before and after implementing mitigation measures. Mitigation measures were identified (where possible) in an attempt to minimise the visual impact of the proposed development. The rating matrix made use of a number of different factors including geographical extent, probability, reversibility, irreplaceable loss of resources, duration, cumulative effect and intensity, in order to assign a level of significance to the visual impact of the project. A separate rating matrix was used to assess the visual impact of the proposed wind farm on each potentially sensitive receptor locations, as identified. This matrix is based on the distance of a receptor from the proposed development, the primary focus / orientation of the receptor, the presence of screening factors, the visual character and sensitivity of the area / surrounding views and the degree to which the proposed development would contrast with the surrounding environment.

Visualisation Modelling

Visual simulations were produced from specific viewpoints in order to support the findings of the visual assessment. The proposed WEF was modelled at the correct scale and superimposed onto the landscape photographs which were taken during the site visit. These were used to demonstrate the visibility of the proposed turbines from various locations within the visual assessment zone and to assist with rating the visual impact.

Consultation with I&APs

Although no feedback has been received from Interested and Affected Parties (I&APs) during the public participation process to date, some feedback regarding the visual environment has been received following the site visit. The feedback received from the socio-economic specialist has therefore been included in the Visual Specialist Report - Appendix D (Volume II).

Visual Sensitivity

Visual Sensitivity can be defined as the inherent sensitivity of an area to potential visual impacts associated with a proposed development. It is based on the physical characteristics of the area (i.e. topography, landform and land cover), the spatial distribution of potential receptors, and the likely value judgements of these receptors towards a new development (Oberholzer: 2005). A viewer's perception is usually based on the perceived aesthetic appeal of an area and on the presence of economic activities (such as recreational tourism) which may be based on this aesthetic appeal.

In order to assess the visual sensitivity of the area SiVEST has developed a matrix based on the characteristics of the receiving environment which, according to the Guidelines for Involving Visual and Aesthetic Specialists in the EIA Processes, indicate that visibility and aesthetics are likely to be 'key issues' (Oberholzer: 2005).

Based on the criteria in the matrix, the visual sensitivity of the area is broken up into a number of categories, as described below:

- **High** - The introduction of a new development such as a wind farm would be likely to be perceived negatively by receptors in this area; it would be considered to be a visual intrusion and may elicit opposition from these receptors
- **Moderate** - Presence of receptors, but due to the nature of the existing visual character of the area and likely value judgements of receptors, there would be limited negative perception towards the new development as a source of visual impact.
- **Low** - The introduction of a new development would not be perceived to be negative, there would be little opposition or negative perception towards it.

3.2.8 Heritage

The study area lies within a rural context. In terms of the UNESCO guidelines it is a natural evolving landscape. In terms of the assessment checklist published by Baumann et al. (2005) the landscape is largely intact as a natural landscape and intrusions within the last 60 years are moderate. The landscape may, therefore be considered reasonably authentic.

The site was comprehensively searched, mainly on foot in that all but 19 of 78 proposed turbine location were located in the field. The team was unable to reach some turbines due to distance and impassable roads, even for an off-road vehicle. Large tracks of land between turbines and farm roads were walked on foot. The team members were equipped with a GPs unit each, field kit and UHF radios. Any heritage site that was located, was mapped, recorded and graded as per the SAHRA grading system. No trial holes were dug and all observations were based on surface material. The palaeontological assessment involved identifying geological exposures in the project area that would provide suitable opportunities for identifying fossil remains giving an indication of what could be expected sub-surface. Sites were mapped, photographed and described.

3.2.9 Social

The approach to the SIA study is based on the Western Cape Department of Environmental Affairs and Development Planning Guidelines for Social Impact Assessment (February 2007). These guidelines are based on international best practice. The key activities in the SIA process embodied in the guidelines include:

- Collection and review of baseline socio-economic data;
- Review of relevant planning and policy frameworks for the area;
- Site specific information collected during the site visit to the area and interviews with key stakeholders;
- Review of information from similar projects; and
- Identification of social issues associated with the proposed project.

3.2.10 Wake Effect Analysis

The wake effect study was carried out according to the best industry practices, including MEASNET, Evaluation of site specific wind conditions (Version 1, November 2009) and International Energy Association, Recommended practices for wind turbine testing and evaluation, wind speed measurement and use of cup anemometry (second print, 2003), and managed according to the ISO 9001:2008 standard, under which the specialist consultancy has been certified since 2010.

3.2.11 Traffic Impact Assessment

Surveys were undertaken at four count stations surrounding the site consisting of 12-hour manual traffic counts. The counts were done on Wednesday, 10 January 2018 from 06:00 to 18:00 at the following locations:

- Station M1: N9 and Shaw St

- Station M2: N9 and Murray St
- Station M3: N9 and N10
- Station M4: R389 and road to N10

The vehicles were classified as light, taxi, bus and heavy vehicles per direction in 15-minutes intervals. It should be noted that the majority of light vehicles were holiday traffic. A correction was applied to traffic volumes, as discussed below, using the regression analysis equations to normalise data.

Regression Analysis

To estimate representative traffic volumes, on a normal Wednesday, the following methodology was applied:

- Correlation plot/regression analysis was used to determine the degree of relationship between two data sets, namely:
  - Data set 1: 2nd Wednesday of January (Abnormal)
  - Data set 2: 2nd Wednesday of October (Normal)

This was done to normalize January data using normal conditions for a normal day defined as a Wednesday in October.

- Scaling equations where derived from applying a regression model using SANRAL permanent station data and 24-hour traffic counts.

Source	Type	Count Station	Data Type	Data Available	Scaling Equations
Trafftrans	New Count	1	12 Hour	10 January 2018	y = 0.739x + 5.068
Trafftrans	New Count	2	12 Hour	10 January 2018	y = 0.739x + 5.068
Trafftrans	New Count	3	12 Hour	10 January 2018	y = 0.739x + 5.068
Trafftrans	New Count	4	12 Hour	10 January 2018	y = 0.739x + 5.068
SANRAL	Historical	1477	Yearly	2016 & 2017	y = 0.8666x + 3.0366
SANRAL	Historical	2741	3 Day	21-24 Jan 2014	y = 0.2103x + 2.3938 y = 0.7841x + 2.0136 y = 0.8666x + 3.0366
SANRAL	Historical	2733	3 Day	26-29 August 2013	y = 0.917x - 9.5429 y =0.6642x+4.2617 y = 0.8666x + 3.0366

3.3 Identification of Potential Impacts

The identification of potential impacts covers the three phases of the proposed development: construction, operation and decommissioning. During each phase, the potential environmental impacts may be different.

The project team have experience from environmental studies for other projects in the locality of the proposed development as well as other WEFs. The team are therefore able to identify potential impacts addressed in the EIA based on their experience and knowledge of the type of development proposed and the local area. Their inputs informed the scope for the EIA.

Each specialist assessment considered:

- The extent of the impact (local, regional or (inter) national);
- The intensity of the impact (low, medium or high);
- The duration of the impact and its reversibility;
- The probability of the impact occurring (improbable, possible, probable or definite);
- The confidence in the assessment; and
- Cumulative impacts.

Following identification of potential environmental impacts, the baseline information was used to predict changes to existing conditions, and undertake an assessment of the impacts associated with these changes.

3.4 Assessment of Potential Effects

The potential impact that the proposed grid connection may have on each environmental receptor could be influenced by a combination of the sensitivity and importance of the receptor and the predicted degree of alteration from the baseline state (either beneficial or adverse).

Environmental sensitivity (and importance) may be categorised by a multitude of factors, such as the rarity of the species; transformation of natural landscapes or changes to soil quality and land use.

The overall significance of a potential environmental impact is determined by the interaction of the above two factors (i.e., sensitivity/importance and predicted degree of alteration from the baseline).

Specialists, in their terms of references were supplied with a standard method with which to determine the significance of impacts to ensure objective assessment and evaluation, while enabling easier multidisciplinary decision-making. The methodology[19] is outlined below.

The table below, taken from the above guideline, indicates the categories for the rating of impact magnitude and significance.

The assessment methodology that was used is in accordance with the recent revised 2014 EIA Regulations (as amended). The significance of environmental impacts is a function of the environmental aspects that are present and to be impacted on, the probability of an impact occurring and the consequence of such an impact occurring before and after implementation of proposed mitigation measures.

3.4.1 Extent (spatial scale)

L	M	H
Impact is localized within site boundary	Widespread impact beyond site boundary; Local	Impact widespread far beyond site boundary; Regional/national

[19] Adapted from T Hacking, AATS – Envirolink, 1998: An innovative approach to structuring environmental impact assessment reports. In: IAIA SA 1998 Conference Papers and Notes.

3.4.2 Duration

L	M	H
Quickly reversible, less than project life, short term	Reversible over time; medium term to life of project	Long term; beyond closure; permanent; irreplaceable or irretrievable commitment of resources

3.4.3 Intensity (severity)

Type of Criteria	Negative			Positive		
	H-	M-	L-	L+	M+	H+
Qualitative	Substantial deterioration death, illness or injury, loss of habitat /diversity or resource, severe alteration or disturbance of important processes.	Moderate deterioration, discomfort, Partial loss of habitat /biodiversity /resource or slight or alteration	Minor deterioration, nuisance or irritation, minor change in species/habitat/diversity or resource, no or very little quality deterioration.	Minor improvement, restoration, improved management	Moderate improvement, restoration, improved management, substitution	Substantial improvement, substitution
Quantitative	Measurable deterioration Recommended level will often be violated (e.g. pollution)	Measurable deterioration Recommended level will occasionally be violated	No measurable change; Recommended level will never be violated	No measurable change; Within or better than recommended level.	Measurable improvement	Measurable improvement

3.4.4 Probability of Occurrence

L	M	H
Unlikely; low likelihood; Seldom No known risk or vulnerability to natural or induced hazards.	Possible, distinct possibility, frequent Low to medium risk or vulnerability to natural or induced hazards.	Definite (regardless of prevention measures), highly likely, continuous High risk or vulnerability to natural or induced hazards.

3.4.5 Status of the Impact

The specialist should describe whether the impact is positive, negative or neutral for each parameter. The ranking criteria are described in negative terms. Where positive impacts are identified, use the opposite, positive descriptions for criteria.

3.4.6 Degree of Confidence in Predictions:

The degree of confidence in the predictions, based on the availability of information and specialist knowledge, is to be stated.

3.4.7 Consequence: (Duration x Extent x Intensity)

Having ranked the severity, duration and spatial extent, the overall consequence of impacts is determined using the following qualitative guidelines:

Intensity = L				
Duration	H			
	M			Medium

	L	Low		
Intensity = M				
Duration	**H**			High
	M		Medium	
	L	Low		
Intensity = H				
Duration	**H**			
	M			High
	L	Medium		
		L	M	H
		Extent		

Positive impacts are ranked in the same way as negative impacts, but result in high, medium or low positive consequence.

3.4.8 Overall Significance of Impacts

Combining the consequence of the impact and the probability of occurrence provides the overall significance (risk) of impacts.

PROBABILITY	**Definite Continuous**	H	MEDIUM		HIGH
	Possible Frequent	M		MEDIUM	
	Unlikely Seldom	L	LOW		MEDIUM
			L	M	H
			CONSEQUENCE (from Table 5)		

3.4.9 Mitigation

The EIA proposes measures to avoid, reduce or remedy significant adverse impacts which were identified; these are termed mitigation measures. Where the assessment process identified any significant adverse impacts, mitigation measures were proposed to reduce those impacts where practicable. Such measures include the physical design evolutions such as movement of turbines and management and operational measures. Design alterations such as the route of the servitude to avoid certain sensitive receptors are mitigation embedded into the design of the proposed development, i.e., embedded mitigation.

This strategy of avoidance, reduction and remediation is a hierarchical one which seeks:

- First to avoid potential impacts;
- Then to reduce those which remain; and
- Lastly, where no other measures are possible, to propose compensatory measures.

Each specialist consultant identified appropriate mitigation measures (where relevant).

3.5 Cumulative Impact Assessment

In accordance with the EIA Regulations, consideration is also given to 'cumulative impacts'.

By definition, cumulative impacts are those that result from incremental changes caused by past, present or reasonably foreseeable future actions together with the proposed development. Cumulative impacts are the combined impacts of several developments that are different to the impacts from the developments on an individual basis. For example the landscape impact of one WEF may be insignificant, but when combined with another it may become significant.

For the purpose of this assessment cumulative impacts is defined and has been assessed in the future baseline scenario, i.e. Cumulative impact of the proposed development = change caused by proposed development when added to the cumulative baseline (The cumulative baseline includes all other identified developments. In the cumulative assessment the effect of adding the proposed development to the cumulative baseline is assessed.)

In line with best practice, the scope of this assessment will include all operational, approved or current and planned renewable energy applications (including those sites under appeal), within a 35 km radius of the site (as a minimum).

The WEF sites included in the assessment of cumulative impacts has been based on the knowledge and status of the surrounding areas at the time of finalising the EIA Report.

Each of the specialists used existing publicly available information for the developments that occur within 35 km of the proposed San Kraal WEF, in order to assess the cumulative impacts. Cumulative impacts that have been considered are those residual impacts that remain medium to high post mitigation. It should be noted that this assessment is highly qualitative and based on specialists' knowledge.

4 PUBLIC PARTICIPATION

The first stage of public consultation was undertaken during the Scoping phase where the draft scoping report was made available for presentation and public review. The objective of this consultation was to inform the National, Provincial and local Government Authorities, relevant public, private sector entities, NGOs and local communities about the project and capture their initial views and issues of concern that is important for the formulation of plan of study. All issues raised during the scoping phase has been taken into consideration and included in the EIA report. Appendix C has the comments and response report, which includes comments received during the scoping phase, as well all the tasks that were undertaken.

The primary aims of the public participation process are:

- To inform Interested and Affected Parties (I&APs) of the proposed development;
- To identify issues, comments and concerns as raised by I&APs;
- To promote transparency and an understanding of the project and its potential consequences;
- To facilitate open dialogue and liaise with all I&APs;
- To assist in identifying potential environmental (biophysical and socio-economic) impacts associated with the proposed development; and
- To ensure that all I&AP issues and comments are accurately recorded, addressed and documented in an issues trail.

4.1 EIA Phase Public Participation

During the EIA phase the following tasks will be undertaken for public participation:

- Notification letters to be sent out to registered I&APs, key stakeholders, and organs of state to inform them of the availability of the Environmental Impact Report (EIR) for review and comment (30 days);
- A public event will be held in order to explain the findings of the EIR, if required;
- An Issues Trail/Comments and Reponses Report shall be compiled, recording comments and/or queries received and the responses provided;
- Notification letters to all registered I&APs, key stakeholders, and organs of state to inform them of the decision by the DEA and the appeal procedure; and
- Placement of advertisements in the same local and regional newspapers (in English and Afrikaans) to inform I&APs of the decision taken by the DEA.

Focus Group Meetings or One-on-One meetings shall be held if necessary, during the EIA phase. Furthermore, I&APs will also be able to register on the I&AP database throughout the duration of the EIA process and registered, I&APs will be informed about the progress of the application.

The public participation in the EIA phase has the following objectives:

- Inform I&APs about the EIA process followed to date;
- Present the specialist studies undertaken, impacts and proposed mitigation measures;
- Present the results of the Environmental Impact Assessment; and
- Collect concerns and expectations and take them into consideration in the EIA.

The public participation activities undertaken during this phase thus far included:

- Updating the stakeholders' database prepared during the Scoping phase;
- Notification of the availability of the EIA report for comment;
- Registered I&AP notification of public meetings, if required;
- Provision of copy of the EIA report for public review and comment;

Details of the above information is attached in a public participation report included as Appendix C.

A summary of the issues raised to date are included in Table 4.1 below.

Table 4.1: Issues Trail

	Commentator	Comment	Respondent	Response
1	Jacoline Mans Designation: Chief Forester (NFA Regulation) Directorate: Forestry Management (Other Regions) Northern Cape Department of Agriculture, Forestry and Fisheries PO Box 2782 Upington 8800 Tel: 054 338 5909 Fax: 054 334 0030 www.daff.gov.za JacolineMa@daff.gov.za 21/04/2017	The project must consider the following comments: The 2 X 140 MW proposed Wind Energy Facilities (WEF), Phezukomoya and San Kraal, are located approximately 62 km south of Colesberg and 8 km South East of Noupoort in the Northern Cape, bordering the Eastern Cape. The impacts on NFA listed protected trees should be assessed (if any) and avoided as far as possible. Where impacts cannot be avoided, the developer must apply for and obtain a valid Forest Act License prior to disturbance of protected trees. The Forest Act License application must be submitted to the DAFF after obtaining a positive Environmental Authorisation and Preferred Bidder Status, but at least 3 months prior to construction to allow sufficient time for processing of the license. The proposed developments may also need a Flora Permit from the Provincial Department of Environment and Nature Conservation (DENC) for destruction of common indigenous, protected or specially protected plant species under the Northern Cape Nature Conservation *Act,* Act 9 of 2009 (NCNCA). Also assess potential impacts TOPS or CITES listed plant species. Please send a hard copy of Environment Impact Assessment reports to this office for comments. Alternately send an electronic copy.	EAP 04/05/2016	Good day Jacoline, Thank you for providing us with your comments. 1.) We have acknowledged the need for a Forest Act Licence application, should Environmental Authorisation be granted, And 2.) the need for a flora permit from the Provincial Department of Environment and Nature Conservation. We will be working in consultation with our project specialists regarding the aforementioned. We will notify you when the Draft Scoping Report is made available for comment, for both the proposed San Kraal and Phezukomoya Wind Energy Facilitates. 3.) Finally, we have noted that you require a hard/electronic copy of the Final Environmental Impact Assessment Reports, you will receive these on completion of these reports. As a registered Interested and Affected party you will be receiving project updates. However, please do not hesitate to contact us should you require any additional information, or if you have any further concerns. Kind Regards,
2	Leonard S Shaw Specialist : Network Transformation and Planning Tel: +27 12 311 2012 Mobile: +27 81 428 6729 ShawLS@telkom.co.za	The San Kraal site is clear but Phezukomoya project has a Telkom radio link running through the site. I have attached a file with the radio links for your reference. Please check that turbines clear radio links by 300m.	EAP 11/05/2016	Thank-you very much Leonard for your comment, which we have noted. The 300m clearance from the Radio links will be adhered to when designing the layout of the turbines. The attached file has been passed on to the client. As the EIA progresses for the two proposed projects, we will keep you informed of the layout and

	Commentator	Comment	Respondent	Response
	11/05/2016			updated on any new information or developments. Wishing you a pleasant day further. Kind Regards,
3	John Geeringh Senior consultant Environmental Management Eskom GC: Land Development Megawatt Park D1Y39 P O Box 1091 Johannesburg 2000 Tel: 011 516 7233 Fax: 086 661 4064 Cell: 083 632 7663 GeerinJH@eskom.co.za 13/05/2016	Please find attached Eskom requirements for works at or near Eskom infrastructure. Please send me KMZ files of the proposed developments, land portions and proposed substation sites, line routes and turbine layouts. Kind regards, <u>Eskom requirements for work at or near Eskom infrastructure.</u> Eskom's rights and services must be acknowledged and respected at all times. Eskom shall at all times retain unobstructed access to and egress from its servitudes. Eskom's consent does not relieve the developer from obtaining the necessary statutory, land owner or municipal approvals. Any cost incurred by Eskom as a result of non-compliance to any relevant environmental legislation will be charged to the developer. If Eskom has to incur any expenditure in order to comply with statutory clearances or other regulations as a result of the developer's activities or because of the presence of his equipment or installation within the servitude restriction area, the developer shall pay such costs to Eskom on demand. The use of explosives of any type within 500 metres of Eskom's services shall only occur with Eskom's previous written permission. If such permission is granted the developer must give at least fourteen working days prior notice of the commencement of blasting. This allows time for arrangements to be made for supervision and/or precautionary instructions to be issued in terms of the blasting process. It is advisable to make application separately in this regard. Changes in ground level may not infringe statutory ground to conductor clearances or statutory visibility clearances. After any changes in ground level, the surface shall be rehabilitated and stabilised so as to prevent erosion. The measures taken shall be to Eskom's satisfaction. Eskom shall not be liable for the death of or injury to any person or for the loss of or damage to any property whether as a result of the encroachment or of the use of the servitude area by the developer, his/her agent, contractors, employees, successors in title, and assignees. The developer indemnifies Eskom against loss, claims or damages including claims pertaining to consequential damages by third parties and whether as a result	EAP 16/05/2016	Good Afternoon John, Thank you for your comments and the attached requirements, which have been noted and passed on to the Client. We are currently in the scoping phase of the Environmental Impact Assessment for both projects. As soon as we have additional information i.e. line routes and turbine layouts I will pass these onto you in KMZ format. Many thanks once again and wishing you a wonderful week further. Kind Regards,

	Commentator	Comment	Respondent	Response
		of damage to or interruption of or interference with Eskom's services or apparatus or otherwise. Eskom will not be held responsible for damage to the developer's equipment. No mechanical equipment, including mechanical excavators or high lifting machinery, shall be used in the vicinity of Eskom's apparatus and/or services, without prior written permission having been granted by Eskom. If such permission is granted the developer must give at least seven working days' notice prior to the commencement of work. This allows time for arrangements to be made for supervision and/or precautionary instructions to be issued by the relevant Eskom Manager Note: Where and electrical outage is required, at least fourteen work days are required to arrange it. Eskom's rights and duties in the servitude shall be accepted as having prior right at all times and shall not be obstructed or interfered with. Under no circumstances shall rubble, earth or other material be dumped within the servitude restriction area. The developer shall maintain the area concerned to Eskom's satisfaction. The developer shall be liable to Eskom for the cost of any remedial action which has to be carried out by Eskom. The clearances between Eskom's live electrical equipment and the proposed construction work shall be observed as stipulated by *Regulation 15* of the *Electrical Machinery Regulations of the Occupational Health and Safety Act, 1993 (Act 85 of 1993).* Equipment shall be regarded electrically live and therefore dangerous at all times. In spite of the restrictions stipulated by Regulation 15 of the Electrical Machinery Regulations of the Occupational Health and Safety Act, 1993 (Act 85 of 1993), as an additional safety precaution, Eskom will not approve the erection of houses, or structures occupied or frequented by human beings, under the power lines or within the servitude restriction area. Eskom may stipulate any additional requirements to highlight any possible exposure to Customers or Public to coming into contact or be exposed to any dangers of Eskom plant. It is required of the developer to familiarise himself with all safety hazards related to Electrical plant. Any third party servitudes encroaching on Eskom servitudes shall be registered against Eskom's title deed at the developer's own cost. If such a servitude is brought into being, its existence should be endorsed on the Eskom servitude deed concerned, while the third party's servitude deed must also include the rights of the affected Eskom servitude.		

	Commentator	Comment	Respondent	Response
		RENEWABLE ENERGY PLANT SETBACKS TO ESKOM INFRASTRUCTURE EXECUTIVE SUMMARY In recent decades, the use of wind turbines, concentrated solar plants and photovoltaic plants have been on the increase as it serves as an abundant source of energy. This document specifies setbacks for wind turbines and the reasons for these setbacks from infrastructure as well as setbacks for concentrated solar plants and photovoltaic plants. Setbacks for wind turbines employed in other countries were compared and a general setback to be used by Eskom was suggested for use with wind turbines and other renewable energy generation plants. INTRODUCTION During the last few decades, a large amount of wind turbines have been installed in wind farms to accommodate for the large demand of energy and depleting fossil fuels. Wind is one of the most abundant sources of renewable energy. Wind turbines harness the energy of this renewable resource for integration in electricity networks. The extraction of wind energy is its primary function and thus the aerodynamics of the wind turbine is important. There are many different types of wind turbines which will all exhibit different wind flow characteristics. The most common wind turbine used commercially is the Horizontal Axis Wind Turbine. Wind flow characteristics of this turbine are important to analyse as it may have an effect on surrounding infrastructure. Wind turbines also cause large turbulence downwind that may affect existing infrastructure. Debris or parts of the turbine blade, in the case of a failure, may be tossed behind the turbine and may lead to damage of infrastructure in the wake path. This document outlines the minimum distances that need to be introduced between a wind turbine and Eskom infrastructure to ensure that debris and/or turbulence would not negatively impact on the infrastructure. Safety distances of wind turbines from other structures as implemented by other countries were also considered and the reasons for their selection were noted. Concentrated solar plants and photovoltaic plants setbacks away from substations were also to be considered to prevent restricting possible power line access routes to the substation. SUPPORTI NG CLAUSES 2.1 SCOPE This document provides guidance on the safe distance that a wind turbine should be located from any Eskom power line or substation. The document specifies setback distances for transmission lines (220 kV to		

	Commentator	Comment	Respondent	Response
		765 kV), distribution lines (6.6 kV to 132 kV) and all Eskom substations. Setbacks for concentrated solar plants and photovoltaic plants are also specified away from substations. 2.1.1 Purpose Setbacks for wind turbines and power lines / substations are required for various reasons. These include possible catastrophic failure of the turbine blade that may release fragments and which may be thrown onto nearby power lines that may result in damage with associated unplanned outages. Turbulence behind the turbine may affect helicopter flight during routine Eskom live line maintenance and inspections that may lead to safety risk of the aircraft / personnel. Concentrated solar plants and photovoltaic plants setback away from substations were required to prevent substations from being boxed in by these renewable generation plants limiting line route access to the substations. 2.1.2 Applicability This document is applicable to the siting of all new and existing wind turbines, concentrated solar plants and photovoltaic plants near power lines and substations. 2.2 NORMATIVE / INFORMATIVE REFERENCES 2.2.1 Normative http://www.envir.ee/orb.aw/class=file/action=preview/id=1170403/Hiiumaa +turbulence+impact+EMD.pdf http://www.energy.ca.gov/2005publications/CEC-500-2005-I 84/CEC-500-2005-I84.PDF http://www.adamscountywind.com/Revised%20Site/Windmills/Adams%20County%200rdinance/Adams%20County%20W ind%200rd.htm http://www.dsireusa.org/incentives/incentive.cfm?IncentiveCode=PA11R&RE =I&EE=l http://www.wind-watch.org/documents/european-setbacks-minimum-distance-between-wind-turbines-and-habitations/ http://www.publications.parliament.uk/pa/ld201011/ldbills/017/11017.1-i.html http://www.caw.ca/assets/pdf/Turbine_Safety_Report.pdf Rogers J, Siegers N , Costello M. (201 1) A method for defining windturbine setback standards. Wind energy I 0.1002/we.468 2.2.2 Informative None 2.3 DEFINITIONS Definition | Description		

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<tr><th></th><th>Commentator</th><th>Comment</th><th>Respondent</th><th>Response</th></tr>
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<tr><td>Setback</td><td>The minimum distance between a wind turbine and a boundary line/dwelling/road/infrastructure/servitude etc.</td></tr>
<tr><td>Flicker</td><td>Effect caused when rotating wind turbine blades periodically cast shadows</td></tr>
<tr><td>Tip Height</td><td>The total height of the wind turbine ie.hub height plus rotor diameter.</td></tr>
</table>
2.3.1 Disclosure Classification
Controlled disclosure: controlled disclosure to external parties (either enforced by law, or discretionary).
2.4 ABBREVIATIONS: NONE
2.5 ROLES AND RESPONSIBILITIES
All personnel involved in the positioning wind turbines, concentrated solar plants and photovoltaic plants near power lines/substations must follow the setbacks outlined in this guideline.
2.6 PROCESS FOR MONITORING Approval by Eskom in writing.
2.7 RELATED/SUPPORTING DOCUMENTS None
DOCUMENT CONTENT
3.1 INTERNATIONAL SETBACK COMPARISON
Wind Turbine setbacks employed by various countries were considered. It was found that setbacks were determined for various reasons that include noise, flicker, turbine blade failure and wind effects. The distances (setbacks) varied based on these factors and were influenced by the type of infrastructure.
Wind turbine setbacks varied for roads, power lines, dwellings, buildings and property and it was noted that the largest setbacks were employed for reasons of noise and flicker related issues [1-7]. Very few countries specified setbacks for power lines. The literature survey [1-7], yielded information about studies and experiments were conducted to determine the distance that a broken fragment from a wind turbine might be thrown. Even though of low probability of hitting a power line [5.0x10-5181], the distances recorded were significant [750m 1s1]
Setbacks were thus introduced to prevent any damage to Eskom infrastructure.
Wind turbines may also cause changes in wind patterns with turbulent effects behind the hub. These actors dictate the wind turbine setbacks specified in this document. Concentrated solar plants and photovoltaic plants also can limit access into the substation for power lines of all voltages. A setback
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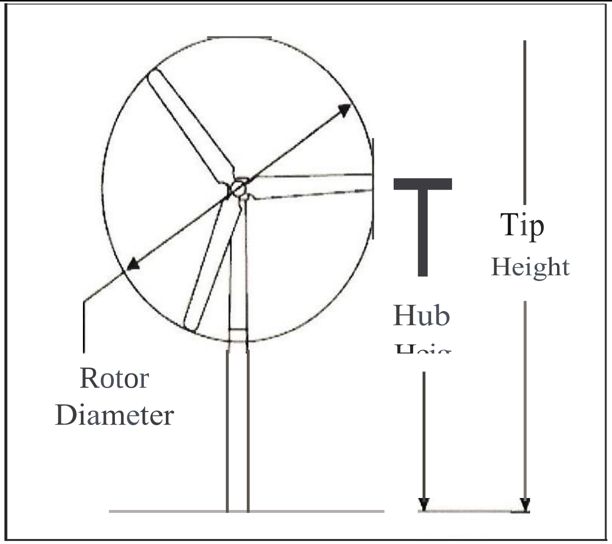
	Commentator	Comment	Respondent	Response
		distance must therefore be employed to prevent the substation from being boxed in by these generation plants. These setback distances are specified in this document. 3.2 ESKOM REQUIRED SETBACKS Eskom requires a setback distance of 3 times the tip height of the wind turbine from the edge of the closest Eskom servitude (including vacant servitudes) for transmission lines. Eskom requires a setback distance of 1 times the tip height of the wind turbine from the edge of the closest Eskom servitude (including vacant servitudes) for distribution Lines. Eskom must be informed of any proposed wind turbine, concentrated solar plants and photovoltaic activity within a 5 km radius of a substation. No wind turbine structure shall be built within a 2 km radius of the closest point of the substation. Where concentrated solar plants and photovoltaic structures fall within a 2 km radius of the closest point of a substation, Eskom should be informed in writing during the planning phase of the construction of such plant or structure. Applicants must show that Eskom radio telecommunication systems (mainly microwave systems) will not be affected in any way by wind turbines.		

	Commentator	Comment	Respondent	Response
		 Figure 1: Horizontal Axis Wind Turbine		
4	Rene de Kock SANRAL statutory control Western Region 1 Havenga Street Oakdale Bellville | Private Bag X19 Tel: +27 21 957 4607 Fax: +27 21 946 1630 Dekockr@nra.co.za http://www.nra.co.za 16/05/2016	Good day, The South African National Roads Agency SOC Limited (SANRAL) has received background information for the above proposed project. Please provide me with a locality plan, indicating the site in relation to the national road. If access to the site will be required from the N9, the owner must apply for written permission from SANRAL, before any work may be carried out. Kind regards	EAP 16/05/2016	Good Afternoon Rene, Thank you for your comment which has been noted and passed on to the client. The projects are currently in the scoping phase of the Environmental Impact Assessment Process. As an identified Interested and affected party you will be notified of any developments throughout the EIA process. Please find attached the Site Locality (KML files) for the two proposed Wind Energy Facilitates. Kind Regards,
5	Rene de Kock SANRAL	Thank-you for your email dated 16 May 2016: The South African National Roads Agency SOC Limited (SANRAL) has the	EAP 25/05/2016	Dear René, We acknowledge receipt of your

	Commentator	Comment	Respondent	Response
	statutory control Western Region 1 Havenga Street Oakdale Bellville | Private Bag X19 Tel: +27 21 957 4607 Fax: +27 21 946 1630 Dekockr@nra.co.za http://www.nra.co.za 24/05/2016	following comments: If abnormal loads have to be transported by road to the site, a permit needs to be obtained from the provincial government Northern Cape (PGNC) For safety reasons, SANRAL requires turbines to be located not less than 1.5X the turbine height, inclusive of the blade tip height from the road reserve fence. Access from the national road to the site will be taken from existing roads, which could be either gravel farm roads or public roads. SANRAL requires detail plans for approval of any alteration or upgrading measures that will be required at an access-intersection with the N9 & N10 national roads. The plans must be produced by an ECSA registered consulting engineer. All costs associated with any alteration or upgrading measures will be for the applicant's account.		comments, Thank-you kindly for these. We will make note of SANRAL's Request, and incorporate these into the Environmental Impact Assessment and Basic Assessment Processes. As you have been identified as an I&AP you will receive updates on both proposed projects throughout the EIA process. Thank you once again, please do not hesitate to contact us should you have any further queries or concerns. Kind Regards, Arcus Consulting
6	Lizell Stroh SA Civil Aviation Authority Obstacle Specialist PANS-OPS (Procedures for Air navigation Services – Aircraft Operations) Air Navigation Services Tel: +27 11 545 1232 strohl@caa.co.za 01/06/2016	We don't foresee any problem with the 2 propose wind farms. Please have a look at the information doc on Wind farms attached for your guidance. Please find the SACAA procedure for the SACAA in providing yourself Approval. Kindly provide a .kml (Google Earth) file reflecting the footprint of the proposed development site including the proposed overhead electric power line route that will evacuate the generated power to the national grid. Also indicate the highest structure of the project & the Overhead electric power transmission line. Thanks. Kind regards Wind Farms and Obstacle Assessments 1. Introduction The effective use of an aerodrome may be considerably affected by natural features and by manmade constructions both inside and outside the boundaries of the aerodrome. This may result in restrictions to the optimal use of the aerodrome It is therefore necessary to consider the local airspace as an integral part of the aerodrome environment The control of obstacles, and here I include the prevention or removal of obstacles, is clearly related to the safe and efficient use of the aerodrome. What is an Obstacle? International Civil Aviation Organization (ICAO) Annex 14 definition:- All fixed or mobile objects or parts thereof, whether temporary or permanent, that: a) are located on an area intended for the surface movement of aircraft; or	EAP	Dear Lizelle Stroh, Thank you for the below information. This has been passed on to the developer. We will send you the coordinates and shapefiles once we have a confirmed final layout. Kind Regards,

	Commentator	Comment	Respondent	Response
		b) Extend above a defined surface intended to protect aircraft in flight; or c) Stand outside those defined surfaces and that have been assessed as being a hazard to air navigation. 1.6 It is a legal requirement to obtain prior approval for an obstacle in terms of the Aviation Act with parts 139.01.30, the dominant regulation. The standards for Markings of obstacles can be found in the technical standards to this regulation and is essentially that of annex 14 and some differences in character exist to accommodate local practices and conditions. Part 171 and its associated CATS-ESO technical standards are also applicable in as far the protection of Communication; Navigation and Surveillance systems are concerned. 1.7 Part 91.01.10 also has reference. Note:- The above reference refers to the regulations the new Civil Aviation Act (Act 13 of 2009) as promulgated 2. Discussion 2.1 The significance of any proposed or existing obstacle on or in the vicinity of an aerodrome is accessed by two separate sets of criteria defining airspace. 2.2 The first and the one that will be concentrated on, is the obstacle limitation surfaces as defined in Annex 14 chapter 4, the second being the PANS-OPS surfaces defined in Doc8168 Vol II (Construction of Visual and Instrument Flight Procedures) 2.3 Annex 14 define surfaces such as the strip width of the runway, approach and departure surfaces, transition surfaces, the inner horizontal , the conical and the outer horizontal surfaces. The dimensions of these surfaces vary with runway classification and the dimensions of the runway. Runway classification ranges from code 1 to code 4 and a numerical sub classification (A to G) and the runways could be non-instrument, instrument non-precision and precision. 2.4 Obstacle assessments inside the boundaries of the aerodrome are not discussed in this document due to the amount of variables and complexity thereof. Obstacle assessments outside the aerodrome would look at obstacles differently depending on utilization of the aerodrome and considers runways to be used for both departure and approach purposes:- a) Small aerodromes utilized by small slow flying aircraft and featuring short runways would be evaluated against the criteria for code 2 instrument non precision approach surfaces with a slope of 3.3 % and a diversion of 15%. The inner horizontal would be regarded as a simple horizontal disk and		

	Commentator	Comment	Respondent	Response
		diameter of 3500m above the published reference point of the aerodrome. b) Large aerodromes utilized by large(r) and fast aircraft and featuring longer runways are evaluated against the criteria applicable for precision approaches with an ideal slope of 1.6% but to a slope of not exceeding 2% as may be dictated by existing structures or terrain. The inner horizontal now becomes a composite shape with circular arcs centered on the runway thresholds, and 45m above the runway threshold, and joined tangentially by straight lines. The same principle would apply to aerodromes featuring multiple runways. In practice this means that an obstacle is evaluated against the threshold elevation of the closest threshold. This two tier approach to obstacle assessment is aimed at offering aerodromes more protection to facilitate future expansion 2.5 In some cases obstacles in the vicinity of aerodromes are subject to more stringent requirements dictated by possible interference to Radar and/or ILS systems as is the case at ORTIA where Radar absorbing cladding may be required on structures exceeding 1730m AMSL – a figure 6m below the inner horizontal surface. 2.6 All obstacles exceeding 45m AGL are marked by default in South Africa in terms of and to the standards of Part 139 while, structures exceeding 30mAGL and also 150m above aerodrome elevation is regarded as significant within 15 Km from the aerodrome and is also marked. The latter which relates to Doc 9137 Vol 6 is however adapted and applies to any structure exceeding 150m above the mean ground level. 2.7 Wind turbine generators or collectively called Wind farms, are obstacles with unique properties as not only are they of variable geometry; they also have the ability to interfere on avionic systems. a) Most notable interference is false targets produced on primary radar when in line of sight but could also interfere when in close proximity of secondary radar. It is generally accepted that it would not interfere on secondary radar beyond 15 Km in distance. b) Wind turbines also cause disturbance in the air that shows up on meteorological radar systems as storm cells. This disturbance also holds a potential danger to small aircraft if allowed in close proximity of small aerodromes or areas of recreational flying. 2.8 By Part 139, no wind farm SHOULD be built within 35 km from an aerodrome. This 35 km is not a forbidden zone but rather a caution zone where extended investigation will be done if required and will involve all role players. This 35 km zone is bases on the Annex 10 protection criteria for ILS plus a buffer zone.		

	Commentator	Comment	Respondent	Response
		a) If an investigation indicates a possibility of interference, mitigation measures will be investigated and may involve repositioning or relocation of turbines. Options such as fill in radar may be considered if required or an application may be rejected outright if an acceptable level of mitigation cannot be reached. b) Wind farms are subjected to unique marking methods differentiating it from any other obstacle. Any telecommunications structure or other structure within a wind farm will be regarded as part of the wind farm and will be marked accordingly. c) Night markings of wind farms consist of dual flashing red lights of 2000 candela intensity. Not all turbines are marked but rather aimed at defining the outline of a wind farm and the most significant points. The flashing lights are synchronized. 2.9 It should be noted that the Northern Cape Province has proven to be a popular location for wind farms. While this location may have limited impact on aviation, the high intensity night markings of wind farms may bring it in conflict with the AGA Act, which saw the light as an effort to protect the Northern Cape for purposes of astronomy. This may lead to a re-consideration of marking methods. 3. Conclusion 3.1 While South Africa has got legislation in place to protect aviation from obstacles, including wind farms in Part 139.01.30 and also protection of Communication, Navigation and Surveillance systems including aeronautical meteorological systems in Part 171, this is a slow and cost intensive process.		
7	Karoo News Group (No contact person) Tel: 0603341648 karoonewsgroup@gmail.com 21/07/2016	Dear 'Sandkraal' (No contact person has been mentioned in this email?) -Please confirm that there will be a cumulative impact assessment undertaken which considers both WEF applications and their impacts as well as all other energy projects and applications that will have an impact on this area? -Please confirm that Van Rooyen will undertake a cumulative impacts assessment for all priority Avian species con sidering all impacts as per NEMA requirements -Please confirm the heritage impacts assessment will consider the cumulative impact on the Karoo's sense of place at this site -Please also be advised that the site lies on a very important Interval on the Southern Great Escarpment and that the Scoping needs to consider this context. -Please advise who is the EAP as it is not in the BID document Sincerely KNG	EAP 29/07/2016	Thank you for your email received on 21st July 2016. Please supply us with the name and contact details of a representative of your group so that the group's registration may be completed on the Interested and Affected Party database. In response to your query, the following can be confirmed: A cumulative impact assessment will be undertaken which considers both WEF applications and their impacts as well as any other energy projects in the area; The bird specialist will undertake a

	Commentator	Comment	Respondent	Response
				cumulative impacts assessment for all priority Avian species as per the NEMA requirements; Both the heritage and visual impact assessments will consider the cumulative impact on the Karoo's sense of place. These reports will take the location of the sites on the Southern Great Escarpment into consideration. The EAP is Ashlin Bodasing, SA Team Leader of Arcus Consulting. As a registered I&AP, you will be kept up to date with the progress of these proposals. Please do not hesitate to contact us should you have any further queries or concerns.
			Avifaunal Specialist	This is covered by Section 10 of the report. A 12-months pre-construction monitoring programme was implemented assess the importance of the site for priority avifauna
8	Karoo News Group (No contact person) Tel: 0603341648 karoonewsgroup@gmail.co m 01/08/2016	You have already registered the Karoo News Group – see email below *"Thank-you for your enquiry, you have been added to the I&AP database as requested and will therefore receive updates regarding the two proposed projects."* Please provide a list of 'other projects in the area that will be included in the various cumulative impact assessments The bird specialsist will need to do a cumulative impacts assessment that takes in all likely and existing impacts. Please provide detail We would like the avaina consultant also to use the Southern Great Escarpments in its context for migrating birds as well as semigrating birds species There has also been a request for a study on the negative impacts on property value in the area outside of the site. The EAP is aware of the negative impacts as she was the EAP in another Karoo site Sincerely KNG	EAP 17/08/2016	Thank you for your e-mail received 01 August 2016 regarding the proposed San Kraal and Phezukomoya Wind Energy Facilities. The Draft Scoping Report for each project will detail all other projects that will be included in the cumulative assessment. You will be notified as soon as the Draft Scoping Report becomes available for you to review and comment on. Details of the avifaunal assessments will also be given in the Draft Scoping Report. The avifaunal specialist will take the location of the site on the Southern Greta Escarpment and migrating

	Commentator	Comment	Respondent	Response
				species into consideration. The issue of property values will be addressed in the EIA Phase of the project. As a registered I&AP, you will be kept up to date with the progress of these proposals. Please do not hesitate to contact us should you have any further queries or concerns.
			Avifaunal Specialist	The presence of migrating birds at the site was recorded and factored into the assessments and mitigation measures.
9	Karoo News Group (No contact person) Tel: 0603341648 karoonewsgroup@gmail.com 29/08/2016	Dear Arcus, Please ask the Avian specialist how he intends to comply with International Bird Conservation Agreements which require a SEA for industrial wind3farms which is consider and assess cumulative impacts for priority specis for which current RE SEA does not comply Sincerely KNG	EAP 29/08/2016	Dear Karoo News Group, Thank you for your comments, please note that the specialist will include cumulative assessment as required by the EIA process. In order to assist the specialist in this assessment and ensure that all vital information is considered, could you kindly send through the specific "International Bird Conservation Agreements" you are referring to below, and we will be sure to consider this as part of the EIA process. Thank you, Regards
			Avifaunal Specialist	The issue of cumulative impacts is covered in Section 10 of the avifaunal Specialist Study. An SEA for wind and solar developments has been completed under the auspices of the CSIR and falls outside the scope of this specialist study.
10	Karoo News Group (No contact person) Tel: 0603341648 karoonewsgroup@gmail.co	Dear Arcus We are sure you are aware of what is required, however….. 1)Convention on the Conservation of Migratory Species of Wild Animals (CMS) and 2) the Agreement on the Conservation of African Eurasian Migratory	EAP 30/08/2016	Dear KNG, Thank - you for this, we will forward this to the avifaunal specialist for their consideration into the EIA

	Commentator	Comment	Respondent	Response
	m 29/08/2016	Waterbirds (AEWA), "…. strategic planning on national or sub-national level by carrying out a Strategic Environmental assessment (SEA). This requires that all countries have introduced legal or other provisions to formalize SEA as a planning re quirement at national or sub-national levels Strategic Environmental Assessments (SEAs) followed up with site specific Environmental Impact Assessments (EIAs) are the necessary tools to e nsure that the impacts of renewable energy deployment on migratory species are minimized and should be in place and applied. .. SEAs should consider the cumulative effects of multiple renewable ener gy technology deployments in conjunction with other renewable and non-renewable energy developments in a given region." Sincerely KNG		process. As previously mentioned, cumulative assessments will be undertaken for both the San Kraal WEF and the Phezukomoya WEF during the EIA process for these two proposed projects.
			Avifaunal Specialist	The legislative context is covered in section 5 of the Avifaunal Specialist Study. The issue of cumulative impacts is covered in Section 10 of the Avifaunal Specialist Study. An SEA for wind and solar developments has been completed under the auspices of the CSIR and falls outside the scope of this specialist study.
11	Karoo News Group (No contact person) Tel: 0603341648 karoonewsgroup@gmail.co m 31/08/2016	Dear Arcus, Yes you already have mentioned that you will be a doing a cumulative impact assessment for all relevant studies for your 2 projects however you are missing the point. What is required and is quite clear in the agreements is that a spatial cumulative impact assessment for priority species is a requirement. This would mean that all renewable energy developments in the Noupoort area need to be considered cumulative impacts assessments are required that assess all renewable energy impacts on the Great Escarpment Please confirm that the above will be assessed Sincerely, KNG	EAP 22/09/2016	Dear Karoo News Group, Thank you for your comment which has been forwarded to the avifaunal specialist for his consideration in the EIA process. Your comment has also been included in the Issues & Response Trail and will be included in the Scoping Report. Kind Regards,

	Commentator	Comment	Respondent	Response
			Avifaunal Specialist	The issue of cumulative impacts is covered in Section 10 of the Avifaunal Specialist Study.
COMMENT PERIOD 12 June – 12 July 2017				
12	John Geeringh Senior consultant Environmental Management Eskom GC: Land Development Megawatt Park D1Y39 P O Box 1091 Johannesburg 2000 Tel: 011 516 7233 Fax: 086 661 4064 Cell: 083 632 7663 GeerinJH@eskom.co.za 12/06/2017	Please find attached Eskom requirements for developments at or near infrastructure to be taken into consideration during the planning and development phases of the proposed WEF. Please send me KMZ files of the proposed land parcels, connector power line routes and layouts when available. Regards, John Eskom requirements for work at or near Eskom infrastructure. Eskom's rights and services must be acknowledged and respected at all times. Eskom shall at all times retain unobstructed access to and egress from its servitudes. Eskom's consent does not relieve the developer from obtaining the necessary statutory, land owner or municipal approvals. Any cost incurred by Eskom as a result of non-compliance to any relevant environmental legislation will be charged to the developer. If Eskom has to incur any expenditure in order to comply with statutory clearances or other regulations as a result of the developer's activities or because of the presence of his equipment or installation within the servitude restriction area, the developer shall pay such costs to Eskom on demand. The use of explosives of any type within 500 metres of Eskom's services shall only occur with Eskom's previous written permission. If such permission is granted the developer must give at least fourteen working days prior notice of the commencement of blasting. This allows time for arrangements to be made for supervision and/or precautionary instructions to be issued in terms of the blasting process. It is advisable to make application separately in this regard. Changes in ground level may not infringe statutory ground to conductor clearances or statutory visibility clearances. After any changes in ground level, the surface shall be rehabilitated and stabilised so as to prevent erosion. The measures taken shall be to Eskom's satisfaction. Eskom shall not be liable for the death of or injury to any person or for the loss of or damage to any property whether as a result of the encroachment or of the use of the servitude area by the developer, his/her agent, contractors, employees, successors in title, and assignees. The developer indemnifies Eskom against loss, claims or damages including claims	EAP 13/06/2017	Dear Mr. Geeringh, Thank-you very much for your response and for providing the attached information which will be forwarded to the Project Developer for their consideration during planning and development phases. Both developments (San Kraal and Phezukomoya WEFs) are currently in Scoping Phase. You will be kept updated as the EIA progresses. As soon as we have a final layout we will send you the updated KMZ files as requested. I hope you have wonderful day and week ahead! Kindest Regards,

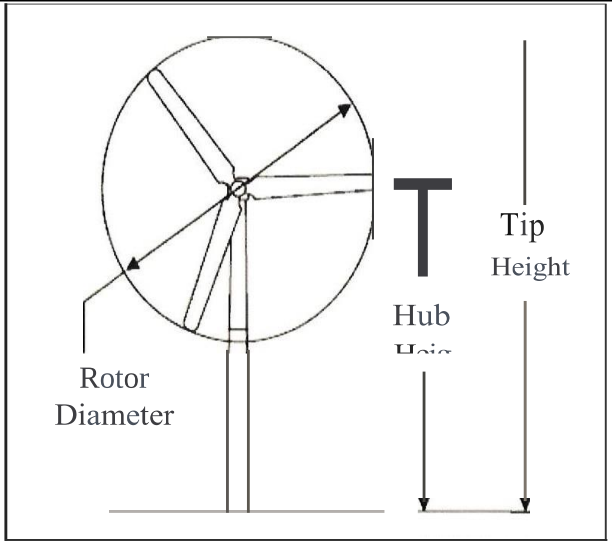
	Commentator	Comment	Respondent	Response
		pertaining to consequential damages by third parties and whether as a result of damage to or interruption of or interference with Eskom's services or apparatus or otherwise. Eskom will not be held responsible for damage to the developer's equipment. No mechanical equipment, including mechanical excavators or high lifting machinery, shall be used in the vicinity of Eskom's apparatus and/or services, without prior written permission having been granted by Eskom. If such permission is granted the developer must give at least seven working days' notice prior to the commencement of work. This allows time for arrangements to be made for supervision and/or precautionary instructions to be issued by the relevant Eskom Manager Note: Where and electrical outage is required, at least fourteen work days are required to arrange it. Eskom's rights and duties in the servitude shall be accepted as having prior right at all times and shall not be obstructed or interfered with. Under no circumstances shall rubble, earth or other material be dumped within the servitude restriction area. The developer shall maintain the area concerned to Eskom's satisfaction. The developer shall be liable to Eskom for the cost of any remedial action which has to be carried out by Eskom. The clearances between Eskom's live electrical equipment and the proposed construction work shall be observed as stipulated by *Regulation 15* of the *Electrical Machinery Regulations of the Occupational Health and Safety Act, 1993 (Act 85 of 1993).* Equipment shall be regarded electrically live and therefore dangerous at all times. In spite of the restrictions stipulated by Regulation 15 of the Electrical Machinery Regulations of the Occupational Health and Safety Act, 1993 (Act 85 of 1993), as an additional safety precaution, Eskom will not approve the erection of houses, or structures occupied or frequented by human beings, under the power lines or within the servitude restriction area. Eskom may stipulate any additional requirements to highlight any possible exposure to Customers or Public to coming into contact or be exposed to any dangers of Eskom plant. It is required of the developer to familiarise himself with all safety hazards related to Electrical plant. Any third party servitudes encroaching on Eskom servitudes shall be registered against Eskom's title deed at the developer's own cost. If such a servitude is brought into being, its existence should be endorsed on the Eskom servitude deed concerned, while the third party's servitude deed must		

	Commentator	Comment	Respondent	Response
		also include the rights of the affected Eskom servitude. <u>RENEWABLE ENERGY PLANT SETBACKS TO ESKOM INFRASTRUCTURE</u> EXECUTIVE SUMMARY In recent decades, the use of wind turbines, concentrated solar plants and photovoltaic plants have been on the increase as it serves as an abundant source of energy. This document specifies setbacks for wind turbines and the reasons for these setbacks from infrastructure as well as setbacks for concentrated solar plants and photovoltaic plants. Setbacks for wind turbines employed in other countries were compared and a general setback to be used by Eskom was suggested for use with wind turbines and other renewable energy generation plants. INTRODUCTION During the last few decades, a large amount of wind turbines have been installed in wind farms to accommodate for the large demand of energy and depleting fossil fuels. Wind is one of the most abundant sources of renewable energy. Wind turbines harness the energy of this renewable resource for integration in electricity networks. The extraction of wind energy is its primary function and thus the aerodynamics of the wind turbine is important. There are many different types of wind turbines which will all exhibit different wind flow characteristics. The most common wind turbine used commercially is the Horizontal Axis Wind Turbine. Wind flow characteristics of this turbine are important to analyse as it may have an effect on surrounding infrastructure. Wind turbines also cause large turbulence downwind that may affect existing infrastructure. Debris or parts of the turbine blade, in the case of a failure, may be tossed behind the turbine and may lead to damage of infrastructure in the wake path. This document outlines the minimum distances that need to be introduced between a wind turbine and Eskom infrastructure to ensure that debris and/or turbulence would not negatively impact on the infrastructure. Safety distances of wind turbines from other structures as implemented by other countries were also considered and the reasons for their selection were noted. Concentrated solar plants and photovoltaic plants setbacks away from substations were also to be considered to prevent restricting possible power line access routes to the substation. SUPPORTI NG CLAUSES 2.1 SCOPE This document provides guidance on the safe distance that a wind turbine should be located from any Eskom power line or substation. The		

	Commentator	Comment	Respondent	Response
		document specifies setback distances for transmission lines (220 kV to 765 kV), distribution lines (6.6 kV to 132 kV) and all Eskom substations. Setbacks for concentrated solar plants and photovoltaic plants are also specified away from substations. 2.1.1 Purpose Setbacks for wind turbines and power lines I substations are required for various reasons. These include possible catastrophic failure of the turbine blade that may release fragments and which may be thrown onto nearby power lines that may result in damage with associated unplanned outages. Turbulence behind the turbine may affect helicopter flight during routine Eskom live line maintenance and inspections that may lead to safety risk of the aircraft I personnel. Concentrated solar plants and photovoltaic plants setback away from substations were required to prevent substations from being boxed in by these renewable generation plants limiting line route access to the substations. 2.1.2 Applicability This document is applicable to the siting of all new and existing wind turbines, concentrated solar plants and photovoltaic plants near power lines and substations. 2.2 NORMATIVE / INFORMATIVE REFERENCES 2.2.1 Normative http://www.envir.ee/orb.aw/class=file/action=preview/id=1170403/Hiiumaa+turbulence+impact+EMD.pdf http://www.energy.ca.gov/2005publications/CEC-500-2005-I 84/CEC-500-2005-I84.PDF http://www.adamscountywind.com/Revised%20Site/Windmills/Adams%20County%200rdinance/Adams%20County%20W ind%200rd.htm http://www.dsireusa.org/incentives/incentive.cfm?IncentiveCode=PA11R&RE=I&EE=l http://www.wind-watch.org/documents/european-setbacks-minimum-distance-between-wind-turbines-and-habitations/ http://www.publications.parliament.uk/pa/ld201011/ldbills/017/11017.1-i.html http://www.caw.ca/assets/pdf/Turbine_Safety_Report.pdf Rogers J, Siegers N , Costello M. (201 1) A method for defining windturbine setback standards. Wind energy I 0.1002/we.468 2.2.2 Informative None 2.3 DEFINITIONS		

	Commentator	Comment	Respondent	Response
		<table><tr><td>Definition</td><td>Description</td></tr><tr><td>Setback</td><td>The minimum distance between a wind turbine and a boundary line/dwelling/road/infrastructure/servitude etc.</td></tr><tr><td>Flicker</td><td>Effect caused when rotating wind turbine blades periodically cast shadows</td></tr><tr><td>Tip Height</td><td>The total height of the wind turbine ie.hub height plus rotor diameter.</td></tr></table>2.3.1 Disclosure Classification Controlled disclosure: controlled disclosure to external parties (either enforced by law, or discretionary). 2.4 ABBREVIATIONS: NONE 2.5 ROLES AND RESPONSIBILITIES All personnel involved in the positioning wind turbines, concentrated solar plants and photovoltaic plants near power lines/substations must follow the setbacks outlined in this guideline. 2.6 PROCESS FOR MONITORING Approval by Eskom in writing. 2.7 RELATED/SUPPORTING DOCUMENTS None DOCUMENT CONTENT 3.1 INTERNATIONAL SETBACK COMPARISON Wind Turbine setbacks employed by various countries were considered. It was found that setbacks were determined for various reasons that include noise, flicker, turbine blade failure and wind effects. The distances (setbacks) varied based on these factors and were influenced by the type of infrastructure. Wind turbine setbacks varied for roads, power lines, dwellings, buildings and property and it was noted that the largest setbacks were employed for reasons of noise and flicker related issues [1-7]. Very few countries specified setbacks for power lines. The literature survey [1-7], yielded information about studies and experiments were conducted to determine the distance that a broken fragment from a wind turbine might be thrown. Even though of low probability of hitting a power line [5.0x10-5181], the distances recorded were significant [750m 1s1] Setbacks were thus introduced to prevent any damage to Eskom infrastructure. Wind turbines may also cause changes in wind patterns with turbulent effects behind the hub. These actors dictate the wind turbine setbacks specified in this document. Concentrated solar plants and photovoltaic plants also can		

	Commentator	Comment	Respondent	Response
		limit access into the substation for power lines of all voltages. A setback distance must therefore be employed to prevent the substation from being boxed in by these generation plants. These setback distances are specified in this document. 3.2 ESKOM REQUIRED SETBACKS Eskom requires a setback distance of 3 times the tip height of the wind turbine from the edge of the closest Eskom servitude (including vacant servitudes) for transmission lines. Eskom requires a setback distance of 1 times the tip height of the wind turbine from the edge of the closest Eskom servitude (including vacant servitudes) for distribution Lines. Eskom must be informed of any proposed wind turbine, concentrated solar plants and photovoltaic activity within a 5 km radius of a substation. No wind turbine structure shall be built within a 2 km radius of the closest point of the substation. Where concentrated solar plants and photovoltaic structures fall within a 2 km radius of the closest point of a substation, Eskom should be informed in writing during the planning phase of the construction of such plant or structure. Applicants must show that Eskom radio telecommunication systems (mainly microwave systems) will not be affected in any way by wind turbines.		

	Commentator	Comment	Respondent	Response
		 Figure 1: Horizontal Axis Wind Turbine		
13	Olwetu Vongwe Mzimvubu to Tsitsikamma Proto-CMA Water Use Authorisation Administration Officer: EWULAAS Department of Water and Sanitation PO BOX 7019 EAST LONDON 5200 FAX : 043 722 6152 E-mail: VongweO@dws.gov.za	Dear Mrs. Ashlin Bodasing NOTIFICATION OF TRANSFER OF THE DRAFT SCOPING REPORTS FOR THE PROPOSED SAN KRAAL WIND ENERGY FACILITY AND ASSOCIATED GRID CONNECTION AND THE PROPOSED PHEZUKOMOYA WIND ENERGY FACILITY AND ASSOCIATED GRID CONNCETION, NORTHERN AND EASTERN CAPE PROVINCES The abovementioned reports which were received by our office are being transferred to the Bloemfontein office, in the Free State. The properties/areas in question fall outside the Eastern Cape's Water Management Area. Find attached an official notification letter together with the transfer letter sent to the Bloemfontein office. Letter: Dear Mrs. Ashlin Bodasing	EAP 27/06/2017 cc: BeraM@dws.gov.za	Dear Olwetu, Thank-you very much for your correspondence. This email serves to confirm we have received your request to direct all future correspondence relating to the Proposed San Kraal and Phezukomoya Wind Energy Facilities to Mr. Carlo Schrader. Many Thanks once again, And wishing you a wonderful week further! Kindest Regards,

	Commentator	Comment	Respondent	Response
	26/06/2017	NOTIFICATION OF TRANSFER OF THE DRAFT SCOPING REPORT THE PROPOSED SAN KRAAL WIND ENERGY FACILITY AND ASSOCIATED GRID CONNECTION AND THE PROPOSED PHEZUKOMOYA WIND ENERGY FACILITY AND ASSOCIATED GRID CONNECTION, NORTHERN AND EASTERN CAPE PROVINCES The above mentioned Draft Scoping Reports refers: These reports have been transferred to the Free State Office (Orange Water Management Area 6) as the properties in question fall outside the Eastern Cape Water Management Area. Take note that the contact person for future correspondence is: Mr. Carlo Schrader Department of Water and Sanitation Free State P.O. Box 528 BLOEMFONTEIN 9300 Phone Number: (051) 405-9000 Email address: SchraderC@dws.gov.za If you have any further enquiries please feel free to contact this office. Yours faithfully, Attention: Mr. Carlo Schrader DRAFT SCOPING REPORTS FOR THE PROPOSED SAN KRAAL WIND ENERGY FACILITY AND ASSOCIATED GRID CONNECTION AND THE PROPOSED PHEZUKOMOYA WIND ENERGY FACILITY AND ASSOCIATED GRID CONNECTION, NORTHERN AND EASTERN CAPE PROVINCES The above mentioned Draft Scoping Reports refers: These Draft Scoping Reports have been received by our Eastern Cape Office on the 19 June 2017. It has been established that the properties in question fall outside the Eastern Cape Water Management Area; they are within the Free State Management Area (Orange Water Management Area 6). We hereby transfer these reports to your office for your comments.		

	Commentator	Comment	Respondent	Response
		Take note we have informed Arcus Consultancy Services South Africa (Pty) Limited accordingly. If you have any further enquiries please feel free to contact this office.		
14	Mr. Sabelo Malaza Chief Director: Integrated Environmental Authorisations Department of Environmental Affairs Private Bag X 447 Environment House 473 Steve Biko Road Pretoria 0001 027 12 399 9372 Enquiries: Mr Vincent Chauke Tel: 012 399 9399 vchauke@environment.gov.za 07/07/2017	Dear Sir/Madam, COMMENTS ON THE DRAFT SCOPING REPORT FOR THE SAN KRAAL WIND ENERGY FACILITY AND ASSOCIATED 132KV GRID CONNECTION TRANSMISSION LINE, NORTHERN AND EASTERN CAPE PROVINCE The Draft Scoping report (SR) dated June 2017 and received by this Department on 09 June 2017, and the application form received by this department 09 June 2017 refer. <u>This Department has the following comments on the abovementioned application:</u> a.) Please ensure that all relevant listed activities applied for, are specific and can be linked to the development activity or infrastructure as described in the project description. b.) If the activities applied for in the application form differ from those mentioned in the Draft Scoping Report (DSR), an amended application form must be submitted with the final SR. Please note that the Department's application form template has been amended and can be downloaded from the following link https://www.envi ronment.gov.za/documents/form c.) The Final Scoping Report (FSR) must investigate and identify all traffic impacts associated with the proposed development d.) Please ensure that all issues raised and comments received, during the circulation of the SR, from registered I&APs and organs of state which have jurisdiction (including this Department's Biodiversity Section) in respect of the proposed activity are adequately addressed in the Final SR. Proof of correspondence with the various stakeholders must be included in the Final SR. Should you be unable to obtain comments, proof should be submitted to the Department of the attempts that were made to obtain comments. The Public Participation Process must be conducted in terms of Regulation 39, 40 41, 42, 43 & 44 of the EIA Regulations 2014, as amended e.) Due to the number of similar applications in the area, all the specialist assessments must include a cumulative environmental impact statement. All identified cumulative impacts must be clearly defined, and where possible the size of the identified impact must be quantified and indicated, i.e. hectares of cumulatively transformed land.	EAP In Final Scoping Report	Section 5, Table 5.1 NEMA Listed Activities in Relation to the Proposed Development; The application form dated 2016 and downloaded from the website on day of application was used; Section 15.3.3 and Section 15.4.6 have addressed traffic impacts associated with the proposed development; Section 16, 16.3 Synopsis of Key Issues and Table 16.1 Summary of Issues Raised and Project Team Responses, Appendix B5 I&AP Issues Trail and Comments – Scoping Phase; Specialists have undertaken preliminary cumulative assessments (Volume 2 and Section 5-15). The EIA cumulative impacts will be addressed nd included as part of the EIA Report. Section 18.4 Significance Assessment Methodology to be completed during EIA Phase; Section 4 Need and Desirability – addresses cumulative impacts. Cumulative impacts will be further investigated during the EIA phase and inform the need and desirability of the proposed development further. Section 18 Plan of Study for EIA Phase – see reference Assess potentially significant impacts (direct, indirect and cumulative) associated

	Commentator	Comment	Respondent	Response
		f.) The identified cumulative impacts associated with the proposed development must be rated with the significance rating methodology g.) The cumulative impacts significance rating must inform the need and desirability of the proposed development h.) Detailed cumulative impact assessments must be provided in the EIAr for all specialist studies conducted. The specialist studies must provide proof that other specialist reports that were conducted for renewable energy projects in the area were reviewed and indicate how the recommendations, mitigation measures and conclusions have been taken into consideration when the conclusion and mitigation measures were drafted for this project i.) It is noted that the noise specialist did not sign the "specialist declaration of interest" form contained within the specialist study, and as such the specialist must sign the declaration of interest form and the signed document must be submitted with the final SR j.) The 12 months Bird and Bat Monitoring must be conducted in line with the latest guidelines. It is noted that monitoring was done in 2015. As such, this must be amended to include the updated requirements. A copy of the latest guidelines can be found on the BirdLife South Africa's and SABAAP's website k.) The final Scoping Report must indicate and describe the competing land uses in the area. This must further motivate the desirability of locating the wind energy facility at the preferred location		with the proposed WEF and its grid connection, see reference in section 18.5 Cumulative Impact Assessment; Refer to Volume 2 Specialist Studies Noise Report for Scoping Purposes, see page v – completed and signed Declaration of Interest; The bird specialist has confirmed that monitoring was conducted according to the latest (2015) guidelines. The bat specialist has confirmed that the monitoring was conducted according to the 2014 guidelines which were applicable at the time, but that monitoring was done in line with the 2016 guidelines released thereafter. The specialist reports were amended to reflect this; Bird and Bat Specialist report Volume 2. Section3.2 and Section 4. No other land uses are known to be competing with the proposed development, other than low intensity grazing which can continue at the site if the development proceeds. This will be further evaluated during the EIA phase.
15	Natasha Higgitt Heritage Officer: Archaeology, Palaeontology and Meteorites Unit South African heritage Resources Agency 111 Harrington Street Cape Town 8001	Good morning, Please note that Interim Comments have been issued on SAHRIS Case ID 11182 and 11193. Please see links below: http://sahra.org.za/sahris/cases/proposed-san-kraal-390-mw-wind-energy-facility http://sahra.org.za/sahris/cases/proposed-phezukomoya-315-mw-wind-energy-facility Kind Regards, Natasha Higgitt	EAP 18/07/2017	Dear Natasha, With Reference to Case 11182, Arcus would like to thank SAHRA for providing their interim Comment, supplied on 18th July 2017. Arcus will ensure the HIA assesses all heritage resources as defined in section 3(2) of the National Heritage Resources Act, Act 25 of 1999 (NHRA) and the report will comply with section 38(3) of the NHRA. Furthermore, Arcus will

	Commentator	Comment	Respondent	Response
	T: +27 21 462 4502 F: +27 21 462 4509 C: +27 82 507 0378 E: nhiggitt@sahra.org.za 18/07/2017	Case Reference: THE PROPOSED SAN KRAAL 390 MW WIND ENERGY FACILITY Heritage Authority: SAHRA Committee: By Delegation of Authority Decision Date: Tuesday, July 18, 2017 - 15:00 NHRA: 38 Decision Status: Interim Comment Case Discussion: Arcus Consultancy Services South Africa (Pty) Ltd were appointed by San Kraal Wind Power (Pty) Ltd to conduct an Environmental Impact Assessment (EIA) Process in support of an Environmental Authorisation Application for the Proposed San Kraal 390 MW Wind Energy Facility (WEF), Northern and Eastern Cape. A Draft Scoping Report was completed in term of the National Environmental Management Act, 1998 (NEMA) and the EIA Regulations 2014. The proposed development will comprise the construction of a 390 MW WEF of up to 78 wind turbines, a switching station, internal roads, laydown areas, operations and maintenance buildings, and a 25 km 132 kV double or single string transmission line. It must be noted that approximately 13 turbines are proposed for the Eastern Cape portion of the development, with 4 on the border with the Northern Cape Province. ACO Associates CC has been appointed to conduct the Heritage Component of the EIA process. *Hart, T. 2016. Heritage Impact Assessment (Scoping) for the Proposed San Kraal Wind Power (Pty) Ltd Wind Energy Facility to be situated in the Northern Cape.* The Heritage Scoping Report found that several types of heritage resources can be expected in the proposed development area. These include palaeontological resources such as fish fossils, early vertebrates, plant remains and trace fossils located within the Beaufort Group. Archaeological resources expected to be present include Early Stone Age (ESA), Middle Stone Age (MSA) and Later Stone Age (LSA) lithics and sites, rock-art sites, stone walled structures, colonial settlements and farm houses, railways and graves. The N9 is a National Route and the Kikvorsberge escarpment is a scenic area. The development area has a strong wilderness quality that may be diminished by the proposed WEF. The combined cumulative impact of other renewable energy facilities in the immediate surroundings will impact the aesthetic qualities of the region. Recommendations provided in the report include the following:		ensure that the Visual Impact of the proposed development on heritage resources is addressed and any comments provided by the public regarding heritage resources will be taken into consideration during the EIA Phase. Finally, the Scoping Report, appendices, the draft EIA and appendices including the heritage reports, will be submitted to SAHRIS as soon as these are available. Once again thank-you for your comments supplied.

	Commentator	Comment	Respondent	Response
		The physical remnants of human activity need to be identified and assessed through physical site inspection, mapped and assigned field grades; Detailed work has to be done through physical field assessment of palaeontological resources; The assessment of the landscape as a heritage resource will require the integration of the findings impacts assessment as well as consideration of the methods of landscape characterization and grading to produce an integrated statement of impact for purposes of the EIA. Interim Comment SAHRA Archaeology, Palaeontology and Meteorites (APM) Unit accepts and promotes the recommendations provided by the heritage specialist. The pending HIA must assess all heritage resources as defined in section 3(2) of the National Heritage Resources Act, Act 25 of 1999 (NHRA) and the report must comply with section 38(3) of the NHRA. Additionally, the Visual Impact of the proposed development on heritage resources and any comments provided by the public regarding heritage resources must be taken into consideration. The Scoping report appendices, the draft EIA with all appendices must be submitted along with the heritage reports in order for further comments to be issued.		
16	Ryan Oliver Commission on Restitution of Land Rights Ms M Du Toit Chief Director: Land Restitution Support-Northern Cape ryan.oliver@drdlr.gov.za 18/07/2017	Good day, Please find attached response letters of Land Claim enquiries. Yours sincerely, Ryan Oliver Attached letters: Dear Sir/ Madam, LAND CLAIMS ENQUIRY – Portion 46 (a portion of portion 15) of the Farm Hartbeest Hoek No. 182, Omsobomvu Municipality, Province Northern Cape. Remainder of portion 15 (Oude Hartbeest Hoek) of the Farm Hartbeest Hoek No. 182, Omsobomvu Municipality, Province Northern Cape. Portion 3 (Heathwall) (A portion of portion 1) of the Farm Hartbeest Hoek No. 182, Omsobomvu Municipality, Province Northern Cape. Farm No. 14 (Oude Hartbeest Hoek) of the Farm Hartbeest Hoek No. 182, Omsobomvu Municipality, Province Northern Cape.	EAP 18/07/2017	Dear Mr. Oliver, RE: The Proposed San Kraal and Phezukomoya Wind Energy Facilities, Northern and Eastern Cape Provinces Arcus would like to thank-you for providing us with your comments which were supplied on 18th July 2017. We acknowledge that at this stage there are no land claims on the specified project properties. We have included your comments in the issues trail of the Final Scoping Reports, these will be submitted to the Department of Environmental Affairs for approval. Once again thank-you for your participation.

	Commentator	Comment	Respondent	Response
		We confirm that as at the date of this letter no land claims appear on our database in respect of the Property. This includes the database for claims lodged by 31 December 1998; and those lodged between 1 July 2014 and 27 July 2016 in terms of the Restitution of Land Rights Amendment Act, 2014. Whilst the Commission takes reasonable care to ensure the accuracy of the information it provides, there are various factors that are beyond the Commission 's control, particularly relating to claims that have lodged but not yet been gazetted such as: Some Claimants referred to properties they claim dispossession of rights in land against using historical property descriptions which may not match the current property description; and Some Claimants provided the geographic descriptions of the land they claim without mentioning the particular actual property description they claim dispossession of rights in land against. The Commission therefore does not accept any liability whatsoever if through the process of further investigation of claims it is found that there is in fact a land claim in respect of the above property. If you are aware of any change in the description of the above property after 19 June 1913 kindly supply us with such description so as to enable us to do a further search. Yours faithfully, Ms M Du Toit Chief Director: Land Restitution Support-Northern Cape -- Dear Sir/ Madam LAND CLAIMS ENQUIRY Portion 47 (a portion of portion 15) of the Farm Hartbeest Hoek No. 182, Omsobomvu Municipality, Province Northern Cape. Remainder of the Farm Hartbeest Hoek No. 182, Omsobomvu Municipality, Province Northern Cape. We confirm that as at the date of this letter no land claims appear on our database in respect of the Property. This includes the database for claims lodged by 31 December 1998; and those lodged between 1 July 2014 and 27 July 2016 in terms of the Restitution of Land Rights Amendment Act, 2014.		

	Commentator	Comment	Respondent	Response
		Whilst the Commission takes reasonable care to ensure the accuracy of the information it provides, there are various factors that are beyond the Commission's control, particularly relating to claims that have lodged but not yet been gazetted such as: Some Claimants referred to properties they claim dispossession of rights in land against using historical property descriptions which may not match the current property description; and Some Claimants provided the geographic descriptions of the land they claim without mentioning the particular actual property descript ion they claim dispossession of rights in land against. The Commission therefore does not accept any liability whatsoever if through the process of further investigation of claims it is found that there is in fact a land claim in respect of the above property. If you are aware of any change in the description of the above property after 19 June 1913 kindly supply us with such description so as to enable us to do a further search. Yours faithfully, Ms M Du Toit Chief Director: Land Restitution Support-Northern Cape Dear Sir/ Madam LAND CLAIMS ENQUIRY Remaining extent of the Farm Winterhoek No. 118, Hanover Registration Division, Province Northern Cape. Remainder of the Farm Winterhoek No. 136, Hanover Registration Division, Province Northern Cape. Remaining extent of the Farm Elands Kloof No. 135, Hanover Registration Division, Province Northern Cape. We confirm that as at the date of this letter no land claims appear on our database in respect of the Property. This includes the database for claims lodged by 31 December 1998; and those lodged between 1 July 2014 and 27 July 2016 in terms of the Restitution of Land Rights Amendment Act, 2014. Whilst the Commission takes reasonable care to ensure the accuracy of the information it provides, there are various factors that are beyond the		

	Commentator	Comment	Respondent	Response
		Commission 's control, particularly relating to claims that have lodged but not yet been gazetted such as: Some Claimants referred to properties they claim dispossession of rights in land against using historical property descriptions which may not match the current property description; and Some Claimants provided the geographic descriptions of the land they claim without mentioning the particular actual property description they claim dispossession of rights in land against. The Commission therefore does not accept any liability whatsoever if through the process of further investigation of claims it is found that there is in fact a land claim in respect of the above property. If you are aware of any change in the description of the above property after 19 June 1913 kindly supply us with such description so as to enable us to do a further search. Yours faithfully, Ms M Du Toit Chief Director: Land Restitution Support-Northern Cape Chief Director: Land Restitution Support-Northern Cape --- Dear Sir/ Madam LAND CLAIMS ENQUIRY REMAINDER OF PORTION 1 OF THE FARM KLEINFONTEIN NO. 117, HANOVER REGISTRATION DIVISION, PROVINCE NORTHERN CAPE. Remainder of the Farm Kleinfontein No. 117, Hanover Registration Division, Province Northern Cape. We confirm that as at the date of this letter no land claims appear on our database in respect of the Property. This includes the database for claims lodged by 31 December 1998; and those lodged between 1 July 2014 and 27 July 2016 in terms of the Restitution of Land Rights Amendment Act, 2014. Whilst the Commission takes reasonable care to ensure the accuracy of the information it provides, there are various factors that are beyond the Commission's control, particularly relating to claims that have lodged but not yet been gazetted such as: Some Claimants referred to properties they claim dispossession of rights in land against using historical property descriptions which may not match the current property description; and Some Claimants provided the geographic descriptions of the land they claim without mentioning the particular actual property description they claim		

	Commentator	Comment	Respondent	Response
		dispossession of rights in land against. The Commission therefore does not accept any liability whatsoever if through the process of further investigation of claims it is found that there is in fact a land claim in respect of the above property. If you are aware of any change in the description of the above property after 19 June 1913 kindly supply us with such description so as to enable us to do a further search. Yours faithfully, Ms M Du Toit Chief Director: Land Restitution Support-Northern Cape		
COMMENT PERIOD 22 August – 20 September 2017				
17	Lizell Stroh Obstacle Inspector PANS-OPS (Procedures for Air Navigation Services-Aircraft Operations) Air Navigation Services Tel: +27 11 545 1232 Fax: +27 011 545 1282 Mobile: +27 83 461 6660 Email: strohl@caa.co.za www.caa.co.za 22/08/2017	The S. A. Civil Aviation Authority has taken note of your intention to develop a wind farm and requires the following information in order to assess the possible impact on aviation. An formal application via Form CA139-26 – Wind Farm application, available electronically from the SACAA website (www.caa.co.za), follow link "Information for the industry" – drop down list – Obstacles- Forms. Completion of the attached Excel spreadsheet – Property boundaries co – ordinates. Completion of the attached Pylon geographic co-ordinates. Should these co-ordinates not be available at this stage, an indication of the planned route of the power evacuation lines to the point of connection with the national grid. A live .kmz file (Google Earth or similar) indicating proposed planned turbine layout. In order to assist with the DEA process, the SACAA will, subject to the proposed wind farm not presenting a hazard, issue a "in principle" conditional approval on the receipt of the planned turbine layout which will be subjected to an in depth assessment accordance with the Civil Aviation Technical Standards. Should the turbine layout change from that which has been provided initially, a new assessment would be required to be conducted. Kindly note, that the conditional approval will be valid for a period of 5 years from date of issue. On completion of the project and receipt of "as built" detail and a statement of compliance to specified conditions, the SACAA will provide a final approval. As the proposed site may be adjacent to areas of military interest, the SAAF will be included in the request for review, once the proposed site and wind farm information is made available for assessment. The SACAA refrains from commenting on a proposal, but will either conditionally support or disapprove the project; from an aviation perspective should the project create a hazard or obstacle to aviation in the area of the project.	EAP 29/08/2017	Dear Lizelle Stroh, Thank you for the below information. This has been passed on to the developer. We will send you the coordinates and shapefiles once we have a confirmed final layout. Kind Regards,

	Commentator	Comment	Respondent	Response
		Following the receipt of the information, an invoice to cover the assessment will be generated and becomes payable before the assessment results will be released.		
18	John Geeringh (Pr Sci Nat) Senior Consultant Environmental Management Eskom: GC Land Development D1 Y39 Megawatt Park P O Box 1091 Johannesburg 2000 Tel: 011 516 7233 Fax: 086 661 4064 Cell: 083 632 7663 E-mail: john.geeringh@eskom.co.za 18/09/2017	Please find attached Eskom requirements for developments at or near infrastructure to be taken into consideration during the planning and development phases of the proposed WEF. Please send me KMZ files of the proposed land parcels, connector power line routes and layouts Letter: <u>Eskom requirements for work at or near Eskom infrastructure.</u> Eskom's rights and services must be acknowledged and respected at all times. Eskom shall at all times retain unobstructed access to and egress from its servitudes. Eskom's consent does not relieve the developer from obtaining the necessary statutory, land owner or municipal approvals. Any cost incurred by Eskom as a result of non-compliance to any relevant environmental legislation will be charged to the developer. If Eskom has to incur any expenditure in order to comply with statutory clearances or other regulations as a result of the developer's activities or because of the presence of his equipment or installation within the servitude restriction area, the developer shall pay such costs to Eskom on demand. The use of explosives of any type within 500 metres of Eskom's services shall only occur with Eskom's previous written permission. If such permission is granted the developer must give at least fourteen working days prior notice of the commencement of blasting. This allows time for arrangements to be made for supervision and/or precautionary instructions to be issued in terms of the blasting process. It is advisable to make application separately in this regard. Changes in ground level may not infringe statutory ground to conductor clearances or statutory visibility clearances. After any changes in ground level, the surface shall be rehabilitated and stabilised so as to prevent erosion. The measures taken shall be to Eskom's satisfaction. Eskom shall not be liable for the death of or injury to any person or for the loss of or damage to any property whether as a result of the encroachment or of the use of the servitude area by the developer, his/her agent, contractors, employees, successors in title, and assignees. The developer indemnifies Eskom against loss, claims or damages including claims pertaining to consequential damages by third parties and whether as a result	EAP 18/09/2017	Dear John, Thank-you very much for your response and for providing the attached information which has already been forwarded to the Project Developer for their consideration during planning and development phases. You will be kept updated as the EIA progresses. As soon as we have a final layout we will send you the updated KMZ files as requested. Kind Regards,

	Commentator	Comment	Respondent	Response
		of damage to or interruption of or interference with Eskom's services or apparatus or otherwise. Eskom will not be held responsible for damage to the developer's equipment. No mechanical equipment, including mechanical excavators or high lifting machinery, shall be used in the vicinity of Eskom's apparatus and/or services, without prior written permission having been granted by Eskom. If such permission is granted the developer must give at least seven working days' notice prior to the commencement of work. This allows time for arrangements to be made for supervision and/or precautionary instructions to be issued by the relevant Eskom Manager Note: Where and electrical outage is required, at least fourteen work days are required to arrange it. Eskom's rights and duties in the servitude shall be accepted as having prior right at all times and shall not be obstructed or interfered with. Under no circumstances shall rubble, earth or other material be dumped within the servitude restriction area. The developer shall maintain the area concerned to Eskom's satisfaction. The developer shall be liable to Eskom for the cost of any remedial action which has to be carried out by Eskom. The clearances between Eskom's live electrical equipment and the proposed construction work shall be observed as stipulated by *Regulation 15* of the *Electrical Machinery Regulations of the Occupational Health and Safety Act, 1993 (Act 85 of 1993).* Equipment shall be regarded electrically live and therefore dangerous at all times. In spite of the restrictions stipulated by Regulation 15 of the Electrical Machinery Regulations of the Occupational Health and Safety Act, 1993 (Act 85 of 1993), as an additional safety precaution, Eskom will not approve the erection of houses, or structures occupied or frequented by human beings, under the power lines or within the servitude restriction area. Eskom may stipulate any additional requirements to highlight any possible exposure to Customers or Public to coming into contact or be exposed to any dangers of Eskom plant. It is required of the developer to familiarise himself with all safety hazards related to Electrical plant. Any third party servitudes encroaching on Eskom servitudes shall be registered against Eskom's title deed at the developer's own cost. If such a servitude is brought into being, its existence should be endorsed on the Eskom servitude deed concerned, while the third party's servitude deed must also include the rights of the affected Eskom servitude.		

