Basic Assessment for the Proposed Development of the 325MW Kudusberg Wind Energy Facility and associated infrastructure, between Matjiesfontein and Sutherland in the Western and Northern Cape Provinces

DRAFT
BASIC ASSESSMENT REPORT





PREPARED FOR: KUDUSBERG WIND FARM (Pty) LTD

PREPARED BY: CSIR

CSIR Report Number: CSIR/IU/021SE/IR/2018/0006/A

November 2018

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BASIC ASSESSMENT PROCESS

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November 2018

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REPORT DETAILS

Title:	Basic Assessment for the Proposed Development of the 325MW Kudusberg Wind Energy Facility and associated infrastructure, between Matjiesfontein and Sutherland in the Western and Northern Cape Provinces
Purpose of this report:	Basic Assessment Report for the Proposed Development of the Kudusberg Wind Energy Facility and associated infrastructure, between Matjiesfontein and Sutherland in the Western and Northern Cape Provinces. The purpose of this BA Report is to: • Present the proposed project (including alternatives) and the need for the proposed project; • Describe the legislative context; • Describe the affected environment at a sufficient level of detail to facilitate informed decision-making; • Provide an overview of the BA Process being followed, including public consultation; • Assess the predicted positive and negative impacts of the proposed project on the environment; • Provide recommendations to avoid or mitigate negative impacts and to enhance the positive benefits of the project; • Provide an Environmental Management Programme (EMPr) for the proposed project; and • Meet all requirements as per Appendix 1 of the EIA Regulations (2014), as amended to enable the DEA to issue a decision on the project. This BA Report is being made available to all Interested and Affected Parties (I&APs), Organs of State and stakeholders for a 30-day review period. All comments submitted during the 30-day review of this BA Report will be incorporated into the Final BA Report and responded to in a comments and responses report which will be submitted to the national Department of Environmental Affairs for decision-making.
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LIST OF ABBREVIATIONS

AAA	Astronomy Advantage Area
AC	Alternating Current
AIA	Archaeological Impact Assessment
AGIS	Agricultural Geo-Referenced Information System
BA	Basic Assessment
BGIS	Biodiversity Geographic Information System
BLSA	BirdLife South Africa
CA	Competent Authority
CAA	Civil Aviation Act (Act 13 of 2009)
CARA	Conservation of Agricultural Resources Act (Act 43 of 1983)
CBA	Critical Biodiversity Area
CEMP	Construction Environmental Management Plan
CPV	Concentrated Photovoltaic
CSIR	Council for Scientific and Industrial Research
CSP	Concentrated Solar Power
DAFF	National Department of Agriculture, Forestry and Fisheries
DC	Direct Current
DEA	National Department of Environmental Affairs
DEA&DP	Western Cape Department of Environmental Affairs and Development Planning
DENC	Northern Cape Department of Environment and Nature Conservation
DM	District Municipality
DMR	National Department of Minerals Resources
DNI	Direct Normal Irradiance
DoE	Department of Energy
DOT	National Department of Transport
DWS	National Department of Water and Sanitation
EA	Environmental Authorization
EAP	Environmental Assessment Practitioner
EC	Electrical Current
EIA	Environmental Impact Assessment
EMS	Environmental Management Services
EMPr	Environmental Management Programme
EPC	Engineering, Procurement and Construction
GA	General Authorization
GDP	Gross Domestic Product
GG	Government Gazette
GHI	Global Horizontal Irradiation
GIS	Geographical Information Systems
GNR	Government Notice Regulation
HIA	Heritage Impact Assessment
I&AP	Interested and Affected Party
IDP	Integrated Development Plan
IEM	Integrated Environmental Management
IFC	International Financial Corporation
IPP	Independent Power Producer
IRP	Integrated Resource Plan
LED	Local Economic Development
LM	Local Municipality

MW	Megawatts
NC	Northern Cape
NCPAES	Northern Cape Protected Area Expansion Strategy
NEMA	National Environmental Management Act (Act 107 of 1998)
NEMBA	National Environmental Management: Biodiversity Act
NEMPA	National Environmental Management: Protected Areas Act
NHRA	National Heritage Resources Act (Act 25 of 1999)
NIA	Noise Impact Assessment
NSD	Noise Sensitive Development
NWA	National Water Act (Act No. 36 of 1998)
O&M	Operation and Maintenance
PIA	Palaeontology Impact Assessment
PPA	Power Purchasing Agreement
PPP	Public Participation Process
PSDF	Provincial Spatial Development Framework
PSEIA	Plan of Study for Environmental Impact Assessment
PV	Photovoltaic
REDZs	Renewable Energy Development Zones
REIPPPP	Renewable Energy Independent Power Producer Procurement Programme
RfP	Request for Proposal
SABAP2	South African Bird Atlas Project
SAHRA	South African Heritage Resources Agency
SAHRIS	South African Heritage Resources Information System
SALA	Subdivision of Agricultural Land Act (Act 70 of 1970)
SALT	The South African Large Telescope
SANBI	South African National Biodiversity Institute
SANRAL	South African National Roads Agency Limited
SANS	South African National Standards
SARERD	South African Renewable Energy Resource Database
SCC	Species of Conservation Concern
SDF	Spatial Development Framework
SIP	Strategic Infrastructure Plan
SEA	Strategic Environmental Assessment
SKA	Square Kilometre Array
TIA	Transportation Impact Assessment
ToR	Terms of Reference
VIA	Visual Impact Assessment
WASA	Wind Atlas of South Africa
WC	Western Cape
WEF	Wind Energy Facility
WMA	Water Management Area
WULA	Water Use License Application

EXECUTIVE SUMMARY

INTRODUCTION

Kudusberg Wind Farm (Pty) Ltd (hereafter referred to as the applicant) is proposing to develop the Kudusberg Wind Energy Facility (WEF) with a maximum generation capacity of 325 MW at Kudusberg, a site approximately 45 km south-west of Sutherland in the Northern and Western Cape Provinces (hereafter referred to as the 'proposed WEF'). The proposed WEF is located within the Witzenberg and Karoo Hoogland Local Municipalities, which fall within the Cape Winelands and Namakwa District Municipalities respectively. The locality map is provided in Figure A.1.

The proposed project falls entirely within the Renewable Energy Zone (REDZ) 2 (i.e. Komsberg REDZ), that was Gazetted in February 2018 by the Minister of Environmental Affairs (GN 114). In terms of the National Environmental Management Act (Act 107 of 1998, as amended) (NEMA) and the 2014 NEMA EIA Regulations promulgated in Government Gazette 40772 and Government Notice (GN) R326, R327, R325 and R324 on 7 April 2017, wind and solar PV projects located within a REDZs are subject to a Basic Assessment (BA) and reduced decision-making period by the authorities. A Basic Assessment (BA) Process in terms of Appendix 1 of the Environmental Impact Assessment (EIA) Regulations (2014, as amended) has therefore been undertaken for the proposed project. The competent authority for this BA is the national Department of Environmental Affairs.

This Basic Assessment (BA) Report has been compiled to provide an assessment of the proposed Kudusberg WEF and associated infrastructure. A separate BA will be undertaken for the associated 132 kV powerline that will connect the proposed Kudusberg WEF to the Komsberg substation via the Bon Espirange substation.

This Draft BA Report is hereby released for a 30-day commenting period. All comments received during the 30-day review period will be included in the Final BA Report and responded to in a Comments and Responses Report. The Final BA Report will be submitted to the Competent Authority (CA), i.e. the DEA, in accordance with Regulation 19 (1) of the 2014 NEMA EIA Regulations (as amended), for decision-making in terms of Regulation 20 of the 2014 NEMA EIA Regulations (as amended), however within the shortened 57 days.

PROJECT LOCATION

The proposed Kudusberg WEF, including the associated infrastructure, will be developed on the land portions in the Western Cape and Northern Cape Provinces as indicated in Table 1.

Table 1: Land portions that will be affected by the proposed Kudusberg WEF and associated infrastructure

Number	Farm name and number	SG Code
Western Cape:		
1	Portion 1 of 156 Gats Rivier Farm	C01900000000015600001
2	Portion 2 of 156 Gats Rivier Farm	C01900000000015600002
3	Remainder of 156 Gats Rivier Farm	C01900000000015600000
4	Portion 1 of 157 Riet Fontein Farm	C01900000000015700001
5	Portion 1 of 158 Amandelboom Farm	C01900000000015800001
6	Remainder of 158 Amandelboom Farm	C01900000000015800000
7	Portion 1 of 159 Oliviers Berg Farm	C01900000000015900001
8	Remainder of 159 Oliviers Berg Farm	C01900000000015900000
9	Portion 2 of 157 Riet Fontein Farm	C01900000000015700002
10	Remainder of 161 Muishond Rivier Farm	C01900000000016100000
11	Remainder of 395 Klipbanks Fontein Farm	C01900000000039500000
Northern Cape:		
12	Portion 4 of 193 Urias Gat Farm	C07200000000019300004
13	Portion 6 of 193 Urias Gat Farm	C07200000000019300006
14	Remainder of 193 Urias Gat Farm	C07200000000019300000
15	Remainder of 194 Matjes Fontein Farm	C07200000000019400000
16	Remainder of 196 Karree Kloof Farm	C07200000000019600000
Properties affected by public access road:		
17	169 Zeekoegat Farm	C07200000000016900000
18	Portion 1 of 170 Roodeheuvel Farm	C07200000000017000001
19	Remainder of 170 Roodeheuvel Farm	C07200000000017000000
20	Remainder of 190 Wind Heuvel Farm	C07200000000019000000
21	Portion 1 of 190 Wind Heuvel Farm	C07200000000019000001
22	Portion 5 of 193 Urias Gat Farm	C07200000000019300005
23	Remainder of 171 Vinke Kuil Farm	C07200000000017100000
24	Alkant Re/220 Farm	C07200000000022000000
25	Portion 1 of 174 Lange Huis Farm	C07200000000017400001

The co-ordinates of the centre and boundary/corner points of the project site are detailed in Table 2 below.

Table 2: Co-ordinates of the Centre and Corner Points of the Kudusberg WEF project site

Site	Point	Latitude	Longitude
Kudusberg WEF	Centre	32° 52.952'S	20° 19.397'E
	North	32° 40.498'S	20° 24.963'E
	North-East	32° 49.917'S	20° 22.099'E
	South-East	32° 54.111'S	20° 23.063'E
	East	32° 43.897'S	20° 29.538'E
	South-West	32° 55.534'S	20° 16.415'E
	North-West	32° 52.213'S	20° 14.345'E
	South	32° 55.243'S	20° 20.179'E

PROJECT BASIC ASSESSMENT TEAM

In accordance with Regulation 12 (1) of the 2014 NEMA EIA Regulations (as amended, GN R326), the Applicant has appointed the CSIR to undertake the BA Process in order to determine the biophysical, social and economic impacts associated with undertaking the proposed development.

The project team, including the relevant specialists, is indicated in the Table 3 below:

Table 3: Project team for the proposed Kudusberg WEF

ROLE/STUDY TO BE UNDERTAKEN	ORGANISATION	NAME
Environmental Management Services (CSIR)		
Environmental Assessment Practitioner (EAP) (*Pr. Sci. Nat*. Reg No: 117078)	CSIR	Minnelise Levendal
Technical Advisor and Quality Assurance *(Pr. Sci. Nat. Reg No: 117078)*	CSIR	Lizande Kellerman
Mapping	CSIR	Surina Laurie
Specialist Assessment		
Visual Impact	SiVEST SA (Pty) Ltd	Andrea Gibb
Heritage: Archaeology	Private	Katie Smuts
Heritage: Cultural Landscape	Hearth Heritage	Emmylouw Rabe
Heritage: Palaeontology	Natura viva cc	Dr John Almond
Agriculture & Soils	Private	Johann Lanz
Terrestrial Ecology	Ekotrust cc	Dr Noel van Rooyen
Aquatic Ecology	BlueScience (Pty) Ltd	Toni Belcher
Birds & Bats	BioInsight	Craig Campbell
Noise Impact	SAFETECH	Dr Brett Williams
Socio-Economic	Urban-Econ Development Economists	Elena Broughton and Conrad Swart
Transportation	JG AFRIKA (Pty) Ltd	Iris Wink

PROJECT DESCRIPTION

A brief description of the components of the proposed Kudusberg WEF is provided in the table below.

Table 4: Components of the proposed Kudusberg WEF

Infrastructure	Footprint and dimensions
Number of turbines	56
Turbine Capacity	Between 3 MW- up to 6.5 MW
Hub Height	Up to 140 m
Rotor Diameter	Up to 180 m
Blade length	Up to 90 m (depending on final rotor diameter)
Project Size	325 MW
Area occupied by on-site substation	Up to 2.25 ha
Capacity of on-site substation	33/132 kV
Area occupied by construction camp	~12.6 ha which includes an on-site concrete batching plant for use during the construction phase and for offices, administration,

Infrastructure	Footprint and dimensions
	operations and maintenance buildings during the operational phase.
Permanent area occupied by the development footprint of the project	Approximately 126 ha
Internal access roads	Internal access roads up to 12 m wide, including structures for storm water control, are required to access each turbine and the substation, with a total footprint of about 82.44 ha. Where possible, existing roads will be upgraded. Turns will have a radius of up to 50 m for abnormal loads (especially turbine blades) to access the various turbine positions. 200m wide corridor along proposed access road to enable micro sitting
Turbines	Turbine foundations: Reinforced concrete foundation – 30 m x 30 m (total footprint ~4ha), 5m deep Crane pads (laydown areas) –56 turbines x 90 m x 50 m (total footprint 25.2 ha)
Electrical transformer	Electrical transformers (690V/33kV) will be placed adjacent to each turbine (typical footprint of 2 m x 2 m, but can be up to 10 m x 10 m at certain locations) to step up the voltage to 33 kV. Underground 33 kV cabling between turbines buried along access roads, where feasible, with overhead 33 kV lines grouping turbines to crossing valleys and ridges outside of the road footprints to get to the onsite 33/132 kV substation.
Wind Monitoring masts	Up to 4 x 140 m high (depending on the final hub height) wind measuring lattice masts strategically placed within the wind farm development footprint to collect data on wind conditions during the operational phase.
Fencing	Permanent fencing will be required around the batching plant, the on-site substation and the and will be a maximum of 4 m high.

Please note that alternatives were assessed during the BA process. In response to the specialist findings, the layout was amended (revised layout 1) during the BAR process.

NEED FOR THE BA

The proposed project triggers listed activities in GN R327, R325 and R324, dated 7 April 2017 of the NEMA EIA Regulations, as amended. As such, the project requires Environmental Authorisation from the DEA. As noted previously, due to the project being proposed in a REDZ, the proposed project requires a BA Process.

The main activity that is triggered by the proposed Kudusberg WEF is Activity 1 of GN 325, i.e.

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

See section A.18 of the report for a full overview of all activities applied for.

IMPACT ASSESSMENT

A total of 10 specialist studies were undertaken as part of the BA Process. The full specialist studies are provided in Appendix D of this report. Section B of this report provides a summary of the affected environment associated with these studies. Section D of this report provides a summary of the impact assessments conducted by the specialists.

A summary of the specialist studies is outlined below.

Visual Impact Assessment

Although the study area has a largely natural, untransformed visual character with some elements of rural / pastoral infrastructure, it is not predominantly utilised for its tourism significance, with the predominant land use being agriculture. The study area has however seen very limited transformation / disturbance and is considered to be largely natural / scenic. As such the proposed development is expected to alter the visual character of the area and contrast significantly with the typical land use and / or pattern and form of human elements present.

Due to the low levels of leisure-based or nature-based tourism activities in the assessment area, only two sensitive visual receptors were originally identified. These receptors were later eliminated from the assessment due to the fact that the owner of both properties has a vested interest in the proposed development and would not therefore perceive the WEF in a negative light. It was further ascertained that, although 52 potentially sensitive receptors were identified within the visual assessment zone, the proposed WEF development is likely to visually impact only 23 of these receptors. Overall it can therefore be concluded that the visual impact of the proposed WEF would be reduced due to the lack of sensitive visual receptors present. In addition, the perception of the viewer/receptor is highly subjective, and as such, not all of these receptors would necessarily consider a WEF to be a negative visual impact. Therefore, tourist facilities and parties that have stated that they are opposed to the WEF would be considered to be particularly sensitive, and to date, no such feedback has been received from interested and affected parties. Landowners that form part of the wind farm are expected to have a positive or neutral opinion to wind farms as they would not have consented to a wind farm on their property, if they were opposed to it.

The visual impact of the proposed development on the majority of the potentially sensitive visual receptors **was rated as being negligible** (28 in total). This is due to the fact that these receptor locations are either located outside of the proposed WEF development's viewshed or are situated further than 8 km from the nearest proposed wind turbine. Impacts on 23 potentially sensitive receptor locations were rated as medium, while only one receptor location (VR54) would be subjected to high visual impacts. Impacts affecting VR54 are however mitigated somewhat by the fact that this receptor is located on the WEF application site and the owner has consented to the proposed development. It is therefore assumed that the owner of VR54 would not perceive the WEF in a negative light.

The impact rating revealed that overall the proposed WEF is expected to have a **moderate negative visual impact** rating during both construction and operation, with relatively few mitigation measures available. It could be argued that the key mitigation measure is to cluster wind energy developments in line with the intended outcome of the recently promulgated Komsberg REDZ – one of eight designated zones for renewable energy development. By clustering developments, the visual impacts are contained in one zone instead of sprawling over vast areas. Cumulative impacts associated with the proposed WEF would have a **moderate negative visual impact** rating during both construction and operation, with relatively few mitigation measures available. These impacts would however remain moderate after the implementation of the relevant mitigation measures, due to the nature of the impacts.

A comparative assessment of alternatives for the proposed access road, construction camp and substation site was undertaken in order to determine which of the alternatives would be preferred from a visual perspective. No fatal flaws were identified for any of the alternatives. All the access road and Substation site alternatives were deemed as favourable, as were Construction Camp Alternatives 2 and 3. Construction Camp Alternative 1 was however seen as the least preferred option. No-go alternative was not preferred.

From a visual perspective therefore, the project is deemed acceptable and the EA should be granted. SiVEST is of the opinion that the impacts associated with the construction, operation and decommissioning phases can be mitigated to acceptable levels provided the recommended mitigation measures outlined in the Visual Impact Assessment are implemented.

Heritage Impact Assessment

Heritage resources identified on site included archaeological and built environment features. Archaeological resources included scattered, isolated Middle and Later Stone Age artefacts, although these were very infrequent. A single cave with finger painted rock art, Later Stone Age artefactual material and a single sherd of indigenous pot was also identified. Several stone-built kraals, either rounded or rectilinear in shape, and dry stacked or mortared, were recorded and are likely of historic age, although some could be pre-colonial. Ruined dwellings and other disused farm buildings that are all likely over 100 years old were also recorded, usually in association with one or more kraals. Built environment features included farmsteads and associated outbuildings at several farms.

A single, fenced grave with marble headstone was recorded, as well as a likely child's grave and a further graveyard containing about 12 graves with hand carved sandstone headstones and stone covered graves. Likely burials included an informal graveyard containing over ten stone cairns. The cultural landscape of the region comprises the largely undeveloped ridges and slopes, as well as the cumulative evidence for hundreds of years of continuous patterns of transhumant pastoralism that has left, at most, ephemeral traces on the landscape.

Almost all features were found along valley bottoms or on open plains near watercourses, with no significant heritage resources of any kind identified at higher elevations.

Anticipated Impacts on Heritage Resources

Any excavations into bedrock of the Abrahamskraal Formation is, **highly likely** to impact any fossils present. Given that the prevalence of fossils in these deposits in this area is rare, however, impacts to significant palaeontological remains are expected to be **very low.** The cumulative impacts are also rated as **very low** for the associated with fossil remains**.** The cumulative impacts for Destruction archaeological remains, graves and built environment features is rate as high (before mitigation) and **moderate (after mitigation).**

With the ridges devoid of artefactual material of any kind, impacts are likely only to occur at sites at lower elevations, where most of the infrastructure is NOT proposed. These impacts will arise from the widening of existing roads, the creation of new access roads, and the development of construction camps and the onsite substation. Impacts could be direct or indirect and include damage, destruction and degradation of sites, as well as loss of sense of place resulting in diminished significance of heritage resources.

The anticipated direct impacts of the turbines themselves on heritage resources are expected to be **low**. The originally proposed alignment of Access Alternative 1 would have resulted in impacts to sites including one stone cairn, a U-shaped stone-built structure, several kraal structures and a three-roomed stone-built structure, and further kraals and a stone and mudbrick-built structure. Similarly, Common Access Road 1 would have bisected Wind Heuvel farmstead and passed directly adjacent to the graveyard located there. Impacts to these sites would have been **high** to **very high**.

The applicant has subsequently amended these layouts, reducing likely impacts to **low or insignificant**. Construction Camp Alternative 3 is proposed for construction on the site of the informal graveyard, posing a **very high** threat of impact to those sites. A **moderate**, indirect threat is posed to the stone-built features in the landscape, and a **low** threat to the rock art cave; this threat is derived from the increase of people in the landscape who could accidentally or intentionally damage or destroy features. Further indirect impacts are likely to the context of the region by the nature of the proposed development which will detract from the sense of place and degrade the cultural landscape. Impacts to the cultural landscape are expected to be **very high** and are generally impossible to mitigate without avoidance of sensitive areas by infrastructure. Sensitive placement of turbines and infrastructure, along with observation of appropriate buffers can, however, be expected to reduce these impacts to cultural landscapes and sense of place from **high to moderate**. The no-go alternative is not preferred.

Alternatives
In summary, recommendations on alternatives are as follow:

- **Substation Alternative 1** is the **recommended** substation alternative, although Substation Alternatives 2 and 3 are not considered to be a no-go option;
- **Construction Camp 2** is the **recommended** construction camp alternative, although Construction Camp 1 is likely to be an acceptable alternative. **Construction Camp 3 should be considered a no-go option;**
- The realignment of **Access Road Alternative 1** renders it an **acceptable** choice, while Access Road Alternative 2 is likely to be an acceptable alternative. The proposed alignment for Access Road Alternative 2 should be subjected to a walkdown by an archaeologist prior to commencement of development to identify any areas or sites that require protection or mitigation, should it be selected; and
- **Common Access Road 1** has been realigned to the east to avoid Wind Heuvel farmstead and is considered an **acceptable** route. The road should not be widened or altered at this point and a proper fence should be erected around the Stadler graveyard.

It is not anticipated that the proposed development will have significant impacts to heritage resources, beyond those to the cultural landscape, given that they are generally of low heritage significance. The potential high impact to the cultural landscape should be viewed in the context of the site being located with REDZ 2, i.e. an area identified for the proposed development of wind projects. One WEF is currently under construction in the area and another three are proposed to commence construction in 2019. It is therefore recommended that the project be authorised, subject to implementation of the above recommendations.

Soils and Agricultural Impact Assessment

South Africa has very limited arable land and it is therefore critical to ensure that development does not lead to an inappropriate loss of potentially arable land. This assessment has found that the proposed development will only impact agricultural land which is of extremely low agricultural potential and which is only suitable for low intensity grazing. The proposed infrastructural footprint of the wind farm is classified with land capability evaluation values of 1 – 4, which is very low to low. All impacts (positive and negative) were assessed as having **low or very low significance** after mitigation. The potential cumulative impact is a regional loss of agricultural land which was assessed to be of **very low significance** before and after mitigation.

Under the No-Go option the Kudusberg WEF would not be developed. As such, all the proposed impacts outlined above would be “neutral” i.e. should the development not occur none of the negative or positive impacts identified during the construction, operational and decommissioning phases would arise.

Furthermore, should the Kudusberg WEF not be developed, the potential job opportunities, and associated improvement in livelihoods, that could be created are forgone. Improvements in energy supply would likewise also be foregone.

The no-go alternative is assessed to have a **neutral significance.**

Due to the low agricultural potential of the site, and the consequent very low, negative agricultural impact after mitigation, there are no restrictions relating to agriculture which preclude authorisation of the proposed development (including all alternatives) and therefore, from an agricultural impact point of view, the development should be authorised.

Ecological Impact Assessment (Terrestrial)

According to Mucina and Rutherford (2006) the vegetation types which cover the study site are the **Koedoesberge-Moordenaars Karoo** and the Central Mountain Shale Renosterveld. The vegetation occurs at the transition between the Fynbos Biome and the Succulent Karoo Biome and elements of both biomes are therefore represented. Van der Merwe et al. (2008a, 2008b) described six vegetation units for the study area. The current brief vegetation survey classified the study area into six physiognomic-floristic habitat types, (1) cliffs; (2) the mountain crests, upper plateaux and upper slopes; (3) the midslopes and mid-plateaux; (4) footslopes and lower plateaux; (5) plains; and (6) drainage lines (mountain streams and rivers in the valleys).

According to the lists of protected flora in the Northern Cape, 354 of the 792 species were classified as either Schedule 1 (Specially Protected Species) or Schedule 2 (Protected Species). In total 223 species qualified as protected in the Western Cape province. Twenty-two of the species potentially on site (Appendix A of the Ecological Impact Assessment in Appendix D of this report) qualify as CITES Appendix II species. There are no nationally protected tree species on site.

Fifty-seven mammal species occur/could potentially occur on the site.

The study area is not located in a Protected Area, although a small section in the southeast falls marginally within a zone earmarked for the National Protected Areas Expansion Strategy (NPAES). Two turbines lie in this area earmarked for NPAES. Small sections of the study area are classified as Critical Biodiversity Areas (CBAs) in the Western Cape (2017) and this does affect the position of six turbines. A seventh turbine falls partially into a CBA. Most of the development in the Western Cape lies in Other Natural Areas (ONAs), with some Ecological Support Areas (ESAs) being impacted. In the Northern Cape, parts of the development fall in ESAs and the rest in ONAs. It should be noted that the mapping of CBAs, ESAs and ONAs for the Western Cape has changed markedly since 2010.

To assess the impact, a **detailed site walkthrough** of the **entire project footprint** was undertaken in the **flowering season**. This detailed assessment informed the sensitivity map compiled in the current study (considering a number of biodiversity and ecological parameters) scored the mountain crest habitat, that will be affected most severely by the development, as moderate. Based on the confirmed sensitive areas, the **layout was amended to avoid the sensitive areas**. Considering the current sensitivity map of the plant associations the improved micro-siting of eight turbines or their crane pads is called for (1, 3, 31, 35, 37, 42, 22 and 36). In the revised layout provided by the project applicant on 15 October 2018 these turbines/associated crane pads were all repositioned to avoid the Very High sensitivity features.

A full assessment of the direct, and indirect impacts during the construction, operational and decommissioning phases of the development is provided. The construction phase will have the highest impact on the environment. Overall, the roads, loss of vegetation and resulting erosion will have the highest associated impacts. Faunal behaviour will be affected by a loss of habitat, altered physical conditions of the habitat, increased human presence, increased noise and light levels, and habitat dissection. The ecologist concluded that after mitigation actions have been applied, most of the impacts had a **low or very low significance rating**.

No impacts have been identified that will render the project fatally flawed. The specialist made recommendations to avoid impacts in areas of very high ecological significance. The applicant has revised the initial layout by taking these recommendations into account. Therefore, with the implementation of the mitigation measures recommended in the Ecology report the project can be authorised from a terrestrial biodiversity perspective. <u>The revised layout has reduced any potential impacts to the terrestrial biodiversity on the project site to an acceptable level.</u>

Freshwater Assessment

The proposed 325 MW Kudusberg WEF is located on the Oliviersberg and Koedoesberg Mountains which form the watershed between the Tankwa, Ongeluks and Groot Rivers, all in the upper reaches of the Olifants/Doring River System, on the border of the Northern and Western Cape Provinces. The aquatic features within the study area consist of the upper reaches of the Doring River (Muishond, Ongeluks, Jakkalshok, Brak, Windheuwels, Wilgebos and Kleinpoorts Rivers and their lesser, unnamed tributaries, as well as some valley bottom wetlands associated with the larger watercourses and some small dams, vernal ponds and seeps on the hill tops).

The ecological habitat integrity of the rivers within the study area is still natural in the upper reaches with few modifications (some roads and very small dams). Downstream, in the middle reaches of the Windheuwels and Ongeluks Rivers, the rivers become largely natural to moderately modified. The riparian habitat is slightly more degraded as a result of direct habitat modification from the surrounding agricultural activities. The hillslope seeps and the vernal pool are in a natural ecological condition while the valley bottom wetlands have been modified but are still in a largely natural ecological condition.

In terms of biodiversity importance, the study area is located within an Upstream River Freshwater Ecosystem Priority Area. The Brak River as well as portions of the Jakkalshok and Ongeluks Rivers (rivers in the valleys between the ridges on which the wind turbines are placed) are mapped as aquatic CBAs where they occur within terrestrial CBAs. The remainder of the watercourses is mapped as aquatic Ecological Support Areas (ESAs). Very limited aquatic ESAs occur where there is localised disturbance within the watercourses such as at the gravel road crossings. There is also a wetland at the source of the largest southwards flowing tributary of the Ongeluks River that is mapped as an aquatic CBA. Most of the terrestrial areas adjacent to the watercourses in the area are mapped as Other Natural Areas (ONAs).

Within the Northern Cape CBA mapping, most of the watercourses occur within ESAs, with reaches that are on the mid-slopes of the hillsides being mapped as ONAs. The width of the ESA corridor along the Windheuwels River (a tributary of the Tankwa River where the planned access to the WEF is located) within the site is 1000 m wide. There is a CBA located along the upper Windheuwels River that is avoided by the project activities.

The wetland features within the study area are considered of moderate ecological importance and sensitivity. The hillslope seeps and valley bottom wetlands are closely associated with the rivers in the area and the importance of the habitat in providing ecological corridors for the movement of biota. The vernal pools are small but contain a unique aquatic habitat and specific associated biota.

In terms of the proposed project and its alternatives:

- **Access road:** Alternative 1 would have the lesser freshwater impact as, with a slight realignment, it would not need to cross any watercourse and only an upgrade to the existing crossing over the river would be required. Alternative 2 would however still be acceptable, with mitigation;

- **Substation:** Alternative 3 is located along a proposed internal access road and thus would not require an additional access road to be constructed. This alternative is likely to have the lowest potential freshwater impacts of the three alternatives proposed. Alternatives 1 and 2 would however still be acceptable, with mitigation;
- **Construction camp:** Alternative 1 is located outside of any watercourses or their proposed buffers. The area is also relatively flat therefore runoff to the watercourses would be low. The camp will however need to be established in an area that comprises of natural vegetation cover and would need to be rehabilitated after the construction phase. Construction Camp Alternatives 2 and 3 are located adjacent to the larger Uriasgat River, on a small rise between the river and one of its larger tributaries. From a freshwater perspective these Construction Camp Alternatives 2 and 3 have a higher potential freshwater impact than Construction Camp Alternative 1 but these impacts could be mitigated such that the potential freshwater impacts associated with the use of either of these sites would be acceptable.
- WEF turbines, crane pads, access roads and electrical transformers and cables: With these small alterations to the proposed layout plan, the potential impacts of the turbines and associated infrastructure would be very limited and of a low significance.

With mitigation, the potential freshwater impacts of the proposed Kudusberg WEF for the construction, operation and decommissioning phases are likely to be low. One can also expect that the cumulative impact of the proposed project would not be significant provided mitigation measures are implemented. The risk assessment determined that the proposed development of the Kudusberg WEF poses a low risk of impacting aquatic habitat, water flow and water quality.

Based on the above findings, there is no reason from a freshwater perspective, why the proposed activity (with implementation of the proposed mitigation measures in the Freshwater Impact Assessment in Appendix D of this report) should not be authorized. The revised layout has further reduced any potential impacts to the aquatic ecosystems in the area.

Avifauna Impact Assessment (Birds)

The study area is characterised by accentuated mountainous areas with vegetation adapted to the semi-arid conditions and harsh rocky conditions. Currently, the area where Kudusberg WEF is proposed shows no signs of intense disturbance. The area is logistically very difficult for human access and therefore remains in almost pristine natural conditions, apart from the general impacts on the veld caused by the three-year period of drought and grazing.

A 12-month pre-construction bird monitoring has been conducted at the site in accordance with the best practice pre-construction monitoring guidelines (Jenkins *et al.,* 2015). Site visits confirmed the occurrence of relatively high abundances of Accipitrid and Falcon species. The results have shown that both groups have a constant presence at the site throughout the year and spend a high proportion of their time and/or number of contacts at rotor height in comparison with the other groups of species. It is also noteworthy that their activity was especially associated with the hillside and escarpment areas, where most of the potential collision risk movements (flight at potential rotor height depending on the turbine specifications) were observed.

A total of eight species confirmed on site may be of special concern for having an unfavourable conservation status in South Africa: Black Harrier *Circus maurus*, Ludwig's Bustard *Neotis ludwigii*, Martial Eagle *Polemaetus bellicosus* – Endangered; Black Stork *Ciconia nigra*; Verreauxs' Eagle *Aquila verreauxii* – Vulnerable; Karoo Korhaan *Eupodotis vigorsii*; Maccoa Duck *Oxyura maccoa*; and Greater Flamingo *Phoenicopterus roseus* – Near Threatened.

Sensitive areas identified at the proposed site considered the relevant aspects collected through the bird monitoring programme, including: relevant activity of sensitive species and associated potential for collision recorded in areas of hillsides and escarpments; particular association of passerine species and other relevant sensitive species to riverine thickets and water features;

association of red-listed species with their potential breeding/roosting locations. This allowed for establishment of avoidance areas (areas with very high sensitivity for birds).

The main direct impacts identified to potentially occur are: increased habitat loss, increased fatalities due to collision with various project infrastructures, and increased disturbance/displacement effects. The overall significance of these impacts expected to occur during the construction, operation, and decommissioning phases, is expected to be **low before mitigation, and very low after mitigation.** The overall significance of cumulative impacts expected to occur is estimated to be moderate before mitigation, **and low after mitigation**.

No-go alternative:

Should the Kudusberg Wind Farm not be constructed, then all impacts (whether it be negative or positive) identified within the impact analysis will not take place. As a result, it is expected that the present environmental characteristics relevant for the bat community on site will remain unchanged, relative to that which is being observed at present, under current land-use practices."

Based on the bird impact assessment undertaken no fatal flaws were identified for the proposed Kudusberg WEF. Provided the proposed mitigation measures in the Bird Assessment are implanted, the proposed project can be authorised from the bird specialist's perspective.

Bat Impact Assessment

The main results of the bat community 12-months pre-construction monitoring programme of the Kudusberg WEF are presented in the final bat pre-construction monitoring report resulting from the analysis of the surveys conducted between December 2015 and December 2016. These methodologies resulted in confirming the occurrence of four bat species and the identification of them. The confirmed species are the Egyptian free-tailed bat (*Tadarida aegyptiaca*), the Cape serotine (*Neoromicia capensis*), the Natal long-fingered bat (*Miniopterus natalensis*) and the Egyptian slit-faced bat (*Nycteris thebaica*). These are all "Near Threatened", or "Least Concern" species, according to the South African Red List (Friedmann & Daly, 2004b) and are considered sensitive species to the WEF development since three of them are considered to have medium to high risk of collision with wind turbines.

Results of the pre-construction bat monitoring indicate that the bat activity at the proposed Kudusberg WEF area is low in general considering the Bat Guidelines (Sowler et al., 2016).

According to pre-construction phase results, Kudusberg WEF is classified has having low sensitivity, but with some areas in particular with high and very high sensitivity due to the presence of specific features and habitat that may have an increased bat activity. These include the presence of potential roosts, as well as water lines which are important for bats, since they are likely to act as commuting routes, providing food resources likely to be associated to a higher bat activity.

It is recommended that the very high (no-go) areas identified for the bat community should be excluded from turbine placement and the areas considered as high sensitivity avoided as much as possible. This was implemented in the proposed layout.

The overall significance of impacts expected to occur during the construction, operation, and decommissioning phases, **is expected to be low before mitigation, and very low after mitigation.**

Impacts may also be magnified due to cumulative impacts caused by other wind energy developments proposed in the area. The main direct cumulative impacts identified to potentially occur are: increased habitat loss, increased fatalities due to collision with various project infrastructures, and increased disturbance/displacement effects. The overall significance of cumulative impacts expected to occur is estimated to be moderate before mitigation, **and low after mitigation.**

Consequently, no fatal flaws were identified for the project, only very high (no-go) areas were identified which should be excluded from development due to the high sensitivity of the environmental features located within these areas. This was implemented in the proposed layout.

No-go alternative:
Should the Kudusberg Wind Farm not be constructed, then all impacts (whether it be negative or positive) identified within the impact analysis will not take place. As a result, it is expected that the present environmental characteristics relevant for the bat community on site will remain unchanged, relative to that which is being observed at present, under current land-use practices."

From the perspective of the impact on bats, the proposed Kudusberg WEF may be authorised subject to the implementation of the recommendations proposed in the Bat Impact Assessment.

Socio-Economic Impact Assessment

The proposed Kudusberg WEF will usher in notable positive impacts and contribute to the improvement of some of the main challenges experienced in the region and in both local municipalities. This includes the injection of expenditure which will stimulate production, create business opportunities and boost the economy. Furthermore, local employment creation will likely begin to address unemployment in the area, lead to higher household income and enhance skills development. Numerous stakeholders will evidently benefit, such as business, the community and government. Government revenue will be accrued and will most likely aid socio-economic development.

On the contrary, negative impacts may also be evident. The employment opportunities serve as a pull factor and will most likely attract job seekers. Further to this, migrant labour will need to be accommodated in the area. This culmination will result in an increased demand for services, housing and social facilities. This is exacerbated by the additional 19 similar projects authorised and proposed in the region. The increased number of vehicular and pedestrian traffic on the proposed project site may potentially lead to increases in crime incidents in the surrounding area if not mitigated properly.

Nonetheless, the net effect of the proposed project is positive as it ultimately leads to improved energy supply, increased energy security and indicates a path towards clean energy generation, which the country needs to curb climate change. This subsequently contributes to improved service delivery and socio-economic development. To improve the positive impact particularly for the local municipality, it is highly recommended that local procurement and employment is concentrated herein, as far as is feasible.

Positive impacts of high significance (before and after mitigation) were identified. These include the stimulation of the economy and the creation of employment opportunities.

<u>From a socio-economic perspective therefore, no objections are made with regard to the proposed project or its alternatives and it is recommended that the project is authorised.</u>

Noise Impact Assessment

The noise from the turbines at the identified noise sensitive areas is predicted to be less than the 35 dB(A) night limit and 45 dB(A) day/night limit for rural areas presented in SANS 10103:2008. **<u>The overall noise impact with recommended mitigation is expected to be negative and of very low significance before and after mitigation.</u>**

The results of the study indicate that the following conclusions can be drawn:

- There will be a short-term increase in noise in the vicinity of the site during construction as the ambient level will be exceeded. The impact during construction will be difficult to mitigate.
- The impact of low frequency noise and infra sound will be negligible and there is no evidence to suggest that adverse health effects will occur as the sound power levels generated in the low frequency range are not high enough to cause physiological effects.

Due to the potential low noise impacts associated with the construction and operational phases of the proposed Kudusberg WEF, it is recommended that the proposed WEF receives Environmental Authorisation from a noise perspective, provided that the mitigation measures in the NIA are adhered to.

Traffic Impact Assessment

It is assumed that the wind turbine components will be imported to South Africa via the Port of Saldanha, although the Port of Ngqura is a viable alternative. The preferred route from the Port of Saldanha utilizes existing National and Provincial Roads as far as possible, Alternative routes were assessed but these routes have geometrical constraints and include large sections of gravel roads that will require upgrading.

Two site Access Routes have been proposed and both alternatives were considered acceptable. However, the Access Road Alternative 1 is the preferred access alternative as it is an existing jeep track.

The main transport impacts will be during the construction and decommissioning phases of a WEF where the delivery of the infrastructure will generate significant traffic. The duration of these phases is short term i.e. the impact of the traffic on the surrounding road network is temporary and when the WEF is operational, do not add any significant traffic to the road network. **The traffic impact on the surrounding network is therefore deemed moderate following mitigation.**

Traffic generated by the construction activities of the WEF will have a significant impact on the road infrastructure, albeit of a short-term nature. Additionally, the construction of the WEF will create dust and noise pollution that will have a low (short term) impact during the construction and decommissioning phases.

No-go Alternative:

The no-go alternative implies that the proposed development of the Kudusberg WEF will not proceed. This would mean that there will be no negative environmental impacts and no traffic impact on the surrounding network. However, this would also mean that there would be no socio-economic benefits to the surrounding communities and it will not assist government in meeting the targets for renewable energy. Hence, the no-go alternative is not a preferred alternative.

The development is supported from a transport perspective provided that the recommendations and mitigations included in the TIA are adhered to.

EAP'S RECOMMENDATION

No negative impacts have been identified within this BA that, in the opinion of the EAP who have conducted this BA Process, should be considered "fatal flaws" from an environmental perspective, and thereby necessitate substantial re-design or termination of the project. This echo's the findings of the specialists as summarised above.

Section 24 of the Constitutional Act states that "everyone has the right to an environment that is not harmful to their health or well-being and to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures, that prevents pollution and ecological degradation; promotes conservation; and secures ecologically sustainable development and use of natural resources while promoting justifiable economic and social development." Based on this, this BA was undertaken to ensure that these principles are met through the inclusion of appropriate management and mitigation measures, and monitoring requirements. These measures will be undertaken to promote conservation by avoiding the sensitive environmental features present on site and through appropriate monitoring and management plans (refer to the EMPr in Appendix G of this BA Report).

It is understood that the information contained in this BA Report and appendices is sufficient to make a decision in respect of the activity applied for.

Based on the findings of the specialist studies, the proposed project is considered to have an **overall low negative environmental impact** and an **overall moderate positive socio-economic impact** (with the implementation of respective mitigation and enhancement measures). All of the specialists have recommended that the proposed project receives EA if the recommended mitigation measures are implemented.

Taking into consideration the findings of the BA Process, it is the opinion of the EAP, that the project benefits outweigh the costs and that the project will make a positive contribution to sustainable infrastructure development in the Matjiesfontein/Sutherland region. Provided that the specified mitigation measures proposed in the Socio-Economic Impact Assessment and all other specialist assessments are applied effectively, it is recommended that the proposed project receives EA in terms of the EIA Regulations promulgated under the NEMA.

Scope of assessment and content of BA in terms of Appendix 1 of EIA Regulations

APPENDIX 1	YES / NO	SECTION IN BA REPORT
Objective of the basic assessment process 2) The objective of the basic assessment process is to, through a consultative process- a) determine the policy and legislative context within which the proposed activity is located and how the activity complies with and responds to the policy and legislative context; b) identify the alternatives considered, including the activity, location, and technology alternatives; c) describe the need and desirability of the proposed alternatives; d) through the undertaking of an impact and risk assessment process inclusive of cumulative impacts which focused on determining the geographical, physical, biological, social, economic, heritage, and cultural sensitivity of the sites and locations within sites and the risk of impact of the proposed activity and technology alternatives on these aspects to determine- (i) the nature, significance, consequence, extent, duration, and probability of the impacts occurring to; and (ii) the degree to which these impacts- (aa) can be reversed;	Yes	**Section A of the report includes the Introduction (Section A.1), legislative review (Section A.8), alternatives assessment (Section A.8 & A.9) and needs and desirability (Section A.11).** **Section D includes a summary of the specialist studies and associated impact assessments undertaken, including mitigation measures. The full impact assessment for each specialist study (including nature, significance, consequence,**

<u>APPENDIX 1</u>	YES / NO	SECTION IN BA REPORT
(bb) may cause irreplaceable loss of resources; and (cc) can be avoided, managed or mitigated; and e) through a ranking of the site sensitivities and possible impacts the activity and technology alternatives will impose on the sites and location identified through the life of the activity to- (i) identify and motivate a preferred site, activity and technology alternative; (ii) identify suitable measures to avoid, manage or mitigate identified impacts; and (iii) identify residual risks that need to be managed and monitored.		**duration, extent, reversibility and irreplaceability is included in Appendix D of this BA Report.**
Scope of assessment and content of basic assessment reports 3) (1) A basic assessment report must contain the information that is necessary for the competent authority to consider and come to a decision on the application, and must include: (a) details of: (i) the EAP who prepared the report; and (ii) the expertise of the EAP, including a curriculum vitae;	**Yes**	**Section A.4 and Appendix H**
(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 coordinates of the boundary of the property or properties;	**Yes**	**Section A.2.2**
(c) a plan which locates the proposed activity or activities applied for as well as 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;	**Yes**	**Section A** **Figure A.23** **Figure D. 41 and Figure D.42**
(d) a description of the scope of the proposed activity, including all listed and specified activities triggered and being applied for; and a description of the activities to be undertaken including associated structures and infrastructure;	**Yes**	**Section A.8**
(e) a description of the policy and legislative context within which the development is proposed including- (i) an identification of all legislation, policies, plans, guidelines, spatial tools, municipal development planning frameworks, and instruments that are applicable to this activity and have been considered in the preparation of the report; and	**Yes**	**Section A.8**

APPENDIX 1	**YES / NO**	**SECTION IN BA REPORT**
(ii) how the proposed activity complies with and responds to the legislation and policy context, plans, guidelines, tools frameworks, and instruments;		
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;	**Yes**	**Section A.11**
(g) a motivation for the preferred site, activity and technology alternative;	**Yes**	**Section A.9**
(h) A full description of the process followed to reach the proposed preferred alternative within the site, including - (i) details of all the alternatives considered;	**Yes**	**Section A.9**
(ii) details of the public participation process undertaken in terms of regulation 41 of the Regulations, including copies of the supporting documents and inputs;	**Yes**	**Section 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;	**Yes**	**No issues have been raised by I&APs as yet. Comments received following the review of the Draft BAR will be incorporated into the Final BAR.**
(iv) the environmental attributes associated with the alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects;	**Yes**	**Section B**
(v) the impacts and risks identified for each alternative, 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;	**Yes**	**Section D** **Section A. 9** **(for the outcome of the site selection process) and Section A.10 (concluding statement on the preferred alternatives)**
(vi) the methodology used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks associated with the alternatives;	**Yes**	
(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;	**Yes**	
(viii) the possible mitigation measures that could be applied and level of residual risk;	**Yes**	
(ix) the outcome of the site selection matrix;	**Yes**	
(x) if no alternatives, including alternative locations for the activity were investigated, the motivation for not considering such; and	**Yes**	
(xi) a concluding statement indicating the preferred alternatives, including preferred location of the activity.	**Yes**	**Section A.10**

<u>APPENDIX 1</u>	YES / NO	SECTION IN BA REPORT
(i) a full description of the process undertaken to identify, assess and rank the impacts the activity 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;	Yes	**Section A.9** **Section D** **Appendix D**
(j) an assessment of each identified potentially significant impact and risk, including- (i) cumulative impacts; (ii) the nature, significance and consequences of the impact and risk; (iii) the extent and duration of the impact and risk; (iv) the probability of the impact and risk occurring; (v) the degree to which the impact and risk can be reversed; (vi) the degree to which the impact and risk may cause irreplaceable loss of resources; and (vii) the degree to which the impact and risk can be avoided, managed or mitigated;	Yes	**Section D** **Appendix D**
(k) where applicable, a summary of the findings and impact management measures identified in any specialist report complying with Appendix 6 to these Regulations and an indication as to how these findings and recommendations have been included in the final report;	Yes	**Section D** **Appendix D**
(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;	Yes	**Section E**
(m) based on the assessment, and where applicable, impact management measures from specialist reports, the recording of the proposed impact management outcomes for the development for inclusion in the EMPr;	Yes	**Section D**
(n) 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;	Yes	**Section E**
(o) a description of any assumptions, uncertainties, and gaps in knowledge which relate to the assessment and mitigation measures proposed;	Yes	**Section A.4** **Please refer to each specialist study included in Appendix D**

APPENDIX 1	YES / NO	SECTION IN BA REPORT
(p) 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;	**Yes**	**Section E**
(q) where the proposed activity does not include operational aspects, the period for which the environmental authorisation is required, the date on which the activity will be concluded, and the post construction monitoring requirements finalised;	**N/A**	
(r) an undertaking under oath or affirmation by the EAP in relation to - (i) the correctness of the information provided in the reports; (ii) the inclusion of comments and inputs from stakeholders and I&APs; (iii) the inclusion of inputs and recommendations from the specialist reports where relevant; and (iv) any information provided by the EAP to interested and affected parties and any responses by the EAP to comments or inputs made by interested and affected parties; and	**Yes**	**Appendix B**
(s) where applicable, details of any financial provisions for the rehabilitation, closure, and ongoing post decommissioning management of negative environmental impacts;	**X**	
(t) any specific information that may be required by the competent authority; and	**X**	
(u) any other matters required in terms of section 24(4)(a) and (b) of the Act.	**X**	
2) Where a government notice *gazetted* by the Minister provides for the basic assessment process to be followed, the requirements as indicated in such a notice will apply.	**X**	

Basic Assessment for the Proposed Development of the 325MW Kudusberg Wind Energy Facility and associated infrastructure, between Matjiesfontein and Sutherland in the Western and Northern Cape Provinces






DRAFT
BASIC ASSESSMENT REPORT

SECTION A: INTRODUCTION, PROJECT DESCRIPTION AND LEGISLATIVE REVIEW

A.1 Introduction

Kudusberg Wind Farm (Pty) Ltd (hereafter referred to as the applicant) is proposing to develop the Kudusberg Wind Energy Facility (WEF) with a maximum generation capacity of 325 MW at Kudusberg, a site approximately 45 km south-west of Sutherland in the Northern and Western Cape Provinces (hereafter referred to as the 'proposed WEF'). The proposed WEF is located within the Witzenberg and Karoo Hoogland Local Municipalities, which fall within the Cape Winelands and Namakwa District Municipalities respectively. The locality map is provided in Figure A.1.

The proposed project falls entirely within the Renewable Energy Zone (REDZ) 2 (i.e. Komsberg REDZ), that was Gazetted in February 2018 by the Minister of Environmental Affairs (GN 114). In terms of the National Environmental Management Act (Act 107 of 1998, as amended) (NEMA) and the 2014 NEMA EIA Regulations promulgated in Government Gazette 40772 and Government Notice (GN) R326, R327, R325 and R324 on 7 April 2017, wind and solar Photovoltaic (PV) projects located within a REDZs are subject to a Basic Assessment (BA) and reduced decision-making period by the authorities.

A BA Process in terms of Appendix 1 of the Environmental Impact Assessment (EIA) Regulations (2014, as amended) has therefore been undertaken for the proposed project. This BA Report has been compiled to provide an assessment of the proposed Kudusberg WEF. It excludes the assessment of the associated powerline to connect the proposed Kudusberg WEF to the Komsberg substation, via the Bon Espirange substation) as this will be assessed as part of a separate BA process that will be undertaken at a later stage.

This Draft BA Report is currently being released for a 30-day commenting period. Comments received on the Draft BA Report will be included and responded to in the Final BA Report that will be submitted to the CA, i.e. the national Department of Environmental Affairs (DEA) for decision-making.