	Commentator	Comment	Respondent	Response
		RENEWABLE ENERGY PLANT SETBACKS TO ESKOM INFRASTRUCTURE EXECUTIVE SUMMARY In recent decades, the use of wind turbines, concentrated solar plants and photovoltaic plants have been on the increase as it serves as an abundant source of energy. This document specifies setbacks for wind turbines and the reasons for these setbacks from infrastructure as well as setbacks for concentrated solar plants and photovoltaic plants. Setbacks for wind turbines employed in other countries were compared and a general setback to be used by Eskom was suggested for use with wind turbines and other renewable energy generation plants. INTRODUCTION During the last few decades, a large amount of wind turbines have been installed in wind farms to accommodate for the large demand of energy and depleting fossil fuels. Wind is one of the most abundant sources of renewable energy. Wind turbines harness the energy of this renewable resource for integration in electricity networks. The extraction of wind energy is its primary function and thus the aerodynamics of the wind turbine is important. There are many different types of wind turbines which will all exhibit different wind flow characteristics. The most common wind turbine used commercially is the Horizontal Axis Wind Turbine. Wind flow characteristics of this turbine are important to analyse as it may have an effect on surrounding infrastructure. Wind turbines also cause large turbulence downwind that may affect existing infrastructure. Debris or parts of the turbine blade, in the case of a failure, may be tossed behind the turbine and may lead to damage of infrastructure in the wake path. This document outlines the minimum distances that need to be introduced between a wind turbine and Eskom infrastructure to ensure that debris and/or turbulence would not negatively impact on the infrastructure. Safety distances of wind turbines from other structures as implemented by other countries were also considered and the reasons for their selection were noted. Concentrated solar plants and photovoltaic plants setbacks away from substations were also to be considered to prevent restricting possible power line access routes to the substation. SUPPORTI NG CLAUSES 2.1 SCOPE This document provides guidance on the safe distance that a wind turbine should be located from any Eskom power line or substation. The document specifies setback distances for transmission lines (220 kV to		

	Commentator	Comment	Respondent	Response
		765 kV), distribution lines (6.6 kV to 132 kV) and all Eskom substations. Setbacks for concentrated solar plants and photovoltaic plants are also specified away from substations. 2.1.1 Purpose Setbacks for wind turbines and power lines I substations are required for various reasons. These include possible catastrophic failure of the turbine blade that may release fragments and which may be thrown onto nearby power lines that may result in damage with associated unplanned outages. Turbulence behind the turbine may affect helicopter flight during routine Eskom live line maintenance and inspections that may lead to safety risk of the aircraft I personnel. Concentrated solar plants and photovoltaic plants setback away from substations were required to prevent substations from being boxed in by these renewable generation plants limiting line route access to the substations. 2.1.2 Applicability This document is applicable to the siting of all new and existing wind turbines, concentrated solar plants and photovoltaic plants near power lines and substations. 2.2 NORMATIVE / INFORMATIVE REFERENCES 2.2.1 Normative http://www.envir.ee/orb.aw/class=file/action=preview/id=1170403/Hiiumaa+turbulence+impact+EMD.pdf http://www.energy.ca.gov/2005publications/CEC-500-2005-I 84/CEC-500-2005-I84.PDF http://www.adamscountywind.com/Revised%20Site/Windmills/Adams%20County%200rdinance/Adams%20County%20W ind%200rd.htm http://www.dsireusa.org/incentives/incentive.cfm?IncentiveCode=PA11R&RE=I&EE=l http://www.wind-watch.org/documents/european-setbacks-minimum-distance-between-wind-turbines-and-habitations/ http://www.publications.parliament.uk/pa/ld201011/ldbills/017/11017.1-i.html http://www.caw.ca/assets/pdf/Turbine_Safety_Report.pdf Rogers J, Siegers N, Costello M. (201 1) A method for defining windturbine setback standards. Wind energy I 0.1002/we.468 2.2.2 Informative None 2.3 DEFINITIONS Definition | Description		

	Commentator	Comment	Respondent	Response
		Setback: The minimum distance between a wind turbine and a boundary line/dwelling/road/infrastructure/servitude etc. Flicker: Effect caused when rotating wind turbine blades periodically cast shadows Tip Height: The total height of the wind turbine ie.hub height plus rotor diameter. 2.3.1 Disclosure Classification Controlled disclosure: controlled disclosure to external parties (either enforced by law, or discretionary). 2.4 ABBREVIATIONS: NONE 2.5 ROLES AND RESPONSIBILITIES All personnel involved in the positioning wind turbines, concentrated solar plants and photovoltaic plants near power lines/substations must follow the setbacks outlined in this guideline. 2.6 PROCESS FOR MONITORING Approval by Eskom in writing. 2.7 RELATED/SUPPORTING DOCUMENTS None DOCUMENT CONTENT 3.1 INTERNATIONAL SETBACK COMPARISON Wind Turbine setbacks employed by various countries were considered. It was found that setbacks were determined for various reasons that include noise, flicker, turbine blade failure and wind effects. The distances (setbacks) varied based on these factors and were influenced by the type of infrastructure. Wind turbine setbacks varied for roads, power lines, dwellings, buildings and property and it was noted that the largest setbacks were employed for reasons of noise and flicker related issues [1-7]. Very few countries specified setbacks for power lines. The literature survey [1-7], yielded information about studies and experiments were conducted to determine the distance that a broken fragment from a wind turbine might be thrown. Even though of low probability of hitting a power line [5.0x10-5181], the distances recorded were significant [750m 1s1] Setbacks were thus introduced to prevent any damage to Eskom infrastructure. Wind turbines may also cause changes in wind patterns with turbulent effects behind the hub. These actors dictate the wind turbine setbacks specified in this document. Concentrated solar plants and photovoltaic plants also can limit access into the substation for power lines of all voltages. A setback		

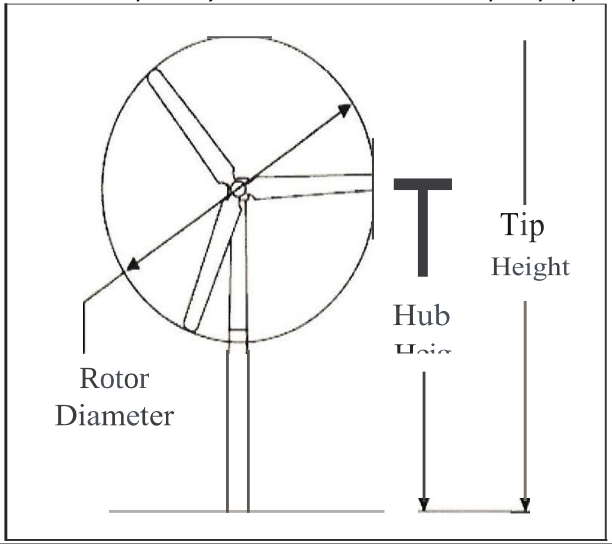
	Commentator	Comment	Respondent	Response
		distance must therefore be employed to prevent the substation from being boxed in by these generation plants. These setback distances are specified in this document. 3.2 ESKOM REQUIRED SETBACKS Eskom requires a setback distance of 3 times the tip height of the wind turbine from the edge of the closest Eskom servitude (including vacant servitudes) for transmission lines. Eskom requires a setback distance of 1 times the tip height of the wind turbine from the edge of the closest Eskom servitude (including vacant servitudes) for distribution Lines. Eskom must be informed of any proposed wind turbine, concentrated solar plants and photovoltaic activity within a 5 km radius of a substation. No wind turbine structure shall be built within a 2 km radius of the closest point of the substation. Where concentrated solar plants and photovoltaic structures fall within a 2 km radius of the closest point of a substation, Eskom should be informed in writing during the planning phase of the construction of such plant or structure. Applicants must show that Eskom radio telecommunication systems (mainly microwave systems) will not be affected in any way by wind turbines.  		

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		Figure 1: Horizontal Axis Wind Turbine		
19	Natasha Higgitt Heritage Officer: Archaeology, Palaeontology and Meteorites Unit South African heritage Resources Agency 111 Harrington Street Cape Town 8001 T: +27 21 462 4502 F: +27 21 462 4509 C: +27 82 507 0378 E: nhiggitt@sahra.org.za 28/08/2017	Thank you for the notification. Please ensure that all documents are uploaded to the relevant SAHRIS Case application. Please ensure that when the documents are uploaded, the status of the case is changed to SUBMITTED and please email me, and reference the Case ID number.	EAP 29/08/2017	We have uploaded the notification of lapsed application from the DEA to Case 11193 under Final Decision. Please can you confirm us when this case is closed. We have created and submitted a new case for San Kraal 390 MW Wind Energy Facility. The new case number is 11587.
20	Natasha Higgitt Heritage Officer: Archaeology, Palaeontology and Meteorites Unit South African heritage Resources Agency 111 Harrington Street Cape Town 8001 T: +27 21 462 4502 F: +27 21 462 4509 C: +27 82 507 0378 E: nhiggitt@sahra.org.za 18/09/2017	Good morning, Please note that a Letter has been issued on SAHRIS Case ID 11182. Please see link below: http://sahra.org.za/sahris/cases/proposed-san-kraal-390-mw-wind-energy-facility This case is now closed. Kind Regards, Letter In terms of Section of the National Heritage Resources Act (Act 25 of 1999) Attention: InnoWind (Pty) Ltd San Kraal Wind Power (Pty) Ltd are applying for environmental authorisation to construct the San Kraal 390 MW wind energy facility (WEF) and its associated infrastructure, including a 132 kV grid connection (the proposed San Kraal WEF). Arcus Consultancy Services South Africa (Pty) Ltd ('Arcus') has been appointed by San Kraal Wind Power (Pty) Ltd to conduct the Environmental Impact Assessment (EIA) process as required by the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA), as	EAP 18/09/2017	Thank you for this information and closing the lapsed application.

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		amended. The proposed development site is located approximately six kilometres south east of the town of Noupoort in the Umsobomvu Local Municipality (ULM) which forms part of the Pixley ka Seme District in the Northern Cape Province. A small portion of the development site falls within the Inxuba Yethemba Local Municipality, within the Chris Hani District of the Eastern Cape Province. The town of Middelburg and Colesberg are located approximately 25 km and 58 km to the south and north east of the site respectively. Thank you for notifying SAHRA that the Environmental Authorisation Application for the proposed 390MW San Kraal Wind Energy Facility and associated 132kV grid connection (DEA Ref: 14/12/16/3/3/2/1014) has lapsed. This case will be closed for further comments. Should you have any further queries, please contact the designated official using the case number quoted above in the case header. Yours faithfully, Natasha Higgitt, Heritage Officer		
21	Natasha Higgitt Heritage Officer: Archaeology, Palaeontology and Meteorites Unit South African heritage Resources Agency 111 Harrington Street Cape Town 8001 T: +27 21 462 4502 F: +27 21 462 4509 C: +27 82 507 0378 E: nhiggitt@sahra.org.za 18/09/201731	Good morning, Please note that an Interim Comment has been issued on SAHRIS Case ID 11587. Please see link below: http://sahra.org.za/sahris/cases/san-kraal-390-mw-wind-energy-facility Kind Regards, N Higgitt Interim Comment In terms of Section 38(3) of the National Heritage Resources Act (Act 25 of 1999) Attention: InnoWind (Pty) Ltd San Kraal Wind Power (Pty) Ltd are applying for environmental authorisation to construct the San Kraal 390 MW wind energy facility (WEF) and its associated infrastructure, including a 132 kV grid connection (the proposed San Kraal WEF). Arcus Consultancy Services South Africa (Pty) Ltd ('Arcus') has been appointed by San Kraal Wind Power (Pty) Ltd to conduct the Environmental Impact Assessment (EIA) process as required by the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA), as amended. The proposed development site is located approximately six kilometres south east of the town of Noupoort in the Umsobomvu Local	EAP 18/09/2017	Dear Natasha Higgitt, Thank you for your interim comment on the Draft Scoping report for the proposed San Kraal WEF. Notifications have been sent to the ECPHRA and they will be invited to comment again on the EIA report when it becomes available. Your comments have been forwarded to the Heritage specialist for consideration. The Final Scoping Report and Appendices and Draft EIA with all appendices will be uploaded to SAHRIS once finalized. Kind Regards,

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		Municipality (ULM) which forms part of the Pixley ka Seme District in the Northern Cape Province. A small portion of the development site falls within the Inxuba Yethemba Local Municipality, within the Chris Hani District of the Eastern Cape Province. The town of Middelburg and Colesberg are located approximately 25 km and 58 km to the south and north east of the site respectively. Arcus Consultancy Services South Africa (Pty) Ltd were appointed by San Kraal Wind Power (Pty) Ltd to conduct an Environmental Impact Assessment (EIA) Process in support of an Environmental Authorisation Application for the Proposed San Kraal 390 MW Wind Energy Facility (WEF), Northern and Eastern Cape. A Draft Scoping Report was completed in term of the National Environmental Management Act, 1998 (NEMA) and the EIA Regulations 2014. The proposed development will comprise the construction of a 390 MW WEF of up to 78 wind turbines, a switching station, internal roads, laydown areas, operations and maintenance buildings, and a 25 km 132 kV double or single string transmission line. It must be noted that approximately 13 turbines are proposed for the Eastern Cape portion of the development, with 4 on the border with the Northern Cape Province. ACO Associates CC has been appointed to conduct the Heritage Component of the EIA process. Hart, T. 2016. Heritage Impact Assessment (Scoping) for the Proposed San Kraal Wind Power (Pty) Ltd Wind Energy Facility to be situated in the Northern Cape. The Heritage Scoping Report found that several types of heritage resources can be expected in the proposed development area. These include palaeontological resources such as fish fossils, early vertebrates, plant remains and trace fossils located within the Beaufort Group. Archaeological resources expected to be present San Kraal 390 MW Wind Energy Facility include Early Stone Age (ESA), Middle Stone Age (MSA) and Later Stone Age (LSA) lithics and sites, rock-art sites, stone walled structures, colonial settlements and farm houses, railways and graves. The N9 is a National Route and the Kikvorsberge escarpment is a scenic area. The development area has a strong wilderness quality that may be diminished by the proposed WEF. The combined cumulative impact of other renewable energy facilities in the immediate surroundings will impact the aesthetic qualities of the region. Recommendations provided in the report include the following: The physical remnants of human activity need to be identified and assessed through physical site inspection, mapped and assigned field grades; Detailed work has to be done through physical field assessment of palaeontological resources; The assessment of the landscape as a heritage resource will require the integration of the findings impacts assessment as well as consideration of the methods of landscape		

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		characterization and grading to produce an integrated statement of impact for purposes of the EIA. Interim Comment It must be noted that comments for the Eastern Cape section of the proposed development must be sought from the Eastern Cape Provincial Heritage Resources Authority (ECPHRA). The SAHRA Archaeology, Palaeontology and Meteorites (APM) Unit accepts and promotes the recommendations provided by the heritage specialist. The pending HIA must assess all heritage resources as defined in section 3(2) of the National Heritage Resources Act, Act 25 of 1999 (NHRA) and the report must comply with section 38(3) of the NHRA. Additionally, the Visual Impact of the proposed development on heritage resources and any comments provided by the public regarding heritage resources must be taken into consideration. The Scoping report appendices, the draft EIA with all appendices must be submitted along with the heritage reports in order for further comments to be issued. Should you have any further queries, please contact the designated official using the case number quoted above in the case header. Yours faithfully		
22	Mr. Sabelo Malaza Chief Director: Integrated Environmental Authorisations Department of Environmental Affairs Private Bag X 447 Environment House 473 Steve Biko Road Pretoria 0001 027 12 399 9372 Enquiries: Toinette van der Merwe Tel: 012 399 8630 tvandermerwe@environment.gov.za 19/09/2017	Dear Madam COMMENTS ON THE DRAFT SCOPING REPORT FOR THE 390MW SAN KRAAL WIND ENERGY FACILITY AND ITS ASSOCIATED 132KV GRID CONNECTION TRANSMISSION LINE SOUTH EAST OF THE TOWN OF NOUPOORT WITHIN THE UMSOBOMVU LOCAL MUNICIPALITY IN THE NORTHERN PROVINCE AND THE INXUBA YETHEMBA LOCAL MUNICIPALITY IN THE EASTERN CAPE PROVINCE The draft Scoping Report (SR) dated June 2017 and received by this Department on 23 August 2017, and the application form received by this Department on 23 August 2017 refer. <u>This Department has the following comments on the abovementioned application:</u> Please ensure that all relevant listed activities applied for, are specific and can be linked to the development activity or infrastructure as described in the project description. If the activities applied for in the application form differ from those	EAP in Final Scoping report	Table 5.1 indicating the applicable listed activities describes how it relates to the proposed development. The activities applied for do not differ from those indicated in the DSR. Please see Appendix B public participation for proof of correspondence and notifications during the public participation process of the proposed development. Please see Section 16 of the Final Scoping report for the issues trail and responses to comments received. Appendix B contains proof of correspondence and notifications during the public participation process. Section 16 Public participation, elaborated on the methods used during the public

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		mentioned in the draft SR, an amended application form must be submitted with the final SR. Please note that the Department's application form template has been amended and can be downloaded from the following link https:1/www.environment.gov.za/documents/forms. The final SR must provide evidence that all identified and relevant competent authorities have been given an opportunity to comment on the proposed development; particularly the Square Kilometre Array South Africa, the South African Astronomical Observatory, the Department of Agriculture and the Department of Mineral Resources. Please ensure that all issues raised and comments received, during the circulation of the draft SR, from registered I&APs and organs of state which have jurisdiction (including this Department's Biodiversity Section) in respect of the proposed activity are adequately addressed in the final SR. Proof of correspondence with the various stakeholders must be included in the final SR. Should you be unable to obtain comments, proof should be submitted to the Department of the attempts that were made to obtain comments. The Public Participation Process must be conducted in terms of Regulation 39, 40 41, 42, 43 & 44 of the EIA Regulations 2014, as amended. A comments and Response trail report {C&R) must be submitted with the final SR. The C&R report must incorporate all historical comments for this development. The C&R report must be a separate document from the main report and the format must be in the table format as indicated in Annexure 1 of this comments letter. Please refrain from summarizing comments made by I&APs. All comments from I&APs must be copied verbatim and responded to clearly. Please note that a response such as "Noted" is not regarded as an adequate response to I&AP's comments. Specialist studies to be conducted must provide a detailed description of their methodology, as well as indicate the locations and descriptions of turbine positions, and all other associated infrastructures that they have assessed and are recommending for authorisations. The specialist studies must also provide a detailed description of all limitations to their studies. All specialist studies must be conducted in the right season and providing that as a limitation, will not be accepted. Should the appointed specialists specify contradicting recommendations, the EAP must clearly indicate the most reasonable recommendation and substantiate this with defendable reasons; and were necessary, include further expertise advice. Please note that the Department considers a 'no-go' area, as an area where no development of any infrastructure is allowed; therefore, no development		participation process and the methodology undertaken. Section 16, Table 16.1 of this report contains the issues trail, including all historical comments received for the proposed development. Appendix B contains all the original comments and documentation received during PPP. Appendix B also contains the complete issues trail, including historical comments received for the proposed development. The EAP has responded to all comments, as per the requirements of DEA. Table 16.1 and Appendix B. The specialist's studies will include detailed description of their methodology and specialists will indicate the location and description of turbine positions and all other associated infrastructures that they have assessed and those that they are recommending for authorisation. This comment has been forward to all specialist to comply with during the compilation of specialist reports for EIA phase. This request has been sent to the specialist to ensure compliance with these comments. The EAP will ensure that specialists incorporate and consider these comments in their EIA reports. The EAP will ensure that where there are any contradicting specialists recommendations in the EIA reports, the most reasonable recommendation will be put forward for authorisation and this will be substantiated with

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		of associated infrastructure including access roads and internal cables is allowed in the 'no-go' areas. Should the specialist definition of 'no-go' area differ from the Departments definition; this must be clearly indicated. The specialist must also indicate the 'no-go' area's buffer. Where specialist studies are conducted in-house or by a specialist other than a suitably qualified specialist in the relevant field, such specialist reports must be peer reviewed by a suitably qualified external specialist in the relevant field. The terms of reference for the peer review must include: A CV clearly showing expertise of the peer reviewer; Acceptability of the terms of reference; Is the methodology clearly explained and acceptable; Evaluate the validity of the findings (review data evidence); Discuss the suitability of the mitigation measures and recommendations; Identify any short comings and mitigation measures to address the short comings; Evaluate the appropriateness of the reference literature; Indicate whether a site-inspection was carried out as part of the peer review; and Indicate whether the article is well-written and easy to understand. The terms of reference for the ecological assessment must also investigate the following: The property falls within the National Protection Areas Expansion Strategy Focus Area (NPAES). The ecological study must assess the impact on the proposed development on the integrity of the NPAES in the area. Must indicate the location of both private and government nature protection areas in the area Must indicate and describe the competing land uses in the area The bat and avifaunal specialist assessments must assess and make recommendations for definite measurements for the preferred hub heights and rotor diameter. The avifaunal specialist assessment must indicate the proximity of the study area to any Important Bird Areas (IBA) and assess potential impacts on the integrity of said IBA. It is noted that the 12 months avifauna and bat monitoring was conducted in 2015. The EAP is advised to ensure that the proposed mitigation measures are in line with the latest guidelines from the Birdlife South Africa and SABAAP.		defendable reasons, and if and where necessary, the EAP will seek further expertise advice. The EAP will ensure that the department's consideration of no go areas are forwarded to specialists and will ensure that if the report and recommendations differ from the department's definition this will be clearly defined in the EIA report. This will be indicated in the specialist reports and the EIA report. The specialist's will be advised that they must indicate the no go areas buffer. The specialists appointed for this EIA process are all suitably qualified and none of the specialists are in-house. Each specialist has provided their CV as appendices to their reports. This comment has been provided to the ecologist for consideration in the EIA report. These terms of reference have been included in the Plan of Study, Section 18. This has been forward to the bird and bat specialists for consideration for the EIA specialist reports. This has been forward to the bird specialist for consideration and inclusion in the EIA Report. This comment will be taken into consideration and the EAP will ensure that the bird and bat specialists are proposing mitigation measures that are in line with the latest guidelines from BLSA and SABAA. The proposed San Kraal WEF is situated six kilometres south of the town of Noupoort, on the edge of the

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		The proposed development is located adjacent to the operational Noupoort WEF and the authorised Umsobomvu WEF. The final SR must include a terms of reference for a wake effect analysis input to assess the impact of the proposed development on the above-mentioned authorized developments; where this is not necessary, a specialist input must be included. Should there be any other similar projects within a 30km radius of the proposed development site, the cumulative impact assessment for all identified and assessed impacts must be refined to indicate the following: Identified cumulative impacts must be clearly defined, and where possible the size of the identified impact must be quantified and indicated, i.e. hectares of cumulatively transformed land. Detailed process flow and proof must be provided, to indicate how the specialist's recommendations, mitigation measures and conclusions from the various similar developments in the area were taken into consideration in the assessment of cumulative impacts and when the conclusion and mitigation measures were drafted for this project. The cumulative impacts significance rating must also inform the need and desirability of the proposed development. A cumulative impact environmental statement on whether the proposed development must proceed The final Scoping Report must indicate and describe the competing land uses in the area. This must further motivate the desirability of locating the wind energy facility at the preferred location. The EAP must ensure that all appointed specialists sign the "specialist declaration of interest" form. xx. In accordance with Appendix 2 of the EIA Regulations 2014, as amended, the details of- (i) the EAP who prepared the report; and (ii) the expertise of the EAP to carry out Scoping and Environmental Impact Assessment procedures; must be submitted. You are further reminded that the final SR to be submitted to this Department must comply with all the requirements in terms of the scope of assessment and content of Scoping reports in accordance with Appendix 2 and Regulation 21(1) of the EIA Regulations 2014, as amended. Further note that in terms of Regulation 45 of the EIA Regulations 2014, as amended, this application will lapse if the applicant fails to meet any of the timeframes prescribed in terms of these Regulations, unless an extension has been granted in terms of Regulation 3(7). You are hereby reminded of Section 24F of the National Environmental Management Act, Act No 107 of 1998, as amended, that no activity may commence prior to an environmental authorisation being granted by the		escarpment of a high lying area known locally as the Kikvorsberge (Figure 1.1). The proposed facility would be built on high lying ground at the edge of the Kikvorsberge Escarpment (Figure 1.2). The average turbine separation distance on typical wind farm in the non-prevailing wind direction is approximately between 200 m – 400 m. The closest turbine on the San Kraal WEF is approximately 1 km SW from the nearest Noupoort Wind Farm turbine, and therefore exceeds the average minimum requirement. In addition, the San Kraal turbine is also approximately 50 m higher than that of the Noupoort Wind Farm Turbine. The prevailing wind direction is NW-SE, and as a result, with a combination of these factors, the San Kraal WEF is deemed to have no impact on the existing Noupoort Wind Farm. Noupoort Wind Farm has been contacted in this regard to provide comment on the proposed development. The approved Umsobomvu WEF is a development that is owned by the same developer as the proposed San Kraal WEF, and therefore it is not deemed necessary to include this project in the above. The EAP will take this into consideration in the compilation of the EIA report, and ensure that the specialists are aware of the requirement of the DEA regarding cumulative impacts. The methodology for cumulative assessment, is

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		Department. Yours faithfully, Mr Sabelo Malaza Chief Director: Integrated Environmental Authorisation, Department of Environmental Affairs. Signed by Mr Coenrad Agenbach Designation: Deputy Director: Strategic Infrastructure Developments date 19/09/2017		included in Section 2 and Plan of Study Section 18 of the Final Scoping report. Please see Section 4 of this final scoping report for the need and desirability and the competing land use in the area. As per comment xii above, this will also be included as part of the ecological specialists assessment for inclusion in the EIA Report. All specialist have signed the declaration and is included in Volume II of the report. Please see Section 1 and Appendix A of the report for details of the EAP and the CV of the EAP that prepared this report. Please see Table E for compliance with the requirement with Appendix 2 and the EAP will ensure that Regulation 21 (1) of the EIA Regulations, as amended is complied with. The EAP will ensure that the applicant meets the prescribed timeframes in terms of the regulations.
Additional comments received				
23	Dr Adrian Tiplady Head of Strategy and Business Systems SKA South Africa Tel: 011 442 2434 Fax: 011 442 2454 atiplady@ska.ac.za 02/10/2017	Hi Anja, Please find attached. Regards, Adrian Letter: Dear Anja Albertyn, RE: DEVELOPMENT OF SAN KRAAL 390 MW WIND ENERGY FACILITY, NORTHERN AND EASTERN CAPE PROVINCES	EAP 02/10/2017	Dear Adrian, Thank you very much for your comments which we have included in our Final Scoping report and forwarded to the developer. You will be kept informed on the progress of the proposed development as requested.

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		This letter is in response to your email request to provide an assessment on the potential development of San Kraal wind energy facility and the risk it may pose on the Square Kilometre Array Project. A high level risk assessment has been conducted at the South African SKA Project Office to determine the potential impact of such facility on the Square Kilometre Array. This letter serves to confirm the outcomes of the risk assessment, and proposals for any future investigations associated with this facility. i. The location of the proposed facility has been identified from the background information document compiled by Arcus Consulting. The nearest SKA station is Rem-Opt-10 located at a distance of approximately 90km from proposed wind farm location; ii. Based on distances to the nearest SKA stations, and the information currently available on the detailed design of wind installations, this facility poses a low risk of detrimental impact on the SKA; iii. Any transmitters that are to be established, or have been established, at the site for the purposes of voice and data communication will be required to comply with the relevant AGA regulations concerning the restriction of use of the radio frequency spectrum that applies in the area concerned; iv. As a result of the low risk associated with the San Kraal wind facility, no mitigation measures would be required at this stage. However, the South African SKA Project Office would like to be kept informed of progress with this project, and reserves the right to further risk assessments at a later stage. This technical advice is provided by the South African SKA Project Office on the basis of the protection requirements of the SKA in South Africa, and does not constitute legal approval of the renewable energy projects in terms of the Astronomy Geographic Advantage Act, the Management Authority, and its regulations or declarations. Regards,		Kind Regards,
24	Rebecca Thomas Development Executive Mainstream Renewable Power South Africa 4th Floor, Mariendahl House	Please note that Mainstream Renewable Power, on behalf of Noupoort Wind Farm (Pty) Ltd, would like to be kept informed of the proposed project, specifically being supplied with the indicative turbine layouts as and when they become available, and an indication whether San Kraal Wind Power (Pty) Ltd believes there will be any wake loss effects on Noupoort and the significance thereof.	EAP	Mainstream Renewable Power South Africa will be kept informed on the progress of the proposed development as requested.

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	Newlands on Main Main Road & Campground Roads Claremont, Cape Town 7708 Tel: +27 (0)21 657 4040 Mob: +27 (0)73 452 0096 Email: Rebecca.Thomas@mainstreamrp.com	Please ensure we receive a copy of the Acceptance of Scoping Report, as well as a copy of the DEIR once made available. Kind Regards,		

5 NEED AND DESIRABILITY

WEFs can play a role in mitigating or reducing the effects of climate change, addressing South Africa's energy resource constraints and producing a lower cost of energy. In addition, operating WEFs in South Africa contribute significantly to the economic development of the areas in which they are located through the requirements of the REIPPPP adjudication process. This section of the report highlights the national, provincial and local plans and policies that are in support of renewable energy facilities. Throughout this section, it is demonstrated that at all levels of governance, policy supports the development of renewable energy in order to address energy supply issues, and to promote economic growth in South Africa.

Reference is made to the Western Cape Department of Environmental Affairs and Development Planning's 2010 Guideline on Need and Desirability[20] which states that while the "concept of need and desirability relates to the type of development being proposed, essentially, the concept of need and desirability can be explained in terms of the general meaning of its two components in which need refers to time and desirability to place – i.e. is this the right time and is it the right place for locating the type of land-use/activity being proposed? Need and desirability can be equated to wise use of land – i.e. the question of what is the most sustainable use of land." It should be noted that even though this development is located in the Northern and Eastern Cape, the relevance of this Guideline is still applicable, as it deals with Need and Desirability and its assessment in the EIA process.

5.1 Wind Resource at San Kraal WEF

Wind energy projects are characterised by a number of additional factors, besides the wind resource, that make a particular site a viable alternative. These include topography, proximity to and capacity of the national electricity grid, site accessibility, availability of land and land use, as well as possible environmental and permitting constraints. The site selection process undertaken for this project took into account a high-level assessment of various opportunities and constraints which may be applicable at a regional level before narrowing its focus on potential individual wind energy facilities at a local and site specific level.

The wind resource in the area and on this site specifically is competitive by national and international comparison. This is evidenced by the awarding of projects by the DoE on neighbouring properties (and one currently operational WEF) as well as data collected by on-site meteorological masts. InnoWind has monitored the wind speeds at the site with the WASA M09 Noupoort 59, a 60 m met mast and has a reading of 7.59 m/s at 60 m, this mast has been recording since 2015.

This is well above the wind speeds recorded at many projects that are currently in operation or construction in South Africa. It is therefore considered that the San Kraal WEF is ideally located for energy generation.

Based on their preliminary assessment of the wind resource from these measurements, San Kraal Wind Power (Pty) Ltd has determined that the proposed development would generate sufficient energy to support an economically viable wind energy project.

[20] DEA&DP's (2010) Guideline on Need and Desirability, EIA Guideline and Information Document Series. Western Cape Department of Environmental Affairs & Development Planning (DEA&DP).

5.2 Wind Energy Facilities' Contribution to Climate Change

The scientific consensus is that climate is changing and that these changes are in large part caused by human activities[21]. Of these human activities, increase in carbon dioxide (CO_2) levels due to emissions from fossil fuel combustion is regarded as a significant contributor to anthropogenic climate change.

South Africa is one of the world's largest emitters of CO_2 in absolute and per capita terms.

The following climate change impacts have been predicted in relation specifically to South Africa[22]:

- *South Africa's coastal regions will warm by around 1 - 2°C by about 2050 and around 3 - 4°C by about 2100;*
- *South Africa's interior regions will warm by around 3 - 4°C by about 2050 and around 6 - 7°C by about 2100;*
- *There will be significant changes in rainfall patterns and this, coupled with increased evaporation, will result in significant changes in respect of water availability;*
- *Our biodiversity will be severely impacted, especially the grasslands, fynbos and succulent Karoo where a high level of extinction is predicted;*
- *Small scale and homestead farmers in dry lands are most vulnerable to climate change and although intensive irrigated agriculture is better off than these farmers, irrigated lands remain vulnerable to reductions in available water;*
- *Some predictions suggest that maize production in summer rainfall areas and fruit and cereal production in winter rainfall areas may be badly affected;*
- *Commercial forestry is vulnerable to an increased frequency of wildfires and changes in available water in south-western regions;*
- *Rangelands are vulnerable to bush encroachment which reduces grazing lands;*
- *Alien invasive plant species are likely to spread more and have an ever-increasing negative impact on water resources;*
- *Although strong trends have already been detected in our seas, including rising sea levels and the warming of the Agulhas current and parts of the Benguela current, we are not yet sure what impacts these could have on our seas, the creatures living in the seas or on the communities dependant on the sea;*
- *Because of our already poor health profile, South Africans are specifically vulnerable to new or exacerbated health threats resulting from climate change. For example, some effects of climate change may already be occurring due to changes in rainfall (droughts and floods) and temperature extremes and cholera outbreaks have been associated with extreme weather events, especially in poor, high density settlements; and*
- *There will be an increase in the frequency and severity of extreme weather events. Damage costs due to extreme weather-related events (flooding, fire, storms and drought) have already been conservatively estimated at being roughly 1 billion rand per year between 2000 and 2009.*

As explained in National Treasury's Carbon Tax Policy Paper (May 2013)[23], addressing the challenges of climate change through facilitating a viable and fair transition to a low-carbon economy is essential to ensure an environmentally sustainable economic development and growth path for South Africa. Further the Policy Paper states that the South African government is of the view that South Africa needs to reduce its greenhouse

[21] http://adsabs.harvard.edu/abs/2013ERL.....8b4024C.

[22] http://www.cop17-cmp7durban.com/en/south-africa-on-climate-change/effects-of-climate-change-on-south-africa.html.

[23] National Treasury Carbon Tax Policy Paper. Available online http://www.treasury.gov.za/public%20comments/Carbon%20Tax%20Policy%20Paper%202013.pdf

gas emissions while working to ensure economic growth, increase employment, and reduce poverty and inequality[24].

Under the Copenhagen Accord[25], South Africa pledged in 2009 to ensure that its greenhouse gas emissions deviate from the business-as-usual growth trajectory by around 34% by 2020 and 42% by 2025.

Renewable energy projects will play a significant role in assisting the transition to a low-carbon economy.

5.3 Energy Constraint

South Africa faces major energy constraints, with the country's energy operating reserve margin i.e., the amount of electric generation resources planned to be available in the electricity generation system, as compared to the systems expected maximum demand for the year, of currently between 0% - 5%. Internationally, reserve margin requirements are usually kept at about 15% of total demand. To ensure that South Africa's economy can continue to grow, the energy constraint can be addressed by constructing additional electricity generators.

WEFs in particular have a relatively short construction period when compared to other conventional generation technologies of the same scale, meaning that much-needed power can be added to the grid from WEFs in the short term.

5.4 Diversification and Decentralisation of Supply

With its abundant coal supplies, approximately 85% of South Africa's energy needs are currently met through coal-fired generators, with nuclear energy contributing 5% and the balance by pumped storage (1.2%), hydroelectric (0.5%), renewable energy (5%) and gas turbines (0.1%). Electricity generation is dominated by state-owned power company Eskom, which currently produces over 96.7% of the power used in the country.[26][27]

A diversification of energy supplies and produces, particularly with respect to renewable energy sources, would lead to greater energy security and economic and environmental benefits.

The deployment of various renewable technologies increases the diversity of electricity sources and, through local decentralised generation, contributes to the flexibility of the system and its resistance to central shocks.

According to the International Energy Agency, "*renewable energy resources ... exist virtually everywhere, in contrast to other energy sources, which are concentrated in a limited number of countries. Reduced energy intensity, as well as geographical and technological diversification of energy sources, would result in far-reaching energy security and economic benefits.*"[28]

Progress in this regard has been made under the DoE REIPPPP, with 79 approved wind, solar, small hydro and bioenergy projects at various stages of development in the first four bidding windows of the REIPPPP, including 5243 MW of wind power. According to the DoE's Integrated Resource Plan for Electricity 2010-2030, South Africa is aiming to procure 9200 MW of wind power by 2030.

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[24] http://www.treasury.gov.za/public%20comments/Carbon%20Tax%20Policy%20Paper%202013.pdf
[25] Copenhagen Accord https://unfccc.int/meetings/copenhagen_dec_2009/items/5262.php
[26] http://www.usea.org/sites/default/files/event-file/497/South_Africa_Country_Presentation.pdf
[27] http://www.energy.gov.za/files/electricity_frame.html. Accessed 26-04-2016.
[28] www.iea.org/textbase/npsum/ETP2012SUM.pdf

5.5 Reduced Cost of Energy

In terms of cost, wind energy is globally one of the cheapest forms of new generation capacity available[29]. Under the REIPPPP, the fully-indexed tariffs for wind energy projects have dropped from R1.15/kilowatt hour (kWh) to as low as 62c/kWh, representing globally very competitive prices for energy generation. With Eskom currently producing power at 60c/kWh and with electricity from the coal-fired power stations currently under construction expected to cost more than 97c/kWh[30], wind energy is one of the lowest cost forms of new generation capacity in South Africa.

In addition to the levelled cost of developing, financing, constructing, operating and decommissioning energy generating facilities, all energy generators produce an external cost (or externality) such as the additional indirect costs incurred by society and the environment, including health, climate change, environmental, mining and water costs.

WEFs produce relatively small external costs when compared to other energy generation technologies. Any externalities can be considered positive in the form of local ownership of the project, local job creation and zero pollution resulting from wind facilities.

5.6 Economic Development and Job Creation

The REIPPPP requires Economic Development ("ED") commitments from onshore wind energy projects and projects are adjudicated according to their ED commitments. The main ED beneficiaries of approved projects are currently communities living within a 50 km radius of renewable energy facilities. Projects are bid and thereafter adjudicated according to tariff (70%) and Economic Development (30%). There is therefore an incentive for projects to focus on Economic Development of the Local Community and to assign as much revenue, jobs, procurement etc. to local people as well as South African companies and people as possible in order to stand a chance of having a successful project.

Projects are adjudicated according to the following points:

Economic Development Elements	**Weighting**
Job Creation	25%
Local Content	25%
Ownership	15%
Management Control	5%
Preferential Procurement	10%
Enterprise Development	5%
Socio-Economic Development	15%
Total	**100%**
Total points	**30 points**

A number of these elements will have a significant and positive impact on the Local Community.

In terms of job creation, bidders are required to indicate the actual number of jobs that will be created for South African citizens, Skilled People, Black People, Skilled Black People and Citizens from the Local Communities. Significant skilled and unskilled job

[29] https://about.bnef.com/press-releases/renewable-energy-now-cheaper-than-new-fossil-fuels-in-australia/
http://www.bloomberg.com/news/2013-02-06/australia-wind-energy-cheaper-than-coal-natural-gas-bnef-says.html
http://www.eia.gov/forecasts/aeo/electricity_generation.cfm
[30] http://mg.co.za/article/2012-08-24-00-eskom-grilled-on-power-price

opportunities will be created in the Local Communities, particularly during the construction period.

For Ownership, bidders are required to indicate the total shareholding of the Project Company in the hands of Black People and Local Communities. The minimum ownership percentage for Local Community is 2.5% but projects have committed up to 40% Local Community Ownership in order to have a competitive project. Broad-based community trusts are established as a vehicle for Local Community Ownership to received dividend revenue from an operating project that will be invested in socio-economic development imperatives as determined by trustees. The ownership stake is funded either through debt or through equity partners ("a free-carry").

The Socio-Economic Development and Enterprise Development commitments require a percentage of gross revenue from the operating wind farm to be invested in education, health, small business development etc. Projects are required to commit at least 1% of gross revenue towards socio-economic development. As an indication, 1% of gross revenue of a 140 MW wind farm, with a capacity factor of 35% and a tariff of 80 c/kWh would equal approximately R3.5 m/year (and R68 million over the 20 year operation period of a project). Projects in the REIPPPP receive additional points if the socio-economic and enterprise development investments are committed to be invested in the Local Community.

WEFs in South Africa will create skilled and unskilled jobs, particularly during the construction period. Under the REIPPPP, projects are incentivised to maximise the direct job creation opportunities, particularly for people in the communities surrounding the project.

WEFs tend to be constructed in rural areas with small communities and limited infrastructure and social amenities. A wind farm would create indirect jobs in accommodation, catering and other services that would support a wind farm and cater for the material and social needs of wind farm workers.

Localisation is considered one of the major contributors to job creation and general improvement of the economy of South Africa. Localisation through the construction of new manufacturing facilities to build wind turbine towers and other turbine components in South Africa is currently progressing.

Wind energy can provide technical skills to South Africans and thus improve the technical skills profile of the country and the regions where wind energy facilities are located. Through the REIPPPP, developers' own initiatives and through support from international donor agencies, a number of young South Africans are being trained on various aspects of wind farm construction and operation.

These projects, if successfully implemented, have the potential to transform for the better key development areas of South Africa and would assist South Africa in meeting its development goals, while meeting its carbon emission reduction targets as per international protocols.

5.7 Review of Policies in Support of Renewable Energy

5.7.1 Renewable Energy Independent Power Producer Procurement Programme (REIPPPP)

The REIPPPP is the mechanism which the Department of Energy (DoE) has provided for Independent Power Producers (IPPs), that is, private companies, to develop, construct and operate renewable energy facilities in South Africa.

Renewable energy in terms of the REIPPPP includes projects making use of any onshore wind, solar thermal, solar photovoltaic, biomass, biogas, landfill gas, or small hydro technologies.

The REIPPPP is a selection process which enables the DoE to evaluate potential renewable energy developments proposed by the IPP's through a competitive bidding process.

The bid is first evaluated to confirm that it is compliant with the bidding requirements. Bidding requirements include a completed EIA process and Environmental Authorisation from the competent authority. Compliant bids are then evaluated against two main criteria; price of electricity from the project and its economic development commitments.

In terms of the project's economic development commitments, bidders must demonstrate how a project would contribute towards elements such as job creation, local content and local manufacturing, rural development and community involvement, education and development of skills, enterprise development, socio-economic development and participation by historically disadvantaged individuals (HDIs). Reporting to demonstrate compliance with commitments made by the project over the life of the project is a strict requirement of the REIPPPP.

The most competitive compliant projects are awarded "Preferred Bidder Status" based on 70/30 split between the price and project's economic development commitments.

If awarded Preferred Bidder Status, the IPP would enter into an implementation agreement with the DoE and a Power Purchase Agreement (PPA) with Eskom. Once operational, the electricity would be sold to Eskom under the PPA at the agreed bid price. Eskom then distributes the energy through the national grid to energy users.

5.7.2 National Energy Act (Act 34 of 2008)

The National Energy Act was promulgated in 2008 (Act No 34 of 2008). One of the objectives of the 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).

5.7.3 White Paper on the Energy Policy of South Africa

Investment in renewable energy initiatives, such as the proposed WEF, is supported by the White Paper on Energy Policy for South Africa (December, 1998). In this regard the document notes:

"*Government policy is based on an understanding that renewables are energy sources in their own right, are not limited to small-scale and remote applications, and have significant medium and long-term commercial potential*".

"*Renewable resources generally operate from an unlimited resource base and, as such, can increasingly contribute towards a long-term sustainable energy future*".

The support for renewable energy policy is guided by a rationale that South Africa has a very attractive range of renewable resources, particularly solar and ***wind*** and that renewable applications are in fact the least cost energy service in many cases; more so when social and environmental costs are taken into account.

Government policy on renewable energy is thus concerned with meeting the following challenges:

- *Ensuring that economically feasible technologies and applications are implemented;*
- *Ensuring that an equitable level of national resources is invested in renewable technologies, given their potential and compared to investments in other energy supply options; and*
- *Addressing constraints on the development of the renewable industry.*

The White Paper also 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.

The White Paper also notes that renewable energy applications have specific characteristics that need to be considered. Advantages include:

- *Minimal environmental impacts in operation in comparison with traditional supply technologies; and*
- *Generally lower running cost, and high labour intensities.*

Disadvantages include:

- *Higher capital cost in some cases;*
- *Lower energy densities; and*
- *Lower levels of availability, depending on specific conditions, especially with sun and wind based systems.*

The IRP 2010 aims to allocate 43% of new energy generation facilities in South Africa to renewables.

5.7.4 White Paper on Renewable Energy

The White Paper on Renewable Energy (November, 2003) (further referred to as the White Paper) supplements the *White Paper on Energy Policy*, which recognizes 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.

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. As signatory to the Kyoto Protocol[31], Government is determined to make good the country's commitment to reducing greenhouse gas emissions. To this purpose, Government has committed itself to the development of a framework in which a national renewable energy framework can be established and operate.

South Africa is also a signatory of the Copenhagen Accord, a document that delegates at the 15th session of the Conference of Parties (COP 15) to the United Nations Framework Convention on Climate Change agreed to "take note of" at the final plenary on 18 December 2009. The accord endorses the continuation of the Kyoto Protocol and confirms that climate change is one of the greatest challenges facing the world. In terms

[31] The Kyoto Protocol is a protocol to the United Nations Framework Convention on Climate Change (UNFCCC), aimed at fighting global warming. The UNFCCC is an international environmental treaty with the goal of achieving "stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system". The Protocol was initially adopted on 11 December 1997 in Kyoto, Japan and entered into force on 16 February 2005. As of November 2009, 187 states have signed and ratified the protocol (Wikipedia).

of the accord, South Africa committed to a reduction target of 34% compared to business as usual.

Apart from the reduction of greenhouse gas emissions, the promotion of renewable energy sources is aimed at ensuring energy security through the diversification of supply (in this regard, also refer to the objectives of the National Energy Act).

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.

5.7.5 National Integrated Resource Plan for Electricity (2010 – 2030)

The current iteration of the Integrated Resource Plan (IRP) for South Africa, initiated by the Department of Energy (DoE) after a first round of public participation in June 2010, led to the Revised Balanced Scenario (RBS) that was published in October 2010 and later up-dated in November 2013. The document outlines the proposed generation new build fleet for South Africa for the period 2010 to 2030. 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 a nuclear fleet of 9,6 GW; 6,3 GW of coal; 11,4 GW of renewables; and 11,0 GW of other generation sources.

A second round of public participation was conducted in November/December 2010, which led to several changes to the IRP model assumptions. The main changes were the disaggregation of renewable energy technologies to explicitly display solar photovoltaic (PV), concentrated solar power (CSP) and wind options; the inclusion of learning rates, which mainly affected renewables; and the adjustment of investment costs for nuclear units, which until then represented the costs of a traditional technology reactor and were too low for a newer technology reactor (a possible increase of 40%).

Additional cost-optimal scenarios were generated based on the changes. The outcomes of these scenarios, in conjunction with the following policy considerations, led to the Policy-Adjusted IRP:

- *The installation of renewables (solar PV, CSP and wind) were 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 was included in the IRP;*
- *The emission constraint of the RBS (2140 million tons of carbon dioxide per year after 2024) was maintained; and*
- *Energy efficiency demand-side management (EEDSM) measures were maintained at the level of the RBS.*

Plate 5.1 indicates the new capacities of the Policy commitment. The dates shown indicate the capacity is required in order to avoid security of supply concerns. The document notes that projects could be concluded earlier than indicated. In terms of allocation, wind was allocated between 600 and 800MW per year and solar between 500 and 700MW. With Round 4 announcement in April 2015 the allocation for wind and solar was doubled in the so called Round 4b and even an expedited Round 4c with an additional 1 800MW was introduced for bidding in October 2015. Furthermore the department announced that the current REIPPPP will be extended with an additional 63 00MW for the upcoming years. To date, there have been four (4) volumes or bidding windows under the REIPPPP. In April 2015, the DoE announced additional preferred bidders for the REIPPPP Bid Window 4 contributing 1 121MW to the national grid contributing to a total of 5 243MW procured since the implementation of the programme to date (DoE, 2015).

The key conclusions that are relevant to the renewable energy sector is that an accelerated roll-out of renewable energy options should be allowed in order to derive the benefits of these technologies.

	New build options								Committed					Non IRP
	Coal (PF, FBC, imports, own build)	Nuclear	Import hydro	Gas – CCGT	Peak – OCGT[1]	Wind	CSP	Solar PV	Coal	Other	DoE Peaker	Wind[2]	Other Renew.	Co-generation
	MW	MW	MW	MW	MW	MW	MW	MW	MW	MW	MW	MW	MW	MW
2010	0	0	0	0	0	0	0	0	380	260	0	0	0	0
2011	0	0	0	0	0	0	0	0	679	130	0	0	0	0
2012	0	0	0	0	0	0	0	300	303	0	0	400	100	0
2013	0	0	0	0	0	0	0	300	823	333	1020	400	25	0
2014	500	0	0	0	0	400	0	300	722	999	0	0	100	0
2015	500	0	0	0	0	400	0	300	1444	0	0	0	100	200
2016	0	0	0	0	0	400	100	300	722	0	0	0	0	200
2017	0	0	0	0	0	400	100	300	2168	0	0	0	0	200
2018	0	0	0	0	0	400	100	300	723	0	0	0	0	200
2019	250	0	0	237	0	400	100	300	1446	0	0	0	0	0
2020	250	0	0	237	0	400	100	300	723	0	0	0	0	0
2021	250	0	0	237	0	400	100	300	0	0	0	0	0	0
2022	250	0	1 143	0	805	400	100	300	0	0	0	0	0	0
2023	250	1 600	1 183	0	805	400	100	300	0	0	0	0	0	0
2024	250	1 600	283	0	0	800	100	300	0	0	0	0	0	0
2025	250	1 600	0	0	805	1 600	100	1 000	0	0	0	0	0	0
2026	1 000	1 600	0	0	0	400	0	500	0	0	0	0	0	0
2027	250	0	0	0	0	1 600	0	500	0	0	0	0	0	0
2028	1 000	1 600	0	474	690	0	0	500	0	0	0	0	0	0
2029	250	1 600	0	237	805	0	0	1 000	0	0	0	0	0	0
2030	1 000	0	0	948	0	0	0	1 000	0	0	0	0	0	0
Total	6 250	9 600	2 609	2 370	3 910	8 400	1 000	8 400	10133	1722	1020	800	325	800

2011 Determinations 2012 Determinations Eskom commitments (pre IRP)

Notes: 1. OCGT is seen as natural gas in the determination
2. Includes Sere (100MW)

Source: IRP 2010-2030 Update Report November 2013

Plate 5.1 IRP2010 Policy Adjusted Plan with Ministerial Determinations

5.7.6 National Development Plan

The National Development Plan (NDP) contains a plan aimed at eliminating poverty and reducing inequality by 2030. The NDP identifies nine key challenges and associated remedial plans. Managing the transition towards a low carbon national economy is identified as one of the 9 key national challenges. Expansion and acceleration of commercial renewable energy is identified as a key intervention strategy.

5.7.7 The New Growth Path Framework

Government released the New Economic Growth Path Framework on 23 November 2010. The aim of the framework is to enhance growth, employment creation and equity. The policy's principal target is to create five million jobs over the next ten years and reflects government's commitment to prioritising employment creation in all economic policies. The framework identifies strategies that will enable South Africa to grow in a more equitable and inclusive manner while attaining South Africa's developmental agenda. **Central to the New Growth Path is a massive investment in infrastructure as a critical driver of jobs across the economy.** In this regard the framework identifies investments in five key areas namely: energy, transport, communication, water and housing.

The New Growth Path also identifies five other priority areas as part of the programme to create jobs, through a series of partnerships between the State and the private sector. The Green Economy is one of the five priority areas, including expansions in construction and the production of technologies for solar, wind and biofuels. In this regard clean manufacturing and environmental services are projected to create 300 000 jobs over the next decade.

5.7.8 National Infrastructure Plan

The South African Government adopted a National Infrastructure Plan in 2012. The aim of the plan is to transform the economic landscape while simultaneously creating significant numbers of new jobs and strengthen the delivery of basic services. The plan also supports the integration of African economies. In terms of the plan, Government will invest R827 billion over the next three years to build new and upgrade existing infrastructure. The aim of the investments is to improve access for South Africans to healthcare facilities, schools, water, sanitation, housing and electrification. The plan also notes that investment in the construction of ports, roads, railway systems, electricity plants, hospitals, schools and dams will contribute to improved economic growth.

As part of the National Infrastructure Plan, Cabinet established the Presidential Infrastructure Coordinating Committee (PICC). The Committee identified and developed 18 strategic integrated projects (SIPS). The SIPs cover social and economic infrastructure across all nine provinces (with an emphasis on lagging regions) and consist of:

- *Five geographically-focussed SIPs;*
- *Three spatial SIPs;*
- *Three energy SIPs;*
- *Three social infrastructure SIPs;*
- *Two knowledge SIPs;*
- *One regional integration SIP; and*
- *One water and sanitation SIP.*

The three energy SIPS are SIP 8, 9 and 10.

5.7.9 Northern Cape Provincial Growth and Development Strategy

The Northern Cape Provincial Growth and Development Strategy (NCPGDS) identifies poverty reduction as the most significant challenge facing the government and its partners. All other societal challenges that the province faces emanate predominantly from the effects of poverty. The NCPGDS notes that the only effective way to reduce poverty is through long-term sustainable economic growth and development. The sectors where economic growth and development can be promoted include:

- *Agriculture and Agro-processing;*
- *Fishing and Mariculture;*
- *Mining and Mineral-processing;*
- *Transport;*
- *Manufacturing; and*
- *Tourism.*

However, the NCPGDS also notes that economic development in these sectors also requires:

- *Creating opportunities for lifelong learning;*
- *Improving the skills of the labour force to increase productivity; and*
- *Increasing accessibility to knowledge and information.*

The achievement of these primary development objectives depends on the achievement of a number of related objectives that, at a macro-level, describe necessary conditions for growth and development. These are:

- *Developing requisite levels of human and social capital;*
- *Improving the efficiency and effectiveness of governance and other development institutions; and*
- *Enhancing infrastructure for economic growth and social development.*

The NCPGDS makes reference to the need to ensure the availability of inexpensive energy. The section notes that in order to promote economic growth in the Northern Cape, the availability of electricity to key industrial users at critical localities at rates that enhance the competitiveness of their industries must be ensured. The development of new sources of energy through the promotion of the adoption of energy applications that display a synergy with the province's natural resource endowments must also be encouraged. The NCPGDS notes "*the development of energy sources such as wind and solar energy, the natural gas fields, bio-fuels, etc., could be some of the means by which new economic opportunity and activity is generated in the Northern Cape*". The NCPGDS also highlights the importance of close co-operation between the public and private sectors in order for the economic development potential of the Northern Cape to be realised.

The NCPGDS also highlights the importance of enterprise development, and notes that the current levels of private sector development and investment in the Northern Cape are low. In addition, the province also lags in the key policy priority areas of SMME Development and Black Economic Empowerment. The proposed wind energy facility therefore has the potential to create opportunities to promote private sector investment and the development of SMMEs in the Northern Cape Province.

Care will need to be taken to ensure that the proposed development and other renewable energy facilities do not negatively impact on the region's natural environment. The NCPGDS notes that the sustainable utilisation of the natural resource base on which agriculture depends is critical in the Northern Cape with its fragile eco-systems and vulnerability to climatic variation. The document also indicates that due to the province's exceptional natural and cultural attributes, it has the potential to become the preferred adventure and ecotourism destination in South Africa. The development of large renewable energy projects, such as the proposed WEF, should not affect the tourism potential of the province. Noupoort is not known as a tourist town and impacts to local tourism are anticipated to be of low negative significance.

5.7.10 Northern Cape Provincial Spatial Development Framework

The Northern Cape Provincial Spatial Development Framework (NCSDF) (2012) lists a number of sectoral strategies and plans that are to be read and treated as key components of the PSDF. Of these there are a number that are relevant to this proposed development. These include:

- *Sectoral Strategy 1: Provincial Growth and Development Strategy of the Provincial Government;*
- *Sectoral Strategy 2: Comprehensive Growth and Development Programme of the Department of Agriculture, Land Reform and Rural Development;*

- *Sectoral Strategy 5: Local Economic Development (LED) Strategy of the Department of Economic Development and Tourism;*
- *Sectoral Strategy 11: Small Micro Medium Enterprises (SMME) Development Strategy of the Department of Economic Development and Tourism;*
- *Sectoral Strategy 12: Tourism Strategy of the Department of Economic Development and Tourism; and*
- *Sectoral Strategy 19: Provincial renewable energy strategy (to be facilitated by the Department of Economic Development and Tourism).*

Section C8.2.3, Energy Objectives, sets out the energy objectives for the Northern Cape Province. The section makes specific reference to renewable energy. The objectives are listed below:

- *Promote the development of renewable energy supply schemes. Large-scale renewable energy supply schemes are strategically important for increasing the diversity of domestic energy supplies and avoiding energy imports while minimizing detrimental environmental impacts;*
- *Enhance the efficiency of Eskom's power station at the Vanderkloof Power Station;*
- *In order to reinforce the existing transmission network and to ensure a reliable electricity supply in the Northern Cape, construct a 400 kV transmission power line from Ferrum Substation (near Kathu/Sishen) to Garona Substation (near Groblershoop). There is a national electricity supply shortage and the country is now in a position where it needs to commission additional plants urgently. Consequently, renewable energy projects are a high priority;*
- *Develop and institute innovative new energy technologies to improve access to reliable, sustainable and affordable energy services with the objective to realize sustainable economic growth and development. The goals of securing supply, providing energy services, tackling climate change, avoiding air pollution and reaching sustainable development in the province offer both opportunities and synergies which require joint planning between local and provincial government as well as the private sector; and*
- *Develop and institute energy supply schemes with the aim to contribute to the achievement of the targets set by the White Paper on Renewable Energy (2003). This target relates to the delivery of 10 000 GWh of energy from renewable energy sources (mainly biomass, wind, solar, and small-scale hydro) by 2013.*

Section C8.3.3, Energy Policy, sets out the policy guidelines for the development of the energy sector, with specific reference to the renewable energy sector.

Renewable energy sources such as wind, solar thermal, biomass and domestic hydroelectricity are to constitute 25% of the province's energy generation capacity by 2020;

The following key policy principles for renewable energy apply:

- *Full cost accounting: Pricing policies will be based on an assessment of the full economic, social and environmental costs and benefits of energy production and utilisation;*
- *Equity: There should be equitable access to basic services to meet human needs and ensure human well-being. Each generation has a duty to avoid impairing the ability of future generations to ensure their own well-being;*
- *Global and international cooperation and responsibilities: Government recognises its shared responsibility for global and regional issues and act with due regard to the principles contained in relevant policies and applicable regional and international agreements;*

- *Allocation of functions: Government will allocate functions within the framework of the Constitution to competent institutions and spheres of government that can most effectively achieve the objectives of the energy policy;*
- *The implementation of sustainable renewable energy is to be promoted through appropriate financial and fiscal instruments;*
- *An effective legislative system to promote the implementation of renewable energy is to be developed, implemented, and continuously improved;*
- *Public awareness of the benefits and opportunities of renewable energy must be promoted;*
- *The development of renewable energy systems is to be harnessed as a mechanism for economic development throughout the province in accordance with the Sustainable Development Initiative (SDI) approach (refer to Toolkit D10) or any comparable approach; and*
- *Renewable energy must, first, and foremost, be used to address the needs of the province before being exported.*

5.7.11 Northern Cape Provincial Climate Change Response Strategy (PCCRS)

The key aspects of the PCCRS Report are summarised in the MEC's (NCPG: Environment and Nature Conservation) 2011 budget speech: "*The Provincial Climate Change Response Strategy will be underpinned by specific critical sector climate change adaptation and mitigation strategies that include the Water, Agriculture and Human Health sectors as the three key Adaptation Sectors, the Industry and Transport alongside the Energy sector as the three key Mitigation Sectors with the Disaster Management, Natural Resources and Human Society, livelihoods and Services sectors as three remaining key sectors to ensure proactive long term responses to the frequency and intensity of extreme weather events such as flooding and wild fire, with heightened requirements for effective disaster management*".

Key points from the MEC's address include the NCPG's commitment to develop and implement policy in accord with the National Green Paper for the National Climate Change Response Strategy (2010), and an acknowledgement of the NCP's extreme vulnerability to climate-change driven desertification. The development and promotion of a provincial green economy, including green jobs, and environmental learnership is indented as an important provincial intervention in addressing climate change. The renewable energy sector, including solar and wind energy (but also biofuels and energy from waste), is explicitly indicated as an important element of the Provincial Climate Change Response Strategy. The MEC also indicated that the Northern Cape Province was involved in the processing a number of WEF and Solar Energy Facility EIA applications.

5.7.12 Eastern Cape Vision 2030 Provincial Development Plan (2014)

Vision is "in 2030 we will see the fruits of careful and collective hard work towards this commitment in":

- An Eastern Cape with a proliferation of innovation and industry, and citizens who can feed themselves
- All children and youth manifesting our shared belief that they are the cornerstone of the future
- Participatory local development action driven by committed, capable citizens and conscientious institutional agents

The plan notes that given the spatial imbalance in the province and the persistent underdevelopment of its rural regions where the majority of citizens live, the provinces long-term plan prioritises rural development as key to sustainable development. The PDP seeks to achieve a flourishing and thriving province by strengthening positive interactions between human, economic and institutional development:

- Economic development contributes to human development through increased household incomes and greater fiscal resources for public services;
- Economic development contributes to institutional development through increased fiscal resources for public institutions, parastatals, non-government organisations, private-sector partners and service providers to development programmes and projects;
- Human development is a prerequisite for institutional development by providing well-educated and ethical institutional leadership and employees;
- Human development contributes to economic development through a well-educated, creative, healthy and productive workforce;
- Institutional development and the creation of a capable and developmental state are crucial for driving rapid and equitable economic development;
- Institutional development contributes to human development through better use of public resources, for example, better health and education.

The PDP is based on a principled approach. The following key principles and assumptions underpin the PDP's implementation:

- Understanding of context;
- Social justice;
- Spatial equity and justice;
- Intergenerational equity;
- People-centred development;
- Keeping the public good public;
- Distributed agency and shared agenda-setting;
- Integrated coordination and efficiencies.

The PDP lists five key goals, namely:

Goal 1: A growing, inclusive and equitable economy

The objectives and strategic actions for achieving goal 1 are:

- Improved economic infrastructure that promotes new economic activity across all regions of the Eastern Cape. Of relevance the PDP identifies positioning the Eastern Cape as a key investment hub in the energy sector and ensuring reliable energy supplies to high potential sectors
- Accelerated economic development of rural areas and all regions;
- Stronger industry and enterprise support. The PDP notes that this will be achieved by encouraging and creating partnerships to drive economic development, supporting enterprise development, R&D and innovation;
- An accelerated and completed land-reform process;
- Rapid development of high-potential economic sectors. Of relevance to the study, the high-level sector strategies in include mining and energy and tourism:

Renewable energy is specifically discussed in the context of the first objective (Improved economic infrastructure that promotes new economic activity). In this regard, 'Positioning the province as a key investment hub in the energy sector and ensuring reliable energy supply to high-potential sectors' is identified as one of seven key strategic actions for meeting this objective.

The PDP notes that by positioning the province as an energy investment hub, opportunities would be created to develop the capital goods sector and heavy industries. This new investment could become a major catalyst for provincial economic development, particularly if the benefits and costs are well managed. Regional and local benefits accruing from new investment in the energy sector could include:

- Cheaper energy (fuel and electricity), leading to cheaper food and transport, and more competitive labour markets;
- Employment in the construction, operation and maintenance of new energy facilities;
- Employment in the supply of manufactured components for the new energy facilities;
- Downstream linkages; and
- New rental collection systems to capture a portion of the surplus from these new investments.

The PDP notes that approved wind energy projects already account for 63 percent of the average provincial energy demand (1 700 MW). However, at present there are serious institutional hindrances to wind-farm developments (a reported 35 permits are required), particularly in the former homelands where there are land-tenure issues. Pre-authorisation arrangements in "renewable energy zones" (to be located in Cacadu and Chris Hani districts) would allow this industry to expand to its full potential (5000 MW).

Goal 2: An educated, empowered and innovative citizenry

The objectives and strategic actions for achieving goal 2 are:

- Access to quality early childhood development opportunities;
- Quality basic education;
- Teacher development;
- Improved leadership, management and governance;
- Infrastructure;
- Quality and relevant post-schooling with expanded access.

Goal 3: A healthy population

The objectives and strategic actions for achieving goal 3 are:

- Health system stability through primary healthcare re-engineering;
- Leadership and social partnering;
- Social determinants of health and disease.

Goal 4: Vibrant, equitably enabled communities

The objectives and strategic actions for achieving goal 4 are:

- Spatial planning and land-use management;
- Integrated, quality human settlements;
- Universal access to social infrastructure. To achieve universal access to water and sanitation, the province will upgrade and rehabilitate existing, and develop new, bulk-water supply and waste-water infrastructure; manage, monitor, protect and use water resources; review institutional arrangements for water resource management and water services management; and expand water services and sanitation to cover under-serviced rural areas and informal settlements. The province will review and resource the integrated public transport plan to ensure an improved public transport network;
- Promote safer communities.

Goal 5: Capable, conscientious and accountable institutions

The PDP reflects on the nine key challenges identified in the NDP with reference to the status quo in the Eastern Cape, namely:

High levels of unemployment: Unemployment statistics for the Eastern Cape – at 27.8 % (narrow rate) and 43.5 % (expanded rate including discouraged work-seekers) are higher than the national averages of 24.1 % and 34 % respectively. The situation is worse still in the economically depressed rural regions where the majority of the province's population resides.

Poor standard of education for most black learners: The Eastern Cape has fared worse than other provinces, despite its early history of educational leadership. Over the period 2000 to 2011, about 22 % of learners who entered Grade 1 progressed to Grade 12 within the 12-year period, with only 14 % successfully completing the National Senior Certificate examination.

Poorly located and maintained infrastructure that is insufficient to foster higher growth and spatial transformation: Despite efforts to address backlogs, infrastructure needs remain high, especially in rural regions, the road network is severely stressed and deteriorating, there is inadequate bulk infrastructure for services due to persistent underinvestment and poor maintenance and energy transmission and distribution networks are under-maintained and undercapitalised.

Spatial patterns exclude the poor from development. The province's two metropolitan areas together account for 65.5 % of gross value added (GVA) to the provincial economy (42.5 % in Nelson Mandela Bay Municipality and 23.0 % in Buffalo City Municipality). In addition, development patterns still reflect the inherited structure of the colonial, apartheid and Bantustan economies. In this regard, the freehold white-owned farms in the western part of the province still make up the bulk of the province's agricultural output.

The economy is overly and unsustainably resource intensive. The province has the smallest primary sector in the country, a relatively small agricultural sector, and the largest tertiary services sector of all the provinces. The contribution of government services to the provincial economy is significantly higher than the national average.

The widespread disease burden is compounded by a failing public health system: The low life expectancy and high infant and maternal mortality rates in the province are clear indications of a dysfunctional health system, as well as a symptom of poverty and other adverse socioeconomic conditions. The rural nature of the Eastern Cape, with dispersed settlements, poor infrastructure and inaccessibility in some areas, also contributes to the complexities of providing healthcare services.

Public services are uneven and often of poor quality. The province's civil service is unprofessional and underperforms across all spheres. It is characterised by poor administration, a poor work ethic and weak consequence management.

Corruption is widespread. Corruption in the public service continues, including fruitless and wasteful expenditure and unaccounted-for funds. Systemic corruption in the private sector is also a key concern.

The province, like much of South Africa, remains a divided society. The slow pace of land reform and other forms of redress, and the stresses of continued exclusion from the economy still pose significant hurdles to social stability and cohesion.

The PDP identifies a number of opportunities including:

- Rich and diverse natural resources, including renewable energy and agriculture potential;
- Rich cultural history;
- Well established education systems and history. In this regard the Eastern Cape is also home to four universities and a number of further education and training (FET) colleges (which in future will be known as technical vocational education and training [TVET] colleges).

The PDP notes that the Chris Hani District has significant agricultural potential, with good water resources and some irrigation infrastructure. This presents the province with an opportunity to develop a large agro-industrial hub and significantly re-order spatial patterns of economic activity and growth by promoting value-adding agro-processing industry, related industries and services, and develop new settlements of a technical and professional employees in this region. The PDP further notes that the CHDM is also establishing itself as a model district by piloting new forms of collective enterprise – mainly cooperatives to help grow poor black citizens' participation in the economy. Cradock is identified a growth node for agriculture and the emerging biofuel industry in the province, with its proximity to the port city of Nelson Mandela Metro giving it a distinct advantage.

5.7.13 Eastern Cape Climate Change Response Strategy (2011)

In keeping with national policy initiatives, the Eastern Cape Climate Change Response Strategy (ECCCRS) was developed by Provincial Government from 2010-2011. The ECCCRS gives expression to the realization that the Eastern Cape is contributing to climate change, while at the same time being vulnerable to its effects. The ECCCRS is intended to facilitate planned and coordinated policy approaches to both climate change mitigation and adaptation.

The ECCCRS was developed in four phases, each resulting in a stand-alone report which compliments those of the other three phases. The relevant Phases/ Reports are:

- Phase I: Climate Change Scenario. This report focused on an understanding of the issues and context of climate change in the Province;
- Phase II: Provincial Needs and Technology Assessment. This report investigated technical options for climate change mitigation most appropriate to the Province's identified circumstances and needs;
- Phase III: Guideline Document on Sectoral Climate Change Action Plans. This report identified and developed cross-sectoral priority response programmes aimed at adaptation as well as mitigation responses; and
- Phase IV: Climate Communications, Education and Public Awareness Strategy. This report focused on disseminating the key information contained in the other reports to all relevant stakeholders.

Each of the four Phases are briefly discussed below.

Phase 1: Climate Change Scenarios and Impacts

The ECCCRS notes that manifestations of climate change are likely to include:

- Higher temperatures;
- Altered rainfall patterns;
- More frequent or intense extreme weather events including heat-waves, droughts, storms and floods; and
- Rising sea levels (which, associated with more intense storm surges and floods, may result in local inundation and coastal erosion).

The Eastern Cape is expected to experience the highest temperature increases towards the northwest interior (i.e. the Middelburg study area), while lowest increases are likely along the coast. Associated with the higher temperature will be increases in evaporation rates and increased intensity of droughts.

With regard to rainfall, it is anticipated that the Province will have generally stable or slightly higher rainfall than present, but with increasing intensity. Increased precipitation is more likely in the eastern parts of the Province.

The Strategy notes that the effects of climate change may have significant knock-on effects which could combine to threaten the environmental, economic and social systems of the province.

More hot days and heat waves would result in increased evaporation of water resources and in increased wildfire frequency. This would have significant negative impacts on the Province's commercial -, subsistence agriculture and forestry sectors, while also posing a risk to human and livestock health. With regard to human health, the elderly and infirm are the most vulnerable.

Increased storm severity/ Extreme weather events would result in increased risks of flooding and storm damage. Longer dry spells and increased likelihood/ severity of droughts pose an increased risk to primary production and subsistence farming, and thus to food security and sustainable human settlements.

The ECCCRS notes that all these manifestations of climate change would all have profound implications for the Province's social and economic development plans and programmes. The assessment outlines the relevance of climate change to these plans and programmes, including:

- Initiatives and programmes reflected in provincial plans and programmes need to take into consideration risks and impacts and limitations imposed by climate change, such as increased temperatures; changes in precipitation levels; increased storm events; tidal surges and sea-level rise; and consider adaptation measures.
- Infrastructure development needs to take into account the impact of changing variables such as higher return periods for flooding and droughts, more extreme weather events, and sea level rise. Infrastructure development should pay close attention to geographic areas at highest risk such as flood–prone areas and areas close to sea-level;
- Development plans and programmes need to take into consideration the growing need for climate change mitigation and clean energy projects as development direction and economic opportunity. Such a development direction is underscored by the growing green economy; and
- Development plans and programmes need to consider co-funding opportunities through mechanisms such as trading of Carbon Credits and Climate Change Adaptation Funds.

The ECCCRS emphasizes that the successful outcomes of development plans and programmes, particularly in regard to poverty alleviation and food security, will increase the resilience of vulnerable communities to climate change.

A preliminary Greenhouse Gas Inventory for the Eastern Cape was undertaken as part of the ECCCRS. Four categories of emission sources were considered, namely Energy; Industrial Processes and Product Use; Solid Waste Management; and Agriculture, Forestry and other Land Use. The results of the preliminary provincial inventory indicated that the energy sector (electricity and fuels) was the key source of emissions, accounting for 67% of the ECP's greenhouse gas emissions.

Phase 2: Technology Assessment

The ECCCRS notes that opportunities for mitigation of climate change impacts by means of technical interventions and programmes are generally well understood and are described in the international literature. An analysis of the literature indicates that - apart from some contributions from forestation, livestock and soils - the predominant opportunities for mitigation are in the energy sector.

The highest priority opportunities are in terms of energy efficiency – both on the demand and the supply side. This would entail no-cost or relatively low-cost interventions which realise savings in resource consumption, and also hence costs, and which have attractive paybacks or returns on investment. The ECCCRS notes that according to the IEA's World Energy Outlook, energy efficiency has the potential to account for two-thirds of abatement targets set for 2020. Increased use of renewable energy would contribute approximately a fifth.

With regard to the ECP context, the ECCCRS assessed the most important and promising technologies and the appropriateness of technology opportunities in terms of the maturity of the technology; opportunities for cooperation with other organizations; and options for promotion within ECP Policies and Sector Plans.

Based on the assessment, priority technologies for an ECP mitigation response were identified. These represent technologies where the most significant gains in mitigation can be achieved for the time, effort and finances invested. Ten such technologies were identified, namely:

- Energy efficiency in buildings and appliances;
- Heat pump technologies;
- Solar space and water heating;
- Energy efficiency in transport;
- Industrial energy efficiency;
- Smart grids and metering systems;
- Biomass energy systems;
- Wind energy systems;
- Hydro energy systems; and
- Solar PV systems,

With regard to **wind energy**, the ECCCRS notes that applications would include utility-scale WEFs, as well as small-scale mini-grid and stand-alone systems. Wind energy has the benefit of quicker development turnaround times relative to many other of the identified technologies. The Strategy further notes that the Province has some of the most suitable wind regimes in South Africa for the development of utility-scale WEFs. Within the ECP, the northern (including the Middelburg study area) and south-western portions have the highest average annual wind speeds (Plate 5.2)

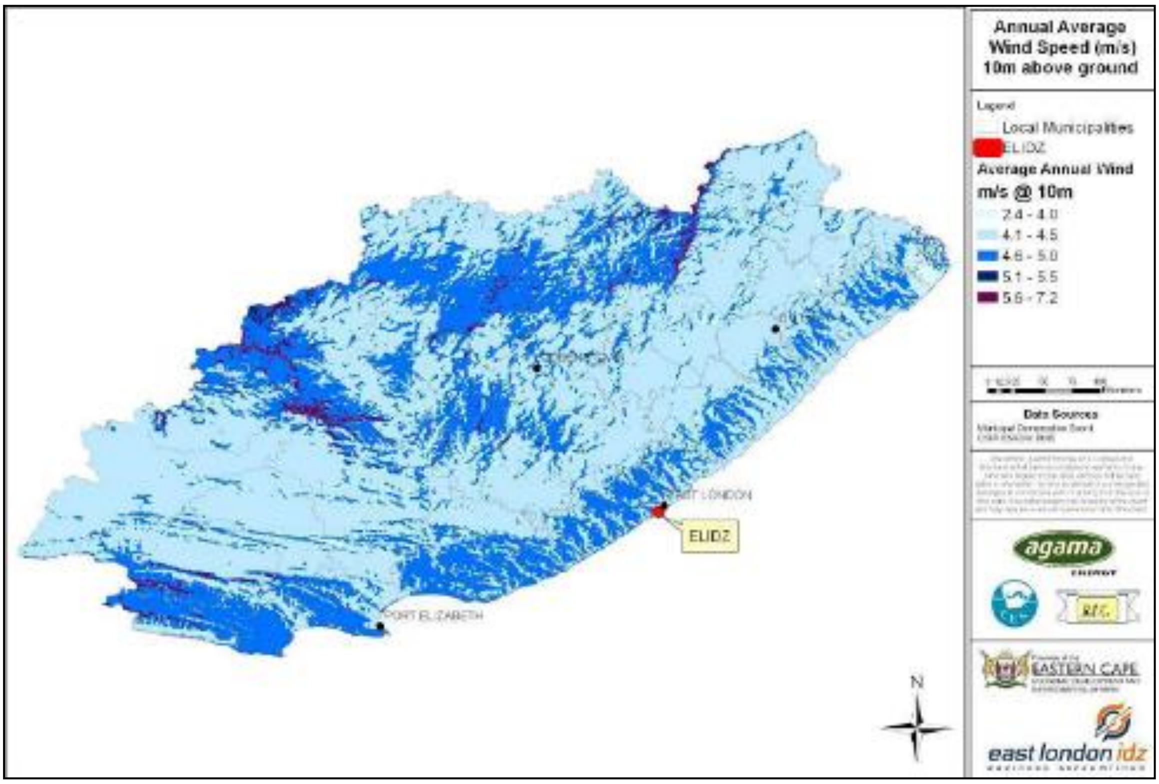


Plate 5.2: Average Annual wind speed (Source: ECCCRS, Phase 2 Report, p. 14)

The ECCCRS notes that although climate change has many negative social and economic implications, the necessary adjustment of global modes of production to a more sustainable, low carbon economy is likely to result in many opportunities for the generation of "green" jobs. Renewable energy technologies typically result in more jobs per unit energy generated than conventional technologies such as coal, gas and nuclear.

Policies and measures that can be introduced by the Eastern Cape Provincial Government to promote technical options for mitigation include requirements for market creation and development, Research and Development efforts, investments in new technologies, standard setting and the development of an enabling regulatory environment.

Phase 3: Sectoral Climate Change Action Plans

As indicated, Phase 3 deals with the development of provincial response programmes and plans. These are divided into two main categories, namely ones dealing with adaptation, and ones dealing with mitigation.

Measures and policy objectives identified in terms of Adaptation responses include water resources management; flood and storm prevention; and improved wildfire prevention and suppression.

Measures and policy objectives identified in terms of Mitigation responses are the following:

- Mainstreaming greenhouse gas Mitigation in Provincial and Local Government and in Industry;
- Promotion of Renewable Energy in the EC. Here the key mitigation objective should be to create an enabling environment for investment implementation and use of clean energy in the Eastern Cape;
- Mitigation and opportunities for sustainable livelihoods;
- Mitigation in Solid Waste and Wastewater Treatment; and

- Greenhouse Gas Mitigation in Transport.

Key potential opportunities are mainly associated with Mitigation responses. These include:

- Creating new streams of revenue from greenhouse gases reduction projects;
- Technology transfer and development;
- Access to foreign investment;
- Cost saving from increased energy efficiency and conservation;
- Poverty alleviation through income and employment generation associated with mitigation and development programmes;
- The Clean Development Mechanism (CDM) and the carbon market and involvement in emissions trading (buying or selling carbon credit);
- Opportunities to develop new products, services or technologies;
- Carbon neutral activities or projects to offset emissions from parts of its operations by buying or acquiring carbon credits; and
- Development of strategic partnerships with national and international partners.

Phase 4: Communication, Education and Public Awareness Strategy

The ECCCRS notes that, as climate change is a global problem with wide-ranging impacts, it is essential that the climate change message is communicated successfully to as many different and affected groups as possible.

With regard to the ECP, a targeted approach relevant to the types of audience, together with specific communication approaches, is recommended. Recommended target audiences include:

- Provincial legislature and local government councillors;
- Provincial and local government departments;
- Affected industry and service sectors;
- The general public.

The key message to be communicated to all groups is that "Everyone has a role to play in reducing emissions (mitigation) and everyone will be affected by climate change (adaptation)".

5.7.14 Eastern Cape Provincial Growth and Development Programme (2004-2014)

The Eastern Cape Provincial Growth and Development Programme (PGDP)(2004-2014) sets out the vision and plan for development for the Eastern Cape up until 2014[32]. It highlights, in particular, strategies to fight poverty, promote economic and social development, and create jobs.

The strategy document does not highlight any specific measures to promote the development of renewable energy sources. However, an analysis of energy sources within the province reveals that 23% of the population of the province still rely on paraffin for their energy needs while 25% rely on candles for lighting.

Section 5 of the PGDP identifies six strategic objective areas or programs aimed at addressing the challenges facing the province. The PGDP indicates that the programs have been selected for their potential in leveraging significant resources, creating a large multiplier effect, and providing a foundation for accelerated economic growth. Of specific relevance to the proposed development is the Strategic Infrastructure Programme. This programme indicates that enabling economic and logistics infrastructure – energy, roads, rail, ports, and air transport among others – is a necessary condition for economic growth and development. Specific reference is therefore made to energy infrastructure.

[32] An up-dated PGDP had not been prepared at the time of undertaking this study.

The report notes that development of infrastructure, especially in the former homelands, is a necessary condition to eradicate poverty through:

- The elimination of social backlogs in access roads, schools and clinics and water and sanitation;
- To leverage economic growth through access roads and improving the road, rail and air networks of the Province.

Energy demands and electricity infrastructure rollout forms part of the Strategic Infrastructure Programme of the PGDP. The PGDP states that the, "…economic and logistics infrastructure – energy, roads, rail, ports, and air transport among others – is a necessary condition for economic growth and development."

Infrastructure development, in turn, will have strong growth promotion effects on the agriculture, manufacturing and tourism sectors by improving market access and by "crowding in" private investment. Poverty alleviation should also be promoted through labour-intensive and community based construction methods.

The Strategic Infrastructure Programme also seeks to consolidate and build on this coastal advantage through the provision of world-class infrastructure and logistics capability at the Coega and East London IDZs, and improving connectivity and linkages with major industrial centers such as Johannesburg.

The high-level objectives of the Strategic Infrastructure Programme include consolidating and building upon the strengths of the Province's globally-competitive industrial sector through the development of world-class infrastructure and logistics capability in the East London and Coega IDZs. A reliable energy supply will be critical to achieving these objectives.

5.7.15 Pixley ka Seme District Municipality Integrated Development Plan

The vision for the Pixley ka Seme District Municipality (PKSDM) as set out in the IDP is *"Pixley Ka Seme DM, Pioneers of Development, a Home and Future for All"*. In terms of the mission statement, the PKSDM sets out to achieve the vision in the following ways:

- *Using the integrated development planning process to create a home for all in our towns, settlements and rural areas through rendering efficient and effective, excellent and dedicated services;*
- *Providing political and administrative leadership in the development planning process;*
- *Promoting economic growth that is shared across and within communities;*
- *Assisting local municipalities to provide a sustainable delivery of services to local communities;*
- *Mainstream integrated planning in the operations of our municipalities; and*
- *Ensuring that all development initiatives in the district are aligned to the National Development Plan.*

The IDP lists a number of developmental challenges facing the area including poverty, economic stagnation, unemployment and geographically imbalanced settlement structure. However, the IDP indicates that the most critical challenge facing the district is the reduction of poverty. Other key challenges identified that are relevant to the proposed development include:

- *Lack of diversification of the district economy;*
- *Lack of investment in the region;*
- *Lack of employment opportunities;*
- *Lack of skills;*
- *Lack of entrepreneurship;*
- *Small number of SMME's active in the region;*

- *Underutilization of the regions natural resources and economic opportunities; and*
- *Lack of water for irrigation farming.*

The IDP also lists a number of strengths, weaknesses, opportunities and threats. The following opportunities and threats are relevant to the proposed development.

Opportunities

- *Participation in green economic activities-solar power;*
- *Revitalization of the rail network- cargo hub;*
- *Tourism opportunities – N1, N9, N10 and N12 and Vanderkloof resort; and*
- *Revamped Railway line.*

Threats

- *Diminishing income that inhibits service delivery;*
- *Low levels of graduates in the district;*
- *Impact of HIV/ Aids;*
- *Unemployment;*
- *Poverty;*
- *Climatic conditions e.g. drought;*
- *Alcohol/Drug abuse; and*
- *Teenage pregnancy.*

The Key Performance Areas (KPAs) listed in the IDP relevant to the proposed development includes Key Performance Area 3: Local Economic Development. The promotion of a green economy linked to renewable energy is identified as a key opportunity. The IDP notes that the PKSDM is actively promoting a green economy that seeks to promote economic activities that preserve and enhance environmental quality, while using natural resources more efficiently.

In this regard, the IDP makes specific reference to the Pixley Renewable Energy Hub. The establishment of the hub was initiated at the Pixley ka Seme District 2010 Investment and Renewable Energy Conference. A key objective of the hub is to diversify the economy by attracting foreign direct investments into solar, wind, hydro and Biomass projects. To date a number of renewable energy projects have been awarded in the PKSDM.

Tourism is also identified as a key sector. The potential projects / areas identified include:

- *Adding value and local incomes from game hunting;*
- *Enhanced promotion and site development of the district's Anglo Boer war battlefields; and*
- *Development of water sports facilities at Xhariep Dam.*

The proposed WEF supports a number of development objectives listed in the IDP, including:

- *Promotion of economic development and the creation of sustainable job opportunities;*
- *Poverty reduction;*
- *Development of human and social capital; and*
- *Provision of adequate infrastructure for economic and social development.*

Key interventions would include promoting SMMEs; attracting and retaining investors in the region; development of identified development corridors; value-adding to/ beneficiation of local produce; and the promotion of tourism development. Local Economic Development (LED) Policies/ targets aimed at addressing these challenges include:

- *LED 1: Promote Local Economic Development in the region;*
- *LED 2: Increase SMME promotion;*
- *LED 4: Increased tourism promotion; and*
- *LED 6: Poverty Reduction.*

Through the REIPPPP, the proposed development will be able to assist achieving the above.

5.7.16 Umsobomvu Local Municipality Integrated Development Plan

The vision for the Umsobomvu Municipality as set out in the IDP is "to be the Fastest Economically Developing Municipality in South Africa". The mission statement linked to the vision is "to serve our community by delivering quality services and customer care through dedicated staff for the upliftment of our community socially and economically".

The IDP notes that the ULM's economic activities are largely dominated by agriculture, followed by financial services, trade, hospitality industry, tourism and transport. The main agricultural activities are linked to merino sheep and horses, with irrigation along the Orange River. The status of the municipality's economy reflects the legacy of apartheid through its skewed development among former white areas and townships. Upliftment of the local economy is therefore a key focus area for the Municipality. Of relevance to the proposed development the IDP notes that the local economy is characterised by:

- *High levels of poverty and unemployment, and low levels of education;*
- *A declining economy that is largely based on sheep farming;*
- *An economy that was too dependent on Spoornet in Noupoort, which has since declined because of the withdrawal of Spoornet;*
- *Promising growth in tourism in Colesberg Area;*
- *Rapid population growth in Colesberg because of the migration from other parts of the municipal area, which puts a heavy burden on the infrastructure. This has resulted in housing shortages and increase in number of informal dwellings;*
- *Increase of HIV infections amongst the youth;*
- *Alcohol and substance abuse;*
- *Increase in teenage pregnancies; and*
- *Abuse of social grants.*

The IDP identifies a number of challenges and opportunities facing the UM. The key challenge identified is poverty. Other challenges of relevance to the proposed development include:

- *Ensuring all citizens have access to basic services such as water, sanitation, electricity and housing;*
- *Increasing access to services in education, health and social services;*
- *Stabilizing and decreasing the rate of HIV and AIDS infection and TB;*
- *Economic empowerment;*
- *Shortage of critical skills;*
- *Targeting special groups e.g. women, disabled and youth; and*
- *Sustainable job creation.*

A Strengths, Weakness, Opportunities and Threats (SWOT) analysis was undertaken as part of the IDP review process. The strengths and opportunities of potential relevance to the proposed development include:

- *Tourism potential;*
- *Infrastructure – conducive to development;*
- *Low crime rates;*
- *Existing physical infrastructure.*
- *Good infrastructure;*

- *Industrial and economic potential; and*
- *Tourism development.*

Potential weaknesses and threats include:

- *Lack of capacity to environment service;*
- *Inadequate social and economic conditions;*
- *Scarce skills backlog;*
- *Depopulation of district;*
- *Sustainable Income for Municipality;*
- *Alcohol and drug abuse;*
- *Illiteracy;*
- *Migration to urban centres;*
- *TB and impact of HIV/Aids;*
- *Unemployment;*
- *High levels of poverty;*
- *Disinvestment; and*
- *Lack of training in technology.*

The IDP also identifies a number of opportunities for growth and development, including agriculture and agro-processing, manufacturing and tourism. Though development of renewable energy is not specifically identified as an opportunity. A number of development nodes aimed at stimulating economic growth and attracting investment to the area are listed in the IDP, namely:

- *Colesberg, which is located along the N1 national road that links Gauteng and Western Cape, and the N9 that links the district with Port Elizabeth and the Eastern Cape;*
- *The Orange River, which not only plays an important role in agriculture but also in tourism; and*
- *The Gariep Dam, which is located on the Orange River on the border of the Free State and Eastern Cape Provinces. The dam is one of the main tourist attractions of the region and forms part of the development corridor that runs in a north-south direction and links Bloemfontein, Trompsburg, Gariep Dam and Colesberg with one another along the N1 route.*

In terms of key services the IDP lists a number of key issues. These are listed below:

- *Low population growth in rural areas;*
- *Demand for services, such as education, shelter, recreational facilities;*
- *Limited employment opportunities;*
- *Crime as a result of unemployment;*
- *Shortage of skilled workers; and*
- *High poverty levels, with majority of the households in the municipality living below the Minimum Living Level (MLL) of Poverty Datum Line (PDL).*

The priorities identified in the IDP that are of relevance to the proposed development include:

- *Local economic development (LED), tourism and poverty alleviation;*
- *Social upliftment;*
- *Education and development;*
- *Youth development; and*
- *Sport and recreation.*

At a local ward level, the proposed development is located in Wards 1 and 2, Noupoort. The needs identified in the IDP based on an extensive consultation process that could benefit from the establishment of a Community Trust associated with the proposed WEF include:

- *Building of houses;*
- *Street lights;*
- *Library in KwaZamuxolo; and*
- *Public toilets in Noupoort.*

In terms of social and community facilities, the IDP notes that there is a lack schools especially in the rural areas, which results in many young people having to travel long distances to school. There is also no tertiary institution. School leavers therefore leave the area and seldom return. The health centres in urban areas are poorly equipped and under-staffed and there is a general lack health centres in the rural areas. There is also lack of aftercare facilities and support services for out-patients. In terms of recreational facilities, there is a shortage in the historically disadvantaged communities. The existing recreational facilities in the townships do not have basic services and infrastructure.

5.7.17 Chris Hani District Municipality Climate Change Vulnerability Assessment and Response Plan (2017)

The Chris Hani DM recognises climate change as a threat to the environment, its residents, and to future development. Responding to climate change has therefore been identified as a key issue for the Chris Hani District Municipality. With the aid of Local Government Climate Change Support (LGCCS) program and the German Federal Government, a Climate Change Vulnerability Assessment and Response Plan (CCVARP) was developed for the DM in 2017.

The CCVARP focuses specifically on Adaptation strategies. Mitigation strategies such as renewable energy generation are not addressed in the Plan.

Five key vulnerable sectors were identified for the DM, namely:

- Agriculture;
- Biodiversity and the Environment;
- Human Health;
- Disaster Management, Infrastructure and Human Settlements; and
- Water resources.

Cross-cutting risks were identified for these sectors. Key risks include:

- Increased risk of agricultural pests and diseases;
- Changes in cropping conditions for subsistence staples like sorghum;
- Crops and livestock affected by frequency of droughts and storm events;
- Heat stress (human and animal health);
- Increased isolation of rural communities;
- Increased migration into urban areas;
- Increased risk of wildfires;
- Increased risk of flooding; and
- Water scarcity and impacts on water quality as a result of reduced runoff and increased evaporation

In the Chris Hani District Municipal Area, it is predicted that climate change will increase average temperatures, increase the variability of rainfall, and also exacerbate the risk and frequency of severe weather events such as floods, droughts and damaging storms.

The Plan notes that while the Agricultural sector is a modest contributor to the DM's Gross Value Added (GVA), it is one of the largest providers of employment opportunities. Approximately 44.34% of the DM's households are engaged in agricultural activity. While climate change may result in higher rainfall favourable to the DM's agricultural sector, it is also predicted to increase rainfall variability and decrease water security.

A reduction in biodiversity and/ or the impairment of ecosystem services could have direct negative consequences for the economy and social structures in the DM. These consequences could have a detrimental effect on efforts to reduce poverty, inequity and unemployment in the DM.

Climate change is expected to have a significant negative impacts on socio-economic development as well as the water and sanitation, food security, health, and energy sectors.

Climate change impacts are also likely to impact negatively on human health in the DM, affecting clean air, secure shelter, safe drinking water, and sufficient food. Potential impacts would include more frequent natural disasters, changes in behaviour of vector-borne diseases, decreased food security and nutrition, increased heat stresses, and increased air pollution. Human health and economic factors would also have impacts on sustainable human settlements and communities.

Climate change induced deterioration in the quantity and quality of the fresh water resource would profoundly affect environmental health, agriculture as well as human health and wellbeing.

Nine Desired Adaptation Outcomes have been identified for the Chris Hani DM, namely:

- Robust/integrated plans, policies and actions for effective delivery of climate change adaptation, together with monitoring, evaluation and review over the short, medium and longer-term;
- Appropriate resources (including current and past financial investments), capacity and processes (human, legal and regulatory) and support mechanisms (institutional and governance structures) to facilitate climate change adaptation;
- Accurate climate information (e.g. historical trend data, seasonal predictions, future projections, and early warning of extreme weather and other climate-related events) provided by existing and new monitoring and forecasting facilities/networks (including their maintenance and enhancement) to inform adaptation planning and disaster risk reduction;
- Capacity development, education and awareness programmes (formal and informal) for climate change adaptation (e.g. informed by adaptation research and with tools to utilise data/outputs);
- New and adapted technologies/knowledge and other cost-effective measures (e.g. nature-based solutions) used in climate change adaptation;
- Climate change risks, impacts and vulnerabilities identified and addressed;
- Systems, infrastructure, communities and sectors less vulnerable to climate change impacts (e.g. through effectiveness of adaptation interventions/response measures);
- Non-climate pressures and threats to human and natural systems reduced (particularly where these compound climate change impacts); and
- Secure food, water and energy supplies for all citizens (within the context of sustainable development).

As indicated, the Plan only addresses Adaptation measures, and therefore does not address renewable energy. The DM is however currently in the process of drafting a Climate Change Adaptation and Mitigation Strategy. This Strategy would also address renewable energy generation.

5.7.18 Inxuba Yethemba Local Municipality IDP

The vision for the Inxuba Yethemba LM (IYLM) as set out in its most recent (2014/ 2015) IDP is "A Coherent Developmental Municipality putting people first and providing a better life for all its citizens". In terms of the mission statement, the IYLM sets out to achieve this vision by:

- Promoting social and economic development;
- Ensuring effective community participation;
- Providing and maintaining affordable services; and
- Effectively and efficiently utilising all available resources.

Key municipal needs

Key basic infrastructure and services needs affecting the whole IYLM, as identified in the IDP, include the following:

- Roads and Storm water;
- Bulk water supply and infrastructure rehabilitation;
- Rehabilitation of bulk sewer pumps and sewer stations;
- Land for housing; and
- Waste management facilities.

Key social infrastructure needs affecting the whole IYLM include the following:

- More mobile health care facilities;
- An HIV/ Aids programme;
- Disaster management centre and associated equipment;
- Increased safety and security; and
- Increased traffic control enforcement.

Key economic developmental needs affecting the whole IYLM include the following:

- Employment creation;
- Support for emerging farmers;
- Support to existing projects and Community Based Enterprises;
- Support to cooperatives and SMME's;
- Tourism Development and Transformation;
- Development and Growing the Local Economy; and
- Land for land redistribution.

Key development strategies

The IYLM's development strategies are informed by the Local Government 5 year strategic agenda, and its turnaround strategy which involves:

- Service delivery and basic infrastructure;
- Local economic development;
- Financial Viability;
- Institutional Development and Municipal transformation; and
- Good governance and Public Participation.

Social needs strategies

Based on the needs analysis above, Council's key developmental objectives/ strategies include:

- Providing 5 000 low and medium cost serviced housing opportunities by 2020;
- Ensuring that all communities receive an uninterrupted power supply;
- Providing a safe and secure environment, amongst others by close co-operation between Council and the SAPS, and by petitioning the SAPS for more satellite stations;
- Facilitating the process of providing adequate educational facilities, in particular for pre-school and crèches, amongst others by lobbying with the Departments of Public

Works and Social Development, as well as donor agents for the funding of structures; and

- Reducing the HIV infection rate and its impact on individuals, families and the community, by amongst others improving access to facilities for sufferers, increasing community awareness and testing, promoting safe sex and the use of condoms, and ensuring compliance by circumcision officials.

Economic development strategies

The IYLM's key economic development priorities and strategies include:

- Developing the Local Economy by stimulating it and strengthening part partnerships with the business and labour sectors. Key strategies include the promotion of local businesses and local spending; offering incentives for business retention, expansion and attraction; and promoting SMMEs;
- Poverty alleviation and employment creation. Key strategies include encouraging capacity building, development and training; and promoting projects which will create sustainable jobs;
- Growing the local underdeveloped tourism sector. Key strategies include general beautification; increased promotion of the region; and diversification of tourism assets and facilities; and
- Improving agricultural productivity as well as access to land. Key strategies include promoting existing enterprises while facilitating support for emerging farmers.

Sector Plans

The IDP also contains an overview of a number of existing and envisaged municipal sector plans. Of these, the following are of relevance here:

Spatial Development Framework

The IYLM SDF was in the process of revision when the IDP was compiled in 2014, and does not seem to have been finalized yet. Key principles which would underpin the SDF include ones dealing with sustainability, efficiency, integration; densification and land reform. Sustainability principles are of specific relevance to the WEF project, and include:

- Protecting the environmental resources such as vegetation and environmentally sensitive areas, during future development;
- Ensuring that sufficient natural resources such as water and land are available for future expansion;
- Ensuring economical, affordable services; and
- Creating and investor friendly environment.

Local Economic Development Framework

Key objectives identified for the revision of the IYLM's LED Framework include the following:

- Plugging Leaks in Local Economy by promoting local spending;
- Infrastructure Development for SMME development. Building and construction contracts should be labour intensive, thus creating jobs for economic growth;
- Attracting Business to Inxuba Yethemba by means of a business incentive scheme;
- Retention of Existing Business by ensuring flexibility of regulating by-laws to favour local business;
- SMME Development; and
- Maximising the region's tourism potential.

5.7.19 Inxuba Yethemba Local Municipality Draft Spatial Development Framework (2014)

The most recent version of the IYLM Spatial Development Framework (SDF) appears to be a December 2014 revision draft.

The key spatial development principles underpinning the SDF are identified as Sustainability (environmental, social and economic), Efficiency, Urban Integration, Urban Densification, and Land Reform.

The SDF notes that Middleburg is an important urban centre, serving as the centre of urbanization for surrounding rural populations thus putting Council under significant pressure to provide new housing. The majority of the households moving to Middleburg are poor and without adequate income opportunities. Sufficient land for low cost housing is available in Middelburg.

Most of the spatial proposals in the SDF pertain to urban areas, and are not applicable to the study area. Renewable resources are discussed in the context of climate change.

The SDF notes that Council does not currently have any climate change mitigation policies in place. The SDF notes that the IYLM is likely to suffer from higher, but more unpredictable rainfall, increased evaporation, and hotter summers and winters. All of these would significantly impact on existing land use, specifically agriculture. Increased energy efficiency and the support of renewable sources of energy are identified as key mitigation responses.

The SDF notes the suitability of the IYLM for wind and other renewables proposals, and recommends that Council takes the appropriate measures to prepare itself for dealing with specific applications. The SDF notes that physical impacts should be restricted to suitable areas, but does not provide any spatial suitability guidance in this regard.

5.8 Need and Desirability Conclusion

The findings of the review indicated that renewable energy is strongly supported at a national, provincial and local level. The development of and investment in renewable energy is supported by the National Development Plan (NDP), New Growth Path Framework and National Infrastructure Plan, which all make reference to renewable energy. At a provincial level the development of renewable energy is supported by the Northern Cape Provincial Growth and Development Strategy and Northern Cape Provincial Spatial Development Framework, as well as the Eastern Cape Provinccial Development Plan (2014) and the Eastern Cape Climate Change Response Strategy.

However, the provincial and local policy and planning documents also make reference to the importance of tourism and the region's natural resources. Care therefore needs to be taken to ensure that the siting of renewable energy facilities (including wind farms) does not impact negatively on the areas tourism potential[33].

The need for the proposed development is supported in terms of meeting the country's climate change goals, and in terms of reducing the country's dependence on fossil fuels as the main source of meeting the country's electricity requirements. Both national and provincial spheres of government support the development of renewable energy facilities. The need for these types of developments plays a role in meeting energy and climate change targets and also provides an economic boost at the local level in areas that are in need of it.

[33] The findings of the literature review indicate that the impact of wind farms impact on tourism is low to negligible

The proposed development site is currently used for low intensity grazing and has little potential for other types of land use. Grazing could continue on the site during the construction and operation of the development. Therefore the change to a mixed land use of grazing and renewable energy would be an improvement to the areas.

A requirement of the REIPPPP is that in the development of any WEF, the local economy must benefit through employment opportunities, skills development, and the development or enhancement of community infrastructure. *The cumulative effect of the proposed development and other developments in the area has the potential to result in significant positive socio-economic opportunities for the region.*

The establishment of the proposed WEF and the other renewable energy facilities in the ULM and IYLM may place pressure on local services, specifically medical, education and accommodation. This pressure will be associated with the potential influx of workers to the area associated with the construction and operational phases of renewable energy projects proposed in the area, including the proposed WEF. The potential impact on local services can be mitigated by employing local community members. With effective mitigation the impact is rated as **Low Negative.**

In addition, as indicated below, this impact should also be viewed within the context of the potential positive cumulative impacts for the local economy associated with the establishment of renewable energy as an economic driver in the area.

Cumulative impact on local economies

In addition to the potential negative impacts, the establishment of the proposed WEF and other renewable energy projects in the area also has the potential to create a number of socio-economic opportunities for the ULM and IYLM, which, in turn, will result in a positive social benefit. The positive cumulative impacts include creation of employment, skills development and training opportunities, creation of downstream business opportunities. The Community Trusts associated with each project will also create significant socio-economic benefits. This benefit is rated as **High Positive** with enhancement.

6 ASSESSMENT OF ALTERNATIVES

Alternatives are different means of meeting the general purpose and need of a proposed development and may include alternative sites, alternative layouts or designs, alternative technologies and the "no development" or "no go" alternative. This section describes alternatives in relation to the proposed development.

The EIA Regulations indicate that alternatives that are considered in an assessment process should be reasonable and feasible, and that I&APs should be provided with an opportunity to provide inputs into the process of formulating alternatives.

The assessment of alternatives should, as a minimum, include the following:

- *The consideration of the no-development or "no-go option" alternative as a baseline scenario;*
- *A comparison of reasonable and feasible selected alternatives; and*
- *The provision of reasons for the elimination of an alternative.*

A comprehensive alternative assessment was undertaken as part of the scoping phase, in terms of site selection process. Therefore only a summary has been included in this EIA report. The alternative that will be assessed and discussed further include the design / layout of the WEF and the grid connection alternatives.

6.1 The No Development Scenario / "No-Go" Option

This scenario assumes that the proposed development does not proceed. It is equivalent to the future baseline scenario in the absence of the proposed development.

Relative to the proposed development, the implications of this scenario include:

- *The land-use remains agricultural, with no further benefits derived from the implementation of a complementary land use;*
- *There is no change to the current landscape or environmental baseline;*
- *No additional electricity will be generated on-site or supplied through means of renewable energy resources. This would have negative implications for the South African government in achieving its proposed renewable energy target, given the need for increased generation;*
- *There is no opportunity for additional employment (permanent or temporary) in the local area where job creation is identified as a key priority; and*
- *The national and local economic benefits associated with the proposed project's REIPPPP commitments and broader benefits would not be realised.*

The purpose of the proposed development is to generate renewable electricity and export this to the national grid. Other socio-economic and environmental benefits will result from the proposed development such as:

- *Reduced air pollution emissions - burning fossil fuels generates CO_2 emissions which contributes to global warming. Emissions of sulphurous and nitrous oxides are produced which are hazardous to human health and impact on ecosystem stability;*
- *Water resource saving – conventional coal-fired power stations use large quantities of water during their cooling processes. WEFs require limited amounts of water during construction and a minimal amount of water during operation. As a water stressed country, South Africa needs to be conserving such resources wherever possible;*
- *Improved energy security – renewables can be deployed in a decentralised way close to consumers, improving grid strength while reducing expensive transmission and*

distribution losses. Renewable energy projects contribute to a diverse energy portfolio;

- *Exploit significant natural renewable energy resources – biomass, solar and wind resources remain largely unexploited;*
- *Sustainable energy solutions – the uptake of renewable energy technology addresses the country's energy needs, generation of electricity to meet growing demands in a manner which is sustainable for future generations; and*
- *Employment creation and other local economic benefits associated with support for a new industry in the South African economy.*

The 'No Development' alternative would not assist the government in addressing climate change, energy security and economic development. Implementing this option would also not allow for any beneficial socio-economic and environmental impacts as outlined above.

Addressing climate change is one of the benefits associated with the implementation of this proposed development. Climate change is widely considered by environmental professionals as one of the single largest threats to the environment on a local, national and global scale.

Based on the above, the 'No Development' alternative is **not a preferred alternative**.

6.2 Site Selection

Feasibility studies undertaken by InnoWind indicated that the San Kraal site is suitable to develop and operate a wind farm as it satisfies the following criteria:

- Feasibility of access for wind turbine delivery, the site is easily accessible from the national road;
- Proximity to the Eskom grid with available evacuation capacity;
- Viable wind resource;
- The surrounding area is not densely populated and has very limited tourism related activities;
- The proposed site is transformed agricultural land and current land use is gazing;
- Willingness of landowners to host a wind farm on their properties;
- Support received from the Umsobomvu Municipality which is a landowner of the project; and
- Location adjacent to one existing WEF and other approved and consented WEFs (Mainstream Noupoort WEF, operational July 2016) such that the turbine cluster could be viewed as a single cohesive unit.

It was concluded, based on available information, that the San Kraal site is suitable for the construction and operation of wind turbines.

6.3 Site Location Alternatives

Feasibility studies undertaken by InnoWind indicated that the San Kraal site is suitable to develop and operate a wind farm as it satisfies the following criteria:

- *Feasibility of access for wind turbine delivery, the site is easily accessible from the national road;*
- *Proximity to the Eskom grid with available evacuation capacity;*
- *Viable wind resource;*
- *The surrounding area is not densely populated and has very limited tourism related activities;*
- *The proposed site is transformed agricultural land and current land use is gazing;*
- *Willingness of landowners to host a wind farm on their properties;*
- *Support received from the Umsobomvu Municipality which is a landowner of the project; and*

- *Location adjacent to one existing WEF and other approved and consented WEFs (Mainstream Noupoort WEF, operational July 2016) such that the turbine cluster could be viewed as a single cohesive unit.*

It was concluded, based on available information, that the site is suitable for the construction and operation of wind turbines, and **San Kraal preferred site alternative**.

6.4 Design Evolution Alternatives

Following the selection of a suitable site, consideration was given to the design of the WEF and grid connection within that site. It is important that wind turbines are sited in the optimum position to maximise the wind energy yield whilst minimising environmental impacts as far as possible.

Information collated during the scoping phase was used to inform the design of the WEF progressively. Best practice advises that the EIA should be an iterative process rather than a post design environmental appraisal. In this way, the findings of the technical environmental studies have been used to inform the design of a development.

This approach has been adopted with respect to this proposed development, and where potentially significant impacts were identified, efforts were made to avoid these through evolving the design of the proposed development. This will be referred to within this report as mitigation to be embedded in the layout and design, or 'embedded mitigation'.

A preliminary layout was produced showing suggested locations of wind farm turbines on the site, which was assessed and included as part of the scoping phase. This layout has been adjusted, based on the initial scoping assessment and specialists' findings. This adjusted layout, was assessed in further detail during the EIA Phase. All specialists assessed this layout now called as part of the EIA phase, and based on these assessments, turbines have been moved or removed by the applicant, and reassessed by the specialists, this is the preferred Final Mitigated Layout for Authorisation.

There are three proposed alignments for the grid connection, namely 'alternative 1' (south), 'alternative 2' (north) and 'the preferred' (middle). A description of the alternative is expanded further in Section 6.5 below.

The table below indicates the location of the turbines, pre and post EIA assessment and indicates the final preferred locations to be considered for authorisation.

Table 6.1 Turbine Layout Design Evolution[34]

Scoping Phase Layout (78 WTG)			EIA Phase Layout (78 WTG)			Final EIA Phase Mitigated Layout (78 WTG)		
WTG No.	**Coordinates**		**WTG No.**	**Coordinates**		**WTG No.**	**Coordinates**	
WTG28	31° 13' 32.875" S	25° 0' 9.628" E	WTG01	31° 13' 32.875" S	25° 0' 9.628" E	WTG01	31° 13' 32.875" S	25° 0' 9.628" E
WTG27	31° 13' 49.378" S	25° 0' 56.140" E	WTG02	31° 13' 49.378" S	25° 0' 56.140" E	WTG02	31° 13' 49.378" S	25° 0' 56.140" E
WTG26	31° 13' 39.637" S	25° 1' 13.047" E	WTG03	31° 13' 39.637" S	25° 1' 13.047" E	WTG03	31° 13' 39.637" S	25° 1' 13.047" E
WTG69	31° 13' 34.141" S	25° 1' 46.378" E	WTG04	31° 13' 34.141" S	25° 1' 46.378" E	WTG04	31° 13' 34.141" S	25° 1' 46.378" E
WTG25	31° 13' 53.837" S	25° 1' 53.829" E	WTG05	31° 13' 53.837" S	25° 1' 53.829" E	WTG05	31° 13' 53.837" S	25° 1' 53.829" E
WTG29	31° 14' 7.864" S	25° 1' 49.533" E	WTG06	31° 14' 7.864" S	25° 1' 49.533" E	WTG06	31° 14' 7.864" S	25° 1' 49.533" E
WTG33	31° 14' 13.506" S	25° 1' 15.137" E	WTG07	31° 14' 13.506" S	25° 1' 15.137" E	WTG07	31° 14' 13.506" S	25° 1' 15.137" E
WTG31	31° 14' 19.872" S	25° 0' 43.635" E	WTG08	31° 14' 19.872" S	25° 0' 43.635" E	WTG08	31° 14' 19.872" S	25° 0' 43.635" E
WTG30	31° 14' 22.807" S	25° 0' 10.958" E	WTG09	31° 14' 22.807" S	25° 0' 10.958" E	WTG09	31° 14' 22.807" S	25° 0' 10.958" E
WTG38	31° 14' 36.154" S	25° 0' 48.699" E	WTG10	31° 14' 36.154" S	25° 0' 48.699" E	WTG10	31° 14' 36.154" S	25° 0' 48.699" E
WTG34	31° 14' 31.907" S	25° 1' 22.804" E	WTG11	31° 14' 31.907" S	25° 1' 22.804" E	WTG11	31° 14' 31.907" S	25° 1' 22.804" E
WTG63	31° 14' 26.176" S	25° 1' 51.420" E	WTG12	31° 14' 26.176" S	25° 1' 51.420" E	WTG12	31° 14' 26.176" S	25° 1' 51.420" E
WTG36	31° 14' 47.684" S	25° 2' 6.962" E	WTG13	31° 14' 47.684" S	25° 2' 6.962" E	WTG13	31° 14' 47.684" S	25° 2' 6.962" E
WTG43	31° 14' 48.146" S	25° 1' 22.957" E	WTG14	31° 14' 48.146" S	25° 1' 22.957" E	WTG14	31° 14' 48.146" S	25° 1' 22.957" E
WTG35	31° 14' 51.221" S	25° 0' 44.415" E	WTG15	31° 14' 51.221" S	25° 0' 44.415" E	WTG15	31° 14' 51.221" S	25° 0' 44.415" E
WTG44	31° 15' 6.742" S	25° 0' 42.275" E	WTG16	31° 15' 6.742" S	25° 0' 42.275" E	WTG16	31° 15' 6.742" S	25° 0' 42.275" E
WTG42	31° 15' 4.626" S	25° 1' 21.895" E	WTG17	31° 15' 4.626" S	25° 1' 21.895" E	WTG17	31° 15' 4.626" S	25° 1' 21.895" E
WTG19	31° 15' 1.440" S	25° 1' 59.798" E	WTG18	31° 15' 1.440" S	25° 1' 59.798" E	WTG18	31° 15' 1.440" S	25° 1' 59.798" E
WTG20	31° 15' 10.203" S	25° 2' 24.942" E	WTG19	31° 15' 10.203" S	25° 2' 24.942" E	WTG19	31° 15' 10.203" S	25° 2' 24.942" E
WTG39	31° 15' 20.231" S	25° 2' 5.418" E	WTG20	31° 15' 20.231" S	25° 2' 5.418" E	WTG20	31° 15' 20.231" S	25° 2' 5.418" E

[34] Coordinates in red text italics indicate turbines that have been relocated in response to the findings of the EIA studies.

Scoping Phase Layout (78 WTG)			EIA Phase Layout (78 WTG)			Final EIA Phase Mitigated Layout (78 WTG)		
WTG45	31° 15' 20.207" S	25° 1' 19.378" E	WTG21	31° 15' 20.207" S	25° 1' 19.378" E	WTG21	31° 15' 20.207" S	25° 1' 19.378" E
WTG47	31° 15' 32.390" S	25° 1' 7.102" E	WTG22	31° 15' 32.390" S	25° 1' 7.102" E	WTG22	31° 15' 32.390" S	25° 1' 7.102" E
WTG50	31° 15' 44.030" S	25° 0' 55.405" E	WTG23	31° 15' 44.030" S	25° 0' 55.405" E	WTG23	31° 15' 44.030" S	25° 0' 55.405" E
WTG52	31° 15' 52.623" S	25° 0' 33.639" E	WTG24	31° 15' 52.623" S	25° 0' 33.639" E	WTG24	31° 15' 52.623" S	25° 0' 33.639" E
WTG74	31° 16' 11.925" S	25° 0' 42.836" E	WTG27	31° 16' 11.925" S	25° 0' 42.836" E	WTG27	31° 16' 11.925" S	25° 0' 42.836" E
WTG73	31° 16' 20.821" S	25° 1' 3.784" E	WTG28	31° 16' 20.821" S	25° 1' 3.784" E	WTG28	31° 16' 20.821" S	25° 1' 3.784" E
WTG53	31° 16' 4.533" S	25° 1' 6.733" E	WTG29	31° 16' 4.533" S	25° 1' 6.733" E	WTG29	31° 16' 4.533" S	25° 1' 6.733" E
WTG64	31° 15' 51.080" S	25° 1' 14.613" E	WTG30	31° 15' 51.080" S	25° 1' 14.613" E	WTG30	31° 15' 51.080" S	25° 1' 14.613" E
WTG49	31° 15' 43.424" S	25° 1' 38.324" E	WTG31	31° 15' 43.424" S	25° 1' 38.324" E	WTG31	31° 15' 43.424" S	25° 1' 38.324" E
WTG55	31° 16' 2.112" S	25° 1' 45.685" E	WTG32	31° 16' 2.112" S	25° 1' 45.685" E	WTG32	31° 16' 2.112" S	25° 1' 45.685" E
WTG56	31° 16' 19.513" S	25° 1' 47.478" E	WTG33	31° 16' 19.513" S	25° 1' 47.478" E	WTG33	31° 16' 19.513" S	25° 1' 47.478" E
WTG75	31° 16' 35.814" S	25° 1' 58.066" E	WTG34	31° 16' 35.814" S	25° 1' 58.066" E	WTG34	31° 16' 35.814" S	25° 1' 58.066" E
WTG76	31° 16' 50.463" S	25° 2' 19.503" E	WTG35	31° 16' 50.463" S	25° 2' 19.503" E	WTG35	31° 16' 50.463" S	25° 2' 19.503" E
WTG60	31° 17' 18.083" S	25° 2' 54.817" E	*WTG36*	*31° 17' 18.083" S*	*25° 2' 54.817" E*	*WTG36*	*31° 17' 18.633" S*	*25° 2' 52.258" E*
WTG59	31° 16' 58.734" S	25° 2' 46.556" E	*WTG37*	*31° 16' 58.734" S*	*25° 2' 46.556" E*	*WTG37*	*31° 16' 59.939" S*	*25° 2' 43.239" E*
WTG57	31° 16' 32.509" S	25° 2' 23.996" E	WTG38	31° 16' 32.509" S	25° 2' 23.996" E	WTG38	31° 16' 32.509" S	25° 2' 23.996" E
WTG58	31° 16' 17.601" S	25° 2' 28.123" E	WTG39	31° 16' 17.601" S	25° 2' 28.123" E	WTG39	31° 16' 17.601" S	25° 2' 28.123" E
WTG54	31° 16' 4.384" S	25° 2' 34.445" E	WTG40	31° 16' 4.384" S	25° 2' 34.445" E	WTG40	31° 16' 4.384" S	25° 2' 34.445" E
WTG51	31° 15' 54.739" S	25° 2' 8.937" E	WTG41	31° 15' 54.739" S	25° 2' 8.937" E	WTG41	31° 15' 54.739" S	25° 2' 8.937" E
WTG46	31° 15' 35.404" S	25° 2' 1.701" E	WTG42	31° 15' 35.404" S	25° 2' 1.701" E	WTG42	31° 15' 35.404" S	25° 2' 1.701" E
WTG40	31° 15' 48.035" S	25° 2' 37.769" E	WTG43	31° 15' 48.035" S	25° 2' 37.769" E	WTG43	31° 15' 48.035" S	25° 2' 37.769" E
WTG48	31° 15' 31.466" S	25° 2' 37.241" E	WTG44	31° 15' 31.466" S	25° 2' 37.241" E	WTG44	31° 15' 31.466" S	25° 2' 37.241" E
WTG17	31° 15' 43.036" S	25° 3' 9.967" E	WTG45	31° 15' 43.036" S	25° 3' 9.967" E	WTG45	31° 15' 43.036" S	25° 3' 9.967" E
WTG41	31° 16' 5.327" S	25° 3' 25.879" E	WTG46	31° 16' 5.327" S	25° 3' 25.879" E	WTG46	31° 16' 5.327" S	25° 3' 25.879" E
WTG18	31° 15' 55.237" S	25° 3' 43.741" E	WTG47	31° 15' 55.237" S	25° 3' 43.741" E	WTG47	31° 15' 55.237" S	25° 3' 43.741" E

Scoping Phase Layout (78 WTG)			EIA Phase Layout (78 WTG)			Final EIA Phase Mitigated Layout (78 WTG)		
WTG15	31° 15' 39.443" S	25° 3' 47.239" E	WTG48	31° 15' 39.443" S	25° 3' 47.239" E	WTG48	31° 15' 39.443" S	25° 3' 47.239" E
WTG16	31° 15' 30.756" S	25° 3' 22.467" E	WTG49	31° 15' 30.756" S	25° 3' 22.467" E	WTG49	31° 15' 30.756" S	25° 3' 22.467" E
WTG37	31° 15' 3.191" S	25° 2' 50.714" E	WTG50	31° 15' 3.191" S	25° 2' 50.714" E	WTG50	31° 15' 3.191" S	25° 2' 50.714" E
WTG21	31° 14' 41.938" S	25° 2' 36.864" E	WTG51	31° 14' 41.938" S	25° 2' 36.864" E	WTG51	31° 14' 41.938" S	25° 2' 36.864" E
WTG32	31° 14' 25.483" S	25° 2' 28.965" E	WTG52	31° 14' 25.483" S	25° 2' 28.965" E	WTG52	31° 14' 25.483" S	25° 2' 28.965" E
WTG03	31° 14' 6.082" S	25° 2' 28.004" E	WTG53	31° 14' 6.082" S	25° 2' 28.004" E	WTG53	31° 14' 6.082" S	25° 2' 28.004" E
WTG70	31° 13' 45.995" S	25° 2' 20.407" E	WTG54	31° 13' 45.995" S	25° 2' 20.407" E	WTG54	31° 13' 45.995" S	25° 2' 20.407" E
WTG65	31° 13' 30.068" S	25° 2' 23.684" E	WTG55	31° 13' 30.068" S	25° 2' 23.684" E	WTG55	31° 13' 30.068" S	25° 2' 23.684" E
WTG10	31° 13' 17.503" S	25° 2' 32.408" E	WTG56	31° 13' 17.503" S	25° 2' 32.408" E	WTG56	31° 13' 17.503" S	25° 2' 32.408" E
WTG06	31° 13' 4.580" S	25° 2' 43.178" E	WTG57	31° 13' 4.580" S	25° 2' 43.178" E	WTG57	31° 13' 4.580" S	25° 2' 43.178" E
WTG24	31° 12' 58.673" S	25° 1' 39.595" E	WTG58	31° 12' 58.673" S	25° 1' 39.595" E	WTG58	31° 12' 58.673" S	25° 1' 39.595" E
WTG14	31° 12' 41.480" S	25° 1' 25.934" E	WTG59	31° 12' 41.480" S	25° 1' 25.934" E	WTG59	31° 12' 41.480" S	25° 1' 25.934" E
WTG23	31° 12' 50.202" S	25° 2' 1.043" E	WTG60	31° 12' 50.202" S	25° 2' 1.043" E	WTG60	31° 12' 50.202" S	25° 2' 1.043" E
WTG62	31° 12' 39.635" S	25° 2' 19.360" E	WTG61	31° 12' 39.635" S	25° 2' 19.360" E	WTG61	31° 12' 39.635" S	25° 2' 19.360" E
WTG12	31° 12' 32.988" S	25° 2' 43.451" E	WTG62	31° 12' 32.988" S	25° 2' 43.451" E	WTG62	31° 12' 32.988" S	25° 2' 43.451" E
WTG11	31° 12' 52.246" S	25° 2' 56.392" E	WTG63	31° 12' 52.246" S	25° 2' 56.392" E	WTG63	31° 12' 52.246" S	25° 2' 56.392" E
WTG07	31° 13' 16.343" S	25° 3' 17.927" E	WTG64	31° 13' 16.343" S	25° 3' 17.927" E	WTG64	31° 13' 16.343" S	25° 3' 17.927" E
WTG08	31° 13' 30.539" S	25° 3' 11.779" E	WTG65	31° 13' 30.539" S	25° 3' 11.779" E	WTG65	31° 13' 30.539" S	25° 3' 11.779" E
WTG66	31° 13' 43.901" S	25° 3' 4.212" E	WTG66	31° 13' 43.901" S	25° 3' 4.212" E	WTG66	31° 13' 43.901" S	25° 3' 4.212" E
WTG71	31° 14' 2.660" S	25° 3' 7.832" E	WTG67	31° 14' 2.660" S	25° 3' 7.832" E	WTG67	31° 14' 2.660" S	25° 3' 7.832" E
WTG05	31° 14' 19.413" S	25° 3' 7.564" E	WTG68	31° 14' 19.413" S	25° 3' 7.564" E	WTG68	31° 14' 19.413" S	25° 3' 7.564" E
WTG61	31° 14' 36.842" S	25° 3' 13.405" E	WTG69	31° 14' 36.842" S	25° 3' 13.405" E	WTG69	31° 14' 36.842" S	25° 3' 13.405" E
WTG04	31° 14' 58.912" S	25° 3' 25.501" E	WTG70	31° 14' 58.912" S	25° 3' 25.501" E	WTG70	31° 14' 58.912" S	25° 3' 25.501" E
WTG02	31° 14' 54.567" S	25° 4' 4.673" E	WTG71	31° 14' 54.567" S	25° 4' 4.673" E	WTG71	31° 14' 54.567" S	25° 4' 4.673" E
WTG01	31° 14' 34.556" S	25° 3' 49.131" E	WTG72	31° 14' 34.556" S	25° 3' 49.131" E	WTG72	31° 14' 34.556" S	25° 3' 49.131" E

Scoping Phase Layout (78 WTG)			**EIA Phase Layout (78 WTG)**			**Final EIA Phase Mitigated Layout (78 WTG)**		
WTG72	31° 14' 16.233" S	25° 3' 46.406" E	WTG73	31° 14' 16.233" S	25° 3' 46.406" E	WTG73	31° 14' 16.233" S	25° 3' 46.406" E
WTG67	31° 14' 2.455" S	25° 3' 58.781" E	*WTG74*	*31° 14' 2.455" S*	*25° 3' 58.781" E*	*WTG74*	*31° 14' 4.785" S*	*25° 4' 3.038" E*
WTG09	31° 13' 44.370" S	25° 3' 50.344" E	WTG75	31° 13' 44.370" S	25° 3' 50.344" E	WTG75	31° 13' 44.370" S	25° 3' 50.344" E
WTG13	31° 13' 31.050" S	25° 4' 0.743" E	*WTG76*	*31° 13' 31.050" S*	*25° 4' 0.743" E*	*WTG76*	*31° 13' 22.016" S*	*25° 3' 46.783" E*
WTG68	31° 14' 12.333" S	25° 4' 27.265" E	*WTG77*	*31° 14' 12.333" S*	*25° 4' 27.265" E*	*WTG77*	*31° 14' 12.632" S*	*25° 4' 25.550" E*
WTG22	31° 14' 53.137" S	25° 4' 43.597" E	WTG78	31° 14' 53.137" S	25° 4' 43.597" E	WTG78	31° 14' 53.137" S	25° 4' 43.597" E
WTG77	31° 15' 56.229" S	24° 59' 56.099" E	*Removed*			*Removed*		
WTG78	31° 16' 5.820" S	24° 59' 38.128" E	*Removed*			*Removed*		
			WTG101	31° 15' 10.954" S	25° 1' 42.549" E	WTG101	31° 15' 10.954" S	25° 1' 42.549" E
			WTG102	31° 16' 20.088" S	25° 2' 10.530" E	WTG102	31° 16' 20.088" S	25° 2' 10.530" E

6.5 Electrical Grid Infrastructure Alternatives

Three 132 kV transmission line alternatives were assessed as part of the EIA phase. A description of each of these alternatives is provided below.

The three proposed line Alternatives would affect properties which form part of the San Kraal site, the adjacent Proposed Phezukomoya WEF site, and non-site portions of the properties of one of the Phezukomoya site owners. All three Alternatives would affect two non-site cadastral properties (Bergplaas) which do not form part of the WEF site, but do belong to a Phezukomoya WEF site property owner.

Six land owners in total would be affected. A core set of four landowners would be affected by all three Alternatives. One of the owners affected by the other two Alternatives would not be affected by Alternative 2 (Mr Erasmus), while Alternative 2 would affect an owner not affected by the two other Alternatives (Mr de Villiers). In addition, Alternative 2 affects two of Mr Gillmer's properties, Edendale and De Rust, while the other two only affect De Rust. Each of the Alternatives is described below.

Preferred Alternative – Middle

The Preferred Alternative is the shortest (~23 km), most centrally located, and most direct of the three Alternatives. It also has the least amount of line turns. This Alternative affects properties which belong to five land owners, namely:

- Farms 15/182; 47/ 182 (Hartebeeshoek), which belong to the Umsobomvu LM, and would be affected over a distance of 2.4 km;
- Farm RE/ 13 (Beskuitfontein), which belongs to Mr Pieter Erasmus, over a distance of 450 m;
- Farms 2; 3/1; 11/1; 18/1 (De Rust), which belong to Mr Jean Gillmer, over a distance of ~5 km;
- Farm RE/1/1 (Vrede), which belongs to Mr Tollie Jordaan, over a distance of ~4.1 km; and
- Farms RE/118 (Winterhoek) RE/ 135 and RE/ 136 (Bergplaas), which both belong to Ms Vivian van der Merwe, over a distance of 11.1 km.

The Preferred Alternative would feed out from the south-west of the on-site substation on Hartebeeshoek (15/182), and continue south-west for ~1.3 km before changing direction west-south west ~300m north of Hartebeeshoek's (47/182) southern boundary (with Beskuitfontein RE/13). Hartebeeshoek 15/182 forms part of the San Kraal site, while 47/182 forms part of the Phezukomoya WEF site. The west-south-west line segment continues for ~1 km across Hartebeeshoek before crossing over into the Beskuitfontein. The entire alignment on Hartebeeshoek is located in a relatively inaccessible portion of Hartebeeshoek, not currently affected by proximate transmission lines or other service industrial infrastructure.

Only the extreme northern portion of Beskuitfontein RE/13 is affected, and only over a relatively short distance, namely ~450 m. The relevant area forms part of the San Kraal WEF site, and is located in broken terrain.

West of Beskuitfontein, the line continues straight west-south-west across portions of De Rust farm, located to the east of the N9. Roughly the eastern half of the alignment (across 2 and 3/1) would affect broken terrain on De Rust. The western portion (11/1 and 18/1) would be located across flatter, lower lying terrain located to the south of the old De Rust railway siding. The line would pass ~300 m to the south of the unoccupied cottages associated with the old siding, effectively the 'farm yard' on De Rust. This portion of De Rust is affected by the old Port Elizabeth railway line and the underground portion (and associated above ground structures) of the operational line. The N9 ~500 m east of the railway cottages, demarcates De Rust's western boundary. An existing transmission line is located ~100 m parallel to the southern boundary of 18/1 (with Vrede), ~700 m south-west of the old De Rust rail siding.

The Preferred Alternative crosses the N9 ~170m south of an existing transmission line crossing. Another existing transmission line is located ~360 m to the east of this point. The proposed crossing is located ~1.1 km north-east of the uninhabited farmstead on Vrede. The initial ~1.9 km portion of the alignment across Vrede continues its straight west-north-west alignment, up to a point ~1.2 km north-west of the Vrede farmstead. Here the alignment turns south-west, and continues in a straight line for the remainder of its course (~2.2 km) across Vrede. Apart from the extreme terminal portion across Vrede which would traverse a koppie, the remainder of the alignment is located on relatively flat, low-lying terrain. The eastern portion of Vrede around the farmstead is already transformed by the N9 and existing transmission lines, but the area to the west thereof is not.

From the western boundary of Vrede, the alignment continues in an unbroken line due south-west across Winterhoek to the boundary with Bergplaas, across a succession of hills and lower lying areas. The extreme south-eastern portion of RE/ 118 north of the N10 is affected. The alignment traverses the N10 across a broad low-lying area 2.2 km north-east of the farmstead on Winterhoek, along a straight ~3.8 km stretch of the N10. This portion of the N10 is not currently affected by infrastructure. Most of the alignment of the line portion across the portion of RE/ 118 south of the N10 would affect broken terrain in the central portion of Winterhoek. The alignment would pass ~1.2 km to the south-east of the inhabited farm house on Winterhoek. An intervening koppie would screen the line from Winterhoek farmstead.

The terminal portion of the alignment across Bergplaas to the south of Winterhoek affects very broken terrain in the central portion of the property, just to the west of the farm access road from Winterhoek. The Alternative is located ~260 m to the west of the uninhabited farm yard (essentially stock pens and a shed) on Bergplaas. The line would feed into the Umsobomvu substation located immediately across the south-western boundary point of RE/ 135.

<u>Alternative 1 – South</u>

Alternative 1 is the southernmost of the Alternatives. It is somewhat longer (~25.4 km) than the Preferred Alternative. The portion to the west of Winterhoek is characterized by numerous line bends. Alternative 1 would affect the same set of land owners as the Preferred Alternative, but a slightly different set of cadastral parcels:

- Farms 15/182; 47/ 182 (Hartebeeshoek), which belong to the Umsobomvu LM, and would be affected over a distance of 1.8 km;
- Farms 1/11 and RE/ 13 (Beskuitfontein), which belong to Mr Pieter Erasmus, over a distance of 3.2 km;
- Farms 2/11; 3/1; 11/1; 18/1 (De Rust), which belong to Mr Jean Gillmer, over a distance of ~4.3 km;
- Farm RE/1/1 (Vrede), which belongs to Mr Tollie Jordaan, over a distance of ~5 km; and
- Farms RE/118 (Winterhoek) RE/ 135 and RE/ 136 (Bergplaas), which both belong to Ms Vivian van der Merwe, over a distance of 11.1 km.

Alternative 1 would affect the same portions (15/182 and 47/182) as the Preferred Alternative. Essentially the same area on Hartebeeshoek would be affected, namely broken terrain to the south-west of the proposed on-site substation. The initial ~1.5 km across Hartebeeshoek is roughly parallel in general direction to the Preferred Alternative. At a point ~240m north of the boundary with Beskuitfontein RE/13, Alternative 1 turns south-south-west before crossing the boundary.

The alignment across Beskuitfontein affects broken terrain located to the north and north-west of the inhabited farmstead on Beskuitfontein. In addition to RE/13 affected by the Preferred Alternative, 1/11 would also be affected. The alignment changes course from east-south-east to west-north-west across Beskuitfontein as it gradually loops back in the direction of the Preferred Alternative. The line would be located ~850 m to the north-west of the farmstead on Beskuifontein and associated access road. Buskuitfontein is not currently affected by any service industrial infrastructure such as transmission lines.

The line enters De Rust from the hilly terrain north-west of Beskuitfontein farmstead, but is largely located across lower lying, even terrain across De Rust. The alignment across De Rust initially runs west-north-west, gradually turning north-west, and again west-north-west. The initial ~2.7 km line portion from the Beskuitfontein boundary across 2/11 and 3/11 would be located a portion of De Rust not currently affected by any service industrial infrastructure. No houses or other structures are located in this portion of De Rust. The line portion across 11/1 and 18/1 however traverses a portion of De Rust affected by an existing transmission line corridor, the small above-ground portion of the active Port Elizabeth railway line on De Rust, and the old railway line just to its west. The terminal 500 m across De Rust is located just inside the property's south-western boundary (with Vrede RE/1/1), and ~50m parallel and to the west of an existing transmission line across Vrede. Alternative. Approximately 540 m of De Rust's boundary with the N9, the alignment changes direction, more or less directly west, and crosses onto Vrede. This is the nearest point to the uninhabited railway cottages on De Rust, which are located ~800 m to the north-east.

The initial ~1 km line portion across Vrede maintains a roughly westward course. This portion is essentially located less than 300m parallel to the south of the Preferred Alternative. It consequently crosses the N9 closer to the currently uninhabited Vrede farmstead (760m), and its alignment across Vrede is in closer proximity to the farmstead (360 m) than the Preferred Alternative. The relevant portion of Vrede is however already affected by two existing transmission lines, the nearest of which located 600 m north-east of the farmstead.

Approximately 400 m north-west of the Vrede farmstead, the alignment changes direction, roughly towards the south-south-west, before swinging south-west along its terminal ~560 m across Vrede. The entire alignment across Vrede is located within approximately 300 m to 2 km to the south of the Preferred Alternative. The alignment is less direct, but roughly parallel in direction to the Preferred Alternative. The alignment skirts to the north of two koppies along Vrede's boundaries with De Rust and Winterhoek, but essentially traverses lower-lying, flatter terrain on the property.

The line traverses the N10 in the extreme south-western portion of Vrede. The road crossing is located at the eastern end of the same straight ~3.8 km stretches of the N10 west of Winterhoek farmstead.

Unlike the Preferred Alternative and Alternative 2, Alternative 1 only affects the portion of Winterhoek located to the south of the N10. The initial 4.3 km of the alignment traverses hilly terrain located in the eastern portion of the property, just to the south of the N10. Approximately 1 km south-east of the Winterhoek farmstead, the alignment turns south-east.

The remainder of the alignment across Winterhoek and Bergplaas is essentially located within 300 m (east and then south) of the Preferred Alternative. Again, the same intervening koppie screens the alignment from the Winterhoek farmstead, located ~970 m to the north-west of the nearest line portion. Essentially the same portion of Bergplaas to the Umsobomvu substation as the Preferred Alternative would be affected. The line would however be located marginally closer (~220 m to the west) to the uninhabited farm yard on Bergplaas.

Alternative 2 – North

Alternative 2 is the northernmost of the Alternatives, and the longest of the three Alternatives (~26.9 km) than Alternative 1. Alternative 2 would affect four of the same set of five land owners as the Preferred Alternative and Alternative 1 (Mr. Erasmus of Beskuitfontein would not be affected), although a slightly different site of associated cadastral portions of these 4 would be affected. In addition, the Alternative 2 corridor would affect a land owner not affected by the other two Alternatives (Mr de Villiers of Kleinfontein).

Alternative 2 would affect the following owners and properties:

- Farms 15/182; 47/ 182; 46/182 and RE/182 (Hartebeeshoek), which belong to the Umsobomvu LM, and would be affected over a distance of 6.4 km;
- Farms 11/1; RE/11/1 (De Rust) and RE/11/1; 12/1 and 21/1 (Edendale), which belong to Mr Jean Gillmer, over distances of ~4.3 km and ~1.2 km, respectively (total 5.5km);
- Farm 1/117 (Kleinfontein), which belongs to Mr Jim de Villiers, over a distance of ~1.4 km (corridor only);
- Farm RE/1/1 (Vrede), which belongs to Mr Tollie Jordaan, over a distance of ~3.5 km; and
- Farms RE/118 (Winterhoek) RE/ 135 and RE/ 136 (Bergplaas), which both belong to Ms Vivian van der Merwe, over a distance of 11.7 km.

Unlike the Preferred Alternative and Alternative 1, Alternative 2 would feed out of the on-site substation on Hartebeeshoek towards the north-west. The bulk of the alignment (~4.7 km) would be located on site portions of Hartebeeshoek, namely 15/182 and 46/182. The terminal (western) portion across Hartebeeshoek is located across RE/182 which forms part of the proposed Phezukomoya WEF site.

The alignment across Hartebeeshoek affects a succession of hills and narrow valleys in the southern and central portions of the farm over a broad arc. The alignment runs ~620 m to the south of one of the nearest of a number of uninhabited farmsteads on Hartbeeshoek. Portions 15/182 and 46/182 are not currently affected by any service industrial infrastructure. The westernmost portion of RE/182 is affected by the existing 132 kV feeder line from the operational Noupoort WEF to the north of the San Kraal site. The relevant line is however located to the north of a koppie to the south of which Alternative 2 is located.

West of Hartebeeshoek, the alignment crosses over onto De Rust from north-east to south east, affecting lower lying terrain in its extreme northern portion over a distance of ~1.1 km. Alternative 2 crosses De Rust's western boundary and the N9 ~230 m north-east of the Barredeel railway siding along the Port Elizabeth railway line.

An existing transmission line across Edendale farm is located ~970 m west of, and roughly parallel to the N9. West of the Barredeel siding and railway line, Alternative 2 enters onto land which also belongs to Mr Gillmer (De Rust owner), namely the north-eastern corner of Edendale farm. The alignment across Edendale and is essentially from the property's north-eastern to south-western corners. The entire alignment is across lower-lying, flat terrain to the south of Afrikaberg. The terminal ~350 m across Edendale is located just within the boundary of 21/11. Alternative 2 would be located ~1.2 km north-west from the Edendale farmstead, partially screened by a low koppie. The eastern half of of Edendale is currently affected by proximity to the rail and N9 corridors, and the transmission line referred to above. The western half of Edendale is not currently affected by service industrial infrastructure.

The alignment across Vrede would affect the extreme north-western portion of the property. The relevant portion consists of hilly terrain, and is not located in proximity to the farmstead on Vrede (3.4 km). The alignment be located within 500 m of the property's boundary with Kleinfontien to the west. The 500-m corridor of a 1.4 km portion of this line portion across Vrede would also affect the south-easternmost portion of Kleinfontein. The relevant portion of Kleinfontein consists of broken terrain ~6 km south-east of the Kleinfontein farmstead. The relevant portions of Vrede and Kleinfontein are currently not affected by transmission line corridors.

The bulk of the alignment across the portion of Winterhoek north of the N10 is located ~1km parallel to the north of the Preferred Alternative. The initial and terminal portions of the alignment would affect broken terrain, while the bulk of the alignment would traverse the same large low-lying area as the Preferred Alternative. Approximately 300 m north of the N10, the line changes direction to south-south east across a distance of ~1.6 km to a point located ~1.2 km south-east of the Winterhoek farmstead.

The line crosses the N10 ~1.2 km of the west of the Preferred Alternative crossing, and ~1 km north-east of the farmstead along the same straight stretch of the N10 as traversed by the other two Alternatives. From the point ~1.2 km south-east of the farmstead to its terminus, Alternative 2 is located within 300 m of both the Preferred Alternative and Alternative 1. Again, the same intervening koppie screens the alignment from the Winterhoek farmstead, located ~750 m north-west of the nearest line portion. The portion across Bergplaas is almost identical to that of Alternative 1, and also passes ~220 m to the west of the uninhabited Bergplaas farm yard.

6.5.1 Grid Connection Layout Assessment

The three grid connection alternatives have been assessed by each of the specialists. The table below provides a comparative assessment of each of the alternative by the specialists.

Specialists	Alternative 1 (South)	Alternative 2 (North)	Preferred Alternative (Middle)
Aquatic	No impacts on the aquatic environment will occur based on the proposed alignments and the alternatives. This is based on the assumption that during the final design process all transmission line towers will be located outside of the delineated water courses and the 32m buffer. This alternative is acceptable	No impacts on the aquatic environment will occur based on the proposed alignments and the alternatives. This is based on the assumption that during the final design process all transmission line towers will be located outside of the delineated water courses and the 32m buffer. This alternative is acceptable	No impacts on the aquatic environment will occur based on the proposed alignments and the alternatives. This is based on the assumption that during the final design process all transmission line towers will be located outside of the delineated water courses and the 32m buffer. This alternative is acceptable
Terrestrial Flora and Fauna	This power line alternative traverses the least extent of sensitive habitat. The majority of the route is across flat plains of Eastern Lower Karoo and is likely to generate the lowest overall impact on fauna and flora. This alternative is preferred.	Alternative 2 is not preferred. Although the sensitivity of the majority of the route is similar to the other options, the route traverses a large ridge that would be likely to require significant transformation for access and also increase the likelihood of erosion.	This Alterative is not preferred from an ecological perspective. Although the sensitivity of the majority of the route is similar to the other options, the route traverses a large ridge that would be likely to require significant transformation for access and also increase the likelihood of erosion.

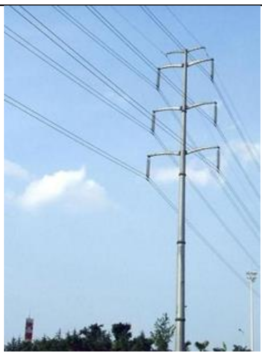
Specialists	Alternative 1 (South)	Alternative 2 (North)	Preferred Alternative (Middle)
Avifauna	No issues from an avifaunal perspective with this alternative.	Alternative 2 is not the preferred route due to the buffer area around the Verreauxs' Eagle nest.	No issues from an avifaunal perspective with this alternative.
Bats	No objection to this alternative. The electrical infrastructure will not impact bats	No objection to this alternative. The electrical infrastructure will not impact bats	No objection to this alternative. The electrical infrastructure will not impact bats
Noise	Not preferred due to potential noise impact during construction.	No issues with this alternative from a noise perspective	No issues with this alternative from a noise perspective.
Visual	One (1) sensitive visual receptor location (namely VR 36 – Carlton Heights Lodge) can be found within 5km of this power line corridor alternative, within the low impact zone. The other sensitive receptor location (namely VR 28 – The Dairy BnB) is located further than 5km and is thus negligible from a visual perspective. Despite the fact this alternative will have a negligible visual impact for VR 36 – Carlton Heights Lodge, this alternative is not preferred from a visual perspective as it is located within 500m of four (4) of the potentially sensitive receptor locations and will result in a moderate visual impact for VR 28 – The Dairy BnB.	One (1) sensitive visual receptor location (namely VR 28 – The Dairy BnB) can be found within 5km of this power line corridor alternative, within the low impact zone. The other sensitive receptor location (namely VR 36 – Carlton Height Lodge) is located further than 5km and is thus negligible from a visual perspective. Despite the fact that this alternative will result in a moderate visual impact for VR 28 – The Dairy BnB, this power line corridor alternative is still favourable from a visual perspective as this alternative will only have one (1) potentially sensitive receptor located within 500m and will result in a negligible visual impact for VR 36 – Carlton Heights Lodge.	No sensitive visual receptor locations can be found within 5km of this power line corridor alternative. Despite the fact that two (2) potentially sensitive receptor locations are located within 500m of this alternative, this alternative is preferred from a visual perspective due to the fact that this alternative will result in negligible visual impact for both of the sensitive visual receptor locations (namely VR 28 and VR 36).
Heritage	Low impact significance, but not preferred. Close to buffer zone area. Not preferred from a heritage perspective.	Not preferred as of Alternative 2 will trigger a need for mitigation of an archaeological site	Preferred Alternative, low impacts and shorter distance
Social	Not preferred based on visual from landowner	No issues with this alternative	Preferred due to shortest distance

6.5.2 Grid Connection Technology Alternatives

The main purpose of the proposed switching station and overhead powerline is to connect the proposed San Kraal WEF to the national grid. Note that technologies change on a regular basis and the most reliable, safest and cost effective technology that is available and that meets industry standards will be used. Alternatives are proposed for the type of structures which will support the overhead lines. These may include:

- Concrete, steel or wood monopoles (preferred);
- Guy line supported steel structures (small footprint);
- Free standing metal lattice towers; or
- Multi-pole structures such as H-towers or K-towers.

Refer to **Plates 6-1 to 6 -4** for typical examples of these tower types. All aspects of the grid connection, including powerline and supporting structures would need to adhere to industry standards.

 ***Plate 6-1: Concrete, steel or wood monopoles.***	 ***Plate 6-2: Guy line supported steel structures.***
 ***Plate 6-3: Free standing metal lattice towers.***	 ***Plate 6-4: Multi-pole structures such as H-towers or K-towers.***

<u>Alternative 1 (preferred alternative)</u>

The preferred supporting structure would be a concrete or steel monopole as these are the Eskom standard and are cost effective. This preferred structure would be subject to line design and engagement with Eskom.

<u>Alternatives 2-4</u>

Free standing metal lattice towers or guy-line supported steel structures would be beyond the need of the conductor in this case. In addition, these structures are expensive.

The visual and heritage specialists have recommended that lattice structures are also acceptable for use as they are visually more permeable and almost invisible at a distance. Should the proposed power line be parallel with any existing power lines then the same pylons should be used.

6.6 Wind Turbine Technology Alternatives

Additional renewable energy technologies include hydro-electric power, photovoltaic solar or concentrated solar power. The site itself has no resource for hydro-electricity. The site topography is less suited to the construction of large scale ground mounted solar facilities. Solar electricity generation would also require a much greater infrastructure footprint to generate the equivalent energy of the proposed WEFs.

Wind energy is likely to present less of an impact on the continued use of the land for grazing, as it does not result in the shading that occurs from solar facilities which may affect vegetation and consequently farming practices. Whilst there are potential impacts associated with wind energy which are not associated with solar, such as collision risk with avifauna, there are different potential impacts for solar facilities such as loss of habitat and foraging areas for avifauna and other ecological receptors.

Various wind turbine designs and layouts have been considered for the site in order to maximise the electricity generation capacity and efficiency, whilst taking into account environmental constraints.

Based on the site's physical characteristics and existing land uses, the renewable energy technology best suited to the site, taking into account the potential environmental impacts, is a WEF, the design and layout of the WEF, has been advised through public and specialist consultations.

The turbine manufacturer and turbine model has not yet been determined and will not be decided upon until the completion of further wind analysis and competitive tendering. The developer has been evaluating several turbine models, however the selection will only be finalised at a later stage once a most optimal wind turbine are identified (factors such as meteorological data, price and financing options, guarantees and maintenance costs, etc.). As the noise propagation modelling requires the details of a wind turbine, it was selected to use the sound power emission levels of the Acciona AW125/3000 which would represent a worst-case scenario.

6.7 Alternative Assessment Summary

Based on the assessment of alternatives, it was decided that the proposed location of the WEF will be the San Kraal site, located in the Eastern and Northern Cape Provinces. Through the scoping process the design of the WEF has been assessed, taking into consideration environmental constraints. These constraints were provided by the specialists, and included, no-go areas based on avifaunal and bat constraints, as well as floral and faunal constraints and visual. A provisional layout for the proposed development was designed based on these constraints, and provided to the specialists to use as part of the impact assessment phase. Due to the nature of the process, this provisional layout has continued to evolve throughout the process. This Final Mitigated Layout is submitted to the DEA (Figure 6.1), and if approved and awarded preferred bidder status, this layout will further be developed, through micro siting of turbines and roads, with the assistance from the relevant specialists.

7 THE PREFERRED ALTERNATIVE – THE PROPOSED SAN KRAAL 390 KV WIND ENERGY FACILITY AND ASSOCIATED 132 KV GRID CONNECTION (PREFERRED GRID ALTERNATIVE)

Based on the alternatives analysis, the preferred project to be assessed in this EIA Report is a 390 MW wind energy facility at a site 58 km from Middleburg and 6 km from the town of Noupoort in the Eastern Cape Province (San Kraal) with up to 78 turbines and a 23 km 132 kV grid connection from the San Kraal switching station to the proposed Umsobomvu Substation (Figure 7.1).

7.1 Description of the Proposed Development

The proposed development will consist of up to 78 three-bladed horizontal-axis wind turbines with a maximum hub height of 150 m and blade length of 75 m (Figure 7.2). The maximum generating capacity of the development will be 390 MW, with WTGs having a potential maximum rated power of 5 MW each (between 2 MW – 5 MW).

The final choice of turbine will be dependent on the technology available at the time of construction, project economics and the desired output from the development.

The maximum capacity applied for in this application is greater than the current Department of Energy's (DoE) limit of 140 MW of installed capacity. The reason for applying for a greater capacity at this point in time is due to the long lead times involved in wind farm developments (2 – 5 years) from conception to construction. Hence, the applicant is applying for 390 MW in order to cater for a potential change in policy in future Government procurement processes where the limit may be increased.

The level of installed capacity applied for (390 MW) also relies on the proposed use of a 5 MW wind turbine. The WTG capacity can only be confirmed to be technically or commercially optimal at the time of implementation.

Should a positive Environmental Authorisation be obtained for this WEF, and in the event that no change to installed capacity limits are made by Government and/or should the optimal turbine size for the site be of a rated power less than 5 MW, the applicant will implement the approved layout to suit current policy and turbine type at the time of development.

The blades will be manufactured from fibre-reinforced epoxy or equivalent performance materials and the towers will be of tapering or cylindrical tubular steel/concrete construction. The nacelle, which is located at the top of the tower, houses the gearbox and generator.

The turbines are computer-controlled to ensure that each turbine faces directly into the wind during operation to ensure optimum efficiency. When not in operation the turbine may turn away from the wind if the wind is too strong to protect the drive train.

The purpose of a wind energy facility is to harness energy from the wind. It is important that wind turbines are sited in the optimum position to maximise the wind yield whilst minimising environmental impacts.

The optimum layout of a wind energy facility depends on a range of criteria. These vary depending on the type and size of turbine as well as the local topography and the turbulence which may be created by surface features. Turbine manufacturers generally recommend that turbines should be spaced between three and six rotor diameters apart depending on the prevailing wind direction, turbine type and site characteristics.

The electricity generated from the WEF will need to be transferred from the on-site switching station to the proposed 132/400 kV Umsobomvu Substation and then to the existing national grid (Figure 7.1). Eskom has an existing grid network in the area and it is proposed that the electricity will be transferred from the WEF to the proposed 132/400 kV Umsobomvu Substation via a system of 132 kV overhead power lines. From the Umsobomvu Substation the energy will be transferred to the existing high-voltage lines of the national grid.

The route for the 132 kV power lines will include a servitude corridor of up to 500 m in width on either side. At this stage it is recommended that the proposed route of the overhead line follows existing linear infrastructure as far as possible as this will potentially reduce the impacts associated with its construction and operation. This is taken into consideration with the preferred route alternative.

At the proposed Umsobomvu Substation, the distribution overhead lines will connect into a newly constructed 132/400 kV substation yard, which will be located on a concrete foundation covering up to 600 m by 600 m. This foundation will include transformers and the switch gear required to connect the energy into the existing national grid network. A 400 kV transmission line turn-in is intended to connect the substation with the nearby 400 kV transmission lines, which will require a servitude corridor of up to 55 m in width.

7.2 Site Description and Location of the Proposed Development

The proposed San Kraal WEF would be situated six kilometres south of the town of Noupoort, on the edge of the escarpment of a high lying area known locally as the Kikvorsberge (Figure 1.1). The proposed facility would be built on high lying ground at the edge of the Kikvorsberge Escarpment. Details of the land parcels that make up the development site are presented in Table 7.1, Figures 6.1; 7.1.

Noupoort is located adjacent to the west of the N9 (Colesberg–Middelburg route). The WEF site is located 2.2 km to the east of the N9. The town of Middelburg (~19 000 population) is located approximately 25 km (linear) to the south-east of the site, also along the N9. The town of Colesberg (~17 500 population), located at the northern terminus of the N9, is located approximately 58 km north of the site.

The majority of the site and proposed infrastructure is located in the Umsobomvu Local Municipality (LM) of the Pixley ka Seme District Municipality (DM) in the Northern Cape Province (NCP). The southernmost portion of the site (Beskuitfontein farm) and the terminal portions of all three proposed 132 kV transmission line alternatives are located in the Inxuba Yethemba LM in the Chris Hani DM in the Eastern Cape Province (ECP). Noupoort is one of three towns in the Umsobomvu LM, the other being Colesberg (municipal seat and leader town) and the small town of Norvalspont. De Aar is the administrative seat of the Pixley ka Seme DM. The towns of Middelburg and Cradock (municipal seat) are the key settlements in the Inxuba Yethemba LM. Queenstown is the administrative seat of the Chris Hani DM.

Table 7.1: Property Details of the Proposed Development Site

	Property Owner	Farm Portion	SG number	Size (ha)
1	Gerhard Talijaard	RE 181 Holbrook	C02100000000018100000	5008.6
2	Beskuitfontein Trust	1/11 Beskuitfontein	C04800000000001100001	1792
3	Beskuitfontein Trust	RE/13 Beskuitfontein	C04800000000001300000	389
4	Umsobomvu Municipality	15/182 Hartebeeshoek	C02100000000018200000	1812.4
5	Umsobomvu Municipality	3/182 Hartebeeshoek	C02100000000018200003	1230.5
6	Umsobomvu Municipality	14 Hartebeeshoek	C04800000000001400000	107.5
7	Umsobomvu Municipality	46/182 Hartebeeshoek	C02100000000018200046	151.5
Preferred Grid Connection Land Portions				
1	Umsobomvu Municipality	15/182	C02100000000018200000	1812.4

2	Umsobomvu Municipality	47/182	C02100000000018200047	752.6
3	Beskuitfontein Trust	RE/13	C04800000000001300000	390.2
4	Jean Gillmer	3/1		413.0
5	Gillroy Trust	RE/11/1	C04800000000000100011	2331.8
6	Jean Gillmer	18/1		92.9
7	Pieter Jordaan	RE/1/1	C04800000000000100001	3949.1
8	Vivien van der Merwe	RE/118	C03000000000011800000	4518.5
9	Vivien van der Merwe	RE/136	C03000000000013600000	355.4
10	Vivien van der Merwe	RE/135	C03000000000013500000	1155.9
Alternative 1 Grid Connection Land Portions				
1	Umsobomvu Municipality	15/182	C02100000000018200000	1812.4
2	Umsobomvu Municipality	47/182	C02100000000018200047	752.6
3	Beskuitfontein Trust	RE/13	C04800000000001300000	346.8
4	Beskuitfontein Trust	1/11	C04800000000001100001	1789.4
5	Gillroy Trust	2/11	C04800000000001100002	348.3
6	Gillroy Trust	3/1	C04800000000000100003	413.0
4	Gillroy Trust	RE/11/1	C04800000000000100011	2331.8
5	Jean Gillmer	18/1		92.9
6	Pieter Jordaan	RE/1/1	C04800000000000100001	3949.1
7	Vivien van der Merwe	RE/118	C03000000000011800000	4518.5
8	Vivien van der Merwe	RE/136	C03000000000013600000	355.4
9	Vivien van der Merwe	RE/135	C03000000000013500000	1155.9
Alternative 2 Grid Connection Land Parcels				
1	Umsobomvu Municipality	15/182	C02100000000018200000	1812.4
2	Umsobomvu Municipality	46/182	C02100000000018200046	151.5
3	Umsobomvu Municipality	RE/182	C02100000000018200000	1113.9
4	Transnet	8/1	C04800000000000100008	574.26
5	Isle of Eden farming and Eco-Tourism CC	12/1	C04800000000000100012	623.4
6	Isl of Eden farming and Eco-Tourism CC	21/1	C04800000000000100021	279.2
7	Jim De Villiers	1/117	C03000000000011700001	1637
8	Vivien van der Merwe	RE/118	C03000000000011800000	4518.5
9	Vivien van der Merwe	RE/136	C03000000000013600000	355.4
10	Vivien van der Merwe	RE/135	C03000000000013500000	1155.9

On the proposed development site, the escarpment breaks up into a series of flat topped ridges and hills which provide expanses of flat elevated areas suitable for wind energy development (Figure 7.4). The N9 between Noupoort and Middelburg and the railway system lie a short distance (5 km) to the west of the proposed development site and passes through the town of Noupoort.

The area is characterised by often arid conditions, large dolerite sills, ridges and outcrops and deep valleys. It is sparsely populated and generally rural, with grazing of sheep and cattle being the primary occupation of local famers.

Beskuitfontein

Beskuitfontein (1/11; RE/13) and adjacent Vlakfontein to its south are owned by Mr Pieter Erasmus (Beskuitfontein Trust). The two properties are farmed as one unit. Mr Erasmus lives on Vlakfontein (Photograph 7.1) and his son Stefan on Beskuitfontein (Photograph 7.2). The operation's labour force – five households - resides on Beskuitfontein, just to the north of the farm yard (Photograph 7.3). Carlton Heights Lodge is located on Vlakfontein, adjacent to the Vlakfontein farm house. Both properties are accessed via a single access road from the N9. The road also provides primary access to the adjacent Glenmoor farm.

Photograph 7.1: Farm house (left) and Carlton Heights Lodge on Vlakfontein farm

Photograph 7.2: Farm house and outbuildings on Beskuitfontein

Photograph 7.3: Labourers' houses on Beskuitfontein north of the farm yard

Beskuitfontein and Vlakfontein are used for livestock farming (Photograph 7.4). Wool sheep and Beef cattle are farmed. Stock is present year-round on the property, rotated between internal camps. The hilly northern portion of Beskuitfontein is considered too inaccessible to farm effectively. The area to the east and south-east of the farm yard on Beskuitfontein is used for growing irrigated fodder crops for own use (Photograph 7.5). No game farming or paid hunting is associated with the properties (Pieter and Stefan Erasmus, pers. Comm, with social specialist).

Photograph 7.4: Stock pen and farm buildings on Beskuitfontein yard

Photograph 7.5: Irrigated fodder cropping area to the east of Beskuitfontein farmstead

Carlton Heights Lodge mainly caters to travellers along the N9, and, more recently, long-stay guests, typically contractors. The facility benefited from large construction projects in the area, such as the construction of the Noupoort WEF, and the owners have indicated that they intend focusing progressively more on long-stay guests. The owners also intend to expand operations by making more accommodation available on Vlakfontein (Pieter and Yolandi Erasmus, pers. Comm, with social specialist).

No transmission lines are located on the Beskuitfontein portion of Mr Erasmus' property. Two 132 kV lines are however located on the Vlakfontein portion of the property. Both are located between the Vlakfontein farmstead and the N9. Both traverse the Beskuitfontein/ Vlakfontein access road (Photograph 7.6).

Photograph 7.6: Existing Tx line across Vlakfontein, with farm yard in middle distance, seen from farm access road to the north

The old railway line corridor (no longer in use) is located along the western boundary of Vlakfontein, near the N9. Abandoned railway cottages are also located in this portion of

Vlakfontein. A private wind mast (the owner's) is also located on Vlakfontein. Turbines associated with the Noupoort WEF are not visible from the property.

Twelve turbines are proposed on Beskuitfontein. The nearest turbine would be 2.5 km to the north-east of Beskuitfontein farmstead, and 6.2 km to the north-east of the Vlakfontein one. All proposed turbine locations are on high ground associated with the hilly northern portion of Beskuitfontein (Photograph 7.7). As indicated, this area is considered of low agricultural potential. Beskuitfontein would not be affected by substations, switching stations, batch plants or site access roads.

Photograph 7.7: Entrance to Beskuitfontein farm from Vlakfontein. Turbines are proposed on the hills (ridgeline) in the far distance

A portion of Alternative 1 would be located on Beskuitfontein, while a small portion of the 500m lateral corridor associated with Alternative 3 (preferred) would also affect Beskuitfontein. In both instances, the extreme north-western hilly portion of Beskuitfontein would be affected. West of Beskuitfontein, Alternative 1 traverses more level terrain (on adjacent De Rust), and would be potentially be within the viewshed of the Vlakfontein and Beskuitfontein access road (Photograph 7.8). The owner has indicated a preference for Alternative 2 and the Preferred Alternative which would affect the broken terrain further to the north (Pieter Erasmus, pers. Comm, with social specialist).

Photograph 7.8: Looking towards Carlton Heights from the entrance road to Beskuitfontein and Vlakfontein. Transmission line Alternative 1 would be located to the south of (viewer's side) of the low koppie in the centre of the photo

Hartebeeshoek

Hartebeeshoek is located to the east of the N9. Noupoort station and town were established on a portion of the original Hartebeeshoek farm. Today, six adjacent cadastral portions of the original farm 182 are collectively known as Hartebeeshoek Farm. Hartebeeshoek belongs to the Umsobomvu Municipality. The farm is accessed from the Oorlogspoort gravel Rd to the north, or directly from the N9 east of Noupoort (extension of Moss Street).

The eastern portion of Hartebeeshoek (14; 3/182; 15/182; 46/182) form part of the San Kraal site. The western portion of Hartebeeshoek (RE/ 182; 47/ 182) forms part of the site of San Kraal's proposed sister farm, the Phezukomoya WEF. The entire farm is currently leased out to a loose collective of around 40 communal farmers living in Noupoort (Kapp, pers. Comm, with social specialist).

The property is used for grazing by goats, sheep and cattle. The currently non-operational broiler farm community project is located approximately 300 m east of the N9, on the non-site portion of the farm (Photograph 7.9). This project is envisaged to be revived at some point.