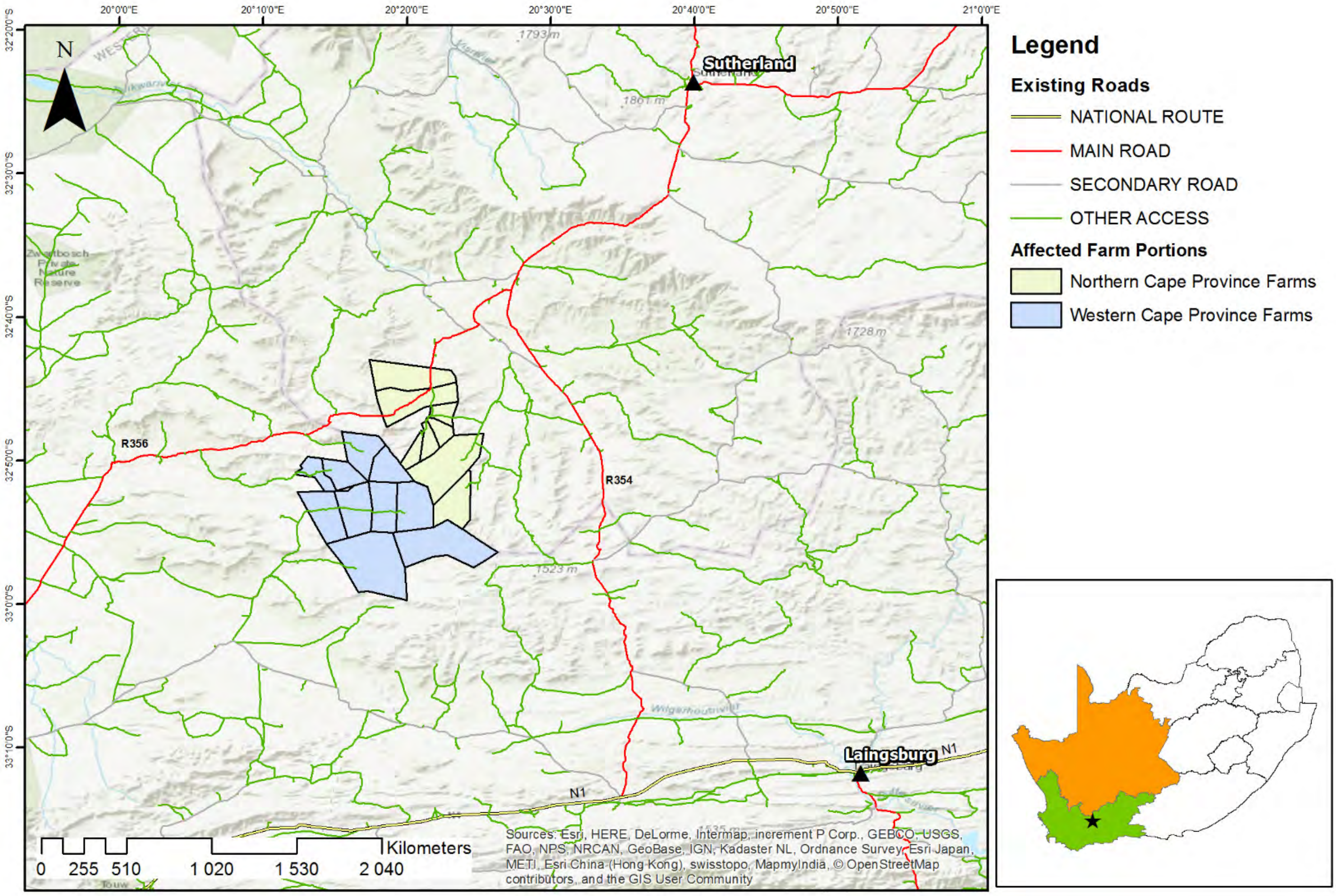

Figure A.1: Locality map of the proposed Kudusberg WEF

A.2 Project overview

A.2.1 General overview

As noted above, the proposed project falls entirely within the REDZ 2 (i.e. Kombsberg REDZ), that was Gazetted in February 2018 by the Minister of Environmental Affairs (Figure A.2). The REDZs represent areas where wind and solar PV development is being incentivised from resource, socio-economic and environmental perspectives. The Wind and Solar Strategic Environmental Assessment (SEA) identified REDZs in five provinces, namely the Eastern Cape, Western Cape, Northern Cape, Free State and North West, as defined in Notice No. 114 – Notice for Renewable Energy Development Activities procedure to apply for Environmental Authorisation (EA) - in Government Gazette No 41445 of 16 February 2018.

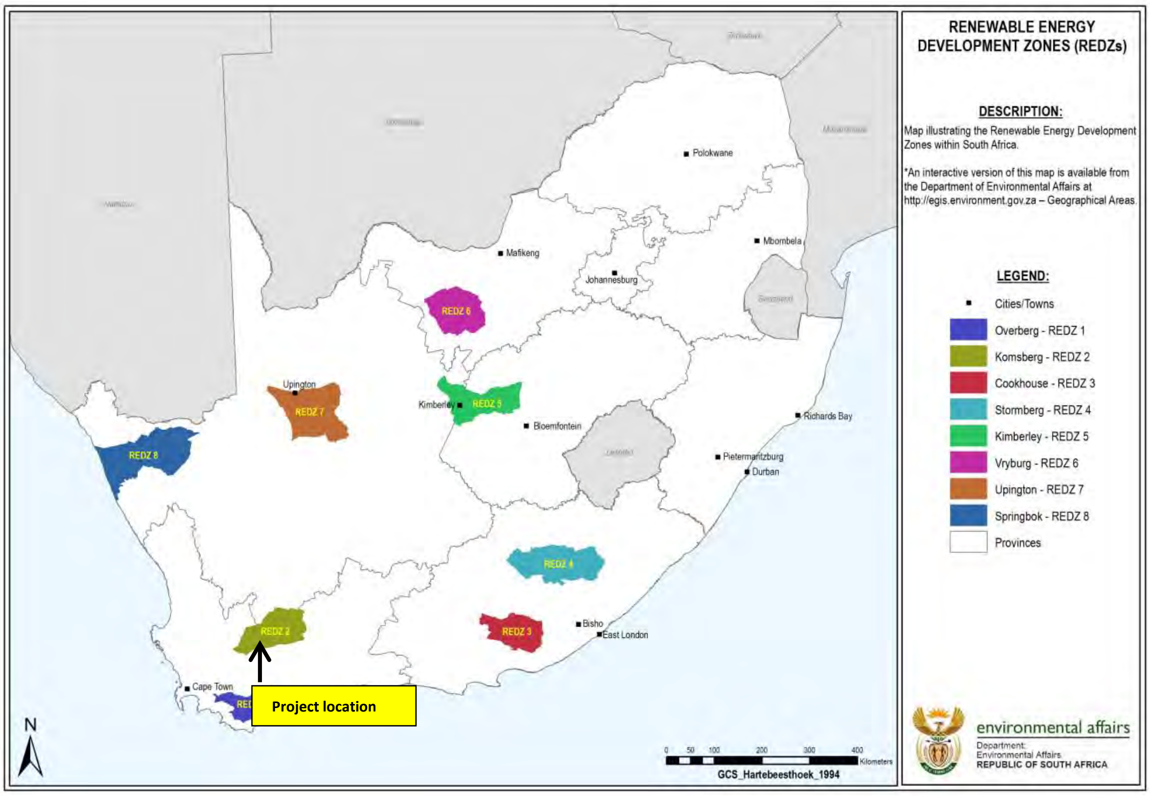

Figure A.2: Projects location in relation to the REDZ 2 (Komsberg REDZ)

The proposed Kudusberg WEF will comprise of a maximum of 56 turbines with a hub height and rotor diameter of up to 140 m and up to 180 m, respectively. The development footprint of the proposed WEF will be approximately 126 ha. The key components of the proposed Kudusberg WEF are discussed in more detail in section A.3 below.

A.2.2 Project location

The proposed Kudusberg WEF, including the associated road infrastructure, will be developed on the land portions indicated in Table A.1 in the Western Cape and Northern Cape Provinces.

Table A.1: Land portions that will be affected by the proposed Kudusberg WEF and associated road infrastructure

Number	Farm name and number	SG Code
Western Cape:		
1	Portion 1 of 156 Gats Rivier Farm	C01900000000015600001
2	Portion 2 of 156 Gats Rivier Farm	C01900000000015600002
3	Remainder of 156 Gats Rivier Farm	C01900000000015600000
4	Portion 1 of 157 Riet Fontein Farm	C01900000000015700001
5	Portion 1 of 158 Amandelboom Farm	C01900000000015800001
6	Remainder of 158 Amandelboom Farm	C01900000000015800000
7	Portion 1 of 159 Oliviers Berg Farm	C01900000000015900001
8	Remainder of 159 Oliviers Berg Farm	C01900000000015900000
9	Portion 2 of 157 Riet Fontein Farm	C01900000000015700002
10	Remainder of 161 Muishond Rivier Farm	C01900000000016100000
11	Remainder of 395 Klipbanks Fontein Farm	C01900000000039500000
Northern Cape:		
12	Portion 4 of 193 Urias Gat Farm	C07200000000019300004
13	Portion 6 of 193 Urias Gat Farm	C07200000000019300006
14	Remainder of 193 Urias Gat Farm	C07200000000019300000
15	Remainder of 194 Matj es Fontein Farm	C07200000000019400000
16	Remainder of 196 Karree Kloof Farm	C07200000000019600000
Properties affected by public access road:		
17	169 Zeekoegat Farm	C07200000000016900000
18	Portion 1 of 170 Roodeheuvel Farm	C07200000000017000001
19	Remainder of 170 Roodeheuvel Farm	C07200000000017000000
20	Remainder of 190 Wind Heuvel Farm	C07200000000019000000
21	Portion 1 of 190 Wind Heuvel Farm	C07200000000019000001
22	Portion 5 of 193 Urias Gat Farm	C07200000000019300005
23	Remainder of 171 Vinke Kuil Farm	C07200000000017100000
24	Alkant Re/220 Farm	C07200000000022000000
25	Portion 1 of 174 Lange Huis Farm	C07200000000017400001

The co-ordinates of the centre and boundary/corner points of the project site are detailed in Table A.2 below.

Table A.2: Co-ordinates of the Centre and Corner Points of the Kudusberg WEF project site

Site	Point	Latitude	Longitude
Kudusberg WEF	Centre	32° 52.952'S	20° 19.397'E
	North	32° 40.498'S	20° 24.963'E
	North-East	32° 49.917'S	20° 22.099'E
	South-East	32° 54.111'S	20° 23.063'E
	East	32° 43.897'S	20° 29.538'E
	South-West	32° 55.534'S	20° 16.415'E
	North-West	32° 52.213'S	20° 14.345'E
	South	32° 55.243'S	20° 20.179'E

The affected land portions of the Kudusberg WEF are shown in Figure A.3.

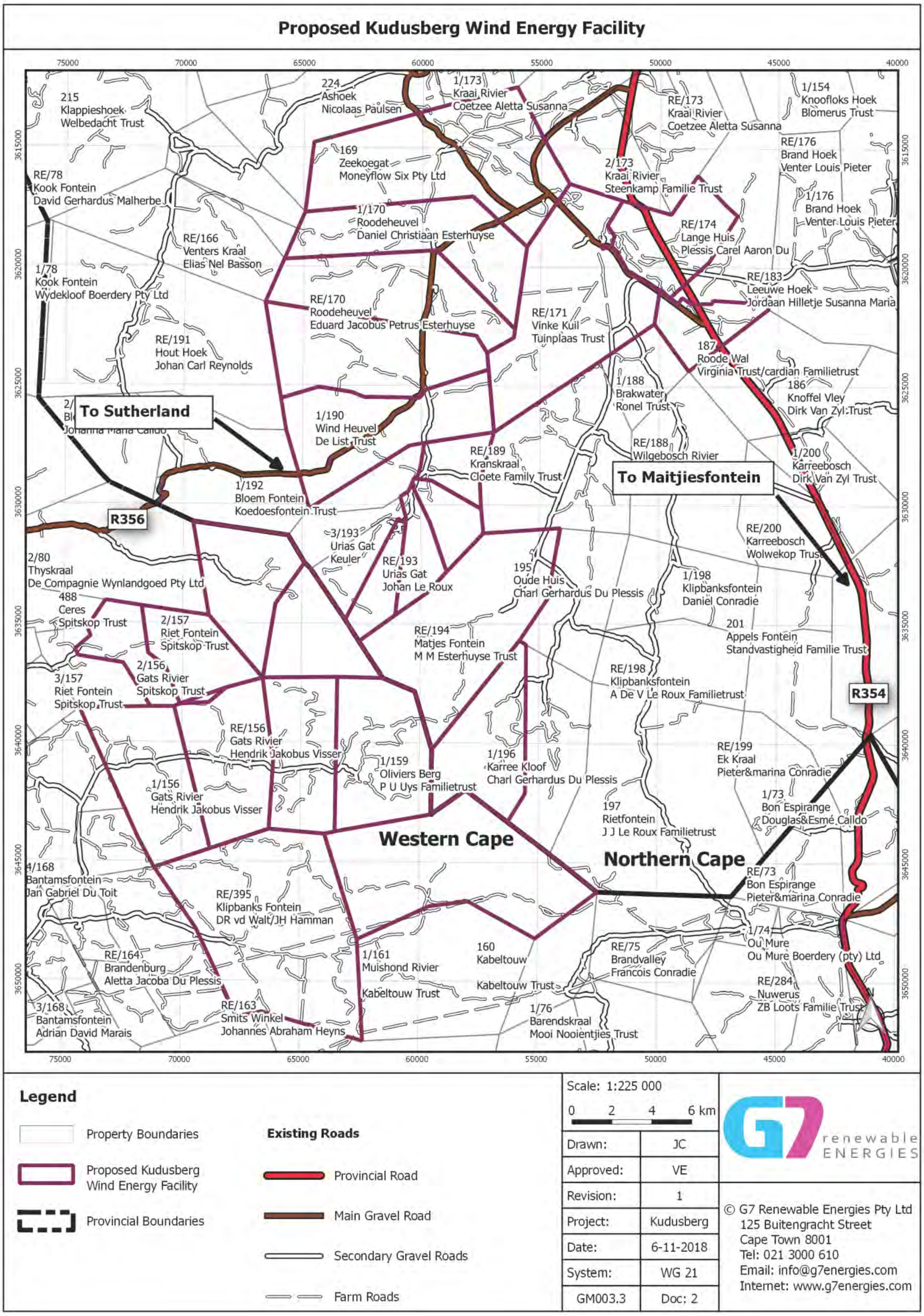

Figure A.3: Affected land portions for the proposed Kudusberg WEF.

A.3 Project description

This section provides an overview of the conceptual project design and an overview of the site and technology selection process for the Kudusberg WEF, as provided by the project applicant.

The purpose of this section is to present sufficient project information on the proposed Kudusberg WEF (including the facility itself and the associated infrastructure) to inform the BA Process in terms of design parameters applicable to the project.

As noted above, Kudusberg Wind Farm (Pty) Ltd is proposing to develop the Kudusberg WEF and associated infrastructure including and on-site substation near Sutherland and Matjiesfontein in the Northern Cape and the Western Cape. While the exact type and generation capacity of the turbines are yet to be finalised, the turbines are expected to have a combined maximum generation capacity of 325 MW. The proposed Kudusberg WEF will consist of a maximum of 56 individual turbines which will be positioned at strategic locations that have been informed by the specialists on the project team.

A.3.1 Key components of the proposed Kudusberg WEF

It is important to note at the outset that the exact specifications of the proposed project components will be determined during the detailed engineering phase (subsequent to the issuing of an EA, should such an authorisation be granted for the proposed project, and shortly before construction commences). In line with the precautionary approach and in order to ensure that any environmental impacts which may arise as a result of the project are adequately assessed in the BA, worst-case scenarios and estimates have been provided in this section. For example, the current project description is representative of a worst-case scenario in terms of the total number of turbines proposed for implementation, as it reflects the maximum number of wind turbines which may be implemented, i.e. 56 turbines. The maximum hub height and rotor diameter are also provided i.e. 140 m and 180 m respectively and were considered by the specialists.

The total physical footprint of the proposed project (i.e. maximum 56 turbines and supporting infrastructure) is estimated to be approximately 126 ha.

Once commercial operation date is achieved, the proposed facility will generate electricity for a minimum period of 20 years. The properties on which the WEF is to be constructed will be leased by the project owner from the property owners for the life span of the project.

All high resource areas along the ridges of the relevant properties, as well as potential locations for all supporting infrastructure were assessed during the BA process. Based on the specialist inputs, the footprint of the wind turbines has been amended through detailed technical planning to avoid environmentally sensitive areas as much as possible, while still retaining a technically and financially viable layout. The total extent of the affected areas is approximately 30 000 ha. As the proposed Kudusberg WEF requires approximately 126 ha of land, there is spatial scope to avoid major environmental constraints through optimisation of the final design. Figure A.4 indicates the initial project layout, including the associated infrastructure.

A summary of the key components of the proposed project is described below. Furthermore, technical components forming part of the proposed WEF are discussed in detail in Sections A.3.2 and A.3.3 below.

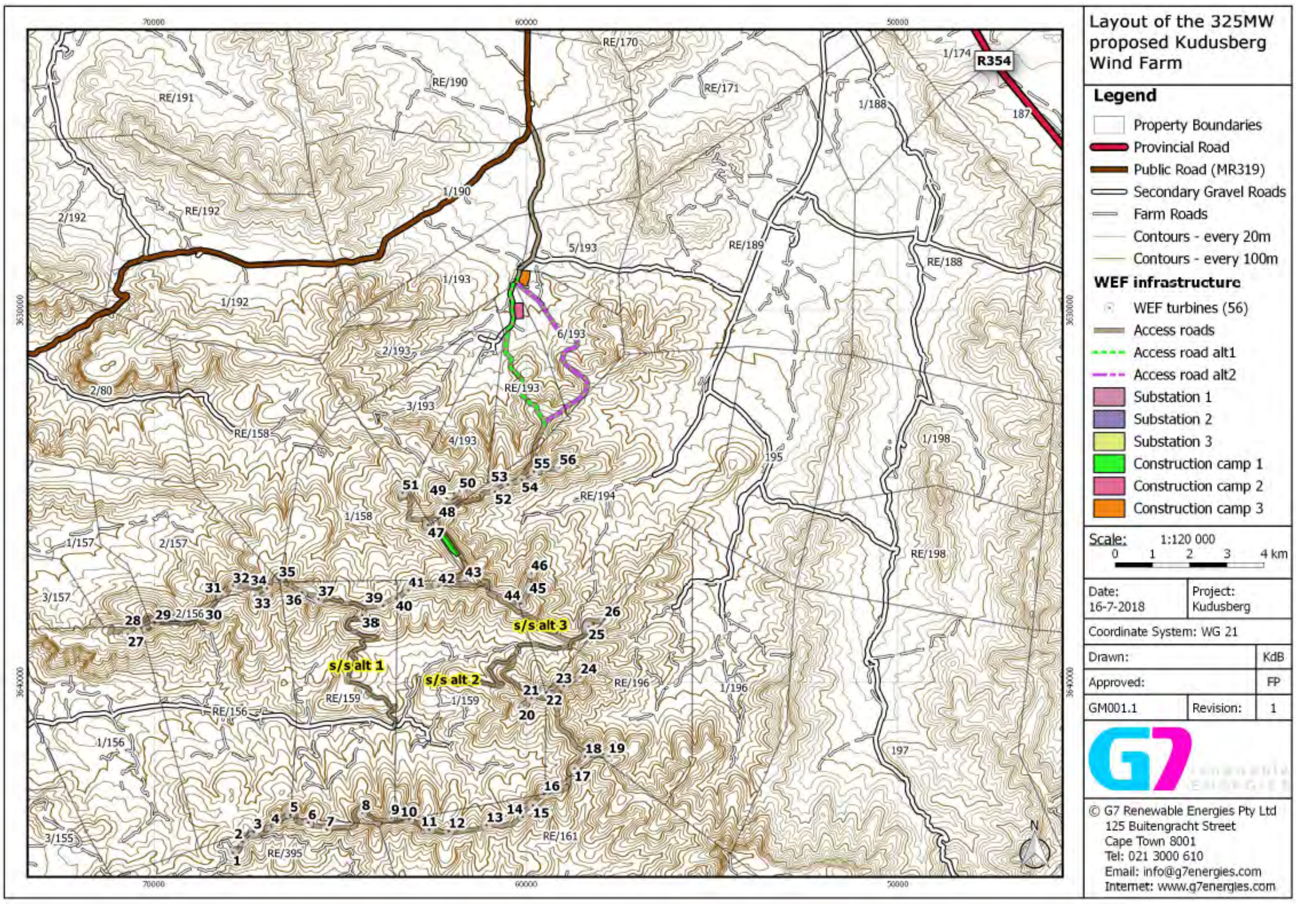

Figure A.4: The initial project layout for the proposed Kudusberg WEF (including the alternatives for the infrastructure components)

- ***Wind turbines:***
  - Maximum number of 56 turbines;
  - Approximate hub height of up to 140 m and rotor diameter of up to 180 m;
  - Blade length of up to 90 m;
  - Reinforced concrete foundation: 30 m x 30 m; at a depth of 5 m;
  - Crane pad (hard stand areas): 90 m x 50 m at each turbine (total footprint 25.2 ha); and
  - Turbine capacity: 3 MW – up to 6.5 MW.

- ***Collector substation:***
  - One 33/132kV onsite substation will be constructed on site. The 33 kV footprint was assessed in this BA and the 132 kV footprint will be assessed in a separate BA process as the current applicant will remain in control of the low voltage components of the 33/132 kV substation, whereas the high voltage components of this substation will likely be ceded to Eskom shortly after the completion of construction. The total footprint of this onsite substation will be approximately 2.25 ha;
  - Electrical transformers (690 V/33 kV) adjacent to each turbine (typical footprint of 2 m x 2 m, but can be up to 10 m x 10 m at certain locations) to step up the voltage to 33 kV; and
  - Underground 33 kV cabling between turbines buried along access roads, where feasible, with overhead 33 kV lines grouping turbines to crossing valleys and ridges outside of the road footprints to get to the onsite 33/132 kV substation.

- ***<u>Operations and Maintenance building:</u>***

  - Operations and Maintenance (O&M) buildings of approximately 1 ha. These buildings will comprise the following:
    - General ware house;
    - Chemical product storage area;
    - Ablution facilities;
    - Control room;
    - Relay room;
    - Switch gear area;
    - Parking area, reception area, offices, ablution facilities;
    - Workshops, storage areas for materials and spare parts;
    - Water storage tanks;
    - Septic tanks and sewer lines to service ablution facilities; and
    - Central waste collection and storage area.

- ***<u>Construction site office area and laydown area (used during construction and rehabilitated thereafter):</u>***

  - Temporary infrastructure including a construction camp (~12.6 ha) which includes an on-site concrete batching plant for use during the construction phase.

- ***<u>Access road:</u>***

  - The proposed access to the site is from the tarred R354 connecting Matjiesfontein and Sutherland, turning west onto the district gravel road DR02249 and then heading southwest onto the R356 (MR00319) provincial gravel road from where the main access road (MN04469/OG51) branches off towards the south.

- ***<u>Internal access roads:</u>***

  - Internal access roads up to 12 m wide, including structures for stormwater control would be required to access each turbine and the associated infrastructure, with a total footprint of about 82.44 ha. Where possible, existing roads will be upgraded. Turns will have a radius of up to 50 m in order for abnormal loads (especially turbine blades) to access the various turbine positions.
  - A 200 m wide corridor along the access roads are proposed to allow for micro-sitting.

- ***<u>Wind measuring masts:</u>***

  - Up to 4 x 140 m tall (depending on the final hub height) wind measuring lattice masts strategically placed within the wind farm development footprint to collect data on wind conditions during the operational phase.

- ***<u>Other infrastructure:</u>***

  - Fencing of approximately 4 m high around the construction camp, on-site substation and the batching plant;
  - Temporary infrastructure to obtain water from available local sources/ new or existing boreholes including a potential temporary above ground pipeline (approximately 35 cm diameter) to feed water to the on-site batching plant. Water will potentially be stored in temporary water storage tanks. The necessary approvals from the Department of Water and Sanitation will be applied for separately; and
  - Stormwater channels and culverts.

The proposed Kudusberg WEF's collector substation will connect to the Komsberg substation via a 132 kV overhead transmission line and the Bon Espirange substation. Note that this transmission infrastructure will be assessed under a separate BA process. The proposed Kudusberg WEF will consist of the components presented, but not limited to, in Figure A.5 below.

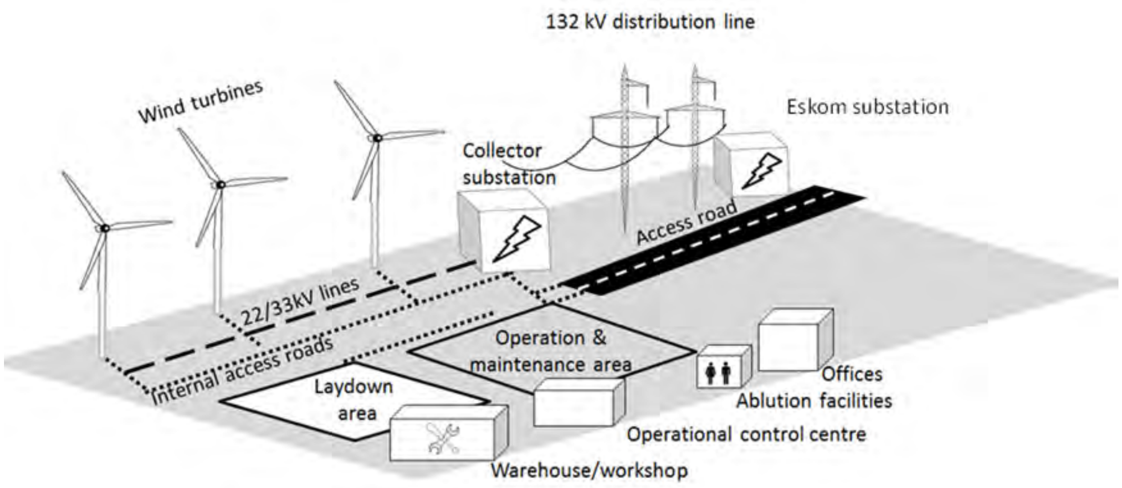

Figure A.5: Diagrammatic representation of the components of the proposed Kudusberg WEF

A.3.1.1 General Description of a Wind Turbine and Wind Turbine Technology

Wind turbines generate electricity by converting movement or kinetic energy produced by the wind into electricity. Different turbine technologies achieve this through slightly different means. A typical horizontal-axis wind turbine consists of a number of components, which work together to generate electricity as depicted in Figure A.6 below. When the rotor spins the shaft, the shaft spins the assembly of magnets, which generate voltage in the coil of wire. This voltage provides alternating electrical current which can then be distributed through powerlines. The wind turbine tower supports the rotor and nacelle and provides the height for the rotor blades to clear the ground safely, and to capitalise on atmospheric wind resources which occur approximately 80 - 200 m above the earth's surface. It is anticipated that the individual wind turbines and rotor blades will have maximum heights of approximately up to 140 m and a rotor diameter of approximately up to 180 m.