Photograph 7.9: Defunct broiler houses on non-site portion of Hartebeeshoek, seen from the N9

A number of houses are located on Hartebeeshoek, all in various stages of disrepair (Photograph 7.10). None are inhabited, although some are occasionally used as night shelters by herders (Kapp, Majuba, pers. Comm, with social specialist).

Photograph 7.10: One of several uninhabited houses on Hartebeeshoek, this one located near the Oorlogspoort Rd on the site portion of the farm

The non-site portion of Hartebeeshoek is largely hidden from the N9 and Noupoort town by the hilly topography. The site portion of Hartebeeshoek may be described as isolated. With the exception of a small section of the Oorlogspoort road in the extreme north, no public roads traverse the property.

Turbines on the adjacent Noupoort WEF are clearly visible from small portions the Oorlogspoort road and Hartebeeshoek. However, the broken topography precludes massed viewings, and screens the turbines from much of the lower-lying portions of the property. The non-site portion is unaffected by existing transmission lines. The westernmost portion of RE/182 (non-site portion) is traversed by the 132-kV line feeding power from the adjacent Noupoort WEF into the grid. The line is located parallel to the N9, less than 100 m from the road, on the non-site portion of Hartebeeshoek (Photograph 7.11).

Photograph 7.11: Noupoort WEF 132 kV feeder line across non-site portion of Hartebeeshoek east of the N9

Thirty-one turbines and the project substation are proposed on the site portion of Hartebeeshoek (Photograph 7.12). As only the inaccessible, difficult-to-farm higher-lying portions of Hartebeeshoek would be affected by proposed infrastructure, the Municipality envisages that existing grazing activities could comfortably co-exist with the operation of the proposed WEF (Ngcineni, pers. Comm, with social specialist).

Photograph 7.12: Proposed turbine development area (ridgeline) on Hartebeeshoek seen from the Oorlogspoort Road

All three transmission line Alternatives would affect Hartebeeshoek, both the site and non-site portions. Alternatives 1 and 3 (Preferred) would only affect the extreme south-westernmost portion of the site, while 4.4 km of Alternative 2 would traverse the property. The bulk of all alignments is on high ground. A portion of Alternative 2 is also located on lower lying ground 700 m from the nearest farm house (uninhabited) on Hartebeeshoek.

Holbrook

Holbrook (RE/181) is owned by Mr Gerhard Taljaard. The property is accessed from the Oorlogspoort road, which is partially aligned along its northern boundary (Photograph 7.13).

Photograph 7.13: Entrance to Holbrook farmstead from the Oorlogspoort road

Holbrook is used primarily for beef cattle farming. In addition, a number of horses are also kept on the property. Three farm houses on Holbrook are inhabited, all located on the farm yard almost at the centre of the property. Two labourers are permanently employed on Hollbrook. They live with their households on Holbrook, near the farm yard (Taljaard, pers. Comm, with social specialist). No accommodation facilities or commercial hunting are associated with Holbrook.

No major service industrial infrastructure is currently located on Holbrook. No Tx lines are currently located in significant proximity to Holbrook. Turbines associated with the Noupoort WEF are however clearly visible from Holbrook's northern boundary and access road (Photograph 7.14). The nearest turbine is 3.5 km from the Holbrook farmstead.

Photograph 7.14: Turbines on the Noupoort WEF seen from the entrance to Holbrook, looking west

Thirty turbines are proposed on Holbrook. A switching station and the two project batching plants (construction phase) are also proposed on Holbrook. In addition, the San Kraal site access point is proposed off the Oorlogspoort road via Holbrook. Holbrook would not be affected by any of the transmission line alternatives, but a portion of the medium-voltage overhead line from the switching station to the on-site substation on Hartebeeshoek would affect the extreme north-western portion of Holbrook. In all instances, the relevant infrastructure is concentrated in the hilly western portion of Holbrook (Photograph 7.15). The proposed site access road would be located ~4 km to the west of the access road to the farmstead, and would not affect this road.

Photograph 7.15: Turbine development area (ridge line) on Holbrook seen from the Oorlogspoort road

De Rust

The San Kraal Preferred Alternative and Alternative 1 would affect De Rust, while Alternative 2 would also affect Edendale. Alternative 2 would affect Mr Gillmer's properties over a distance of ~6.7 km, while the Preferred Alternative would affect De Rust over a distance of 5 km, and Alternative 1 over 4.3 km. All Alternatives would be located on land used for grazing. No fodder cropping areas would be affected.

The Preferred Alternative is located ~320 m south of old De Rust siding (Photograph 7.16). As indicated, the buildings are not inhabited. Both the Preferred Alternative and Alternative 1 are located more than 1 km from the inhabited Edendale farm yard (Ballard). However, both lines would be screened from the yard by intervening topography. Alternative 2 would be located 2.1 km to the north-west of the Edendale farm yard. The area to the north of Edendale is already transformed by road, rail and transmission line corridors. An existing transmission line is located ~670 m west of the Edendale farm yard. The owner has indicated that, due to existing service industrial infrastructure, neither De Rust nor Edendale are considered visually sensitive (Gillmer, pers. Comm, with social specialist).

Photograph 7.16: Portion of De Rust south of the old De Rust siding which would be affected by the Preferred Alternative and Alternative 1

Vrede

Vrede (RE/1/1), 2826 ha in extent, straddles the N9, with the largest portion to the west of the N9. The farm is accessed directly from the N9 via private gravel roads with locked entrances. The bulk of the property is located on relatively flat terrain, hemmed in by large hills on all sides (Photograph 7.17). These include the Carlton Hills which straddle the property's southern boundary.

Photograph 7.17: Vrede farm yard and access road off the N9. Note 132 kV cables traversing access road in foreground

Vrede is currently registered to Mr Tollie Jordaan. However, Vrede has recently been sold, and is in the process of being transferred to Mr Jean Gillmer (Droeefontein). (Gillmer, pers. Comm, with social specialist).

The easternmost portion of Vrede is currently affected by the N9, the Noupoort-Middelburg rail corridor, and two 132 kV power lines. The farm house is located ~700 m west of the N9. A 132 kV line traverses the main farm entrance road, and is located ~650 m east of the farm house. Topography screens much of the property from the rail corridor and the second 132 kV line.

Portions of all three transmission line alternatives would traverse Vrede, roughly from north-east to south-west. Approximately 4.1 km of the Preferred Alternative would traverse Vrede, while 5 km of Alternative 1 and 2.1 km of Alternative 2 would traverse the property. The Preferred Alternative and Alternative 1 would largely be located on lower lying, flatter terrain in the central part of the property, while Alternative 2 would be located in hilly terrain just inside the property's north-western boundary.

All three Alternatives traverse Vrede to the north of the farm yard, with Alternative 1 the nearest (360m), followed by the Preferred Alternative (620m), and Alternative 2 (3.5 km) (Photograph 7.18). The portions of the Preferred Alternative and Alternative 1 in proximity to the farm yard would affect a portion of Vrede which already accommodates an existing transmission line.

Photograph 7.18: Area north-west of Vrede farm yard. The Preferred Alternative and Alternative 1 would traverse the flat area in the foreground, while Alternative 2 would be located in the hilly area in the distance

Winterhoek and Bergplaas

The Preferred Alternative and Alternative 2 would affect portions of Winterhoek located to the north and south of the N10, while Alternative 1 would only affect the property portion located to the south of the N10.

All three Alternatives would affect mainly broken topography south of the N10 (Photograph 7.19). All three Alternatives would traverse Winterhoek to the east of the farm yard. Alternative 2 would be located nearest to the farm yard, namely 750m, followed by the Preferred Alternative (970m) and Alternative 1 (1.2 km). The lines would be screened from the farm yard by intervening topography. All three Alternatives would traverse Bergplaas within 260 m of the farm yard. However, as indicated, Bergplaas is uninhabited, and used as a stock post.

Photograph 7.19: Portion of Winterhoek south of the N9, east of the farmstead. The preferred Alternative and Alternative 2 would traverse the hills in the background

N9

All three Alternatives would traverse the N9 between Carlton Heights and Noupoort. The relevant portion of the N9 is already affected by 3 transmission line corridors (Photograph 7.20), as well as the rail corridor and associated infrastructure (Barredeel siding, Midlandia rail yard). Turbines on the Noupoort WEF are clearly visible from the road. The area may be described as transformed.

Photograph 7.20: Existing feed in Tx line from the Noupoort WEF which traverses the N9 between Barredeel rail siding and Midlandia.

N10

All three transmission line alternatives would traverse the N10. The three alternatives would traverse the road within a straight 3.8 km stretch of the road to the east of the Winterhoek farm turnoff (Photograph 7.21). The relevant portion of the N10 is not currently in any significant proximity to existing transmission lines or the rail corridor, and turbines of the Noupoort WEF are not within viewing distance. Telecommunications infrastructure on Carlton Hills is however visible from the N10 along this stretch.

Photograph 7.21: Straight portion of N10 east of Winterhoek turnoff, seen from ~4 km the east. All three Tx lines would traverse the N10 along this road portion

7.3 Wind Energy Facility (WEF) Components

The WEF will comprise components described below. It should be noted that as the design of the proposed development is not yet finalised, all dimensions are maximums as is required by the EIA process. The final design may include infrastructure which is of equal or less than dimensions to those stated below, but not more than.

Turbines

The proposed WEF will comprise of up to 78 turbines.

At this stage, it is envisaged that the turbines will each have a capacity to generate between 3 and 5 MW of power. Each turbine will have a maximum height to blade tip of 225 m. The turbines will be three-bladed horizontal-axis design with a hub height of up to 150 m and a rotor diameter of up to 150 m and a blade length of up to 75 m (Figure 7.2). The exact turbine model has not yet been selected and will be subject to competitive tendering after further wind analysis has been completed. The turbine model will depend upon the technical, commercial and site specific requirements.

The turbine rotor speed will vary according to the energy available in the wind, the wind speed. The turbines will generate power in wind speeds between approximately 3 metres per second (m/s) and 28 m/s (depending on the model of turbine) with maximum power output usually achieved at wind speeds of around 10 - 12 m/s. On average, wind speeds greater than approximately 28 m/s the turbines will automatically turn the angle of the blade to reduce energy capture (this is known as 'pitching') and stop turning to prevent damage.

Each turbine will require a transformer and, depending on the selected model of turbine, this will be either located within the turbine tower or adjacent to the turbine on a concrete plinth.

The turbines would be placed on steel and concrete foundations, each foundation area occupying an area of up to 25 m by 25 m in total (which includes the maximum total area that may need to be disturbed during construction of the foundation). The foundation areas are typically up to 5 m deep and will include concrete and steel plinths depending upon local ground conditions.

Figure 6.1 indicates the preferred positions of the turbines for approval.

Turbine Power Output and Transformers

When operating, the rotational speed of the rotor is multiplied through the gearbox, which drives the generator. This produces a three-phase power output which is transferred from the generator to a transformer located either within the turbine or externally at ground level adjacent to each tower.

The turbine transformer converts the electrical output from the turbine to a higher voltage, 33 kilo volts (kV), for grid connection purposes. Stepping up the voltage helps to reduce electrical losses and in this case match the electrical system voltage for transmission to the grid. Power generated from the turbines is transmitted back to the site switching station via the underground site cables.

Electric Cabling and On-site Switching Station

The electricity from the turbines will be transferred via a 33 kV electrical network to 2 x 80 MVA on-site switching station. Where possible this will be underground but the feasibility of this will be confirmed as the design progresses and geotechnical studies are conducted. The on-site switching station will house electrical infrastructure such as transformers and switch gear to enable the energy to be transferred into the existing national grid. The operations and maintenance building including parking will be approximately 7500 m^2.

Underground cabling will link the turbines to each other and to the on-site transformer/ control building. Detailed construction and trenching specifications will depend on the ground conditions encountered. Typically cables would be laid in a trench approximately 1 m deep and 0.5 m wide. To minimise ground disturbance, cables will be routed along the side of the access tracks where practicable.

Hard Stand Areas

Each turbine requires an area of hard-standing to be built adjacent to the turbine foundation. This provides a flat, stable base on which to lay down the turbine components ready for assembly and erection and to site the two cranes necessary to lift the tower sections, nacelle and rotor into place (Figure 6.1).

A hardstanding area of up to 7500 m^2 will be established adjacent to each turbine location. This will be used to provide a platform for cranes to operate during construction (and unscheduled maintenance), as well as a clear area to lay out turbine components prior to erection.

The crane hard-standing will be left in place following construction in order to allow for use of similar plant should major components need replacing during the operational phase of the proposed development.

7.3.1 Ancillary Equipment

In addition to the key components outlined above, the WEF will also require:

- Meteorological masts;
- Security fencing; and
- CCTV monitoring equipment.

Access

The turbine locations will be accessed through a network of unsealed roads which will be established across the WEF Site. These access roads will be between 8 m and 14 m wide.

A width of 14 m is required during the construction phase for curves in order to allow trucks to turn. Such roads are required to facilitate access for the cranes and abnormal load deliveries of turbine components.

Existing farm access roads will be upgraded and utilised where possible, as will existing watercourse crossings.

7.4 Description of the Construction Phase of the WEF

It is estimated that construction will take approximately 18 - 24 months subject to the final design of the WEF, weather and ground conditions, including time for testing and commissioning. The construction process will consist of the following principal activities:

- Site survey and preparation;
- Construction of site entrance, access roads and passing places;
- Enabling works to sections of the public roads to the WEF site (if required) to facilitate turbine delivery;
- Construction of the contractors' compound;
- Construction of crane pads;
- Construction of turbine foundations;
- Construction of substation building;
- Excavation of the cable trenches and cable laying;
- Delivery and erection of wind turbines;
- Erection of electricity overhead powerlines;
- Testing and commissioning of the wind turbines; and
- Rehabilitation.

It is possible for certain operations to be carried out concurrently, although predominantly in the order mentioned above. This would minimise the overall length of the construction programme. Construction would be phased such that the civil engineering works would be continuing on some parts of the site, whilst wind turbines are being erected elsewhere. Site rehabilitation will be programmed and carried out in order to allow the rehabilitation of disturbed areas as early as possible and in a progressive manner.

Based on the developers' experience from other WEF developments, the construction phase is likely to create approximately 300 to 400 employment opportunities, at its peak. Of this total, approximately 25% will be available to skilled personnel (engineers, technicians, management and supervisory), 15% to semi-skilled personnel (drivers, equipment operators) and 60% to low skilled personnel (construction labourers, security staff). The number and nature of employment opportunities will be refined as the development process progresses. These figures are based on other WEF developments, the exact number and nature of the employment opportunities will be defined during the bidding process, should the project be selected as a preferred bidder. These are requirements of the bidding process as defined by the DoE.

Water for construction purposes (e.g. mass earthworks and roads) will be transferred from the source to the point of use on the site via tanker. All storage of water will be below Water Use License Application (WULA) authorisation limits, i.e. 10 000 m^3. If this goes beyond this limit, a WULA will be submitted to the Department of Water Affairs.

7.4.1 Temporary Infrastructure

Laydown Areas

Additional temporary laydown areas will be required for equipment and component storage during construction across the site. These areas will be levelled and compacted and used for component storage. Temporary infrastructure would include a site camp, laydown areas and a batching plant.

Cement Batching Plant

A cement batching plant is proposed as part of the construction camp area. The total volume of cement that is required for the project is expected to be at least 25,300 m^3 and would require on-site bulk storage of aggregate, cement and sand, all of which would be imported to the site from commercial sources, i.e. no mining or crushing of materials is proposed. It is anticipated that the water demand for concrete production would be approximately 5,060 kL (14.4 kL /day) over a 16 month period and would be supplied by new borehole(s) in vicinity of the batching plant.

Details of the batching plant are not known at this stage, but will all be contained within the footprint area allocated for the construction camp site (approximately 4 ha). It is anticipated that at the peak of construction, the batching plant will operate 24 hours a day.

Some of the aggregate required for the construction of the on-site tracks may be sourced from cut and fill operations during construction from within the proposed development site with additional material imported from permitted quarries as required.

If required, a separate application will be lodged with the Department of Mineral Resources in regard to this activity.

Storage of Hazardous Chemicals

It is anticipated that temporary storage facilities for various hydrocarbons would be required during construction including Liquid Petroleum gas, petrol, diesel, and transformer oils.

All construction camps, lay down areas, batching plants or areas with any fuel stores should be more than 50 m from any demarcated water courses. No permanent hydrocarbon storage facilities are proposed and temporary facilities will be completely be removed on completion of construction and the area rehabilitated.

Estimated Volume of Hazardous Materials Stored on Site for 78 turbines over a construction period of 24 months. Construction Phase 176.64m^3; Operational Phase 197.62m^3. The Environmental Management Programme, must be adhered to by the appointed contractors, and mitigation measures for the storage and handling of hazardous chemicals are included in the EMPr.

7.4.2 Water Supply for Construction

The estimated total water demand for construction is approximately 65,000 kL (200 kL/day). It is anticipated that this will be abstracted from boreholes, supplemented with municipal supply and temporarily stored in a number of plastic water storage tanks (total storage capacity of approximately 300 m^3) in the construction camp area. The water will be supplied via 15 kL water trucks to the various construction areas.

7.5 Description of the Operational Phase of the WEF

The proposed development will be designed to have an operational life of 20 years as set out in the current REIPPPP by the DoE. There is the possibility to further expand the lifetime by an extra 20 years. The only development related activities on-site will be routine servicing and unscheduled maintenance, as detailed in the sections below.

Based on the developer's experience from other WEFs, the operational phase is likely to create approximately 75 permanent employment opportunities. Of this total, approximately 80% (60) will be low and medium-skilled and 20% (15) will be high skilled positions. The number and nature of employment opportunities will be refined as the development process progresses. The figures provided here are early estimates.

7.5.1 Routine Servicing

Wind turbine operations will be overseen by suitably qualified local contractors who will visit the site regularly to carry out maintenance. The following turbine maintenance will be carried out along with any other maintenance required by the manufacturer's specifications:

- Initial service;
- Routine maintenance and servicing;
- Gearbox oil changes; and
- Blade inspections.

Routine scheduled servicing will likely take place every three months with a main service likely to occur at twelve-monthly intervals. Servicing will include the performance of tasks such as maintaining bolts to the required torque, adjustment of blades, inspection of blade tip brakes and inspection of welds in the tower. In addition, oil sampling and testing from the main gearbox will be required once every year and oil and other consumables replaced at regular intervals. Technicians are on site daily to ensure that the turbines are operating safely and at their maximum efficiency.

Site tracks will be maintained in good order. Safe access will be maintained all year round.

The turbines are monitored 24 hours a day real-time via a supervisory control and data acquisition (SCADA) system.

Unscheduled Maintenance

Unscheduled maintenance associated with unforeseen events will be dealt with on an individual basis. In the unlikely event of a main component failure cranes may be mobilised to site to carry out repairs and/or replacement works.

7.6 Description of the Decommissioning Phase of the WEF

San Kraal Wind Power will either operate the facility for 20 years (duration of PPA with Eskom) and then decommission the plant and rehabilitate the site, or should San Kraal Wind Power manage to secure a new PPA, the project will be repowered to continue its operation for a further 10 to 20 years. It is impossible at this stage to anticipate the kind of advanced wind technology that will be available in the distant future.

Repowering would not be undertaken under this application or resulting Environmental Authorization, and would be subject to a new application at the time. In the event that the technology changes significantly, San Kraal Wind Power will engage with DEA to understand what additional requirements might need to be fulfilled in order to be authorised to use more advanced technology on the site.

In the event of decommissioning, typically, all above ground equipment will be dismantled and removed from the site. Cables and the turbine foundations will be cut off below ground level and covered with topsoil. Access tracks will be left for use by the landowners, or if appropriate, covered with topsoil or reduced in width.

This approach is considered to be best practice environmentally and less damaging than seeking to remove all foundations, underground cables in their entirety. Decommissioning will take account of the environmental legislation and technology available at the time of decommissioning.

7.7 Transportation of Wind Turbine Components to Site

A complete transportation management plan will be undertaken prior to construction, should the project be awarded preferred bidder status.

8 DESCRIPTION OF THE BASELINE ENVIRONMENT

This section of the EIA Report provides the description of the baseline environment of the proposed development site (within which the proposed project lies). The desktop baseline environmental assessment was presented in the Scoping Report (Arcus, 2017). This section highlights the significant findings of the site visits undertaken during the EIA phase of the process.

8.1 Climate

The climate of the area has a mostly summer rainfall distribution, but the annual average is low, at around 345 mm per year, although this might be slightly higher in the higher parts of the landscape. Temperatures are cool to cold in winter, with frequent frost, often heavy, between May and September.

8.2 Topography

The area consists of slightly undulating to steeply sloping topography, with slopes of less than 10% over much of the area, but becoming as steep as 80-100% on the escarpment zones of the upper mountain slopes (Figure 7.4). The altitude of the area is between 1600 and 1700 metres in most of the area, but the highest parts are at over 1850 metres.

8.3 Geology & Soils and Agricultural Potential

The area is underlain by mudstone of the Beaufort and Tarkastad Groups, Karoo Sequence, along with small areas of dolerite intrusions (Figure 8.1).

The area under investigation is covered by six land types (Figure 8.2), namely:

- Da77 (Duplex soils[35], mostly red);
- Fb174, Fb259, Fb372, Fb373 (Shallow soils, occasionally calcareous); and
- Ib316 (Shallow soils with much rock).

There are a minimum of high potential soils in the study area and very few medium potential soils. Every land type is dominated by either (in the west) structured, clayey duplex soils (Swartland and Valsrivier forms) or rock and shallow lithosols (Mispah and Glenrosa soil forms), which have low to very low arable potential.

A summary of the dominant soil characteristics of each land type is given in Table 8.1. The far right column shows the distribution of dryland agricultural potential within each land type with the dominant class shown in bold. These figures add up to 100%, so that the relative proportions of each potential class within every land type can be determined and easily compared with other land types.

Current land use is dominantly natural vegetation (used for low intensity grazing), with a significant proportion of exposed rock (Figure 8.3). The prevailing agricultural potential is low to very low as a result of a combination of soil restrictions (shallow depth, steep slopes and/or clay-rich duplex soils and climatic factors (low rainfall of 350 mm per annum). There is little or no agriculture being practiced in the vicinity of the proposed development.

[35] Soils with a relatively sandy topsoil horizon abruptly overlying a structured, clayey subsoil horizon

The low rainfall in the area means that there is low to very low potential for rain-fed arable agriculture in the area. Arable production would therefore be problematic without irrigation. Currently, only a few small cultivated lands can be identified, and these occur in the west of the area on the farms Hartebeeshoek and Beskuitfontein (land type Da77).

In general, the soils are suited for extensive grazing at best and the grazing capacity of the area is relatively low, at around 18-25 ha/large stock unit[36].

Table 8.1: Land Types occurring (with Soils in Order of Dominance)

Land Type	Dominant soils	Depth (mm)	Percent of land type	Characteristics	Agric. Potential (%)
Da77	Swartland 10/11 + Valsrivier 21/41 Lithosols + rock	200-800 50-150	30% 22%	Red-brown, sandy topsoils on structured, sandy clay loam to sandy clay subsoils on weathering rock Grey-brown, sandy/loamy topsoils on hard rock, with rock outcrops	High: 0.0 Mod: 12.2 **Low: 87.8**
Fb174	Mispah 10/20 Glenrosa 13/16	20-100 50-150	30% 23%	Grey-brown, sandy/loamy topsoils on hard rock/calcrete Grey-brown, sandy/loamy topsoils on weathering rock	High: 0.0 Mod: 12.3 **Low: 87.7**
Fb259	Mispah 10/22 Glenrosa 13/16	50-150 200-300	30% 20%	Grey-brown, sandy/loamy topsoils on hard rock/calcrete Grey-brown, sandy/loamy topsoils on weathering rock	High: 0.0 Mod: 12.0 **Low: 88.0**
Fb372	Mispah 10/20 Glenrosa 13/16	50-100 200-300	46% 18%	Grey-brown, sandy/loamy topsoils on hard rock/calcrete Grey-brown, sandy/loamy topsoils on weathering rock	High: 0.0 Mod: 13.1 **Low: 86.9**
Fb373	Mispah 10/22 Swartland 11/12 + Valsrivier 21/41	50-150 200-900	27% 16%	Grey-brown, sandy/loamy topsoils on hard rock/calcrete Red-brown, sandy topsoils on structured, sandy clay loam to sandy clay subsoils on weathering rock	High: 0.0 Mod: 7.1 **Low: 92.9**
Ib316	Rock Mispah 10	- 50-100	62% 18%	Surface rock outcrops Grey-brown, sandy/loamy topsoils on hard rock	High: 0.0 Mod: 3.4 **Low: 96.6**

8.4 Freshwater and Wetlands

The results of the respective surveys in 2016 and 2017 coincided with summer and early spring cycles, both following some degree of rainfall, totalling 6 full days in the field. However, the site was also visited during the 2012-2014 period when heavy rainfalls had occurred thus an understanding of the area by the specialist is known during both winter/summer and flooding/drought events.

[36] ARC-ISCW, 2004. Overview of the status of the agricultural natural resources of South Africa (First Edition). ARC-Institute for Soil, Climate and Water, Pretoria.

The proposed development occurs within the following catchments associated with the Drought Corridor Ecoregion spanning the boundary between the Orange and Mzimvubu / Tsitsikamma Water Management Areas.

The WEF site is situated in the following subquaternary catchments (Figure 8.4):

- Q11C – Rooispruit River
- Q14B - Droe River
- D32G – Noupoortspruit
- D32C – Kleinseekoei (Portions of the transmission alternatives only)

These catchments are characterised by several perennial water courses and drainage lines associated with these mainstem systems listed above (Photograph 8.1 and 8.2). The larger systems are characterised by alluvial riverbeds / washes. Most of these showing signs of erosion, with large head cuts forming in the upper catchment / foothills of these systems located within the study area. The turbines are however located on the higher lying ridges, and only the required road crossings would have a direct impact on these systems. The closest turbine was measured at 60m from one such system, while the remainder are far greater distances from the centre lines of the observed water courses.

Photograph 8.1: Smaller foothill systems containing water

Photograph 8.2: water courses showing erosion or head cut formation

The transmission line alternatives similarly span several systems, dominated by alluvial sediment transport systems, but also show some degree of alteration due to local road networks and grazing. The greatest current impact within the whole study area is the creation of dams, which are contributing to habitat fragmentation within the water courses as well as changes to the hydrological regimes of the riverine systems.

In terms of the National Freshwater Ecosystems Priority Areas (NFEPA) assessment, all of watercourses within the site were assigned condition scores between AB and C (Nel *et al.* 2011), indicating that they largely intact or moderately modified, but still with biological function. This is largely due to these catchments falling with the headwaters of the Gariep (Orange) River and thus some (D32C & G) were earmarked as upstream support areas for important fish habitats located in the Gariep River, by the NFEPA assessment.

The proposed transmission lines within the D32C catchment will cross the observed rivers within reaches that were classed as C (Moderately Modified) but it is anticipated that all towers could span these systems including their respective riparian zones (i.e. the 32m buffer). The riparian systems are mostly limited to a grass species associated with water courses, but no facultative or obligate species wetland species were found, i.e. species within any areas where soil moisture levels are higher, e.g. along roadsides were observed. These species included *Tenaxia disticha* (Mountain wire grass previously *Merxmerulla disticha*), *Miscanthus ecklonii* (previously *Miscanthus capensis*), *Agrostis lachnantha*. The only obligate tree species found included Willow trees (*Salix mucronata*) both near the Wind Farm and along the transmission line routes. The only well-defined riparian system was located on a tributary of the Noupoortspruit River, which was shown a high degree of Sweet thorn (*Vachellia karroo*) encroachment. No new direct impacts on this system are anticipated as the Oorlogskloof, the access road to the WEF is already constructed and was used by the Noupoort WEF.

The wetlands (seeps and valley bottom systems) that were found on the Noupoort WEF site, where not evident within this project area (WEF) and this is possibly due to the site mostly being on the Eastern and Northern slopes of the mountain ranges which are typically drier. This coupled to the fact that most of the study area is located on the highest lying areas of the upper plateaus. This was also confirmed by the National Wetland Inventory (ver 5.2), which indicated that no natural wetlands are located within the site and any of the springs which result in the wetland seeps within the area are all located within the WEF site.

The only wetland areas (Phragmites dominated reedbeds) observed were located within the Droe River and will not be affected by the transmission line alternatives, i.e. more than 3km away from the closest alternative alignment. These wetlands are intersected by the N10, and have always had higher runoff volumes than most rivers within the region possibly due to the road and its associated stormwater management structures, resulting in these small wetlands.

According to the National Freshwater Ecosystems Priority Area (NFEPA) wetland data, no natural wetlands occur within the study area. The waterbodies identified are artificial or man-made systems. This was verified during the site visit that no natural wetlands were observed within the WEF or transmission line alignments.

Figure 8.5 indicates significant watercourses observed within the site. Any activities within these areas or the 32 m buffer (or the 1:100 floodline, whichever is the greatest) will require a Water Use license (possible General Authorisation) should any structures (e.g. transmission line towers) be placed within these zones. At this point only the two water course crossings within the WEF are anticipated.

However, it has been assumed that all the proposed transmission lines (all alternatives) projects could adequately span any water courses, thus no direct impacts on these ephemeral systems are anticipated.

8.4.1 Present Ecological State and Conservation Importance

The Present Ecological State of a river represents the extent to which it has changed from the reference or near pristine condition (Category A) towards a highly impacted system where there has been an extensive loss of natural habit and biota, as well as ecosystem functioning (Category E).

The national Present Ecological Score or PES scores have been revised for the country and based on the new models, aspects of functional importance as well as direct and indirect impacts have been included (DWS, 2014). The new PES system also incorporates EI (Ecological Importance) and ES (Ecological Sensitivity) separately as opposed to EIS (Ecological Importance and Sensitivity) in the old model. Although the new model is still heavily centered on rating rivers using broad fish, invertebrate, riparian vegetation and water quality indicators. The Recommended Ecological Category (REC) is still contained within the new models, with the default REC being B, when little or no information is available to assess the system or when only one of the above mentioned parameters is assessed or then overall PES is rated between a C or D.

The Present Ecological State scores (PES) for the drainage lines and the rivers in the study area were rated as follows (DWS, 2014 – where A = Natural or Close to Natural & B = Moderately Modified):

Subquaternary Catchment Number	Present Ecological State	Ecological Importance	Ecological Sensitivity
5861	C	Moderate	Moderate

6007	C	Low	Moderate
6010	C	Low	Moderate
6082	B	High	Moderate
6103	C	Moderate	Moderate

It is thus evident that the study area systems are largely functional and or have limited impacts as a result of current land use practices. Current impacts are mostly associated with grazing, livestock trampling, the large number of farm dams and alien Poplar trees (*Populus X canescens*).

This was confirmed for each of the affected reaches located within the development footprint and in particular the areas that would be crossed by the proposed road layout shown in Figure 6.1 (Two Crossings). In other words, the systems observed are largely natural, with small or narrow riparian zones, dominated by *Searsia lancea* and *Vachellia karroo.* The only obligate species observed include small areas of *Juncus rigidus* and *Phragmites australis* associated with small pools created by road culverts found throughout the study area.

8.5 Flora & Terrestrial Fauna

8.5.1 Vegetation Types

Four vegetation types occur within the study area (Figure 8.6). The majority of the proposed development site falls within the Karoo Escarpment Grassland vegetation type, with Tarkastad Montane Shrubland on the adjacent slopes and Eastern Upper Karoo on the plains. The slopes along the grid connection route alternatives also include areas of Besemkaree Koppies Shrubland. These different units are briefly described below and then illustrated and characterised as they occur at the site.

Karoo Escarpment Grassland is listed as Least Threatened, but it has very little area under formal protection (<4%) and contains many Camdebo endemic species. The vegetation type is associated with shallow soils typical of lb, Fb and Fc land types on mudstones and sandstones of the Beaufort Group and includes dolerite intrusions which form ridges in the area. Levels of transformation are however low and it is considered to be more than 97% intact.

Within the site, Karoo Escarpment Grassland is mapped as occurring on the high-lying plateau area of the San Kraal study area[29]. However, the site visit revealed that some of the high-lying areas along the grid connection routes west of the N9 also correspond with this unit. The majority of the San Kraal WEF development footprint would be within this vegetation unit. Overall, these areas were generally fairly homogenous with not a lot of variation in species composition or habitat condition. The plateau areas dominated by Karoo Escarpment Grassland are generally flat to gently sloping with sandy soils interspersed with occasional low rocky areas and small outcrops which have a higher proportion of woody species.

Within the site, the areas of Karoo Escarpment Grassland are dominated by grasses and shrubs. Trees and taller shrubs are not common in the open veld, but are usually prevalent around the rocky outcrops which occur scattered across the plateau areas. The abundance of species of conservation concern within this habitat is relatively low and no species of high conservation concern were observed. Some provincially protected species are however present including *Brunsvigia radulosa, Boophone disticha, Aloe broomii var. broomii* and *Avonia ustulata.*

The Tarkastad Montane Shrubland vegetation type occurs in the Eastern Cape and slightly into the Northern Cape, with Noupoort and Middelburg defining the western extent of this unit. It is characterised by ridges, hills and isolated mountain slopes, often covered in large, round boulders and the vegetation consists of low, semi-open, mixed shrubland with 'white' grasses and dwarf shrubs forming a large component. The unit's soils are sedimentary rocks of the Beaufort Group, with dolerite intrusions. The vegetation type is considered Least Threatened although less than 2% is formally protected. One of the important taxa from this vegetation type is the rare cycad *Encephalartos friderici-guilielmi* but this does not appear to occur in the vicinity of the site.

Tarkastad Montane Shrubland is mapped as occurring east of the N9 and is replaced by Besemkaree Koppies Shrubland west of the N9. However, based on the site visit, there did not appear to be a material difference in the vegetation composition of the slopes between the east and west of the site. Due to the lack of differentiation of these two units in the study area, they are described together as a single unit here. The lower layer of the vegetation is dominated by dwarf small-leaved shrubs and the upper layer is dominated by tall shrubs. The geology consists of dolerite koppies and sills embedded within Karoo Super Group sediments. The vegetation is classified as Least Threatened and the target for conservation is 28%; only 5% is formally conserved at present.

The slopes of the site are differentiated from the plains and plateau areas in that the vegetation tends to be denser and at least on wetter aspect slopes, contains a significantly higher abundance of taller woody species. The grass component is largely similar to the plateau areas with some changes in abundance. Although the abundance of species of conservation concern within this habitat is relatively low, the slopes are generally considered sensitive on account of the high diversity of these areas as well as their vulnerability to soil erosion. The development footprint in this habitat is however low and restricted to a few turbines and some access roads.

The Eastern Upper Karoo vegetation type is one of the largest vegetation types in the country and consists of flat and gently sloping plains vegetation dominated by dwarf microphyllous shrubs with 'white' grasses. The Eastern Upper Karoo is classified as Least Threatened and less than 2% has been transformed. The vegetation type is however poorly represented in formal protected areas. Its geology consists of mudstones and sandstones of the Beaufort Group supporting duplex soils, which are vulnerable to erosion. Species of conservation concern were not abundant and this habitat is not considered sensitive.

8.5.2 Listed & Protected Plant Species

According to the SANBI POSA database, 112 indigenous plant species have been recorded from the four degree squares around the site, which is clearly an underestimate and reflects the poor historical sampling of the area rather than an indication of the species richness of the site. There is a relatively low number (13) of species of conservation concern known from the area, but given the low number of records there are likely to be additional species present as well. Species which can be confirmed present in the area include *Anacampseros subnuda subsp. lubbersii* (Vulnerable), *Boophone disticha* (Declining) and *Pelargonium sidoides*, which is listed as Declining on account of heavy harvesting pressure for use in herbal and traditional medicine. This species is common in the higher lying grasslands of the site. Listed and protected species are usually confined to specific habitats such as wetlands and rock pavements which occur mostly around the edge of the plateau areas or other exposed ridges within the site. Some species such as *Boophone* and *Pelargonium sidoides* are however widespread and avoiding these would be more difficult.

8.5.3 Mammals

At least 50 mammal species potentially occur at the site. Due to the diversity of habitats available, which includes rocky uplands and ridges, some small wetlands areas, as well as open plains and low shrublands, the majority of species with a distribution that includes the site are likely to be present in at least part of the broader site. The mammalian community is therefore relatively rich and due to the remote and inaccessible nature of large parts of the area current disturbance levels are generally relatively low.

Medium sized carnivores such as jackal and caracal are relatively common in the area, despite widespread eradication efforts by livestock farmers in the region. The ridges, hills and uplands of the site, with rocky outcrops, rocky bluffs and cliffs provide suitable habitat for species which require or prefer rock cover such as Cape Rock Elephant Shrew, Smith's Red Rock Hare, Namaqua Rock Mouse, and Rock Hyrax. The lowlands contain an abundance of species associated with lowland habitats and deeper soils, which includes the Bush Vlei Rat, Hairy-footed Gerbil, and Common Duiker.

A number of antelope are relatively common at the site and would potentially be impacted by the development. Springbuck are confined by fences and occur only where farmers have introduced them or allowed them to persist and should be considered as part of the farming system rather than as wildlife per se. Both Duiker and Steenbok are adaptable species that are able to tolerate moderate to high levels of human activity and are not likely to be highly sensitive to the disturbance associated with the development. Grey Rhebok and Mountain Rhebok are usually present on the higher-lying ground where turbines are more likely to be located.

8.5.4 Reptiles

There is a wide range of habitats for reptiles present at the site, including rocky uplands and cliffs, open flat and lowlands and densely vegetated areas. As a result the site is likely to have a relatively rich reptile fauna which is potentially composed of 2 tortoise species, 15 snakes species, 16 lizard species and skinks, one chameleon and 5 gecko species. The rocky outcrops are of above average sensitivity for reptiles due to the likely presence of a variety of associated species and general shelter and cover provided by these areas. Similarly, the more-densely vegetated wetlands and kloofs are also likely to be of significance. While no snakes were found during the site visit, which can probably be ascribed to the dry conditions, a variety of lizards and skinks were captured or observed and proved to be very abundant in some areas. The flat mudstone rocks that characterise the high-lying plateau areas create an abundance of narrow crevices which are particularly attractive for reptiles. Species observed include Karoo Girdled Lizard, Ground Agama, Rock Agama, Spotted Sand Lizard, Burchell's Sand Lizard, Rock Monitor and Red-sided Skink.

8.5.5 Amphibians

Although there are no perennial rivers within the site, there are several areas where amphibians are present and breeding. There are a number of farm dams distributed across the site with frogs present as well as pools in rocky reaches of the streams which offer breeding opportunities. In particular, there is narrow gorge on the eastern margin of the plateau of the San Kraal site, which contains springs that maintain pools within the stream bed that contain a variety of frogs. This was identified as an important area for frogs at the site. This area has been classified as a no-go area as such perennial springs are rare in the landscape and should be protected from impact.

8.5.6 Critical Biodiversity Areas and Broad-Scale Ecological Processes

The Northern Cape Critical Biodiversity Areas (CBAs) (Oosthuysen & Holness 2016) biodiversity assessment identifies biodiversity priority areas which should be maintained in a natural to near natural state (Figure 8.7). The CBA maps indicate the most efficient selection and classification of land portions requiring safeguarding in order to maintain ecosystem functioning and meet national biodiversity objectives. Although the site also intrudes into the Eastern Cape, there are no Eastern Cape CBAs within the study area.

A small portion of the eastern section of the San Kraal WEF is located within a Tier 1 CBA. In addition, the majority of the grid connection route alternatives is located within a Tier 2 CBA. This is a potentially significant issue for the development as some types of development are not compatible with the stated conservation goals of CBAs. However, based on the technical report which accompanies the CBA map, it appears that the CBAs in the east are determined primarily due to their potential as areas supporting climate change resilience and in the south west due their potential as conservation expansion areas associated with the Karoo Seekoei River Nature Reserve.

Based on the above, the primary drivers for the CBAs in the area are related to the maintenance of ecosystem processes and not to protect biodiversity patterns, as the area does not have any features of known high significance in this regard (i.e. rare habitats or an abundance of localised or endangered species).

The suitability of the development of a wind farm in the area therefore centers on the extent to which the development can be considered compatible with the presence and functioning of the CBAs and the extent to which it may compromise or disrupt the processes the CBAs are intended to protect. A key component of the development that needs to be considered in this regard is the total footprint of the development. Transformation of intact habitat is a key driver of habitat loss and is also the main driver leading to declines in ecosystem function and the effective delivery of ecosystem services. The total footprint of the wind farm component of the development can be estimated at approximately 150ha of which about 10% is within the CBAs. In context of the 10 000ha site this is relatively small proportion of the site and with the appropriate mitigation is not likely to significantly disrupt or alter the ability of the landscape to provide ecosystem services or provide gradients and corridors for flora and faunal movement and dispersal. The development will however result in some habitat loss within the high elevation parts of the site equivalent to about 2.5% of the extent of Karoo Escarpment Grassland that is within the site. This will have a limited impact on the habitat quality of these areas as the habitat will be somewhat fragmented and the additional disturbance caused by the turbines may be a deterrent for some species.

8.6 *Ecological Sensitivity*

The sensitivity of the San Kraal Wind Farm site (Figure 8.8) is determined largely by the topography and elevation of the landscape. The low-lying plains are dominated by Eastern Upper Karoo which is a widespread vegetation type of low overall sensitivity, with few species or features of concern. The slopes of the site are often steep and considered generally of moderate to high sensitivity on account of their high biodiversity value for fauna and flora as well as their vulnerability to disturbance and consequent erosion. The high-lying plateau areas consist of Karoo Escarpment Grassland and are considered potentially sensitive due to the higher elevation and limited extent, but in practice these areas were observed to contain few species or features of concern and are considered to be of moderate sensitivity, although there are certain areas of higher sensitivity present such as the narrow gorge with springs that has been classified as a no-go area. All of the affected vegetation types are still overwhelmingly intact and have not been significantly affected by transformation to date, with the result that the habitat loss that each would experience is not considered to be of high significance.

The fauna of the area is composed of widespread species, with very few species of conservation concern likely to be present in the area. The most important areas for fauna at the site are the drainage systems and the well-vegetated slopes which are largely outside of the development footprint and would not be significantly affected. The rocky outcrops on the plateau were however observed to have a high abundance of reptiles, which relates to the weathering patterns of the mudstones and the resultant abundance of refugia.

8.7 Avifauna

The proposed development site is located approximately 30 km from the closest Important Bird Area (Platberg-Karoo Conservancy IBA SA037).

Six bird habitat types were identified: Grassy Karoo, waterbodies, slopes and cliffs, trees, high voltage and telephone lines and agricultural lands.

Grassy Karoo supports a particularly high diversity of endemic species, particularly lark species, and its avifauna typically comprises ground-dwelling, nomadic species of open habitats. Priority species potentially present are Ludwig's Bustard, which may occur in flocks following rainfall events, Karoo Korhaan, Blue Korhaan, Blue Crane, Booted Eagle, Martial Eagle, Steppe Buzzard, Southern Pale Chanting Goshawk, Northern Black Korhaan, Grey-winged Francolin, Greater Kestrel, Lesser Kestrel, Amur Falcon, Spotted Eagle-Owl, Melodious Lark, Black Harrier, Black-shouldered Kite, White Stork and Lanner Falcon. Secretarybird, Jackal Buzzard, Black Harrier and Verreaux's Eagle could occur irregularly CAR counts indicate particularly high densities of Blue Crane, Northern Black Korhaan and White Stork.

Waterbodies in the proposed development site consist of boreholes, small man-made dams and a few small pans. There are larger dams in the greater area, which when filled with water can act as roosting areas and focal points for waterbirds, Blue Crane and possibly Greater Flamingo.

Slopes and cliffs are potentially attracting Verreaux's Eagle, Booted Eagle, Jackal Buzzard, cape Eagle Owl, Lanner Falcon and African Rock Pipit.

Trees are only found as isolated stands of alien species at farmyards, dams and in Noupoort town. They potentially provide roosting and/or nesting habitat for Black Sparrowhawk, Rufous-chested Sparrowhawk, Lesser kestrel, Black-shouldered Kite, Jackal Buzzard, Steppe Buzzard, Martial Eagle, Verreauxs' Eagle, Amur Falcon, Spotted Eagle-Owl and White Stork.

High voltage lines are an important potential roosting and breeding substrate for large raptors in the greater study area but no existing high voltage lines cross the proposed development site. There are two high voltage lines running through the centre of the study area along the N9 motorway, and also in the extreme south-west of the study area. There is an abandoned Martial Eagle nest on a power line approximately 16 km south of proposed development site. There are also a multitude of smaller reticulation and telephone lines which are used as perches by priority species such as Lesser Kestrel, Amur Falcon, Jackal Buzzard, Steppe Buzzard and Southern Pale Chanting Goshawks in the largely treeless environment.

There are a few agricultural lands in the area where lucerne is cultivated as fodder for livestock. Priority species which could be attracted to these fields are White Stork, Ludwig's Bustard, Blue Crane, Amur Falcon, Steppe Buzzard and Lesser Kestrel.

An estimated 184 species could potentially occur in the study area of which 32 are classified as priority species for wind farm developments (Table 8.2).

8.7.1 Pre-construction monitoring results

The Index of Kilometric Abundance (IKA) for all birds counted on walked transects was 23.85. The overall abundance of priority species was moderate with 0.37 birds/km recorded during drive transects and 0.53 priority species recorded during walked transects. Grey-winged Francolin and African Rock Pipit were the most frequently recorded priority species on transects, which reflects the mountainous and grassland character of the area.

240 hours of vantage point (VP) watches recorded 64 individual flights by eight priority species flying for a total of 02:45:15. Of this 01:54:00 was by Lesser Kestrel, of which 01:16:00 was at medium altitude (30 – 220 m, i.e. rotor swept height), and the balance below rotor swept height. Verreauxs' Eagle was recorded flying for 00:23:00 in 240 hours of observations, of which only two minutes were at medium height, and the balance above 220 m altitude. Blue Crane was recorded flying for a total of 00:13:00 with only one minute and thirty seconds at risk height. Martial Eagle was recorded for 00:12:15 of which three minutes were at medium height. Steppe Buzzard was recorded for three minutes at high altitude, Greater Kestrel for 00:01:45 at low altitude and Southern Pale Chanting Goshawk for 00:01:30 at rotor swept height

59.3% of all recorded flights were at medium altitude. The passage rate for priority species at all heights was 0.26 birds/hour. Lesser Kestrel was the most recorded priority species during pre-construction monitoring VP watches.

No priority species were recorded at the larger dams outside of the proposed development site that were monitored as focal sites. Only common species such as Yellow-billed Duck, Southern Pochard, Grey Heron, Black-winged Stilt, Red-knobbed Coot, South African Shelduck, Little Grebe and Egyptian Goose were recorded. This may be partially due to drought conditions at the time of the surveys.

A pair of Blue Crane with a chick was consistently recorded in the vicinity of two pans in the proposed development site that were monitored as focal sites. In natural habitat, Blue Cranes tend to select an area close to a waterbody for breeding, presumably as a safety measure. A study on Blue Crane nest selection in natural grassland habitat found that the mean proximity of water sources to the nests was 300 m. They also tend to breed in the same general area every year. It should therefore be assumed that the two small pans and the immediate surrounds are core habitat for the pair of Blue Cranes (Figure 8.9).

No evidence of breeding raptors was found within the proposed development site. This is possibly due to the cliffs being too low and not vertical enough to provide suitable nesting habitat.

A Verreauxs' Eagle nest was located to the west of the proposed development site and monitored as a focal site (Figure 8.9). The nest was in use during the initial site visit in April 2015. The nest was subsequently monitored for four seasons. Breeding activity was recorded in June 2015, but the pair did not breed successfully, and was not recorded at the nest again that year. An adult bird was recorded soaring near the nest in October 2015, and the nest showed signs of still being occupied (fresh droppings). The nest was subsequently inspected several times after the 12-months monitoring had come to an end, the latest inspection having been performed on 10 and 11 August 2017, but the nest was not active. The nest has now been inactive since June 2015, with the last breeding activity was observed more than two years ago. While it cannot be assumed yet that the territory has been abandoned, it seems increasingly likely to be the case. The reason for that might be human disturbance, as the nest is accessible and human activity has been observed at the nest previously by the field monitors.

There are several Verreaux's Eagle nests south of the study area, but they all fall outside the immediate vicinity of the proposed development area. However, one of the nests is located on a cliff approximately 500 m from where Alternative C for the turn-in to the proposed Umsobomvu MTS is located. Although this distance is probably enough to prevent any disturbance impacts on the eagles, it would still be preferable to use Alternative A or B which will eliminate any risk of disturbance.

8.7.2 Current Impacts on Avifauna

The avifauna of the Karoo environment is currently impacted by overgrazing, resulting in a loss of habitat and a decrease in food availability. Poisoning of damage-causing predators such as Black-backed Jackal and Caracal has reduced raptor populations and continues without quantification or confirmation of this impact. Road-kills are a common cause of mortality for birds, especially nocturnal species, such as Cape Eagle Owl.

Three wind and several solar development are approved or proposed within a 35 km radius around the proposed development site, which has implications for several priority species, both in terms of collision mortality for some species, especially raptors, and displacement due to permanent habitat transformation, which affects most of the priority species to some degree. Numerous existing and new power lines are significant threats to large terrestrial priority species in the Karoo. Power lines kill substantial numbers of all large terrestrial bird species in the Karoo, including threatened species such as Karoo Korhaan, Kori Bustard and Ludwig's Bustard. There is currently no completely effective mitigation method to prevent collisions.

Climate change scenarios for the region predict slightly higher summer rainfall by 2050, and increased rainfall variability. Droughts are expected to become more severe. The climate change is predicted to have both positive and negative consequences for priority species. Increased summer rainfall could improve survival, and conversely drought years can lower long-term average survival. Large, mainly resident species dependent on rainfall are also more vulnerable to climate change. This would include the slow-breeding Martial Eagle, which also exhibit extended parental care. Severe hailstorms kill many priority species, e.g. Lesser Kestrel, and could become more frequent.

There is a potential threat of shale gas fracking throughout the Karoo. Populations of bird species may be locally reduced through disturbance caused by lights, vibration, vehicles and dust, and may be affected by pollutants in ponds containing contaminated water produced by returned fracking fluids.

Although it is difficult to prove, the direct persecution of raptors such as Verreaux's Eagle and Martial Eagle for stock predation is still taking place.

8.7.3 Avifaunal Sensitivity

Based on the results of 12 months of pre-construction monitoring no-go areas, in which no turbines or infrastructure is permitted, where identified as a 2.5 km area surrounding the Verreauxs' Eagle nest to the west of the proposed development site, as well as a 500 m area surrounding the Blue Crane breeding pans within the proposed development site. (Figure 8.9). In addition, no turbine areas, in which other infrastructure is permitted, were identified as a 150 m set back buffer zone around the escarpment, where there is a higher collision risk for slope soaring species.

Table 8.2: Priority species potentially occurring in the proposed development site

Family name	Taxonomic name	Global status	Regional status	Endemic status South Africa	Endemic status Southern Africa	SABAP2 reporting rate	Recorded during pre-construction monitoring	Potential impacts: Collisions with power line	Collisions with turbines	Displacement through disturbance	Displacement through habitat transformation
Bustard, Ludwig's	Neotis ludwigii	EN	EN		(*)	4.41	x	**x**	**x**	**x***	**x**
Buzzard, Jackal	Buteo rufofuscus			(*)	*	34.62	x		x		
Crane, Blue	Anthropoides paradiseus	VU	NT		*	42.65	x	x	x	x*	
Eagle, Booted	Hieraaetus pennatus					20.59	x		x		
Eagle, Martial	Polemaetus bellicosus	VU	EN			2.94	x		x		
Eagle, Verreaux's	Aquila verreauxii	LC	VU			16.18	x		x		
Francolin, Grey-winged	Scleroptila afra			SLS	*	30.88	x		x	x*	
Goshawk, Southern Pale Chanting	Melierax canorus				(*)	23.53			x		
Kestrel, Greater	Falco rupicoloides					2.94			x		
Kestrel, Lesser	Falco naumanni					35.29	x		x		
Kestrel, Rock	Falco rupicolus					38.24	x		x		
Lark, Melodious	Mirafra cheniana	NT	LC	(*)	*	2.94			x	x*	
Pipit, African Rock	Anthus crenatus	LC	NT	SLS	*	39.71	x		x	x*	x
Sparrowhawk, Rufous-chested	Accipiter rufiventris					1.47					
Buzzard, Steppe	Buteo buteo					14.71			x		

Family name	Taxonomic name	Global status	Regional status	Endemic status South Africa	Endemic status Southern Africa	SABAP2 reporting rate	Recorded during pre-construction monitoring	Potential impacts			
								Collisions with power line	Collisions with turbines	Displacement through disturbance	Displacement through habitat transformation
Eagle, Tawny	Aquila rapax	LC	EN			1.47			x		
Eagle, African Fish	Haliaeetus vocifer					0	x	x	x		
Eagle-owl, Cape	Bubo capensis					1.47	x		x		
Eagle-owl, Spotted	Bubo africanus					5.88			x		
Falcon, Amur	Falco amurensis					7.35			x		
Falcon, Lanner	Falco biarmicus	LC	VU			2.94			x		
Flamingo, Greater	Phoenicopterus roseus	LC	NT			1.47		x			
Harrier, Black	Circus maurus	VU	EN	(*)	*	0			x		
Hawk, African Harrier-	Polyboroides typus					1.47	x		x		
Kite, Black-shouldered	Elanus caeruleus					13.24			x		
Korhaan, Blue	Eupodotis caerulescens	NT	LC	SLS	*	10.29	x	x	x	x*	x
Korhaan, Karoo	Eupodotis vigorsii	LC	NT		*	1.47		x	x	x*	x
Korhaan, Northern Black	Afrotis afraoides				*	33.82	x	x	x	x*	x
Secretarybird	Sagittarius serpentarius	VU	VU			0		x	x	x*	
Sparrowhawk, Black	Accipiter melanoleucus					1.47					
Stork, Black	Ciconia nigra	LC	VU			2.94		x	x		

Family name	Taxonomic name	Global status	Regional status	Endemic status South Africa	Endemic status Southern Africa	SABAP2 reporting rate	Recorded during pre-construction monitoring	Potential impacts			
								Collisions with power line	Collisions with turbines	Displacement through disturbance	Displacement through habitat transformation
Stork, White	Ciconia ciconia					5.88		x	x	x*	

8.8 Bats

Three factors need to be present for most South African bats to be prevalent in an area: availability of roosting space, food (insects/arthropods or fruit), and accessible open water sources. The importance of these factors can vary greatly between bat species, their respective behaviour and ecology. Nevertheless, bat activity, abundance and diversity are likely to be higher in areas supporting all three above-mentioned factors.

The site was evaluated in terms of the amount of 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 (influences insects and acts as a source of drinking water) to identify bat species that may be impacted by wind turbines. This evaluation is done chiefly by studying the geographic literature of each site, available satellite imagery and observations during site visits. Species probability of occurrence, based on the above-mentioned factors, is estimated for the site and the surrounding larger area.

"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. The probability of occurrence is described by a percentage indicative of the expected numbers of individuals present on site and the frequency with which the site will be visited by the species (in other words the likelihood of encountering the bat species).

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 Sowler *et al.* (2016) based on species distributions, altitudes at which they fly and distances they travel; and assumes a 100% probability of occurrence. The ecology of most applicable bat species recorded in the vicinity of the site is discussed in the table below.

8.8.1 Abundance and Composition of Assemblages

Average bat passes detected per bat detector night (nights on which detectors recorded correctly) and total number of bat passes detected over the monitoring period by all systems are displayed. Five bat species were detected by the passive monitoring systems, namely, *Eptesicus hottentotus, Miniopterus natalensis, Neoromicia capensis, Rhinolophus clivosus* and *Tadarida aegyptiaca.*

Tadarida aegyptiaca and *Neoromicia capensis* are the most abundant bat species recorded by all systems. Common and abundant species, such as *Neoromicia capensis, Tadarida aegyptiaca* and *Miniopterus natalensis*, are of a larger value to the local ecosystems as they provide a greater contribution to most ecological services than the rarer species due to their higher numbers.

Miniopterus natalensis is the only migratory species detected on site. The results of the full 12 months have been analysed for the presence of a migratory event. However, no migratory event was detected by the three passive monitoring systems. Thus, the results are indicative of the site not being within a migratory route.

The Met Mast East, and Short Mast 4, monitoring systems detected a significantly higher number of bat passes than any of the other monitoring systems.

The Met Mast East, Short Mast 3 and Short Mast 4 monitoring systems show the general trend of increased bat activity during Spring and Summer, and lowered bat activity over the winter months from June. All monitoring systems display a relatively sustained level of activity throughout the months of September 2015 to April 2016, with Met Mast East and Short Mast 3 having highest activity during March and Short Mast 4 indicating highest activity in December 2015. Whereas Short Mast 5 monitoring system only detected bat passes over certain months due to possible tampering, and later due to theft.

Species	Common name	Probability of occurrence (%)	Conservation status	Possible roosting habitat on site	Possible foraging habitat utilised on site	Likelihood of risk of fatality (Sowler *et al.*, 2016)
Eptesicus hottentotus	Long-tailed serotine	70 - 80	Least Concern	It is a crevice dweller roosting in rock crevices, expansion joints in bridges and road culverts	It seems to prefer woodland habitats, but has been caught in granitic hills and near rocky outcrops. Clutter edge forager	Medium
Cistugo lesueuri	Lesueur's Wing- gland bat	10 - 20	Vulnerable	Roosts in rock crevices near water. Associated with broken terrain in high-altitude montane grasslands.	Not well known, probably near water.	Not known
Miniopterus natalensis	Natal long-fingered bat	90 - 100	Near Threatened	It is mostly cave/mine dependent and hence the availability of suitable roosting sites is a critical factor in determining its presence. It may be found in the Noupoort copper mines. Have been found roosting singly or in small groups inside culverts and manmade hollows.	Forages around the edge of clutters of vegetation, and may therefore avoid most of the site and may only be found at the denser drainage systems. It is also dependant on open surface water sources.	Medium - High
Myotis tricolor	Temmink's myotis	20 - 30	Least Concern	Roosts gregariously in caves, but have been found roosting singly or in small groups inside culverts and manmade hollows.	It is restricted to areas with suitable caves or hollows, which may explain its absence from flat and featureless terrain; its close association with mountainous areas may therefore be due to its roosting requirements.	Medium - High
Neoromicia capensis	Cape serotine	90 - 100	Least Concern	Roosts under the bark of trees, at the base of aloe leaves, and inside the roofs of houses. The farm buildings are the most likely roosting space.	It appears to tolerate a wide range of environmental conditions from arid semi-desert areas to montane grasslands, forests, and savannas. Highly adaptable species, but a clutter edge forager limiting its utilisation of the site.	Medium - High

Nycteris thebaica	Egyptian slit-faced bat	10 - 20	Least Concern	Roosts in caves, aardvark burrows, culverts under roads and the trunks of large trees and hollows (manmade or natural). Roosting space unlikely on site.	It appears to occur throughout the savanna and karoo biomes, but avoids open grasslands. May be found in denser drainage systems. Relatively small foraging range and an open space forager	Low
Rhinolophus clivosus	Geoffroy's horseshoe bat	10 - 20	Least Concern	Roosts in caves, mine adits and hollows (manmade and natural).	Arid savanna, woodland and riparian forest. Clutter forager that may only possibly be found in denser drainage systems. Relatively small foraging range	Low
Rhinolophus capensis	Cape horseshoe bat	40 - 50	Near Threatened	Roosts in caves and mine adits	Forages predominantly in the canopy of trees	Low
Sauromys petrophilus	Roberts's flat-headed bat	60 - 70	Least Concern	Roosts in narrow cracks and under slabs of exfoliating rock. Closely associated with rocky habitats in dry woodland, mountain fynbos or arid scrub.	Open space forager with relatively large foraging range.	High
Tadarida aegyptiaca	Egyptian free-tailed bat	90 - 100	Least Concern	Roost in rock crevices, under exfoliating rocks, in hollow trees, and behind the bark of dead trees. The species has also taken to roosting in buildings, in particular roofs of houses.	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 with a relatively large foraging range. Open space forager	High

8.9 Noise

8.9.1 Environmental Sound Character

Natural sounds are a part of the environmental noise surrounding humans. In rural areas the sounds from insects and birds would dominate the ambient sound character, with noises such as wind flowing through vegetation increasing as wind speed increase. Work by Fégeant (2002) stressed the importance of wind speed and turbulence causing variations in the level of vegetation generated noise. In addition, factors such as the season (e.g. dry or no leaves versus green leaves), the type of vegetation (e.g. grass, conifers, deciduous), the vegetation density and the total vegetation surface all determine both the sound level as well as spectral characteristics.

Ambient sound levels are significantly affected by the area where the sound measurement location is situated. When the sound measurement location is situated within an urban area, close to industrial plants or areas with a constant sound source (ocean, rivers, etc.), seasons and even increased wind speeds have an insignificant to massive impact on ambient sound levels.

Sound levels in undeveloped rural areas (away from occupied dwellings) however are impacted by changes in season for a number of complex reasons. The two main reasons are:

- Faunal communication during the warmer spring and summer months as various species communicate in an effort to find mates; and
- Seasonal changes in weather patterns, mainly wind.

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 1000 m away can sound very loud or can be completely inaudible.

Other, environmental factors that impact on sound propagation includes wind, temperature and humidity, as discussed in the following sections.

Effect of wind on sound propagation

Wind alters sound propagation by the mechanism of refraction; that is, wind bends sound waves. Wind nearer to the ground moves more slowly than wind at higher altitudes, due to surface characteristics such as hills, trees, and man-made structures that interfere with the wind. This wind gradient, with faster wind at higher elevation and slower wind at lower elevation, causes sound waves to bend downward when they are traveling to a location downwind of the source and to bend upward when traveling toward a location upwind of the source. Waves bending downward means that a listener standing downwind of the source will hear louder noise levels than the listener standing upwind of the source. This phenomenon can significantly impact sound propagation over long distances and when wind speeds are high.

Over short distances, wind direction has a small impact on sound propagation as long as wind velocities are reasonably slow, i.e. less than 3 – 5 m/s.

Effect of temperature on sound propagation

On a typical sunny afternoon, air is warmest near the ground and temperature decreases at higher altitudes. This temperature gradient causes sound waves to refract upward, away from the ground and results in lower noise levels being heard at a measurement location. In the evening, this temperature gradient will reverse, resulting in cooler temperatures near the ground. This condition, often referred to is a temperature inversion will cause sound to bend downward toward the ground and results in louder noise levels at the listener position. Like wind gradients, temperature gradients can influence sound propagation over long distances and further complicate measurements.

Generally sound propagate better at lower temperatures (down to 10°C), and with everything being equal, a decrease in temperature from 32°C to 10°C would decrease the sound level at a listener 600 m away by 3 dB (at 1,000 Hz).

Effect of humidity on sound propagation

The effect of humidity on sound propagation is quite complex, but effectively relates how increased humidity changes the density of air. Lower density translates into faster sound wave travel, so sound waves travel faster at high humidity. With everything being equal, an increase in humidity from 20% to 80% would increase the sound level at a listener 600 m away by 3 dB (at 1,000 Hz).

Effect of wind speeds on vegetation and sound levels

Wind speed is a determining factor for sound levels at most rural locations. With no wind, there is little vegetation movement that could generate noises, however, as wind speeds increase, the rustling of leaves increases which subsequently can increase sound levels. This directly depends on the type of vegetation in a certain area. The impact of increased wind speeds on sound levels depends on the vegetation type (deciduous versus connivers), the density of vegetation in an area, seasonal changes (in winter deciduous trees are bare) as well as the height of this vegetation. This excludes the effect of faunal communication as vegetation may create suitable habitats and food sources.

Influence of wind on Noise Limits

Current local regulations and standards do not consider changing ambient (background) sound levels due to natural events such as can be found near the coast or areas where wind-induced noises are prevalent. This is unfeasible with wind energy facilities as these facilities will only operate when the wind is blowing. It is therefore important that the contribution of wind-induced noises be considered when determining the potential noise impact from such as a facility. Care should be taken when taking this approach due to other factors that complicate noise propagation from wind turbines.

While the total ambient sound levels are of importance, the spectral characteristics also determine the likelihood that someone will hear external noises that may or may not be similar in spectral characteristics to that of the vegetation that created the noise. Bolin (2006) did investigate spectral characteristics and determined that annoyance might occur at levels where noise generated by wind turbine noise exceeds natural ambient sounds with 3 dB or more.

Low frequency noises can also be associated with some wind turbines. Separating the potential low frequency noise from wind turbines from that generated by natural sources as well as other anthropogenic sources can and will be a challenge.

There are a number of factors that determine how ambient sound levels close to a dwelling (or the low-frequency noise levels inside the house) might differ from the ambient sound levels further away (or even at another dwelling in the area), including:

- Type of activities taking place in the vicinity of the dwelling;
- Equipment being used near the dwelling, especially equipment such as water pumps, compressors and air conditioners;
- Whether there are any windmills (*"windpompe"*) close to the dwelling as well as their general maintenance condition;
- Type of trees around dwelling (conifers vs. broad-leaved trees, habitat that it provides to birds, food that it may provide to birds);

- The number, type and distance between the dwelling (measuring point) and trees. This is especially relevant when the trees are directly against the house (where the branches can touch the roof);
- Distance to large infrastructural developments, including roads, railroads and even large diameter pipelines;
- Distances to other noise sources, whether anthropogenic or natural (such as the ocean or running water);
- The material used in the construction of the dwelling;
- The design of the building, including layout and number of openings;
- How well the dwelling is maintained; and
- The type and how many farm animals are in the vicinity of the dwelling.

8.9.2 Ambient Sound Measurements

Measurement Point INWEFLTASL01: Mrs. Eleanore van der Merwe

This location is approximately 20 km from the proposed San Kraal WEF and the data is used as the sound character is considered typical of the dwellings in the area (Figure 8.3 and 8.4).

The SLM equipment was erected in an open area in the garden adjacent to the house. There were dogs on the site but they were quiet. Sounds heard during the period the instrument was deployed and collected (approximately 60 – 80 minutes) are defined in Table 8.3.

Table 8.3: Noises/sounds heard during site visits at receptor INWEFLTASL01

<table>
<tr><th></th><th></th><th>During Deployment</th><th>During Collection</th></tr>
<tr><td rowspan="3">Magnitude Scale Code:
Barely Audible
Audible
Dominating or clearly audible</td><td>Faunal and natural</td><td>Bird calls dominated (Dominating or clearly audible). Bleating sheep clearly audible (Audible). Insect communication at times (clearly audible).</td><td>Bird call (Dominating or clearly audible). Bleating sheep clearly audible. (Audible)</td></tr>
<tr><td>Residential</td><td colspan="2">Dogs at house but they were relatively silent.</td></tr>
<tr><td>Industrial & transportation</td><td>Vehicles clearly audible during passing ((Audible).</td><td>-</td></tr>
</table>

Impulse equivalent sound levels (South African legislation): Table 8.4 defining the average values for the time period. This sound descriptor is mainly used in South Africa to define sound and noise levels. The instrument is set to measure the impulse time-weighted sound levels.

Fast equivalent sound levels (International guidelines): Fast-weighted 10-minute equivalent (average) sound levels for the day and night-time periods are shown in Table 8.4 defining the average values for the time period. 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.

Statistical sound levels (LA90,f): The LA90 level is presented in this report as it is used 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 the average sound level. LA90 is a statistical indicator that describes the noise level that is exceeded 90% of the time and frequently used to define the background sound level internationally. The instrument is set to fast time-weighting.

Measured maximum and minimum sound levels: These are statistical sound descriptors that can be used to characterise the sound levels in an area along with the other sound descriptors.

Table 8.4: Sound levels considering various sound level descriptors at INWEFLTASL01

	$L_{Amax,i}$ (dBA)	$L_{Aeq,i}$ (dBA)	$L_{Aeq,f}$ (dBA)	$L_{A90,f}$ (dBA90)	$L_{Amin,f}$ (dBA)	Comments
Day arithmetic average	-	44	40	30	-	-
Night arithmetic average	-	29	27	18	-	-
Day minimum	-	19	18	-	16	-
Day maximum	85	62	54	-	-	-
Night minimum	-	17	17	-	16	-
Night maximum	77	56	48	-	-	-
Day 1 equivalent	-	50	43	-	-	Late afternoon and evening only
Night 1 Equivalent	-	39	33	-	-	8 hour night equivalent average
Day 2 equivalent	-	49	45	-	-	16 hour day equivalent average
Night 2 Equivalent	-	42	35	-	-	8 hour night equivalent average
Day 3 equivalent	-	49	41	-	-	Early morning only

The data indicate an area with increased noise levels, but the noises are mainly from natural origin. As such the area can be considered naturally quiet.

Third octaves were measured and are displayed in the following Figures. Wind-induced noises had a significant impact on the data for the first day, night and most of the second day (the relatively smooth curves).

Lower frequency (20 – 250 Hz) – Noise sources of significance in this frequency band would include nature (wind and surf especially – indicated by a relative smooth curve) and sounds of anthropogenic origin and vehicles (engine sounds and electric motors – erratic bumps at certain frequencies). Lower frequencies tend to travel further through the atmosphere than higher frequencies.

There was no specific character identifiable at this location. There are various sources of sounds that generate acoustic energy in this frequency band.

Third octave surrounding the 1,000 Hz (200 – 2,000 Hz) – This range contains energy mostly associated with human speech (350 Hz – 2,000 Hz; mostly below 1,000 Hz) and dwelling noises (including sounds from larger animals such as chickens, dogs, goats, sheep and cattle). Road-tyre interaction (from vehicular traffic) normally features in 630 – 1,600 Hz range.

As with the low frequency component, there were little measurements that indicated sounds from any specific sound source. There were a few measurements at night that indicated noise in the 500 and 1,000Hz frequency bands.

Higher frequency (2,000 Hz upwards) – Smaller faunal species such as birds, crickets and cicada use this range to communicate and hunt etc.

As with the other frequencies bands, there were little significant sounds in this frequency band. Night-time was especially quiet, with a few measurements indicating sounds in the 2,500Hz (mainly afternoon) and 4,000 – 5,000Hz band (likely birds).

Compliance with international guidelines: Sound levels are typical of a rural area and the acceptable zone rating level would be typical of a rural area (35 dBA at night and 45 dBA during the day) as defined in SANS 10103.

Measurement Point INWEFLTASL02: Mr. Taljard

This location is approximately 4.5 km from the centre of the San Kraal WEF, around 1,400m from the closest wind turbine (Figure 8.3 and 8.4).

The SLM equipment was erected in an unused kraal approximately 100m from the main residential dwelling, mainly due to the presence of dogs around this residence. There was livestock (cattle) roaming in the area of the kraal. Sounds heard during the period the instrument was deployed and collected (approximately 60 – 80 minutes) are defined in Table 8.5.

Table 8.5: Noises/sounds heard during site visits at receptor INWEFLTASL02

		During Deployment	During Collection
Magnitude Scale Code: **Barely Audible** **Audible** **Dominating or clearly audible**	**Faunal and natural**	Bird calls (Dominating or clearly audible). Insects at times (Barely Audible).	Wind-induced noises (Dominating or clearly audible). Bird call (audible).
	Residential	-	-
	Industrial & transportation	Two petrol engines (driving pumps) (audible).	-

Impulse equivalent sound levels (South African legislation): Table 8.6 defining the average values for the time period. This sound descriptor is mainly used in South Africa to define sound and noise levels. The instrument is set to measure the impulse time-weighted sound levels.

Fast equivalent sound levels (International guidelines): Table 8.6 defining the average values for the time period. 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.

Statistical sound levels (LA90,f): The LA90 level is presented in this report as it is used 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 the average sound level. LA90 is a statistical indicator that describes the noise level that is exceeded 90% of the time and frequently used to define the background sound level internationally. The instrument is set to fast time-weighting.

Measured maximum and minimum sound levels: These are statistical sound descriptors that can be used to characterise the sound levels in an area along with the other sound descriptors.

Table 8.6: Sound levels considering various sound level descriptors at INWEFLTASL02

	$L_{Amax,i}$ (dBA)	$L_{Aeq,i}$ (dBA)	$L_{Aeq,f}$ (dBA)	$L_{A90,f}$ (dBA90)	$L_{Amin,f}$ (dBA)	Comments
Day arithmetic average	-	49	43	35	-	-
Night arithmetic average	-	33	29	22	-	-
Day minimum	-	24	20	-	9	-
Day maximum	79	65	57	-	-	-
Night minimum	-	19	16	-	9	-

Night maximum	65	51	43	-	-	-
Day 1 equivalent	-	50	44	-	-	Evening only
Night 1 Equivalent	-	43	34	-	-	8 hour night equivalent average
Day 2 equivalent	-	54	47	-	-	16 hour day equivalent average
Night 2 Equivalent	-	34	29	-	-	8 hour night equivalent average
Day 3 equivalent	-	54	47	-	-	Early morning only

The data indicate an area with increased noise levels during the day but that are very quiet at night. Daytime noises are the combination of wind-induced noises and sound typical of a working farm, with night-time sound levels being typical of a rural noise district. It should be noted that the quiet night-time measurements may also be due to the location being away from the typical vegetation and habitats found close to a residential dwelling, although, these sound levels are comparable to the sound levels measured at INWEFLTASL01.

Third octaves were measured and are displayed in the following Figures. Wind-induced noises had a significant impact on the data for the first day, night and most of the second day (the relatively smooth curves).

Lower frequency (20 – 250 Hz) – Noise sources of significance in this frequency band would include nature (wind and surf especially – indicated by a relative smooth curve) and sounds of anthropogenic origin and vehicles (engine sounds and electric motors – erratic bumps at certain frequencies). Lower frequencies tend to travel further through the atmosphere than higher frequencies.

Night-time measurements were generally devoid of sounds in this frequency band. Daytime measurements indicate various sources of sounds with acoustic energy in this frequency band. The second day indicates at least 3 distinctive sound sources, namely:

- Wind induced noises during the second day and third;
- A sound source with energy in the 20, 80 and 100Hz frequency bands, operational early morning;
- A sound source with energy in the 25, 50, 80 and 100 - 160Hz frequency bands, operational late afternoon and evening after the wind died down.

Third octave surrounding the 1,000 Hz (200 – 2,000 Hz) – This range contains energy mostly associated with human speech (350 Hz – 2,000 Hz; mostly below 1,000 Hz) and dwelling noises (including sounds from larger animals such as chickens, dogs, goats, sheep and cattle). Road-tyre interaction (from vehicular traffic) normally features in 630 – 1,600 Hz range.

Sounds in this frequency band were generally masked by wind-induced noises during the day, although afternoon, evening and night-time data indicating various sources of acoustical energy. The sound sources were relatively far from the microphone and are likely cattle.

Higher frequency (2,000 Hz upwards) – Smaller faunal species such as birds, crickets and cicada use this range to communicate and hunt etc.

Night-time measurements indicated a quiet area with little sound sources that communicated in this frequency band. A few measurements indicated peaks in the 4,000 and 20,000Hz frequencies. Daytime data indicate significant acoustic energy in the 2,500 – 5,000Hz frequency band, likely due to bird calls.

Compliance with international guidelines: While the daytime sound levels are elevated and higher than the sound levels typical of a rural area, night-time data indicate a quiet environment, typical of a rural noise district. Considering the developmental character of the area, the acceptable zone rating level would be typical of a rural area (35 dBA at night and 45 dBA during the day) as defined in SANS 10103.

Single measurements around project area

A number of single measurements were collected to gauge the ambient sound character and levels around the project site. Equipment used at these locations is defined in the following table.

The data collected and information about the measurement locations are presented in **Table 8.7**[37].

8.9.3 Ambient Sound Levels – Summary

The data indicate that traffic is a major source of the noise in the area, but the road traffic will only influence the sound levels in an area 500 – 1,000m from the road. Away from the roads (N9 and N10), the area have a high potential to be very quiet. Birds, faunal and wind-induced noises does influence sound levels and considering the data collected, wind-induced noises significantly influences sound levels as wind speeds increases.

There is a high confidence in the ambient sound levels measured and the subsequent Rating Levels determined. **For the purpose of the Environmental Noise Impact Assessment study, the strictest rating level (rural) will be used as defined in SANS 10103 (35 dBA at night, 45 dBA during the day during low wind conditions) for all the receptors living in the area.**

8.9.4 Current Noise Levels (Conceptual)

The Ambient sound levels were low and the area is considered naturally quiet. It is too far from any roads or any other significant noise sources to consider the potential cumulative impacts. As the night-time environment is of interest other activities in the area are highly unlikely to influence night-time sound levels. The larger project area is considered to have a sound character typical of a rural noise district.

[37] Note:

$L_{Aeq,i}$ - Equivalent (average) A-weighted impulse-time-weighted noise level
$L_{Aeq,f}$ - Equivalent (average) A-weighted fast-time-weighted noise level
L_{A90} - Noise level that is exceeded 90% or more of the time, A-weighted fast-time-weighted noise level

Table 8.7: Summary of singular noise measurement

Measurement location	$L_{Aeq,i}$ level (dBA)	$L_{Aeq,f}$ level (dBA)	L_{A90} Level (dBA90)	Comments
INWEFSTASL01	27	22	19	Next to road in rural area near entrance gate of Holbrook farm. Very quiet with sound of insects audible. Birds audible in distance. No wind.
INWEFSTASL02	33	27	19	Next to road in rural area. Birds dominant sound. Insects. Some wind gusts at times.
INWEFSTASL03	34	30	26	Lots more vegetation. Birds dominating. Some insects. Soft wind but little (audible) wind induced noises.
INWEFSTASL04	24	22	19	Wind induced noises dominates. Birds audible. Quiet location.
INWEFSTASL05	22	19	16	Birds audible. Quiet location. Low wind.
INWEFSTASL06	22	19	18	Birds audible. Quiet location. Low wind.
INWEFSTASL07	71	68	37	Wind induced noises. 22 cars, 3 trucks first measurement, 20 cars, 1 truck second measurement.
	70	67	32	
INWEFSTASL08	74	71	24	Noise from passing vehicles dominating during event. Dogs barking constant background. Voices. 16 cars first measurement, 20 cars second measurement.
	68	65	25	
INWEFSTASL09	55	52	29	Some wind induced noises. Insect sounds at time. 4 cars first measurement, 7 cars second measurement.
	68	63	26	
INWEFSTASL10	66	63	44	Dog at dwelling constant barking. Dove in distance. Sound level of 35 dBA due to dog. Max noise due to truck. 24 cars, 2 trucks first measurement, 14 cars and 2 trucks second measurement.
	66	62	42	
INWEFSTASL11	55	51	47	Wind induced noises dominate. Little traffic. Birds at times. 4 cars first measurement, 5 cars second measurement.
	62	59	49	
INWEFSTASL12	41	38	30	Wind induced noises dominate. Little traffic. Birds at times. 2 cars first measurement, 4 cars and 1 truck second measurement.
	60	54	27	

Figure 8.11 Potential Noise Sensitive Receptors

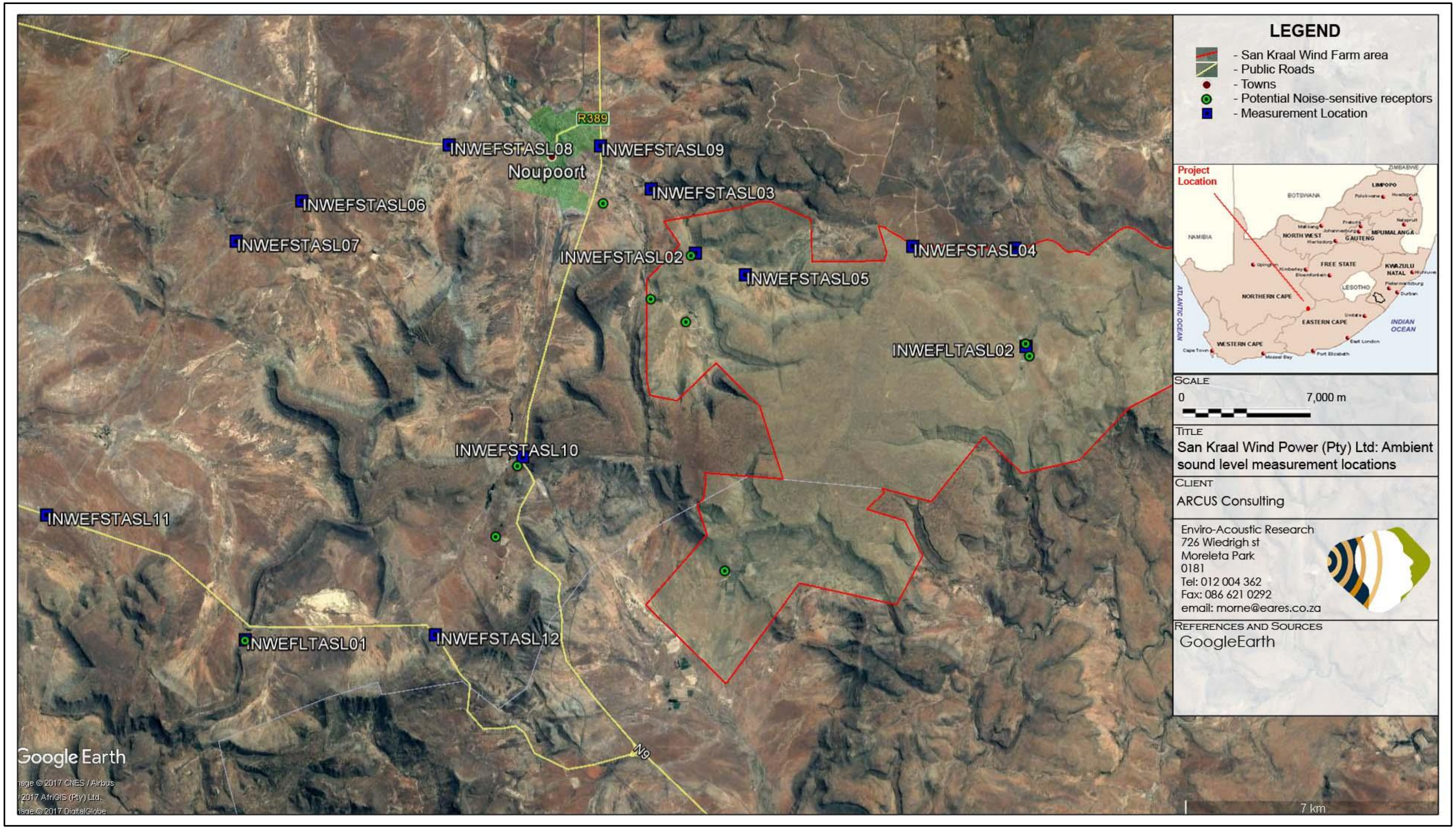


Figure 8.12 Location of ambient sound level measurements

8.10 Visual

The physical and land use-related characteristics of the study area contribute to its overall visual character, this includes topography, vegetation, and land use. Visual character can be defined based on the level of change or transformation from a completely natural setting, which would represent a natural baseline in which there is little evidence of human transformation of the landscape. Varying degrees of human transformation of a landscape would engender differing visual characteristics to that landscape, with a highly modified urban or industrial landscape being at the opposite end of the scale to a largely natural undisturbed landscape. Visual character is also influenced by the presence of built infrastructure such as buildings, roads and other objects such as telephone or electrical infrastructure.