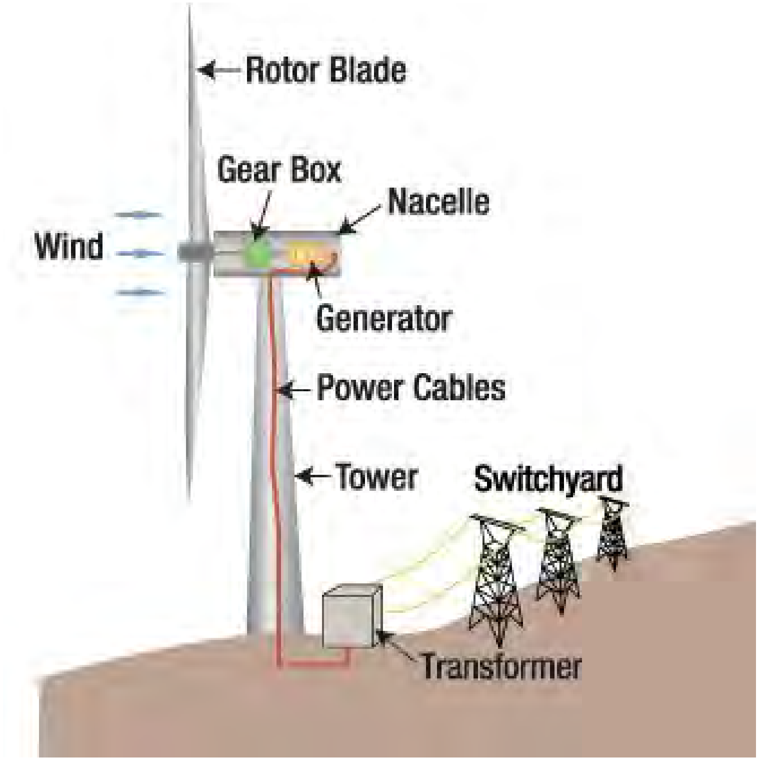

Figure A.6: Generic design for a wind turbine (*Source*: Tennessee Valley Authority, Wikimedia).

The energy output of a wind turbine ultimately depends on the size of the generator, velocity of the wind, the height of the hub, and the length of the rotor blades. Wind turbines operate at a range of wind speeds and have a start-up speed, which is the speed at which the blades and rotor start to rotate, and a cut-in speed, which reflects the minimum wind speed at which usable power is generated. This is typically about 3 - 4 m/s with full power output occurring at higher wind speeds of approximately 8 to 12 m/s. Wind turbines are also equipped with a cut-out speed or pitch control system as a safety feature to prevent mechanical damage at high or turbulent wind speeds. The cut-out speed is the highest wind speed after which a wind turbine will stop producing power, and a braking system will be activated. This is typically between 25 and 28 m/s depending on the manufacturer and type of turbine selected for implementation. The pitch control system will turn the rotor out of the mean wind direction and change the orientation of the blades, so the rotor will capture lower wind speeds and the output power of generator stays within the allowed range. Once the wind drops below the cut-out speed back to a safe level, the turbine can resume normal operation.

Even though wind turbines are relatively high they do not require extensive land space. Each turbine will have a concrete base. The concrete foundation of each turbine will have a footprint of approximately 30 x 30 m in diameter at a depth of 5 m, and a crane platform of up to 90 m x 50 m (total footprint 25.2 ha) that will be established next to each turbine. The comparatively small base of the turbine allows other existing land use activities to continue uninterrupted in the space underneath and around the turbine. Conventional large scale development footprints often lead to habitat fragmentation and interference with fauna. As such the micro-siting of the wind turbines will be in an optimum position (proposed layout) that minimises the possibility of habitat fragmentation and interference with movement of fauna.

In terms of wind turbine technology to be used as part of the proposed development, the project applicant is currently considering a range of wind turbine designs and capacity. The exact turbine specifications have not been determined yet. Some turbine specifications will only be finalised closer to construction. However, the “worst-case scenario” was presented and assessed by the specialists.

The turbine technology selection process shall be subjected to further wind analysis and is also dependent on technical and commercial viability that will be finalised before construction.

A.3.1.2 Associated Infrastructure

Construction Laydown and Hardstand Areas

During construction, a construction camp area with a maximum footprint of ~12.6 ha. This area will include a temporary batching plant and for offices, administration, operations and maintenance buildings during the operational phase. The on-site operation and maintenance area is required to support the functioning of the proposed Kudusberg WEF and provide services to personnel who will be responsible for the operation and routine maintenance of the facility. The proposed infrastructure entails establishment of the following: operational control centre, workshop or warehouse, ablution facilities, site offices, on-site substation building, security enclosures, and an area for the storage of maintenance equipment.

During the project lifecycle, crane areas (hardstand areas) (including boom erection, storage and assembly area) will be established adjacent to each turbine. These hard stand areas will be utilised by cranes during the construction phase (and also possibly when maintenance is done in the operational phase). The crane pad will be established at each wind turbine. The crane pad will support turbine assembly, off-loading and storage during the construction phase. A schematic illustration of a typical hard stand area and crane platform is provided in Figure A.7 below.

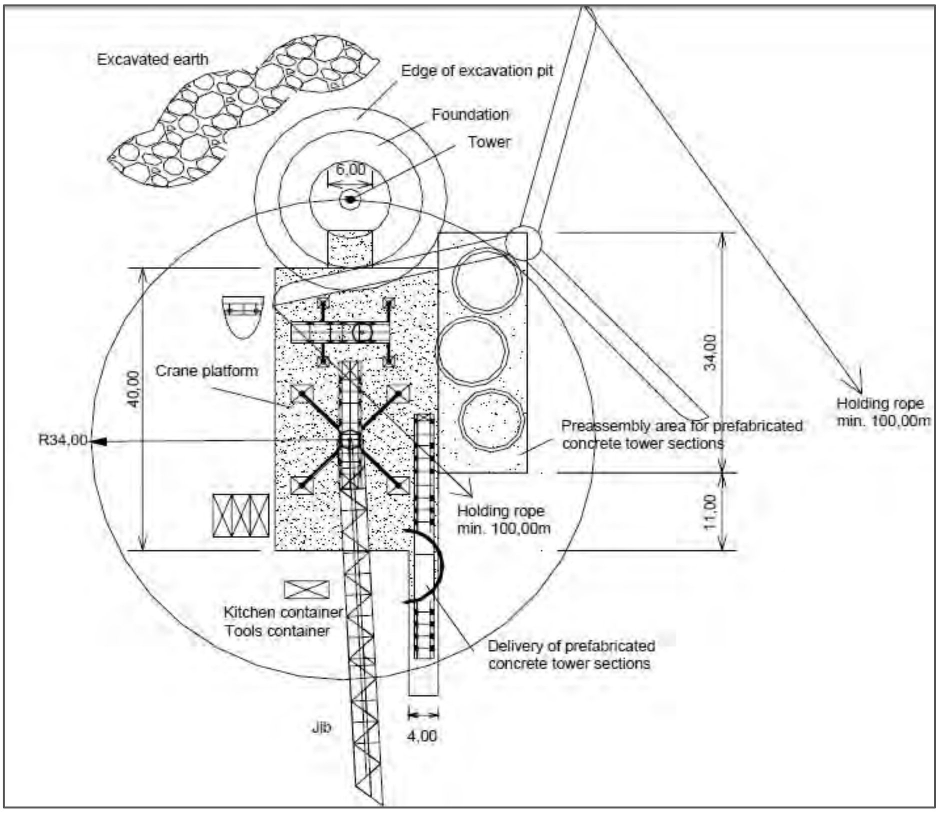

Figure A.7: Example of a hard-standing area and crane pad.

Fencing

For various reasons (such as security, public protection and lawful requirements), the proposed facility will be secured via the installation of boundary fencing. Permanent fencing will be required around the O&M Building and on-site substation. Temporary fencing will be required around the batching plant and the construction camp. The fencing is planned to be approximately 4 m high.

Access points will be managed and monitored by an appointed security service provider. The type of fencing is yet to be determined and detailed design will follow as the development progresses.

Stormwater Channels and Water Pipelines

Stormwater drainage systems will be constructed on site to ensure that stormwater run-off from site is appropriately managed. Water from these systems will not contain any chemicals or hazardous substances, and will be released into the surrounding environment based on the natural drainage contours.

Other infrastructure

Where practical and possible, the internal cabling (33 kV) will be routed underground between each turbine and will be located alongside on-site access roads as far as possible. This will reduce the visual impact of the proposed project, and the risk of collision with overhead powerlines for birds and provides increased security against cable theft. However, it is important to note that the extent to which cabling may be routed underground would be dependent on site conditions present along the cabling route. Once internal overhead lines are designed, the bird and bat specialist would need to consider the design and recommend additional mitigation measures where appropriate, prior to the applicant submitting the final layout to DEA. All cabling constructed on site must be bird friendly.

A.4 Project team

In accordance with Regulation 12 (1) of the 2014 NEMA EIA Regulations (as amended, GN R326), the Applicant has appointed the Council of Scientific and Industrial Research (CSIR) to undertake the BA Process in order to determine the biophysical, social and economic impacts associated with undertaking the proposed development.

The BA is being managed by the **Environmental Assessment Practitioner (EAP), Minnelise Levendal. Professional Natural Scientist (Pri. Sci. Nat. registered,117078):**

Minnelise is a Senior EAP in the Environmental Management Services (EMS Group) of the CSIR and holds a Master's degree in Botany from the Stellenbosch University. She also obtained her BSc (Education) and BSc (Honours) degrees at the University of the Western Cape. She has 15 years of experience in Environmental Management (which includes nine years working as an EAP). Before she joined the CSIR she was employed at the Western Cape Department of Environmental Affairs and Development Planning (DEA&DP) where she assessed EIAs, BAs and EMPs. Minnelise is currently managing various EIAs and BAs for wind and solar renewable energy projects in South Africa. Minnelise was the CSIR project manager for the 100 MW Ubuntu WEF near Jeffrey's Bay (EA granted in June 2012), as well as the 50 MW Banna Ba Pifhu WEF proposed by WKN Wind current near Humansdorp in the Eastern Cape (EA granted in July 2014). She was the project manager of ten BAs for wind monitoring masts in South Africa as part of the National Wind Atlas Project of the Department of Energy (DoE). EAs for all the ten masts were obtained from DEA in 2010. Minnelise was also the Project Leader for seven solar PV facilities near Kenhardt for Mulilo in the Northern Cape in 2016. Four of these projects received EA, and two are currently under appeal (the applicant withdrew one project). Minnelise is currently the Project Manager of the Special Needs and Skills Development Programme of DEA which *provides pro bono* environmental assessments (BAs) to applicants with special needs, i.e. who do not have the financial means to appoint an EA to undertake a BA for their small-scale projects. Thirty BAs have been undertaken under this Programme of which 20 received EAs to date.

Minnelise is supported by the Project Manager, **Lizande Kellerman. (Quality Assurance & Internal Review, CSIR): (Pr.Sci.Nat. Number 400076/10)**

Lizande holds a Bachelor's degree in Zoology and Entomology, with an Honours and Masters in Botany both at the University of Pretoria. She is currently completing her PhD in Conservation Ecology. She has more than 10 years' experience in environmental assessment and management studies, primarily in planning, preparing, managing and conducting environmental impact assessments (BA & EIAs), environmental management plans (EMPs), environmental screening studies, fatal flaw assessments, ploughing rights and license applications for air emissions, water use, waste management, mining, bioprospecting and biodiversity permitting for numerous projects in the agricultural (including aquaculture), construction, conservation and mining sectors. The past decade she's gained experience in environmental auditing and legal compliance of various projects throughout rural South Africa, focusing on agro-processing of essential oil crops and indigenous plant species with cosmetic, medicinal and nutritional value. She has been a full-time employee of the CSIR since January 2012 working in the Enterprise Creation for Development (ECD) unit in Pretoria. Since April 2016, she's been working as a Principal Environmental Assessment Practitioner (EAP) in the CSIR's Environmental Management Services (EMS) group in Stellenbosch. She is also a registered Professional Natural Scientist (Pr.Sci.Nat. Number 400076/10 - Botanical Sciences) with the SACNASP. Her main focus the past two years is to undertake a national-scale Strategic Environmental Assessment (SEA) for Aquaculture development in South Africa on behalf of the National Departments of Environmental Affairs (DEA) and Agriculture, Forestry and Fisheries (DAFF). In addition, she has also been involved in BAs and EIAs for various renewable energy projects, specifically wind farms in the Northern and Western Cape provinces.

The project will also be informed by various specialist studies undertaken by external specialists.

The project team which is involved in this BA Process is listed in Table A.3 below.

Table A.3: The BA Project Team

ROLE/STUDY TO BE UNDERTAKEN	ORGANISATION	NAME
Environmental Management Services (CSIR)		
EAP (*Pr. Sci. Nat.*)	**CSIR**	Minnelise Levendal
Technical Advisor and Quality Assurance	**CSIR**	Lizande Kellerman
Mapping	**CSIR**	Surina Laurie
Specialist Assessment		
Visual Impact	SiVEST SA (Pty) Ltd	Andrea Gibb
Heritage: Archaeology	Private	Katie Smuts
Heritage: Cultural Landscape	Hearth Heritage	Emmylouw Rabe
Heritage: Palaeontology	Natura viva cc	Dr John Almond
Agriculture & Soils	Private	Johann Lanz
Terrestrial Ecology	Ekotrust cc	Dr Noel van Rooyen
Aquatic Ecology	BlueScience (Pty) Ltd	Toni Belcher
Birds & Bats	BioInsight	Craig Campbell
Noise Impact	SAFETECH	Dr Brett Williams
Socio-Economic	Urban-Econ Development Economists	Elena Broughton and Conrad Swart
Transportation	JG AFRIKA (Pty) Ltd	Iris Wink

A.4.1 Wake loss effect

In addition to the environmental impacts, DEA has recently by means of industry correspondence, expressed concerns around the wake loss effect of one wind farm on another. Therefore, Kudusberg wind farm has entered into confidential commercial agreements with directly adjacent wind farms namely the Karreebosch, Brandvalley and the Rondekop Wind Farms and can warrant to DEA that this impact was considered and addressed with all surrounding wind farm project companies. All other proposed wind farms are too far from Kudusberg wind farm to experience a wake loss effect. Therefore, not further technical studies are required.

A.4.2 Assumptions and limitations of specialist studies

Below is a summary of the assumptions and limitations of the specialist studies undertaken for the Kudusberg WEF BA. Please refer to Appendix D for the full specialist studies where these aspects are discussed in more detail.

Visual

The following assumptions and limitations apply:

- The visual study has been undertaken based on the project description provided by the client and the CSIR at the inception of the project.

- Although photographs were taken during the site visit, these have been supplemented with additional imagery and photographs which were sourced from the internet as photographs could not be taken from certain locations in the study area (such as from all of the accommodation facilities at SR1 and SR2).

- 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 8 km from the proposed WEF – i.e. an area of 8 km from the boundary of the application site. This 8 km limit on the visual assessment zone relates to the importance of distance when assessing visual impacts. Although the WEF may still be visible beyond 8 km, the degree of visual impact would diminish considerably and as such the need to assess the impact on potential receptor locations beyond this distance would not be warranted.

- Despite the fact that the study area or visual assessment zone encompasses a zone of 8 km from the boundary of the application site, the distance from the nearest proposed turbine position was used when determining the zones of visual impact for the identified visual receptor locations (both sensitive and potentially sensitive). As such, even though a receptor location may be located within a negligible visual impact zone, it was still taken into consideration for the purposes of this study.

- The identification of visual receptor locations has been based on a combination of desktop assessment as well as field-based observation. Initially Google Earth imagery, 2018 was used to identify potential visual receptor locations within the study area. Thereafter a three (3) day site visit was undertaken between the 25th and 27th of July 2018 (winter) to verify the sensitive visual receptor locations within the study area and assess the visual impact of the development from these receptor locations. 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 location in an area potentially affected by the proposed development does not therefore necessarily mean that visual impacts will be experienced.

- Due to access limitations during the field investigation and the inaccessible mountainous nature of the study area, the identified potentially sensitive visual receptor locations (such as farmsteads and dwellings) could not be visited and investigated during the field investigation. As such several broad assumptions have been made in terms of the sensitivity of the receptors to the proposed development. All identified receptor locations were regarded as being potentially sensitive to the visual impacts associated with the proposed development and were assessed as part of the VIA.

- Impact rating assessments for the sensitive and potentially sensitive visual receptor locations have been undertaken in this VIA report. A matrix has been developed to assist in the assessment of the potential visual impact at each visual 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 three (3) 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 visual receptor location by the proposed WEF development. The matrix should therefore be seen as a representation of the likely visual impact at a visual receptor location. The results of the matrix should be viewed in conjunction with the visualisation modelling exercise to gain a full understanding of the likely visual impacts associated with the proposed WEF development.

- No feedback regarding the visual environment has been received from the public participation process to date. Any feedback from the public during the review period of the Draft Basic Assessment Report (DBAR) will however be incorporated into further drafts of this report, if relevant.

- A viewshed analysis was undertaken to identify parts of the study area from where the proposed WEF development would not be visible. Despite the fact that receptor locations situated within these areas are not expected to experience a visual impact as a result of the development of the proposed WEF, these locations were still taken into consideration for the purposed of this study.

- The viewshed analysis does not take into account any existing vegetation cover or built infrastructure which may screen views of the proposed development. In addition, detailed topographic data was not available for the broader study area and as such the visibility analysis does not take into account any localised topographic variations which may constrain views. This analysis should therefore be seen as a conceptual representation or a worst-case scenario.

- The visual sensitivity analysis is based purely on the likely degree of visibility of the wind turbines from the potentially sensitive receptors. This analysis does not therefore 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 sensitive and potentially sensitive receptor locations.

- Due to the varying scales and sources of information as well as the fact that the terrain data available for the study area (NGI 25m DEM) is fairly coarse and somewhat inconsistent; 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 DEM.

- As the study area lies within the Sutherland Central Advantage Area, it is assumed that pilot activated lighting methods, as prescribed by the CAA, will be utilised for obstacle lighting on the turbines and that other lighting on the WEF site will be kept to a minimum. As such, the night-time environment in the study area was not fully investigated and only general measures to mitigate the impact of additional light sources on the ambiance of the nightscape have been provided.

- The visual study has been based on the design and layout information for the proposed development which was made available by the client the CSIR. The potential visual impact of the typical infrastructure associated with a WEF development has also been assessed.

- The assessment of receptor-based impacts has been based on the turbine layout provided by the client and the CSIR. It is however recognised that this is a preliminary layout and is subject to changes based on a number of potential factors, including the findings of the BA studies. The turbine sizes, numbers and/or locations may thus change, which may require a re-assessment of the visual impacts on identified receptor locations.

- The cumulative impact assessment in this VIA has been based on the information made available by the Environmental Assessment Practitioner (EAP), namely the CSIR. In addition, this cumulative impact assessment is based on broad assumptions as to the likely impacts of these developments.

- Visualisation modelling from all sensitive and potentially sensitive receptor locations has not been undertaken. 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 development. The visual models represent a visual environment that assumes that all vegetation cleared during construction will be restored to its current state after the construction phase. This is however an improbable scenario as some vegetation cover may be permanently removed which may reduce the accuracy of the models generated. At the time of this study the proposed project was still in the planning phase and as such the turbine layouts, as provided by the client, may change. Although infrastructure associated with the facility has not been included in the models, this is not considered to be a major limitation as the visual impact of associated infrastructure would be minor when considering the infrastructure next to the wind turbine.

  It should be noted that the fieldwork was undertaken in late July 2018, during late winter. The study area is however typically characterised by low levels of rainfall all year round and therefore the season is not expected to affect the significance of the visual impact of the proposed development

- The overall weather conditions in the study area have certain visual implications and are expected to affect the visual impact of the proposed development to some degree. Clear weather conditions, as experienced during the field visit, tend to prevail throughout the year in the study area. In these clear conditions, the wind turbines would present a greater contrast with the surrounding environment than they would on a cloudy overcast day. The weather conditions during the time of the study were therefore taken into consideration when undertaking this VIA.

Heritage (including Archaeology and Cultural Landscape)

The following limitations apply:

- The vast area and hilly terrain, as well as the expansive layout of the proposed development meant that exhaustive survey was not possible.
- Areas between spot checks conducted from the vehicle were not surveyed and could contain heritage resources, however this risk is mitigated by the requirement to undertake a final site walkthrough prior to the finalisation of the layout before construction

commences.

- Farm roads were in variable condition, which made progress across the study area slow and limited the time available for foot survey.
- The survey can only account for artefacts and archaeological features visible on the ground, and sub-surface heritage that could be present could not be verified.
- Limited previous research has been undertaken in the area in terms of cultural landscape assessments.
- No stakeholder participation was conducted to determine intangible heritage resources for the purposes of the cultural landscape assessment. Stakeholder engagement will be done as part of the BA process.

Palaeontology

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

1. 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.
2. 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 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.
3. Inadequate sheet explanations for geological maps, with little or no attention paid to palaeontological issues in many cases, including poor locality information;
4. 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;
5. 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 present case, site visits to the various loop and borrow pit study areas in some cases considerably modified our understanding of the rock units (and hence potential fossil heritage) represented there.

In the case of the present study area in the Klein Roggeveld region near Sutherland (Western and Northern Cape) exposure of potentially fossiliferous bedrocks is very limited, due to extensive cover by superficial sediments and karroid *bossieveld* vegetation. However, sufficient exposures were examined to allow a realistic assessment of their palaeontological sensitivity (See Appendix 1 of the PIA in Appendix D), while a substantial amount of relevant geological and palaeontological data is available from previous PIAs in the region (See, for example, references under Almond). Confidence levels for this assessment are accordingly rated as *medium*. Comparatively few academic palaeontological studies have been carried out in the region so any new data from impact studies here are of scientific interest.

Agriculture

The following assumptions were used in this specialist study:

- The study assumes that water for irrigation is not available across the site. This is based on the assumption that a long history of farming experience in an area will result in the exploitation of viable water sources if they exist, and none have been exploited in this area.
- Cumulative impacts are assessed by adding expected impacts from this proposed development to existing and proposed developments with similar impacts in a 50 km radius. The existing and proposed developments that were taken into consideration for cumulative impacts are listed in Appendix B of the Agricultural study included in Appendix D of this BA Report.

The following limitation was identified in this study:

- The assessment rating of impacts is not an absolute measure. It is based on the subjective considerations and experience of the specialist, but is done with due regard and as accurately as possible within these constraints.

There are no other specific limitations or knowledge gaps relevant to this study.

Terrestrial Ecology

The following assumptions, limitations or uncertainties are listed regarding the ecological assessment of the Kudusberg site:

- Two site visits were conducted: the first from 17 to 20 July 2018 and the second from 5 to 13 September 2018. The timing of these site visits coincided quite well with the flowering time of most of the SCC (see section 6. Flora).
- The area has been poorly collected and the list of plant species that could potentially occur on site was therefore taken from a far broader area than the study site.
- The terrain is fairly inaccessible with few roads to the crests where most of the development is planned.
- Rare and threatened plant and animal species are usually not easily spotted and can easily be missed.
- The site layout was presented as Google.kml images but the proposed roads were not finalised at the time of the site visits.
- It should be borne in mind that the sensitivity map provided in the SEA (CSIR, 2015) was based on an earlier version of the mapping of CBAs in the Western

Cape. The SEA sensitivity map is therefore noted, but the sensitivity map produced in this study is used as benchmark.

- Cumulative impacts are assessed by adding expected impacts from this proposed development to existing and proposed developments with similar impacts in a 50 km radius of the site. The existing and proposed developments that were taken into consideration for cumulative impacts include:
  - Brandvalley WEF;
  - Esizayo WEF
  - Gunstfontein WEF NC;
  - Hidden Valley WEF NC;
  - Karreebosch Wind Farm NC & WC;
  - Konstabel Renewable Energy;
  - Maralla East;
  - Maralla West;
  - Perdekraal Renewable Energy Western Cape;
  - Rietkloof WEF;
  - Rietrug WEF NC;
  - Roggeveld WEF WC & NC;
  - Rondekop WEF;
  - Sutherland Wind Farm NC & WC;
  - Suurplaat WEF NC & WC; and
  - Witberg WEF WC.

Freshwater Ecology

Limitations and uncertainties often exist within the various techniques adopted to assess the condition of ecosystems. The methodologies and techniques used in this assessment have been developed nationally and are typically of a rapid nature as is required for this freshwater impact assessment.

No baseline long-term monitoring was undertaken as part of this assessment. In addition, there is very little existing information available for the aquatic features within the study area. Data was utilised for adjacent aquatic ecosystems and where available more detailed assessments were used for the aquatic features within the area. The nature of the proposed activities however also allows them to be placed some distance from any mapped aquatic features such that the likely impacts would be very low. It is usually the associated infrastructure that has the potential to have a greater impact on the aquatic features. The impacts of roads and powerlines on the aquatic features are however well understood and can be effectively mitigated to ensure the impacts remain low. The preferred mitigation measure is to limit the disturbance to aquatic features as far as possible by avoiding and minimising the number of crossings and providing adequate buffer areas. This will also ensure that the cumulative impacts will remain low.

The ground-truthing of aquatic features was undertaken during winter when the use of vegetation as an indicator was possible. However, given the topography at the site, it was not possible to cover the site in a high level of detail. Extrapolation of the areas ground-truthed to those not covered was thus done using the latest available aerial imagery for the site.

Cumulative impacts of the proposed project were assessed by reviewing all available documentation for the other wind energy facilities within a 50 km radius of the site, particularly in terms of the aquatic features occurring on site; the proposed mitigation measures and the indicated potential impacts to these ecosystems as well as the association of these ecosystems with that within the study area.

The level of aquatic assessment undertaken was considered to be adequate for this study. No further fieldwork will be required, if the proposed project activities remain outside of the delineated aquatic features and the recommended buffers.

Avifauna (Birds)

The following assumptions and limitations apply:

- The pre-construction bird monitoring is based on both primary (data collection) and secondary data sources, such as those indicated in section 1.1.5 of the Avifauna Impact Assessment (Appendix D of this report).
- Any inaccuracies or lack of information in the bibliographic sources consulted could limit this study. In particular, the SABAP1 data is now fairly old (Harrison *et al*., 1997). To surpass this possible problem in the data used, the more recent and updated SABAP2 was consulted. However, the number of lists submitted for this area in the SABAP 2 is not yet adequate for the single use of this more recent data source. Therefore, both South African Bird Atlases (Project 1 and 2) were consulted in a complementary way. Species were considered as being possibly present within the study area if they occurred in any of the pentads, QDGS or wetland sites considered for analysis. Coordinate Avifauna Roadcounts data and Coordinated Waterbird Counts data was also requested for consideration in this study.
- As vantage points had good visibility conditions, it was assumed that not only flying birds but also individuals on the ground should be detected. However, large terrestrial birds which do not fly often or spend long periods on the ground, would be more difficult to detect on hilly or wooded areas. This fact directly implies that activity indexes for these species can be underestimated. To deal with this issue a vehicle based transect was set up in the development area. This allowed moving through the area and having different perspectives over topographic features - therefore increasing the chance of detecting these types of birds, though activity indexes obtained through these two different methods cannot be directly compared.
- Vantage point surveys are only conducted during daylight. Therefore, any bird movement occurring at night is not recorded.
- At this stage, no inter-annual variations are taken into consideration as only one year of data has been collected. Nevertheless, the basis for comparisons with subsequent years has been established.
- The recommendations on the current version of the applied guidelines were followed to the maximum extent possible and exceeded whenever feasible. The methodologies implemented were adjusted to the specificities of the area. Compliance and any deviations from the guidelines are presented in this report.
- Mitigation measures pertaining to any avifaunal component that are inherent to the project design, include the complete avoidance of any areas that are considered to have a very high sensitivity (i.e. no-go areas).
- Cumulative impacts are assessed by adding expected impacts from this proposed development to existing and proposed developments with similar impacts, within a 50km

radius. The existing and proposed developments that were taken into consideration for cumulative impacts are listed in Appendix 2 of the Avifauna Impact Assessment.

Bats

- The pre-construction bat monitoring is based on both primary (data collection) and secondary data sources, such as those indicated in section 1.1.5 of the Bat Impact Assessment in Appendix D of this BA Report
- In South Africa, data on migratory paths of bats is still largely unknown, this limiting the ability to determine if the wind farm might have impact on migratory species.
- Any inaccuracies or lack of information in the bibliographic sources consulted could limit this study. In particular, 8 years have passed since the leading literature that is available for bat distribution in South Africa has been updated (Monadjem et al., 2010).
- Bat detectors were installed and used according to the manufacturer's indications. However, data gaps still occurred due to technical limitations of the detector and/or unavoidable malfunctions. Nevertheless, a sampling effort of more than 75% of the year was obtained as per the requirements of the 4th Edition of the "South African Good Practice Guidelines for Surveying Bats in Wind Farm Developments" (Sowler et al., 2016).
- At this stage, no inter-annual variations are taken into consideration as only one year of data has been collected. Nevertheless, the basis for comparisons with subsequent years has been established.
- The very high sensitivity areas (no-go areas) identified for the bat community are to be excluded from development (excluding the use/upgrading of existing roads).
- The quantification or even evaluation of cumulative impacts is uncertain as there is not a generalised knowledge of the large-scale movements or connection between bat populations within the greater area. If present, cumulative impacts will be reflected on a very rapid decline of bat populations far from the impacts expected from a single wind energy facility operation. As such, further monitoring during the operational phase will be beneficial in helping to determine the presence of this type of impact.
- Cumulative impacts are assessed by adding expected impacts from this proposed development to existing and proposed developments with similar impacts in a 50 km radius. The existing and proposed developments that were taken into consideration for cumulative impacts are listed in Appendix 1 of the Bat Impact Assessment.

Socio-Economic

The following assumptions and limitations apply:

- The secondary data sources used to compile the socio-economic baseline, although not exhaustive, can be viewed as being indicative of broad trends within the study area.
- Possible impacts and stakeholder responses to these impacts cannot be predicted with complete accuracy, even when circumstances are similar, and these predictions are based on research and years of experience, taking the specific set of circumstances into account.
- It is assumed that the motivation and ensuing planning and feasibility studies for the project were done with integrity and that all information provided to the specialist by the project proponent and its consultants to date is accurate.

- With regard to the telephonic interviews undertaken, the following assumption is made:
  - Questions asked during the interviews were answered accurately.

The following approved and proposed energy developments within a 50 km radius were taken into consideration as they have the potential to create supplementary positive or negative socio-economic impacts identified in this study or vice versa. A list of these projects is provided in Appendix 3 of the Socio-Economic Impact Assessment in Appendix B of this BA Report.

Noise

The following assumptions and limitations are applicable to this study:

- The turbine positions were supplied by the applicant and are accepted as an accurate layout for the purposes of the environmental impact assessment.
- The worst-case scenario impacts were modelled i.e. wind from any direction, not only the prevailing wind, maximum turbine size as required for the site and the worst-case meteorological conditions.
- No wind noise masking effect is considered.
- The noise levels at the identified noise sensitive areas could thus be lower if the wind noise masks the turbine noise emissions.
- For the cumulative impact assessment, it was assumed that all proposed projects would enter into construction. Although this is very unlikely, the assumption was made in order to assess the worst-case scenario.

Traffic

The following assumptions and limitations apply:

- This study is based on the project information provided by G7/CSIR and the subsequent site visit.
- Due to access constraints during the site visit and the topography of the area, certain sections of the proposed WEF development could not be assessed and reasonable assumptions were hence made.
- It is assumed that the turbine positions would be optimized in the future and that the exact and final turbine locations have not been provided. Therefore, turbine corridors were used as an indication of the possible location.
- According to the Eskom Specifications for Power Transformers (Eskom Power Series, Volume 5: Theory, Design, Maintenance and Life Management of Power Transformers), the following dimensional limitations need to be kept when transporting the transformer – total maximum height 5 000 mm, total maximum width 4 300 mm and total maximum length 10 500 mm.
- Maximum vertical height clearances along the haulage route is 5.2 m for abnormal loads.
- The imported elements will be transported from the most feasible port of entry, which is deemed to be Port of Saldanha. It is expected that the inverter will be imported and shipped.

- All haulage trips will occur on either surfaced national and provincial roads or existing gravel roads.
- Material for the construction of internal access roads will be sourced locally as far as possible.

A.5 Site Access and Transportation of Construction material and Wind Turbine Components to Site

The nearest towns in relation to the proposed WEF site are Matjiesfontein, Sutherland, Touws River and Laingsburg. It is envisaged that the majority of materials, plant and labour will be sourced from these towns (except for Matjiesfontein which is mainly a tourism town) and transport to the WEF will be via the N1 and R354 or R356.

Concrete batch plants and quarries in the vicinity could be contracted to supply materials and concrete during the construction phase, which would reduce the impact on traffic on the surrounding road network. Alternatively, mobile concrete batch plants and temporary construction material stockpile yards could be commissioned on vacant land near the proposed WEF site. Delivery of materials to the mobile batch plant and the stockpile yard could be staggered to minimise traffic disruptions.

It is envisaged that most materials, water, plant, services and people will be procured within a 100 km radius from the proposed WEF, however, this would be informed by the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) requirements.

A.5.1 Site Access

The proposed main access to the site is from the tarred R354 connecting Matjiesfontein and Sutherland, turning west onto the district gravel road DR02249 (public road) and then heading southwest onto the R356 (MR00319) provincial gravel road from where the main access road (MN04469/OG51, public road) branches off towards the south (Figure A.8).

Internal access roads up to 12 m wide, including structures for storm water control, are required to access each turbine and the substation, with a total footprint of about 82.44 ha. Where possible, existing roads will be upgraded. Turns will have a radius of up to 50 m for abnormal loads (especially turbine blades) to access the various turbine positions. The final site access will be optimised within a 200 m corridor.

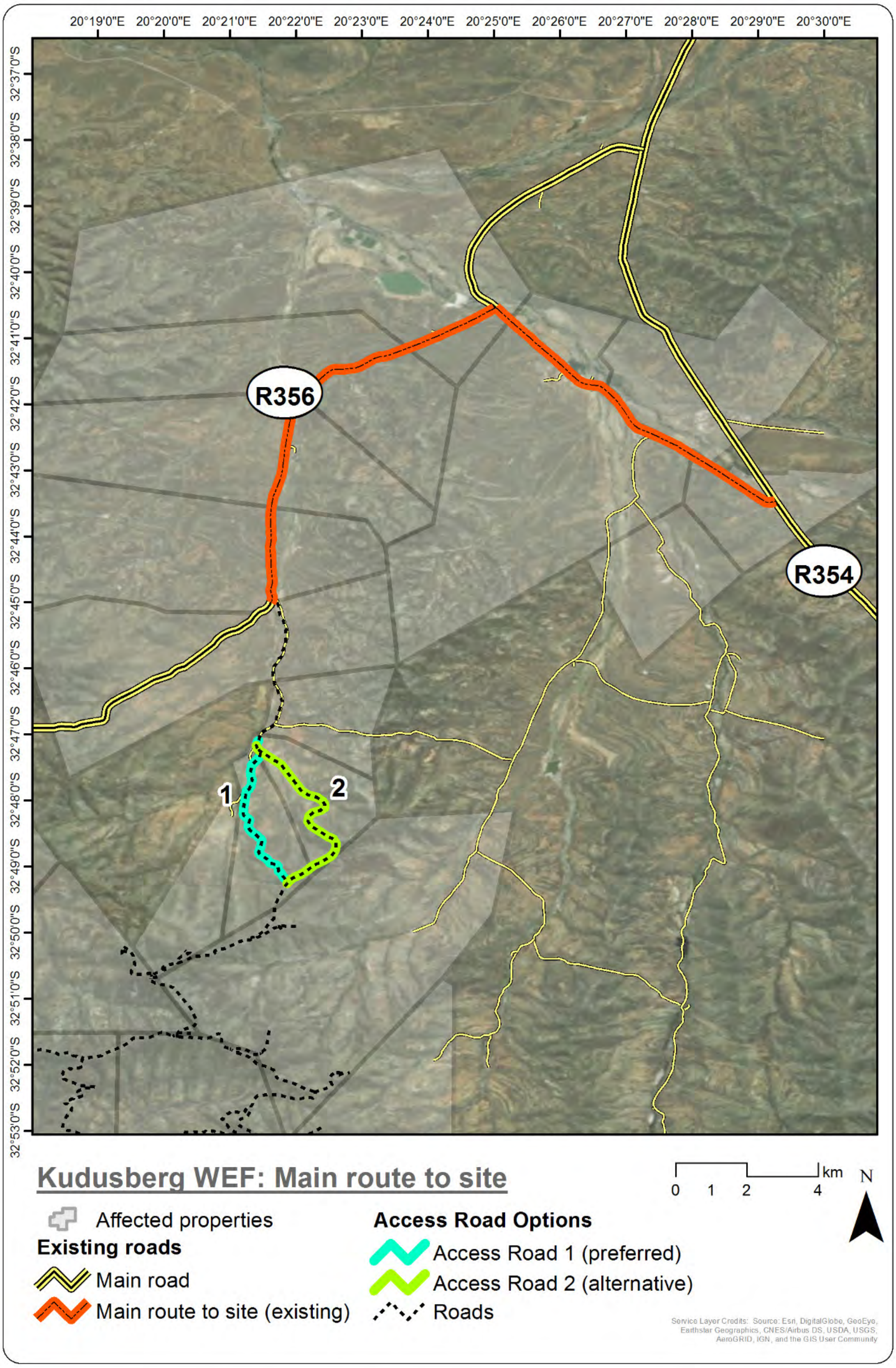

Figure A.8: Main route to the Kudusberg WEF site

The project applicant appointed JG AFRIKA to undertake a Transportation Impact Assessment (TIA) for the proposed Kudusberg WEF. The TIA assessed the expected traffic related impacts of the proposed facility during the construction, operation and subsequent decommissioning phases. The purpose of the study was also to consider the traffic impact that the facility will have on the surrounding road network and environment, and to propose mitigating measures to address these impacts, where required. See Appendix D for a full copy of the assessment.

A.5.2 Routes for Transportation of Wind Turbine Components to Site

A.5.2.1 National Route to Site

The most suitable port where turbine components can be transported from is the Port of Saldanha, which is located 392 km travel distance from the site. However, the Port of Ngqura in Coega, Port Elizabeth can be considered as an alternative.

The preferred route for abnormal load vehicles will be from the port, heading east on the R45 to Hopefield and onto the R311 at Moorreesburg (see Figure A.9). At Hermon, the abnormal load vehicle will travel on the R46 to Ceres, passing Gouda and Tulbagh. The abnormal load vehicle will turn right at the R355/R46 intersection and continue on the R46 towards the N1. At Matjiesfontein on the N1, the vehicle will turn north onto the R354, left at DR02249, left at R356 and west onto MN04469.

Figure A.9: Preferred route from Port to WEF site

An alternative route exists along the R27/N1, as shown in Figure A.10 below. This route, however, has geometrical constraints (mountain pass, tunnel, steep gradients etc.) that would negatively impact the transportation of the components.

Figure A.10: Alternative Route 1

An alternative option exists to access the proposed site via the R355, avoiding the N1 highway, as shown in the Figure A.11 below. This route follows the same alignment as the Preferred Route to the R46, turning right onto the R355 and then heading east on the R356 to the R356/MN04469 intersections. The section of R356 would require upgrading of the road and an assessment of the drainage structures along the route. This route, however, would require extensive upgrading and there is a significant number of drainage structures located along the route. Although the upgrade work would be extensive, this is a potential viable alternative.

Figure A.11: Alternative Route 2

It is critical to ensure that the abnormal load vehicle will be able to move safely and without obstruction along the preferred routes. The preferred route should be surveyed to identify problem areas e.g. intersections with limited turning radii and sections of the road with sharp horizontal curves or steep gradients, that may require modification. After the road modifications have been implemented, it is recommended to undertake a "dry-run" with the largest abnormal load vehicle, prior to the transportation of any turbine components, to ensure that the delivery of the turbines will occur without disruptions.

It needs to be ensured that the gravel sections of the haulage routes remain in good condition and will need to be maintained during the additional loading of the construction phase and reinstated after construction is completed.

A.5.2.2 Access to the proposed WEF

Access to the proposed WEF will be provided via the MN04469 which is a public road. Two access road alternatives would connect MN04469 to the new wind farm road network between the turbines. These roads are shown in Figure A.12 below and described below:

- Access Road Alternative 1 – An existing jeep track. Approximately 4.6 km in length.
- Access Road Alternative 2 – New road. Approximately 5.7 km in length.

Both access road alternatives are considered suitable. However, access road alternative 1 is deemed the preferred access road as it is an existing jeep track.

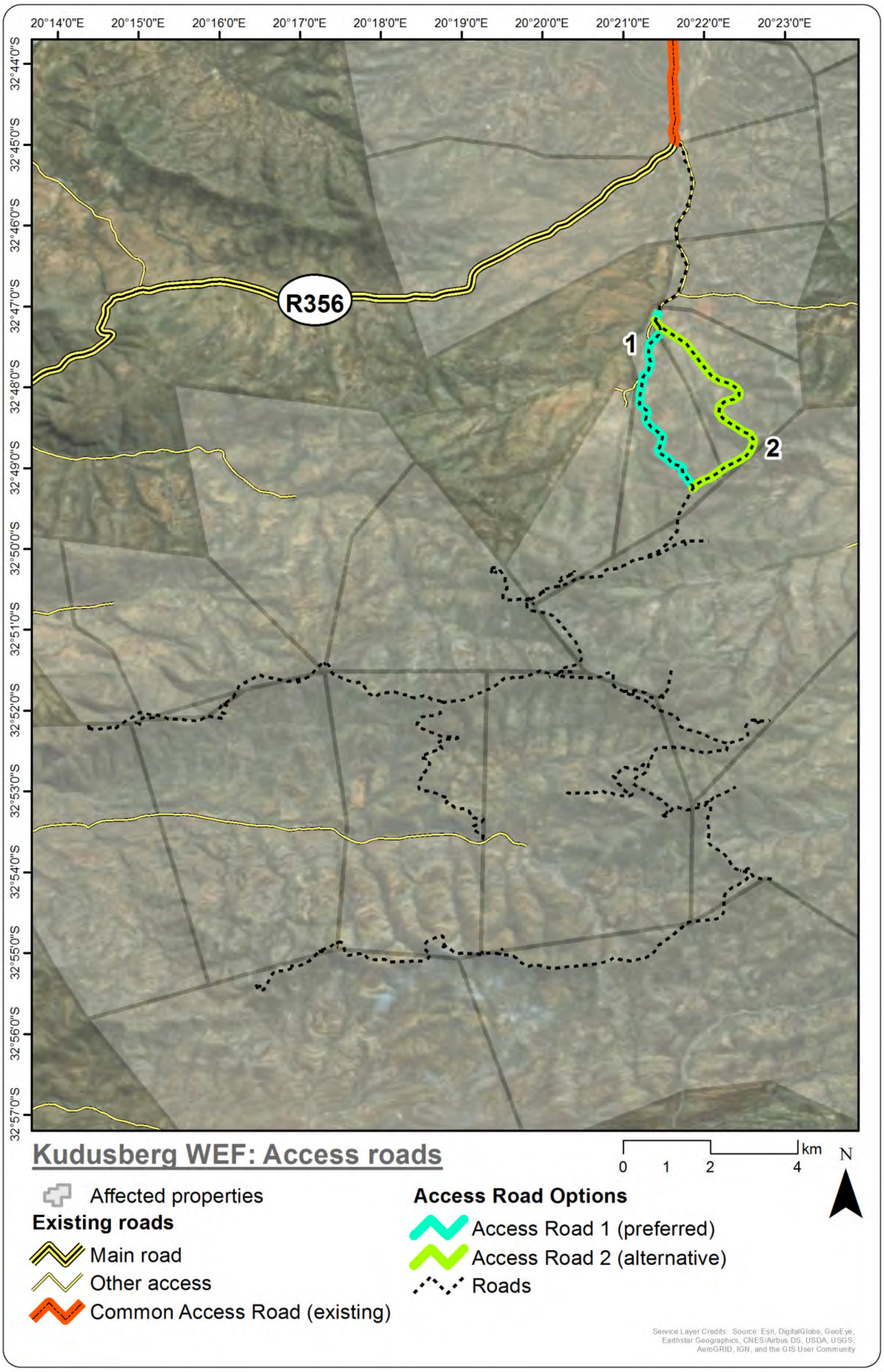

Figure A.12: Access Road Alternatives to the proposed Kudusberg site

A minimum required road width of 4 meters needs to be kept and all turning radii must conform with the specifications needed for the abnormal load vehicles and haulage vehicles.

A.5.3 Transportation of wind turbines to site

For the transportation of the turbines to the WEF site, it was assumed that the turbine blades will be transported separately to site. Consequently, for each wind turbine three abnormal loads will be required for the blades, seven abnormal loads for the tower sections and another abnormal load for the nacelle (11 abnormal loads in total). All further components will be transported with normal limitations haulage vehicles. In terms of the Road Traffic Act (Act 29 of 1989) the trucks delivering turbine components will be considered as abnormal loads. Approval may have to be obtained from National, Provincial and Local CAs for the transportation of abnormal heavy components. Figure A.13 to Figure A.16 below provide examples of transportation of some of the turbine components.

Figure A.13: Tower section being transported.

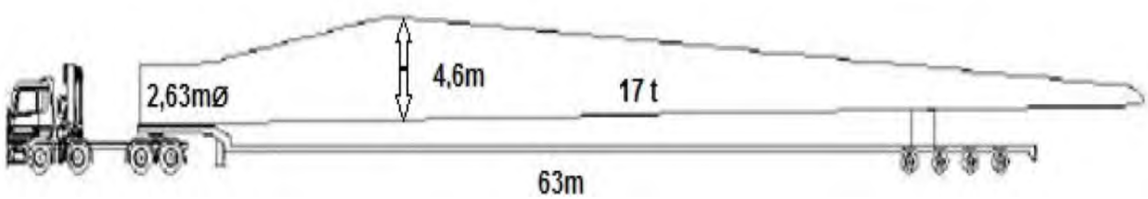

Figure A.14: Rotor blade being transported.

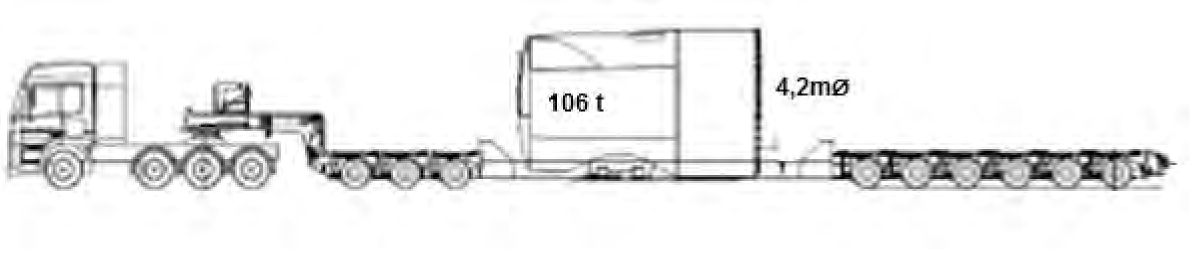

Figure A.15: Nacelle being transported.

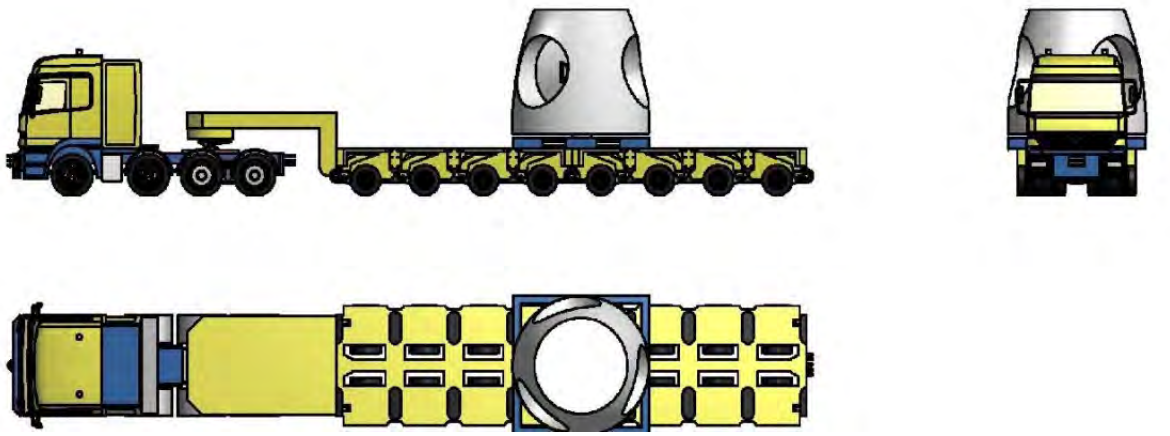

Figure A.16: Hub and Rotary units being transported.

Note: Photos from Transportation study: prepared by JG AFRIKA (PTY) LTD, 2018

A.6 Service Provision: Water, Sewage and Waste Requirements

Kudusberg Wind (Pty) Ltd will first consult with the two municipalities in order to confirm the supply of services (in terms of water, waste removal, sewage and electricity) for the proposed project. The municipalities will be consulted as part of the 30-day public review period of this report and the confirmation services provision will be included in the Final BA Report. However, it must be noted that should the municipality not have adequate capacity for the handling of waste, provision of water and sewage handling provisions available; then the applicant will make use of private contractors to ensure that the services are provided. The applicant will also ensure that adequate waste disposal measures are implemented by obtaining waste disposal slips for waste removed from site (in line with the EMPr).

An outline of the services that will be required is discussed below.

A.6.1 Water Usage

During the construction phase a temporary water supply for construction will need to be installed that will make use of existing or new boreholes and will comprise of over-ground water pipelines and tanks to the construction camp. Approval for any additional water requirements will form part of a separate water use authorization approvals process. A maximum of 50000 m^3/ annum would be required for the construction phase.

During the operational phase, water use will be minimal.

A.6.2 Sewage or Liquid Effluent

The project will require sewage services during the construction and operational phases. Low volumes of sewage or liquid effluent are estimated during both phases. Liquid effluent will be limited to the ablution facilities during the construction and operational phases. Portable sanitation facilities (i.e. chemical toilets) will be used during the construction and operational phases, which will be regularly serviced and emptied by a suitable (private) contractor on a weekly basis. It is anticipated that sewage will be disposed of in the municipal waterborne sewage system, if the municipality confirms capacity.

A.6.3 Solid Waste Generation

The quantity of waste generated will depend on the construction phase, which is estimated to extend between 18 to 24 months. During the construction phase, the following waste materials are expected:

- Packaging material, such as the cardboard, plastic and wooden packaging and off-cuts;
- Hazardous waste from empty tins, oils, cement bags, soil containing oil and diesel (in the event of spills), and chemicals;
- Building rubble, discarded bricks, wood and concrete;
- Domestic waste generated by personnel; and
- Vegetation waste generated from the clearing of vegetation.

Solid waste will be managed via the EMPr (Appendix G of the BA Report), which incorporates waste management principles. General waste will be collected and temporarily stockpiled in skips in a designated area on site and thereafter removed, emptied into trucks, and disposed at a registered waste disposal facility on a regular basis by an approved waste disposal Contractor (i.e. a suitable Contractor). Any hazardous waste (such as contaminated soil as a result of spillages) will be temporarily stockpiled (for less than 90 days) in a designated area on site (i.e. placed in leak-proof storage skips), and thereafter removed off site by a suitable service provider for safe disposal at a registered hazardous waste disposal facility. Waste disposal slips and waybills will be obtained for the collection and disposal of the general and hazardous waste. These disposal slips (i.e. safe disposal certificates) will be kept on file for auditing purposes as proof of disposal. The waste disposal facility selected will be suitable and able to receive the specified waste stream (i.e. hazardous waste will only be disposed of at a registered/licenced waste disposal facility). The details of the disposal facility will be finalised during the contracting process, prior to the commencement of construction. Where possible, recycling and re-use of material will be encouraged. Waste management is further discussed in the EMPr (Appendix G of this BA Report). During the operational phase of the proposed Kudusberg WEF, waste generation will be minimal and will be disposed of a licenced landfill site.