The majority of the study area / visual assessment zone is considered to have a natural (almost vacant) visual character as natural shrub land prevails throughout the site and there is minimal human habitation and associated infrastructure. In addition, the predominant land use (livestock rearing) has not significantly transformed the natural landscape and the area has thus largely retained its natural rural character. It should be noted that the study area / visual assessment zone is also characterised by the presence of certain pastoral elements, which are expected to give the surrounding area a more pastoral feel. Built infrastructure across much of the study area / visual assessment zone is limited to a low density of gravel access roads, boundary fences, farm buildings, other farming infrastructure, such as windmills and an already operational WEF which can be found in the north-eastern section of the study area / visual assessment zone. As explained above, the low density of human settlement and associated low level of change to the natural environment has resulted in a largely rural or pastoral visual character with some existing WEF development present. In this context, the introduction of a WEF with associated power lines in the area could however be considered to be a further degrading factor, although an operational WEF is already present.

Divergence from the above-mentioned rural character however occurs in the area around the town of Noupoort. Although it is a small town, Noupoort has a concentration of housing and other buildings such as schools, hospitals and churches, as well as relatively large railway shunting yards to distinguish it from the surrounding rural landscape. The town thus has an urban visual character, which means that it is characterised more by anthropogenic objects (such as buildings and roads) than natural features. However it should be noted that the small population of the town, and its limited spatial extent in the town being firmly set in a rural setting, and the rapid change from the edge of the town to rangeland or commonage contributes to the limited spatial extent of its particular urban visual character.

Significant alteration to the rural or pastoral visual character is also evident in the north-eastern sector of the study area / visual assessment zone where the newly established Noupoort Wind Farm has introduced a more industrial-type visual character. The turbines of the Noupoort Wind Farm can be seen from various parts of the study area / visual assessment zone and are highly visible in the northern and north-eastern parts of the visual assessment zone, such as from within the town of Noupoort and the northern parts of the N9 national route.

The presence of these turbines has thus transformed the natural visual character of the northern and north-eastern parts of the study area / visual assessment zone to some degree. In addition, several other renewable energy facilities (solar and wind) are proposed within relatively close proximity to the proposed San Kraal WEF, which will further alter the visual character and baseline in the study area once constructed.

The scenic quality of the landscape is also an important factor that contributes to the visual character or inherent sense of place. Visual appeal is often associated with unique natural features or distinct variations in form. As such, the various hilly / mountainous terrain which occurs within the application site and within the wider study area / visual assessment zone are considered to be important features that would increase the scenic appeal and visual interest in the area.

The greater area surrounding the proposed development site is an important component when assessing visual character. The area can be considered to be typical of a Karoo or "platteland" landscape that would characteristically be encountered across the high-lying dry western and central interior of South Africa. Much of South Africa's dry Karoo interior consists of wide open, uninhabited spaces sparsely punctuated by widely scattered farmsteads and small towns.

The typical Karoo landscape can also be considered a valuable 'cultural landscape' in the South African context. Although the cultural landscape concept is relatively new, it is becoming an increasingly important concept in terms of the preservation and management of rural and urban settings across the world (Breedlove, 2002).

Cultural Landscapes can fall into three categories (according to the Committee's Operational Guidelines):

i. "a landscape designed and created intentionally by man";
ii. an "organically evolved landscape" which may be a "relict (or fossil) landscape" or a "continuing landscape";
iii. an "associative cultural landscape" which may be valued because of the "religious, artistic or cultural associations of the natural element"

The typical Karoo landscape consisting of wide open plains, and isolated relief, interspersed with isolated farmsteads, windmills and stock holding pens, is an important part of the cultural matrix of the South African environment. The Karoo farmstead is also a representation of how the harsh arid nature of the environment in this part of the country has shaped the predominant land use and economic activity practiced in the area, as well as the patterns of human habitation and interaction. The presence of small Karoo towns, such as Noupoort, engulfed by an otherwise rural environment, form an integral part of the wider Karoo landscape. As such, the Karoo landscape as it exists today has value as a cultural landscape in the South African context. In the context of the types of cultural landscape listed above, the Karoo cultural landscape would fall into the second category, that of an organically evolved, "continuing" landscape.

8.10.1 Visual Sensitivity

Based on the above factors, the study area is rated as having a moderately-low visual sensitivity. This is mainly owing to the rural or pastoral character of the area. An important factor contributing to the visual sensitivity of an area is the presence, or absence of visual receptors that may value the aesthetic quality of the landscape and depend on it to produce revenue and create jobs. Relatively few sensitive receptors are present in the study area. In addition, relatively few potentially sensitive receptors are present in the study area. Although no formal protected areas or leisure / nature-based tourism activities exist within the study area, the area would still be valued as a typical Karoo cultural landscape and for its scenic mountainous terrain.

The Noupoort Wind Farm is located directly adjacent to the proposed San Kraal WEF application site and is currently operational. In addition, several other renewable energy facilities (solar and wind) are proposed within relatively close proximity to the proposed project. As such, an assessment of the cumulative impact that will be experienced from each potentially sensitive receptor has been undertaken.

8.10.2 Sensitive Visual Receptors

A sensitive receptor location is defined as a location from where receptors would potentially be adversely impacted by a proposed development. This takes into account a subjective factor on behalf of the viewer – i.e. whether the viewer would consider the impact as a negative impact. As described above, the adverse impact is often associated with the alteration of the visual character of the area in terms of the intrusion of the wind farm into a 'view', which may affect the 'sense of place'. The identification of sensitive receptors is typically undertaken based on a number of factors which include:

- the visual character of the area, especially taking into account visually scenic areas and areas of visual sensitivity;
- the presence of leisure-based (especially nature-based) tourism in an area;
- the presence of sites / routes that are valued for their scenic quality and sense of place;
- the presence of homesteads / farmsteads in a largely natural settings where the development may influence the typical character of their views; and
- feedback from interested and affected parties, as raised during the public participation process conducted as part of the EIA study.

Based on the height and scale of the project, the radii chosen to assign these zones of visual impact for the proposed San Kraal WEF are as follows:

- $\leq$ 2km (high impact zone);
- 2 $\leq$ 5km (moderate impact zone); and
- 5km $\leq$ 8km (low impact zone).

During the EIA phase VIA, only two (2) receptor locations were identified as being visually sensitive to the proposed development. These are The Dairy BnB and the Carlton Heights Lodge. These guesthouses / guest farms are regarded as sensitive visual receptors as they are used as tourism facilities and visitors to these facilities are likely to perceive the proposed development in a negative light.

The Dairy Bed and Breakfast is situated approximately 2km outside of the town of Noupoort and is accessed via the N9 national route. It should be noted that this facility is situated approximately 4.8km from the nearest proposed turbine location and is located within the moderate zone of potential visual impact. This guesthouse / guest farm is set on a quiet farm and offers three (3) bedrooms (https://airportstay.co.za/noupoort/the-dairy-bnb-adventures/). This facility is frequently used as a stop-over for a nights rest when travelling to Cape Town or Port Elizabeth via the N9 national route. In addition, this guesthouse / guest farm offers a range of activities and outdoor facilities, such as horse riding, cycling and hiking (https://www.booking.com/hotel/za/the-dairy-bnb.ro.html).

It should however be noted, according to the socio-economic specialist, potential visual intrusion by the proposed WEF turbines was not identified as a concern as the owner of this facility (Annatjie van Huyssteen) has indicated that many of her visitors consider it a draw card (Barbour, T and van der Merwe, S., September 2017).

This guesthouse / guest farm is situated within a largely natural or rural setting and is characterised by the presence of certain pastoral elements as well as some other anthropogenic elements such as existing low voltage power lines. Views from this receptor are thus considered to be mostly natural / scenic with some pastoral elements present. There are also a significant number of screening factors (such as the surrounding mountains and vegetation) surrounding this receptor which are expected to block most views towards the proposed development. It should however be noted that the town of Noupoort is slightly visible from this receptor and reduces the visual character of the area to some degree.

Carlton Heights Lodge is situated approximately 25km north of the town of Middelburg, 1.5km from the national highway on the N9/N10 towards Port Elizabeth. As such, this facility is accessible via either the N9 or N10 national routes. It should be noted that this facility is situated approximately 6.2km from the nearest proposed turbine location and is located within the low zone of potential visual impact. This facility is situated in scenic surroundings and offers a fully equipped Karoo Style farmhouse with 5 rooms, DSTV and braai facilities. The area offers scenic views, walking opportunities, bird watching and viewing of game such as Springbuck, Reebuck, Kudu, Steenbuck and Duiker among others. This facility also offers scenic 4x4 routes on the farm and a campsite with power points for caravans, motor homes and tents (http://www.carltonheights.co.za/).

This guesthouse / guest farm is situated within a largely natural or rural setting and as such views from this receptor are considered to be mostly natural / scenic. It should be noted that the series of tall trees located to the north-east of the main guesthouse (towards the proposed San Kraal WEF) are expected to provide a significant amount of screening and thus obscure most views towards the proposed development. This receptor is also characterised by the presence of anthropogenic elements such as existing power lines which are visible from this receptor.

A total number of twenty-one (21) potentially sensitive receptors have been identified within the visual assessment zone of the proposed San Kraal WEF (4 of which are situated within the moderate zone of potential visual impact and 17 which are within the low zone of potential visual impact). These include residential areas in the town of Noupoort, the Noupoort Golf Course, and several scattered farmsteads / homesteads which house the local farmers as well as farm workers. These receptors are regarded as potentially sensitive visual receptors as they are located within a mostly rural setting and the proposed development will likely alter natural vistas experienced from these dwellings. It should be noted that the local farmers that own farmsteads within the application site form part of the project. In addition, some of the farmers that own farmsteads on some of the surrounding farms also form part of this project or the proposed Phezukomoya WEF project (also being proposed by InnoWind as part of a separate on-going EIA process). As such, these farm owners will benefit financially from either this proposed development or the proposed

Phezukomoya WEF development. This is likely to offset the visual impact experienced by the landowners and reduce the negative sentiments they may have towards the developments. Accordingly, two (2) of these farmsteads (namely VR 30 and VR 40) have been eliminated from the list of potentially sensitive receptor locations for the purpose of this EIA phase study as the owners will benefit financially from this proposed development. Certain farmsteads (namely VR 9, VR 10, VR 11, VR 31 and VR 32) were however not eliminated from the list of potentially sensitive receptor locations, despite having a vested interest in this development or the proposed Phezukomoya WEF development, as they are still currently occupied (either by the owners or tenants) and according to the socio-economic specialist, could still perceive the proposed WEF in a negative light. In addition, some of these farmsteads (such as VR 11) could become potentially sensitive receptor locations in the future (Barbour, T and van der Merwe, S., September 2017). These receptors were thus not eliminated and were still regarded as potentially sensitive visual receptor locations for the purpose of this study (Figure 8.13).

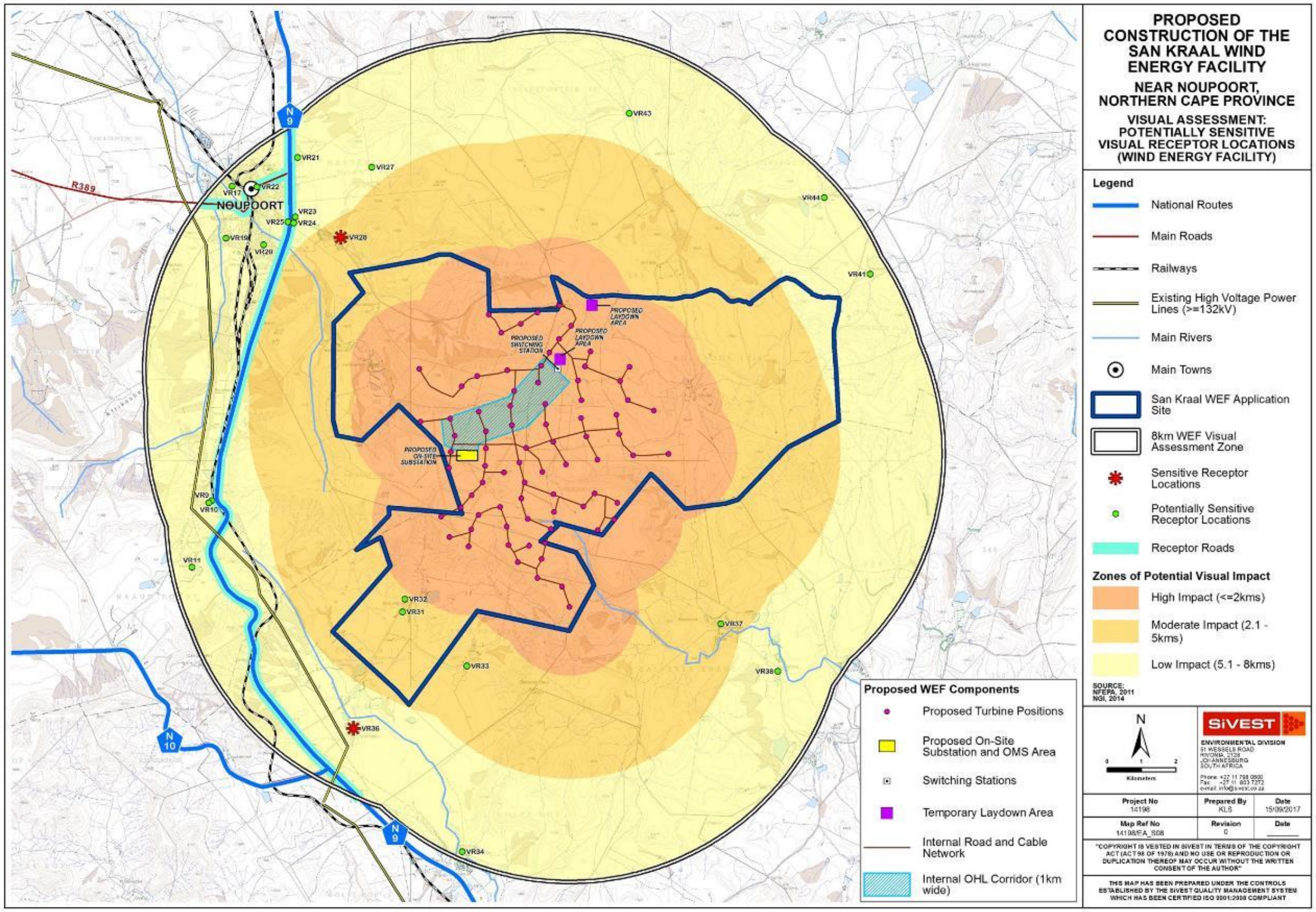


Figure 8.13 Sensitive and Potentially Sensitive Visual Receptors

Table 8.8 below provides details of the sensitive and potentially sensitive places that have cultural and symbolic importance that were identified within the study area.

Table 8.8: Visual receptor locations sensitive and/or potentially sensitive to the proposed San Kraal WEF

Name	Details	Distance from the nearest wind turbine location	Visual Impact Zone
VR9*	Farmstead/Homestead	Approximately 6.5km	Low
VR10**	Farmstead/Homestead	Approximately 6.6km	Low
VR11***	Farmstead/Homestead	Approximately 7.3km	Low
VR17	Smallholdings	Approximately 7.5km	Low
VR19	Noupoort Residential (west)	Approximately 6.4km	Low
VR20	Kwazamuxolo Residential	Approximately 5.2km	Low
VR21	Noupoort Golf Course	Approximately 6.9km	Low
VR22	Noupoort Residential (central)	Approximately 6.3km	Low
VR23	Farmstead/Homestead	Approximately 5.6km	Low
VR24	Farmstead/Homestead	Approximately 5.6km	Low
VR25	Farmstead/Homestead	Approximately 5.7km	Low
VR27	Farmstead/Homestead	Approximately 5.4km	Low
VR28	The Dairy B&B	Approximately 4.8km	Moderate
VR31****	Farmstead/Homestead	Approximately 2.6km	Moderate
VR32*****	Farmstead/Homestead	Approximately 2.2km	Moderate
VR33	Farmstead/Homestead	Approximately 3.5km	Moderate
VR34	Farmstead/homestead	Approximately 7.7km	Low
VR36	Carlton Heights Lodge	Approximately 6.2km	Low
VR37	Farmstead/homestead	Approximately 4.4km	Moderate
VR38	Farmstead/homestead	Approximately 6.3km	Low
VR41	Farmstead/homestead	Approximately 7.4km	Low
VR43	Farmstead/homestead	Approximately 5.9km	Low
VR44	Farmstead/homestead	Approximately 7.4km	Low

** VR 9 is located on an adjacent property which will be used for the proposed Phezukomoya WEF application site (also being proposed as part of a separate on-going EIA process by InnoWind). It was thus advised that the owner of this dwelling has a vested interest in the development and would therefore not perceive the proposed development in a negative light. Despite this however, it was advised by the landowner that this dwelling is currently occupied by tenants. The current occupants could therefore possibly still perceive the development in a negative light and thus this receptor was still regarded as a potentially sensitive visual receptor location.*

*** VR 10 is located on an adjacent property which will be used for the proposed Phezukomoya WEF application site (also being proposed as part of a separate on-going EIA process by InnoWind). It was thus advised that the owner of this dwelling has a vested interest in the development and would therefore not perceive the proposed development in a negative light. Despite this however, it was advised by the landowner that this dwelling is currently occupied by tenants. The current occupants could therefore possibly still perceive the development in a negative light and thus this receptor was still regarded as a potentially sensitive visual receptor location.*

****During the time of the site visit it was noted that this farmstead / homestead was unoccupied / uninhabited. Despite this however, it was advised that this receptor could be revived as a guest farm (as* *it was until 7 years ago), possibly also to include a paid hunting component. This is however still uncertain, as transfer of the property to the new owner (Mr. Jean Gillmer) has not been finalised (Barbour, T and van der Merwe, S., September 2017). This receptors was thus still regarded as a potentially sensitive visual receptor location.*

*****VR 31 is located within the proposed San Kraal WEF application site. It is assumed that the occupants of this dwelling would have a vested interest in the development and would therefore not perceive the proposed development in a negative light. Despite this however, it was advised by the socio-economic specialist that the occupants could possibly still perceive the proposed development in a negative light (Barbour, T and van der Merwe, S., September 2017) and thus this receptor was still regarded as a potentially sensitive visual receptor location.*

******VR 33 is located within the proposed San Kraal WEF application site. It is assumed that the occupants of this dwelling would have a vested interest in the development and would therefore not perceive the proposed development in a negative light. Despite this however, it was advised by the socio-economic specialist that the occupants could possibly still perceive the proposed development in a negative light (Barbour, T and van der Merwe, S., September 2017) and thus this receptor was still regarded as a potentially sensitive visual receptor location.*

In many cases, roads along which people travel, are regarded as sensitive receptors. The N9 national route traverses the study area / visual assessment zone in a north-south direction, passing through a very scenic area as it approaches the town of Noupoort, and can be considered to be the primary sensitive receptor road through the area (**Error! eference source not found.**). Proposed turbine locations for the San Kraal WEF development are all situated on higher-lying plateaux on the eastern side of the N9 and these are likely to be highly visible to motorists travelling along this road. Other potentially sensitive receptor roads include the following:

- The N10 national route which passes through the south-western section of the study area / visual assessment zone in an east-west direction. This is a national route linking Port Elizabeth on the Eastern Cape coast with Upington and the Namibian border to the west. Turbines situated on higher-lying plateaux are likely to be highly visible to motorists travelling along this road.
- The R389 provincial (un-surfaced) road that runs from the town of Noupoort in a westerly direction providing a link to the N1 and the town of Hanover. It should however be noted that only a small section of this road can be found within the northern part of the study area / visual assessment zone (near the town of Noupoort). In the setting of flat Karoo plains, turbines placed on top of the higher plateaux on the development site would be highly visible to motorists travelling along this road.

It is important to note that none of the identified sensitive and potentially sensitive receptor locations can be found within the high zone of potential visual impact.

8.10.3 Power Line Receptors

Given the length of the proposed power line and the likely height of the associated towers, the radii chosen for the zones of visual impact are as follows:

- ≤ 500m (high impact zone);
- 500m ≤ 2km (moderate impact zone); and
- 2km ≤ 5km (low impact zone).

A total number of twenty-two (22) receptors (4 of which are situated within the high zone of potential visual impact, 5 within the moderate zone of potential visual impact and 13 in the low zone of potential visual impact) have been identified within the combined visual assessment zone for the proposed 132kV power line and the Dual Turn-In lines, most of which are scattered farmsteads / homesteads which house the local farmers as well as farm workers. One (1) of these receptor locations was identified as being the Middelburg Hang Gliding Club, namely VR 52. These receptors are regarded as potentially sensitive visual receptors as they are located within a mostly rural setting and the proposed development will likely alter natural vistas experienced from these locations. It should be noted that two (2) of these receptor locations (namely VR 28 – The Dairy BnB and VR 36 – Carlton Heights Lodge) were however identified as sensitive visual receptors.

Table 8.9 below provide details of the sensitive and potentially sensitive places that have cultural and symbolic importance that were identified within the study area (Figure 8.14).

Table 8.9: Visual receptor locations sensitive and/or potentially sensitive to the proposed 132kV power line linking the proposed San Kraal WEF to the proposed Umsobomvu MTS Substation

Name	Details	Corridor Option 1		Corridor Option 2		Corridor Option 3	
		Distance	Zone	Distance	Zone	Distance	Zone
VR9*	Farmstead/Homestead	686m	Moderate	1.6km	Moderate	916m	Moderate
VR10**	Farmstead/Homestead	633m	Moderate	1.6km	Moderate	853m	Moderate
VR11***	Farmstead/Homestead	94m	High	2.9km	Low	Inside	High
VR13	Farmstead/Homestead	8.7km	N/A	4.5km	Low	8.9km	N/A
VR19	Noupoort Residential (west)	7.8km	N/A	3.4km	Low	8.3km	N/A
VR20	Kwazamuxolo Residential	7.3km	N/A	2.6km	Low	7.6km	N/A
VR22	Noupoort Residential (central)	8.6km	N/A	4.1km	Low	8.9km	N/A
VR23	Farmstead/Homestead	7.9km	N/A	3.8km	Low	8.3km	N/A
VR24	Farmstead/Homestead	7.9km	N/A	3.7km	Low	8.2km	N/A
VR25	Farmstead/Homestead	8.0km	N/A	3.7km	Low	8.3km	N/A
VR28	The Dairy BnB	6.8km	N/A	3.2km	Low	7.2km	N/A
VR31****	Farmstead/homestead	2.4km	Low	4.2km	Low	345m	High
VR32*****	Farmstead/homestead	2.0km	Moderate	3.9km	Low	5.5m	High
VR33	Farmstead/homestead	4.3km	Low	5.7km	N/A	2.6km	Low
VR36	Carlton Heights Lodge	5.6km	N/A	7.9km	N/A	3.7km	Low
VR45	Farmstead/Homestead	2.4km	Low	2.8km	Low	2.8km	Low
VR46	Farmstead/Homestead	2.4km	Low	2.8km	Low	2.8km	Low
VR47	Farmstead/Homestead	2.3km	Low	2.2km	Low	2.2km	Low
VR48	Farmstead/Homestead	4.1km	Low	4.4km	Low	4.4km	Low
VR49	Farmstead/Homestead	Inside	High	Inside	High	Inside	High
VR51	Farmstead/Homestead	3.3km	Low	4.8km	Low	1.8km	Moderate
VR52	Middelburg Hang-gliding	2.5km	Low	3.8km	Low	1.1km	Moderate

** VR 9 is located on an adjacent property which will be used for the proposed Phezukomoya WEF application site (also being proposed as part of a separate on-going EIA process by InnoWind). It was thus advised that the owner of this dwelling has a vested interest in the development and would therefore not perceive the proposed development in a negative light. Despite this however, it was advised by the landowner that this dwelling is currently occupied by tenants. The current occupants* *could therefore possibly still perceive the development in a negative light and thus this receptor was still regarded as a potentially sensitive visual receptor location.*

*** VR 10 is located on an adjacent property which will be used for the proposed Phezukomoya WEF application site (also being proposed as part of a separate on-going EIA process by InnoWind). It was thus advised that the owner of this dwelling has a vested interest in the development and would therefore not perceive the proposed development in a negative light. Despite this however, it was advised by the landowner that this dwelling is currently occupied by tenants. The current occupants could therefore possibly still perceive the development in a negative light and thus this receptor was still regarded as a potentially sensitive visual receptor location.*

*****During the time of the site visit it was noted that this farmstead / homestead was unoccupied / uninhabited. Despite this however, it was advised that this receptor could be revived as a guest farm (as it was until 7 years ago), possibly also to include a paid hunting component. This is however still uncertain, as transfer of the property to the new owner (Mr. Jean Gillmer) has not been finalised (Barbour, T and van der Merwe, S., September 2017). This receptors was thus still regarded as a potentially sensitive visual receptor location.*

*****VR 31 is located within the proposed San Kraal WEF application site. It is assumed that the occupants of this dwelling would have a vested interest in the development and would therefore not perceive the proposed development in a negative light. Despite this however, it was advised by the socio-economic specialist that the occupants could possibly still perceive the proposed development in a negative light (Barbour, T and van der Merwe, S., September 2017) and thus this receptor was still regarded as a potentially sensitive visual receptor location.*

******VR 33 is located within the proposed San Kraal WEF application site. It is assumed that the occupants of this dwelling would have a vested interest in the development and would therefore not perceive the proposed development in a negative light. Despite this however, it was advised by the socio-economic specialist that the occupants could possibly still perceive the proposed development in a negative light (Barbour, T and van der Merwe, S., September 2017) and thus this receptor was still regarded as a potentially sensitive visual receptor location.*

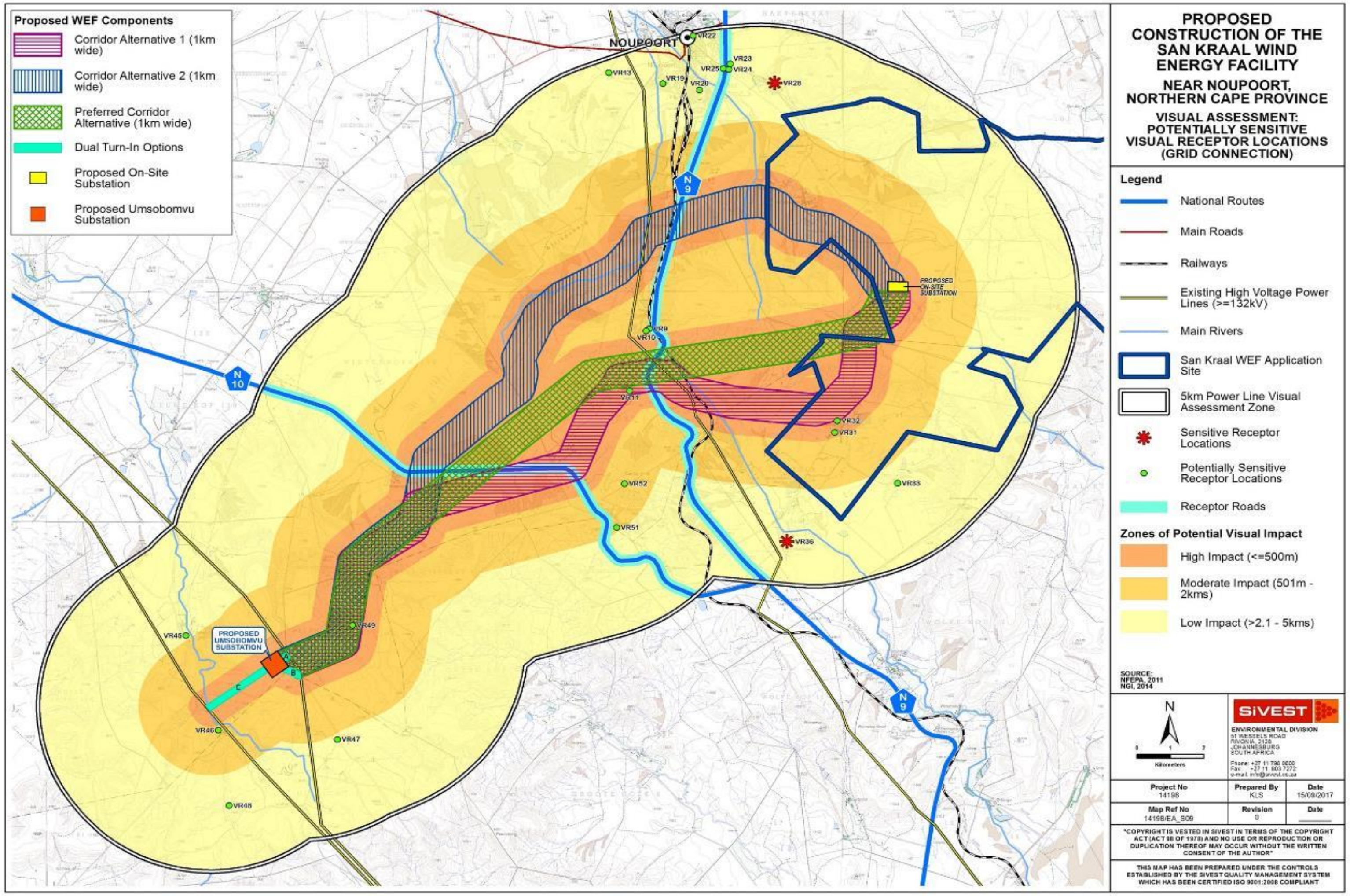


Figure 8.14 Sensitive and Potentially Sensitive Receptor Locations for the 132 kV Grid Connection

8.10.4 Site Sensitivity

During the scoping phase, all project specialists were requested to indicate environmentally-sensitive areas within the development site. This exercise was undertaken to inform the design of the development layout within the application site.

The aim of the assessment was to identify those parts of the application site where locating turbines and other associated infrastructure would result in the greatest probability of visual impacts on potentially sensitive visual receptors, and should be precluded from the proposed development i.e. areas within the application site that should be avoided.

The visual prominence of a tall structure such as a wind turbine would be exacerbated if located on a ridge top or high lying plateau. Preliminary layout plans for the proposed development have largely utilised the higher lying plateaus within the application site for turbine placement and as such the development is likely to be highly visible from much of the surrounding area. This does not necessarily mean that these plateaus should be precluded from any development and as such a desktop analysis was conducted to determine likely visual sensitivity in relation to the potentially sensitive receptors in the study area. The analysis conducted during the scoping phase of the study was revisited during the EIA phase of the study to factor in changes in the list of potentially sensitive visual receptors resulting from the field investigation.

Using GIS-based visibility analysis, it was possible to determine which sectors of the site would be visible to the highest numbers of receptors in the study area. This analysis took into account all the potentially sensitive receptor locations above as well as points along the receptor roads at 500m intervals. The areas visible to the highest number of receptors were rated as areas of 'medium-high sensitivity' and turbines should preferably be precluded from these areas in order to reduce the potential visual impact on the identified sensitive and potentially sensitive receptor locations. However, as the study area as a whole is rated as having a moderately-low visual sensitivity, these zones are not considered areas of high visual sensitivity or no go areas.

As no turbines are located within the zones of 'medium-high sensitivity' the layout is considered to be acceptable from a visual perspective. The results of this analysis are shown in Figure 8.15.

It should be noted that the visibility analysis is based purely on topographic data available for the broader study area and does not take into account any localised topographic variations or any existing infrastructure and / or vegetation which may constrain views. In addition, the analysis does not take into account differing perceptions of the viewer which largely determine the degree of visual impact being experienced.

The visual sensitivity analysis should therefore be seen as a conceptual representation or a worst-case scenario which rates the visibility of the site in relation to potentially sensitive receptors.

8.11 Heritage

This study has focused on the notion of the project area as a series of layered cultural landscapes which form the main heritage indicators assessed in this study. The study area is a typical slice of this eastern central Karoo landscape.

8.11.1 Cultural Landscape

The heritage of the Karoo is essentially a series of layers of events (or landscapes) that has become superimposed on the land surface. The earliest of these is the Karoo palaeontology – an ancient landscape that was deposited as a result of a vast inland sea. The shores and swamps of this landscape abounded with ancient species of fish, plants, invertebrates and early mammal-like reptiles. After the breakup of Gondwanaland the Karoo took on the geology that has resulted in its particular character. Millions of years later it was home to successions of early human occupation. Stone Age occupations of the Early, Middle and Later Stone age left half a million years of human made debris on the land surface. Superimposed on the Karoo landscape one more is the history of European colonisation and the wars that went with it.

8.11.2 Palaeontological Landscape

The Karoo is to all intents and purposes is a massive palaeontological landscape consisting of multiple layers of sediments that contain a vast array of fossils ranging from fish, early vertebrates, plant remains and trace fossils. It is considered to be one of the most complete fossil repositories on the planet. Generally the Karoo fossils predate the age of the life forms popularly known as dinosaurs by some scores of millions of years. The vertebrates of these times are known as early mammal-like reptiles which were ancestral to dinosaurs, hence the Karoo palaeontological sequence has contributed on a world scale to understanding the development of life forms on the planet. The project area lies in a mosaic of highly fossiliferous areas within the Karoo. The project area has been surveyed in detail by John, Almond the palaeontological site report is included as Appendix B of the Heritage Report (Volume II).

The geology and paleontology of the region has been a subject of research since the early 20th century. The flat plains of the Nama Karoo are underlain by a series of shale and mudstone strata which represent some 400 million years of depositional events (Visser 1986). The basal rocks of the Karoo sequence are known as the Dwyka formation which was deposited by a wet based glacier during the Permo-Carboniferous glaciation. This was followed by the deposition of the Ecca formation which is made up of sediments deposited in a shallow lake that covered what is now the interior of Southern Africa. Ecca shales form many of the large flat plains of the Northern Karoo (Truswell 1977; Tankard et al 1982; Visser 1986). The best known depositional event of the Karoo sequence is the laying down of the Beaufort shales about 230 million years ago. These shales are rich in a stratified sequence of fish, reptilian and amphibian remains that lie fossilized in Permian and Triassic period swamp deposits (Truswell 1977; Visser 1986; Oelofsen and Loock 1987). At the end of the Triassic period a series of geological upheavals took place with the fragmentation of the Gondwanaland continent. These were largely responsible for giving the Karoo its characteristic landscape. Triassic period volcanic activity took place over an extended period of time beginning at 187 million years ago (Truswell 1977). During this time the horizontal volcanics of the Drakensberg were laid down and the shales of the Karoo were penetrated by dolerite intrusions and extrusions in the form of vertical dykes and horizontal sills following the bedding planes of the shales. These geological structures give rise to a very characteristic topography with general occurrences of mesas, hillocks and sharp ridges (Visser 1986). In the study area extruding dolerite dykes and hillocks exposed through differential erosion are dominant features of the landscape giving rise to the vast flat plains of mudstones dolerite outcrops and hills that are so characteristic of this area. These igneous events resulted in the formation of Hornfels a fine grained black rock with a conchoidal fracture. Hornfels is formed when a dolerite intrusion takes place and bakes the surrounding mudstone to a metamorphic form (Visser 1986). Millions of years later prehistoric peoples enthusiastically exploited hornfels exposures for raw material for making artefacts – a staple resource in the Karoo for hundreds of thousands of years.

8.11.3 The Pre-Colonial Cultural Landscape

A comprehensive survey of a 5000 square kilometre catchment area (the Valley of the Zeekoei River from the Sneeuberg Mountains to the Gariep River Valley) which lies immediately west of the project area revealed the presence of some 10 000 archaeological sites representing a history of human occupation that dates back at least 250 000 years (or more). Of the 10 000 sites recorded and identified to industry (phases), some 6000 were attributable to the Late Stone Age. Sampson (1985) identified some 7 industries (phases) of human history within his study area – each of which are legible on the landscape today, and each of which represent a pre-colonial layer of the human history of the Karoo. A deep discussion of technicalities of Karoo archaeology is not warranted in this report as it is complex and pre-supposes knowledge of archaeology that most members of the general public don't have. It would be inappropriate to discuss the details of the specific occupation phases in this report, other than to mention that each one the phases of human occupation described by Sampson (1985) represents a pulse of human occupation of the central Karoo – the population of people at any given time reflecting variations in climate and the degrees of aridity and temperature that dictate the viability of the landscape as a place suitable for people to live. Each phase of occupation has left its archaeological signature on the landscape which is identifiable by the kinds of stone artefacts that have been left behind. The different phases are broadly termed the Early Stone Age and Middle Stone Age. Artefacts of both the Early and Middle Stone Age are widespread and may generally be described as an ancient litter that occurs at a low frequency across the landscape. Where definable scatters of Early and Middle Stone Age material occur, they are considered to be significant heritage sites. More intensive occupation of the Karoo started around 13 000 years ago during the Later Stone Age, which is essentially the heritage of Khoisan groups who lived throughout the region.

The latest phase of occupation of the Great Karoo is a period known as the Late Stone Age. It is a very important layer on the landscape as this represents the heritage of the Khoekhoen (historically known as "Hottentot" by early writers) and San (popularly known as Bushman) people of South Africa. The direct descendants of these groups make up a significant proportion of the population today. This heritage is represented by two industries (phases). These are the Interior Wilton which is characterised by a microlithic stone artefact industry characterised by lightly patinated hornfels (indurated shale stone) and the later Smithfield industry characterised by specific classes of stone artefacts and the presence of grass tempered ceramics.

8.11.4 Landscape of Colonial Settlement

The indigenous people of Karoo waged a bitter war against colonial expansion as they gradually lost control of their traditional land. Penn (2005) notes the most determined indigenous resistance to trekboer expansion occurred when they entered the harsh environment of the escarpment of the interior plateau (namely Hantam, Roggeveld and Nieuweveld and Sneeuberg Mountains). Similarly trekboer settlers find their progress onto the upper escarpment halted at the Sneeuberg close to the project area. San launched an almost successful campaign to drive them out. Numerous place names throughout the Karoo such as Oorlogspoort and Oorlogskloof are testimony the skirmishes of the late 18th century. The situation became so desperate that the colonists fought back by establishing the "Kommando" system – the "hunting" of San was officially sanctioned in 1777 (Dooling 2007) and in some instances bounties were obtainable from the local landrost (on presentation of body parts). The Drostdy of Graaff Reinet (the northernmost regional center of the time) played a significant role in this long and bitter war which eventually saw the almost complete destruction of the Karoo San.

The advent of the early European Settlers into the Great Karoo is one which is largely un-documented. These European pastoralists were highly mobile; trekking between winter and summer grazing on and off the escarpment. Land ownership was informal, and only became regulated after the implementation of the quitrent system of the 19th century used by the Government to control the lives and activities of the farmers.

Noupoort was established in the 1870's as a railway junction when the Union Railway Company established the railway system. It was a railway village until 1942 when it gained a formal municipality (Raper, Undated). It continues to play an important role in the functioning of the railway system but is not a tourist destination of consequence.

8.11.5 Heritage Sensitivities

Palaeontology

Any form of bedrock excavation has the potential to affect continental sediments of the Beaufort Group. Most of the San Kraal WEF footprint will be situated in dissected rocky plateau areas underlain by continental sediments of the Katberg Formation (Upper Beaufort Group / Tarkastad Subgroup, Karoo Supergroup) of earliest Triassic age. Latest Permian sediments of the underlying Balfour Formation crop out along the foot of the Katberg escarpment but are generally mantled by a thick apron of colluvium (sandy and gravelly scree, hillwash) and alluvium. Elsewhere in the Main Karoo Basin these sediments have yielded locally abundant vertebrate fossils, large vertebrate burrows, a small range of invertebrate burrows but only rare plant remains. The uppermost Balfour and Katberg Formations preserve an important record of biological and palaeoenvironmental events on land during the catastrophic Permo-Triassic extinction of 252 Ma (million years ago) and subsequent biotic recovery. Several vertebrate fossil localities in the Noupoort area are noted in the scientific literature but only a few fossil remains were recorded during a four-day field assessment of the San Kraal WEF and associated powerline. These include fragmentary bones and teeth within calcrete breccias as well as several large vertebrate burrows, one with associated disarticulated bones. The paucity of recorded fossil sites here is probably due to (1) the very low exposure levels seen here of overbank mudrocks where most fossils are preserved, and (2) the predominance of amalgamated channel sandstone facies in the upper part of the Katberg Formation building the plateau areas. Scientifically-important fossil remains in the subsurface may well be compromised by the proposed WEF development during the construction phase, notably due to voluminous bedrock excavations for wind turbine footings (Almond 2017) (Appendix B – Heritage Report, Volume II).

Excavations and other construction work undertaken into bedrock in order to install the wind turbines and associated infrastructure could expose, disturb, destroy or seal-in valuable fossil heritage. Although the direct impact will be local, these fossils are of importance to national as well as international research projects on the fossil biota of the ancient Karoo and the Permian mass extinction events.

Archaeological heritage

The pre-colonial heritage sensitivities of the site are typical of what has been found in the area before. Rock paintings are known to exist in the area while Orton (2014) located evidence of numerous Late Stone Age archaeological sites, stone features, graves and historic ruins in the Blydefontein area at the site of the nearby Noupoort WEF.

Experience throughout the Karoo has shown that high ridges seldom attracted any form of prehistoric occupation. Ridge tops tend to be dry, windswept and very cold in winter. Unless there was a large rock shelter, source of water or a raw material, it is not expected that the system of ridges with the study area are likely to be sensitive in terms of archaeology. The turbine sites which are normally situated on high ground are likely to be relatively insensitive.

Valley bottoms were rather more favoured by pre-colonial people for occupancy. Here there are normally sources of water, shelter from the prevailing winds as well as the potential for grazing small stock on or close to the sandy river beds. Also important were low ridges on or adjacent to flat plains. Khoikhoi kraals were almost always built adjacent to or against low ridges and cliffs. Anywhere where there is a cluster of rock that provided shelter from the wind or a shallow cave inevitably has archaeological material associated with it.

The field survey, which was comprehensive, identified some 19 archaeological occurrences and sites and historical period kraals and ruins. The majority of these sites consist of insignificant surface scatters of 3-4 stone artefacts of patinated hornfels of Middle Stone Age origin. There is one site (below) that requires mitigation is the form of collection of artefactual material prior to commencement of the construction phase.

Holbrook JG017-JG019: Four co-ordinates mark the presence of a scatter of Middle Stone Age material associated with rocky shelves and a stone outcrop which is worth mitigation. It lies some 30m from a turbine position and is therefore in danger of being impacted. The site contained a number of formal artefacts (blades, a scraper and regular cores in hornfels).

Figure 8.16 The Holbrook archaeological occurrences are associated with this rock outcrop.

Generally the archaeology of the high suurveld plateaux's is sparse and ephemeral. The area is bitterly cold in winter and there are no sizeable rock outcrops that provide shelter from the strong winds of the area. No ceramic period sites, rock engravings, San rock paintings were identified.

Landscape and setting

Aesthetic impacts along the escarpment of the Kikvorsberge will be affected. The escarpment while not dramatic, is a scenic area, while the N9 is a scenic Karoo route. It has strong wilderness qualities, typical Karoo vistas and a sense of isolation. The combined effect of wind energy facilities will impact the aesthetic qualities of the region which will diminish the value of the landscape as an aesthetic resource. The nearby Noupoort Wind Farm, which has been completed (Figure 8.17), provides a good idea of the industrialising affect the turbines will have on the landscape. It can also be argued that tourism in this remote area is undeveloped. The Kikvorsberge are difficult to access and not generally used for tourism, but are used for grazing when vegetation quality

allows.

Figure 8.17. The nearby established Noupoort wind farm reflects how the San Kraal landscape will change.

8.12 Traffic Assessment

In November 2017, the DEA accepted the final scoping report for the proposed San Kraal WEF. One of the requirements of the acceptance letter, was that a traffic impact assessment be undertaken. The terms of reference included:

- Evaluate the impacts of the proposed development on existing road network and traffic volumes;
- Determine the specific traffic needs during the different phases of implementation, namely wind turbine construction and installation, decommissioning and operation;
- Evaluate the roadway capacity of the road network;
- Identify the position and suitability of the preferred access road alternative;
- Confirm the associated clearances required for the necessary equipment to be transported from the point of delivery to the various sites;
- Confirm freight and transport requirements during construction, operation and maintenance;
- Propose origins and destinations of equipment; and
- Determine (Abnormal) Permit requirements if any.

8.12.1 Site Access

In June 2016 a route assessment report was written by AECOM SA (Pty) Ltd for a proposed Umsobomvu WEF for InnoWind. The site is situated is approximately 5 km from the intersection of the N9 and N10, south of the proposed San Kraal WEF. The San Kraal site boundary is approximately 14 km north from the Umsobomvu site boundary. In the route assessment, the WT components were expected to travel from Ngqura Habour habour at the Coega Industrial Development Zone (IDZ), north of Port Elizabeth (PE) to the WEF site.

The route assessment included the N10 (Coega IDZ to Middleburg), N9 & N10 (north of Middleburg towards Noupoort), R389 (from Middleburg to Hanover), N1 (from Richmond to Hanover) and the N10 (fo rm Hanover to the northern access road). The assessed routes to site are presented in Figure 8.18.

The following routes were assessed in the report:

- Main route- From Coega up to interchange N9/N10 south of Middleburg.
- Route A-Through Middleburg via Meintjies Street.
- Route B- Around Middleburg via N9.
- Route C- From Middleburg via N9 towards Noupoort.
- Route D-From Middleburg via Richmond and Hanover.
- Northern Access Route to site
- Southern Access Route to site

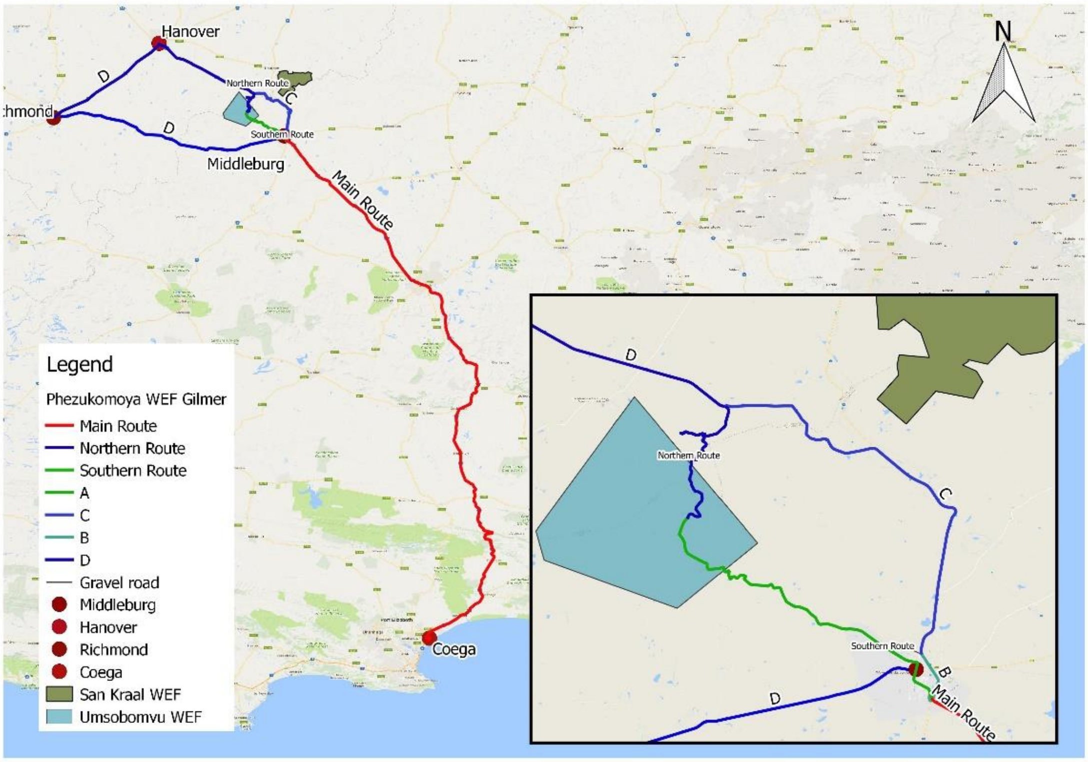


Figure 8.18 Transportation Routes to the Proposed Umsombomvu WEF

From the route determination assessment the following was concluded:

- The main route from Main route- From Coega up to interchange N9/N10 south of Middleburg was identified as being suitable for transportation of WT components using abnormal truck combinations, provided the abnormal loads is less than 4.8 m high.

- The route will require various physical modifications to ensure its suitability for abnormal load transportation.

For purposes of the traffic assessment, the main route as identified by the route determination report as being suitable will be the transportation route for the San Kraal WEF. From Middleburg the vehicles will make use of the N9 heading north towards Noupoort and turn R389 towards the San Kraal Access. One access point was identified to serve San Kraal WEF, referred to as Access E. A site visit was conducted on the 11th of January 2018 to assess Access E's suitability to serve the WEF. Figure 8.19 presents the site access option. Intersections 2 was also assessed for its suitability in terms of accessibility to main transportation route.

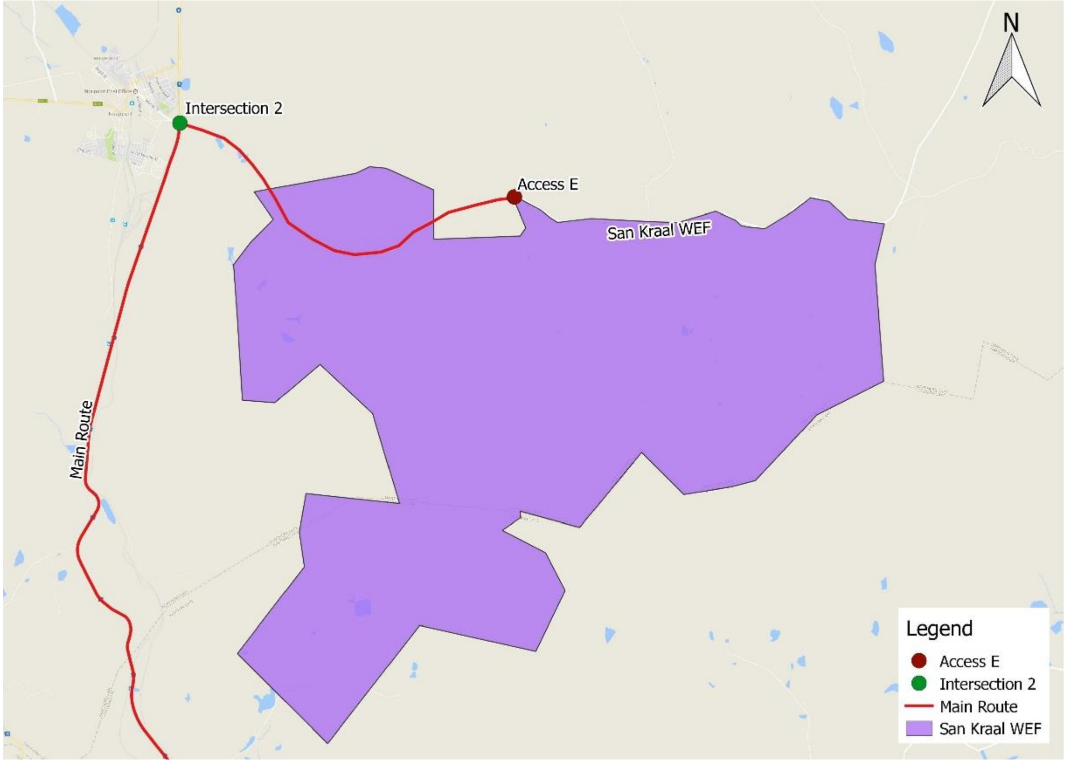


Figure 8.19: Site Access Options for San Kraal WEF

The San Kraal WEF must be accessible to passenger cars, buses, trucks and multi vehicle combinations which will be delivering WT components. Access to site needs to be safe and practical to minimise risk of pedestrian and vehicle accidents with sufficient traffic control, clear visibility through sufficient stopping site distances, clear markings and warnings signs.

Based on the site visit, San Kraal access, as recommended by the client is sufficient to meet visibility, accessibility and safety requirements.

It is recommended that Access E be stop controlled and widened to allow for dedicated right turn and left turn lanes off the main road that will incorporate the turning circles of the expected abnormal vehicles.

8.12.2 Traffic Data Analysis

Intersection capacity analyses were undertaken to determine the anticipated operational performance of the site access roads and surrounding road network. The intersection capacity analysis was conducted using SIDRA Intersection 7.0 Intersection software. It should be noted that Intersection LOS and Major Road Approach LOS values are not applicable for two-way sign control since the average intersection delay is not a good LOS measure due to zero delays associated with major road movements however results will be able to give is an indication of delay and LOS of the minor road approaching the major road. The intersections analysed are listed below:

- M1: N9 & Shaw St
- M2: N9 & Murray St
- M3: N9 & N10
- M4: R389 & road to N10
- 1477: N10
- 2733: N9
- 2741: N9

The trips generated at the San Kraal WEF will vary during the different phases of the project implementation, these include pre-construction, construction, operational, decommissioning and closure. In order to evaluate the impacts and traffic needs of the development on the existing road network estimated vehicles trips are used based on information provided.

A majority of WT components are assumed to be transported to San Kraal WEF on the N10 using the San Kraal access.

The trips generated were distributed onto the surrounding road network with:

- 100% of delivery trips traveling from the Coega PE Port along the N10 & N9
- 100% of daily commuter trips from Noupoort town via R389

8.12.3 Capacity Analysis Scenarios

It is required to grow traffic flow to an acceptable horizon year to ensure that the future road network would be able to operate adequately. In the absence of historical data, the COTO, TMH17 Volume 1 Manual provides typical growth rates to be used for growth areas based on the existing/anticipated rate of growth. Typical traffic growth rates are illustrated in table below:

Typical Traffic Growth Rates

DEVELOPMENT AREA	GROWTH RATE
Low Growth Areas	0% - 3%
Average Growth Areas	3% - 4%
Above Average Growth Areas	4% - 6%
Fast Growing Areas	6% - 8%
Exceptionally High Growth Areas	> 8%

The Noupoort area was considered to be a low growth area. Taking into account the additional WEF being developed in the area, a 3% per annum growth rate was assumed to represent the expected traffic growth.

To identify any shortcomings in the road based capacity in the short term, a base year assessment was undertaken. Furthermore, the traffic was grown to an acceptable horizon year to ensure that the proposed road network would be able to operate adequately once the development is constructed.

If construction starts in 2019 the scenarios analysed are as follows:

Phase	*Senario*	*Year*	
Base	1	2018	Existing Traffic

Pre-construction	2	2019	Background Traffic
	3		Background+ Development Traffic
Construction	4	2021	Background Traffic
	5		Background+ Development Traffic
Operation	6	2041	Background Traffic
	7		Background+ Development Traffic
Decommissioning	8	2043	Background Traffic
	9		Background+ Development Traffic

8.12.4 Potential Imapct of the development on the intersections

From the capacity analysis is can be seen that all assessed legs of the intersections operate at a LOS A or B. The following is a summary of results:

- Intersection 1 – N9 & Shaw St: All approaches operate at acceptable LOS during both the AM and PM peak hours;
- Intersection 2 – N9 & Murray St: All approaches operate at acceptable LOS during both the AM and PM peak hours;
- Intersection 3 – N9 & N10: All approaches operate at acceptable LOS during both the AM and PM peak hours;
- Intersection 4 – R389 & road to N10: All approaches operate at acceptable LOS during both the AM and PM peak hours;
- Intersection 5 –2733: All approaches operate at acceptable LOS during both the AM and PM peak hours;
- Intersection 6 –2741: All approaches operate at acceptable LOS during both the AM and PM peak hours; and
- Intersection 7 –1477: All approaches operate at acceptable LOS during both the AM and PM peak hours.

8.12.5 Evaluation of Abnormal Weights and Dimensions

Transport requirements for the WEF project will require the use of abnormal load vehicles as stipulated in the TRH 11, especially in the construction phase of the project for the delivery of construction materials and turbine components. Very little to no special transport will be required during the remainder of the development phases as standard transport will be used.

All WT components are considered to be abnormal loads, either through length, weight or height, usually comprising of 3 tower sections, 1 hub, 1 nacelle and 3 blades. These require different truck / trailer combinations and configurations to be transported. These issues will be investigated at a later stage when the transporting contractor and the plant hire companies apply for the necessary permits from the permit issuing authorities. The heaviest component of a wind turbine is the nacelle (approximately 67 to 85 tons depending on manufacturer and design of the unit). Combined with road-based transport, it has a total vehicle mass of approximately 130 000 kg (for the 85 ton unit). Thus route clearances and permits will be required for transporting the nacelle by road based transport.

Blades are the longest component, ranging between 45 – 75 m, and need to be transported on a specially imported extendible blade transport trailer or in a rigid container with rear steerable dollies. The blades can be transported individually, in pairs or in three's although different manufacturers have different methods of packaging and transporting the blades. Where required, existing public roads may need to be upgraded along the proposed equipment transport route to allow for the transportation and delivery of wind turbine components and other associated infrastructure components. The national roads on the potential national access routes are generally of high standard and many of the structures have been assessed for load bearing capacity and height clearance in the past. Turbine supplier/s or the contractor selected for implementation would be responsible for the transportation of wind turbine components to site. A complete transportation management plan will be undertaken prior to construction, should the project be awarded preferred bidder status.

8.12.6 Permit Requirements

In transportation of loads the following guidelines are available. According to the TRH 11, the expected load dimensions are classified as abnormal load, therefore an exemption permit for each province that the load has to transit is required.

Provision for the type of abnormal loads in this development is made in the National Road Transport Act (NRTA), and specifically in Section 81 of the NRTA, which reads as follows:

"Vehicle and load may be exempted from provisions of Act

An MEC may, subject to such conditions an upon payment of such fees or charges as he or she may determine, authorise in writing, either generally or specifically, the operation on a public road of a vehicle which does not comply with the provisions of this Act or the conveyance on a public road of passengers or any load otherwise that in accordance with the provisions of this Act."

When the movement of an abnormal load is considered to be in the economic and/or social interest of the country, an exemption permit may be issued to allow a vehicle(s) transporting such an abnormal load to operate on a public road for a limited period. The fundamental principles guiding this process are:

- An exemption permit for an abnormal load will only be considered for an indivisible load, abnormal in dimension and/or mass, where there is no possibility of transporting the load in a legal manner.
- The risks to other users must be reduced to a level equivalent to what it would be without the presence of the abnormal vehicle on the road; and
- The conditions imposed must take the economic and/or social interest of the country and public at large into account.

8.12.7 Traffic Study Conclusion

- The base year and forecast year road capacity has indicated that the proposed development will have no significant impact on the existing road network capacity.
- Given the findings of this report, it is recommended that the proposed construction be considered favourably from a traffic engineering point of view as the intended construction will have no negative impact on the surrounding road network.

San Kraal Access point (E) is recommended as the access position, based on safety considerations.

- The preferred access road is recommended to be the N10 from PE to Middelburg, the N9 from Middelburg to Noupoort and the R389 to the San Kraal Access E.
- A comprehensive route assessment of the entire route is recommended should the project be awarded preferred bidder as part of the REIPPP process.
- It is recommended that Access point E be stop controlled and widened to allow for dedicated right turn and left turn lanes off the main road, which will incorporate the turning circles of the expected abnormal vehicles.

- In addition, allowance must be made for public transport vehicle lay byes on both sides of the access along the main road as well as safe pedestrian crossings on all 3 approaches of the access.
- Clearances will be required for the transport of the WT components.

It is recommended that applications for Abnormal Permits be lodged to the Department of Transport and Public Works, Eskom and Telkom

8.13 Social

The majority of the study area is located within the Umsobomvu Local Municipality (ULM, which is located in the Northern Cape Province. A small section of the site is located in the Inxuba Yethemba Local Municipality (IYLM), which falls within the Eastern Cape Province. The IYLM falls within the Chris Hani District Municipality.

The IYLM is one of six B-Municipalities that constitute the Chris Hani District Municipality (CHDM) (DC13). Cradock is the administrative seat of the IYLM, and together with Middelburg, one of the two major towns in the LM. The main land uses in the area are linked to stock farming and agriculture.

The ULM is one of the eight B-Municipalities that constitute the Pixley ka Seme District Municipality (PKSDM) (NC7). Colesberg is the administrative centre of the ULM. The town of Colesberg is located on the N1 in the Great Karoo, approximately halfway between Johannesburg and Cape Town. Colesberg is also located on the N9, which provides a link to Port Elizabeth to the south. The other two urban centres in the UM are Noupoort and Norvalspont, a small settlement located near the Gariep Dam.

8.13.1 The Northern Cape

The Northern Cape Province is the largest province in South Africa, covers an area of 361,830 km^2, and constitutes approximately 30% of South Africa. The province is divided into five district municipalities (DM), namely, Pixley ka Seme, Frances Baard, Namakwa, ZF Mgcawu[38], and John Taola Gaetsewe[39], twenty-six Category B municipalities and five district management areas. The site itself is located in the Umsobomvu Local Municipality.

8.13.1.1 PIXLEY KA SEME AND UBUNTU MUNICIPALITY

Demographic Overview

As indicated in Table 8.10, the population of the PKSDM increased by from 166 547 in 2001 to 186 351 in 2011, which represents an increase of ~ 12%. The population of the ULM increased from 23 641 in 2001 to 28 376 in 2011 (~ 20%) over the same period. This represents an average annual increase of ~ 1.12% and 1.83% for the PKSDM and ULM respectively. The increase in the population in the PKSDM and ULM was linked to an increase in the 15-64 and 65 and older age groups. This is likely to reflect a situation where the majority of job seekers in the 15-64 age group are single males who have not settled down and started a family and increase in retirees settling in the area. In terms numbers, 87% of the ULM population is urbanised. The relatively higher increase in the population in the towns was due to farm workers moving to the towns. As expected, the number of households in both the PKSDM and ULM increased between 2001 and 2011. The size of the household sizes in both areas decreased marginally, namely from ~ 3.8-9 to 3.7-3.5.

[38] The ZF Mgcawu DM was previously referred to as the Siyanda DM.
[39] The John Taola Gaetsewe DM was previously referred to as the Kgalagadi DM

The majority of the population is in the ULM was Black African (62.6%), followed by Coloured (30.6%) and Whites (5.7%) (Census, 2011). The dominant language within the Municipality is isiXhosa (~54.2%), followed by Afrikaans (~37.9%), Sesotho (1.9%) and English (~1.8%) (Census 2011). The ULM accounts for ~ 14% of the total population of the PKSDM. Colesburg, the largest town in the ULM, has a population of ~ 13 000. A negative growth rate is forecasted for the rural population due to emigration. Therefore the statistics reveal the rapid migration to towns within the Municipality.

Table 8.10: Overview of key demographic indicators for the PKSDM and ULM

ASPECT	PKSDM		ULM	
	2001	**2011**	**2001**	**2011**
Population	166 547	186 351	23 641	28 376
% Population <15 years	32.6	31.6	33.7	31.4
% Population 15-64	61.5	62.4	61.0	62.8
% Population 65+	5.9	6.1	5.3	5.8
Households	41 707	49 193	5 848	7 841
Household size (average)	3.8	3.7	3.9	3.5
Formal Dwellings %	84.7%	86.3%	81.8%	88.2%
Dependency ratio per 100 (15-64)	62.7	60.4	63.8	59.3
Unemployment rate (official) - % of economically active population	36.4%	28.3%	51.9%	33.0%
Youth unemployment rate (official) - % of economically active population 15-34	44.1%	35.4%	60.8%	40.4%
No schooling - % of population 20+	27.1%	14.6%	27.9%	16.3%
Higher Education - % of population 20+	5.7%	6.1%	5.5%	6.3%
Matric - % of population 20+	12.9%	20.5%	13.1%	23.1%

Source: Compiled from StatsSA Census 2011 Municipal Fact Sheet.

The dependency ratio in both the PKSDM and ULM decreased from 62.7 to 60.4 and 63.8 to 59.3 respectively. The decrease represents a positive socio-economic improvement by indicating that there are a decreasing number of people dependent the economically active 15-64 age group. The age dependency ratio is the ratio of dependents, people younger than 15 or older than 64, to the working, age population, those ages 15-64. However, the dependency ratios for the PKSDM and ULM were higher than the ratio for the Northern Cape as whole, which was 55.7 in 2011.

In terms of percentage of formal dwellings, the number of formal dwellings in the PKSDM increased from 84.7% in 2001 to 86.3% in 2011. In the ULM the number of formal dwellings increased from 81.8 to 88.2% for the same period. This represents a positive socio-economic benefit for both the PKSDM and ULM. However, despite the increase in formal dwelling the ULM IDP indicate that there is housing backlog of ~ 2 000 houses in the ULM, with the majority (1 200) of the backlog located in Noupoort.

Employment

The official unemployment rate in both the PKSDM and ULM decreased for the ten year period between 2001 and 2011. In the PKSDM the rate fell from 36.4% to 28.2%, a decrease of 8.2%. In the ULM the unemployment rate decreased from a significantly high level of 51.9% in 2001 to 33.0% in 2011, a decrease of nearly 19%. Despite the decreases the unemployment levels in the PKSDM and ULM are still higher than the Northern Cape average of 27.4%. This highlights the limited employment opportunities in the area, specifically in the ULM. Youth unemployment in both the PKSDM and ULM also dropped over the same period. Youth unemployment in the both the PKSDM and ULM is still high however (35.4% and 40.4% respectively).

Household income

Based on the data from the 2011 Census, 13.5 % of the population of the ULM have no formal income, 4.5% earn between 1 and R 4 800, 6.3% earn between R 4 801 and R 9 600 per annum, 21.1% between R 9 601 and 19 600 per annum and 21.7% between R 19 600 and R 38 200 per annum (Census 2011). The poverty gap indicator produced by the World Bank Development Research Group measures poverty using information from household per capita income/consumption. This indicator illustrates the average shortfall of the total population from the poverty line. This measurement is used to reflect the intensity of poverty, which is based on living on less than R3 200 per month for an average sized household. Based on this measure 67.1% of the ULMs population live below the poverty line. The low-income levels reflect the reliance on the agricultural sector and limited formal employment opportunities in the ULM. The low income levels are a major concern given that an increasing number of individuals and households are likely to be dependent on social grants. The low income levels also result in reduced spending in the local economy and less tax and rates revenue for the district and local municipality.

Education

The education levels at both the district and local municipal level also improved, with the percentage of the population over 20 years of age with no schooling in the PKSDM decreasing from 27.1% to 14.6%. For the ULM there was a significant decrease from 27.9% to 16.3%. The percentage of the population over the age of 20 with matric also increased in both the PKSDM and ULM, from 12.9% to 20.5% in the PKSDM and 13.1% to 23.1% in the ULM. However, despite this increase the figure for the PKSDM and ULM are still below the national (28.4%) level in 2011.

Municipal Services

As indicated in Table 8.11, the municipal service levels, with the exception of weekly access to refuse removal in the ULM, in the PKSDM and ULM all improved over the period 2001 to 2011. This represents a socio-economic improvement. The service levels in the PKSDM and ULM are, with the exception of households in the ULM that have piped water inside the dwelling and households that use electricity in the PKSDM, all higher than the provincial averages for the Northern Cape Province.

Table 8.11: Overview of access to basic services in the PKSDM and ULM

Municipal Services	PKSDM		ULM	
	2001	**2011**	**2001**	**2011**
% households with access to flush toilet	45.4	65.7	48.3	68.7
% households with weekly municipal refuse removal	67.8	72.6	76.6	76.3
% households with piped water inside dwelling	32.8	47.0	21.3	45.1
% households which uses electricity for lighting	75.1	85.1	80.6	86.7

Source: Compiled from StatsSA Census 2011 Municipal Fact Sheet

8.13.1.2 Social Services

Education

There are 8 primary schools and 6 secondary schools in the ULM (Table 8.12). The IDP notes that while the actual number of schools is generally satisfactory there is an acute shortage in the remote rural areas of the Municipality. As a result children often have to walk long walking distances to access the available schools.

The key issues listed in the IDP include:

- Insufficient and accessibility to education facilities;
- Availability of qualified staff and quality of education facilities.

Table 8.12: Education Facilities Umsobomvu Municipality (2013)

Town	**Crèche**	**Pre-primary**	**Primary**	**Secondary**	**Tertiary**	**Grand Total**
Colesberg	1	1	1	1	0	3
Kuyasa	1	0	2	2	0	4
Lowryville	1	1	1	1	0	3
Norvalspont	0	0	1	0	0	1
Noupoort	1	1	1	1	0	3
Eurekaville	0	0	1	0	0	1
Kwazamuxolo	1	1	1	1	0	3
Umsobomvu LM	**5**	**4**	**8**	**6**	**0**	**18**

Health

The IDP indicates that there are 7 health facilities in the ULM (Table 8.13). This total includes a hospital and clinic in Noupoort. The key issues identified include:

- Insufficient health facilities;
- Lack of public transport services for patients;
- Availability of medical staff;
- Lack of aftercare facilitates and support services to patients;
- Lack of 24 hour health services and emergency services;
- Lack of hospice for aged and terminal ill;
- Support of AIDs/HIV patients.

Table 8.13: Health Facilities Umsobomvu Municipality (2014).

Town	**Hospital**	**Clinic**	**Grand Total**
Colesberg	1	0	2
Kuyasa	0	1	1
Lowryville	0	1	1
Norvalspont	0	1	1
Noupoort	1	1	2
Umsobomvu LM	**2**	**4**	**7**

Safety and security

The IDP indicates that there are 4 police stations in the ULM, one of which is located in Noupoort (Table 8.14). There is also a Magistrates Court in Noupoort. Even though the crime rate in the region is low if compared to other areas in South Africa, some issues were raised regarding the safety and securities. These include:

- Police need to be more visible;
- Police stations are not accessible to greater community- Lowryville, Eurekaville, Kwazamuxolo;
- Shortage of police resources;
- Not enough police stations;
- Shortage of human resources;
- High level of unemployment;
- Youth delinquency.

Table 8.14: Safety and Security Facilities Umsobomvu municipality (2014)

Town	**Police stations**	**Magisterial court**	**District court**

Colesberg	1	1	1
Kuyasa	1	0	0
Lowryville	0	0	0
Norvalspont	1	0	0
Noupoort	1	1	0
Eurekaville	0	0	0
Kwazamuxolo	0	0	0
Umsobomvu LM	**4**	**2**	**1**

8.13.2 Eastern Cape Context

A small portion of the proposed WEF falls within the Inxuba Yethemba LM of the Chris Hani DM in the Eastern Cape Province (ECP). The ECP faces significant social challenges: addressing poverty, income inequality, food insecurity, and unemployment.

8.13.2.1 Inxuba Yethemba Local Municipality

Demographic Overview

According to Census 2011, the IYLM has a population of 65 560, and represented 8.2% of the Chris Hani DM's population (795 461) (Table 3.8). Census 2011 indicates that 84.4% of the IYLM population is urbanised. Commercial farms account for the balance (15.6%), with none of the population classified as living in traditional areas. Ligelihle (18 966), Middelburg (12 523) and Cradock (12 327) are the most populous towns in the IYLM, acounting for the bulk of the LMs population.

The IYLM population increased from 60 364 in 2001 - an increase of 5 196 or ~8.6%. As may be seen in Table 8.15, the population age structure has remained more or less the same, with the 15-64 age group remaining a constant 64.6%, while the youthful group's share decreased slightly by 1%, and that of the aged slightly increased by 0.3%. As may be expected from the increased population, the number of IYLM households also increased between 2001 and 2011. In this regard, the number of households increased by 2 461 (15.3%) during this period. The disparity in growth rates between population and households is reflected in the decrease in household size over the period, namely from 3.6 (2001) to 3.4 (2011).

The majority of the population is in the IYLM is Black African (56.2%), followed by Coloured (32.2%), and Whites (10.5%). Other groups accounted for less than 1% (Census, 2011). The dominant language within the Municipality is isiXhosa (~48.9%), followed by Afrikaans (~43.6%), and English (~3%) (Census 2011).

Table 8.15: Overview of key demographic indicators for Inxuba Yethemba LM

ASPECT	2001	2011
Population	60 364	65 560
% Population <15 years	30.1%	29.1%
% Population 15-64	64.6%	64.6%
% Population 65+	5.9%	6.2%
Households	16 002	18 463
Household size (average)	3.6	3.4
Formal Dwellings %	97.1%	97%
Dependency ratio per 100 (15-64)	56.1	54.7
Unemployment rate (official) - % of economically active population	43.2%	25.7%
Youth unemployment rate (official) - % of economically active population	53.7%	33.2%

15-34		
No schooling - % of population 20+	17%	10.7%
Higher Education - % of population 20+	6.2%	8.8%
Matric - % of population 20+	14.4%	20%

Source: Compiled from StatsSA Census 2001 and 2011 Municipal Fact Sheets

The dependency ratio in the IYLM decreased from 56.1 to 54.7. As indicated, this decrease represents a positive socio-economic improvement by indicating that there are a decreasing number of people dependent on the economically active age group.

The number of formal dwellings in the IYLM slightly decreased (by 0.1%) over the ten year period 2001 to 2011. The decrease was however from a high base (97.1%), and at a 15.3% increase in the number of households.

Employment

The official unemployment rate has dramatically decreased between the two Censuses, namely from 43.2% (2001) to 25.7% (2011), and with the latter figure more or less on par with the 2011 national unemployment rate. The IYLM's youthful unemployment rate also witnessed a significant decrease over the period, namely from 53.7% in 2001 to 33.2% in 2011. While these decreases are impressive, it should be noted that both the official unemployment and youthful unemployment rates are still very high.

Household income

According to Census 2011, 10.8 % of the IYLM population have no formal income, 4.1% earn between 1 and R 4 800, 6.5% earn between R 4 801 and R 9 600 per annum, 21.1% between R 9 601 and 19 600 per annum and 22.4% between R 19 600 and R 38 200 per annum (Census 2011). Based on the World Bank Development Research Group poverty measure, 64.9% of the ULMs population live below the poverty line. As with the ULM, these low-income levels reflect the reliance on an extensive agricultural sector and limited formal local employment opportunities. As noted, such low income levels are a major concern given the link with dependency on social grants. Low income levels also result in reduced local spending and rates revenue for the municipality.

Education

IYLM education levels also showed improvement across all three measured indices. In this regard, the percentage of the population 20+ with no schooling decreased from 17% to 10.7%, and the percentage of the population 20+ with matric increased from 14.4% to 20%. Tertiary education levels witnessed a more modest increase, namely from 6.2% to 8.8%.

Municipal Services

According to StatsSA, service levels in the IYLM increased for all four relevant indices over the period 2001 to 2011 (Table 8.16). Significant progress was made with regard to access to waterborne sewerage (+21.5%) as well as the provision of potable water inside dwellings (+20.6%). Gains in terms of electricity for lighting (13%) and weekly refuse removal (+6.9%) were more modest, but still significant.

Table 8.16: Overview of access to basic services in the IYLM

Municipal Services	IYLM	
	2001	**2011**
% households with access to flush toilet	65.8	87.3
% households with weekly municipal refuse removal	76.3	83.2
% households with piped water inside dwelling	47.6	68.2

% households which uses electricity for lighting	82.6	95.6

Source: Compiled from StatsSA Census 2001 and 2011 Municipal Fact Sheets

8.13.2.2 Social Services

Education

According to the 2014/2015 IDP, the IYLM has a total of 52 education facilities (Table 8.17). Of these, nearly half (24) are crèches and 16 are primary schools. Seven secondary schools are located in the IYLM's towns, while the LM has only one tertiary educational facility, namely the Grootfontein Agricultural Development Institute near Middelburg. Ward 9 within which the San Kraal WEF site falls is represented by one crèche, two primary schools and one secondary school.

Key challenges identified in the IDP include:

- The facilities are not evenly spread throughout the municipality
- Rural earners have to travel long distances to reach nearest schools
- Crèches are unevenly spread throughout the municipality; and
- Unregulated crèches are mushrooming at an alarming rate.

Table 8.17: Education Facilities Inxuba Yethemba LM.

Ward	Crèche	Pre-primary	Primary	Secondary	Tertiary	Grand Total
1	5	1	1	0	0	7
2	3	0	2	1	0	6
3	4	0	2	1	0	7
4	5	1	1	1	0	8
5	3	2	1	1	0	7
6	1	0	4	0	0	5
7	1	0	1	1	0	3
8	1	0	2	1	1	5
9	1	0	2	1	0	4
IYLM Total	**24**	**4**	**16**	**7**	**1**	**52**

Source: Inxuba Yethemba 2014/2015 IDP.

Health

According to the 2014/2015 IDP, the IYLM has a grand total of 10 health care facilities (Table 8.18). Of these, only one is a hospital, namely the Wilhelm Stahl Hospital in Middelburg. The large rural Ward 9 is serviced by two clinics.

Table 8.18: Health Facilities Inxuba Yethemba LM.

Ward	Hospital	Clinic	Grand Total
1	0	0	0
2	0	1	1
3	0	1	1
4	0	1	1
5	1	1	2
6	0	0	0
7	0	1	1
8	1	2	2
9	0	2	2
IYLM Total	**1**	**9**	**10**

Source: Inxuba Yethemba 2014/2015 IDP

The 2014/2015 IDP notes that health care provision conditions for the IYLM are on average at best fair. Key challenges identified in the IDP include:

- The long distances travelled by vulnerable groups such as the elderly to access health care facilities;
- The need for mobile clinics in some parts of the LM;
- The lack of clinic staff; and
- Under stocked clinics (medication); and
- HIV/ Aids.

With regard to HIV/ AIDS, the 2014/2015 IDP indicates that, while the HIV+ case load as well as the number of HIV-related deaths have declined – the latter significantly - from 2009 to 2012, by 2012 ~8.4% of the IYLM's population was diagnosed as HIV+, and ~0.45% was dying as a result of HIV-related causes (Table 8.19).

Table 8.19: HIV+ case load and HIV-related deaths for IYLM 2009-2012

YEAR	HIV+ CASES	HIV-RELATED DEATHS
2009	6 440	498
2010	5 370	252
2011	5 495	273
2012	5 559	291

Source: Inxuba Yethemba 2014/2015 IDP.

8.13.3 NoupoortTown

The town of Noupoort originated around a railway station, and its fortunes have always been closely linked to the railways. Naauwpoort station was established in 1884 on a portion of the farm Hartebeeshoek on the first sizeable flat area north of the defile on the line from Port Elizabeth to the Rand (via Bloemfontein) then under construction. The town gradually developed on both sides of the north-south aligned railway corridor. The lines continue to serve as a barrier to spatial and socio-economic integration in Noupoort.

During the Second Anglo-Boer War (1899-1902) a garrison of British troops was based in Noupoort to protect this strategic point along the railway line. In Noupoort itself, two existing structures bear witness to the War, namely a well-preserved blockhouse to the east of the Bloemfontein line in the Kwazamuxolo suburb of Noupoort, and the All Souls Anglican Chapel in Shaw St opposite the Municipal offices, built by masons stationed at the British garrison.

The Bloemfontein-Port Elizabeth line was later supplemented by a line from De Aar to Port Elizabeth, thus transforming Noupoort into a key railway junction. A rail yard and workshops were established at Midlandia, ~1km south of Noupoort. During its heyday a few decades ago, up to 100 trains a day used to pass through Noupoort station. Due to various factors such as a shift from steam to diesel and then electricity, as well as decreased freight volumes, Noupoort has witnessed a steady disinvestment over the last 20 or so years. As a result most shops, businesses and local services closed down and many owners relocated. In total, during the 1990s, an estimated 300 middle-class households moved out of Noupoort (Gillmer, pers. Comm, with social specialist). Many houses were abandoned, and later torn down or vandalized.

At the same time, Noupoort attracted unskilled farm worker households from the region in response to the roll-out of RDP housing and other government programmers and facilities, such as municipal and grant offices. The lack of economic activities in the town and surrounds has led to very high local unemployment levels. The lack of significant local retail and business in the town also means that little of locally generated income is spent in Noupoort.

Given the proximity of Middelburg, Colesberg and De Aar, Noupoort does not function as a major service center for local farmers. A Lewis Stores, an Agricultural Hardware store, a small fuel station, a large SAPS station, the station, and a few small general dealers are located in Noupoort, but virtually no other retail or services. Noupoort residents typically travel to Middelburg or Colesberg for shopping and services, including private health care. Higher order needs require travelling to Graaff-Reinet, De Aar or Bloemfontein.

Two secondary schools and two primary schools are located in Noupoort. The Noupoort Christian Care Centre has been running a well-known drug rehabilitation center in Noupoort since the 1990s. The Centre runs 1 and 2-year programmes, with wards and staff resident at the facility year-round. The Centre has also been running a number of local community outreach programmers in and around Noupoort. According to a local Municipal official, this has contributed to keeping Noupoort relatively drug-free. Tik and other hard drugs are currently not considered a major problem in the Noupoort community (Majuba, pers. Comm, with social specialist).

Over the past 5 years things have started to improve somewhat for Noupoort. Back to back construction projects associated with the upgrading of the N10 and N9, the recent construction of the Noupoort WEF north-east of Noupoort and the current construction of a large stadium in Noupoort, have created significant employment and skills training opportunities to the Noupoort community. The Noupoort WEF currently also makes use of local community members as security personnel. Since the authors last visited Noupoort in November 2012, the number of in-town accommodation facilities have increased from 2 to at least 6, apparently in response to the demand for long-stay accommodation amongst contractors.