A.6.4 Electricity Requirements

In terms of electricity supply for the construction phase, the developer will utilise a combination of generators and solar systems. During the operational phase, the wind farm will not have any electricity requirements as the project itself will generate and distribute electricity.

A.7 Overview of project development cycle

This section provides an outline of the main activities that are proposed during each phase of the proposed project, i.e. extending from the Planning and Design phase through to the Decommissioning phase. The operational life of the wind turbine facility is expected to be approximately 20 years which could be extended through regular maintenance and/or upgrades in technology.

A.7.1 Detailed Planning and Design

The project layout, including the placement of each individual turbine and subsequent proposed access roads, was finalised during the BA process undertaken to date. The initial project layout was amended to provide project layout (revision 1) which was informed by the findings of the specialist studies, which included the identification of sensitive biophysical areas that need to be avoided. The specialists were requested to comment on the final, revised layout. The turbine manufacturer and turbine capacity to be used will be dependent on availability of turbines in the international market, suitability to the South African wind climate, and service levels and experience in South Africa. See Section D 1.2.5.3 for an overview of the changes made from the initial layout to revised layout 1 (current proposed layout).

A.7.2 Construction Phase

The construction phase will take place subsequent to the issuing of an EA from the DEA and once a Power Purchase Agreement (PPA) with a suitable energy off-taker is signed, this could be Government (Eskom or similar) or private. The construction phase for the proposed Kudusberg WEF project is expected to extend approximately 18-24 months (however the construction period is subject to the actual number of turbines, the final requirements of Eskom and the REIPPPP RfP provisions at that point in time).

The main activities that are proposed to take place during the construction phase will entail the removal of vegetation within the footprint of the infrastructure that will be constructed (including but not limited to the turbines, laydown areas, internal access roads and building structures). The temporary laydown area will then be constructed to enable the storage of construction equipment and machinery and will include the establishment of the construction site camp (including site offices and other temporary facilities for the appointed contractors). The wind turbine foundations will then be constructed at each turbine location. As noted above, each turbine will be supported by a concrete foundation of approximately 706 m^2, with the aid of a mechanical excavator.

Thereafter, the on-site substation, including the substation building will be constructed. The construction of the substation building will entail construction of the foundations and building structures as well as the installation of electrical infrastructure (such as transformers, conductors, etc.). The construction phase will also involve the transportation of personnel, construction material and equipment to and from the site. Subsequently, the trenches will be excavated at a depth of approximately 1,5 m, between each wind turbine, for the laying of the cables to facilitate the connection of the wind turbines to the on-site substation.

The exact sequence of construction activities will be finalised prior to commencement of construction.

All efforts will be made to ensure that all construction work will be undertaken in compliance with local, provincial and national legislation, local and international best practice, as well as the compiled EMPr which is included as Appendix G of this BA Report. An independent Environmental Control Officer (ECO) will be appointed during the construction phase and will monitor compliance with the recommendations and conditions of the EMPr and EA respectively. Skilled as well as unskilled temporary employment opportunities will be created during the construction phase. It is difficult to specify the actual number of employment opportunities that will be created at this stage; however approximately 250 (full-time equivalent) employment opportunities are expected to be created during the construction phase.

A.7.3 Operational Phase

The following main activities will occur during the operational phase:

- Operation of the WEF and generation of electricity to add to the national grid;
- Routine maintenance of the WEF; and
- Unscheduled maintenance of the WEF.

The operational lifespan of the proposed Kudusberg WEF is expected to be approximately 20 years, but may be extended. Wind turbines will be operational for this entire period except under circumstances of mechanical breakdown, extreme weather conditions and/or maintenance activities. Wind turbines will be subject to regular maintenance and inspection (i.e. routine servicing) to ensure the continued optimal functioning of the turbine components. It is expected that the WEF will operate throughout the day and night. During the operational phase, most of the WEF project area will continue its current land use, i.e. agricultural or tourism practices. The only development related activities on-site will be routine servicing and unscheduled maintenance.

The projected operations are expected to provide several services and added economic spin offs (as highlighted in the Socio-Economic Assessment which is included in Appendix D of this report). Approximately 20 employment opportunities (4 are low skilled, 10 are semi-skilled and 6 are skilled.) will be created during the operational phase of the project.

A.7.4 Decommissioning Phase

At the end of the operational phase, the WEF may be decommissioned, or may be repowered i.e. redesigned and refitted so as to operate for a longer period. The main aim of decommissioning is to return the land to its original, pre-construction condition. Should the unlikely need for decommissioning arise (i.e. if the facility becomes outdated or the land needs to be used for other purposes), the decommissioning procedures will be undertaken in line with the EMPr and the site will be rehabilitated and returned to its pre-construction state.

Various components of the proposed Kudusberg WEF which are decommissioned will be reused, recycled or disposed of in accordance with the relevant regulatory requirements. All of the components of the wind turbines are considered to be reusable or recyclable. The turbines may also be traded or sold as there is an active second-hand market for wind turbines and/or it may be used as scrap metal. The decommissioning phase of the project is also expected to create skilled and unskilled employment opportunities.

A.8 Applicable legislation

The scope and content of this BA Report has been informed by the following legislation, guidelines and information series documents (Table A.4). It is important to note that the specialist studies included in Appendix D of this BA Report includes a full list and description of the applicable legislation.

Table A.4: Legislation Applicable to the Proposed Project

Title of legislation, policy or guideline	Applicability to the Proposed Project	Administering Authority	Date
The Constitution of South Africa (No. 108 of 1996)	The Constitution provides environmental rights (Section 24) and includes implications for environmental management. of the Constitution, and state that: *"Everyone has the right –* • *To an environment that is not harmful to their health or well-being; and* • *To have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that:* o *Prevent pollution and ecological degradation;* o *Promote conservation and* o *Secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development."* In terms of the Constitution, the applicant must ensure the project is sustainable.	Republic of South Africa	1996
NEMA (Act 107 of 1998, as amended)	The NEMA provides the overarching framework for environmental law in South Africa. The proposed project will require the implementation of appropriate environmental management practices including proper assessment of specific activities and the impact thereof on the environment.	National DEA	19 November 1998
NEMA EIA Regulations published in GN R982, R983, R984 and R985, and as amended on 7 April 2017 in GN R326, R327, R325 and R324	These Regulations provide the purpose & procedures that need to be followed for the BA Process. These Regulations contain the relevant listed activities that are triggered, thus requiring a BA. Please refer to Section A (7) of this BA Report for the complete list of listed activities.	National DEA	8 December 2014 and amended on 7 April 2017
Section 24(5)a and (b) of the	This project falls within REDZ 2 and a	National DEA	16 February

Title of legislation, policy or guideline	Applicability to the Proposed Project	Administering Authority	Date
NEMA, of the procedure to be followed in applying for EA for large scale wind and solar PV energy development activities identified in terms of Section 24(2)(1) of the NEMA when occurring in geographical areas of strategic importance And GN 114	BA process is therefore required for this project. A full EIA process would have been required before the gazetting of the REDZs as the project entails the generation of electricity of 20 MW or more.		2018
6Northern Cape Nature Conservation Act 2009 (Act No. 9 of 2009) (NCNCA)	This Act lists: Schedule 1 - Specially protected species; and Schedule 2 - Protected species	Northern Cape Department of Environment and Nature Conservation	2009
Western Cape Nature and Environmental Conservation Ordinance, 1974 (No. 19 of 1974, as amended in 2000) (WCNECO)	The Ordinance lists protected species.	CapeNature	1974 (as amended in 2000)
National Environmental Management: Waste Act (Act 59 of 2008) (NEMWA)	General and hazardous waste will be generated during the construction phase, which will require proper management.	National DEA	6 March 2009
National Environmental Management: Waste Amendment Act (Act 26 of 2014)	General and hazardous waste will be generated during the construction phase, which will require proper management.	National DEA	2 June 2014
National Environmental Management: Air Quality Act (Act 39 of 2004)	The proposed stockpiling activities, including earthworks, may result in the unsettling of, and temporary exposure to, dust. Appropriate dust control methods will need to be applied.	National DEA	24 February 2005
Water Services Act (Act 108 of 1997)	Water will be required during the construction and decommissioning phases of the proposed project, for consumption purposes, earthworks and grassing etc.	National Department of Water Affairs and Sanitation	1997
Hazardous Substances Act (Act 15 of 1973)	During the proposed project, fuel and diesel will be utilised to power vehicles and equipment. In addition, potential spills of hazardous materials could occur during the construction and decommissioning phases.	Department of Health	1973
National Forests Act (Act 84 of 1998)	No protected tree species will be affected.	Department of Agriculture, Forestry and Fisheries (DAFF)	1998
National Water Act (NWA)	Wetlands or riparian zones are	Department of	1998

Title of legislation, policy or guideline	Applicability to the Proposed Project	Administering Authority	Date
(Act 36 of 1998)	excluded from developments unless these developments are authorised by the Department of Water and Sanitation for water uses which are defined in Section 21(c) or Section 21 (i). General Authorisation apply in terms of Section 39 of the National Water Act (Act No. 365 of 1998) for water uses as defined in Section 21(c) or Section 21(i) (Department of Water and Sanitation Notice 509 of 2016). This general authorisation replaces the need for a water user to apply for a licence in terms of the National Water Act (Act 36 of 1998) provided that the water use is within limits and conditions of this General Authorisation. A General Authorisation does not apply to any development which triggers 21 (c) and (i) within a distance of 500 m upstream or downstream from the boundary (outer edge) of any wetland (General Notice 1199, Government Gazette No. 32805 of 2009; Replacement General Authorisation in terms of Section 39 of the National Water Act). The need for a Water Use Licence Application will be confirmed with DWS after obtaining preferred bidder status, in line with DWS' protocols.	Water and Sanitation (DWS)	
The National Environmental Management: Protected Areas Act (Act No. 57 of 2003) (NEM:PAA)	NEM:PAA provides for the protection and conservation of ecologically viable areas representative of South Africa's biological diversity and its natural landscapes and seascapes; for the establishment of a national register of all national, provincial and local protected areas; for the management of those areas in accordance with national norms and standards; for intergovernmental co-operation and public consultation in matters concerning protected areas; and for matters in connection therewith.	National DEA	2003
Integrated Environmental Management (IEM) guideline series published by the DEA (various documents	The IEM Guideline series provides guidance on conducting and managing all phases and components of the required BA and	National DEA	2002 - present

Title of legislation, policy or guideline	Applicability to the Proposed Project	Administering Authority	Date
dated from 2002 to present)	PPP, such that all associated tasks are performed in the most suitable manner.		
National Heritage Resources Act (Act 25 of 1999)	The proposed project may require a permit in terms of the National Heritage Resources Act (Act 25 of 1999) prior to any fossils or artefacts being removed by professional palaeontologists and archaeologists.	Heritage Western Cape and SAHRA	1999
Conservation of Agricultural Resources Act (Act 43 of 1983)	The declared alien invasive plant species *Atriplex lindleyi* subsp. *inflata* and *Salsola kali* are encountered at some parts of the site. The Conservation of Agricultural Resources Act (CARA) (Act 43 of 1983) has categorised a large number of invasive plants together with associated obligations of the land owner. Invasive plant species that should be removed or maintained only under certain commercial situations are identified in terms of the CARA.	National Department of Agriculture	1983
National Environmental Management: Biodiversity Act (Act 10 of 2004) (NEM:BA)	This Act serves to control the disturbance and land utilisation within certain habitats, as well as the planting and control of certain exotic species. In addition, the planting and management of exotic plant species on route, if and where required, will be governed by the Alien and Invasive Species (AIS) regulations, which were gazetted in 2014. These regulations compel landowners to manage exotic weeds on land under their jurisdiction and control.	National DEA	September 2004
Subdivision of Agricultural Land Act (Act 70 of 1970)	An application for the change of land use (re-zoning) for the development on agricultural land will be lodged by the Applicant for approval in terms of the Subdivision of Agricultural Land Act (Act 70 of 1970) (SALA) as required.	Republic of South Africa	1970
Convention on the International Trade in Endangered Species of Wild Fauna and Flora (CITES)	CITES is an international agreement to which countries adhere voluntarily. The aim is to ensure that international trade in specimens of wild animals and plants does not threaten their survival. The species covered by CITES are listed in three	Republic of South Africa	2017 (as amended)

Title of legislation, policy or guideline	Applicability to the Proposed Project	Administering Authority	Date
	appendices reflecting the degree of protection that the species needs. Appendix I includes species that are threatened with extinction and trade in these species is permitted only in exceptional circumstances. Appendix II lists species that are not necessarily now threatened with extinction but that may become so unless trade is closely controlled. Appendix III lists species that are protected in at least one country that has asked other CITES parties for assistance in controlling the trade (Website: www.cites.org).		
Civil Aviation Act (Act 13 of 2009)	All proposed developments or activities in South Africa that potentially could affect civil aviation must thus be assessed by SACAA. This is undertaken parallel to the BA.	South African Civil Aviation Authority	2009
Astronomy Geographic Act (Act 21 of 2007)	In terms of section 7(1) and 7(2) of this Act, national government established the following astronomy advantage areas (AAA): — Central Karoo AAA (GN 198 of 2014) – Kudusberg falls outside this AAA. — Sutherland AAA - Kudusberg falls inside this AAA — Northern Cape AAA – GN115 of 2010 - Kudusberg falls inside of this AAA. The purpose of the Act is to protect the radio frequency spectrum for astronomy observations within a core or central astronomy advantage area. The applicant is engaging with the authorities including SKA and SALT.	Department of Science and Technology	2007
Occupational Health and Safety Act (Act 85 of 1993)	The EMPr (as included in Appendix G) will be implemented in line with the requirements of the act.	Department of Labour	1993
Road Safety Act (Act No. 93 of 1996)	Permits for abnormal loads are required for vehicles exceeding the permissible maximum dimensions on road freight transport in terms of the Road Safety Act (Act No. 93 of 1996) and the National Road Traffic Regulations, 2000. Any dimension / mass outside these	Department of Transport and Public Works	1996

Title of legislation, policy or guideline	Applicability to the Proposed Project	Administering Authority	Date
	permissible dimensions stipulated in the said Act will be classified as an Abnormal Load and will necessitate an application to the Department of Transport and Public Works for a permit that will give authorisation for the conveyance of said load. A permit is required for each Province that the haulage route traverses. G7 will apply for all applicable permits.		
South African Noise Control Regulations &	These National Regulations describe a disturbing noise as any noise that exceeds the ambient noise by more than 7 dB.	Republic of South Africa	1998
SANS 10103:2008	In terms of the SANS in rural districts the ambient noise should not exceed the guideline 35 dB(A) at night and 45 dB(A) during the day.		2008

Table A.5 outlines the main relevant national and local polies and its associated objectives as well as the alignment of the proposed Kudusberg WEF with these.

Table A.5: Project alignment with Policy Objectives (as listed in the Socio-Economic Assessment included in Appendix D of this report)

Policy	Key Policy Objectives	Source
National Policy: South Africa		
National Development Plan 2030	• Creating jobs and livelihoods • Expanding infrastructure • Transitioning to a low-carbon economy • Transforming urban and rural spaces • Improving education and training • Providing quality health care • Building a capable state • Transforming society and uniting the nation • Fighting corruption and enhancing accountability	(NPC, 2011)
New Growth Path Framework 2011	• Infrastructure investment • Main economic sectors as employment sectors • Seizing the potential of new economies • Investing in social capital and public services • Fostering rural development and regional integration	(Department of Economic Development, 2011)
Renewable Energy Vision 2030 South Africa	• Renewable energy as an exceptional source of flexible suppl within the context of uncertain energy demand • Comprehensive renewable energy base will support a resilien South African future • A sustainable energy mix that excludes undue risks for th environment of society	(World Wildlife Fund, 2014)
Integrated Energy Plan 2016 (new draft IRP 2018)	South Africa should continue to track a diversified energy mi which lessens reliance on a few primary energy sources In addition to solar energy facilities, wind energy should continu to contribute in the generation of electricity	(Department of Energy, 2016)

Policy	Key Policy Objectives	Source
	Allocations to safeguard the development of wind energy project aligned with the Integrated Resource Plan (IRP) 2010 shoul continue to be pursued • Ensure energy security and supply • Reduce environmental impacts • Endorse job creation and localisation • Lessen cost of energy • Reduce water consumption • Diversify supply sources • Promote energy efficiency • Promote energy access Additionally, the IRP (2018) indicates that: • Wind energy will be 15.1% of the energy mix compared t solar at 10.5% by 2030	
The Constitution of South Africa 1996	"Everyone has the right to an environment that is not harmful t their health or well-being" (S24) The environment should be protected for the benefit of presen and future generations, through reasonable legislative and othe measures that: • Prevent pollution and ecological degradation • Promote conservation • Secure ecologically sustainable development and use o natural resources while promoting justifiable economi and social development	(Republic of South Africa, 1996)
White Paper on Energy Policy of the Republic of South Africa 1998	Seeks to ensure that an equitable level of national resources i invested in renewable technologies, given their potential an compared to investments in other energy supply options Aims to create energy security by diversifying the energy suppl and energy carriers	(Department of Minerals and Energy, 1998)
White Paper on the Renewable Energy Policy of RSA 2003	Pledges government support for the development, demonstratio and implementation of renewable energy sources for both sma and large-scale applications	(Department of Minerals and Energy, 2003)
	Provincial Policy: Northern Cape & Western Cape	
Northern Cape Provincial Development and Resource Management Plan 2012	• Seeks to create a prosperous, sustainable and expandin provincial economy to eradicate poverty and improve socia development • Aims to create a continuous network of natural resource area throughout the province that maintain ecological processe and provide ecosystem services • Aims to endorse and institute innovative energy technologie to improve access to reliable, sustainable and affordabl energy services with the objective to realise sustainabl economic growth and development	(Office of the Premier of the Northern Cape, 2012)
White Paper on Sustainable Energy For the Western Cape Province 2010	Sustainable energy goals from the white paper include: • Alleviate energy poverty • Improve the health of the nation • Reduce harmful emissions • Reduce negative footprints in our environment • Enhance Energy Security • Improve economic competitiveness and job creation	(Province of the Western Cape, 2010)
Sustainable Energy	The objective that specifically aligns to renewable energy in the	(Western

Policy	Key Policy Objectives	Source
Strategy for the Western Cape 2007	strategy is strategic objective 3 specifically the focal point on clean energy supply. Objectives include: • Stimulate demand for renewable energy, and reduce carbon emissions from general energy consumption • Support research, development and roll-out of clean energy sources • Initiate efforts to reduce the Province's Carbon footprint	Cape Department: Environmental Affairs and Development Planning, 2007)
	District Municipal Policy	
Cape Winelands District Municipality Integrated Development Plan 2017 - 2022	Economic Infrastructure: Electricity The District Plans to move to less carbon-intensive electricity production through procuring at least 20 000MW of renewable energy, increased hydro imports from the region and increased demand-side measures, including solar water heating.	(Cape Winelands District Municipality , 2017)
Namakwa District Municipality Integrated Development Plan 2017 - 2022	The IDP states that "Renewable energy is recently one of the cornerstones of the economy of the District and there needs to be engagement on National level to ensure that the District benefit from this resource." Output 10 from IDP indicates: *…To ensure that Environmental assets and natural resources are well protected and continually enhanced, the key partners will focus on the following four key outputs and related sub-outputs*: • *Enhanced quality and quantity of water resources* • *Reduced greenhouse gas emissions, climate change & improved air/atmospheric quality* • *Sustainable environmental management* • *Protected biodiversity…*	(Namakwa District Municipality , 2017)
	Local Municipal Policy	
Witzenberg Local Municipality Integrated Development Plan 2017 - 2022	• Sustainable provision & maintenance of basic infrastructure • Provide for the needs of informal settlements through improved services • Support institutional transformation and development • Ensure financial viability • To maintain and strengthen relations with international &inter-governmental partners as well as the local community through the creation of participative structures • Provide & maintain facilities that make citizens feel like home • Support the poor and vulnerable through programmes and policy • Create and enabling environment to attract investment and support local economy	(Witzenberg Local Municipality , 2017)
Karoo Hoogland Local Municipality Integrated Development Plan 2017 - 2022	• Poverty relief through effective basic service delivery and job creation, • Assist with economic interventions in sector development (agricultural, tourism and renewable energy) • Facilitate education, literacy, skills development and capacity building within the local economy, • Promote business and investment attraction and retention, • Enhance sustainable service delivery through infrastructure development.	(Karoo Hoogland Local Municipality , 2017)

A.8.1 Description of the listed activities associated with the proposed project

Section 24(1) of the 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 CA charged by this Act with granting the relevant environmental authorization."*

The reference to "listed activities" in Section 24 of the NEMA relates to the regulations promulgated in GN R326, R327, R325 and R324, dated 7 April 2017. The relevant GN published in terms of the NEMA collectively comprise the NEMA EIA Regulations listed activities that require either a BA, or Scoping and EIA be conducted. As noted previously, due to the project being proposed in a REDZ, the proposed project requires a BA Process.

The Application for EA for this BA Process will be submitted to the DEA together with the Final BA Report, which makes reference to all relevant listed activities forming part of the proposed development.

All the listed activities forming part of this proposed development and therefore requiring EA are included in the Application Form for EA that has been submitted to the DEA with the Draft BA Report. The listed activities triggered by the proposed Kudusberg WEF are indicated in Table A.6.

Table A.6.below provides a list of the applicable listed activities associated for the proposed project in terms of Listing Notice 1 (GN R 327), Listing Notice 2 (GN 325) and Listing Notice 3 (GN R324) in terms of the 2014 NEMA EIA Regulations (as amended).

Table A.6: Applicable Listed Activities in GN 327, GN 325 and GN 324 that are triggered by the proposed Kudusberg Wind Energy Facility

Listed Activity Number	Listed Activity Description	Description of project activity that may trigger the listed activity
GN R327		
Activity 11 (i)	The development of facilities or infrastructure for the transmission and distribution of electricity- (i) outside urban areas or industrial complexes with a capacity of more than 33 but less than 275 kilovolts;	The proposed project will entail the construction of a 132 kV on-site substation and underground cabling (22/33 kV) to connect the proposed WEF to it. The proposed facility is situated outside of the urban edge. This activity would therefore be triggered.
Activity 12 (ii) (a) (c)	The development of: (ii) infrastructure or structures with a physical footprint of 100 square metres or more; where such development occurs- a) within a watercourse; c) if no development setback	The proposed WEF buildings and infrastructure are expected to exceed a footprint of 100 m^2 with some infrastructure or structures occurring within a watercourse (drainage line) or 32 m of watercourses. The proposed project will take place outside of an urban area. This activity would therefore be triggered.

Listed Activity Number	Listed Activity Description	Description of project activity that may trigger the listed activity
	exists, within 32 metres of a watercourse, measured from the edge of a watercourse;	
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 proposed project will entail the excavation, removal, infilling, depositing and moving of more than 10 m^3 of soil, sand, pebbles or rock from the watercourses. The activity would therefore be triggered.
Activity 24 (ii)	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;	An access road wider than 8 m and up to 12 m in some sections may be constructed.
Activity 28 (ii)	Residential, mixed, retail, commercial, industrial or institutional developments where such land was used for agriculture, game farming, equestrian purposes or afforestation on or after 01 April 1998 and where such development: (ii) will occur outside an urban area, where the total land to be developed is bigger than 1 hectare;	The land is currently used and zoned for agricultural purposes. The proposed Kudusberg WEF which is considered to be a commercial/industrial development which will require a special zoning, will have a footprint of more than 1 ha. This activity would therefore be triggered.
Activity 48 (i) (a) (c)	The expansion of (i) infrastructure or structures where the physical footprint is expanded by 100 square metres or more; where such expansion occurs— (a) within a watercourse; or (c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse;	The proposed Kudusberg WEF may entail the expansion of roads and other infrastructure by 100 square metres or more within a watercourse or within 32 m from the edge of a watercourse.
Activity 56	The widening of a road by more than 6 metres, or the lengthening of a road by more than 1 kilometre- (i) where the existing reserve is wider than 13,5 meters; or (ii) where no reserve exists, where the existing road is wider than 8 metres;	Existing roads may be widened by approximately 8 m which is more than 6 m in some places to provide access to the WEF site. This activity would therefore be triggered.
GN R325		

Listed Activity Number	Listed Activity Description	Description of project activity that may trigger the listed activity
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 proposed project will entail the construction of a WEF with a maximum capacity of 325 MW (i.e. facilities for the generation of more than 20 MW of electricity from a renewable resource) and will be located outside an urban area. This activity would therefore be triggered.
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; or (ii) maintenance purposes undertaken in accordance with a maintenance management plan.	The proposed Kudusberg WEF will have an estimated footprint of 126 ha. As a result, more than 20 ha of indigenous vegetation will be removed for the construction of the proposed WEF. This activity would therefore be triggered.
GN R324		
<u>Activity 4 (g) (ii) (bb) (cc) (ee) and 4 (i) (ii) (aa)</u>	The development of a road wider than 4 metres with a reserve less than 13,5 metres. **g. Northern Cape** ii. Outside urban areas: (bb) National Protected Area Expansion Strategy Focus areas; (cc) Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority; (ee) Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans; **i. Western Cape** ii. Areas outside urban areas; (aa) Areas containing indigenous vegetation;	Access roads wider than 4 m with a reserve less than 13.5 m will be required within the Northern and Western Cape Provinces, outside urban areas within the specific special areas containing indigenous vegetation. Sections of the site are within the NPAES and CBA's. This activity would therefore be triggered.
<u>Activity 12 g (ii) and (i)(ii)</u>	The clearance of an area of 300 square metres or more of indigenous vegetation **g. Northern Cape** ii. Within critical biodiversity areas identified in bioregional plans;	The proposed facility's development footprint will result in in the clearance of more than 300 square meters of indigenous vegetation. The proposed project area partially falls within a CBA. This activity would therefore be triggered.