The government has also invested in at least three agriculture-based projects in Noupoort, namely a broiler farm, an olive planting scheme (aimed at producing oil bearing fruit), and a wool and craft project. None of the projects are currently functional. This appears to be linked to the lack of local management expertise. The broiler farm structures located on Hartebeeshoek in the extreme north-eastern portion of the WEF site, are intact, and will likely be used for the intended purpose in the future (Majuba, Mgcineni, pers. comm).

Noupoort station and railway facilities are also set to benefit from the upgrades associated with the relocation of Port Elizabeth manganese ore line terminal to the new deep-water port of Ngqura in the Coega Industrial Development Zone. This will result in increased volumes of ore traffic and upgrading of the railway route from Postmasburg to Port Elizabeth, including the Noupoort area. The Umsovombo LM is currently lobbying for the revival of some Transnet functions in Noupoort and the revitalizing the station compound (Mgcineni, pers. comm).

8.13.4 Noupoort Rural Area

Livestock farming is the predominant and almost exclusive land use in the Noupoort rural area. The area is too dry to sustain dryland cropping, and lacks significant water sources to sustain commercial-scale irrigated cropping. The area is too arid to sustain significant dairy operations. Most of the farms in the area are actively farmed as commercial operations. Hartebeeshoek (site farm) east of Noupoort is farmed by an informal collective of communal farmers from the local community.

In terms of the grazing resource, Noupoort is located in the transition zone from scrub-dominated Karoo bossiesveld to grassveld more typical of the Southern Free State Highveld. For this reason, the area is colloquially known as 'skyn-Karoo' (pseudo-Karoo) to local farmers (Visser, pers. comm). Around Noupoort, the N9 is said to provide a rough demarcation line between progressively more bossiesveld towards its west, and progressively more grassveld towards its east (van der Walt, pers. comm).

This mixed veld enables Noupoort farmers to farm with both sheep and cattle – typically wool or dual-purpose sheep, and beef cattle. This mixture of scrub and grass also allows for year-round grazing, as the scrub provides food during the winter when the grass component dies back (de Villiers, pers. com).

Carrying capacities are around 4 hectares per 1 sheep (or 18 ha per head of cattle) (de Villiers, Visser, pers. Comm, with social specialist). Large, multi-unit operations are typical. In the area immediately to the west of Noupoort, most farms are used as stock posts in operations based on farms elsewhere in the Noupoort district (Gillmer, pers. comm). These stock posts are typically near enough from main operations to be visited regularly by their owners. Supervising staff reside on a few properties.

Irrigated fodder-cropping for own use is associated with most operations. Cropping activities are typically in proximity to the historical farm werf on farms and stock posts on flat, low-lying areas. Irrigation for fodder plantings is from boreholes and earthen farm dams, some of which fed by fountains.

Extensive livestock farming provides limited employment opportunities. Most farms in the study area have retained a resident labour force component, supplemented by workers driven in daily from Noupoort. Workers residing on farms typically reside on the main farms, i.e. those inhabited by the owner. Seasonal opportunities are mainly associated with annual shearing, typically done by travelling professional shearers from outside the area.

As in other stock farming areas, predators, stock theft and veld fires constitute major operational risks. Stock theft is an on-going concern, with proximity to urban Noupoort and exposure to and isolation from major roads seen as key risk factors. The major threat is to sheep, and at least one operation (Arbeidsgenot) on the outskirts of Noupoort has shifted from sheep to cattle to reduce the risk. Interviewees have however indicated that incidents of stock theft are currently limited, and mainly small-scale in nature. No syndicates are currently thought to operate in the area.

Game occurs on most farms in the study area, typically plains antelope, Kudu and Ribbok, but commercial hunting and eco-wildlife tourism activities are currently limited in the Noupoort area. Key exceptions are Brulberg, located 40 km east of Noupoort along the Oorlogspoort Road, and Wildberg, located ~6 km to the south of the Phezukomoya WEF site. Vrede (site farm) may be revived as an accommodation facility with paid hunting opportunities in future (Gillmer, pers. Comm, with social specialist).

As in Noupoort town, the local guest farms are largely geared to passing travellers, and more recently, long-stay contractors. At least four guest farms are located in proximity to Noupoort, all of which accessed directly off the N9. All four are located on working farms – The Dairy on Arbeidsgenot Farm, Carlton Heights Lodge on Vlakfontein Farm, Sherboure on Wolwekop Farm, and Welvanpas on Welvanpas Farm). None of the operations are geared at destination-tourism. All of them seem to have expanded in response to the demand for long stay opportunities for contractors working in the area over the past few years, and specifically the construction of the Noupoort WEF (Pieter Erasmus, Annatjie Moore, van Huyssteen, pers, comm).

9 WIND ENERGY RELATED IMPACTS

In this section, the typical issues / impacts related to the establishment of a WEF and associated infrastructure (such as on-site substations and power lines) are discussed. It is important to note that over the next few years several WEFs (including substations and power lines) are likely to be constructed in South Africa. The development and associated environmental assessment of WEFs in South Africa is relatively new, and thus it is valuable to draw on international experience. This section of the report therefore draws on international literature and web material (of which there is significant material available) to describe the generic impacts associated with WEFs and associated infrastructure such as on-site substations and power lines. It should be noted that the section is not specific to the site but merely a review of international literature.

9.1 Health Related Impacts

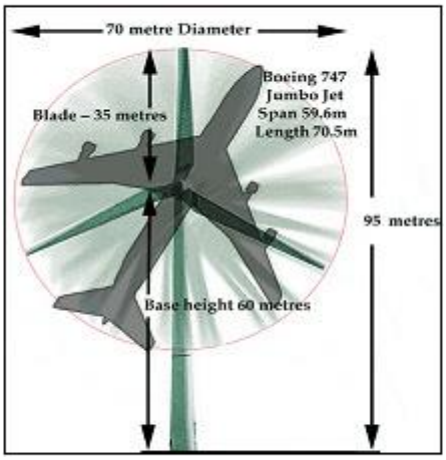
The potential health impacts typically associated with WEFs include, noise, dust, shadow flicker and electromagnetic radiation. The findings of a literature review undertaken by the Australian Health and Medical Research Council published in July 2010 indicate that there is no evidence of wind farms posing a threat to human health. The research also found that wind energy is associated with fewer health effects than other forms of traditional energy generation, and may therefore in fact result in the minimization of adverse health impacts for the population as a whole (WHO, 2004).

The overall conclusion of the review undertaken by the Australian Health and Medical Research Council (July, 2010) is that, based on current evidence, wind turbines do not pose a threat to health if planning guidelines are followed.

9.2 Wind Turbine Generators

The height of the turbines and the fact that a WEF comprises a number of these turbines distributed across the site would result in the development typically being visible over a large area.

Internationally, studies have demonstrated that there is a direct correlation between the number of turbines and the degree of objection to a WEF, with less opposition being encountered when fewer turbines are proposed (Devine-Wright, 2005). Certain objectors to wind energy developments also mention the "sky space" occupied by the rotors of a turbine. As well as height, "sky space" is an important issue. "Sky space" refers to the area in which the rotors would rotate. The diagram below indicates that the "sky space" occupied by rotors would be similar to that occupied by a jumbo jet (http://www.stopbickertonwindturbines.co.uk/ - page on visual impact).



The visual prominence of the development would be exacerbated within natural settings, in areas of flat terrain or if located on a ridge top. Even dense stands of wooded vegetation are likely to offer only partial visual screening, as the wind turbines are of such a height that they will rise above even mature large trees.

9.3 Shadow Flicker

Shadow flicker is an effect which is caused when shadows repeatedly pass over the same point. It can be caused by wind turbines when the sun passes behind the hub of a wind turbine and casts a shadow that continually passes over the same point as the rotor blades of the wind turbine rotate (http://www.ecotricity.co.uk).

The effect of shadow flicker is only likely to be experienced by people situated directly within the shadow cast by the rotor blades of the wind turbine. As such, shadow flicker is only expected to have an impact on people residing in houses located within close proximity of a wind turbine (less than 500m) and at a specific orientation, particularly in areas where there is little screening present. Shadow flicker may also be experienced by and impact on motorists if a wind turbine is located in close proximity to an existing road. The impact of shadow flicker can be effectively mitigated by choosing the correct site and layout for the wind turbines, taking the orientation of the turbines relative to the nearby houses and the latitude of the site into consideration. Tall structures and trees will also obstruct shadows and prevent the effect of shadow flicker from impacting on surrounding residents (http://www.ecotricity.co.uk).

9.4 Motion Based Visual Intrusion

An important component of the visual impacts associated with wind turbines is the *movement* of the rotor blades. Labelled as motion-based visual intrusion, this refers to the inclination of the viewer to focus on discordant, moving features when scanning the landscape. Evidence from surveys of public attitudes towards WEFs suggest that the viewing of moving rotor blades is not necessarily perceived negatively (Bishop and Miller, 2006). The authors of the study suggest two possible reasons for this; firstly when the turbines are moving they are seen as being 'at work', 'doing good' and producing energy. Conversely, when they are stationary they are regarded as a visual intrusion that has no evident purpose. More interestingly, the second theory that explains this perception is related to the intrinsic value of wind in certain areas and how turbines may be an expression or extension of an otherwise 'invisible' presence.

Famous winds across the world include the Mistral of the Camargue in France, the Föhn in the Alps, or the Bise in the Lavaux region of Switzerland. The wind, in these cases, is an intrinsic component of the landscape, being expressed in the shape of trees or drifts of sands, but being otherwise invisible. The authors of the study argue that wind turbines in these environments give expression, when moving, to this quintessential landscape element. In a South African context, this phenomenon may well be experienced if wind farms are developed in areas where typical winds, like berg winds, or the south-easter in the Cape are an intrinsic part of the environment. In this way, it may even be possible that wind farms will, through time form part of the cultural landscape of an area, and become a representation of the opportunities presented by the natural environment.

9.5 Landscape Impacts

The guidelines also note that landscapes change over time, both naturally and through human intervention. In addition, landscape values, being subjective, change not only with time, but also from person to person. As a result, there are a wide variety of opinions of what is valued and what is not. The perceptions by which we value landscapes are influenced by a range of factors such as visual, cultural, spiritual, environmental, and based on memories or different aesthetics (National Wind Farm Development Guidelines, DRAFT - July 2010).

The guidelines note that cumulative impacts need to be considered in relation to dynamic as well as static viewpoints. The experience of driving along a tourist road, for example, needs to be considered as a dynamic sequence of views and visual impacts, not just as the cumulative impact of several developments on one location. The viewer may only see one wind farm at a time, but if each successive stretch of the road is dominated by views of a wind farm, then that can be argued to be a cumulative visual impact (National Wind Farm Development Guidelines, DRAFT - July 2010).

Cumulative impacts may be visual and aesthetic, but they can also occur in relation to non-visual values about landscape. Non-visual values include sounds/noise, associations, memories, knowledge and experiences or other cultural or natural values. As an example, the Guidelines indicate that locating four wind farms in a valley previously best known for its historic wineries might change the balance of perception about the valley's associational character, irrespective of whether all four wind farms were sited in a single view shed (National Wind Farm Development Guidelines, DRAFT - July 2010).

In the Scottish case, the primary argument employed to oppose wind farms related to the impact on valued landscapes. As in the South African case, the visual impacts are exacerbated by the fact that the locations with the greatest wind resources are often precisely those exposed upland areas which are most valued for their scenic qualities, and which are often ecologically sensitive. The establishment of wind farms together with the associated service roads and infrastructure, transforms landscapes which are perceived to be natural into 'landscapes of power' (Pasqualetti et al., 2002, p. 3).

9.6 Impact of Wind Farms on Tourism

A review of international literature in the impact of wind farms was undertaken as part of the SIA. Three articles were reviewed, namely:

- Atchison, (April, 2012). Tourism Impact of Wind Farms: Submitted to Renewables Inquiry Scottish Government. University of Edinburgh
- Glasgow Caledonian University (2008). The economic impacts of wind farms on Scottish tourism. A report prepared for the Scottish Government
- Regeneris Consulting (2014). Study into the Potential Economic Impact of Wind Farms and Associated Grid Infrastructure on the Welsh Tourism Sector

The most comprehensive appears to be a review undertaken by Professor Cara Aitchison from the University of Edinburgh in 2012 which formed part Renewable Energy Inquiry by Scottish Government. The research by Aitchison found that that previous research from other areas of the UK has demonstrated that wind farms are very unlikely to have any adverse impact on tourist numbers (volume), tourist expenditure (value) or tourism experience (satisfaction) (Glasgow Caledonian University, 2008; University of the West of England, 2004). In addition, to date, there is no evidence to demonstrate that any wind farm development in the UK or overseas has resulted in any adverse impact on tourism. In conclusion, the findings from both primary and secondary research relating to the actual and potential tourism impact of wind farms indicate that there will be neither an overall decline in the number of tourists visiting an area nor any overall financial loss in tourism-related earnings as a result of a wind farm development. The study by the Glasgow Caledonian University (2008) found that only a negligible fraction of tourists will change their decision whether to return to Scotland as a whole because they have seen a wind farm during their visit.

The study also found that 51.0% of respondents indicated that they thought wind farms could be tourist attractions. In this regard, the visitor centre at the Whitelee Wind Farm in east Ayrshire Scotland run by ScottishPower Renewables has become one of the most popular 'eco-attractions' in Scotland, receiving 200 000 visitors since it opened in 2009.

9.7 Impact of Wake Effect on surrounding Wind Energy Facilities

During the comment and review period for the draft Scoping Report, the DEA requested that due to the proximity of the proposed San Kraal WEF to the existing operational Noupoort WEF, a wake effect analysis must be undertaken. The purpose of the study is to determine the potential loses, if any to the Noupoort Wind Farm, should the San Kraal WEF be developed. InnowWind engaged directly with Mainstream (oowner and operator of the Noupoort WEF), to understand their concerns regarding the potential wake effect. InnoWind requested wind data information from the Noupoort Wind Farm to include, in their analysis, via and independent third party. Due to commercial reasons, Mainstream, was not comfortable providing this information. 3E, the specialists appointed to undertake the analysis, determined that the two years worth of wind data collected at San Kraal WEF will be sufficient to undertake a comprehensive study.

In order to do the analysis a single wind farm configuration was considered for the proposed San Kraal WEF, comprising 78 Vestas V150 4 MW wind turbines, with 150 hub height for an installed capacity of 213 MW. 29.8 months of data from a 210 m met mast installed at the site was used. The configuration of the measuring device complies with best industry practice. After data processing and analysis, the two year period between 14 September 2015 to 13 September 2017 was selected for being the most presentative of the short term wind regime at the site. short term measurements were then correlated to long term reference data to compensate for seasonal and annual wind variations. ERA-Interim and the Linear regression method were selected. The terrain at the site was modelled (elevation, roughness and obsticles to the wind flow) and wind the wind flow model WAsP was used to extrapolate the wind regime to the location and hub height of each wind turbine. The preliminary study indicated that the impact to the Noupoort Wind Farm's production is minimal with an estimated loss of 0,96% of its production over a twenty year period, based on the current San Kraal wind turbine layout as depicted in this EIA Report.

InnoWind will agree to provide Noupoort Wind Farm with equitable compensation for its loss of production as a result of the wake effect caused by the San Kraal WEF's operations.

To this end InnoWind will negotiate fair compensation with Mainstream in good faith, when San Kraal WEF reaches preferred bidder status in the REIPPP, or any other renewable energy program, and before San Kraal reaches Financial Close. This negotiation is subject to Mainstream cooperating with InnoWind during this process, in good faith without causing any unreasonable delays or interference.

InnoWind will appoint (at its own cost) with Mainstream's prior written consent, which shall not be unreasonably delayed or withheld, an additional independent third-party specialist study that will quantify the loss of production, the Noupoort Wind Farm will incur as a result of the wake effects caused by the San Kraal WEF **based on the final layout and turbine model as submitted to DEA for approval, prior to initiating the construction phase.**

9.8 Impact of Wind Farms on Property Values

The literature review undertaken as part of the SIA does not constitute a property evaluation study and merely seeks to comment on the potential impact of wind farms on property values based on the findings of studies undertaken overseas. The literature reviewed was based on an attempt by the authors of the SIA to identify what appear to be "scientifically" based studies that have been undertaken by reputable institutions. In this regard, it is apparent that there are a number of articles available on the internet relating to the impact of wind farms on property values that lack scientific vigour. The literature review also sought to identify research undertaken since 2010. The literature review does not represent an exhaustive review.

In total five articles were identified and reviewed namely:

- Stephen Gibbons (April, 2014): Gone with the wind: Valuing the Visual Impacts of Wind turbines through house prices. London School of Economics and Political Sciences & Spatial Economics Research Centre, SERC Discussion Paper 159;
- Review of the Impact of Wind Farms on Property Values, Urbis Pty Ltd (2016): Commissioned by the Office of Environment and Heritage, NSW, Australia;
- Yasin Sunak and Reinhard Madlener (May 2012): The Impact of Wind Farms on Property Values: A Geographically Weighted Hedonic Pricing. School of Business and Economics / E.ON Energy Research Center, RWTH Aachen University. Model Working Paper No. 3/2012;
- Martin D. Heintzelman and Carrie M. Tuttle (March 3, 2011): Values in the Wind: A Hedonic Analysis of Wind Power Facilities. Economics and Financial Studies School of Business, Clarkson University;
- Ben Hoen, Jason P. Brown, Thomas Jackson, Ryan Wiser, Mark Thayer and Peter Cappers (August 2013): A Spatial Hedonic Analysis of the Effects of Wind Energy Facilities on Surrounding Property Values in the United States. Ernest Orlando Lawrence Berkeley National Laboratory.

The literature reviewed was based on an attempt by the authors of the SIA to identify what appear to be "academically and or scientifically" based studies that have been undertaken by reputable institutions post 2010. However, the literature review does not represent an exhaustive review. The most comprehensive study appears to the study by Gibbons (2014), which found that "averaging over wind farms of all sizes" the price reduction was around 5-6% within 2km, falling to less than 2% between 2 and 4km, and less than 1% by 14km which is at the limit of likely visibility. While the focus of the Gibbons study was on residential properties it does indicate that the larger the distance the less the impact. The findings of the Urbis (2016) study indicate that "wind farms may not significantly impact rural properties used for agricultural purposes".

Three of the articles indicate that wind farms have the potential to impact on property values, while two indicate that the impacts are negligible and or non-existent.

In terms of the proposed project the most relevant study is the Urbis study (2016). The authors of the study found that appropriately located wind farms within rural areas, removed from higher density residential areas, are unlikely to have a measurable negative impact on surrounding land values.

Based on the outcome of the Urbis study (2016) the authors were of the opinion that wind farms may not significantly impact rural properties used for agricultural purposes. In conclusion, the authors of the Urbis study found that appropriately located wind farms within rural areas, removed from higher density residential areas, are unlikely to have a measurable negative impact on surrounding land values. Based on this information the potential impact of the proposed WEF on the property values in the area is likely to be low.

10 ASSESSMENT OF POTENTIAL IMPACTS

10.1 Geology

10.1.1 San Kraal WEF

Construction Phase Impacts

Impact Phase: Construction and Operational							
Impact Description: Loss of agricultural land In most environmental investigations, the major impact on the natural resources of the study area would be the loss of potentially agricultural land due to the construction of the turbines and associated infrastructure. However, this impact would be of extremely limited significance and would be local in extent.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	L	L	L	Negative	**M**	H	H
With Mitigation	L	L	L	Neutral	**M**	H	H
Can the impact be reversed?		YES: Very little land will be affected and soil can be replaced.					
Will impact cause irreplaceable loss or resources?		NO: Soil potential in vicinity is low, so no agricultural soils will be affected.					
Can impact be avoided, managed or mitigated?		YES					
Mitigation measures to reduce residual risk or enhance opportunities: • Avoid any areas under cultivation (if any).							
Residual Impact No residual geology impact. Considered to be insignificant due to very restricted occurrence of agricultural soils.							

Impact Phase: Construction and Operational							
Impact Description: Increased soil erosion hazard In this area, the steep topography in many parts, coupled with the shallow soils, relatively sandy topsoil and dry climate, means that a possible impact would be the increased danger of erosion of the topsoil when vegetation cover is removed. This would be especially relevant for the construction of access roads, turbine sites and other associated infrastructure.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	L	M	M	Negative	**M**	H	H
With Mitigation	L	L	L	Neutral	**M**	H	H
Can the impact be reversed?		YES: Topsoil coverage can be replaced and affected sites re-vegetated and stabilized.					
Will impact cause irreplaceable loss or resources?		NO: Soil potential in vicinity is low, so no agricultural soils will be affected.					
Can impact be avoided, managed or mitigated?		YES: Soil conservation measures should be implemented.					
Mitigation measures to reduce residual risk or enhance opportunities: • Minimise vegetation removal to the smallest possible footprint. • Control possible runoff by using soil conservation and soil retention measures, especially on steep slopes.							

• Store any removed topsoil for later use (contains indigenous seeds etc.) and re-vegetate as soon as possible. • Once specific infrastructure sites are known, site-specific measures can be devised for implementation and any potentially high risk sites can be identified.
Residual Impact No residual geology impact.

10.1.2 Cumulative impacts on Geology

The likelihood of cumulative impacts is small. Only if other developments (whether wind farms or not) were to occur, using the same access roads and thereby increasing potential soil erosion aspects, would cumulative impacts need to be considered.

10.2 Freshwater and Wetlands

10.2.1 San Kraal WEF

The following impacts were not assessed as the factors were not present within the study area aquatic ecosystems:

- Loss of aquatic species of special concern, and
- Wetland loss as no natural wetlands were observed near any of the proposed WEF infrastructure or transmission line alternatives (i.e. within 500m of the proposed layouts).

The following direct and indirect impacts were assessed with regard the riparian areas and water courses:

- Impact 1: Loss of riparian systems and water courses
- Impact 2: Impact on riparian systems through the possible increase in surface water runoff on riparian form and function
- Impact 3: Increase in sedimentation and erosion
- Impact 4: Potential impact on localised surface water quality

Although no wind farm layout alternatives have been considered for the aquatic assessment, the final layout was derived using sensitivity maps provided to the developer. This has allowed for a largely mitigated layout, with the number of impacts, such as new water course crossing being kept to the minimum.

Construction Phase Impacts

Impact Phase: Construction							
Impact Description: Loss of riparian systems and water courses during the construction phase of the WEF The physical removal of the narrow strips of riparian zones and disturbance of any watercourses by the road crossings only, being replaced by hard engineered surfaces. This biological impact would however be localised, as a large portion of the remaining catchment would remain intact, while the significant structures (e.g. turbines and hard standing areas) have been placed well outside of these areas.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	L	M	L	Negative	**M**	H	H
With Mitigation	L	L	L	Negative	**L**	L	H
Can the impact be reversed?			Yes				
Will impact cause irreplaceable loss or resources?			No				
Can impact be avoided, managed or			Yes				

mitigated?	

Mitigation measures to reduce residual risk or enhance opportunities:

- No construction may take place within 32 m of a watercourse, with the exception of water course crossings.
- Where water course crossings are required, the engineering team must provide effective means to minimise the potential upstream and downstream effects of sedimentation and erosion (erosion protection) as well minimise the loss of riparian vegetation (small footprint).
- If several the transmission line towers for the grid need to be located within some of the watercourses, then this must be carried out in collaboration with an aquatic specialist during the micro siting process
- No vehicles to refuel or be maintained within drainage lines/ riparian vegetation.
- During the operational phase, monitor culverts to see if erosion issues arise and if any erosion control is required.
- Where possible culvert bases must be placed as close as possible with natural levels in mind so that these don't form additional steps / barriers.

Residual Impact

Possible impact on the remaining catchment due to changes in run-off characteristics in the development site.

Cumulative impact

The increase in surface run-off velocities and the reduction in the potential for groundwater infiltration is likely to occur, considering that the site is near the main drainage channels particularly when considering a possible 2 other renewable projects. However, the annual rainfall figures are low and this impact is not anticipated and only a small percentage of the proposed projects reach the construction phase and or cover large portions of the site.

Impact Phase: Construction and Operational

Impact Description: Increase in sedimentation and erosion within the development footprint during the construction phase and to a lesser degree the operational phase

	Extent	Duration	Intensity	Status	Significance	Probability	Confidence
Without Mitigation	L	M	L	Negative	**M**	H	H
With Mitigation	L	L	L	Negative	**L**	L	H

Can the impact be reversed?	Yes
Will impact cause irreplaceable loss or resources?	No
Can impact be avoided, managed or mitigated?	Yes

Mitigation measures to reduce residual risk or enhance opportunities:

- Any storm water within the site must be handled in a suitable manner, i.e. trap sediments and reduce flow velocities.

Residual Impact

During flood events, any unstable banks (eroded areas) and sediment bars (sedimentation downstream) already deposited downstream. However due to low mean annual runoff within the region this is not anticipated due to the nature of the development together with the proposed layout.

Cumulative impact

Downstream erosion and sedimentation of the downstream systems and farming operations. During flood events, any unstable banks (eroded areas) and sediment bars (sedimentation downstream). However due to low mean annual runoff within the region this is not anticipated due to the nature of the development together with the proposed layout.

Impact Phase: Construction

Impact Description: Impact on localized surface water quality mainly during the construction phase.

During construction and to a limited degree the operational activities, chemical pollutants (hydrocarbons from equipment and vehicles, cleaning fluids, cement powder, wet cement, shutter-oil, etc.) associated with site-clearing machinery and construction activities could be washed downslope via the ephemeral systems.

	Extent	Duration	Intensity	Status	Significance	Probability	Confidence
Without Mitigation	L	M	L	Negative	**M**	H	H
With Mitigation	L	L	L	Negative	**L**	L	H

Can the impact be reversed?	Yes
Will impact cause irreplaceable loss or resources?	Yes
Can impact be avoided, managed or mitigated?	Yes

Mitigation measures to reduce residual risk or enhance opportunities:

- Strict use and management of all hazardous materials used on site.
- Strict management of potential sources of pollution (e.g. litter, hydrocarbons from vehicles & machinery, cement during construction, etc.).
- Containment of all contaminated water by means of careful run-off management on the development site.
- Strict control over the behaviour of construction workers.
- Working protocols incorporating pollution control measures (including approved method statements by the contractor) should be clearly set out in the Construction Environmental Management Plan (CEMP) for the project and strictly enforced.
- Appropriate ablution facilities should be provided for construction workers during construction and on-site staff during the operation of the facility.

Residual Impact

Residual impacts will be negligible after appropriate mitigation.

Cumulative impact

Possible impact on the remaining catchment due to changes in run-off characteristics in the development site. However due to low mean annual runoff within the region this is not anticipated due to the nature of the development together with the proposed layout.

Operational Phase Impacts

Impact Phase: Operational

Impact Description: Impact on riparian systems through the possible increase in surface water runoff from hard surfaces and or new road crossings on riparian form and function.

	Extent	Duration	Intensity	Status	Significance	Probability	Confidence
Without Mitigation	L	L	L	Negative	**M**	H	H
With Mitigation	L	L	L	Negative	**L**	L	H

Can the impact be reversed?	Yes
Will impact cause irreplaceable loss or resources?	No
Can impact be avoided, managed or mitigated?	Yes

Mitigation measures to reduce residual risk or enhance opportunities:

- Any storm water within the site must be handled in a suitable manner, i.e. trap sediments, and reduce flow velocities. This is particularly important due to the levels of erosion already observed within the affected catchments.

Residual Impact Possible impact on the remaining catchment due to changes in run-off characteristics in the development site. However due to low mean annual runoff within the region this is not anticipated due to the nature of the development together with the proposed layout.
Cumulative impact Downstream alteration of hydrological regimes due to the increased run-off from the area. However due to low mean annual runoff within the region this is not anticipated due to the nature of the development together with the proposed layout. This is also coupled to the fact that surrounding developments would impact on a different catchment in the neighbouring water management area, coupled to the low average rainfall figures.

10.2.2 Grid Connection Alternatives

It is anticipated the no impacts on the aquatic environment will occur by the proposed grid connection alternatives. This is based on the assumption that during the final design process all transmission line towers will be located outside of the delineated water courses and the 32 m buffer. This includes the 100m corridor extension around the current Eskom substation.

The only recommendation being that should any of the towers be located on steep slopes adequate erosion protection should be installed to prevent any surface water run-off from eroding these areas.

It is however recommended that a walk down of the final tower positions is conducted by an aquatic specialist prior to construction. This will allow for critical comment on the tower positions and allow for any adjustments to avoid any impacts by shifting tower positions where required.

10.2.3 Cumulative impacts on freshwater and wetlands

Impact Phase: All Phases							
Impact Description: Overall cumulative impact during the construction and operational phases. In the assessment of this project, the surrounding projects within a 35 km radius of the site were assessed, including the Noupoort WEF that has recently been constructed. Other projects include, Naauw Poort Solar Energy Facility, Umsombomvu Wind Energy Facility, Aggenys Solar PV and Dida Solar PV. Of these potential projects, the aquatic specialist has been involved in the initial EIA aquatic assessments or has managed / assisted with the Water Use License process for 2 of these projects. The specialist has also reviewed the outcomes of the remaining projects as part of this EIA or other EIA / WUL applications is the region. All of the projects have indicated that this is also their intention with regard to mitigation, i.e. selecting the best possible routes to minimise the local and regional impacts, and improving the drainage or hydrological conditions with these rivers so that the cumulative impact would be negligible. However, the worse-case scenario has been assessed below, i.e. only the minimum of mitigation be implemented by the other projects, noting only a small number of projects ever reach the construction phase and that flows within these systems are sporadic.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	L	M	L	Negative	**M**	H	H
With Mitigation	L	L	L	Negative	**L**	L	H
Can the impact be reversed?			Yes				
Will impact cause irreplaceable loss or resources?			Yes				
Can impact be avoided, managed or mitigated?			Yes				

Mitigation measures to reduce residual risk or enhance opportunities:
• Improve the current stormwater and energy dissipation features not currently found along the tracks and roads within the region. • Install properly sized culverts with erosion protection measures at the present road / track crossings.
Residual Impact
Residual impacts will be negligible after appropriate mitigation.

10.2.4 Recommended Buffers

Presently there are no prescribed aquatic buffers other than those proposed in the Northern Cape, thus the recommendations by Desmet and Berliner (2007) will be applied, as these are becoming more widely accepted (Table 10.1). These are shown below, to make the engineers and contractors aware of these buffers during the planning phase, i.e. construction, associated batch plants, stockpiles, lay down areas and construction camps should avoid these buffer areas i.e. 32m for this development.

Table 10.1: Recommended buffers for rivers, with those applicable to the project highlighted in blue

River criterion used	Buffer width (m)	Rationale
Mountain streams and upper foothills of all 1:500 000 rivers, i.e. rivers mapped at this scale by DWS	50	These longitudinal zones generally have more confined riparian zones than lower foothills and lowland rivers and are generally less threatened by agricultural practices.
Lower foothills and lowland rivers of all 1:500 000 rivers i.e. rivers mapped at this scale by DWS	100	These longitudinal zones generally have less confined riparian zones than mountain streams and upper foothills and are generally more threatened by development practices.
All remaining 1:50 000 scale streams, i.e. all systems that appear on the topo-cadastral maps	32	Generally smaller upland streams corresponding to mountain streams and upper foothills, smaller than those designated in the 1:500 000 rivers layer. They are assigned the riparian buffer required under South African legislation.

10.3 Flora and Terrestrial Fauna

10.3.1 San Kraal WEF

Construction Phase Impacts

Impact Phase: Construction
Impact Description: The development of the wind farm would require vegetation clearing for turbines, roads, internal powerlines or cable trenches and other hard infrastructure. Apart from the direct loss of vegetation within the development footprint, listed and protected species are also highly likely to be impacted. The total extent of habitat loss is expected to be in the order of 150ha. As the abundance of species of conservation concern in the area is low, the impact on SCC is likely to be relatively low and primary impact would be on gross habitat loss of the affected veld types.

	Extent	Duration	Intensity	Status	Significance	Probability	Confidence
Without Mitigation	L	H	H	Negative	**H**	H	H
With Mitigation	L	M	L	Negative	**M**	H	H

Can the impact be reversed?	No - transformation is a necessary outcome of the development and will largely persist for the lifetime of the development and sometime thereafter. Some residual impact will remain even after decommissioning and rehabilitation.
Will impact cause irreplaceable loss or resources?	No, no critical or rare habitats are within the development footprint.
Can impact be avoided, managed or mitigated?	Possibly, through avoidance, but some residual impact is likely.

Mitigation measures to reduce residual risk or enhance opportunities:

- Placement of turbines within the High Sensitivity areas and drainage lines should be avoided.
- Preconstruction walk-though of the approved development footprint to ensure that sensitive habitats and species are avoided where possible.
- Ensure that lay-down and other temporary infrastructure is within medium- or low- sensitivity areas. The assessed locations are considered acceptable, but should be rehabilitated after use.
- Minimise the development footprint as far as possible and rehabilitate disturbed areas that are no longer required by the operational phase of the development.
- The exact routing of the roads should be adjusted where necessary to avoid features of higher sensitivity such as rocky outcrops, as informed by the preconstruction walk-though of the facility.
- Preconstruction environmental induction for all construction staff on site to ensure that basic environmental principles are adhered to. This includes topics such as no littering, appropriate handling of pollution and chemical spills, avoiding fire hazards, minimizing wildlife interactions, remaining within demarcated construction areas etc.
- Demarcate sensitive areas in close proximity to the development footprint as no-go areas with construction tape or similar and clearly mark as no-go area.

Residual Impact

There will be some habitat loss that is an unavoidable impact of the development and cannot be effectively mitigated. As the surrounding landscape is still overwhelmingly intact and there are no very high value plant habitats within the development footprint, post-mitigation impacts are likely to be of Medium Significance.

Impact Phase: Construction

Impact Description: Faunal impacts due to construction-phase noise and physical disturbance.

Increased levels of noise, pollution, disturbance and human presence during construction will be detrimental to fauna. Sensitive and shy fauna are likely to move away from the area during the construction phase as a result of the noise and human activities present, while some slow-moving species would not be able to avoid the construction activities and might be killed. Traffic during construction will be high and will pose a risk of collisions with susceptible fauna. Slower types such as tortoises, snakes and amphibians would be most susceptible. Some mammals and reptiles would be vulnerable to illegal collection or poaching during the construction phase as a result of the large number of construction personnel that are likely to be present. Many of these impacts can however be effectively managed or mitigated. However, faunal habitat loss cannot be mitigated and would persist for the operational lifetime of the facility.

	Extent	Duration	Intensity	Status	Significance	Probability	Confidence
Without Mitigation	L	M	H	Negative	**M**	H	H
With Mitigation	L	M	L	Negative	**M**	H	M

Can the impact be reversed?	Construction-phase disturbance will be transient, but some habitat loss would be long term.
Will impact cause irreplaceable loss	Not likely as there do not appear to be any significant populations of

or resources?	species of conservation concern within the affected area.
Can impact be avoided, managed or mitigated?	Only partly as noise and construction phase disturbance and habitat loss cannot be entirely avoided or mitigated.

Mitigation measures to reduce residual risk or enhance opportunities:

- Preconstruction walk-through of the facility to identify areas of faunal sensitivity.
- During construction any fauna directly threatened by the construction activities should be removed to a safe location by the ECO or other suitably qualified person.
- The illegal collection, hunting or harvesting of any plants or animals at the site should be strictly forbidden. Personnel should not be allowed to wander off the construction site.
- Fires within suitable dedicated containers (i.e. braai drums etc) should only be allowed within the construction camp and similar demarcated and cleared areas and no fires should be allowed in the open veld as there is a risk of runaway veld fires.
- No fuelwood collection should be allowed on-site.
- No dogs or cats should be allowed on site apart from that of the landowners.
- If any parts of site such as construction camps must be lit at night, this should be done with low-UV type lights (such as most LEDs) as far as practically possible, which do not attract insects and which should be directed downwards.
- All hazardous materials should be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel and oil spills that occur at the site should be cleaned up in the appropriate manner as related to the nature of the spill.
- No unauthorized persons should be allowed onto the site and site access should be strictly controlled
- All construction vehicles should adhere to a low speed limit (40km/h for cars and 30km/h for trucks) to avoid collisions with susceptible species such as snakes and tortoises and rabbits or hares. Speed limits should apply within the facility as well as on the public gravel access roads to the site.
- All personnel should undergo environmental induction with regards to fauna and in particular awareness about not harming or collecting species such as snakes, tortoises and owls which are often needlessly persecuted.

Residual Impact

Noise and disturbance during construction cannot be well mitigated, but would be transient. Some habitat loss for fauna would persist for the operational lifetime of the facility.

After mitigation, faunal impacts are likely to be of <u>moderate significance</u> but not of broader implication as there are no listed species which would be significantly affected by the development.

Operational Phase Impacts

Impact Phase: Operational

Impact Description: Faunal impacts due to operational activities

Although noise and disturbance levels during operation will be significantly reduced compared to construction, some noise and disturbance impacts will persist due to operational activities on the wind farm as well as noise generated by the turbines themselves. Although most fauna are likely to quickly become habituated to the presence of the turbines, some fauna may be negatively affected due to noise or other reason and may avoid the proximity of the turbines and would therefore experience greater long-term habitat loss. This is however likely to be a small subset of the species present and this effect has not been documented here or elsewhere for wind farms.

	Extent	Duration	Intensity	Status	Significance	Probability	Confidence
Without Mitigation	L	M	M	Negative	**M**	H	H
With Mitigation	L	M	L	Negative	**L**	L	M

Can the impact be reversed?	The impact will persist for the lifespan of the facility.
Will impact cause irreplaceable loss or resources?	Unlikely as there are few species of concern in the area.
Can impact be avoided, managed or mitigated?	Some management is possible, but residual impact from the wind turbines and general disturbance will persist, albeit at a low intensity.

Mitigation measures to reduce residual risk or enhance opportunities:

- Management of the site should take place within the context of an Open Space Management Plan.

- No unauthorized persons should be allowed onto the site.
- Any potentially dangerous fauna such snakes or fauna threatened by the maintenance and operational activities should be removed to a safe location.
- The collection, hunting or harvesting of any plants or animals at the site should be strictly forbidden by anyone except landowners or other individuals with the appropriate permits and permissions where required.
- If the site must be lit at night for security purposes, this should be done with downward-directed low-UV type lights (such as most LEDs) as far as possible, which do not attract insects.
- All hazardous materials should be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel and oil spills that occur at the site should be cleaned up in the appropriate manner as related to the nature of the spill.
- All vehicles accessing the site should adhere to a low speed limit (40km/h max) to avoid collisions with susceptible species such as snakes and tortoises.
- If parts of the facility are to be fenced, then no electrified strands should be placed within 30cm of the ground as some species such as tortoises are susceptible to electrocution from electric fences as they do not move away when electrocuted but rather adopt defensive behaviour and are killed by repeated shocks. Alternatively, the electrified strands should be placed on the inside of such fenced areas and not the outside.

Residual Impact

Residual impacts will be low and restricted to some low-intensity disturbance associated with the maintenance activities at the site as well as some noise impacts associated with the operation of the turbines.

As the affected areas are not considered to be very high faunal sensitivity and there are no species of very high sensitivity present, the post-mitigation operational impacts on fauna are likely to be of low significance.

Impact Phase: Operational

Impact Description: Soil Erosion Risk

The large amount of disturbance created during construction would leave the site vulnerable to soil erosion, especially as many parts of the site are steep and the duplex soils present in some areas are known to be susceptible to soil erosion. The soil disturbance associated with the development will render the impacted areas highly vulnerable to erosion and measures to limit erosion will need to be a key element of mitigation measures at the site. Furthermore, if the eroded material were to enter streams and rivers at the site it could have significant impact on these systems through siltation of pools and changes in the chemistry and turbidity of the water. Although this impact has a potentially high significance it can be well mitigated.

	Extent	Duration	Intensity	Status	Significance	Probability	Confidence
Without Mitigation	L	H	H	Negative	**H**	H	H
With Mitigation	L	L	L	Negative	**L**	L	H

Can the impact be reversed?	With appropriate mitigation the impact can be ameliorated
Will impact cause irreplaceable loss or resources?	The loss of large amounts to topsoil would potentially be an irreplaceable loss of resources, but with mitigation, this can be avoided.
Can impact be avoided, managed or mitigated?	With appropriate control measures, erosion risk can be well mitigated

Mitigation measures to reduce residual risk or enhance opportunities:

- Erosion management at the site should take place according to the Erosion Management Plan and Rehabilitation Plan.
- All roads and other hardened surfaces should have runoff control features which redirect water flow and dissipate any energy in the water which may pose an erosion risk.
- Regular monitoring for erosion after construction to ensure that no erosion problems have developed as result of the disturbance, as per the Erosion Management and Rehabilitation Plans for the project.
- All erosion problems observed should be rectified as soon as possible, using the appropriate erosion control structures and revegetation techniques.
- All cleared areas should be revegetated with indigenous perennial shrubs and grasses from the local

area. These can be cut when dry and placed on the cleared areas if natural recovery is slow.
Residual Impact With mitigation there would be negligible residual impact.

Impact Phase: Operational							
Impact Description: Alien Plant Invasion The disturbance associated with the construction phase of the project will render the disturbed areas vulnerable to alien plant invasion well into the operational period. Some alien invasion is inevitable and regular alien clearing activities would be required to limit the extent of this problem. Once the natural vegetation has returned to the disturbed areas, the site will be less vulnerable to alien plant invasion, however, the roadsides and turbine service areas are likely to remain foci of alien plant invasion for the duration of the operational phase.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	L	H	M	Negative	**M**	H	H
With Mitigation	L	L	L	Negative	**L**	L	H
Can the impact be reversed?		With appropriate mitigation the impact can be ameliorated					
Will impact cause irreplaceable loss or resources?		With mitigation there would no loss of resources					
Can impact be avoided, managed or mitigated?		With appropriate control measures, alien plants can be controlled and reduced to very low impact					
Mitigation measures to reduce residual risk or enhance opportunities: • Wherever excavation is necessary, topsoil should be set aside and replaced after construction to encourage natural regeneration of the local indigenous species. • Due to the disturbance at the site as well as the increased runoff generated by the hard infrastructure, alien plant species are likely to be a long-term problem at the site and a long-term control plan will need to be implemented. Problem woody species such as *Prosopis* are already present in the area and are likely to increase rapidly if not controlled. • Regular monitoring for alien plants within the development footprint as well as adjacent areas which receive runoff from the facility as there are also likely to be prone to invasion problems. • Regular alien clearing should be conducted, as needed, using the best-practice methods for the species concerned. The use of herbicides should be avoided as far as possible.							
Residual Impact With mitigation there would be little to no residual impact.							

Impact Phase: Operational							
Impact Description: Impact on Critical Biodiversity Areas and Broad-Scale Ecological Processes A significant proportion of the development lies within Critical Biodiversity Areas and would potentially negatively impact the biodiversity value and ecological functioning of these areas. The CBAs in the area are however designed to maintain climate resilience and not for biodiversity pattern protection. As such, the development is not likely to significantly compromise this goal. However, the presence of the development would impact habitat quality to some degree within the higher elevation plateau areas of the site, which would potentially have a low-intensity, long-term impact on some species.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	M	H	M	Negative	**H**	H	H
With Mitigation	L	H	M	Negative	**M**	H	H

Can the impact be reversed?	The impact would last for the lifetime of the development
Will impact cause irreplaceable loss or resources?	Unlikely
Can impact be avoided, managed or mitigated?	To some extent, but some of the impact would result from the presence of the facility which cannot be avoided.

Mitigation measures to reduce residual risk or enhance opportunities:

- Minimise the development footprint, especially within the high sensitivity areas and some reduction in the number of turbines within these areas may be required.
- There should be an integrated management plan for the development area during operation, which is beneficial to fauna and flora.
- Specific avoidance and mitigation may be required to reduce the impact on certain habitats of limited extent and high ecological or conservation significance.

Residual Impact

Some of the impact results from the presence of the facility and would therefore persist for as long as it was operational. With mitigation, this impact is likely to be of medium significance.

Decommissioning Phase Impacts

Impact Phase: Decommissioning

Impact Description: Faunal impacts due to decommissioning phase activities

The impacts on fauna at decommissioning would be similar to those at construction, but of a lower severity as the activity will be taking place within the development footprint. The increased levels of noise, pollution, disturbance and human presence during decommissioning will be detrimental to fauna. Sensitive and shy fauna are likely to move away from the area during this period as a result of the noise and human activities present, while some slow-moving species would not be able to avoid the decommissioning activities and might be killed. Vehicular traffic would be high and will pose a risk of collisions with susceptible fauna. Slower types such as tortoises, snakes and amphibians would be most susceptible. Some mammals and reptiles would be vulnerable to illegal collection or poaching during the decommissioning phase as a result of the large number of personnel that are likely to be present. This would however be a transient impact which would ultimately result in an increase in available habitat for some fauna.

	Extent	Duration	Intensity	Status	Significance	Probability	Confidence
Without Mitigation	M	L	H	Negative	**M**	H	H
With Mitigation	L	L	L	Negative	**L**	M	H

Can the impact be reversed?	The impact would be transient and persist for the decommissioning period only.
Will impact cause irreplaceable loss or resources?	No.
Can impact be avoided, managed or mitigated?	Most the impacts can be mitigated and those that cannot would be transient.

Mitigation measures to reduce residual risk or enhance opportunities:

- Any potentially dangerous fauna such as snakes or fauna threatened by the decommissioning activities should be removed to a safe location prior to the commencement of decommissioning activities.
- All hazardous materials should be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel and oil spills that occur at the site should be cleaned up in the appropriate manner as related to the nature of the spill.
- All vehicles accessing the site should adhere to a low speed limit (40km/h max) to avoid collisions with susceptible species such as snakes and tortoises.
- No excavated holes or trenches should be left open for extended periods as fauna may fall in and become trapped.
- All above-ground infrastructure should be removed from the site. Below-ground infrastructure such as cabling can be left in place if it does not pose a risk, as removal of such cables may generate additional disturbance and impact, however, this should be in accordance with the facilities' decommissioning and

recycling plan, and as per the agreements with the land owners concerned.
Residual Impact Decommissioning would in principle return the site to its former state, but in practice, some degradation of the development footprint can be anticipated, which would reduce its' long-term value as faunal habitat. After mitigation, faunal impacts due to decommissioning are likely to be of low significance.

Impact Phase: Decommissioning							
Impact Description: Following decommissioning, the site will be highly vulnerable to soil erosion The removal and clearing of the site infrastructure would create some soil disturbance which would leave these areas vulnerable to erosion, which if left unchecked could spread significantly. The disturbed areas should be rehabilitated at decommissioning with indigenous species sourced from the local environment to reduce this risk. Although this impact has a potentially high significance it can be well mitigated to low significance.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	M	H	M	Negative	**H**	H	H
With Mitigation	L	L	L	Negative	**L**	L	H
Can the impact be reversed?			With appropriate mitigation the impact can be ameliorated				
Will impact cause irreplaceable loss or resources?			The loss of large amounts to topsoil would potentially be an irreplaceable loss of resources, but with mitigation, this can be avoided.				
Can impact be avoided, managed or mitigated?			With appropriate control measures, erosion risk can be well mitigated				
Mitigation measures to reduce residual risk or enhance opportunities: • Any roads that will not be rehabilitated should have runoff control features which redirect water flow and dissipate any energy in the water which may pose an erosion risk. • There should be regular monitoring for erosion for at least 2 years after decommissioning by the applicant to ensure that no erosion problems develop as result of the disturbance, and if they do, to immediately implement erosion control measures. • All erosion problems observed should be rectified as soon as possible, using the appropriate erosion control structures and revegetation techniques. • All disturbed and cleared areas should be revegetated with indigenous perennial shrubs and grasses from the local area.							
Residual Impact With mitigation, there would be little residual impact.							

Impact Phase: Decommissioning							
Impact Description: Faunal impacts due to decommissioning phase activities The impacts on fauna at decommissioning would be similar to those at construction, but of a lower severity as the activity will be taking place within the development footprint. The increased levels of noise, pollution, disturbance and human presence during decommissioning will be detrimental to fauna. Sensitive and shy fauna are likely to move away from the area during this period as a result of the noise and human activities present, while some slow-moving species would not be able to avoid the decommissioning activities and might be killed. Vehicular traffic would be high and will pose a risk of collisions with susceptible fauna. Slower types such as tortoises, snakes and amphibians would be most susceptible. Some mammals and reptiles would be vulnerable to illegal collection or poaching during the decommissioning phase as a result of the large number of personnel that are likely to be present. This would however be a transient impact which would ultimately result in an increase in available habitat for some fauna.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without	M	L	H	Negative	**M**	H	H

Mitigation							
With Mitigation	L	L	L	Negative	**L**	M	H
Can the impact be reversed?			The impact would be transient and persist for the decommissioning period only.				
Will impact cause irreplaceable loss or resources?			No.				
Can impact be avoided, managed or mitigated?			Most the impacts can be mitigated and those that cannot would be transient.				

Mitigation measures to reduce residual risk or enhance opportunities:

- Any potentially dangerous fauna such as snakes or fauna threatened by the decommissioning activities should be removed to a safe location prior to the commencement of decommissioning activities.
- All hazardous materials should be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel and oil spills that occur at the site should be cleaned up in the appropriate manner as related to the nature of the spill.
- All vehicles accessing the site should adhere to a low speed limit (40km/h max) to avoid collisions with susceptible species such as snakes and tortoises.
- No excavated holes or trenches should be left open for extended periods as fauna may fall in and become trapped.
- All above-ground infrastructure should be removed from the site. Below-ground infrastructure such as cabling can be left in place if it does not pose a risk, as removal of such cables may generate additional disturbance and impact, however, this should be in accordance with the facilities' decommissioning and recycling plan, and as per the agreements with the land owners concerned.

Residual Impact

Decommissioning would in principle return the site to its former state, but in practice, some degradation of the development footprint can be anticipated, which would reduce its' long-term value as faunal habitat. After mitigation, faunal impacts due to decommissioning are likely to be of <u>low significance</u>.

Impact Phase: Decommissioning

Impact Description: Alien Plant Invasion following decommissioning

The disturbance associated with the decommissioning phase of the project will render the disturbed areas vulnerable to alien plant invasion. Some alien invasion is highly likely and regular alien clearing for several years after decommissioning is likely to be required. Once the natural vegetation has returned to the disturbed areas, the site will be less vulnerable to alien plant invasion.

	Extent	Duration	Intensity	Status	Significance	Probability	Confidence
Without Mitigation	M	H	M	Negative	**H**	H	H
With Mitigation	L	L	L	Negative	**L**	L	H
Can the impact be reversed?			With appropriate mitigation the impact can be ameliorated				
Will impact cause irreplaceable loss or resources?			The loss of large amounts to topsoil would potentially be an irreplaceable loss of resources, but with mitigation, this can be avoided.				
Can impact be avoided, managed or mitigated?			With appropriate control measures, erosion risk can be well mitigated				

Mitigation measures to reduce residual risk or enhance opportunities:

- Wherever excavation is necessary for decommissioning, topsoil should be set aside and replaced after decommissioning activities are complete to encourage natural regeneration of the local indigenous species.
- Due to the disturbance at the site alien plant species are likely to be a long-term problem at the site following decommissioning and regular control will need to be implemented until a cover of indigenous species has returned.
- Regular monitoring for alien plants within the disturbed areas for at least two years after decommissioning or until alien invasive species are no longer a problem at the site.

• Regular alien clearing should be conducted using the best-practice methods for the species concerned. The use of herbicides should be avoided as far as possible.
Residual Impact With mitigation, there would be little to no residual impact with low significance

10.3.2 San Kraal Grid Connection Alternatives

Impact Phase: Construction							
Impact Description: Impact on vegetation and listed plant species due to transformation within the development footprint The development of the grid connection and substation infrastructure would require vegetation clearing for access roads, pylon foundations and substations. Apart from the direct loss of vegetation within the development footprint, listed and protected species are also likely to be impacted. The footprint of the grid connection infrastructure would however be less than 2 0ha and the surrounding landscape is still overwhelmingly intact and there are no very high value flora habitats within the development footprint,							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Preferred Alternative							
Without Mitigation	L	H	M	Negative	**M**	H	H
With Mitigation	L	M	L	Negative	**L**	L	H
Alternative 1							
Without Mitigation	L	H	M	Negative	**M**	H	H
With Mitigation	L	M	L	Negative	**L**	L	H
Alternative 2							
Without Mitigation	L	H	M	Negative	**M**	H	H
With Mitigation	L	M	L	Negative	**L**	L	H
Can the impact be reversed?			No - transformation is a necessary outcome of the development and while some areas will become revegetated, some long-term habitat loss is likely.				
Will impact cause irreplaceable loss or resources?			No, no critical or rare habitats are within the development footprint.				
Can impact be avoided, managed or mitigated?			Possibly, through avoidance, but some residual impact is likely				
Mitigation measures to reduce residual risk or enhance opportunities: • Preconstruction walk-though of the approved development footprint to ensure that sensitive habitats and species are avoided where possible. • Ensure that lay-down and other temporary infrastructure is within medium- or low- sensitivity areas, preferably previously transformed areas if possible. • Minimise the development footprint as far as possible and rehabilitate disturbed areas that are no longer required by the operational phase of the development. • A large proportion of the impact of the power line would stem from access roads and these should be minimized as far as possible and not be larger than required. • Preconstruction environmental induction for all construction staff on site to ensure that basic environmental principles are adhered to. This includes topics such as no littering, appropriate handling of pollution and chemical spills, avoiding fire hazards, minimizing wildlife interactions, remaining within demarcated construction areas etc. • Demarcate sensitive areas in close proximity to the development footprint as no-go areas with construction tape or similar and clearly mark as no-go area.							
Residual Impact The will be some habitat loss that is an unavoidable impact of the development and cannot be effectively							

mitigated. Post-mitigation impacts are likely to be of Low Significance.

Impact Phase: Construction							
Impact Description: Faunal impacts due to construction activities Increased levels of noise, pollution, disturbance and human presence during construction will be detrimental to fauna. Sensitive and shy fauna are likely to move away from the affected areas during construction, while some slow-moving species would not be able to avoid the construction activities and might be killed. Traffic during construction will be high and will pose a risk of collisions with susceptible fauna. Slower types such as tortoises, snakes and amphibians would be most susceptible. Some mammals and reptiles would be vulnerable to illegal collection or poaching during the construction phase as a result of the large number of construction personnel that are likely to be present. Many of these impacts can however be effectively managed or mitigated.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Preferred Alternative							
Without Mitigation	L	M	H	Negative	**M**	H	H
With Mitigation	L	L	M	Negative	**L**	L	M
Alternative 1							
Without Mitigation	L	M	H	Negative	**M**	H	H
With Mitigation	L	L	M	Negative	**L**	L	M
Alternative 2							
Without Mitigation	L	M	H	Negative	**M**	H	H
With Mitigation	L	L	M	Negative	**L**	L	M
Can the impact be reversed?			Construction-phase disturbance will be transient, but some habitat loss would be long term.				
Will impact cause irreplaceable loss or resources?			Not likely as there do not appear to be any significant populations of species of conservation concern within the affected area.				
Can impact be avoided, managed or mitigated?			Only partly as noise and construction phase disturbance and habitat loss cannot be entirely avoided or mitigated.				

Mitigation measures to reduce residual risk or enhance opportunities:

- Preconstruction walk-through of the facility to identify areas of faunal sensitivity.
- During construction any fauna directly threatened by the construction activities should be removed to a safe location by the ECO or other suitably qualified person.
- The illegal collection, hunting or harvesting of any plants or animals at the site should be strictly forbidden. Personnel should not be allowed to wander off the construction site.
- Fires within suitable dedicated containers (i.e. braai drums etc) should only be allowed within the construction camp and similar demarcated and cleared areas and no fires should be allowed in the open veld as there is a risk of runaway veld fires.
- If any parts of site such as construction camps must be lit at night, this should be done with low-UV type lights (such as most LEDs) as far as practically possible, which do not attract insects and which should be directed downwards.
- All hazardous materials should be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel and oil spills that occur at the site should be cleaned up in the appropriate manner as related to the nature of the spill.
- No unauthorized persons should be allowed onto the site and site access should be strictly controlled
- All construction vehicles should adhere to a low speed limit (40km/h for cars and 30km/h for trucks) to avoid collisions with susceptible species such as snakes and tortoises and rabbits or hares. Speed limits should apply within the facility as well as on the public gravel access roads to the site.
- All personnel should undergo environmental induction with regards to fauna and in particular awareness

about not harming or collecting species such as snakes, tortoises and owls which are often needlessly persecuted.
Residual Impact Noise and disturbance during construction cannot be well mitigated, but would be transient. Some habitat loss for fauna would persist for the operational lifetime of the facility. After mitigation, faunal impacts are likely to be of low significance.

Impact Phase: Operational							
Impact Description: Soil Erosion Risk The large amount of disturbance created during construction would leave the disturbed areas vulnerable to soil erosion, especially as many parts of the power lien route are steep and the duplex soils present are known to be susceptible to soil erosion. Consequently, specific measures such as erosion berms and water dispersion features will be required along the power line access roads. Although this impact has a potentially high significance it can be well mitigated.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Preferred Alternative							
Without Mitigation	L	H	M	Negative	**M**	H	H
With Mitigation	L	L	L	Negative	**L**	L	H
Alternative 1							
Without Mitigation	L	H	M	Negative	**M**	H	H
With Mitigation	L	L	L	Negative	**L**	L	H
Alternative 2							
Without Mitigation	L	H	M	Negative	**M**	H	H
With Mitigation	L	L	L	Negative	**L**	L	H
Can the impact be reversed?			With appropriate mitigation the impact can be ameliorated				
Will impact cause irreplaceable loss or resources?			The loss of large amounts to topsoil would potentially be an irreplaceable loss of resources, but with mitigation, this can be avoided.				
Can impact be avoided, managed or mitigated?			With appropriate control measures, erosion risk can be well mitigated				
Mitigation measures to reduce residual risk or enhance opportunities: • Erosion management at the site should take place according to the Erosion Management Plan and Rehabilitation Plan. • All roads and other hardened surfaces should have runoff control features which redirect water flow and dissipate any energy in the water which may pose an erosion risk. • Regular monitoring for erosion after construction to ensure that no erosion problems have developed as result of the disturbance, as per the Erosion Management and Rehabilitation Plans for the project. • All erosion problems observed should be rectified as soon as possible, using the appropriate erosion control structures and revegetation techniques. • All cleared areas should be revegetated with indigenous perennial shrubs and grasses from the local area. These can be cut when dry and placed on the cleared areas if natural recovery is slow.							
Residual Impact With mitigation there would be negligible residual impact.							

Impact Phase: Operational

Impact Description: Soil Erosion Risk The large amount of disturbance created during construction would leave the disturbed areas vulnerable to soil erosion, especially as many parts of the power lien route are steep and the duplex soils present are known to be susceptible to soil erosion. Consequently, specific measures such as erosion berms and water dispersion features will be required along the power line access roads. Although this impact has a potentially high significance it can be well mitigated.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Preferred Alternative							
Without Mitigation	L	H	M	Negative	**M**	H	H
With Mitigation	L	L	L	Negative	**L**	L	H
Alternative 1							
Without Mitigation	L	H	M	Negative	**M**	H	H
With Mitigation	L	L	L	Negative	**L**	L	H
Alternative 2							
Without Mitigation	L	H	M	Negative	**M**	H	H
With Mitigation	L	L	L	Negative	**L**	L	H
Can the impact be reversed?		With appropriate mitigation the impact can be ameliorated					
Will impact cause irreplaceable loss or resources?		The loss of large amounts to topsoil would potentially be an irreplaceable loss of resources, but with mitigation, this can be avoided.					
Can impact be avoided, managed or mitigated?		With appropriate control measures, erosion risk can be well mitigated					
Mitigation measures to reduce residual risk or enhance opportunities: • Erosion management at the site should take place according to the Erosion Management Plan and Rehabilitation Plan. • All roads and other hardened surfaces should have runoff control features which redirect water flow and dissipate any energy in the water which may pose an erosion risk. • Regular monitoring for erosion after construction to ensure that no erosion problems have developed as result of the disturbance, as per the Erosion Management and Rehabilitation Plans for the project. • All erosion problems observed should be rectified as soon as possible, using the appropriate erosion control structures and revegetation techniques. • All cleared areas should be revegetated with indigenous perennial shrubs and grasses from the local area. These can be cut when dry and placed on the cleared areas if natural recovery is slow.							
Residual Impact With mitigation there would be negligible residual impact.							

Impact Phase: Operational							
Impact Description: Alien Plant Invasion The disturbance associated with the construction phase of the project will render the disturbed areas along the power line vulnerable to alien plant invasion. The pylons are also frequently used by birds such as crows which often carry seed of alien species to such positions where they can then establish. Some alien invasion is inevitable and regular alien clearing activities would be required to limit the extent of this problem. Once the natural vegetation has returned to the disturbed areas, the site will be less vulnerable to alien plant invasion, however, the roadsides which receive runoff are likely to remain foci of alien plant invasion.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Preferred Alternative							
Without	L	H	M	Negative	**M**	H	H

Mitigation							
With Mitigation	L	L	L	Negative	**L**	L	H
Alternative 1							
Without Mitigation	L	H	M	Negative	**M**	H	H
With Mitigation	L	L	L	Negative	**L**	L	H
Alternative 2							
Without Mitigation	L	H	M	Negative	**M**	H	H
With Mitigation	L	L	L	Negative	**L**	L	H

Can the impact be reversed?	With appropriate mitigation the impact can be ameliorated
Will impact cause irreplaceable loss or resources?	With mitigation there would no loss of resources
Can impact be avoided, managed or mitigated?	With appropriate control measures, alien plants can be controlled and reduced to very low impact

Mitigation measures to reduce residual risk or enhance opportunities:

- Wherever excavation is necessary, topsoil should be set aside and replaced after construction to encourage natural regeneration of the local indigenous species.
- Due to the disturbance at the site as well as the increased runoff generated by the hard infrastructure, alien plant species are likely to be a long-term problem at the site and a long-term control plan will need to be implemented. Problem woody species such as *Prosopis* are already present in the area and are likely to increase rapidly if not controlled.
- Regular monitoring for alien plants within the development footprint as well as adjacent areas which receive runoff from the facility as there are also likely to be prone to invasion problems.
- Regular alien clearing should be conducted, as needed, using the best-practice methods for the species concerned. The use of herbicides should be avoided as far as possible.

Residual Impact

With mitigation there would be little to no residual impact.

Impact Phase: Operational

Impact Description: Impact on Critical Biodiversity Areas and Broad-Scale Ecological Processes

The majority of the power line routes lie within Critical Biodiversity Areas. Development in such is not encouraged as it can negatively impact the biodiversity value and ecological functioning of these areas. The CBAs in the area are however designed to maintain climate resilience and not for biodiversity pattern protection. In addition, the footprint of the power line is not sufficient to compromise the ecological functioning or biodiversity value of the affected CBAs.

	Extent	Duration	Intensity	Status	Significance	Probability	Confidence
Preferred Alternative							
Without Mitigation	L	H	M	Negative	**M**	H	H
With Mitigation	L	M	L	Negative	**L**	L	H
Alternative 1							
Without Mitigation	L	H	M	Negative	**M**	H	H
With Mitigation	L	M	L	Negative	**L**	L	H
Alternative 2							
Without Mitigation	L	H	M	Negative	**M**	H	H
With	L	M	L	Negative	**L**	L	H

Mitigation							
Can the impact be reversed?	The impact would last for the lifetime of the development						
Will impact cause irreplaceable loss or resources?	Unlikely						
Can impact be avoided, managed or mitigated?	To a large extent, but some residual impact would persist for the lifetime of the infrastructure.						
Mitigation measures to reduce residual risk or enhance opportunities: • Minimise the development footprint, especially within the high sensitivity areas. • Specific avoidance and mitigation may be required to reduce the impact on certain habitats of limited extent and high ecological or conservation significance as may be informed by the preconstruction walk-through of the power line route and associated infrastructure.							
Residual Impact Some of the impact results from the presence of the infrastructure and would therefore persist for as long as it was present. With mitigation, this impact is likely to be of <u>low significance</u>.							

Impact Phase: Decommissioning							
Impact Description: Faunal impacts due to decommissioning phase activities The impacts on fauna at decommissioning would be similar to those at construction, but of a lower severity as the activity will be taking place within the development footprint. The increased levels of noise, pollution, disturbance and human presence during decommissioning will be detrimental to fauna. Sensitive and shy fauna are likely to move away from the area during this period as a result of the noise and human activities present, while some slow-moving species would not be able to avoid the decommissioning activities and might be killed. Vehicular traffic would be high and will pose a risk of collisions with susceptible fauna. Slower types such as tortoises, snakes and amphibians would be most susceptible. Some mammals and reptiles would be vulnerable to illegal collection or poaching during the decommissioning phase as a result of the large number of personnel that are likely to be present. This would however be a transient impact which would ultimately result in an increase in available habitat for some fauna.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Preferred Alternative							
Without Mitigation	L	L	M	Negative	**L**	M	H
With Mitigation	L	L	L	Negative	**L**	L	H
Alternative 1							
Without Mitigation	L	L	M	Negative	**L**	M	H
With Mitigation	L	L	L	Negative	**L**	L	H
Alternative 2							
Without Mitigation	L	L	M	Negative	**L**	M	H
With Mitigation	L	L	L	Negative	**L**	L	H
Can the impact be reversed?	The impact would be transient and persist for the decommissioning period only.						
Will impact cause irreplaceable loss or resources?	No.						
Can impact be avoided, managed or mitigated?	Most the impacts can be mitigated and those that cannot would be transient.						
Mitigation measures to reduce residual risk or enhance opportunities: • Any potentially dangerous fauna such as snakes or fauna threatened by the decommissioning activities should be removed to a safe location prior to the commencement of decommissioning activities.							

• All hazardous materials should be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel and oil spills that occur at the site should be cleaned up in the appropriate manner as related to the nature of the spill. • All vehicles accessing the site should adhere to a low speed limit (40km/h max) to avoid collisions with susceptible species such as snakes and tortoises. • No excavated holes or trenches should be left open for extended periods as fauna may fall in and become trapped. • All above-ground infrastructure should be removed from the site.
Residual Impact After mitigation, faunal impacts due to decommissioning are likely to be of low significance.

Impact Phase: Decommissioning

Impact Description: Soil erosion risk

The removal and clearing of the grid connection and substation infrastructure would create some soil disturbance which would leave these areas vulnerable to erosion, which if left unchecked could spread significantly. The disturbed areas should be rehabilitated at decommissioning with indigenous species sourced from the local environment to reduce this risk.

	Extent	Duration	Intensity	Status	Significance	Probability	Confidence
Preferred Alternative							
Without Mitigation	L	M	M	Negative	**M**	M	H
With Mitigation	L	L	L	Negative	**L**	L	H
Alternative 1							
Without Mitigation	L	M	M	Negative	**M**	M	H
With Mitigation	L	L	L	Negative	**L**	L	H
Alternative 2							
Without Mitigation	L	M	M	Negative	**M**	M	H
With Mitigation	L	L	L	Negative	**L**	L	H

Can the impact be reversed?	With appropriate mitigation the impact can be ameliorated
Will impact cause irreplaceable loss or resources?	The loss of large amounts to topsoil would potentially be an irreplaceable loss of resources, but with mitigation, this can be avoided.
Can impact be avoided, managed or mitigated?	With appropriate control measures, erosion risk can be well mitigated

Mitigation measures to reduce residual risk or enhance opportunities:

- Any roads that will not be rehabilitated should have runoff control features which redirect water flow and dissipate any energy in the water which may pose an erosion risk.
- There should be regular monitoring for erosion for at least 2 years after decommissioning by the applicant to ensure that no erosion problems develop as result of the disturbance, and if they do, to immediately implement erosion control measures.
- All erosion problems observed should be rectified as soon as possible, using the appropriate erosion control structures and revegetation techniques.
- All disturbed and cleared areas should be revegetated with indigenous perennial shrubs and grasses from the local area.

Residual Impact

With mitigation, there would be little residual impact of low significance.

Impact Phase: Decommissioning							
Impact Description: Alien Plant Invasion following decommissioning The disturbance associated with the decommissioning phase of the project will render the disturbed areas vulnerable to alien plant invasion. Some alien invasion is highly likely and regular alien clearing for several years after decommissioning is likely to be required. Once the natural vegetation has returned to the disturbed areas, the site will be less vulnerable to alien plant invasion							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Preferred Alternative							
Without Mitigation	L	H	M	Negative	**M**	H	H
With Mitigation	L	L	L	Negative	**L**	L	H
Alternative 1							
Without Mitigation	L	H	M	Negative	**M**	H	H
With Mitigation	L	L	L	Negative	**L**	L	H
Alternative 2							
Without Mitigation	L	H	M	Negative	**M**	H	H
With Mitigation	L	L	L	Negative	**L**	L	H
Can the impact be reversed?			With appropriate mitigation the impact can be ameliorated				
Will impact cause irreplaceable loss or resources?			With mitigation there would no loss of resources				
Can impact be avoided, managed or mitigated?			With appropriate control measures, alien plants can be controlled and reduced to very low impact				
Mitigation measures to reduce residual risk or enhance opportunities: • Wherever excavation is necessary for decommissioning, topsoil should be set aside and replaced after decommissioning activities are complete to encourage natural regeneration of the local indigenous species. • Due to the disturbance at the site alien plant species are likely to be a long-term problem at the site following decommissioning and regular control will need to be implemented until a cover of indigenous species has returned. • Regular monitoring for alien plants within the disturbed areas for at least two years after decommissioning or until alien invasive species are no longer a problem at the site. • Regular alien clearing should be conducted using the best-practice methods for the species concerned. The use of herbicides should be avoided as far as possible.							
Residual Impact With mitigation there would be little to no impact.							

10.3.3 Cumulative impacts on Flora and Terrestrial Fauna

Apart from the current development, there is the existing Noupoort Wind Farm as well as several other proposed wind and solar energy developments in the broader area. Although each may generate an acceptable, low impact when considered alone, this does account for the potential for cumulative impacts to generate significant impacts on fauna and flora as well as future conservation-use options for the area. Although the affected vegetation types are not listed ecosystems, the wind farm developments are focused largely on the high-lying ground, with the result that potential cumulative impacts on these habitats are higher than when considered at the vegetation type level. Although the wind farm is not within a Northern Cape Protected Area Expansion Strategy focus area, that part of the power line outside the wind farm project boundary lies within a focus area. This is however not likely to be significant, given the low total footprint of this section of power line and proximity to existing grid infrastructure. With mitigation, this impact is likely to be low. With mitigation, this impact is likely to be of medium significance.

Impact Phase: All Phases							
Impact Description: Contribution of the San Kraal WEF to cumulative impacts on habitat loss and future ability to meet conservation targets. Apart from the current development, there is the existing Noupoort Wind Farm as well as several other proposed wind and solar energy developments in the broader area. Although each may generate an acceptable, low impact when considered alone, this does account for the potential for cumulative impacts to generate significant impacts on fauna and flora as well as future conservation-use options for the area. At a vegetation-type level, both Besemkaree Koppies Shrubland and Karoo Escarpment Grassland are more than 97% intact and the current developments would not significantly impact their remaining extent. The concern in terms of cumulative impact is therefore at a more local level, with four wind farms all in close proximity to one another around Noupoort. Although the abundance of sensitive species and features within these facilities is low, there is some potential to disrupt broad-scale ecological processes as the projects tend to lie along a higher-lying mountain system where cumulative impacts are more likely due to the more restricted nature of the affected habitat. Although the wind farm is not within a Northern Cape Protected Area Expansion Strategy focus area, that part of the power line outside the wind farm project boundary lies within a focus area. This is however not likely to be significant, given the low total footprint of this section of power line and proximity to existing grid infrastructure. Even if all projects in the area are constructed, the total direct footprint would be less than 300ha and is not likely to generate significant cumulative impact given the widespread nature of the habitat and affected species.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	L	M	M	Negative	**M**	H	H
With Mitigation	L	M	M	Negative	**M**	M	H
Can the impact be reversed?			The impact would persist for as long the various developments were present				
Will impact cause irreplaceable loss or resources?			Potentially if projects do not implement appropriate mitigation and avoidance.				
Can impact be avoided, managed or mitigated?			To some extent, but some of the impact would result from the presence of the facilities themselves which cannot be avoided.				
Mitigation measures to reduce residual risk or enhance opportunities: • The current layout has been arrived at through iteration of various layouts and takes account of the sensitive features identified and mapped, as such, the development footprint will minimize impact on the high sensitivity areas and is considered to represent an acceptable mitigated layout. Further refinement of the layout can occur with turbine micro-siting at the preconstruction phase to minimize impact on local features such as rocky outcrops. • There should be an integrated management plan for the development area during operation, which is beneficial to fauna and flora.							
Residual Impact Some of the impact results from the presence of the facility and would therefore persist for as long as it was operational.							

10.4 Avifauna

10.4.1 San Kraal WEF

Assessment of Construction Impacts

It is highly likely that most priority species will be temporarily displaced in the development area during the construction operations, due to the noise and activity, including the pair of Blue Cranes. The implementation of buffer zones around the nesting area could reduce this impact for Blue Cranes, but not for the other priority species. The significance will therefore remain at a medium level after mitigation collectively for priority species.

<table>
<tr><th colspan="8">Impact Phase: Construction</th></tr>
<tr><td colspan="8">Impact Description: Displacement of priority species due to construction activities at the wind development area
The displacement of birds due disturbance in effect can amount to habitat loss. Displacement may occur as a result of vehicle and personnel movements related to construction activities. The scale and degree of disturbance will vary according to site- and species-specific factors. None of the priority species are likely to be permanently displaced due to disturbance but short term displacement during the construction phase is very likely.</td></tr>
<tr><th></th><th>Extent</th><th>Duration</th><th>Intensity</th><th>Status</th><th>Significance</th><th>Probability</th><th>Confidence</th></tr>
<tr><td>Without Mitigation</td><td>L</td><td>L</td><td>M</td><td>Negative</td><td>M</td><td>H</td><td>M</td></tr>
<tr><td>With Mitigation</td><td>L</td><td>L</td><td>L</td><td>Negative</td><td>M</td><td>M</td><td>M</td></tr>
<tr><td colspan="3">Can the impact be reversed?</td><td colspan="5">YES: The impacts should be temporary and restricted to the construction phase.</td></tr>
<tr><td colspan="3">Will impact cause irreplaceable loss or resources?</td><td colspan="5">NO: The impacts should be temporary and restricted to the construction phase.</td></tr>
<tr><td colspan="3">Can impact be avoided, managed or mitigated?</td><td colspan="5">YES: To some extent, however the impact will be negated naturally after the construction phase.</td></tr>
<tr><td colspan="8">Mitigation measures to reduce residual risk or enhance opportunities:
• Restrict the construction activities to the construction footprint area.
• Do not allow any access to the remainder of the property during the construction period.
• Measures to control noise and dust should be applied according to current best practice in the industry.
• Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum.
• Implement a 500m no development buffer zone around each of the two pans at FP3 at 31°14'15.02"S 25° 2'44.17"E and FP4 at 31°13'55.42"S 25° 2'50.37"E to protect the pair of Blue Cranes from disturbance.
• The appointed Environmental Control Officer (ECO) should be trained by an avifaunal specialist to identify the signs that indicate possible breeding by priority species. The ECO must then, during audits/site visits, make a concerted effort to look out for such breeding activities of such species, and such efforts may include the training of construction staff to identify such species, followed by regular questioning of staff as to the regular whereabouts on site of the species. If any priority species are confirmed to be breeding (e.g. if a nest site is found), construction activities within 500m of the breeding site must cease, and the avifaunal specialist will be contacted immediately for further assessment of the situation and instruction on how to proceed.</td></tr>
<tr><td colspan="8">Residual Impact
It is highly likely that most priority species will be temporarily displaced in the development area during the construction operations, due to the noise and activity, including the pair of Blue Cranes. The implementation of buffer zones around the nesting area could reduce this impact for Blue Cranes, but not for the other priority species. The significance will therefore remain at a medium level after mitigation collectively for priority species.</td></tr>
</table>

Assessment of Operational Phase Impacts

<table>
<tr><th>Impact Phase: Operational</th></tr>
<tr><td>Impact Description: Direct mortality of priority species due to electrocution associated with the internal medium voltage MV powerline at the wind development area.
Electrocution refers to the scenario where a bird is perched or attempts to perch on the electrical structure and causes an electrical short circuit by physically bridging the air gap between live components and/or live and earthed components. The electrocution risk is largely determined by the pole/tower design and medium</td></tr>
</table>

voltage lines are potentially lethal to a variety of raptors.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	L	M	M	Negative	**M**	H	H
With Mitigation	L	M	M	Negative	**L**	L	H
Can the impact be reversed?			YES: Completely reversible. Mitigation measures could eliminate the risk of electrocution.				
Will impact cause irreplaceable loss or resources?			NO: It is not expected that the mortality will lead to the complete eradication of a priority species from the study area.				
Can impact be avoided, managed or mitigated?			YES: Through the use of raptor-friendly poles.				
Mitigation measures to reduce residual risk or enhance opportunities: • The final powerline design and associated electrocution mitigation measures (if necessary) must be approved and signed off by the avifaunal specialist.							
Residual Impact The electrocution risk will persist as long as the lines are up, but it can be completely eliminated at the onset if bird-friendly structures are used.							

Impact Phase: Operational							
Impact Description: Displacement of priority species due to habitat destruction at the wind development site The scale of permanent habitat loss is likely to be small per turbine base. Typically, actual habitat loss amounts to 2–5% of the total development area though effects could be more widespread where developments interfere with hydrological patterns or flows on wetlands. Some changes could also be beneficial by leading to increased mammal prey availability for some species of raptor (for example through greater availability of around turbine bases, though this may also increase collision risk. However, the results of habitat transformation may be subtler, whereas the actual footprint of the wind farm may be small in absolute terms, the effects of the habitat fragmentation brought about by the associated infrastructure (e.g. power lines and roads) may be more significant. The direct habitat transformation at the proposed wind farm is likely to be fairly minimal. The indirect habitat transformation is likely to have a bigger impact on priority species. It is expected that the densities of most priority species will decrease due to this impact, but complete displacement is unlikely. Indications are that bustards and cranes continue to use the wind farm areas. Raptors are unlikely to be affected at all. Species most likely to be affected by the habitat fragmentation are the terrestrial species such as Blue Crane, Ludwig's Bustard, Secretarybird and Grey-winged Francolin.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	L	H	L	Negative	**M**	M	M
With Mitigation	L	H	L	Negative	**L**	L	M
Can the impact be reversed?			NO: While it is expected that most species will continue to use the wind farm area, some species might do so in reduced densities, primarily due to the fragmentation of the habitat.				
Will impact cause irreplaceable loss or resources?			YES: While it is expected that most species will continue to use the wind farm area, some species might do so in reduced densities, primarily due to the fragmentation of the habitat				
Can impact be avoided, managed or mitigated?			YES: To some extent by ensuring that no impacts occur outside the immediate footprint.				
Mitigation measures to reduce residual risk or enhance opportunities:							

• The recommendations of the specialist ecological study must be strictly adhered to. • Maximum used should be made of existing access roads and the construction of new roads should be kept to a minimum. • Following construction, rehabilitation of all areas disturbed (e.g. temporary access tracks and laydown areas) must be undertaken and to this end a habitat restoration plan is to be developed by a rehabilitation specialist.
Residual Impact The rehabilitation of disturbed areas will help to mitigate the impact of the habitat transformation to some extent, but the fragmentation of the habitat due to the construction of the internal road network cannot be mitigated, and will remain an impact for the duration of the operational life-time of the facility.

Impact Phase: Operational							
Impact Description: Direct mortality of priority species due to collisions with the turbines at the wind development area							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	L	M	M	Negative	**M**	H	M
With Mitigation	L	M	L	Negative	**L**	L	L
Can the impact be reversed?			YES: Partly reversible. Mitigation measures could reduce the risk of collisions.				
Will impact cause irreplaceable loss or resources?			NO: It is not expected that the mortality will led to the complete eradication of a priority species at the wind development area.				
Can impact be avoided, managed or mitigated?			YES: To some extent through the application of buffer zones and selective curtailment.				
Mitigation measures to reduce residual risk or enhance opportunities: • Once the turbines have been constructed, post-construction monitoring should be implemented to compare actual collision rates with predicted collision rates. • The avifaunal specialist, in consultation with external experts and relevant NGO's such as BLSA, should determine annual mortality thresholds for priority species anticipated to be at risk of collision mortality, prior to the wind farm going operational. • If actual collision rates exceed the pre-determined threshold levels, curtailment of turbines should be implemented for high risk situations. • A 150m no-turbine set-back buffer zone (infrastructure is allowed) is required around the escarpment to minimise the risk of collisions for slope soaring species. • Care should be taken not to create habitat for prey species that could draw priority raptors into the area and expose them to collision risk. Rock piles must be removed from site or covered with topsoil to prevent them from becoming habitat for Rock Hyrax (Dassie).							
Residual Impact The impact is likely to persist for the operational life-time of the project. Implementation of the proposed mitigation measures should reduce the probability and severity of the impact on priority species to such an extent that the overall significance should be reduced to low.							

Impact Phase: Decommissioning
Impact Description: Displacement of priority species due to dismantling activities at the wind development area The displacement of birds due to disturbance in effect can amount to habitat loss. Displacement may occur as a result of vehicle and personnel movements related to decommissioning activities. The scale and degree of disturbance will vary according to site- and species-specific factors. None of the priority species are likely to be permanently displaced due to disturbance but short term displacement during the decommissioning phase is very likely.

	Extent	Duration	Intensity	Status	Significance	Probability	Confidence
Without Mitigation	L	L	M	Negative	**M**	H	M
With Mitigation	L	L	L	Negative	**M**	M	M
Can the impact be reversed?			YES. The impacts should be temporary and restricted to the closure phase.				
Will impact cause irreplaceable loss or resources?			NO. The impacts should be temporary and restricted to the closure phase.				
Can impact be avoided, managed or mitigated?			YES: To some extent, however the impact will be negated naturally after the closure phase.				