Listed Activity Number	Listed Activity Description	Description of project activity that may trigger the listed activity
	i. Western Cape (ii) Within critical biodiversity areas identified in bioregional plans.	
Activity 14 (ii) (a), (c); g (bb) (ff) and i (i) (bb) (ff) .	The development of - (ii) infrastructure or structures with a physical footprint of 10 square metres or more; where such development occurs – (a) within a watercourse; (c)if no development setback has been adopted, within 32 metres of a watercourse, measured from the edge of a watercourse; **g. Northern Cape** **(ii) Outside urban areas:** (bb) National Protected Area Expansion Strategy Focus areas; (ff) Critical biodiversity areas or ecosystem service areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans; **i Western Cape:** i. Outside urban areas: (bb) National Protected Area Expansion Strategy Focus areas; (ff) Critical biodiversity areas or ecosystem service areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans	The proposed Kudusberg WEF will entail the development of roads and other infrastructure with a footprint of 10 square metres or more within a watercourse or within 32 m from the edge of a watercourse. This activity would therefore be triggered.
Activity 18 g (ii) (bb) (ee) (ii) **And 18 (i)(ii) (aa)** .	The widening of a road by more than 4 metres, or the lengthening of a road by more than 1 kilometre- **g. Northern Cape** ii. 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; (ii) Areas within a watercourse or wetland; or within 100 metres from the edge of a watercourse or wetland;	Existing roads may be widened by more than 4 m in some places to provide access to the WEF site. This activity would therefore be triggered.

Listed Activity Number	Listed Activity Description	Description of project activity that may trigger the listed activity
	i. Western Cape: ii. All areas outside urban areas: (aa) Areas containing indigenous vegetation	
Activity 23 (ii) (a) (c) (g) (ii) (bb) (ee) and Activity 23 i (i) (bb) (ff) .	The expansion of - (ii) infrastructure or structures where the physical footprint is expanded by 10 square metres or more; where such expansion occurs – (a) within a watercourse; (c)if no development setback has been adopted, within 32 metres of a watercourse, measured from the edge of a watercourse; **g. Northern Cape** (ii) 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; **i Western Cape:** i. Outside urban areas: (bb) National Protected Areas Expansion Strategy Focus Areas (ff) Critical biodiversity areas or ecosystem service areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans	The proposed Kudusberg WEF may entail the expansion of roads and other infrastructure by 10 square metres or more within a watercourse or within 32 m from the edge of a watercourse. This activity would therefore be triggered.

Notes regarding the identification of potential listed activities:

- The relevant listed activities applicable to the construction of the proposed 132 kV transmission line and associated electrical infrastructure to connect the proposed Kudusberg WEF to the Komsberg substation, via Bon Espirange substation, will be included in the separate BA Report and the Application for EA for the BA Process.

- The activities in Listing Notice 2 (GN R325) have been provided above, however as captured in GN 114 of February 2018, a BA Process is required for Renewable Energy Developments in the REDZs.

- It is proposed that less than 30 m^3 of dangerous goods (such as petrol and diesel) will be temporarily stored on site during the construction phase at any given time. Furthermore, no infrastructure or structures are planned to be specifically constructed for the aforementioned temporary storage. Recommendations for the temporary storage of petrol and diesel on site during the construction phase have been provided in the EMPr (Appendix G of the BA Report).

- Activity 9 and Activity 10 of GN R327 (Listing Notice 1) are not applicable as these are for piping of water and sewage at a large scale, which the Applicant is not proposing to undertake.

- Activity 21 of GN R327 (Listing Notice 1) which relates to activities requiring a mining permit is not applicable at this stage of the BA. However, if the Engineering, Procurement and Construction (EPC) contractor in future determines that a borrow pit is required, then the necessary approvals will be obtained.

A.9 Description of Alternatives

This section discusses the alternatives that have been considered as part of the BA Process. Sections 24(4) (b) (i) and 24(4A) of the NEMA require an Environmental Assessment to include investigation and assessment of impacts associated with alternatives to the proposed project. In addition, Section 24O (1)(b)(iv) also requires that the Competent Authority, when considering an application for EA, takes into account “where appropriate, any feasible and reasonable alternatives to the activity which is the subject of the application and any feasible and reasonable modifications or changes to the activity that may minimise harm to the environment”.

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

- The consideration of the no-go alternative as a baseline scenario;
- A comparison of the reasonable and feasible alternatives; and
- Providing a methodology for the elimination of an alternative.

Compliance with Regulation 3 (1) (h) (i) of Appendix 1 of the 2014 NEMA EIA Regulations (as amended) is discussed below. Regulation 2 (e) of Appendix 1 of the 2014 NEMA EIA Regulations (as amended) states:

- The objective of the basic assessment process is to, through a consultative process, and through a ranking of the site sensitivities and possible impacts the activity and technology alternatives will impose on the site and location identified through the life of the activity to (i) identify and motivate a preferred site, activity and technology alternative; (ii) identify suitable measures to avoid, manage or mitigate identified impacts; and (iii) identify residual risks that need to be managed and monitored.

A.9.1 No-go Alternative

The no-go alternative assumes that the proposed project will not go ahead i.e. it is the option of not developing the proposed Kudusberg WEF. This alternative would result in no environmental impacts from the proposed project on the site or surrounding local area. It provides the baseline against which other alternatives are compared and will be considered throughout the report. The following implications will occur if the no-go alternative is implemented:

- No benefits will be derived from the implementation of an additional land-use in addition to agricultural land use;

- No additional power will be generated or supplied through means of renewable energy resources by this project at this location;
- The no-go alternative will not contribute to and assist the government in achieving its proposed renewable energy draft target of wind energy to account for 15.1% of South African energy mix by 2030;
- Additional power to the local grid will need to be provided via the Eskom grid, with approximately 90% coal-based power generation with associated high levels of CO_2 emissions and water consumption;
- The local economy will not be diversified;
- Local communities will continue their dependence on agriculture production and government subsidies. The local municipality's vulnerability to economic downturns will increase because of limited access to capital and the downscaling of mining in the area;
- There will be no opportunity for additional employment in an area, where job creation is identified as a key priority. Approximately 250 employment opportunities will be created during the construction period and approximately 20 permanent employment opportunities will be created during the operation period of the proposed project;
- There will be lost opportunity for skills transfer and education/training of local communities;
- The positive socio-economic impacts likely to result from the project such as increased local spending and the creation of local employment opportunities will not be realised;
- The local economic benefits associated with the REIPPPP will not be realised, and socio-economic contribution payments into the local community trust will not be realised;
- The development of wind farms instead of coal fired power stations can directly contribute to South Africa's response to climate mitigation;
- Wind and solar energy are the cheapest source of electricity in South Africa. The development of this wind farm can contribute to the competitive nature of the REIPPPP to drive prices down even further to ensure that South Africans' have access to affordable yet clean electricity.
- A large tract of land within the Komsberg REDZ will be sterilised for renewable energy development. This would mean that land close to the Komsberg substation would not be developed and Komsberg substation may not be utilised to its full capacity, or projects located further away would need to build much longer 132kV powerlines to connect to the Komsberg substation.

Converse to the above, the following benefits could occur if the no-go alternative is implemented:

- Only the agricultural land use (sheep farming and tourism) will remain-no impact on agricultural land use will occur;
- No vegetation will be removed or disturbed during the development of the proposed Kudusberg WEF. No impact on the CBAs and NCPAES Focus Areas;
- No biodiversity (fauna and flora) will be removed or disturbed during the development of these facilities (there will also not be a need to implement a biodiversity offset as no sensitive vegetation will be lost on site);
- No impact on plant Species of Conservation Concern (SCC);
- No aquatic resources will be impacted upon during the construction and operation of the WEF;
- No birds or bats will be impacted upon-either through the loss of their habitat which can lead to displacement, mortalities due to collisions of birds and bats with wind turbines or mortality to bats caused by barotrauma; No visual impact associated with

the construction phase or the presence and rotation of wind turbines during the operational phase of the proposed project;

- No change to the current cultural landscape will occur-the visual character of the area will remain unchanged;
- No heritage artefacts or palaeontological resources will be impacted on;
- No noise impacts either during the construction phase or during the operational phase when wind turbines are rotating;
- No additional traffic generation during the construction of the proposed Kudusberg WEF; and
- No additional water use during the construction phase.

As outlined in Section D of this report, all negative impacts identified as part of this assessment can be reduced to moderate or low significance with the exception of 'the loss of habitat' during the construction phase as identified in the ecological assessment. This assessment found that the 'loss of habitat' impact will have a high negative impact significance after mitigation. The proposed impact will have a high impact within the development footprint, but sufficient crest habitat is available for ecological patterns and processes to continue unaltered. However, no specialists (including the Ecologist) found that the project should not go ahead i.e. no fatal flaws were identified as the **overall impact as assessed by all specialists were overall of low significance**. The Socio-Economic Impact Assessment identified positive impacts from a social upliftment perspective. These include stimulation of economy (high significance), skills development (moderate significance) and employment creation (low significance) during construction. Employment creation will have a very low positive impact during the operational phase.

Hence, while the "no-go" alternative will not result in any negative environmental impacts; it will also not result in any positive community development or socio-economic benefits. It will also not assist government in addressing climate change, reaching its set targets for renewable energy, nor will it assist in supplying the increasing electricity demand within the country. **Hence the "no-go" alternative is not a preferred alternative, or a reasonable and feasible alternative considered in this BA process.**

A.9.2 Land-use Alternatives

All farm portions forming part of the project are zoned for agricultural land-use, and are mainly used for either commercial livestock grazing, or tourism. As noted in Section B of this report agricultural potential is uniformly low across the affected farms and the choice of placement of the proposed Kudusberg WEF on the farms therefore has no agricultural impacts of significance. The proposed infrastructural footprint of the wind farm is classified with land capability evaluation **values of 1 - 4,** which is some of the lowest land capability in the country. **Hence, agricultural land use is not lost, as the WEF and agricultural land use can be undertaken in tandem**. The proposed wind farm will generate an additional income stream to the landowners and is therefore the preferred land use alternative and will not impede on the existing agricultural practises to still continue on site.

A.9.3 Technology Alternatives

Where the "activity" is the generation of electricity from a renewable energy source, possible alternatives that could be considered on the project site include renewable energy technologies such as Biomass, Hydro Energy and Solar Energy. However, based on the preliminary investigations undertaken by the Project Applicant, no other renewable energy technologies are deemed to be appropriate for the site. The unsuitability of other renewable energy developments for the site, as well as the potential risks and impacts of each, are discussed below.

Biomass Energy

The proposed project site lacks any abundant or sustainable supply of biomass. According to the South African Renewable Energy Resource Database (SARERD), the project site is identified as having no cumulative biomass energy potential (as shown in Figure A.17), therefore, the implementation of a Biomass Facility at the proposed site in the Northern and Western Cape is therefore considered not to be a reasonable and feasible alternative to be assessed as part of this BA process.

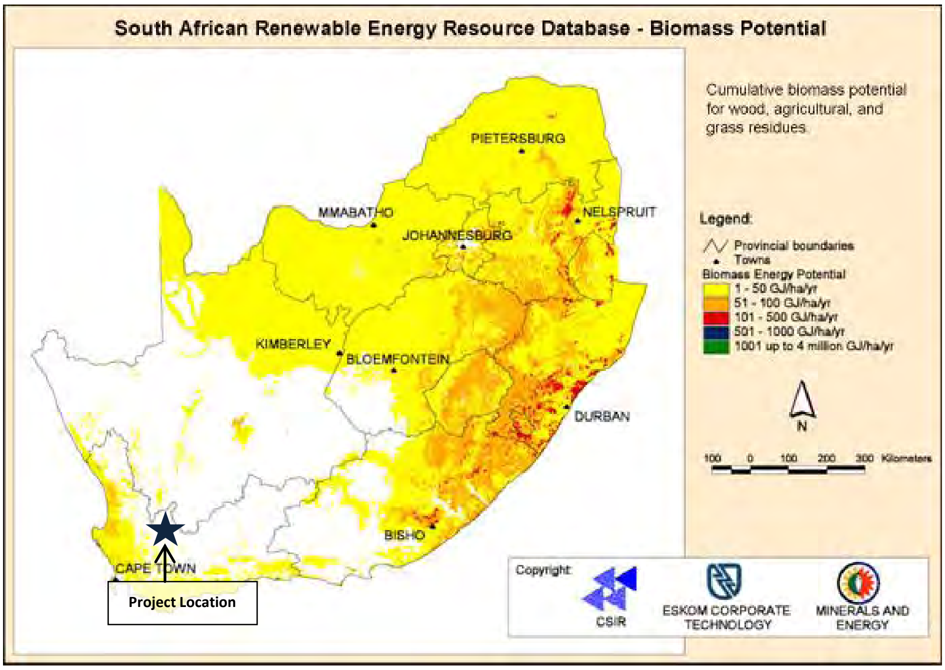

Figure A.17: Biomass Potential (*Source*: SARERD, 2016).

Hydro Energy

The proposed project site lacks any large inland water bodies, which precludes the possibility of renewable energy from small/large scale hydro generation. In terms of micro hydro power potential, the SARERD has classified the proposed project site as "Not Suitable" (as shown in Figure A.18), therefore, the implementation of a Hydro Energy Facility at the proposed site is therefore also considered not to be a reasonable and feasible alternative to be assessed as part of this BA process.

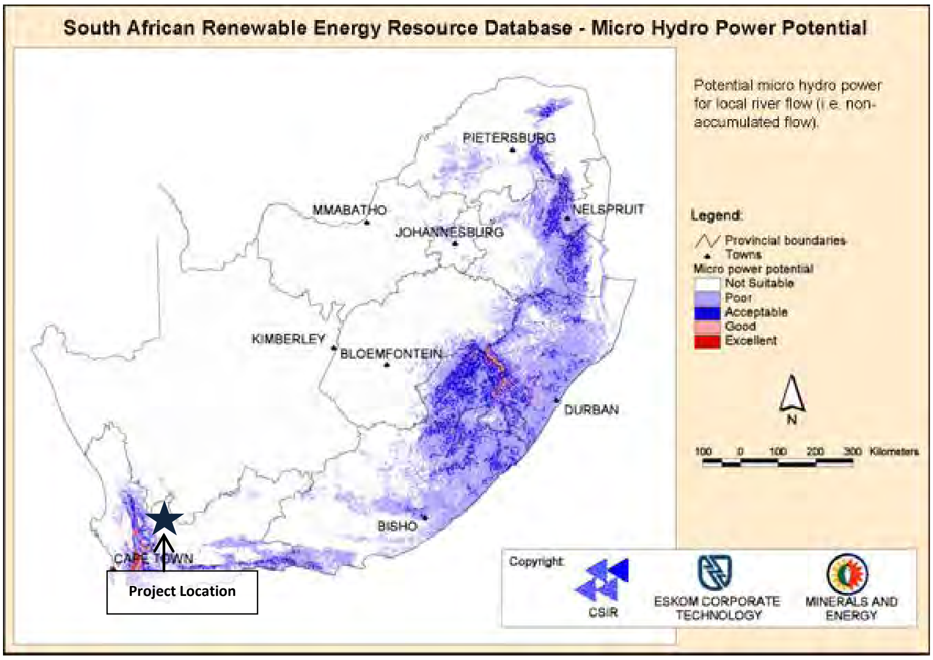

Figure A.18: Micro Hydro Power Potential (Source: SARERD, 2016).

Wind and Solar Energy

- *REIPPPP and Strategic Environmental Assessment for Wind and Solar PV in South Africa*

The Integrated Resource Plan for South Africa for the period 2010 to 2030 (referred to as "IRP2010") and the IRP Updated Report (2013) propose to secure 17 800 MW of renewable energy capacity by 2030. The DoE recently released a draft IRP 2018, which calls for South Africa's energy mix to include 15.1% wind energy by 2030 as indicated in Figure A.19 below.

	Coal	Nuclear	Hydro	Storage (Pumped Storage)	PV	Wind	CSP	Gas / Diesel	Other (CoGen, Biomass, Landfill)	Embedded Generation
2018	39 126	1 860	2 196	2 912	1 474	1 980	300	3 830	499	Unknown
2019	2 155					244	300			200
2020	1 433				114	300				200
2021	1 433				300	818				200
2022	711				400					200
2023	500									200
2024	500									200
2025					670	200				200
2026					1 000	1 500		2 250		200
2027					1 000	1 600		1 200		200
2028					1 000	1 600		1 800		200
2029					1 000	1 600		2 850		200
2030			2 500		1 000	1 600				200
TOTAL INSTALLED	33 847	1 860	4 696	2 912	7 958	11 442	600	11 930	499	2600
Installed Capacity Mix (%)	44.6	2.5	6.2	3.8	10.5	15.1	0.9	15.7	0.7	

Installed Capacity
Committed / Already Contracted Capacity
New Additional Capacity (IRP Update)
Embedded Generation Capacity (Generation for own use allocation)

Figure A.19: Proposed updated Draft IRP for period ending 2030

In order to submit a bid, the proponent is required to have obtained an EA in terms of the EIA Regulations as well as several additional authorisations or consents. The DEA, in discussion with the DoE, was mandated by MinMec to undertake a SEA[1] to identify the areas in South Africa that are of strategic importance for Wind and Solar PV development. The Wind and Solar PV SEA is in support of the Strategic Infrastructure Plan (SIP) 8, which focuses on the promotion of green energy in South Africa. The SEA aimed to identify strategic geographical areas best suited for the roll-out of large scale wind and solar PV energy projects, referred to as REDZs. Through the identification of the REDZs, the key objective of the SEA was to enable strategic planning for the development of large scale wind and solar PV energy facilities in a manner that avoids or minimises significant negative impact on the environment while being commercially attractive and yielding the highest possible social and economic benefit to the country – for example through strategic investment to lower the cost and reduce timeframes of grid access[2]. Following the completion of the SEA, the proposed REDZs, shown in Figure A.20, were submitted for Cabinet approval. After a lengthy process, the REDZs were signed off by the Minister of Environmental Affairs and gazetted on 16 February 2018 in Government Gazette No. 41445. The proposed project site is located within REDZ 2 (Komsberg REDZ), which supports the development of large scale wind and solar energy developments. The proposed project is therefore in line with the national planning vision for wind and solar development in South Africa.

[1] Information on this process can be obtained at: http://www.csir.co.za/nationalwindsolarsea/background.html
[2] More information on the SEA can be read at https://redzs.csir.co.za/

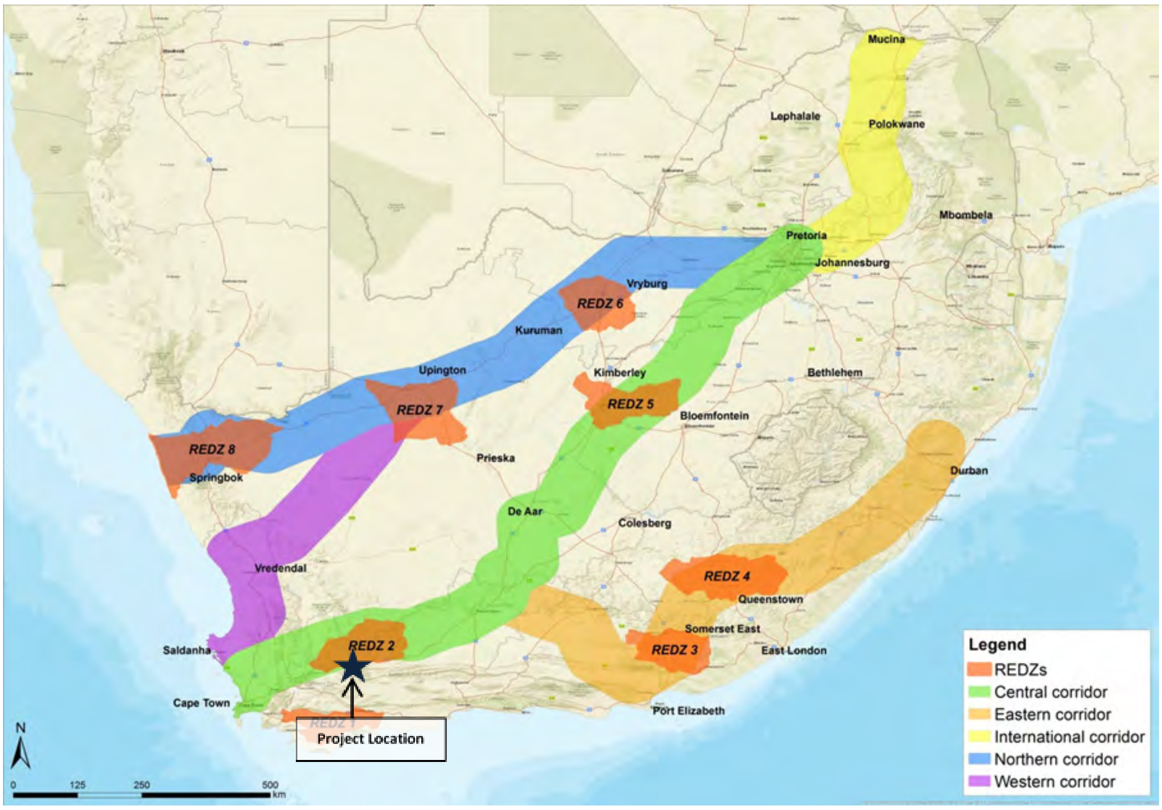

Figure A.20: Renewable Energy Development Zones identified in the Strategic Environmental Assessment which were gazetted on 16 February 2018 in Government Gazette 41445 (the proposed Kudusberg WEF falls within the REDZ 2).

Solar Energy

- *National Level Considerations: Solar Radiation*

The north-western part of South Africa has the highest Global Horizontal Irradiation[3] (GHI), relevant to PV installations and Direct Normal Irradiance[4] (DNI), relevant to Concentrated Photovoltaic (CPV) and tracking PV installations (Figure A.20). Therefore, this section of South Africa is deemed the most suitable for the construction and operation of solar energy facilities as opposed to other areas and provinces within South Africa. For example, coastal regions within KwaZulu-Natal, Eastern Cape and Western Cape mainly have a solar radiation between 1 500 kWh/m^2 and 1 700 kWh/m^2 per annum, which would not provide the same return compared to a solar energy facility located within the north-western part of South Africa. **The proposed site is located in the Western and Northern Cape and is located within an area estimated to have solar radiation of 2 500 kWh/m^2 per annum.** This means that the generation of renewable energy from **solar is not unfeasible, but more favourable locations elsewhere** (based on economic considerations) where the solar radiation is 2 600 kWh/m^2 (as seen in Figure A.21).

[3] Global Horizontal Irradiance is the total amount of shortwave radiation received from above by a surface horizontal to the ground

[4] Direct Normal Irradiance is the amount of solar radiation received per unit area by a surface that is always held perpendicular (or normal) to the rays that come in a straight line from the direction of the sun at its current position in the sky.

Solar energy is considered to be the most feasible alternative to wind energy for this site when compared to biomass and hydro energy; however, the site specific requirements of solar PV facilities make it a less feasible alternative when compared to wind energy for this particular site. The most important limitation for PV development on this site is the topography-the steep slopes and hills will not be suitable for the placement of solar panels. The terrain is not flat enough for a PV facility. Solar panels need to be cleaned regularly and access to good quality water is required. Due to the scarcity of water in the area it will not be feasible to obtain sufficient water to clean the panels. Through the project development process, Kudusberg Wind Farm (Pty) Ltd will continue to consider various wind turbine designs in order to maximise the capacity of the site. Therefore, no technology alternatives are feasible for assessment at this stage of the project other than a wind energy facility.

CSP technology is also not deemed feasible or sustainable for the same reason as solar PV panels, i.e. it requires large amounts of water and there is not enough rainfall in the area to justify a CSP plant. In addition, no additional procurement target was allocated for CPV in Government Gazette 39111 published on 18 August 2015.

Due to the topography of the site, water restrictions and other factors considered by the applicant, solar PV and CSP technologies are therefore not considered to be reasonable and feasible alternatives to be assessed as part of this BA process.

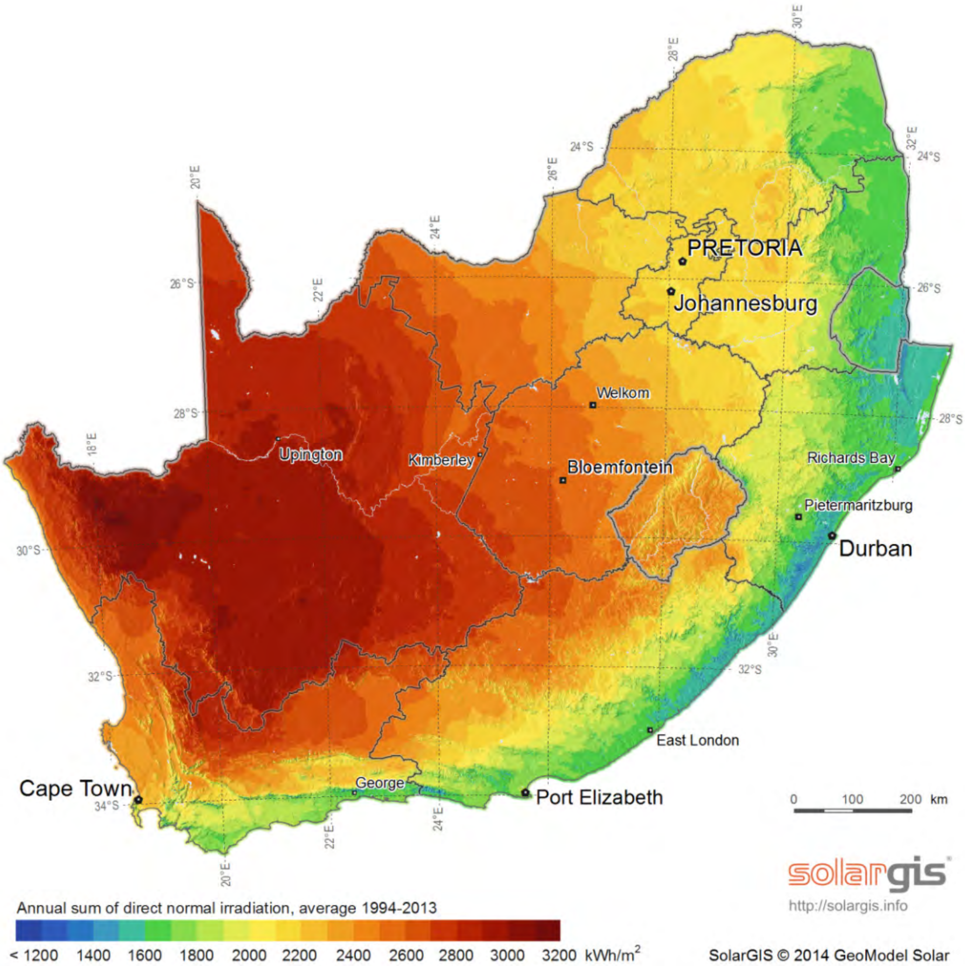

Figure A.21: Solar Resource Availability in South Africa (*Source*: SolarGIS map© 2013 GeoModel Solar).