Mitigation measures to reduce residual risk or enhance opportunities:

- Restrict the dismantling activities to the footprint area.
- Do not allow any access to the remainder of the property during the dismantling period.
- Measures to control noise and dust should be applied according to current best practice in the industry.
- Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum.

Residual Impact

It is highly likely that most priority species will be temporarily displaced in the development area during the dismantling operations, due to the noise and activity. The significance will therefore remain at a medium level in the dismantling phase after mitigation. However, once the dismantling has been completed, the impact will be negated naturally.

10.4.2 Grid Connection Alternatives

The construction activities associated with the grid connection could result in the short-term displacement of priority species from the site. The implementation of the proposed mitigation measures will greatly reduce the probability of disturbance of specifically breeding Verreaux's Eagles.

Impact Phase: Construction

Impact Description: Displacement of priority species due to construction activities at the grid connection powerline

The risk of displacement of priority species due to habitat destruction is likely to be fairly limited given the nature of the vegetation. Very little vegetation clearing will have to be done in the 132kV powerline servitude itself. The Grassy Karoo habitat at the proposed Umsobomvu substation is common in the greater study area and the transformation of approximately 3.6 hectares of habitat should not impact any of the priority species significantly. Apart from direct habitat destruction, the above-mentioned construction and maintenance activities could also potentially displace priority species through disturbance; this could lead to breeding failure if the displacement happens during a critical part of the breeding cycle. Construction activities could be a source of disturbance and could lead to temporary or even permanent abandonment of nests. None of the priority species are likely to be permanently displaced due to disturbance associated to the construction of the proposed grid connection, although displacement in the short term during the construction phase is very likely. Species most likely to be affected by this impact would be large terrestrial species such as Blue Crane, Secretarybird, Ludwig's Bustard, Northern Black Korhaan and Blue Korhaan. No known eagle nests are at risk of disturbance by any of the three alignment alternatives. It would be necessary, though, to conduct a walk-through on the final alignment to inspect the area for any priority species breeding activity, once the pole positions have been determined.

There are several Verreaux's Eagle nests south of the study area, but they all fall outside the immediate vicinity of the proposed WEF development area. However, one of the nests, VE2, is located on a cliff approximately 500 m from where Alternative C for the turn-in to the proposed Umsobomvu MTS is located. Although this distance is probably enough to prevent any disturbance impacts on the eagles, it would still be preferable to use Alternative A or B which will eliminate any risk of disturbance.

	Extent	Duration	Intensity	Status	Significance	Probability	Confidence
Without	L	L	M	Negative	M	M	H

Mitigation							
With Mitigation	L	L	L	Negative	L	L	M

Can the impact be reversed?	YES: The impacts should be temporary and restricted to the construction phase.
Will impact cause irreplaceable loss or resources?	NO: The impacts should be temporary and restricted to the construction phase.
Can impact be avoided, managed or mitigated?	YES: To some extent, however the impact will be negated naturally after the construction phase.
Mitigation measures to reduce residual risk or enhance opportunities: • Restrict the construction activities to the construction footprint area. • Do not allow any access to the remainder of the property during the construction period. • Measures to control noise and dust should be applied according to current best practice in the industry. • Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum. • It is recommended that a 2.5 km pre-cautionary no-go buffer is implemented around the Verreaux's Eagle nest at FP1 (31°12'59.66"S 24°57'26.08"). • Use the Preferred Alternative or Alternative 1 for the grid connection. • Use Alternative A or B for the 400 kV turn-in to the proposed Umsobomvu MTS. • The final powerline route should be assessed by the avifaunal specialist way of a walk-down to identify any priority species nests which could be impacted by the construction activities. Should a nest be discovered, the avifaunal specialist must have input into the construction schedule to assess how and which of the construction activities can be timed to minimize the disturbance potential to the occupants of the nest.	
Residual Impact The construction activities associated with the grid connection could result in the short-term displacement of priority species from the site. The implementation of the proposed mitigation measures will greatly reduce the probability of disturbance of specifically breeding Verreaux's Eagles.	

The electrocution risk will persist as long as the lines are up, but it can be completely eliminated at the onset if bird-friendly structures are used.

Impact Phase: Operational							
Impact Description: Direct mortality of priority species due to collisions with the grid connection powerline at the wind development area – Preferred Alternative, Alternative 1 and Alternative 2 Collisions are a threat posed by transmission lines to birds in southern Africa. Most heavily impacted upon are bustards, storks, cranes and various species of waterbirds. These species are mostly heavy-bodied birds with limited manoeuvrability, which makes it difficult for them to take the necessary evasive action to avoid colliding with transmission lines. Several of the priority species which occur or potentially occur in the study area are power line sensitive from a collision perspective. These include Ludwig's Bustard, Blue Crane, Northern Black Korhaan, Karoo Korhaan, Blue Korhaan, Secretarybird, White Stork and Greater Flamingo. All of these species, but particularly Ludwig's Bustard and Blue Crane, could be impacted by the proposed grid connection and the internal medium voltage MV lines (where they are above ground) through collision. Pro-active marking of powerlines will have to happen, based on a walk-through exercise to identify potential collision high risk areas.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	M	M	M	Negative	M	H	M
With Mitigation	M	M	L	Negative	M	M	M
Can the impact be reversed?			YES: Partly reversible. Mitigation measures could reduce the risk of collisions.				
Will impact cause irreplaceable loss or resources?			NO: It is not expected that the mortality will lead to the complete eradication of a priority species from the study area.				

Can impact be avoided, managed or mitigated?	YES: Partially through the application of anti-collision devices.
Mitigation measures to reduce residual risk or enhance opportunities: • The final power line route should be assessed by way of a walk-through and those sections requiring Bird Flight Diverters (BFDs) must be identified. • Use the Preferred Alternative or Alternative 1 for the grid connection in order to avoid the No-Go zone around the Verreaux's Eagle nest at FP1.	
Residual Impact The application of BFDs should reduce the probability and severity of the collision impact to a lower level, but it is likely to remain at the medium level, as the application of BFD's will reduce, but not eliminate the risk.	

Impact Phase: Decommissioning							
Impact Description: Displacement of priority species due to dismantling of the powerline Decommissioning activities could potentially displace priority species through disturbance; this could lead to breeding failure if the displacement happens during a critical part of the breeding cycle. Decommissining activities could be a source of disturbance and could lead to temporary or even permanent abandonment of nests. None of the priority species are likely to be permanently displaced due to disturbance associated to the decommissioning of the proposed grid connection, although displacement in the short term during the decommissioning phase is very likely. Species most likely to be affected by this impact would be large terrestrial species such as Blue Crane, Secretarybird, Ludwig's Bustard, Northern Black Korhaan and Blue Korhaan. No known eagle nests are at risk of disturbance by any of the three alignment alternatives. It would be necessary, though, to conduct a walk-through on the final alignment to inspect the area for any priority species breeding activity on the pole positions. There are several Verreaux's Eagle nests south of the study area, but they all fall outside the immediate vicinity of the proposed WEF development area. However, one of the nests, VE2, is located on a cliff approximately 500 m from where Alternative C for the turn-in to the proposed Umsobomvu MTS is located. Although this distance is probably enough to prevent any disturbance impacts on the eagles, it would still be preferable to use Alternative A or B which will eliminate any risk of disturbance.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	L	H	L	Negative	M	M	M
With Mitigation	L	H	L	Negative	L	L	M
Can the impact be reversed?	YES. The impacts should be temporary and restricted to the closure phase.						
Will impact cause irreplaceable loss or resources?	NO. The impacts should be temporary and restricted to the closure phase.						
Can impact be avoided, managed or mitigated?	YES: To some extent, however the impact will be negated naturally after the closure phase						
Mitigation measures to reduce residual risk or enhance opportunities: • Restrict the dismantling activities to the footprint area. • Do not allow any access to the remainder of the property during the dismantling period. • Measures to control noise and dust should be applied according to current best practice in the industry. • Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum. • An avifaunal specialist should perform a walk-through of the powerline prior to the commencement of the dismantling activities to identify any raptor nests on the line. Should a nest be discovered, the avifaunal specialist must have input into the dismantling schedule to assess how and which of the dismantling activities can be timed to minimize the disturbance potential to the occupants of the nest.							
Residual Impact The dismantling activities associated with the grid connection could result in the short-term displacement of priority species from the site. The implementation of the proposed mitigation measures will greatly reduce the							

probability of disturbance of specifically raptors breeding on the powerline.

10.4.3 Cumulative Impacts on Avifauna

A cumulative impact, in relation to an activity, is the impact of an activity that may not be significant on its own but may become significant when added to the existing and potential impacts arising from similar or other activities in the area.

Currently there is no agreed method for determining significant adverse cumulative impacts on ornithological receptors. The Scottish Natural Heritage (2005) recommends a five-stage process to aid in the ornithological assessment:

- Define the species/habitat to be considered;
- Consider the limits or 'search area' of the study;
- Decide the methods to be employed;
- Review the findings of existing studies; and
- Draw conclusions of cumulative effects within the study area.

The cumulative impact were assessed on the priority species

The greatest potential concern in the 35km radius around San Kraal WEF is for the large raptor species, particularly the Red Listed Verreaux's Eagle, due to their relatively low numbers and vulnerability to turbine collisions (Ralston – Patton et al. 2017). Another concern is the potential impact of the powerline grid connections on large terrestrial species, particularly Blue Crane, Ludwig's Bustard and Secretarybird. The combined cumulative impact of renewable developments on priority species, and particularly wind energy developments on Verreaux's Eagle, within the 35km radius around the San Kraal WEF, is potentially significant at a local, and require the strict application of mitigation measures such as buffer zones around nests, and the establishment of mortality thresholds and subsequent curtailment of turbines, if thresholds are exceeded. In addition, the marking of powerlines associated with these projects, with anti-collision devices, will be of paramount importance. The impact should be less severe at a regional or national level, due to the large distribution ranges of the species, but should nonetheless be carefully monitored.

Impact Phase: All Phases							
Impact Description: Cumulative impacts • Displacement of priority species due to construction activities at the wind development area • Mortality of priority species due to electrocution associated with the internal medium voltage MV powerlines • Direct mortality of priority species due to collisions with the turbines at the wind development area • Displacement of priority species due to dismantling activities at the wind development area • Direct mortality of priority species due to collisions with the internal medium voltage MV lines and the 132kV grid connection powerline The greatest potential concern in the 35 km radius around San Kraal WEF is for the large raptor species, particularly the Red Listed Verreaux's Eagle, due to their relatively low numbers and vulnerability to turbine collisions. Another concern is the potential impact of the powerline grid connections on large terrestrial species, particularly Blue Crane, Ludwig's Bustard and Secretarybird. The combined cumulative impact of renewable developments on priority species, and particularly wind energy developments on Verreaux's Eagle, within the 35km radius around the San Kraal WEF, is potentially significant at a local, and require the strict application of mitigation measures such as buffer zones around nests, and the establishment of mortality thresholds and subsequent curtailment of turbines, if thresholds are exceeded. In addition, the marking of powerlines associated with these projects, with anti-collision devices, will be of paramount importance. The impact should be less severe at a regional or national level, due to the large distribution ranges of the species, but should nonetheless be carefully monitored.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**

Without Mitigation	M	M	M	Negative	**M**	H	H
With Mitigation	M	M	L	Negative	**L**	L	M

Can the impact be reversed?	YES, with the application of mitigation measures as detailed in the previous impact tables
Will impact cause irreplaceable loss or resources?	NO, not with the application of mitigation measures as detailed in the previous impact tables
Can impact be avoided, managed or mitigated?	YES, with the application of mitigation measures as detailed in the previous impact tables

Mitigation measures to reduce residual risk or enhance opportunities:

- All proposed mitigation measures for Construction, Operational and Decommissioning Impact Phases of the San KraaL WEF detailed in 9.. should be implemented.
- All the proposed mitigation measures proposed for the other renewable energy facilities within a 35km radius should be implemented, see Volume 2, Section 10.4 of the EIA, San Kraal WEF Bird Specialist Study for detailed description.

Residual Impact

The residual impact if all mitigation measures are adhered to are of low significance.

10.5 Bats

10.5.1 San Kraal WEF

Construction Phase Impacts

Impact Phase: Construction

Impact Description: Destruction of bat roosts due to earthworks and blasting

During construction, the earthworks and especially blasting can damage bat roosts in rock crevices. Intense blasting close to a rock crevice roost, if applicable, can cause mortality to the inhabitants of the roost.

	Extent	Duration	Intensity	Status	Significance	Probability	Confidence
Without Mitigation	M	L	H	Negative	**M**	M	H
With Mitigation	L	L	M	Negative	**L**	L	H

Can the impact be reversed?	YES: Over a longer period.
Will impact cause irreplaceable loss or resources?	YES: If blasting occurs close to a rock crevice roost.
Can impact be avoided, managed or mitigated?	YES

Mitigation measures to reduce residual risk or enhance opportunities:

- Adhere to the sensitivity map during turbine placement.
- Blasting should be minimised and used only when necessary.

Residual Impact

No residual impact.

Impact Phase: Construction

Impact Description: Loss of foraging habitat

Some minimal foraging habitat will be permanently lost by construction of turbines and access roads. Temporary foraging habitat loss will occur during construction due to storage areas and movement of heavy vehicles.

	Extent	Duration	Intensity	Status	Significance	Probability	Confidence
Without Mitigation	L	H	L	Negative	**M**	M	H
With Mitigation	L	M	L	Negative	**L**	L	H
Can the impact be reversed?			NO: As minimal foraging habitat will be permanently lost. When habitat is removed for temporary storage areas, the impact can be reversed through rehabilitation of the area.				
Will impact cause irreplaceable loss or resources?			YES: But the scale is insignificant.				
Can impact be avoided, managed or mitigated?			YES				

Mitigation measures to reduce residual risk or enhance opportunities:

- Adhere to the sensitivity map.
- 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 not required after construction should be rehabilitated by an experienced vegetation succession specialist.

Residual Impact

No residual impact.

Impact Phase: Operational

Impact Description: Bat mortalities due to direct blade impact or barotrauma during foraging activities (not migration)

If the impact is too severe (e.g. in the case of no mitigation) local bat populations may not recover from mortalities easily.

	Extent	Duration	Intensity	Status	Significance	Probability	Confidence
Without Mitigation	L	H	H	Negative	**H**	H	H
With Mitigation	L	H	L	Negative	**M**	M	H
Can the impact be reversed?			The impact will occur throughout the lifespan of the wind facility, therefore population numbers may take very long to recover. Population and diversity genetics may be permanently altered.				
Will impact cause irreplaceable loss or resources?			YES				
Can impact be avoided, managed or mitigated?			YES				

Mitigation measures to reduce residual risk or enhance opportunities:

- Adhere to the sensitivity maps.
- Avoid areas of high bat sensitivity and their buffers as well as preferably avoid areas of Moderate bat sensitivity and their buffers.
- Adhere to operational mitigation measures that may be deemed necessary during the operational monitoring assessment, if any is required.

Residual Impact

No residual impact.

Impact Phase: Operational

Impact Description: Artificial Lighting During operation strong artificial lights that may be used at the turbine base or immediate surrounding infrastructure will attract insects and thereby also bats. This will significantly increase the likelihood of impact on bats foraging around such lights. Additionally, only certain species of bats will readily forage around strong lights, whereas others avoid such lights even if there are insect prey available, which can draw insect prey away from other natural areas and thereby artificially favour only certain species.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	L	H	M	Negative	**M**	H	H
With Mitigation	L	H	L	Negative	**L**	L	H
Can the impact be reversed?			YES				
Will impact cause irreplaceable loss or resources?			NO				
Can impact be avoided, managed or mitigated?			YES				
Mitigation measures to reduce residual risk or enhance opportunities: • If possible, utilise lights with wavelengths that attract less insects (low thermal/infrared signature). • Lights should be switched off when not in use or equipped with passive motion sensors.							
Residual Impact No residual impact.							

10.5.2 Assessment of Impacts of San Kraal Grid Connection Alternatives

There are no anticipated impacts to bats during the construction and operation of the grid connection. Therefore this has not been assessed as bat of the bat assessment.

10.5.3 Cumulative Impacts on Bats

Impact Phase: Cumulative							
Impact Description: Due to direct blade collision or barotrauma during foraging – cumulative impact (resident and migrating bats affected). Mortalities of bats due to wind turbines during foraging and migration can have significant ecological consequences as the bat species at risk are insectivorous and thereby contribute significantly to the control of nocturnal flying insects. On a wind farm specific level insect numbers in a certain habitat can increase if significant numbers of bats are killed off. But if such an impact is present on multiple wind farms in close vicinity of each other, insect numbers can increase regionally and possibly cause outbreaks of colonies of certain insect species. If large numbers of a population of a resident species are lost to this impact, it will most likely lead to destabilization of the species population and ultimately possible extinction from the area. If migrating bats are killed off it can have detrimental effects on the ecology of the caves that the specific colonies utilise. This is because bat guano is the primary form of energy input into a cave ecosystem, since no sunshine (which is needed for photosynthesis) exists in cave ecosystems.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	H	H	H	Negative	**H**	M	H
With Mitigation	M	M	M	Negative	**M**	M	H
Can the impact be reversed?			The impact will occur throughout the lifespan of the wind energy facility as well as other facilities in the area, therefore bat population numbers may take very long to recover. There is a higher probability for population and diversity genetics to be permanently altered in cumulative impacts.				
Will impact cause irreplaceable loss			NO				

or resources?	
Can impact be avoided, managed or mitigated?	YES
Mitigation measures to reduce residual risk or enhance opportunities: • The high sensitivity valley areas can serve as commuting corridors for bats in the larger area, potentially lowering the cumulative effects of several WEF's in an area if the valley areas are avoided during turbine placement and are well buffered. • Adhere to recommended mitigation measures for this project during the operational phase study, and it is essential that project specific mitigations be applied and adhered to for each project. • Adhere to the sensitivity map during any further turbine layout revisions, and avoid placement of turbines in bat sensitive areas and their buffers.	
Residual Impact No residual impact.	

10.6 Noise

10.6.1 Potential sources of noise during the construction phase:

Construction Equipment

The equipment likely to be required to complete the above tasks will typically include:

excavator/graders, bulldozer(s), dump trucks(s), vibratory roller, bucket loader, rock breaker(s), drill rig, flatbed truck(s), pile drivers, TLB, concrete truck(s), crane(s), fork lift(s) and various 4WD and service vehicles.

There are a number of factors that determine the audibility as well as the potential of a noise impact on receptors. Maximum noises generated can be audible over a large distance, however, are generally of very short duration. If maximum noise levels however exceed 65 dBA at a receptor, or if it is clearly audible with a significant number of instances where the noise level exceeds the prevailing ambient sound level with more than 15 dB the noise can increase annoyance levels and may ultimately result in noise complaints. Potential maximum noise levels generated by various construction equipment as well as the potential extent of these sounds are presented in Table 10.2.

Average or equivalent sound levels are another factor that impacts on the ambient sound levels and is the constant sound level that the receptor can experience. Typical sound power levels associated with various activities that may be found at a construction site are presented Table 10.3.

Traffic

A significant source of noise during the construction phase is additional traffic to and from the site, as well as traffic on the site. This will include trucks transporting equipment, cement (possibly aggregate) as well as various components used to develop the wind turbine.

Construction traffic is expected to be generated throughout the entire construction period, however, the volume and type of traffic generated will be dependent upon the construction activities being conducted, which will vary during the construction period. Noise levels due to additional traffic will be estimated using the methods stipulated in SANS 10210:2004 (Calculating and predicting road traffic noise).

Table 10.2: Potential maximum noise levels generated by construction equipment

Equipment Description[40]	Impact Device?	Maximum Sound Power Levels (dBA)	Operational Noise Level at given distance considering potential **maximum** noise levels (Cumulative as well as the mitigatory effect of potential barriers or other mitigation not included – simple noise propagation modelling only considering distance) (dBA)											
			5 m	10 m	20 m	50 m	100 m	150 m	200 m	300 m	500 m	750 m	1000 m	2000 m
Auger Drill Rig	No	119.7	94.7	88.7	82.6	74.7	68.7	65.1	62.6	59.1	54.7	51.2	48.7	42.6
Backhoe	No	114.7	89.7	83.7	77.6	69.7	63.7	60.1	57.6	54.1	49.7	46.2	43.7	37.6
Chain Saw	No	119.7	94.7	88.7	82.6	74.7	68.7	65.1	62.6	59.1	54.7	51.2	48.7	42.6
Compactor (ground)	No	114.7	89.7	83.7	77.6	69.7	63.7	60.1	57.6	54.1	49.7	46.2	43.7	37.6
Compressor (air)	No	114.7	89.7	83.7	77.6	69.7	63.7	60.1	57.6	54.1	49.7	46.2	43.7	37.6
Concrete Batch Plant	No	117.7	92.7	86.7	80.6	72.7	66.7	63.1	60.6	57.1	52.7	49.2	46.7	40.6
Concrete Mixer Truck	No	119.7	94.7	88.7	82.6	74.7	68.7	65.1	62.6	59.1	54.7	51.2	48.7	42.6
Concrete Pump Truck	No	116.7	91.7	85.7	79.6	71.7	65.7	62.1	59.6	56.1	51.7	48.2	45.7	39.6
Concrete Saw	No	124.7	99.7	93.7	87.6	79.7	73.7	70.1	67.6	64.1	59.7	56.2	53.7	47.6
Crane	No	119.7	94.7	88.7	82.6	74.7	68.7	65.1	62.6	59.1	54.7	51.2	48.7	42.6
Dozer	No	119.7	94.7	88.7	82.6	74.7	68.7	65.1	62.6	59.1	54.7	51.2	48.7	42.6
Drill Rig Truck	No	118.7	93.7	87.7	81.6	73.7	67.7	64.1	61.6	58.1	53.7	50.2	47.7	41.6
Drum Mixer	No	114.7	89.7	83.7	77.6	69.7	63.7	60.1	57.6	54.1	49.7	46.2	43.7	37.6
Dump Truck	No	118.7	93.7	87.7	81.6	73.7	67.7	64.1	61.6	58.1	53.7	50.2	47.7	41.6
Excavator	No	119.7	94.7	88.7	82.6	74.7	68.7	65.1	62.6	59.1	54.7	51.2	48.7	42.6
Flat Bed Truck	No	118.7	93.7	87.7	81.6	73.7	67.7	64.1	61.6	58.1	53.7	50.2	47.7	41.6
Front End Loader	No	114.7	89.7	83.7	77.6	69.7	63.7	60.1	57.6	54.1	49.7	46.2	43.7	37.6
Generator (>25KVA)	No	116.7	91.7	85.7	79.6	71.7	65.7	62.1	59.6	56.1	51.7	48.2	45.7	39.6
Generator (<25KVA)	No	104.7	79.7	73.7	67.6	59.7	53.7	50.1	47.6	44.1	39.7	36.2	33.7	27.6
Grader	No	119.7	94.7	88.7	82.6	74.7	68.7	65.1	62.6	59.1	54.7	51.2	48.7	42.6
Impact Pile Driver	Yes	129.7	104.7	98.7	92.6	84.7	78.7	75.1	72.6	69.1	64.7	61.2	58.7	52.6
Jackhammer	Yes	119.7	94.7	88.7	82.6	74.7	68.7	65.1	62.6	59.1	54.7	51.2	48.7	42.6
Man Lift	No	119.7	94.7	88.7	82.6	74.7	68.7	65.1	62.6	59.1	54.7	51.2	48.7	42.6
Mounted Impact Hammer	Yes	124.7	99.7	93.7	87.6	79.7	73.7	70.1	67.6	64.1	59.7	56.2	53.7	47.6
Paver	No	119.7	94.7	88.7	82.6	74.7	68.7	65.1	62.6	59.1	54.7	51.2	48.7	42.6

[40] Equipment list and Sound Power Level source: http://www.fhwa.dot.gov/environment/noise/construction_noise/handbook/handbook09.cfm

Equipment Description[40]	Impact Device?	Maximum Sound Power Levels (dBA)	Operational Noise Level at given distance considering potential **maximum** noise levels (Cumulative as well as the mitigatory effect of potential barriers or other mitigation not included – simple noise propagation modelling only considering distance) (dBA)											
			5 m	10 m	20 m	50 m	100 m	150 m	200 m	300 m	500 m	750 m	1000 m	2000 m
Pickup Truck	No	89.7	64.7	58.7	52.6	44.7	38.7	35.1	32.6	29.1	24.7	21.2	18.7	12.6
Pumps	No	111.7	86.7	80.7	74.6	66.7	60.7	57.1	54.6	51.1	46.7	43.2	40.7	34.6
Rivit Buster/Chipping Gun	Yes	119.7	94.7	88.7	82.6	74.7	68.7	65.1	62.6	59.1	54.7	51.2	48.7	42.6
Rock Drill	No	119.7	94.7	88.7	82.6	74.7	68.7	65.1	62.6	59.1	54.7	51.2	48.7	42.6
Roller	No	119.7	94.7	88.7	82.6	74.7	68.7	65.1	62.6	59.1	54.7	51.2	48.7	42.6
Sand Blasting (single nozzle)	No	119.7	94.7	88.7	82.6	74.7	68.7	65.1	62.6	59.1	54.7	51.2	48.7	42.6
Scraper	No	119.7	94.7	88.7	82.6	74.7	68.7	65.1	62.6	59.1	54.7	51.2	48.7	42.6
Sheers (on backhoe)	No	119.7	94.7	88.7	82.6	74.7	68.7	65.1	62.6	59.1	54.7	51.2	48.7	42.6
Slurry Plant	No	112.7	87.7	81.7	75.6	67.7	61.7	58.1	55.6	52.1	47.7	44.2	41.7	35.6
Slurry Trenching Machine	No	116.7	91.7	85.7	79.6	71.7	65.7	62.1	59.6	56.1	51.7	48.2	45.7	39.6
Soil Mix Drill Rig	No	114.7	89.7	83.7	77.6	69.7	63.7	60.1	57.6	54.1	49.7	46.2	43.7	37.6
Tractor	No	118.7	93.7	87.7	81.6	73.7	67.7	64.1	61.6	58.1	53.7	50.2	47.7	41.6
Vacuum Excavator	No	119.7	94.7	88.7	82.6	74.7	68.7	65.1	62.6	59.1	54.7	51.2	48.7	42.6
Vacuum Street Sweeper	No	114.7	89.7	83.7	77.6	69.7	63.7	60.1	57.6	54.1	49.7	46.2	43.7	37.6
Ventilation Fan	No	119.7	94.7	88.7	82.6	74.7	68.7	65.1	62.6	59.1	54.7	51.2	48.7	42.6
Vibrating Hopper	No	119.7	94.7	88.7	82.6	74.7	68.7	65.1	62.6	59.1	54.7	51.2	48.7	42.6
Vibratory Concrete Mixer	No	114.7	89.7	83.7	77.6	69.7	63.7	60.1	57.6	54.1	49.7	46.2	43.7	37.6
Vibratory Pile Driver	No	129.7	104.7	98.7	92.6	84.7	78.7	75.1	72.6	69.1	64.7	61.2	58.7	52.6
Warning Horn	No	119.7	94.7	88.7	82.6	74.7	68.7	65.1	62.6	59.1	54.7	51.2	48.7	42.6
Welder/Torch	No	107.7	82.7	76.7	70.6	62.7	56.7	53.1	50.6	47.1	42.7	39.2	36.7	30.6

Table 10.3: Potential equivalent noise levels generated by various equipment

Equipment Description	Equivalent (average) Sound Levels (dBA)	Operational Noise Level at given distance considering equivalent (average) sound power emission levels (Cumulative as well as the mitigatory effect of potential barriers or other mitigation not included – simple noise propagation modelling only considering distance) (dBA)											
		5 m	10 m	20 m	50 m	100 m	150 m	200 m	300 m	500 m	750 m	1000 m	2000 m
Bulldozer CAT D10	111.9	86.9	80.9	74.9	66.9	60.9	57.4	54.9	51.3	46.9	43.4	40.9	34.9
Bulldozer CAT D11	113.3	88.4	82.3	76.3	68.4	62.3	58.8	56.3	52.8	48.4	44.8	42.3	36.3
Bulldozer CAT D9	111.9	86.9	80.9	74.9	66.9	60.9	57.4	54.9	51.3	46.9	43.4	40.9	34.9
Bulldozer CAT D6	108.2	83.3	77.3	71.2	63.3	57.3	53.7	51.2	47.7	43.3	39.8	37.3	31.2
Bulldozer CAT D5	107.4	82.4	76.4	70.4	62.4	56.4	52.9	50.4	46.9	42.4	38.9	36.4	30.4
Bulldozer Komatsu 375	114.0	89.0	83.0	77.0	69.0	63.0	59.5	57.0	53.4	49.0	45.5	43.0	37.0
Bulldozer Komatsu 65	109.5	84.5	78.5	72.4	64.5	58.5	54.9	52.4	48.9	44.5	41.0	38.5	32.4
Diesel Generator (Large - mobile)	106.1	81.2	75.1	69.1	61.2	55.1	51.6	49.1	45.6	41.2	37.6	35.1	29.1
Dumper/Haul truck - CAT 700	115.9	91.0	85.0	78.9	71.0	65.0	61.4	58.9	55.4	51.0	47.5	45.0	38.9
Dumper/Haul truck - Terex 30 ton	112.2	87.2	81.2	75.2	67.2	61.2	57.7	55.2	51.7	47.2	43.7	41.2	35.2
Dumper/Haul truck - Bell 25 ton (B25D)	108.4	83.5	77.5	71.4	63.5	57.5	53.9	51.4	47.9	43.5	40.0	37.5	31.4
Excavator - Cat 416D	103.9	78.9	72.9	66.8	58.9	52.9	49.3	46.8	43.3	38.9	35.4	32.9	26.8
Excavator - Hitachi EX1200	113.1	88.1	82.1	76.1	68.1	62.1	58.6	56.1	52.6	48.1	44.6	42.1	36.1
Excavator - Hitachi 870 (80 t)	108.1	83.1	77.1	71.1	63.1	57.1	53.6	51.1	47.5	43.1	39.6	37.1	31.1
Excavator - Hitachi 270 (30 t)	104.5	79.6	73.5	67.5	59.6	53.5	50.0	47.5	44.0	39.6	36.0	33.5	27.5
FEL - CAT 950G	102.1	77.2	71.2	65.1	57.2	51.2	47.6	45.1	41.6	37.2	33.7	31.2	25.1
FEL - Komatsu WA380	100.7	75.7	69.7	63.7	55.7	49.7	46.2	43.7	40.1	35.7	32.2	29.7	23.7
General noise	108.8	83.8	77.8	71.8	63.8	57.8	54.2	51.8	48.2	43.8	40.3	37.8	31.8
Grader - Operational Hitachi	108.9	83.9	77.9	71.9	63.9	57.9	54.4	51.9	48.4	43.9	40.4	37.9	31.9
Grader	110.9	85.9	79.9	73.9	65.9	59.9	56.4	53.9	50.3	45.9	42.4	39.9	33.9
JBL TLB	108.8	83.8	77.8	71.8	63.8	57.8	54.3	51.8	48.3	43.8	40.3	37.8	31.8
Road Transport Reversing/Idling	108.2	83.3	77.2	71.2	63.3	57.2	53.7	51.2	47.7	43.3	39.7	37.2	31.2
Road Truck average	109.6	84.7	78.7	72.6	64.7	58.7	55.1	52.6	49.1	44.7	41.1	38.7	32.6
Vibrating roller	106.3	81.3	75.3	69.3	61.3	55.3	51.8	49.3	45.8	41.3	37.8	35.3	29.3
Water Dozer, CAT	113.8	88.8	82.8	76.8	68.8	62.8	59.3	56.8	53.3	48.8	45.3	42.8	36.8

Assessment of Impacts of San Kraal WEF

Impact Phase: Construction							
Impact Description: Daytime construction of the Access Roads Increase in noise levels at potential noise-sensitive receptors during the day. There are no receptors within 400m from any access roads and noises from construction of access roads will not increase noise levels higher than 45 dBA during the day.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	L	L	L	Negative	**L**	L	H
With Mitigation	L	L	L	Negative	**L**	L	H
Can the impact be reversed?			YES: The noise impact is fully reversible.				
Will impact cause irreplaceable loss or resources?			NO: The noise impact will not result in an irreplaceable loss of resources.				
Can impact be avoided, managed or mitigated?			Not required to mitigate the noise impact.				
Mitigation measures to reduce residual risk or enhance opportunities: • No mitigation required.							
Residual Impact No potential for noise impact.							

Impact Phase: Construction							
Impact Description: Night-time construction of the Access Roads Increase in noise levels at potential noise-sensitive receptors at night. There are no receptors within 1,000m from any access roads and noises from construction of access roads will not increase noise levels higher than 35 dBA at night.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	L	L	L	Negative	**L**	L	H
With Mitigation	L	L	L	Negative	**L**	L	H
Can the impact be reversed?			YES: The noise impact is fully reversible.				
Will impact cause irreplaceable loss or resources?			NO: The noise impact will not result in an irreplaceable loss of resources.				
Can impact be avoided, managed or mitigated?			Not required to mitigate the noise impact.				
Mitigation measures to reduce residual risk or enhance opportunities: • No mitigation required.							
Residual Impact No potential for noise impact.							

Impact Phase: Construction							
Impact Description: Noise from daytime construction traffic Increase in noise levels at potential noise-sensitive receptors during the day. There are no receptors within 60m from any access roads and noises from construction traffic will not increase noise levels higher than 45 dBA during the day.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**

Without Mitigation	L	L	L	Negative	**L**	L	H
With Mitigation	L	L	L	Negative	**L**	L	H
Can the impact be reversed?			YES: The noise impact is fully reversible.				
Will impact cause irreplaceable loss or resources?			NO: The noise impact will not result in an irreplaceable loss of resources.				
Can impact be avoided, managed or mitigated?			Not required to mitigate the noise impact.				
Mitigation measures to reduce residual risk or enhance opportunities: • No mitigation required.							
Residual Impact No potential for noise impact.							

Impact Phase: Construction							
Impact Description: Noise from night-time construction traffic Increase in noise levels at potential noise-sensitive receptors at night. There are no receptors within 700m from any access roads and noises from construction traffic will not increase noise levels higher than 35 dBA at night.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	L	L	L	Negative	**L**	L	H
With Mitigation	L	L	L	Negative	**L**	L	H
Can the impact be reversed?			YES: The noise impact is fully reversible.				
Will impact cause irreplaceable loss or resources?			NO: The noise impact will not result in an irreplaceable loss of resources.				
Can impact be avoided, managed or mitigated?			Not required to mitigate the noise impact.				
Mitigation measures to reduce residual risk or enhance opportunities: • No mitigation required.							
Residual Impact No potential for noise impact.							

Impact Phase: Construction							
Impact Description: Daytime construction of Wind Turbines Increase in noise levels at potential noise-sensitive receptors during the day. There are no receptors within 400m from any location where wind turbines are proposed and noises from construction activities will not increase noise levels higher than 45 dBA during the day.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	L	L	L	Negative	**L**	L	H
With Mitigation	L	L	L	Negative	**L**	L	H
Can the impact be reversed?			YES: The noise impact is fully reversible.				
Will impact cause irreplaceable loss or resources?			NO: The noise impact will not result in an irreplaceable loss of resources.				
Can impact be avoided, managed or mitigated?			Not required to mitigate the noise impact.				

Mitigation measures to reduce residual risk or enhance opportunities: • No mitigation required.
Residual Impact No potential for noise impact.

Impact Phase: Construction							
Impact Description: Night-time construction of Wind Turbines Increase in noise levels at potential noise-sensitive receptors at night. There are no receptors within 1,000m from any location where wind turbines are proposed and noises from construction activities will not increase noise levels higher than 35 dBA at night. Due to the low ambient sound levels measured onsite, it is possible that the construction activities may be heard.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	L	L	L	Negative	**L**	L	H
With Mitigation	L	L	L	Negative	**L**	L	H
Can the impact be reversed?			YES: The noise impact is fully reversible.				
Will impact cause irreplaceable loss or resources?			NO: The noise impact will not result in an irreplaceable loss of resources.				
Can impact be avoided, managed or mitigated?			Not required to mitigate the noise impact.				
Mitigation measures to reduce residual risk or enhance opportunities: • No mitigation required.							
Residual Impact No potential for noise impact.							

10.6.2 Potential Noise Sources during Operational Phase

The proposed development would be designed to have an operational life of up to 20 years, as set out in the current REIPPP by the DoE. There is the possibility to further expand the lifetime by an extra 20 years. During operation of the development, the large majority of the WEF sites will continue with agricultural use as it is currently. The only development related activities on-site will be routine servicing and unscheduled maintenance. The noise impact from maintenance activities is insignificant, with the main noise source being the wind turbine blades and the nacelle (components inside).

Noise emitted by wind turbines can be divided in two types of noise sources. These are aerodynamic sources due to the passage of air over the wind turbine blades and mechanical sources that are associated with components of the power train within the turbine, such as the gearbox and generator and control equipment for yaw, blade pitch, etc. These sources generally have different characteristics and can be considered separately. In addition there are other lesser noise sources, such as the substations themselves, traffic (maintenance) as well as transmission line noise.

Wind Turbine Noise: Aerodynamic sources[41]

Aerodynamic noise is emitted by a wind turbine blade through a number of sources such as:

1. Self-noise due to the interaction of the turbulent boundary layer with the blade trailing edge
2. Noise due to inflow turbulence (turbulence in the wind interacting with the blades)

[41] *Renewable Energy Research Laboratory, 2006; ETSU R97: 1996*

3. Discrete frequency noise due to trailing edge thickness
4. Discrete frequency noise due to laminar boundary layer instabilities (unstable flow close to the surface of the blade)
5. Noise generated by the rotor tips

Noise due to aerodynamic instabilities (mechanisms 3 and 4) can be reduced to insignificant levels by careful design. The other mechanisms are an inescapable consequence of the aerodynamics of the turbine that produces the power and between them they will make up most, if not all, of the aerodynamic noise radiated by the wind turbine. The relative contribution of each source will depend upon the detailed design of the turbine and the wind speed and turbulence at the time.

The mechanisms responsible for tip noise (mechanism 5) are currently under investigation, but it appears that methods for its control through design of the tip shape might be available. Self-noise (mechanism 1) is most significant at low wind speeds, whereas noise due to inflow turbulence (mechanism 2) becomes the dominant source at the higher wind speeds. Both mechanisms increase in strength as the wind speed increases, particularly inflow turbulence. The overall result is that at low to moderate wind speeds, the noise from a fixed speed wind turbine increases at a rate of 0.5-1.5 dBA /m/s up to a maximum at wind speeds of 7 -12 m/s (noise generated by the WTG does not increase significantly at wind speeds above 12 m/s).

Therefore, as the wind speed increases, noises created by the wind turbine also increases. At a low wind speed the noise created by the wind turbine is generally (relatively) low, and increases to a maximum at a certain wind speed when it either remains constant, increase very slightly or even drops as illustrated in Figure 10.1.

The developer is investigating a number of different wind turbine models; not excluding the possibility of larger models that are not yet available in the commercial market. Therefore, for the purpose of this noise assessment a worse-case scenario will be investigated, making use of the sound power emission levels of the Acciona AW125/3000 turbine (refer to Figure 10.1).

The developer is also considering the use of the Vestas V126 3.45/3.6 MW and the Acciona AW125/3000. While the sound power emission levels of the Vestas V126 3.45/3.6 are similar to the Vestas V117 3.3 MW, the sound power emission levels of the Acciona AW125/3000 is approximately 2 dB higher than either the Vestas WTGs.

The propagation model makes use of various frequencies, because these frequencies are affected in different ways as it propagates through air, over barriers and over different ground conditions providing a higher accuracy than models that only use the total sound power level. The octave sound power levels for various wind turbines are presented in Figure 10.2.

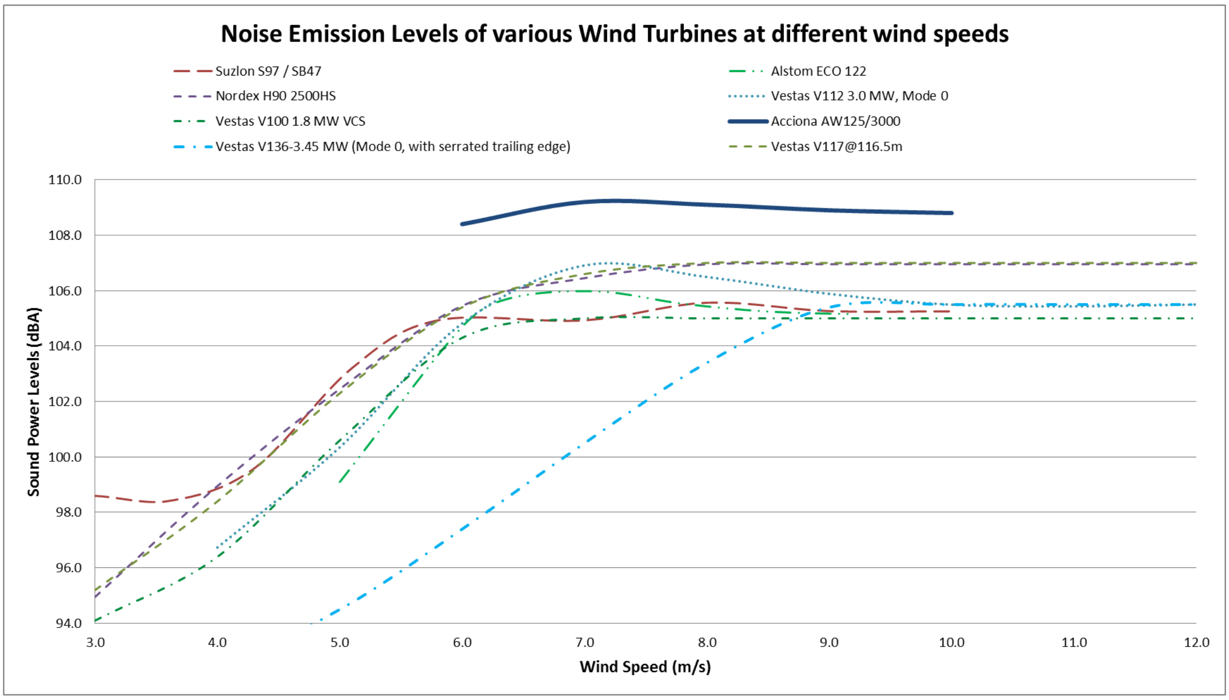


Figure 10.1: Noise Emissions Curve of a number of different wind turbines (figure for illustration purposes only)

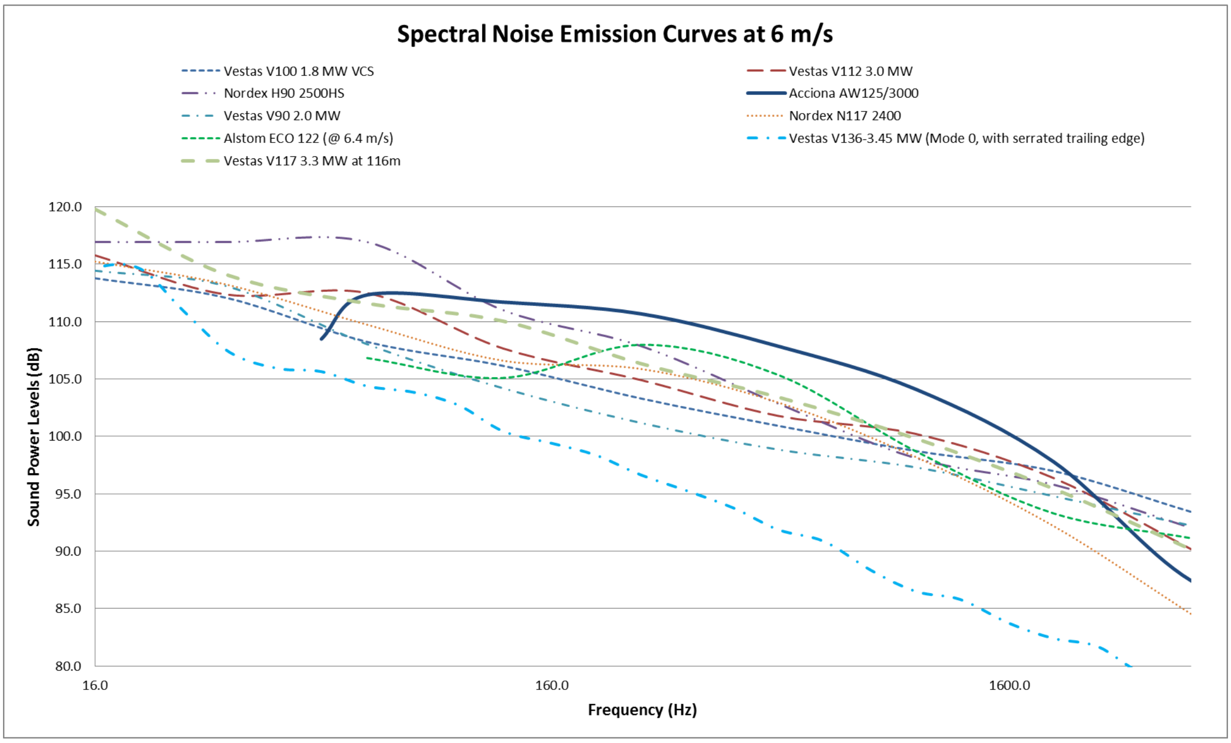


Figure 10.2: Octave sound power emissions of various wind turbines

Control Strategies to manage Noise Emissions during operation

In addition to blade technologies (such as serrated edges) that assist in noise reduction, wind turbine manufacturers also provide their equipment with control mechanisms to allow for a certain noise reduction during operation that can include:

A reduction of rotational speed, and/or the increase of the pitch angle and/or reduction of nominal generator torque to reduce the angle of attack.

These mechanisms are used in various ways to allow the reduction of noise levels from the wind turbines, although this also results in a reduction of power generation.

Wind Turbine Noise

Wind turbines do generate sound in both the inaudible and audible frequency range. However, the manner how this sound is perceived by people would range between people, communities as well as the surrounding environmental conditions in which they live. There are some studies[42] that shows correlations between noise annoyance and a dislike to the facility, with other studies showing a link between wind turbines and increased annoyance levels[43]. Annoyance levels can be further subdivided into people that are annoyed by increased noise levels to the point where people report having to leave their houses to get relieve from the noise.

How widespread annoyance and health issues reports are, are yet to be defined, as there has not been an industry wide scientific study covering noise from wind turbines. Values of 5 – 15% appear to be the most cited, although it depends on the source (it must be reiterated that these are simply reports[44]).

A search on the internet identifies groups that scour the internet for studies, reports and articles about wind energy; some focusing on the positive stories yet others gathering everything mentioned about the negatives, unfortunately also reporting all the negatives as fact without considering all the data. There are numerous wind farms where there has been no noise complaints (a UK study suggest that about 20% of wind farms generated noise complaints, (Cummings, 2011), yet there has been no study assessing the differences between these wind farms.

Cummings (2012) also reports that:

"*it's notable that in ranching country, where most residents are leaseholders and many live within a quarter to half mile of turbines, health and annoyance complaints are close to non-existent; some have suggested that this is evidence of an antidote to wind turbine syndrome: earning some money from the turbines. More to the point, though, the equanimity with which turbine sound is accommodated in ranching communities again suggests that those who see turbines as a welcome addition to their community are far less likely to be annoyed, and thus to trigger indirect stress-related effects. Equally important to consider, ranchers who work around heavy equipment on a daily basis are also likely to be less noise sensitive than average, whereas people who live in the country for peace and quiet and solitude are likely more noise-sensitive than average. And, there are some indications that in flat ranching country, turbine noise levels may be more steady, less prone to atmospheric conditions that make turbines unpredictably louder or more intrusive. When considering the dozens of wind farms in the Midwest and west where noise complaints are minimal or non-existent, it remains true that the vast majority of U.S. wind turbines are built either far from homes or in areas where there is widespread tolerance for the noise they add to the local soundscape.*"

However, on the other hand, there are reports of significant annoyance (that can lead to increased stress levels that can result in other health problems or increase existing problems) from individuals and communities, frequently from people that value the rural quiet and sense of place.

Therefore, when assessing the potential noise impacts one has to consider:

- the complex characteristic of noise from wind turbines (numerous factors that are not yet fully understood);
- the numerous reports about noise impacts;
- the rural character and existing sense of place from a noise perspective;

[42] Gibbons, 2014; Crichton, 2014; Atkinson-Palmbo, 2014; Chapman, 2013; Pedersen, 2003.
[43] Thorne, 2010; *Ambrose, 2011; Pierpont, 2009; Nissenbaum, 2012; Knopper, 2011; Kroesen, 2011; Philips, 2011; Shepherd, 2011a; Shepherd, 2011b; Pedersen, 2011; Wang, 2011; Cooper, 2012; McMurtry, 2011; Havas, 2011; Jeffery, 2013*
[44] Cummings, 2012

- the recommendations from recognised acousticians.

The assessment methodology does consider these factors as discussed in the following section.

10.6.3 Operational Phase Noise Impact

The layout (Scoping Phase Layout) was modelled and evaluated using the sound power emission levels for the Acciona AW125/3000. Being a "loud" wind turbine, this will represent the worst case scenario as the author is not aware of another wind turbine with higher sound power emission levels. This layout was subsequently changed (EIA Layout), but the changes are minimal and have not changed the findings or outcome of the original model. All the NSD are located further than 1,000m from the closest WTG, significantly further than the 400m setback recommended by CNdV Africa (2006).

The calculated octave sound power levels of the Acciona AW125/3000 wind turbine as used for modelling are presented in **Table 10.4**, considering the 6 m/s wind speed for the noise contours. The difference between the proposed height of the nacelle (up to 150 m) and height used for modelling (87.5 m) will have a negligible impact on the results because changes in hub-height generally do not change the sound power emission level (for the same wind turbine), or the change is insignificantly small.

Table 10.4: Octave Sound Power Emission Levels used for modelling: Acciona AW125/3000

Wind Turbine: Acciona AW125/3000 at hh87.5										
Source Reference: Acciona Windpower. General Document DG200383, Rev B dated 04/12/13										
Maximum expected A-weighted Octave Sound Power Levels										
	16	**31.5**	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**
Lpa (dB)	108	109	112.3	111.7	*111.7*	104.6	102.9	98.0	89.5	82.1
L_{WA} (dBA)	*51.6*	*69.1*	*86.1*	*95.5*	*102*	*104.6*	*104.1*	*99*	*88.4*	*82.1*
A-Weighted Sound Power Levels										
Wind speed at 10m height					Sound power level (dBA)					
4					*101.4 **					
5					*105.3 **					
6					108.4					
7					109.2					
8					109.1					
9					108.9					
10					108.8					

* Estimated sound power level considering curves of the Vestas V136-3.45 (see **Figure** 10.1**10.2**)

The calculated noise rating levels are illustrated in Figure 10.3 with the total noise rating level contours presented in Figure 10.4. Noise levels at a 6 m/s wind speed are defined in Table 10.5. As can be seen from Figure 10.3, projected noise levels are not higher than the estimated ambient sound levels and well below the recommended MoE noise level. The projected noise rating levels will not be disturbing.

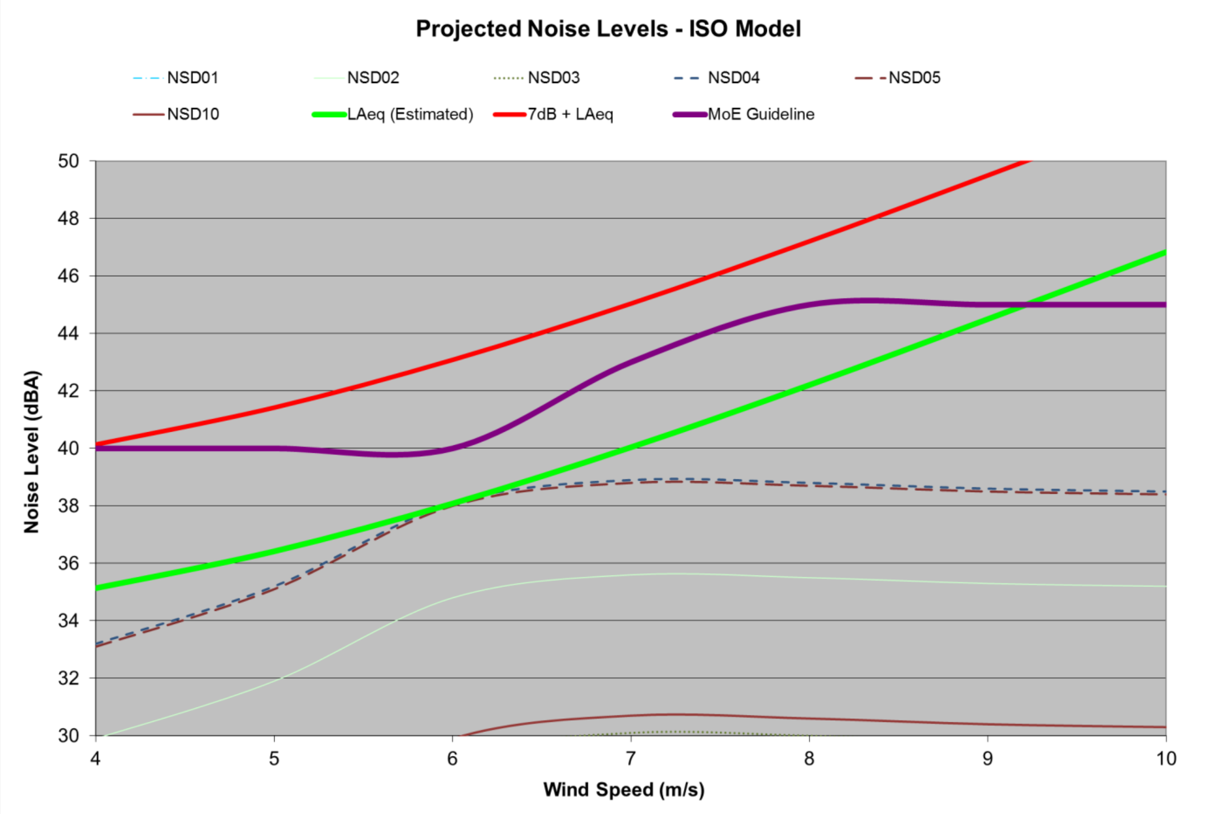


Figure 10.3: Projected noise rating levels at NSDs at different wind speeds

Table 10.5: Noise rating levels at a 6 m/s wind speed

Receptor	Noise Rating Level – San Kraal WEF (dBA)	Noise Rating Level – Cumulative (dBA)
NSD01	< 30	31.4
NSD02	34.8	39.0
NSD03	< 30	35.9
NSD04	38.1	38.2
NSD05	38.0	38.2
NSD06	< 30	< 30
NSD07	< 30	40.9
NSD08	< 30	37.2
NSD09	< 30	< 30
NSD10	< 30	< 30

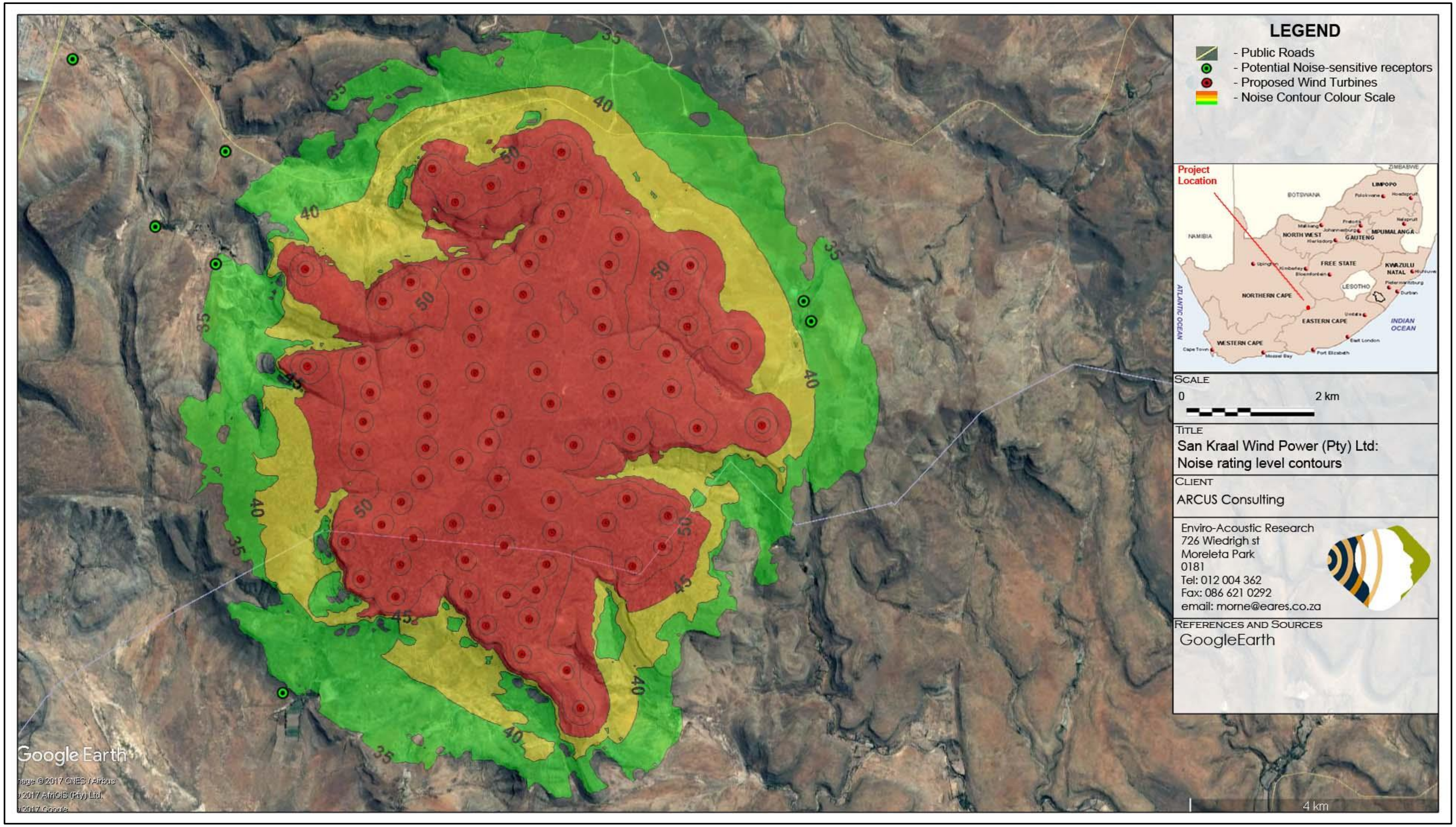


Figure 10.4 Projected Conceptual night time noise rating levels during operation – Acciona WTYG @ 6 m/s

Assessment of Operation Phase Impacts

Impact Phase: Operational							
Impact Description: Daytime operation of Wind Turbines Increase in noise levels at potential noise-sensitive receptors during the day. Projected noise levels are significantly less than 45 dBA at all the surrounding receptors.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	L	M	L	Negative	**L**	L	H
With Mitigation	L	M	L	Negative	**L**	L	H
Can the impact be reversed?			YES: The noise impact is fully reversible.				
Will impact cause irreplaceable loss or resources?			NO: The noise impact will not result in an irreplaceable loss of resources.				
Can impact be avoided, managed or mitigated?			Not required to mitigate the noise impact.				
Mitigation measures to reduce residual risk or enhance opportunities: • No mitigation required.							
Residual Impact No potential for noise impact.							

Impact Phase: Operational							
Impact Description: Night-time operation of Wind Turbines Increase in noise levels at potential noise-sensitive receptors at night due to the operation of the wind turbines. There are no receptors within 1,000m from any location where wind turbines are proposed, but projected noise levels could be as high as 39 dBA. While there is only a few measurements at higher wind speeds, ambient sound levels could be higher than 40 dBA. Wind turbines may be audible during quiet periods.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	M	M	L	Negative	**L**	L	H
With Mitigation	M	M	L	Negative	**L**	L	H
Can the impact be reversed?			YES: The noise impact is fully reversible.				
Will impact cause irreplaceable loss or resources?			NO: The noise impact will not result in an irreplaceable loss of resources.				
Can impact be avoided, managed or mitigated?			Not required to mitigate the noise impact.				
Mitigation measures to reduce residual risk or enhance opportunities: • No mitigation required.							
Residual Impact No potential for noise impact.							

10.6.4 Noise Impacts on Animals

A great deal of research was conducted in the 1960's and 1970's on the effects of aircraft noise on animals. While aircraft noise have a specific characteristic that might not be comparable with industrial noise, the findings should be relevant to most noise sources.

Overall, the research suggests that species differ in their response to:

- Various types of noise;
- Durations of noise; and
- Sources of noise.

A general animal behavioural reaction to aircraft noise is the startle response. However, the strength and length of the startle response appears to be dependent on:

- which species is exposed;
- whether there is one animal or a group; and
- whether there have been some previous exposures.

Unfortunately, there are numerous other factors in the environment of animals that also influence the effects of noise. These include predators, weather, changing prey/food base and ground-based disturbance, especially anthropogenic. This hinders the ability to define the real impact of noise on animals.

From these and other studies the following can be concluded:

- Animals respond to impulsive (sudden) noises (higher than 90 dBA) by running away. If the noises continue, animals would try to relocate.
- Animals of most species exhibit adaptation with noise, including aircraft noise and sonic booms.
- More sensitive species would relocate to a more quiet area, especially species that depend on hearing to hunt or evade prey, or species that makes use of sound/hearing to locate a suitable mate.
- Noises associated with helicopters, motor- and quad bikes significantly impact on animals.

Domestic Animals

It has been observed that most domestic animals are generally not bothered by noise, excluding most impulsive noises.

Wildlife

Studies showed that most animals adapt to noises, and would even return to a site after an initial disturbance, even if the noise is continuous. The more sensitive animals that might be impacted by noise would most likely relocate to a quieter area. Noise impacts are therefore very highly species dependent.

10.6.5 Assessment of Impacts of San Kraal Grid Connection Alternatives

Impact Phase: Construction							
Impact Description: Daytime construction of overhead power line pylons (all 3 alignment options) Increase in noise levels at potential noise-sensitive receptors during the day. There are no receptors within 250m from any locations where the pylons may be constructed and construction noises will not increase noise levels higher than 45 dBA during the day.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	L	L	L	Negative	**L**	L	H
With Mitigation	L	L	L	Negative	**L**	L	H
Can the impact be reversed?			YES: The noise impact is fully reversible.				
Will impact cause irreplaceable loss or resources?			NO: The noise impact will not result in an irreplaceable loss of resources.				
Can impact be avoided, managed or			Not required to mitigate the noise impact.				

mitigated?	
Mitigation measures to reduce residual risk or enhance opportunities: • No mitigation required.	
Residual Impact No potential for noise impact.	

Impact Phase: Construction							
Impact Description: Night-time construction of overhead power line pylons (preferred option) Increase in noise levels at potential noise-sensitive receptors at night. NSD08 are approximately 560m from a location where a pylon may be constructed (within 0 - 1,000m from the proposed corridor), and these construction activities may raise the noise level to approximately 38 dBA. Considering potential low ambient sound levels (low wind conditions) the noise will be audible during low-wind conditions (low ambient sound levels) and could be considered disturbing.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	L	L	M	Negative	**L**	L	H
With Mitigation	L	L	L	Negative	**L**	L	H
Can the impact be reversed?	YES: The noise impact is fully reversible.						
Will impact cause irreplaceable loss or resources?	NO: The noise impact will not result in an irreplaceable loss of resources.						
Can impact be avoided, managed or mitigated?	YES						
Mitigation measures to reduce residual risk or enhance opportunities: • When constructing pylons closer than 350m from any receptor, the construction should be planned to take place during the day. • If possible, the pylons can be relocated further from the receptors (further than 350m). • Minimize simultaneous construction activities, making use of smallest (or quietest equipment) available for the task.							
Residual Impact Noise impact can be managed, no further assessments required.							

Impact Phase: Construction							
Impact Description: Night-time construction of overhead power line pylons (Alternative option 1) Increase in noise levels at potential noise-sensitive receptors at night. NSD08 are approximately 300m from a location where a pylon may be constructed (within 0 - 760m from the proposed corridor), and these construction activities may raise the noise level to higher than 42 dBA at night. Considering potential low ambient sound levels, the noise will be audible during low-wind conditions (low ambient sound levels) and would be disturbing.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	L	L	H	Negative	**M**	M	H
With Mitigation	L	L	L	Negative	**L**	L	H
Can the impact be reversed?	YES: The noise impact is fully reversible.						
Will impact cause irreplaceable loss or resources?	NO: The noise impact will not result in an irreplaceable loss of resources.						

Can impact be avoided, managed or mitigated?	YES
Mitigation measures to reduce residual risk or enhance opportunities: • When constructing pylons closer than 350m from any receptor, the construction should be planned to take place during the day. • If possible, the pylons can be relocated further from the receptors (further than 350m). • Minimize simultaneous construction activities, making use of smallest (or quietest equipment) available for the task.	
Residual Impact Noise impact can be managed, no further assessments required.	

Impact Phase: Construction							
Impact Description: Night-time construction of overhead power line pylons (Alternative option 2) Increase in noise levels at potential noise-sensitive receptors at night. NSDs 2, 3 and 9 are approximately 650m from a location where a pylon may be constructed, and these construction activities may raise the noise level to just higher than 35 dBA. Considering the low ambient sound levels the noise may be audible during low-wind conditions (low ambient sound levels).							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	L	L	M	Negative	**L**	L	H
With Mitigation	L	L	L	Negative	**L**	L	H
Can the impact be reversed?	YES: The noise impact is fully reversible.						
Will impact cause irreplaceable loss or resources?	NO: The noise impact will not result in an irreplaceable loss of resources.						
Can impact be avoided, managed or mitigated?	YES						
Mitigation measures to reduce residual risk or enhance opportunities: • No mitigation required.							
Residual Impact No further noise impact assessment required.							

10.6.6 Cumulative Impacts on Noise

There are a number of existing and proposed noise sources that may cumulatively add to noise levels in the area. This includes sources such as the traffic noises from N9 road as well as renewable projects. There are a number of Photo-voltaic plants in the area, although the status of these is not known. Environmental noise studies are generally not conducted for Photo-voltaic projects due to the low risk of a noise impact from such facilities. The N9 road is too far from this project to cumulatively increase noise levels in the vicinity of the San Kraal Wind Farm.

At the time of the writing of this report, the author is aware of the proposed Umsobomvu and Phezukomoya facilities as well as the existing Mainstream Noupoort WEF. The Environmental Noise Impact Assessments are available for these projects and were evaluated and considered

Cumulative noise impacts generally only occur when noise sources (such as other wind turbines) are closer than 2,000m from each other (around 1,000m from the conceptual receptor located between them). The cumulative impact also only affects the area between the wind turbines of the various wind farms.

If the wind turbines of one wind farm are further than 2,000m from the wind turbines of the other wind farm, the magnitude (and subsequently the significance) of the cumulative noise impact is reduced. If the distance between the wind turbines of two wind farms are further than 4,000m, cumulative noise impacts are non-existent (see also Figure 10.5).

The only projects that may increase the noise levels cumulatively are the Mainstream Noupoort WEF and the Phezukomoya Wind Farms. At more than 5,000m from the wind turbines of the San Kraal WF, there is no risk of a cumulative impact from the Umsobomvu WEF.

Cumulative noises will be calculated considering the sound power emission levels of the Acciona AW125/3000 for the San Kraal and Phezukomoya WEFs and the Siemens SWT-2.3-101 wind turbine for the Mainstream Noupoort WEF. Cumulative noise rating level contours are illustrated in Figure 10.6.

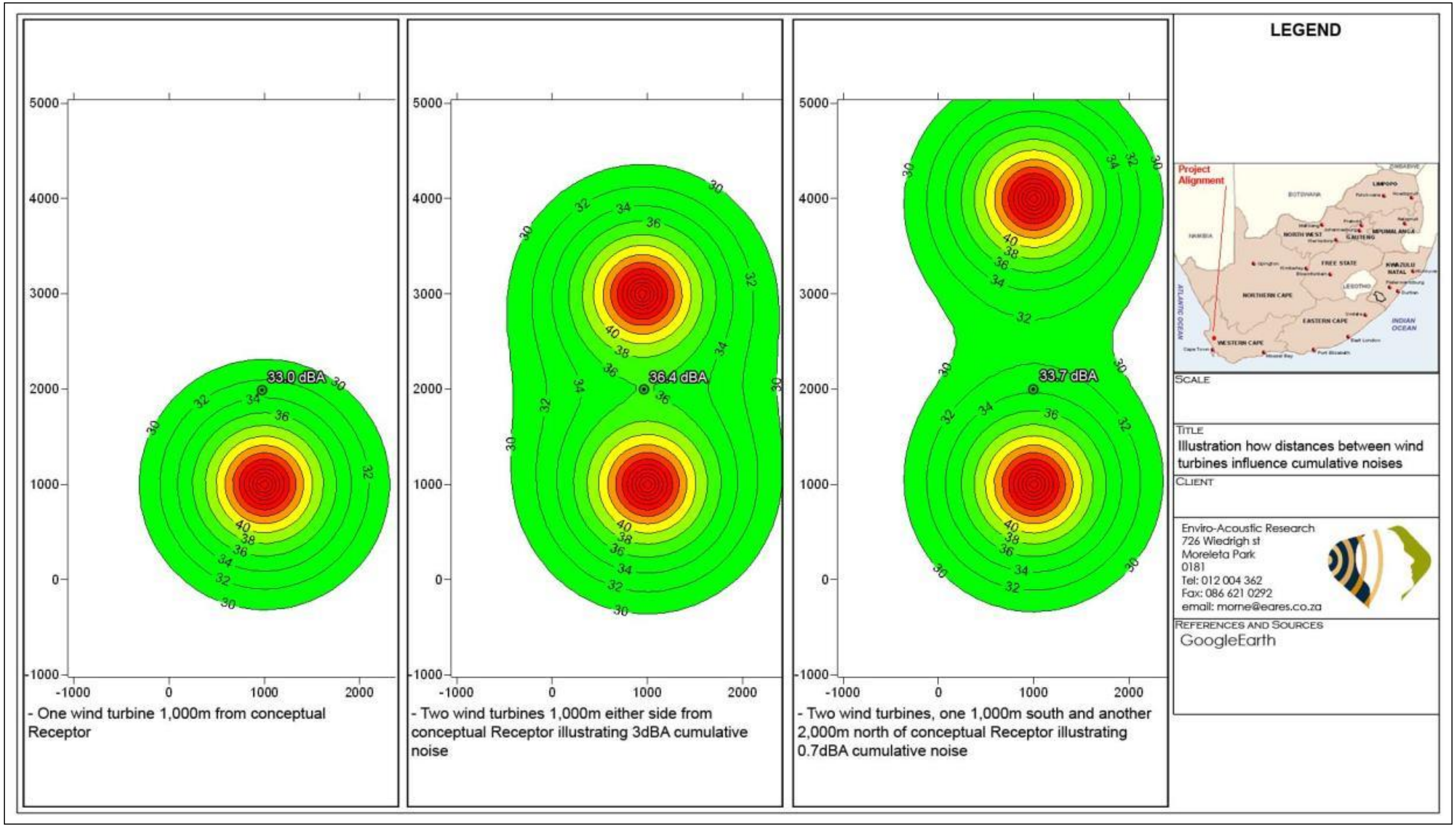


Figure 10.5 Effect of distance between wind turbines – potential cumulative noise

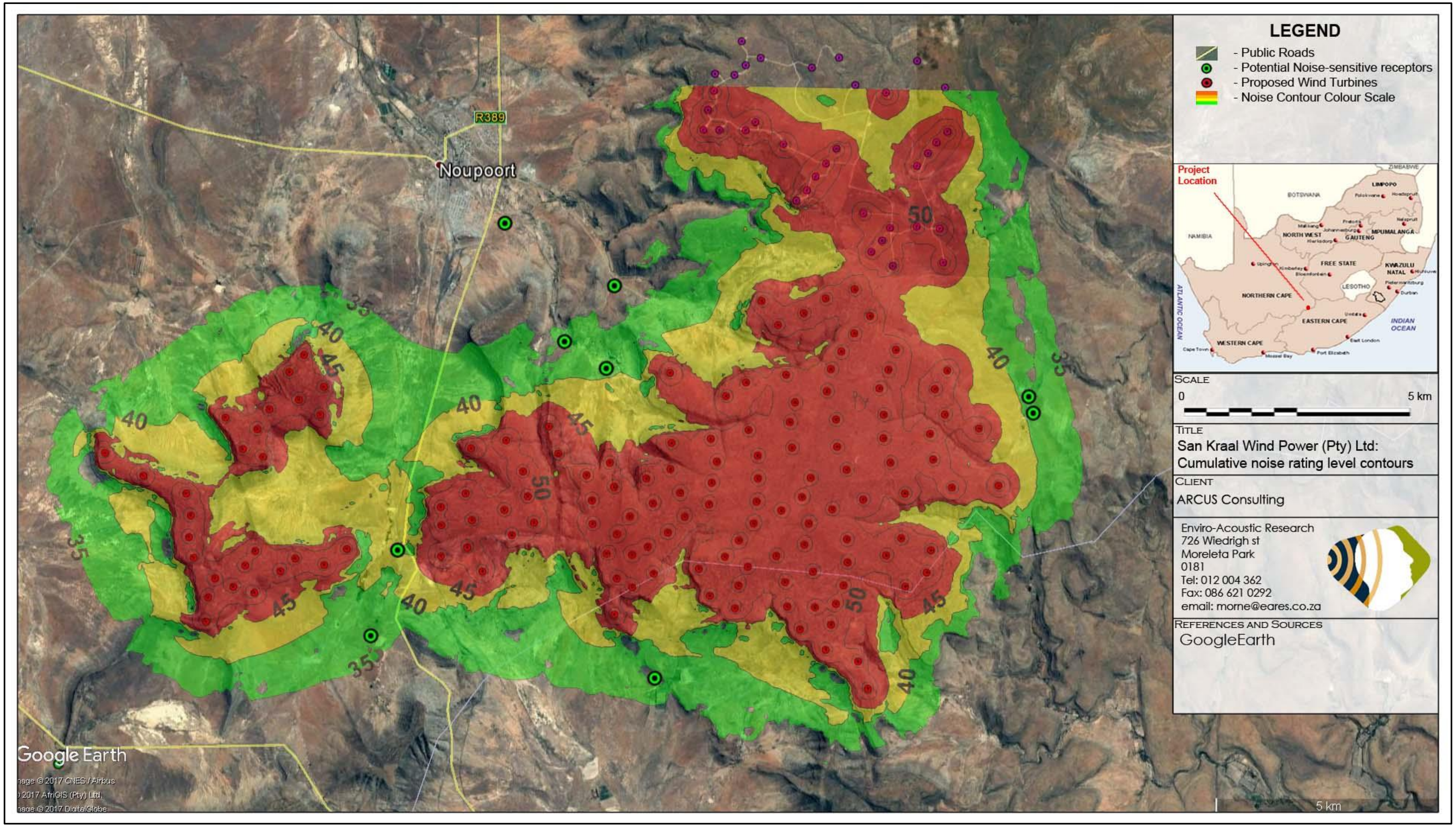


Figure 10.6 Projected cumulative noise rating levels – worst case (at 6 m/s)

Impact Phase: Cumulative							
Impact Description: Potential Cumulative Noise Impact from daytime operation of Wind Turbines Increase in noise levels at potential noise-sensitive receptors during the day. Projected cumulative noise levels are significantly less than 45 dBA at all the surrounding receptors. There is no potential of a daytime cumulative noise impact.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	L	M	L	Negative	**L**	L	H
With Mitigation	L	M	L	Negative	**L**	L	H
Can the impact be reversed?		YES: The noise impact is fully reversible.					
Will impact cause irreplaceable loss or resources?		NO: The noise impact will not result in an irreplaceable loss of resources.					
Can impact be avoided, managed or mitigated?		Not required to mitigate the noise impact.					
Mitigation measures to reduce residual risk or enhance opportunities: • No mitigation required.							
Residual Impact No potential for a cumulative noise impact.							

Impact Phase: Cumulative							
Impact Description: Potential Cumulative Noise Impact of Wind Turbines due to night-time operation Increase in noise levels at potential noise-sensitive receptors at night due to the operation of the wind turbines. There are no receptors within 1,000m from any location where wind turbines of the San Kraal WEF are proposed, but projected noise levels could be as high as 42 dBA at NSD07, however, these noises will be due to the operation of the proposed Phezukomoya. While there is only a few measurements at higher wind speeds, ambient sound levels could be higher than 40 dBA at higher wind speeds. Wind turbines are likely to be audible but this would not be a disturbing sound.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	M	M	L	Negative	**L**	L	H
With Mitigation	M	M	L	Negative	**L**	L	H
Can the impact be reversed?		YES: The noise impact is fully reversible.					
Will impact cause irreplaceable loss or resources?		NO: The noise impact will not result in an irreplaceable loss of resources.					
Can impact be avoided, managed or mitigated?		Not required to mitigate the noise impact.					
Mitigation measures to reduce residual risk or enhance opportunities: • No mitigation required.							
Residual Impact No potential for a cumulative noise impact.							

Considering the cumulative noise impact from the San Kraal, Phezukomoya and the operational Mainstream Noupoort WEFs, the significance of the noise impact is considered to be low on all receptors.

10.7 Visual

10.7.1 Assessment of Impacts of San Kraal WEF

Impact Phase: Construction							
Impact Description: Impact on access roads Large construction vehicles and equipment will alter the natural character of the study area and expose visual receptors to visual impacts associated with construction. The construction activities may be perceived as an unwelcome visual intrusion, particularly in more natural undisturbed settings. Vehicles and trucks travelling to and from the proposed site on gravel access roads are also expected to increase dust emissions. The increased traffic on these roads and the resultant dust plumes could create a visual impact and may evoke negative sentiments from surrounding viewers. Surface disturbance during construction would also expose bare soil which could visually contrast with the surrounding environment. Additionally, temporary stockpiling of soil during construction may alter the landscape. Wind blowing over these disturbed areas could therefore result in dust which would have a visual impact.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	M	L	M	Negative	**M**	M	M
With Mitigation	M	L	M	Negative	**M**	M	M
Can the impact be reversed?			YES: The negative effects of construction will cease once construction is complete.				
Will impact cause irreplaceable loss or resources?			YES: There will be marginal loss of resources				
Can impact be avoided, managed or mitigated?			YES: Mitigation measures can reduce impacts.				
Mitigation measures to reduce residual risk or enhance opportunities: • Carefully plan to reduce the construction period. • Minimise vegetation clearing and rehabilitate cleared areas as soon as possible. • Maintain a neat construction site by removing rubble and waste materials regularly. • Make use of existing gravel access roads where possible. • Ensure that dust suppression techniques are implemented on all access roads, especially those leading up steep slopes.							
Residual Impact No residual impact.							

Impact Phase: Construction							
Impact Description: Impact on cabling During the construction of the 132kV overhead power line, underground cables, on-site switching station, access roads and building infrastructure, large construction vehicles and equipment could exert a visual impact by altering the visual character of the surrounding area and exposing sensitive visual receptor locations to visual impacts associated with the construction phase. The construction activities may be perceived as an unwelcome visual intrusion, particularly in more natural undisturbed settings. Vehicles and trucks travelling to and from the proposed site on gravel access roads are also expected to increase dust emissions. The increased traffic on the gravel roads and the resultant dust plumes could create a visual impact and may evoke negative sentiments from surrounding viewers. Surface disturbance during construction would also expose bare soil which could visually contrast with the surrounding environment. In addition, temporarily stockpiling soil during construction may alter the landscape and wind blowing over these disturbed areas could result in dust which would have a visual impact.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	M	L	M	Negative	**M**	M	M
With	M	L	M	Negative	**M**	M	M

Mitigation							
Can the impact be reversed?			YES: The negative effects of construction will cease once construction is complete.				
Will impact cause irreplaceable loss or resources?			YES: There will be marginal loss of resources				
Can impact be avoided, managed or mitigated?			YES: Mitigation measures can reduce impacts.				

Mitigation measures to reduce residual risk or enhance opportunities:

- All reinstated cable trenches should be re-vegetated with the same vegetation that existed prior to the cable being laid.
- Carefully plan to reduce the construction period.
- Minimise vegetation clearing and rehabilitate cleared areas as soon as possible.
- Maintain a neat construction site by removing rubble and waste materials regularly.
- Make use of existing gravel access roads where possible.
- Ensure that dust suppression techniques are implemented on all access roads.

Residual Impact

No residual impact.

Impact Phase: Operational

Impact Description: Impact on access roads

During the operation phase, the proposed San Kraal WEF could exert a visual impact by altering the visual character of the surrounding area and exposing sensitive visual receptor roads and locations, such as farmsteads / homesteads to visual impacts. The development may be perceived as an unwelcome visual intrusion, particularly in more natural undisturbed settings. Maintenance vehicles may need to access the WEF via gravel access roads and are expected to increase dust emissions in doing so. The increased traffic on these roads and the dust plumes could create a visual impact and may evoke negative sentiments from surrounding viewers. Security and operational lighting at the proposed WEF could result in light pollution and glare, which could be an annoyance to surrounding viewers.

	Extent	Duration	Intensity	Status	Significance	Probability	Confidence
Without Mitigation	M	M	H	Negative	**M**	H	M
With Mitigation	M	M	M	Negative	**M**	H	M
Can the impact be reversed?			YES: If the WEF is decommissioned.				
Will impact cause irreplaceable loss or resources?			YES: There will be marginal loss of resources				
Can impact be avoided, managed or mitigated?			YES: Mitigation measures can reduce impacts.				

Mitigation measures to reduce residual risk or enhance opportunities:

- Medium-high visual impact zones should be viewed as zones where the number of turbines should be limited, where possible.
- No turbines should be placed within 1km of the N9, N10 and R389 provincial road.
- Where possible, fewer but larger turbines with a greater output should be utilised rather than a larger number of smaller turbines with a lower capacity.
- Turbines should be painted plain white, as this is a less industrial colour (Vissering, 2011). Bright colours or obvious logos should not be permitted.
- Turbines should be repaired promptly, as they are considered more visually appealing when the blades are rotating (or at work) (Vissering, 2011).
- If required, turbines should be replaced with the same model, or one of equal height and scale. Repeating elements of the same height, scale and form can result in unity and lessen the visual impact that would typically be experienced in a chaotic landscapes made up of diverse colours, textures and patterns (Vissering, 2011).
- Light fittings for security at night should reflect the light toward the ground and prevent light spill.

• Ensure that dust suppression techniques are implemented on all access roads.
Residual Impact No residual impact.

Impact Phase: Operational							
Impact Description: Impact on cabling The 132kV overhead power line, underground cables, on-site switching station, access roads and building infrastructure could exert a visual impact by altering the visual character of the surrounding area and exposing sensitive visual receptors and roads to visual impacts. The development may be perceived as an unwelcome visual intrusion, particularly in more natural undisturbed settings. Maintenance vehicles may need to access the infrastructure associated with the WEF via gravel access roads and are expected to increase dust emissions in doing so. The increased traffic on these roads and the resultant dust plumes could create a visual impact and may evoke negative sentiments from surrounding viewers. Security and operational lighting at the associated infrastructure could result in light pollution and glare, which could be an annoyance to surrounding viewers.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	M	M	M	Negative	**M**	H	M
With Mitigation	M	M	M	Negative	**M**	H	M
Can the impact be reversed?		YES: If the WEF and power lines and other infrastructure are decommissioned.					
Will impact cause irreplaceable loss or resources?		YES: There will be marginal loss of resources					
Can impact be avoided, managed or mitigated?		YES: Mitigation measures can reduce impacts.					
Mitigation measures to reduce residual risk or enhance opportunities: • Light fittings for security at the on-site switching station at night should reflect the light toward the ground and prevent light spill. • Where practically possible, the operations and maintenance buildings should not be illuminated at night. • Power lines should be aligned to run parallel to existing power lines and other linear infrastructure, if possible. • Power lines should be aligned to avoid ridgelines and steep slopes, if possible. • Cables should be buried underground where possible. • The operation and maintenance buildings should be painted with natural tones that fit with the surrounding environment. Non-reflective surfaces should be utilised where possible. • Ensure that dust suppression techniques are implemented on all access roads. • Select the alternatives that will have the least impact on visual receptors.							
Residual Impact No residual impact.							

10.7.2 Assessment of Impacts of San Kraal Grid Connection Alternatives

Three (3) power line route alternatives are being assessed during the EIA phase of the proposed development.

The alternatives are rated as being either preferred (the alternative will result in a low visual impact / reduce the visual impact), not-preferred (the alternative will result in a relatively high visual impact / increase the visual impact), favourable (the visual impact will be relatively insignificant) and no-preference (each alternative would result in an equal visual impact).

The degree of visual impact of each alternative has been determined based on the following factors:

- The location of the power line in relation to areas of high elevation, especially ridges, koppies or hills;
- The location of the power line in relation to sensitive receptor locations; and
- The location of the power line in relation to areas of natural vegetation (clearing a strip of vegetation under the power line servitude worsens the visibility).

Preferred Alternative: Preferred: the proposed development would result in a moderate visual impact on majority of the potentially sensitive visual receptor locations with the study area / visual assessment zone (9 in total). Additionally, the proposed development would result in a negligible visual impact on seven (7) of the potentially sensitive receptors. The proposed development would also result in a negligible visual impact on both of the sensitive receptor locations (namely VR 28 – The Dairy BnB and VR 36 – Carlton Heights Lodge). This is due to the fact that the above-mentioned sensitive and potentially sensitive receptors are located further than 5km from this power line corridor alternative and therefore the proposed power line is not expected to be visible from these locations. It must be noted that the proposed development would result in a high visual impact on only one (1) of the potentially sensitive visual receptors, namely VR 49. In addition, the proposed development is also expected to have a low visual impact on three (3) of the potentially sensitive visual receptors, namely VR 31, VR 45 and VR 46. As previously mentioned, corridors were assessed with regards to the proposed 132kV power line and the final power line placement can be positioned well away from any of the identified sensitive and/or potentially sensitive receptor locations and any other dwellings. In light of the above, the Preferred Power Line Corridor Alternative is expected to have an overall moderate visual impact.

Alternative 1: Not Preferred: the proposed development would result in a moderate visual impact on majority of the potentially sensitive visual receptor locations with the study area / visual assessment zone (10 in total). The proposed development would also result in a moderate visual impact on one (1) of the sensitive visual receptors, namely VR 36 – Carlton Heights Lodge. Additionally, the proposed development would result in a negligible visual impact on seven (7) of the potentially sensitive receptors. The proposed development would also result in a negligible visual impact on one (1) of the sensitive visual receptors, namely VR 28 – The Dairy BnB. This is due to the fact that the above-mentioned sensitive and potentially sensitive receptors are located further than 5km from this power line corridor alternative and therefore the proposed power line is not expected to be visible from these locations. It must be noted that the proposed development would result in a high visual impact on only one (1) of the potentially sensitive visual receptors, namely VR 49. In addition, the proposed development is also expected to have a low visual impact on two (2) of the potentially sensitive visual receptors, namely VR 45 and VR 46. As previously mentioned, corridors were assessed with regards to the proposed 132kV power line and the final power line placement can be positioned well away from any of the identified sensitive and/or potentially sensitive receptor locations and any other dwellings. In light of the above, the Power Line Corridor Alternative 1 is expected to have an overall moderate visual impact.

Alternative 2: Favourable Alternative: the proposed development would result in a low visual impact on majority of the potentially sensitive visual receptor locations with the study area / visual assessment zone (11 in total). Additionally, the proposed development would result in a negligible visual impact on one (1) of the potentially sensitive receptors, namely VR 33. The proposed development would also result in a negligible visual impact on one (1) of the sensitive visual receptors, namely VR 36 – Carlton Heights Lodge. This is due to the fact that the above-mentioned sensitive and potentially sensitive receptors are located further than 5km from this power line corridor alternative and therefore the proposed power line is not expected to be visible from these locations. It must be noted that the proposed development would result in a high visual impact on only one (1) of the potentially sensitive visual receptors, namely VR 49. In addition, the proposed development is also expected to have a moderate visual impact on seven (7) of the potentially sensitive visual receptors, as well as one (1) of the sensitive visual receptors, namely VR 28 – The Dairy BnB. As previously mentioned, corridors were assessed with regards to the proposed 132kV power line and the final power line placement can be positioned well away from any of the identified sensitive and/or potentially sensitive receptor locations and any other dwellings. In light of the above, the Power Line Corridor Alternative 2 is expected to have an overall low visual impact.

10.7.3 Cumulative Impacts on Visual

Although it is important to assess the visual impacts of the proposed WEF itself, it is equally important to assess the cumulative visual impact that would materialise in the area as a result of the construction of the San Kraal WEF development in addition to the other renewable energy developments in the surrounding area. Cumulative impacts are the combined impacts from different developments / facilities which, in combination, result in significant impacts that may be larger than the sum of all the impacts combined. The addition of the San Kraal WEF is not expected to contribute to a greater visual impact than all of the other renewable energy developments combined and thus the construction of this WEF is not expected to result in an unacceptable overall visual impact. It should be noted that for the purpose of this cumulative impact assessment, it has been assumed that all of the other proposed renewable energy developments have already been constructed. This forms the cumulative baseline, against which the cumulative impact of the construction of the San Kraal WEF was assessed.

The relatively large number of renewable energy facilities within the surrounding area and their potential for large scale visual impacts could significantly alter the sense of place and visual character in the study area, as well as exacerbate the visual impacts on surrounding receptors. As previously mentioned, the height of the proposed development in combination with distance are critical factors when assessing visual impacts. It must be noted that for the purpose of this study, renewable energy developments within a 35km radius of the San Kraal WEF.

The already operational Noupoort Wind Farm, two (2) proposed WEFs and two (2) proposed solar photovoltaic (PV) energy facilities are located with the visual assessment zone. The identified receptors will therefore experience visual impacts from the already operational Noupoort Wind Farm and proposed WEFs, as well as further medium to low impacts should the San Kraal WEF also be constructed. Although the degree of visual impact would be considered to be insignificant from approximately 5km away from the proposed solar PV facilities, these facilities would still impact cumulatively on some receptors as one (1) of these solar PV facilities is located on the south-western boundary of the San Kraal WEF application site.

In addition to the cumulative impact that would be experienced by receptors in the area, the renewable energy facilities in the surrounding area will also impact on the pastoral visual character of the study area. The proposed San Kraal WEF, in combination with the already operational Noupoort Wind Farm and additional two (2) WEFs proposed within the study area, could therefore potentially be viewed as one (1) very large development which significantly alters the character of the area and impacts on receptors. However, the newly established Noupoort Wind Farm has already introduced industrial-type elements into the landscape making the area less sensitive to change as a result of introducing a further renewable energy facility into the area.

The cumulative impacts anticipated as a result of the construction and operation of the proposed San Kraal WEF include visual impacts on users of arterial and secondary roads, the visual impacts on residents of farmsteads / homesteads and settlements, the visual impacts of shadow flicker on sensitive and potentially sensitive visual receptors, the visual impacts of lighting at night on sensitive and potentially sensitive visual receptors, the visual impacts of construction and operation on sensitive and potentially sensitive visual receptors and the visual impacts on the visual quality of the landscape and sense of place. In addition to the other renewable energy developments in the surrounding area, the San Kraal WEF development and its associated infrastructure could exert a greater visual impact within the surrounding area by further altering the visual character, thereby exposing a greater number of sensitive visual receptor locations to visual impacts. The operation of the San Kraal WEF in addition to the other nearby renewable energy developments may be perceived as an unwelcome visual intrusion, particularly in more natural undisturbed settings. Large construction vehicles and equipment during the construction phase of the San Kraal WEF will contribute further to the alteration of the natural character of the study area and will also expose a greater number of visual receptors to visual impacts associated with the construction phase. The construction activities may thus also be perceived as a further unwelcome visual intrusion, particularly in more natural undisturbed settings.

Vehicles and trucks travelling to and from the proposed San Kraal development site on gravel access roads are also expected to result in an increase in dust emissions in the greater area. The increased traffic on these roads and the dust plumes could create a greater visual impact within the greater area and may evoke more negative sentiments from surrounding viewers. It should however be noted that the existing roads which can be found around the project site also appear to be gravel. As such, the gravel access roads are not expected to contribute significantly to the overall cumulative visual impact. Surface disturbance during construction of the San Kraal WEF would also result in a greater amount of bare soil being exposed which could result in a greater visual contrast with the surrounding environment.

In addition, temporary stockpiling of soil during construction may alter the landscape further. Wind blowing over these disturbed areas could result in a greater amount of dust which would have a visual impact. It should however be noted that mitigation measures will be put in place during the construction and operation phases respectively in order to control dust and thus this is not expected to have a significant visual impact. Security and operational lighting at the San Kraal WEF development and its associated infrastructure could also result in a greater amount of light pollution and glare within the surrounding area, which could be a significant annoyance to surrounding viewers. The significance of the above-mentioned visual impacts were however only found to range from medium to low and thus the impact of the San Kraal WEF, in addition to the other renewable energy developments in the surrounding area, is not significant enough to result in the cumulative visual impact being considered unacceptable. Additionally, mitigation measures will be put in place during the construction and operations phases respectively in order to ensure that the proposed development will not result in significant visual impacts.

Rating of cumulative visual impacts as a result of the San Kraal WEF in addition to the other renewable energy developments (including associated infrastructure) proposed nearby during construction

Impact Phase:
Potential impact description: Cumulative visual impacts as a result of the construction of the San Kraal WEF in addition to the other renewable energy developments within a 35km radius of the San Kraal WEF. Large construction vehicles and equipment during the construction phase of the San Kraal WEF will contribute further to the alteration of the natural character of the study area and will also expose a greater number of visual receptors to visual impacts associated with the construction phase. The construction activities may be perceived as an unwelcome visual intrusion,

particularly in more natural undisturbed settings. Vehicles and trucks travelling to and from the proposed San Kraal development site on gravel access roads are also expected to result in an increase in dust emissions in the greater area. The increased traffic on these roads and the dust plumes could create a greater visual impact within the greater area and may evoke more negative sentiments from surrounding viewers. Surface disturbance during construction of the San Kraal WEF would also result in a greater amount of bare soil being exposed which could result in a greater visual contrast with the surrounding environment. In addition, temporary stockpiling of soil during construction may alter the landscape further. Wind blowing over these disturbed areas could result in a greater amount of dust which would have a visual impact.

	Extent	Duration	Intensity	Status	Significance	Probability	Confidence
Without Mitigation	M	M	H	Negative	M	H	M
With Mitigation	M	M	M	Negative	M	M	M

Can the impact be reversed?	YES – The impact is partly reversible. The negative effects of construction will cease once construction is complete
Will impact cause irreplaceable loss or resources?	YES – there will be significant loss of resources
Can impact be avoided, managed or mitigated?	YES – mitigation measures can reduce impacts

Mitigation measures to reduce residual risk or enhance opportunities:

- Carefully plan to reduce the construction period.
- Minimise vegetation clearing and rehabilitate cleared areas as soon as possible.
- Vegetation clearing should take place in a phased manner.
- Maintain a neat construction site by removing rubble and waste materials regularly.
- Make use of existing gravel access roads, where possible.
- Limit the number of vehicles and trucks travelling to and from the proposed San Kraal development site, where possible.
- Ensure that dust suppression techniques are implemented on all access roads.
- Ensure that dust suppression is implemented in all areas where vegetation clearing has taken place.
- Ensure that dust suppression techniques are implemented on all soil stockpiles.
- Temporarily fence-off the construction sites (for the duration of the construction period).
- All reinstated cable trenches should be re-vegetated with the same vegetation that existed prior to the cable being laid, where possible.
- It is not realistic to attempt to screen wind farms visually. Providing a means whereby they can be absorbed into the landscape is more feasible. This can be approached by making use of certain materials and finishes and by presenting the scheme to I&APs.
- Institute a rigorous planting regime around certain boundaries of the project site, the proposed substation, ancillary buildings, N10 and N9 transportation routes.
- Buildings and similar structures must be in keeping with regional planning policy documents, especially the principles of critical regionalism (namely sense of place, sense of history, sense of nature, sense of craft and sense of limits).

Rating of cumulative visual impacts of the San Kraal WEF in addition to the other renewable energy developments (including associated infrastructure) proposed nearby during operation

Impact Phase:
Potential impact description: Cumulative visual impacts as a result of the operation of the San Kraal WEF in addition to the other renewable energy developments within a 35km radius of the San Kraal WEF. The San Kraal WEF development and its associated infrastructure could exert a visual impact by further altering the visual character of the surrounding area and exposing a greater number of sensitive visual receptor locations to visual impacts. The operation of the San Kraal WEF in addition to the other nearby renewable energy developments may be perceived as an unwelcome visual intrusion, particularly in more natural undisturbed settings. Maintenance vehicles may need to access the San Kraal WEF development and its associated infrastructure via gravel access roads and are expected to increase dust emissions in the surrounding area in doing so. The increased traffic on the gravel roads and the dust plumes could create a greater visual impact within the surrounding area and may evoke more

negative sentiments from surrounding viewers. It should however be noted that the existing roads which can be found around the project site also appear to be gravel. As such, the gravel access roads are not expected to contribute significantly to the overall cumulative visual impact. Security and operational lighting at Sa Kraal WEF development and its associated infrastructure could result in a greater amount of light pollution and glare within the surrounding area, which could be a significant annoyance to surrounding viewers.

	Extent	Duration	Intensity	Status	Significance	Probability	Confidence
Without Mitigation	M	M	M	Negative	M	H	M
With Mitigation	M	M	M	Negative	M	H	M
Can the impact be reversed?			YES – if the WEF and power lines and other infrastructure are decommissioned				
Will impact cause irreplaceable loss or resources?			YES – there will be marginal loss of resources				
Can impact be avoided, managed or mitigated?			YES – mitigation measures can reduce impacts				

Mitigation measures to reduce residual risk or enhance opportunities:

- Where possible, fewer but larger turbines with a greater output should be utilised rather than a larger number of smaller turbines with a lower capacity.
- Medium-high visual impact zones should be viewed as zones where the number of turbines should be limited, where possible.
- Light fittings for security at night should reflect the light toward the ground (except for aviation lighting) and prevent light spill.
- The operations and maintenance buildings should not be illuminated at night, if possible.
- Turbines should be painted plain white, as this is a less industrial colour (Vissering, 2011). Bright colours or obvious logos should not be permitted.
- Turbines should be repaired promptly, as they are considered more visually appealing when the blades are rotating (or at work) (Vissering, 2011).
- The operation and maintenance buildings should be painted with natural tones that fit with the surrounding environment. Non-reflective surfaces should be utilised where possible.
- If required, turbines should be replaced with the same model, or one of equal height and scale. Repeating elements of the same height, scale and form can result in unity and lessen the visual impact that would typically be experienced in a chaotic landscapes made up of diverse colours, textures and patterns (Vissering, 2011).
- As far as possible, limit the number of maintenance vehicles, which are allowed to access the sites.
- Bury cables under the ground where possible.
- Ensure that dust suppression techniques are implemented on all access roads.
- Select the alternatives that will have the least impact on visual receptors.
- It is not realistic to attempt to screen wind farms visually. Providing a means whereby they can be absorbed into the landscape is more feasible. This can be approached by making use of certain materials and finishes and by presenting the scheme to I&APs.
- Institute a rigorous planting regime around certain boundaries of the project site, the proposed substation, ancillary buildings, N10 and N9 transportation routes.
- Buildings and similar structures must be in keeping with regional planning policy documents, especially the principles of critical regionalism (namely sense of place, sense of history, sense of nature, sense of craft and sense of limits).

Based on the literature review, the VIA is deemed to have clearly defined the identified cumulative impacts, and has indicated how the recommendations, mitigation measures and conclusions of the other visual impact specialist reports have been taken into consideration when drafting this VIA report. Additionally, the cumulative impact assessment found that the cumulative impact of the proposed San Kraal WEF would not significantly affect the surrounding area from a visual perspective. The anticipated cumulative impact could also be reduced to a medium significance after the implementation of appropriate mitigation measures. As such, the addition of the San Kraal WEF is not expected to contribute to a greater visual impact than all of the other renewable energy developments combined and therefore the construction of this WEF is not expected to result in an unacceptable overall visual impact.

10.8 Heritage

10.8.1 Assessment of Impacts of San Kraal WEF

Impact Phase: Construction							
Impact Description: Impacts to Palaeontology The main cause of impacts to palaeontological sites is physical disturbance/destruction of fossil material and its context which in the study area, may result in an un-redeemable loss to science and knowledge.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	L	H	M	Negative	**M**	M	H
With Mitigation	L	H	L	Neutral-Pos.	**L**	L	H
Can the impact be reversed?			NO: Palaeontological heritage resources are non-renewable and key contextual data for fossils (sedimentology, taphonomy) is difficult to reconstruct following disturbance				
Will impact cause irreplaceable loss or resources?			Possible but UNLIKELY – well-preserved, scientifically valuable fossils are scarce within the project area. Fragments of incidental fossil bone are a widespread occurrence (Exceptions: well-preserved, articulated vertebrate skeletons, vertebrate trackways).				
Can impact be avoided, managed or mitigated?			YES: Effective mitigation of chance fossil finds by the ECO and a professional palaeontologist is possible.				
Mitigation measures to reduce residual risk or enhance opportunities: • Safeguarding of chance fossil finds (preferably in situ) during the construction phase by the responsible ECO, followed by reporting of finds to Heritage Western Cape / SAHRA. • The monitoring of 10% of excavations into bedrock as per SAHRA guideline. • The avoidance of any buffer zones as recommended by the palaeontologist. • Recording and judicious sampling of significant chance fossil finds by a qualified palaeontologist, together with pertinent contextual data (stratigraphy, sedimentology, taphonomy) within the final footprint. • Curation of fossil material within an approved repository (museum / university fossil collection) by a qualified palaeontologist.							
Residual Impact Residual risk can be monitored through ongoing application of the fossil chance finds procedure by ECO.							

Impact Phase: Construction							
Impact Description: Impacts to Archaeological Heritage The main cause of impacts to archaeological sites is physical disturbance of the material itself and its context. The heritage and scientific potential of an archaeological site is highly dependent on its geological and spatial context. This means that even though, for example, a deep excavation may expose archaeological artefacts, the artefacts are relatively meaningless once removed from the area in which they were found. In the case of the proposed activity the main source of impact (if any) is likely to be the construction of access roads, lay-down areas and excavation of the footings of the turbines.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	L	H	L	Negative – Neutral	**L**	L	H
With Mitigation	L	H	L	Negative – Neutral	**L**	L	H

Can the impact be reversed?	Mitigation is required at one turbine position only (WTG 78) which is close to some scatters of archaeological material. Heritage impacts cannot be reversed, but can be mitigated.
Will impact cause irreplaceable loss or resources?	NO: The very few occurrences noted are well represented in other areas.
Can impact be avoided, managed or mitigated?	YES: This impact be avoided through adjustment of turbine position WTG 78, or if needed by systematic collection of the archaeological material.
Mitigation measures to reduce residual risk or enhance opportunities: • Do not disturb and old stone kraals or ruins, do not remove stone from walls, or artefacts from the earth or earth surface. • Report any chance discoveries of human remains to an archaeologist or a heritage authority. • Moderate mitigation requirements have been identified that involve the avoidance of, or professional collection of archaeological material from archaeological sites. These lie within 30 m of the proposed position of WTG 78.	
Residual Impact Residual risk can be monitored through avoidance or seeking advice from and archaeologist or heritage authority if necessary.	

Impact Phase: Construction							
Impact Description: Impacts to Colonial Period Heritage Historic structures are sensitive to physical damage such as demolition as well as neglect. They are also context sensitive in that changes to the surrounding landscape will affect their significance.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	L	L	L	Negative – Neutral	**L**	L	H
With Mitigation	L	L	L	Negative – Neutral	**L**	L	H
Can the impact be reversed?	In the unlikely event of impacts occurring, they cannot be reversed without compromising authenticity. Even though precautionary mitigation provided, significance of impact does not change.						
Will impact cause irreplaceable loss or resources?	NO: This kind of heritage is well represented in the region.						
Can impact be avoided, managed or mitigated?	YES: Impacts can be managed at level of ECO.						
Mitigation measures to reduce residual risk or enhance opportunities: • Do not disturb and old stone kraals or ruins, do not remove stone from walls, or artefacts from the earth or earth surface. • Do not demolish without authority authorisation, ideally reuse old structures and cottages, care for the fabric but change it as little as possible.							
Residual Impact Residual risk can be monitored through avoidance or seeking advice from an archaeologist or heritage authority if necessary.							

Impact Phase: Construction and Operational
Impact Description: Impacts to cultural landscape and setting Cultural landscapes are highly sensitive to accumulative impacts and large scale development activities that change the character and public memory of a place. In terms of the National Heritage Resources Act, a cultural landscape may also include a natural landscape of high rarity value, aesthetic and scientific significance. The construction of a large facility can result in profound changes to the overall sense of place of a locality, if not the

Roggeveld-Komsberg region.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	L	M	M	Negative	**M**	M	H
With Mitigation	L	M	M	Negative	**M**	M	H
Can the impact be reversed?			Impact can be reversed after the life of the facility.				
Will impact cause irreplaceable loss or resources?			NO: Not if rehabilitation can be achieved after life of the facility.				
Can impact be avoided, managed or mitigated?			NO: Some moderate reduction in impacts may be possible with adherence to findings of the Visual Impact Assessment.				
Mitigation measures to reduce residual risk or enhance opportunities: • Mitigation can be achieved only in part due to size of turbines. • Adhere to findings and recommendations of the Visual Impact Assessment.							
Residual Impact No residual impact.							

10.8.2 Assessment of Impacts of San Kraal Grid Connection Alternatives

The impact of the proposed San Kraal connections is of rather a lesser intensity than those associated with the wind energy facility. The footings for the towers are shallower and the service road is normally a simple track. It is possible that archaeological sites could be disturbed but the rather shallower excavations mean the palaeontological impacts will be less. The lines will cause an aesthetic impact for up to a 5 km radius (depending on topography and weather) which means that there is potential for accumulative impacts close to regional substations where grid connections converge. The presence of a certain amount of infrastructure in the area such as the N9 and the electrical and linear infrastructure of the railway system are 20th century clutter which means that the presence of additional powerlines lines are unlikely to be out of place in the local environment.

10.8.3 Cumulative Impacts on Heritage

Impact Phase: Construction and Operational							
Impact Description: Risk of accumulative damage to the National Estate The accumulative impacts to palaeontological resources is difficult to measure as the overall population of fossils is not known. In reality the resource is huge as the fossiliferous Beaufort group continues deep underground (1km or more). Palaeontologists only have access to surface manifestations. Very few of the palaeontological surveys that have been done in the area are more an assessment of rock type and the likelihood of there being fossils rather than an exercise in locating fossils at the points of impact within a given development activity. Virtually every report has recommended some form of monitoring and mitigation, but very seldom have such measures been implemented to date (judging by online and published literature). It is only once palaeontologists have seen deep into site excavations can the frequency and extent of fossils be commented on in any meaningful way. Indications are that the accumulative impacts are likely to be quite low given the massive size of the resource.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	M	M	L	Negative	**L**	L	M
With Mitigation	M	M	L	Negative	**L**	L	M
Can the impact be reversed?			Aesthetic and cultural landscape impacts can be reversed after the life of the facilities. Damage to physical heritage cannot be reversed, however few archaeological sites have been destroyed in				

	development projects within the 35 km radius (in terms of SAHRIS records).
Will impact cause irreplaceable loss or resources?	NO: Not if rehabilitation can be achieved after life of the facilities. Loss of palaeontological resources is unclear, loss of archaeological resources appear to be relatively few.
Can impact be avoided, managed or mitigated?	Impacts can be managed provided that mitigation is carried through. Records on the SAHRIS database contain very few applications to remove or destroy archaeological or palaeontological material from projects in the area which indicate mitigation through avoidance of impacts has been successful.

Mitigation measures to reduce residual risk or enhance opportunities:

- Methods must be developed by heritage authorities to assess the success of mitigation action within renewable energy projects.
- Given the lack of information at present it is difficult to judge success of mitigation, and therefore the degree of accumulative impact that has taken place.

Residual Impact

San Kraal WEF will generally have a low accumulative on physical heritage and not result in a significant impact to the National Estate.

10.9 Social

10.9.1 Assessment of Impacts of San Kraal WEF

Impact Phase: Construction

Impact Description: Creation of local employment, training and business opportunities

Based on the information from other WEF projects the construction phase for the proposed WEF is expected to extend over a period of approximately 2 years and create approximately 350 (full-time equivalent) employment opportunities during peak construction. The work associated with the construction phase will be undertaken by contractors and will include the establishment of the WEF and the associated components, including, access roads, substation, services and power line.

	Extent	Duration	Intensity	Status	Significance	Probability	Confidence
Without Mitigation	M	L	M	Positive	**M**	M	H
With Mitigation	H	L	H	Positive	**H**	H	H

Can the impact be reversed?	YES: By not implementing the project.
Will impact cause irreplaceable loss or resources?	NO
Can impact be avoided, managed or mitigated?	YES: See measures below.

Mitigation measures to enhance local employment and business opportunities associated with the construction phase the following measures should be implemented:

Employment

- Where reasonable and practical the proponent should appoint local contractors and implement a 'locals first' policy, especially for semi and low-skilled job categories. Due to the low skills levels in the area, the majority of skilled posts are likely to be filled by people from outside the area;
- Where feasible, efforts should be made to employ local contactors that are compliant with Broad Based Black Economic Empowerment (BBBEE) criteria;
- Before the construction phase commences the proponent should meet with representatives from the ULM and IYLM to establish the existence of a skills database for the area. If such as database exists it should be made available to the contractors appointed for the construction phase;
- The local authorities, relevant community representatives and local farmers should be informed of the final decision regarding the project and the potential job opportunities for locals and the employment procedures that the proponent intends following for the construction phase of the project;

• Where feasible a training and skills development programmes for local workers should be initiated prior to the initiation of the construction phase; • The recruitment selection process should seek to promote gender equality and the employment of women wherever possible. **Business** • The proponent should liaise with the ULM and IYLM with regards the establishment of a database of local companies, specifically BBBEE companies, which qualify as potential service providers (e.g. construction companies, catering companies, waste collection companies, security companies etc.) prior to the commencement of the tender process for construction contractors. These companies should be notified of the tender process and invited to bid for project-related work; • Where possible, the proponent should assist local BBBEE companies to complete and submit the required tender forms and associated information. • The ULM and IYLM, in conjunction with the local business sector and representatives from the local hospitality industry, should identify strategies aimed at maximising the potential benefits associated with the project. • Note that while preference to local employees and companies is recommended, it is recognised that a competitive tender process may not guarantee the employment of local labour for the construction phase.
Residual Impact No residual impact.

Impact Phase: Construction							
Impact Description: Impact of construction workers on local communities Potential impacts on family structures and social networks associated with the presence of construction workers.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	M	L	M	Negative	**M**	M	H
With Mitigation	M	L	L	Negative	**L**	M	H
Can the impact be reversed?			YES: By not implementing the project.				
Will impact cause irreplaceable loss or resources?			Unlikely at a community level.				
Can impact be avoided, managed or mitigated?			YES: See measures below.				
Mitigation measures to reduce residual risk or enhance opportunities: • Where possible the proponent should make it a requirement for contractors to implement a 'locals first' policy for construction jobs, specifically for semi and low-skilled job categories; • The proponent should consider the need for establishing a Monitoring Forum (MF) in order to monitor the construction phase and the implementation of the recommended mitigation measures. The MF should be established before the construction phase commences, and should include key stakeholders, including representatives from the ULM and IYLM, farmers and the contractor(s). The MF should also be briefed on the potential risks to the local community and farm workers associated with construction workers; • The proponent and the contractor(s) should, in consultation with representatives from the MF, develop a code of conduct for the construction phase. The code should identify which types of behaviour and activities are not acceptable. Construction workers in breach of the code should be dismissed. All dismissals must comply with the South African labour legislation; • The proponent and contractor (s) should implement an HIV/AIDS awareness programme for all construction workers at the outset of the construction phase; • The contractor should provide transport to and from the site on a daily basis for low and semi-skilled construction workers. This will enable the contractor to effectively manage and monitor the movement							

of construction workers on and off the site; • Where necessary, the contractors should make the necessary arrangements to enable low and semi-skilled workers from outside the area to return home over weekends and/ or on a regular basis. This would reduce the risk posed to local family structures and social networks; • It is recommended that no construction workers, with the exception of security personnel, should be permitted to stay over-night on the site.
Residual Impact No residual impact.

Impact Phase: Construction							
Impact Description: Influx of job seekers Potential impacts on family structures, social networks and community services associated with the influx of job seekers.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	M	L	L	Negative	**L**	M	M
With Mitigation	M	L	L	Negative	**L**	M	M
Can the impact be reversed?			YES: By not implementing the project.				
Will impact cause irreplaceable loss or resources?			Unlikely at a community level.				
Can impact be avoided, managed or mitigated?			YES: See measures below.				
Mitigation measures to reduce residual risk or enhance opportunities: • The proponent should implement a "locals first" policy, specifically with regard to unskilled and low skilled opportunities; • The proponent should implement a policy that no employment will be available at the gate and or in the local towns in the area (except for local residents).							
Residual Impact No residual impact.							

Impact Phase: Construction							
Impact Description: Risk to safety, livestock, farm infrastructure and farming operations Potential risk to safety of farmers and farm workers, livestock and damage to farm infrastructure associated with the movement of construction workers on and to the site.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	M	L	M	Negative	**M**	M	H
With Mitigation	M	L	L	Negative	**L**	M	H
Can the impact be reversed?			YES: By repairing damage and compensating for stock losses etc.				
Will impact cause irreplaceable loss or resources?			NO				
Can impact be avoided, managed or mitigated?			YES: See measures below.				
Mitigation measures to reduce residual risk or enhance opportunities: • The proponent should enter into an agreement with the local farmers in the area whereby damages to farm property etc. during the construction phase proven to be associated with the construction activities							

for the WEF will be compensated for. The agreement should be signed before the construction phase commences; • Contractors appointed by the proponent should provide daily transport for workers to and from the site. This would reduce the potential risk of trespassing on the remainder of the farm and adjacent properties; • The proponent should consider the option of establishing a MF (see above) that includes local farmers and develop a Code of Conduct for construction workers. This committee should be established prior to commencement of the construction phase. The Code of Conduct should be signed by the proponent and the contractors before the contractors move onto site; • The proponent should hold contractors liable for compensating farmers in full for any stock losses and/or damage to farm infrastructure that can be linked to construction workers. This should be contained in the Code of Conduct to be signed between the proponent, the contractors and neighbouring landowners. The agreement should also cover loses and costs associated with fires caused by construction workers or construction related activities (see below); • The Environmental Management Programme (EMP) should outline procedures for managing and storing waste on site, specifically plastic waste that poses a threat to livestock if ingested; • Contractors appointed by the proponent must ensure that all workers are informed at the outset of the construction phase of the conditions contained on the Code of Conduct, specifically consequences of stock theft and trespassing on adjacent farms. • Contractors appointed by the proponent must ensure that construction workers who are found guilty of trespassing, stealing livestock and/or damaging farm infrastructure are dismissed and charged. This should be contained in the Code of Conduct. All dismissals must be in accordance with South African labour legislation; • The housing of construction workers on the site should be limited to security personnel.
Residual Impact No residual impact.

Impact Phase: Construction							
Impact Description: Increased fire risk Potential loss of livestock, crops and houses, damage to farm infrastructure and threat to human life associated with increased incidence of grass fires.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	M	L	M	Negative	**M**	M	H
With Mitigation	M	L	L	Negative	**L**	M	H
Can the impact be reversed?			YES: By repairing damage and compensating for damages and losses.				
Will impact cause irreplaceable loss or resources?			NO				
Can impact be avoided, managed or mitigated?			YES: See measures below.				
Mitigation measures to reduce residual risk or enhance opportunities: • The proponent should enter into an agreement with the local farmers in the area whereby losses associated with fires that can be proven to be associated with the construction activities for the WEF will be compensated for. The agreement should be signed before the construction phase commences; • Contractor should ensure that open fires on the site for cooking or heating are not allowed except in designated areas; • No smoking should be permitted on site, except in designated areas; • Contractor should ensure that construction related activities that pose a potential fire risk, such as welding, are properly managed and are confined to areas where the risk of fires has been reduced. Measures to reduce the risk of fires include avoiding working in high wind conditions when the risk of fires is greater. In this regard special care should be taken during the high risk dry, windy summer months; • Contractor to provide adequate fire-fighting equipment on-site; • Contractor to provide fire-fighting training to selected construction staff; • No construction staff, with the exception of security staff, to be accommodated on site over night; • As per the conditions of the Code of Conduct, in the event of a fire proven to be caused by construction							

workers and or construction activities, the appointed contractors must compensate farmers for any damage caused to their farms. The contractor should also compensate the fire-fighting costs borne by farmers and local authorities.
Residual Impact No residual impact.

Impact Phase: Construction							
Impact Description: Impacts associated with construction vehicles Potential dust and safety impacts and damage to road surfaces associated with movement of construction related traffic to and from the site.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	M	L	M	Negative	**M**	M	H
With Mitigation	M	L	L	Negative	**L**	M	H
Can the impact be reversed?			YES: By rehabilitating disturbed areas.				
Will impact cause irreplaceable loss or resources?			NO				
Can impact be avoided, managed or mitigated?			YES: See measures below.				
Mitigation measures to reduce residual risk or enhance opportunities: • As far as possible, the transport of components to the site along the N10 and N9 should be planned to avoid weekends and holiday periods; • The contractor should inform local farmers and representatives from the ULM and IYLM Tourism of dates and times when abnormal loads will be undertaken; • The contractor must ensure that damage caused by construction related traffic to internal farm roads is repaired on a regular basis throughout the construction phase. The costs associated with the repair must be borne by the contractor; • Dust suppression measures must be implemented for heavy vehicles such as wetting of gravel roads on a regular basis, adhering to speed limits and ensuring that vehicles used to transport sand and building materials are fitted with tarpaulins or covers; • 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; • The Contractor should ensure that workers are informed that no waste can be thrown out of the windows while being transported to and from the site. Workers who throw waste out windows should be fined; • The Contractor should be required to collect waste along the road reserve on a weekly basis; • Waste generated during the construction phase should be transported to the local landfill site. • EMP measures (and penalties) should be implemented to ensure farm gates are closed at all times; • EMP measures (and penalties) should be implemented to ensure speed limits are adhered to at all times.							
Residual Impact No residual impact.							

Impact Phase: Construction							
Impact Description: Impact associated with loss of farmland The activities associated with the construction phase, such as establishment of access roads and the construction camp, movement of heavy vehicles and preparation of foundations for the WEFs and power lines will damage farmlands and result in a loss of farmlands for grazing.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	M	L	L	Negative	**L**	M	H
With Mitigation	M	L	L	Negative	**L**	M	H

Can the impact be reversed?	YES: By rehabilitating disturbed areas.
Will impact cause irreplaceable loss or resources?	NO
Can impact be avoided, managed or mitigated?	YES: See measures below.

Mitigation measures to reduce residual risk or enhance opportunities:

- The location of wind turbines, access roads, laydown areas etc. should be informed by the findings of the soil and vegetation study. In this regard areas of high potential agricultural and sensitive vegetation soils should be avoided;
- The developer should consult with affected property owners in order to enable them to factor construction activities into their farming schedules;
- The location of wind turbines, access roads, laydown areas etc. should be discussed with the locally affected landowner in the finalisation process and inputs provided should be implemented in the layout as best as possible;
- The footprint areas for the establishment of individual wind turbines should be clearly demarcated prior to commencement of construction activities. All construction related activities should be confined to the demarcated area and minimised where possible;
- An Environmental Control Officer (ECO) should be appointed to monitor the establishment phase of the construction phase;
- All areas disturbed by construction related activities, such as access roads on the site, construction platforms, workshop area etc., should be rehabilitated at the end of the construction phase. The rehabilitation plan should be informed by input from the soil scientist and discussed with the local farmer;
- The implementation of a rehabilitation programme should be included in the terms of reference for the contractor/s appointed. The specifications for the rehabilitation programme should be drawn up the Environmental Consultants appointed to undertake the EIA;
- The implementation of the Rehabilitation Programme should be monitored by the ECO;
- All workers should receive training/ briefing on the reasons for and importance of not driving in undesignated areas;
- EMP measures (and penalties) should be implemented to strictly limit all vehicle traffic to designated roads and construction areas. Under no circumstances should vehicles be allowed to drive into the veld;
- Disturbance footprints should be reduced to the minimum.
- Compensation should be paid by the developer to farmers that suffer a permanent loss of land due to the establishment of the WEF. Compensation should be based on accepted land values for the area.

Residual Impact

No residual impact.

Impact Phase: Operational

Impact Description: Development of renewable energy infrastructure

Development of infrastructure to generate clean, renewable energy.

	Extent	Duration	Intensity	Status	Significance	Probability	Confidence
Without Mitigation	M	H	M	Positive	**M**	M	H
With Mitigation	M	H	H	Positive	**H**	H	H

Can the impact be reversed?	YES: By removing infrastructure.
Will impact cause irreplaceable loss or resources?	NO
Can impact be avoided, managed or mitigated?	YES: See measures below.

Mitigation measures to reduce residual risk or enhance opportunities:

- Implement a skills development and training programme aimed at maximizing the number of employment opportunities for local community members;
- Maximise opportunities for local content, procurement and community shareholding;

• Establish a visitor centre.
Residual Impact No residual impact.

Impact Phase: Operational							
Impact Description: Creation of employment and business opportunities and support for local economic development Creation of employment and business opportunities associated with the operational phase.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	M	M	L	Positive	**L**	M	H
With Mitigation	M	M	M	Positive	**M**	H	H
Can the impact be reversed?		YES: By removing project.					
Will impact cause irreplaceable loss or resources?		NO					
Can impact be avoided, managed or mitigated?		YES: See measures below.					
Mitigation measures to reduce residual risk or enhance opportunities: • Implement a skills development and training programme aimed at maximizing the number of employment opportunities for local community members; • Maximise opportunities for local content, procurement and community shareholding; • Establish a visitor centre. • The proponent should implement a training and skills development programme for locals during the first 5 years of the operational phase. The aim of the programme should be to maximise the number of South African's and locals employed during the operational phase of the project; • The proponent, in consultation with the ULM and IYLM, should investigate the options for the establishment of a Community Development Trust.							
Residual Impact No residual impact.							

Impact Phase: Operational							
Impact Description: Benefits associated with the establishment of a Community Trust Establishment of a community trust funded by revenue generated from the sale of energy. The revenue can be used to fund local community development.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	M	H	M	Positive	**M**	M	H
With Mitigation	M	H	H	Positive	**H**	H	H
Can the impact be reversed?		YES: By not implementing the project.					
Will impact cause irreplaceable loss or resources?		NO					
Can impact be avoided, managed or mitigated?		YES: See measures below.					
Mitigation measures to reduce residual risk or enhance opportunities: • The ULM and IYLM should be consulted as to the structure and identification of potential trustees to sit on the Trust. The key departments in the ULM and IYLM that should be consulted include the Municipal Managers Office, IDP Manager and LED Manager; • Clear criteria for identifying and funding community projects and initiatives in the area should be identified. The criteria should be aimed at maximising the benefits for the community as a whole and							

not individuals within the community; • Strict financial management controls, including annual audits, should be instituted to manage the funds generated for the Community Trust from the WEF.
Residual Impact No residual impact.

Impact Phase: Operational							
Impact Description: Generate income for affected landowners The generation of additional income represents a significant benefit for the local affected farmer(s) and reduces the risks to their livelihoods posed by droughts and fluctuating market prices for sheep and farming inputs, such as feed etc.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	M	M	L	Positive	**L**	M	H
With Mitigation	M	M	M	Positive	**M**	H	H
Can the impact be reversed?			YES: By not implementing agreements.				
Will impact cause irreplaceable loss or resources?			NO				
Can impact be avoided, managed or mitigated?			YES: See measures below.				
Mitigation measures to reduce residual risk or enhance opportunities: • Implement agreements with affected landowners.							
Residual Impact No residual impact.							

Impact Phase: Operational							
Impact Description: Impact on sense of place and rural character of the landscape based on findings of VIA Visual impact associated with the proposed WEF and the potential impact on the areas rural sense of place.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	M	M	M	Negative	**M**	M	M
With Mitigation	M	M	M-L	Negative	**M-L**	M	M
Can the impact be reversed?			YES: By removing turbines.				
Will impact cause irreplaceable loss or resources?			NO				
Can impact be avoided, managed or mitigated?			YES: See measures below.				
Mitigation measures to reduce residual risk or enhance opportunities: • The recommendations contained in the VIA should be implemented, specifically the measures aimed at addressing the impact of aviation lights at night.							
Residual Impact No residual impact.							

Impact Phase: Operational
Impact Description: Potential impact on property values Potential impact on property values linked to the visual impact associated with the proposed WEF and the

potential impact on the areas rural sense of place.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	M	M	M	Negative	**M**	M	M
With Mitigation	M	M	L	Negative	**L**	M	M
Can the impact be reversed?		YES: By removing turbines.					
Will impact cause irreplaceable loss or resources?		NO					
Can impact be avoided, managed or mitigated?		YES: See measures below.					
Mitigation measures to reduce residual risk or enhance opportunities: • The recommendations contained in the VIA should be implemented.							
Residual Impact No residual impact.							

Impact Phase: Operational							
Impact Description: Potential impact on tourism Potential impact of the WEF on local tourism.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	M	M	L	Negative	**L**	M	H
With Mitigation	M	M	L	Negative	**L**	M	H
Can the impact be reversed?		YES: By removing turbines.					
Will impact cause irreplaceable loss or resources?		NO					
Can impact be avoided, managed or mitigated?		YES: See measures below.					
Mitigation measures to reduce residual risk or enhance opportunities: • The recommendations contained in the VIA should be implemented; • The proponent should consider the establishment of a visitor center should the proposed WEF be approved.							
Residual Impact No residual impact.							

Impact Phase: Decommissioning							
Impact Description: Loss of jobs and associated income Social impacts associated with the decommissioning phase are linked to the loss of jobs and associated income.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	M	M	M	Negative	**M**	M	H
With Mitigation	M	L	L	Negative	**L**	M	H
Can the impact be reversed?		YES: By removing turbines.					

Will impact cause irreplaceable loss or resources?	NO
Can impact be avoided, managed or mitigated?	YES: See measures below.
Mitigation measures to reduce residual risk or enhance opportunities: • The proponent should ensure that retrenchment packages are provided for all staff retrenched when the WEF is decommissioned. • All structures and infrastructure associated with the proposed facility should be dismantled and transported off-site on decommissioning; • The proponent should investigate the option of establishing an Environmental Rehabilitation Trust Fund to cover the costs of decommissioning and rehabilitation of disturbed areas. The Trust Fund should be funded by a percentage of the revenue generated from the sale of energy to the national grid over the 20 year operational life of the facility. The rationale for the establishment of a Rehabilitation Trust Fund is linked to the experiences with the mining sector in South Africa and failure of many mining companies to allocate sufficient funds during the operational phase to cover the costs of rehabilitation and closure. Alternatively, the funds from the sale of the WEF as scrap metal should be allocated to the rehabilitation of the site.	
Residual Impact No residual impact.	

10.9.2 Assessment of Impacts of San Kraal Grid Connection Alternatives

Impact Phase: Operational							
Impact Description: Impact on sense of place The potential social impacts associated with the power line options are largely linked to visual impacts and the potential impact on the areas sense of place.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	L	M	L	Negative	**L**	M	H
With Mitigation	L	M	L	Positive	**L**	M	H
Can the impact be reversed?	YES: By removing the transmission lines.						
Will impact cause irreplaceable loss or resources?	NO						
Can impact be avoided, managed or mitigated?	YES: See measures below.						
Mitigation measures to reduce residual risk or enhance opportunities: • The recommendations of the VIA should be implemented.							
Residual Impact No residual impact.							

10.9.3 Cumulative Impacts on Social

Impact Phase: Cumulative							
Impact Description: Impact on sense of place Cumulative visual impact associated with the establishment of a WEF on the on the areas rural sense of place and character of the landscape.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	M	H	M	Negative	**M**	M	M
With Mitigation	M	M	M	Negative	**M**	M	M

Can the impact be reversed?	YES: By removing turbines.
Will impact cause irreplaceable loss or resources?	NO
Can impact be avoided, managed or mitigated?	YES: See measures below.
Mitigation measures to reduce residual risk or enhance opportunities: • The final placement of wind turbines associated with the proposed WEF should be discussed with the affected landowners; • The recommendations of the VIA should be implemented.	
Residual Impact No residual impact.	

Impact Phase: Cumulative							
Impact Description: Impact on local services and accommodation The establishment of a number of renewable energy facilities has the potential to place pressure on local services, specifically medical, education and accommodation.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	M	L	L	Negative	**L**	M	M
With Mitigation	M	L	L	Negative	**L**	M	M
Can the impact be reversed?	YES: By implementing effective mitigation.						
Will impact cause irreplaceable loss or resources?	NO						
Can impact be avoided, managed or mitigated?	YES: See measures below.						
Mitigation measures to reduce residual risk or enhance opportunities: • The Northern and Eastern Cape Provincial Government, in consultation with the ULM and IYLM and the proponents involved in the development renewable energy projects in the ULM and IYLM area should consider establishing a Development Forum to co-ordinate and manage the development and operation of renewable energy projects in the area, with the specific aim of mitigating potential negative impacts and enhancing opportunities. This would include identifying key needs, including capacity of existing services, accommodation and housing and the implementation of an accredited training and skills development programmes aimed at maximising the opportunities for local workers to be employed during the construction and operational phases of the various proposed projects. These issues should be addressed in the Integrated Development Planning process undertaken by the ULM and IYLM.							
Residual Impact No residual impact.							

Impact Phase: Cumulative							
Impact Description: Impact on local economy The establishment of a number of renewable energy facilities in the region will create employment, skills development and training opportunities, creation of downstream business opportunities.							
	Extent	**Duration**	**Intensity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	M	H	M	Positive	**M**	M	H
With Mitigation	H	H	M	Positive	**H**	M	H

Can the impact be reversed?	YES: By not implementing the project.
Will impact cause irreplaceable loss or resources?	NO
Can impact be avoided, managed or mitigated?	YES: See measures below.
Mitigation measures to reduce residual risk or enhance opportunities: • The proposed establishment of suitably sited renewable energy facilities within the ULM and IYLM should be supported.	
Residual Impact No residual impact.	

Previous palaeontological assessments (PIAs) for several proposed or authorized alternative energy projects within a 35 km radius of the San Kraal WEF project area have been briefly reviewed (Note that heritage assessments for some projects have been accepted without a PIA; *e.g.* Dida Solar Energy Facility on the farm Rietfontein north of Noupoort). These include field-based assessments for the Noupoort WEF (Almond 2012), the Umsobomvu WEF (Almond 2015), the Phezukomoya WEF (Almond 2017) as well as several solar projects near Noupoort and Middelburg (Gess 2012a, 2012b, Butler 2016).

In the author's opinion:

- Palaeontological impact significances inferred for these projects that range from low (Noupoort and Umsobomvu WEFs) to medium (San Kraal and Phezukomoya, Naauwpoort 1 solar project) to unassessed reflect different assessment approaches rather than contrasting palaeontological sensitivities and impact levels;
- Meaningful cumulative impact assessments require comprehensive data on *all* major developments within a region, not just those involving alternative energy, as well as an understanding of the extent to which recommended mitigation measures are followed through;
- Trying to assess cumulative impacts on fossil assemblages from different stratigraphic units (in this case, Late Permian fossils from the Adelaide Subgroup and Early Triassic assemblages from the Tarkastad Subgroup) has limited value.

Given the comparatively small combined footprint of the alternative energy projects under consideration compared with the very extensive outcrop areas of the Balfour and Katberg Formations, the cumulative impact significance of the San Kraal WEF is assessed as LOW.

11 SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATIONS

This EIR has provided a description of the proposed San Kraal WEF and associated grid connection, and its preferred layouts. It has also discussed the need and desirability of the proposed project. The environmental legislation and planning contexts for the proposed WEF has been documented, including the proposed site's baseline environment. Specialist investigations and detailed assessments have been conducted for the following areas of study:

- Terrestrial Ecology (Flora and Fauna);
- Bats;
- Avifauna;
- Aquatic Ecosystems;
- Cultural Heritage, Archaeology and Palaeontology;
- Traffic and Transport;
- Noise;
- Social ; and
- Visual.

The above studies assessment the potential impacts of the proposed development. A summary of the potential impacts is included in the table below.

CONSTRUCTION PHASE IMPACT ASSESSMENT

Construction Phase	Extent	Duration	Intensity	Status	Significance	Probability	Confidence
Geology, Soils and Agricultural Potential Impact							
Loss of Agricultural land	Low	Low	Low	Negative	**Low**	Low	High
With Mitigation	Low	Low	Low	Neutral	**Low**	Low	High
Increased soil erosion hazard	Low	Medium	Medium	Negative	**Medium**	Medium	High
With Mitigation	Low	Low	Low	Neutral	**Low**	Low	High
Freshwater and Wetlands							
Loss of riparian systems and water courses during the construction phase of the WEF	Low	Medium	Low	Negative	**Medium**	High	High
With Mitigation	Low	Low	Low	Negative	**Low**	Low	High
Increase in sedimentation and erosion within the development footprint during the construction phase and to a lesser degree the operational phase	Low	Medium	Low	Negative	**Medium**	High	High
With Mitigation	Low	Low	Low	Negative	**Low**	Low	High
Impact on localized surface water quality	Low	Low	Low	Negative	**Medium**	High	High
With Mitigation	Low	Low	Low	Negative	**Low**	Low	High
Flora and Terrestrial Fauna							

Impacts on vegetation and listed or protected plant species resulting from construction activities	Low	High	High	Negative	**High**	High	High
With Mitigation	Low	Medium	Low	Negative	**Medium**	High	High
Faunal impacts due to construction-phase noise and physical disturbance	Low	Medium	High	Negative	**Medium**	High	High
With Mitigation	Low	Medium	Low	Negative	**Medium**	High	Medium
Avifauna							
Displacement of priority species due to construction activities at the wind development area	Low	Low	Medium	Negative	**Medium**	High	Medium
With Mitigation	Low	Low	Low	Negative	**Medium**	Medium	Medium
Bats							
Destruction of bat roosts due to earthworks and blasting	Medium	Low	High	Negative	**Medium**	Medium	High
With Mitigation	Low	Low	Medium	Negative	**Low**	Low	High
Loss of foraging habitat	Low	High	Low	Negative	**Medium**	Medium	High
With Mitigation	Low	Medium	Low	Negative	**Low**	Low	High
Noise							
Daytime construction of the Access Roads	Low	Low	Low	Negative	**Low**	Low	High
With Mitigation	Low	Low	Low	Negative	**Low**	Low	High
Night-time construction of the Access Roads	Low	Low	Low	Negative	**Low**	Low	High
With Mitigation	Low	Low	Low	Negative	**Low**	Low	High
Noise from daytime construction traffic	Low	Low	Low	Negative	**Low**	Low	High
With Mitigation	Low	Low	Low	Negative	**Low**	Low	High
Noise from night-time construction traffic	Low	Low	Low	Negative	**Low**	Low	High
With Mitigation	Low	Low	Low	Negative	**Low**	Low	High
Daytime construction of Wind Turbines	Low	Low	Low	Negative	**Low**	Low	High
With Mitigation	Low	Low	Low	Negative	**Low**	Low	High
Night-time construction of Wind Turbines	Low	Low	Low	Negative	**Low**	Low	High
With Mitigation	Low	Low	Low	Negative	**Low**	Low	High

Visual							
Impact on access roads	Medium	Low	Medium	Negative	**Medium**	Medium	Medium
With Mitigation	Medium	Low	Medium	Negative	**Medium**	Medium	Medium
Impact on cabling	Medium	Low	Medium	Negative	**Medium**	Medium	Medium
With Mitigation	Medium	Low	Medium	Negative	**Medium**	Medium	Medium
Heritage							
Impacts to Archaeological Heritage	Low	High	Low	Negative – Neutral	**Low**	Low	High
With Mitigation	Low	High	Low	Negative – Neutral	**Low**	Low	High
Impacts to Colonial Period Heritage	Low	Low	Low	Negative – Neutral	**Low**	Low	High
With Mitigation	Low	Low	Low	Negative – Neutral	**Low**	Low	High
Impacts to cultural landscape and setting	Low	Medium	Medium	Negative	**Medium**	Medium	High
With Mitigation	Low	Medium	Medium	Negative	**Medium**	Medium	High
Palaeontological Heritage Impact							
Impacts to Palaeontology	Low	High	Medium	Negative	**Medium**	Medium	High
With Mitigation	Low	High	Low	Neutral – Pos	**Low**	Low	High
Social Impacts							
Creation of local employment, training and business opportunities	Medium	Low	Medium	Positive	**Medium**	Medium	High
With Mitigation	High	Low	High	Positive	**High**	High	High
Impact of construction workers on local communities	Medium	Low	Medium	Negative	**Medium**	Medium	High
With Mitigation	Medium	Low	Low	Negative	**Low**	Medium	High
Influx of job seekers	Medium	Low	Low	Negative	**Low**	Medium	Medium
With Mitigation	Medium	Low	Low	Negative	**Low**	Medium	Medium
Risk to safety, livestock, farm infrastructure and farming operations	Medium	Low	Medium	Negative	**Medium**	Medium	High
With Mitigation	Medium	Low	Low	Negative	**Low**	Medium	High
Increased fire risk	Medium	Low	Medium	Negative	**Medium**	Medium	High
With Mitigation	Medium	Low	Low	Negative	**Low**	Medium	High
Impacts associated with construction vehicles	Medium	Low	Medium	Negative	**Medium**	Medium	High
With Mitigation	Medium	Low	Low	Negative	**Low**	Medium	High

Impact associated with loss of farmland	Medium	Low	Low	Negative	**Medium**	Medium	High
With Mitigation	Medium	Low	Low	Negative	**Medium**	Medium	High

SUMMARY OF OPERATIONAL PHASE IMPACT ASSESSMENT

Operational Phase	Extent	Duration	Intensity	Status	Significance	Probability	Confidence
Geology, Soils and Agricultural Potential Impact							
Loss of Agricultural land	Low	Low	Low	Negative	**Medium**	High	High
With Mitigation	Low	Low	Low	Neutral	**Medium**	High	High
Increased soil erosion hazard	Low	Medium	Medium	Negative	**Medium**	High	High
With Mitigation	Low	Low	Low	Neutral	**Medium**	High	High
Freshwater and Wetlands							
Impact on riparian systems through the possible increase in surface water runoff from hard surfaces and or new road crossings on riparian form and function	Low	Low	Low	Negative	**Medium**	High	High
With Mitigation	Low	Low	Low	Negative	**Low**	Low	High
Increase in sedimentation and erosion within the development footprint during the construction phase and to a lesser degree the operational phase	Low	Medium	Low	Negative	**Medium**	High	High
With Mitigation	Low	Low	Low	Negative	**Low**	Low	High
Flora and Terrestrial Fauna							
Faunal impacts due to operational activities	Low	Medium	Medium	Negative	**Medium**	High	High
With Mitigation	Low	Medium	Low	Negative	**Low**	Low	Medium
Soil Erosion Risk	Low	High	High	Negative	**High**	High	High
With Mitigation	Low	Low	Low	Negative	**Low**	Low	High
Alien Plant Invasion	Low	High	Medium	Negative	**Medium**	High	High
With Mitigation	Low	Low	Low	Negative	**Low**	Low	High
Impact on Critical Biodiversity Areas and Broad-Scale Ecological Processes	Medium	High	Medium	Negative	**High**	High	High
With Mitigation	Low	High	Medium	Negative	**Medium**	High	High
Avifauna							
Direct mortality of priority species due to electrocution associated with the internal medium	Low	Medium	Medium	Negative	**Medium**	High	High

voltage MV powerline at the wind development area							
With Mitigation	Low	Medium	Medium	Negative	**Low**	Low	High
Displacement of priority species due to habitat destruction at the wind development site	Low	High	Low	Negative	**Medium**	Medium	Medium
With Mitigation	Low	High	Low	Negative	**Low**	Low	Medium
Direct mortality of priority species due to collisions with the turbines at the wind development area	Low	Medium	Medium	Negative	**Medium**	High	Medium
With Mitigation	Low	Medium	Low	Negative	**Low**	Low	Low
Bats							
Bat mortalities due to direct blade impact or barotrauma during foraging activities (not migration)	Low	High	High	Negative	**High**	High	High
With Mitigation	Low	High	Low	Negative	**Medium**	Medium	High
Artificial Lighting	Low	High	Medium	Negative	**Medium**	High	High
With Mitigation	Low	High	Low	Negative	**Low**	Low	High
Noise							
Daytime operation of Wind Turbines	Low	Medium	Low	Negative	**Low**	Low	High
With Mitigation	Low	Medium	Low	Negative	**Low**	Low	High
Night-time operation of Wind Turbines	Medium	Medium	Low	Negative	**Low**	Low	High
With Mitigation	Medium	Medium	Low	Negative	**Low**	Low	High
Visual							
Impact on access roads	Medium	Medium	High	Negative	**Medium**	High	Medium
With Mitigation	Medium	Medium	Medium	Negative	**Medium**	High	Medium
Impact on cabling	Medium	Medium	Medium	Negative	**Medium**	High	Medium
With Mitigation	Medium	Medium	Medium	Negative	**Medium**	High	Medium
Heritage							
Impacts to cultural landscape and setting	Low	Medium	Medium	Negative	**Medium**	Medium	High
With Mitigation	Low	Medium	Medium	Negative	**Medium**	Medium	High
Social Impacts							
Development of renewable energy infrastructure	Medium	High	Medium	Positive	**Medium**	Medium	High
With Mitigation	Medium	High	High	Positive	**High**	High	High
Creation of employment	Medium	Medium	Low	Positive	**Low**	Medium	High

and business opportunities and support for local economic development							
With Mitigation	Medium	Medium	Medium	Positive	**Medium**	High	High
Benefits associated with the establishment of a Community Trust	Medium	High	Medium	Positive	**Medium**	Medium	High
With Mitigation	Medium	High	High	Positive	**High**	High	High
Generate income for affected landowners	Medium	Medium	Low	Positive	**Low**	Medium	High
With Mitigation	Medium	Medium	Medium	Positive	**Medium**	High	High
Impact on sense of place and rural character of the landscape based on findings of VIA	Medium	Medium	Medium	Negative	**Medium**	Medium	Medium
With Mitigation	Medium	Medium	Medium – Low	Negative	**Medium – Low**	Medium	Medium
Potential impact on property values	Medium	Medium	Medium	Negative	**Medium**	Medium	Medium
With Mitigation	Medium	Medium	Low	Negative	**Low**	Medium	Medium
Potential impact on tourism	Medium	Medium	Low	Negative	**Low**	Medium	High
With Mitigation	Medium	Medium	Low	Negative	**Low**	Medium	High

SUMMARY OF DECOMMISSIONING PHASE IMPACT ASSESSMENT

Decommissioning Phase	Extent	Duration	Intensity	Status	Significance	Probability	Confidence
Freshwater and Wetlands							
Impact on riparian systems through the possible increase in surface water runoff from hard surfaces and or new road crossings on riparian form and function	Low	Low	Low	Negative	**Medium**	High	High
With Mitigation	Low	Low	Low	Negative	**Low**	Low	High
Increase in sedimentation and erosion within the development footprint during the construction phase and to a lesser degree the operational phase	Low	Medium	Low	Negative	**Medium**	High	High
Flora and Terrestrial Fauna							
Faunal impacts due to decommissioning phase activities	Medium	Low	High	Negative	**Medium**	High	High
With Mitigation	Low	Low	Low	Negative	**Low**	Medium	High

Following decommissioning, the site will be highly vulnerable to soil erosion	Medium	High	Medium	Negative	**High**	High	High
With Mitigation	Low	Low	Low	Negative	**Low**	Low	High
Faunal impacts due to decommissioning phase activities	Medium	Low	High	Negative	**Medium**	High	High
With Mitigation	Low	Low	Low	Negative	**Low**	Medium	High
Alien Plant Invasion following decommissioning	Medium	High	Medium	Negative	**High**	High	High
With Mitigation	Low	Low	Low	Negative	**Low**	Low	High
Avifauna							
Displacement of priority species due to dismantling activities at the wind development area	Low	Low	Medium	Negative	**Medium**	High	Medium
With Mitigation	Low	Low	Low	Negative	**Medium**	Medium	Medium
Social							
Loss of jobs and associated income	Medium	Medium	Medium	Negative	**Medium**	Medium	High
With Mitigation	Medium	Low	Low	Negative	**Low**	Medium	High

The proposed development of a wind energy facility on the site will have a small impact on agricultural activities as the soils are of very low potential and only suited to extensive grazing.

The impacts on the site need to be viewed in the context of the country's energy mix and the negative externalities associated with current dominant energy sources such as coal, often in areas of high potential soils – such as the Eastern Highveld and the pollution that they produce. With this comparison in mind the impact of a wind energy facility is negligible compared to the damaging impacts of coal mining. Indeed wind energy is associated with positive externalities in the form of Economic Development benefits and the cheap tariff at which it is bought. Therefore, in perspective, the impacts of the proposed facility can be motivated as necessary in decreasing the impacts in areas where agriculture potential plays a more significant role and in the role that externalities associated with power production.

No environmental fatal flaws were identified during the assessment. Mitigation measures to avoid impacts are primarily associated with the relocation of turbine positions of concern, as well as measures to be utilised during the construction phase to prevent negative impacts from occurring. Where impacts cannot be avoided, appropriate environmental management measures must be implemented to mitigate impact. Environmental specifications for the management of potential impacts are detailed within the EMPr (Appendix B).

11.1.1 Ecology

Overall, after mitigation the majority of impacts associated with the development of the San Kraal Wind Energy Facility can be reduced to a low level, with some impacts likely to remain at moderate levels of local impact. No fatal flaws or highly significant impacts are likely to be associated with the project. As such, there are no visible reasons to oppose the development of the San Kraal Wind Farm from a terrestrial ecology perspective.

The final mitigated layout provided by the developer and which would be submitted for approval by DEA has been inspected in detail and avoids the no-go areas and high sensitivity features of the site and is therefore considered acceptable and meets the requirements of this study in terms of planning-stage mitigation and avoidance.

The San Kraal Grid Connection and associated infrastructure is likely to generate low impacts on fauna and flora after mitigation. No high impacts that cannot be avoided were observed and from a flora and terrestrial fauna perspective, there are no reasons to oppose the development of the grid connection and associated infrastructure. Alternative 1 is considered the preferred alternative in terms of flora and fauna as it traverses the least extent of sensitive habitat. Both the Preferred Alternative and Alternative 2 traverse additional hills and would generate a greater impact on fauna and flora as well as increased erosion risk.

11.1.2 Aquatic

The proposed mitigated layouts for the facilities and proposed transmission lines (inclusive of substations and turn-ins) have limited impact on the aquatic environment as the proposed structures can avoid the delineated watercourses except for the two water course crossings.

Based on the findings of the aquatic study the proposed development can be authorised including the 100m corridor extension.

No aquatic protected or species of special concern (flora) were observed during the site visit. Therefore, based on the site visit the significance of the impacts assessed for the aquatic systems after mitigation would be LOW.

Figure 8.5 further indicates the two (2 two minor water course crossings will be required that trigger the need for a Water Use License application (a potential GA) in terms of Section 21 c and i of the National Water Act.

Furthermore, an application for the abstraction of groundwater (Section 21a) and the temporary storage of domestic waste (Section 21g - conservancy tanks, if exceeding 10 000cm3) will be required.

A WULA has been submitted and proof of submission is included in Appendix D.

11.1.3 Noise

Ambient sound levels measured indicate that traffic is a major source of the noise in the area, but the road traffic will only influence the sound levels in an area up to 1,000m from the road. Away from the roads (N9 and N10), the area has a high potential to be very quiet during low wind conditions. Birds, faunal and wind-induced noises does influence sound levels and considering the data collected, wind-induced noises significantly influences sound levels as wind speeds increases.

As most of the area was considered naturally quiet, it was selected to assign an acceptable noise rating level of a rural noise district (as per SANS 10103:2008). This allows daytime noise limits of 52 dBA with night-time noise limits of 42 dBA (during lower wind conditions as increased wind speeds would increase ambient sound levels).

The output of the construction and operational modelling indicated that there is low risk of a noise impact for most of the activities during the construction and operational phases. The significance of the noise impact is low for the construction of the preferred and alternative 2 OHL route alignments (preferred route options in terms of acoustics).

Due to the low significance of a noise impact, no routine noise measurement programme is recommended. Measurement locations, frequencies and procedures are provided as a guideline for the developer to consider should there be a noise complaint, this is included in the EMPr.

While this project will have a very slight noise impact at a number of the closest noise-sensitive receptors, these impacts are of low significance (including construction of OHL with mitigation) and can be considered insignificant. This is because all the NSD are located further than 1,000m from the closest WTG, significantly further than the 400m setback recommended by CNdV Africa (2006). It is however important that the potential noise impact be evaluated should the layout be changed where any wind turbines are relocated closer than 1,000m from a confirmed NSD.

The increases in noise levels are of minor significance. It is therefore the recommendation that the project be authorized (from a noise impact perspective).

11.1.4 Avifauna

It is anticipated that the proposed San Kraal Wind Energy Facility will have a variety of impacts on avifauna which ranges from low to high.

Of the 184 species that could potentially occur at the site, 32 are classified as priority species for wind farm developments (Retief et al. 2012).

Displacement of priority species due to disturbance during the construction (and dismantling) phases of the wind energy facility and associated infrastructure is likely to be a temporary, medium negative impact, and will remain at a medium level despite the application of mitigation measures. None of the priority species are likely to be permanently displaced due to disturbance, although partial displacement of terrestrial species e.g. Blue Crane, Secretarybird, Grey-winged Francolin and African Rock Pipit in the short term during the construction phase is very likely. The implementation of buffer zones around the nesting area could reduce this impact for Blue Cranes, but not for the other priority species. The significance will therefore remain at a medium level after mitigation collectively for priority species.

Displacement of priority species due to disturbance during construction (and dismantling) phases of the grid connection is likely to be a temporary, medium negative impact, and should be reduced to a low level with the application of mitigation measures. Species most likely to be affected by this impact would be terrestrial species such as Grey-winged Francolin, Blue Crane, Ludwig's Bustard, Northern Black Korhaan, Secretarybird and Blue Korhaan, but there is also some potential of disturbance for Verreaux's Eagle. The implementation of the proposed mitigation measures will greatly reduce the probability of disturbance of specifically breeding Verreaux's Eagles.

Displacement of priority species due to habitat destruction during operational lifetime of the wind energy facility phase is likely to be a medium negative impact but will be reduced to a low level with the application of mitigation measures. Species most likely to be affected by the habitat destruction (particularly fragmentation) are the terrestrial species such as Blue Crane, Ludwig's Bustard, Secretarybird and Grey-winged Francolin. The rehabilitation of disturbed areas will help to mitigate the impact of the habitat transformation to some extent, but the fragmentation of the habitat due to the construction of the internal road network cannot be mitigated, and will remain an impact for the duration of the operational life-time of the facility.

Collisions of priority species with the turbines in the operational phase are likely to be a medium negative impact and it could be reduced to a low negative level through the application of mitigation measures. Species most likely to be at risk of collision with the turbines are Lesser Kestrel, Martial Eagle, Verreaux's Eagle and Jackal Buzzard. The impact is likely to persist for the operational life-time of the project. Implementation of the proposed mitigation measures should reduce the probability and severity of the impact on priority species to such an extent that the overall significance should be reduced to low.

Mortality of priority species with the grid connection and internal medium voltage network due to collisions in the operational phase is likely to be of medium significance, and will remain as such after the implementation of mitigation measures. Several of the priority species which occur or potentially occur in the study area are power line sensitive from a collision perspective. These include Ludwig's Bustard, Blue Crane, Northern Black Korhaan, Karoo Korhaan, Blue Korhaan, Secretarybird, White Stork and Greater Flamingo. All of these species, but particularly Ludwig's Bustard and Blue Crane, could be impacted by the proposed grid connection and the internal medium voltage lines (where they are above ground) through collision. The application of BFDs should reduce the probability and severity of the collision impact, but it is likely to remain at the medium level, as the application of BFD's will reduce, but not eliminate the risk.

Mortality due to electrocutions with the overhead sections of the medium voltage internal network is likely to be a medium impact, but it can be reduced to low through the use of bird-friendly pole designs, which must be approved by the avifaunal specialist. The poles could potentially be lethal for species such as Jackal Buzzard, Verreaux's Eagle, Martial Eagle, Cape Eagle-Owl, Spotted Eagle-Owl, Steppe Buzzard and African Harrier-hawk. The electrocution risk will persist as long as the lines are up, but it can be completely eliminated at the onset if bird-friendly structures are used.

From a cumulative impact perspective, the greatest potential concern in the 35km radius around San Kraal WEF is for the large raptor species, particularly the Red Listed Verreaux's Eagle and Martial Eagle, due to their relatively low numbers and vulnerability to turbine collisions (Ralston – Patton et al. 2017). Another concern is the potential impact of the powerline grid connections on large terrestrial species, particularly Blue Crane, Ludwig's Bustard and Secretarybird. The combined cumulative impact of renewable developments on priority species, and particularly wind energy developments on Verreaux's Eagle and Martial Eagle, within the 35km radius around the San Kraal WEF, is potentially significant at a local scale, and require the strict application of mitigation measures such as buffer zones around nests, and the establishment of mortality thresholds and subsequent curtailment of turbines, if thresholds are exceeded. The impact should be less severe at a regional and national level, due to the large distribution ranges of the species, but should nonetheless be carefully monitored. If all the mitigation measures proposed for the various renewable projects are strictly implemented, the cumulative impacts of these developments, including the proposed San Kraal WEF, should be reduced to low.

It is our opinion that the proposed development may be approved subject to the strict implementation of the proposed mitigation measures.

11.1.5 Visual

The visual impacts identified in the VIA are not significant enough to prevent the project from proceeding and that an EA should be granted. From a visual impact perspective, only two (2) visually sensitive receptors with tourism significance have been identified within the study area, namely VR 28 – The Dairy BnB and VR 36 – Carlton Heights Lodge. A total number of twenty-one (21) potentially sensitive visual receptors were however identified. These included scattered farmsteads / homesteads which house the local farmers as well as their farm workers. These dwellings are regarded as potentially sensitive visual receptors as they are located within a mostly rural setting and the proposed development will likely alter natural vistas experienced from these dwellings. In addition, the proposed development is expected to alter the largely natural / scenic character of the study area and contrast moderately with the typical land use and/or pattern and form of human elements present as the study area is largely natural / scenic and untransformed. This is however not true for the areas within close proximity of the town of Noupoort and the operational Noupoort Wind Farm. These areas have seen a significant amount of transformation / disturbance over the years and are considered to have an urban / built up / industrial visual character. The visual impact of the proposed development on the sensitive visual receptor locations identified (namely VR 28 and VR 36) was rated as being moderate. In addition, the proposed San Kraal WEF would have a moderate visual impact on five (5) of the potentially sensitive visual receptor locations and a low visual impact on twelve (12) of the potentially sensitive visual receptors. The proposed development would however result in a negligible visual impact on four (4) of the potentially sensitive receptors. Additionally, the proposed development is not expected to result in a high visual impact for any of the sensitive or potentially sensitive visual receptor locations.

11.1.6 Heritage and Palaeontology

There are no fatal flaws in the proposed WEF project from a palaeontological heritage viewpoint and no objects to authorisation of the development, provided that the recommended mitigation measures are fully implemented.

Provided that mitigation is carried out as indicated, the overall impact of the proposed facility is tolerable and generally of low significance. The final mitigated layout prepared by the proponent (December 2017) successfully avoids the identified impacts as described above and is therefore supported. In terms of grid connections, the Preferred Alternative is supported.

11.1.7 Socio - Economic

The findings of the SIA indicate that the development of the proposed San Kraal WEF will create employment and business opportunities for locals during both the construction and operational phase of the project. The establishment of a Community Trust will also benefit the local community. The potential negative social impacts can also be effectively mitigated.

The proposed development also represents an investment in clean, renewable energy infrastructure, which, given the negative environmental and socio-economic impacts associated a coal based energy economy and the challenges created by climate change, represents a significant positive social benefit for society as a whole. The findings of the SIA also indicate that the Renewable Energy Independent Power Producers Procurement Programme (REIPPPP) has resulted in significant socio-economic benefits, both at a national level and at a local, community level. These benefits are linked to foreign Direct Investment, local employment and procurement and investment in local community initiatives.

Based on the findings of the SIA the establishment of the proposed San Kraal WEF is supported. In this regard the project will create significant socio-economic opportunities for the area and have limited potential negative social impacts.

The San Kraal WEF is located in a proven high wind resource area. The project is needed and desirable for the following reasons:

- Positive impact on climate change;
- Overcoming the country's energy constraints;
- Diversification and decentralisation of supply;
- Reduced costs of energy; and

- Positive economic development including job creation.

11.1.8 Traffic

The base year and forecast year road capacity has indicated that the proposed development will have no significant impact on the existing road network capacity.

11.1.9 Wake Effect

InnoWind has engaged and will continue to engage, with Mainstream regarding the wake effect that will have an impact on the Noupoort Wind Farm's energy production once the San Kraal wind farm becomes operational. In order to quantify the magnitude of the impact, InnoWind commissioned a preliminary study by an independent third party. The preliminary study indicated that the impact to the Noupoort Wind Farm's production is minimal with an estimated loss of 0,96% of its production, based on the current San Kraal wind turbine layout as depicted in the Draft EIR and the Vestas V150 turbine model.

InnoWind will agree to provide Noupoort Wind Farm with equitable compensation for its loss of production as a result of the wake effect caused by the San Kraal WEF's operations.

To this end InnoWind will negotiate fair compensation with Mainstream in good faith, when San Kraal WEF reaches preferred bidder status in the REIPPP, or any other renewable energy program, and before San Kraal reaches Financial Close. This negotiation is subject to Mainstream cooperating with InnoWind during this process, in good faith without causing any unreasonable delays or interference.

InnoWind will appoint (at its own cost) with Mainstream's prior written consent, which shall not be unreasonably delayed or withheld, an additional independent third-party specialist study that will quantify the loss of production, the Noupoort Wind Farm will incur as a result of the wake effects caused by the San Kraal WEF based on the final layout and turbine model as submitted to DEA for approval, prior to initiating the construction phase.

11.2 Impact Statement

The proposed San Kraal Wind Energy Facility and its associated grid connection has the potential to provide much needed renewable energy to the country's grid. The use of renewable energy to provide power to South Africa is supported at International, National, Provincial and Local Government Levels. Further, given South Africa's need for additional electricity generation and the need to decrease the country's dependency on coal-based power, renewable energy has been identified as a national priority, with wind energy identified as one of the most readily available, technically viable and commercially cost-effective sources of renewable energy.

The potential positive impacts associated with the proposed project is further recognised through the creation of jobs for the local community, and the positive contributions to the socio-economic development of the surrounding areas and local communities.

Should the San Kraal WEF be developed, the actual physical footprint of the wind turbines and associated onsite infrastructure will occupy an area of land equivalent to less than 1% of the total project area. Small livestock grazing and other agricultural activities can continue in parallel with the operation of the turbines. The project will have no significant impact in terms of loss of agricultural productivity. Should the mitigation measures identified by specialists and the recommendations of the EMPr be effectively implemented the negative impacts associated with the proposed project will be significantly reduced.

Operational phase monitoring of birds and bats must be undertaken according to applicable guidelines current at the start of the operational phase. The monitoring should not be undertaken according to those guidelines that are current at the time of the environmental authorisation. The information collected during the operational monitoring must be shared with Bird Life SA and EWT, as well as the South African Bat Association Panel (or any other agency that comes into effect, which centrally collects information to inform the effects of WEF on birds and bats). Monitoring and carcass searching must be undertaken throughout the life span of the development, at an agreed frequency with specialists.

All recommendations and mitigations must be complied with and adhered to.

Taking into consideration the findings of the EIA process for the proposed development and the fact that recommended mitigation measures have been used to inform the project design, it is the opinion of the Environmental Assessment Practitioner (EAP) that the majority of negative impacts associated with the implementation of the proposed project have been mitigated to acceptable levels. While the residual impacts of the project will have an impact on the local environment, the extent of the benefits associated with the implementation of the projects will benefit a much larger group of people, in terms of renewable energy supply and positive local and regional economic impact.

The study has concluded that there are no negative high residual impacts, including potential cumulative impacts associated with the proposed development.

11.3 Conditions to be Included in the Environmental Authorisation

11.3.1 Noise

- The potential noise impact must again be evaluated should the layout be changed where any wind turbines are located closer than 1,000m from a confirmed NSD.
- The developer must investigate any reasonable and valid noise complaint if registered by a receptor staying within 2,000 m from location where construction activities are taking place or from an operational wind turbine.

11.3.2 Avifauna

- An avifaunal specialist should perform a walk-through of the powerline prior to the commencement of the dismantling activities to identify any raptor nests on the line. Should a nest be discovered, the avifaunal specialist must have input into the dismantling schedule to assess how and which of the dismantling activities can be timed to minimize the disturbance potential to the occupants of the nest
- The final power line route should be assessed by way of a walk-through and those sections requiring Bird Flight Diverters (BFDs) must be identified.
- The final powerline route should be assessed by the avifaunal specialist way of a walk-down to identify any priority species nests which could be impacted by the construction activities. Should a nest be discovered, the avifaunal specialist must have input into the construction schedule to assess how and which of the construction activities can be timed to minimize the disturbance potential to the occupants of the nest.
- Implement a 500m no development buffer zone around each of the two pans at FP3 at 31°14'15.02"S 25° 2'44.17"E and FP4 at 31°13'55.42"S 25° 2'50.37"E to protect the pair of Blue Cranes from disturbance
- Once the turbines have been constructed, post-construction monitoring should be implemented to compare actual collision rates with predicted collision rates.

- The avifaunal specialist, in consultation with external experts and relevant NGO's such as BLSA, should determine annual mortality thresholds for priority species anticipated to be at risk of collision mortality, prior to the wind farm going operational.
- If actual collision rates exceed the pre-determined threshold levels, curtailment of turbines should be implemented for high risk situations.

11.3.3 Ecology

Preconstruction walk-though of the approved development footprint to ensure that sensitive habitats and species are avoided where possible.

11.3.4 Palaeontology

- A representative sample (c. 10%) of excavations for wind turbine footings be monitored by a professional palaeontologist during the early construction phase. The monitoring protocol should be developed by the palaeontologist appointed in consultation with the developer and SAHRA so as to maximise the palaeontological outcome without interfering unduly with the construction program. On completion of this initial phase of monitoring, a Phase 2 palaeontological report, with any recommendations for further specialist monitoring or mitigation, should be submitted by the palaeontologist to SAHRA for comment.
- Any chance fossil finds during the construction phase of the WEF and associated grid connection must involve safeguarding of the fossils (preferably *in situ*) by the responsible ECO and reporting of finds to SAHRA for the Northern Cape (Contact details: SAHRA, 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000, South Africa. Phone: +27 (0)21 462 4502. Fax: +27 (0)21 462 4509. Web: www.sahra.org.za) and to ECPHRA for the Eastern Cape (ECPHRA contact details: Mr Sello Mokhanya, 74 Alexander Road, King Williams Town 5600; Email: smokhanya@ecphra.org.za).

11.3.5 Traffic and Transportation

A comprehensive route assessment of the entire route is recommended should the project be awarded preferred bidder as part of the REIPPP process.

APPENDIX A: EAP DECLARATION OF INDEPENDENCE & CV

APPENDIX B: ENVIRONMENTAL MANAGEMENT PROGRAMME

APPENDIX C: PUBLIC PARTICIPATION REPORT

APPENDIX D: WATER USE LICENSE APPLICATION PROCESS