Wind Energy

One of the most important criterion to take into consideration when selecting a potential site for a WEF is the availability of a reliable wind resource. Wind resource is defined in terms of average wind speed and includes Weibull distribution (used to describe wind speed distributions); turbulence, wind direction, and pattern of wind direction (as depicted by a wind rose). These factors are all key considerations used in determining whether a site is suitable for the development of a WEF.

The wind measurements provided by the Wind Atlas of South Africa (WASA) indicate that the site has a good wind resources (as shown in Figure A.22). Based on the applicant's research of the Kudusberg site as a potential site for the development of a WEF, the proposed land portions were selected as an area with a good wind resource. Four wind measuring masts have been installed on site to provide wind measurements to verify the potential of the resource. The process of collecting on-site wind data is necessary to confirm the bankable viability of the proposed project. The provision of at least 12 months on-site wind monitoring data also forms a requirement of the REIPPPP. Data received from consistent measurements for more than a year indicated that the wind resource at the proposed Kudusberg site is exceptional. Furthermore, in the Updated draft IRP of 2018 a higher allocation target was made to wind energy compared to solar photovoltaic energy in the (i.e. 8 100 MW as opposed to 5 670 MW) which further supports the development of a WEF at this location.

Therefore, the project applicant has determined that the proposed Kudusberg WEF is considered to be the preferred technology alternative, as it would be able to generate sufficient energy to support an economically viable wind energy project.

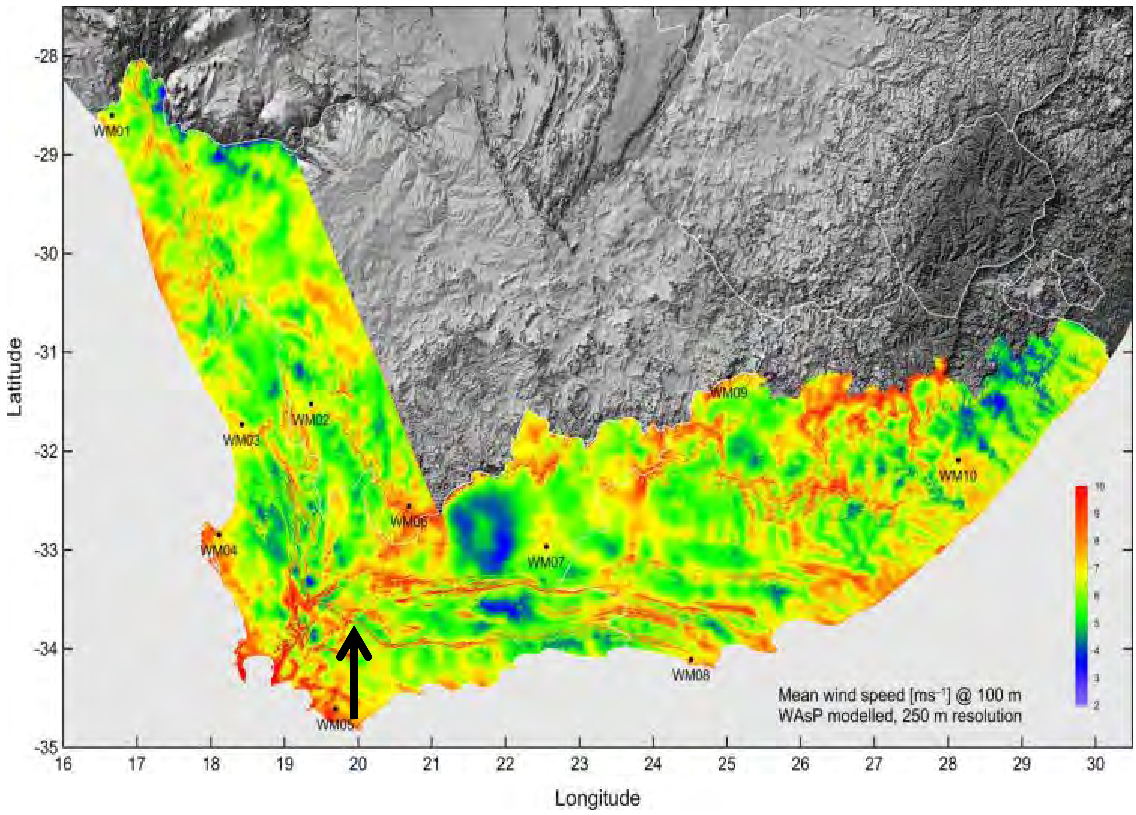

Figure A.22: Representation of Mean Wind Speed (ms^{-1} at 100 m) (*Source*: WASA, 2014).

Given the above, the **development of a WEF is the preferred technology** to be developed on the Kudusberg site because:

- The proposed Kudusberg WEF falls within the REDZ 2 (Komsberg). The REDZs were gazetted on 16 February 2018 in Government Gazette No. 41445. The proposed project is therefore in line with the criteria of the SEA and located in an area of strategic importance for wind energy development;
- The site has an excellent wind resource based on WASA data and on-site measurements;
- Solar energy, a potential developable technology on site, would not be as economically viable compared to wind development at this location. Limitations include the topography of the site, and the scarcity of water in the area to wash the solar panels; and
- The Updated Draft IRP (2018) allocated a higher allocation target to wind energy compared to solar energy.

Since the alternative technologies considered were deemed not to be reasonable and feasible for the area and the site, no other renewable energy technologies alternatives were further assessed in this BA process.

A.9.4 Site Alternatives

As per the requirements listed within Appendix 2 (2) (g) (ix) of the 2014 EIA Regulations (as amended), a site selection matrix should be provided to show how the preferred site was determined through a site selection process. Within this context, it is assumed that the “site” referred to in the Regulations are the farms or land portions on which proposed Kudusberg WEF will be located.

On a site specific level, the site selection factors of land availability, environmental sensitivities, distance to the national grid, site accessibility, topography, fire risk, current land use and landowner willingness were all considered to determine feasible sites. The proposed site was selected through an environmental and social pre-feasibility assessment commissioned by the applicant for several sites in the Northern and Western Cape. This study was undertaken by CES in 2009 and included a high-level screening of potential environmental and socio-economic issues, as well as ‘fatal flaws’ to determine suitable areas for project development. Based on these high-level considerations, the applicant identified fourteen (14) areas in South Africa that could potentially have significant wind resources (Table A.7). The significance of the following environmental and socio-economic issues and potential fatal flaws were identified to rank the 14 potential sites:

- Visual impact including proximity to scenic areas, sense of place, prevailing land use, areas of conservation or recreational use, topography, proximity to dense settlements and shadow flicker;
- Noise/ acoustic considerations including proximity to existing ambient noise sources and settlements;
- Impacts to birds and bats based on proximity to important bird areas and migratory routes;
- Terrestrial fauna and flora assessed in terms of local species and biomes;
- Hydrology impacts in terms of the presence of wetlands and surface water features;
- Heritage impacts;
- Road access and powerline servitudes;
- Potential safety impact considerations; and
- Proximity to airfields.

The pre-feasibility assessment determined that several sites were potentially fatally flawed as indicated in Table A.7 below. Although the other sites (Klawer, Witberg, Lamberts Bay and Rictersverld north) had various areas of concern/ risk, they were not deemed fatally flawed from an environmental and social perspective and were considered further. Sutherland was also considered a no-go due to unfavourable wind conditions and proximity to the astronomy centre, but the applicant proceeded with Roggeveld.

Table A.7: Screening phase or fatal flaw analysis of feasible sites

Site	Visual	Acoustic	Birds	Bats	Fauna	Flora	Hydrology	Heritage	Access	Safety	Motivation
Kleinsee	Minor	Minor	Minor	Major	Minor	Minor	Minor	Minor	Minor	Minor	This project was considered a no-go. The Kleinzee mining area where this site is located was subjected to a tender for land rights with conditions seen technically and financially.
Richtersveld South	Medium	Minor	Medium	Medium	Minor	Minor	Minor	Medium	Minor	Minor	This project was considered a no-go. Unfavourable wind conditions.
Richtersveld North	Medium	Minor	Medium	Medium	Minor	Minor	Minor	Medium	Minor	Minor	The applicant proceeded with the development of this site as technical and environmental pre-screenings seemed favourable.
Lamberts Bay	Extreme	Minor	Medium	Major	Minor	Minor	Minor	Minor	Minor	Minor	The applicant proceeded with the development of this site. Further wind resource evaluation showed that the site had low wind resources.
Witberg	Medium	Minor	Major	Major	Minor	Minor	Minor	Minor	Medium	Minor	The applicant proceeded with the development of this site. All technical and environmental pre-screenings seemed favourable.
Beaufort West	Medium	Minor	Major	Medium	Minor	Minor	Medium	Minor	Minor	Minor	This project was considered a no-go. Unfavourable wind conditions.
Sutherland (Roggeveld)	Minor	Minor	Major	Major	Minor	Minor	Minor	Medium	Medium	Minor	Sutherland was considered a no-go due to unfavourable wind conditions and proximity to the astronomy centre, but the applicant proceeded with Roggeveld

Site	Visual	Acoustic	Birds	Bats	Fauna	Flora	Hydrology	Heritage	Access	Safety	Motivation
											and this Kudusberg wind farm.
Vredendal	Extreme	Minor	Medium	Major	Minor	Minor	Minor	Medium	Minor	Minor	This project was considered a no-go. High environmental risk and less favourable wind conditions
Calvinia	Medium	Minor	Minor	Major	Medium	Medium	Minor	Minor	Minor	Minor	This project was considered a no-go. Limited space and grid connection options for a feasible wind farm.
Klawer	Extreme	Minor	Medium	Major	Minor	Minor	Medium	Minor	Minor	Minor	The applicant proceeded with the development of this site. All technical and environmental pre-screenings seemed favourable.
Struisbay	Major	Minor	Extreme	Extreme	Minor	Minor	Minor	Minor	Minor	Major	This project was considered a no-go. High environmental risks in terms of birds and bats.
Swartbergvlei	Extreme	Major	Extreme	Extreme	Minor	Medium	Minor	Minor	Minor	Major	This project was considered a no-go. High environmental risks in terms of birds and bats.
Uitvlugt	Extreme	Minor	Extreme	Extreme	Minor	Medium	Minor	Minor	Minor	Minor	This project was considered a no-go.
Swellendam2	Extreme	Extreme	Extreme	Major	Minor	Medium	Minor	Minor	Minor	Medium	This project was considered a no-go.

The applicant proceeded to assess the remaining sites to determine technical feasibility, including:

- Wind resource: Analysis of publicly available information, proprietary information and specialist on-site analysis of weather data to determine the wind resource.
- Site extent to ensure that enough land can be secured to allow for a minimum number of wind turbines to make the project feasible.
- Grid access: Grid access and the distance to a viable connection point were key considerations in terms of prioritising appropriate sites.
- Land suitability: The current land use of the site properties was an important consideration for site selection in terms of limiting disruption to existing land use practices.
- Landowner support: The selection of sites where the landowners are supportive of the development of renewable energy is essential for ensuring the success of the project.

These initial pre-feasibility assessments assisted the applicant with forthcoming decisions as to which site alternatives to be prioritised for the development of wind energy facilities.

In addition, the DEA's SEA for wind and solar farms identified an area of about 160 x 60 km, centred on Eskom's Komsberg substation, as one of only eight priority areas for wind farm development in South Africa. The SEA itself is based on a large number of environmental and technical criteria and therefore supports the applicant's findings.

These detailed EIAs undertaken as part of the earlier version of the project Roggeveld, lead the applicant to believe that there is an acceptable risk of environmental impacts by wind farms in this area. Based on high quality wind measurements conducted since 2010, the wind resource in this area also proved to be exceptionally high, further evidenced by the first phase's ability to bid the lowest tariff (R0.56/kWh) of all wind farm projects in round 4 of the REIPPPP in August 2014. Advanced wind modelling conducted for an area about 25 km around the first phase showed that the surrounding terrain (which includes the Kudusberg site) held very similar, if not better wind potential and therefore was feasible for further wind farm development.

As such the applicant decided to proceed with all of the developments in the Roggeveld area of which includes the Kudusberg site.

The Kudusberg site was deemed feasible and was selected as the preferred site for the proposed Kudusberg WEF. It extends over the farm portions as included in Table A.1. No other site alternatives were considered further or assessed as part of this BA process.

A.9.5 Alternative locations of the Development Footprint

The preferred site extends approximately 30 000 ha (extent of all affected cadastral units), while only approximately 126 ha of the available land will be required for the proposed development of the Kudusberg WEF. The preferred development footprint of the Kudusberg WEF on the site is shown in Figure A.23 below. The development footprint within the site was determined through a desktop screening assessment of the site and in consultation with the relevant landowners whereby possible areas that should not be proposed for the development (i.e. exclusion zones) were identified.

The main project components are the wind turbines themselves which inform the layout of associated infrastructure such as roads, crane pads, substation and power line routes. Within the Kudusberg area, detailed consideration was given to selecting areas that would be suitable for turbine placement or project infrastructure. In the selection process, some areas within the local site were eliminated for the following reasons:

- *Wind resources:* To ensure that a project has a good chance of being constructed in the highly competitive REIPPPP space, wind turbines must be placed in the areas with the highest wind resources. Typically, ridgelines prove most suitable in this respect due to flow acceleration effects whereas average wind speeds in the valleys between tend to be very low for the opposite reasons.
- *Buildable Areas:* consideration of all preliminary technical and environmental parameters (before EIA or BA) which demarcate where turbine placement is feasible and exclude areas where not. This is based on maximum allowable slopes, setbacks from farmsteads, setbacks from neighbouring farms required by provincial land use regulations and finally required buffers from Eskom power lines. In addition, the process of identifying buildable areas takes into account certain no-go zones to avoid potential electromagnetic interference on existing telecommunication infrastructure.
- *Landowner input:* The landowners were provided with the opportunity to state preference for certain areas of their properties to be excluded from the development. This meant that some areas of potential development would be excluded due to landowner preferences.

The preferred location for the Kudusberg WEF is shown in Figure A.23. Therefore, no further site location alternatives other than Kudusberg will be considered in this BA process.

A.9.6 Layout Alternatives

The specialist studies (Appendix D of this report) have highlighted sensitive features within the original development footprint, and thus the footprint has been revised to avoid such features (Please refer to Section D where the environmental sensitivities are discussed. The changes that were made to the initial layout are also listed in Section D.). Based on the findings of the specialist studies, an environmental sensitivity map has been produced (see Figure A.23). This map shows the sensitivities on site (e.g. terrestrial ecology, watercourse features, and sensitive heritage features) within area that were identified and assessed. Based on the environmental sensitivities identified, a revised project site layout has been determined by the applicant. Based on this revised map, the preferred location for the 126 ha Kudusberg WEF, avoids the sensitive features that were identified by the specialists. The specialists on the project team have assessed the revised layout and have confirmed that there are no fatal flaws associated with the revised project layout which will preclude the development of the Kudusberg WEF.

Following the exclusion of the required areas, sufficient developable area is still available on site which does not compromise the current ecological integrity of the site or disobey the wishes of the landowners. The areas with feasible wind resources are, however limited to the ridges where the footprints are currently located. Therefore, no reasonable and feasible development footprint alternatives exist to be considered as part of BA process.

Semi-detailed engineering design has also been undertaken to develop the current footprint that is technically feasible in the challenging topographic onsite conditions. The current layout is thus a culmination of extensive technical, economic and environmental planning.

Therefore, the findings of a range of specialist inputs have been used to inform the layout of the proposed facility within the preferred site and the current layout is the only reasonable and feasible one, and therefore the preferred layout consisting of 56 wind turbines with no further alternatives considered in the BA process.

Apart from the alternatives listed above, the following infrastructure component alternatives associated with the proposed Kudusberg WEF were considered and assessed by the specialists on the project team.

A.9.7 Project infrastructure alternatives

Various infrastructure alternatives have been considered and assessed in this BA process. These include alternative Access Roads, Construction Camps and Substation locations.

A.9.7.1 Access Roads

Various access road alternatives were proposed to connect the R356 to the various turbine locations. The proposed access to the site is from the tarred R354 connecting Matjiesfontein and Sutherland, turning west onto the district gravel road DR02249 and then heading southwest onto the R356 (MR00319) provincial gravel road from where the main access road (MN04469/OG51) branches off towards the south. The two access road alternatives branch off the MN04469.

The upgrade of the DR02249 and R356 public roads may involve the upgrade of any watercourse crossings to facilitate the abnormal loads to be transported to site, especially for tower sections, nacelles and blades. The intersections between DR02249 and R354 as well as DR02249 and the R356 will have to be widened to a curve radius of 50 m in order to facilitate safe passage of the very long low bed trailers used for blade transportation. The upgrade of the MN004469 is anticipated to include limited widening, straightening of curves and the installation of culverts or bridges at watercourse crossings.

Two access road alternatives would connect the public MN004469 road to the new wind farm road network between the turbines on the ridges namely:

- Access Road Alternative 1, western route is approximately 4.6 km in length, almost all of which comprises an existing jeep track.

- Access Road Alternative 2, the eastern route is approximately 5.7 km in length, almost all of which would be a new road.

Each road section will be **buffered by approximately 200 m** in order to allow for incremental alternatives i.e. reroute within the buffer in order to avoid any sensitive features identified during the detailed specialist assessments.

The preferred Alternative Access Road is Alternative 1, the western route. It follows an existing track and is also shorter than the eastern route (Alternative 2). None of the access route alternatives were however deemed to be fatally flawed by the specialists.

A.9.7.2 Construction Camps

Three alternative construction camp layouts, including the area required for a batching plant, were assessed by the specialists, namely:

- Construction Camp 1 is located on a flat high-lying area between turbines 43 and 47.

- Construction Camp 2 is located adjacent to and east of the MN4469 public road on the remainder of the farm 193 Urias Gat, south of Construction Camp 3, adjacent to Access Road Alternative 1.

- Construction Camp 3 is located adjacent to and east of the MN4469 public road on portion 6 of the farm 193 Urias Gat, north of Construction Camp 2.

The preferred Construction Camp location is Alternative 2. Construction Camp Alternative 3 was found to be flawed by the heritage specialists and are therefore not deemed feasible.

A.9.8 Substations

Three onsite 33/132kV substation location alternatives were identified based on technical studies which considered aspects such as topography, earth works and levelling, environmentally sensitive features, electrical losses, turbine locations and existing agricultural use. All three positions are located relatively in the centre of the facility.

- Substation Alternative 1 is located south of turbine 38 and north of turbine 9.
- Substation Alternative 2 is located south of turbine 42 and north of turbine 13.
- Substation Alternative 3 is located southeast of turbine 44.

The preferred substation location is Alternative 3, followed by Substation Alternative 1 (Substation Alternative 2 was withdrawn by the landowner and are no longer considered in this BA process).

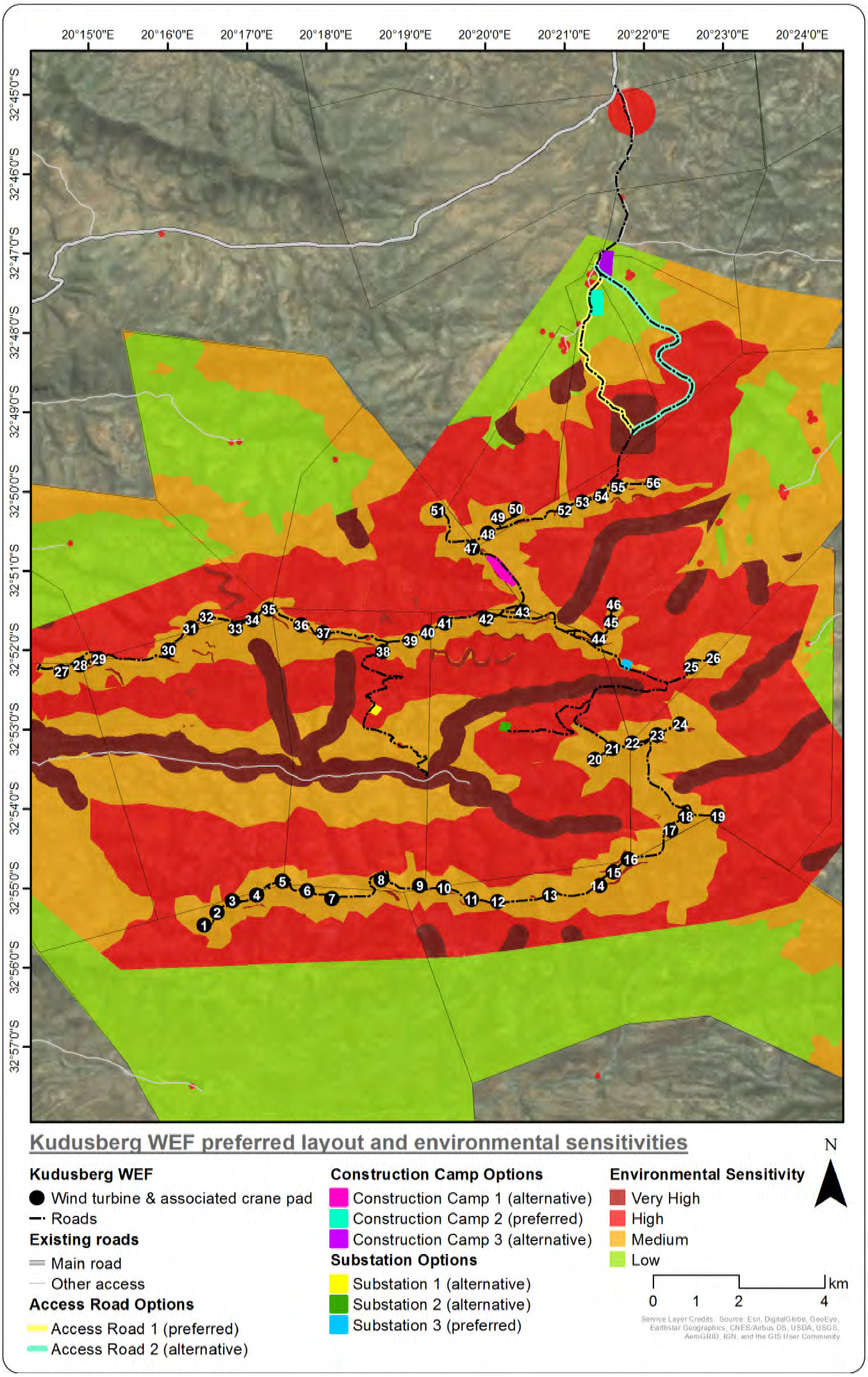

Figure A.23: **The environmental sensitivities on site overlain with the site layout (showing all the project alternatives) of the proposed Kudusberg WEF. *Note*: At the scale of this map some of the turbine locations may appear to be in high sensitivity areas. However, all turbines avoid high sensitivities.**

***Note*: Please note that the very-high sensitive areas are not necessarily no-go areas for all infrastructure and therefore all specialist assessments in Appendix D must be consulted.**

A.10 CONCLUDING STATEMENT OF PREFERRED ALTERNATIVES

As per Appendix 2, Section 2 (xi) of the 2014 amended EIA Regulations, and based on Section 5.1 above, the following alternatives were assessed in the BA Phase:

- **No-go Alternative:**
  - The no-go alternative assumes that the proposed project will not go ahead i.e. it is the option of not constructing the proposed Kudusberg WEF. This alternative would result in no environmental impacts (positive and negative) on the site or surrounding local area, as a result of the facility. It is a baseline against which other alternatives were compared and considered during the BA process.
  - The no-go is not preferred.

- **Land Use (Activity) Alternative:**
  - The current land use is agriculture, and this has been identified as an alternative land use for the site. The agricultural potential of the site is very low and was not deemed feasible to assess further during the BA process. The implementation of a WEF at the proposed project site is more favourable than the agricultural land use alternative and is therefore the preferred and only land use alternative.
  - Only proposed activity is a 325 MW WEF.

- **Technology Alternatives:**
  - The **development of a WEF is the preferred and only renewable energy technology** alternative to be developed on site because:
    - The proposed Kudusberg WEF falls within the REDZ 2. The proposed project is therefore in line with the criteria of the SEA and located in an area of strategic importance for wind energy development;
    - The site has a good wind resource based on WASA data and on-site measurements;
    - Solar energy, a potential developable technology on site, would not be as economically viable compared to wind development at this location (due to the topography of the site-steep hills, mountainous terrain and not enough flat terrain available for the placement of solar PV panels); and
    - Government Gazette 39111 allocated a higher allocation target to wind energy compared to solar energy.

- **Preferred Site and location:**
  - The preferred site for the proposed **Kudusberg WEF** extends over the farm portions as indicated in Table A.1.
  - The location of the Kudusberg WEF was informed by the wind resources on site, the buildable areas that had to be excluded as well as the inputs received from the land owners.

Based on the criteria listed above, the location of the proposed Kudusberg was selected as shown in Figure A.23.

Layout Alternatives:

- o Layout alternatives for the project were determined following the input from the various environmental and technical specialists involved in the project. All high resource areas along the ridges of the relevant properties, as well as potential locations for all supporting infrastructure were assessed by the specialists. Based on the inputs from the specialists the initial layout was revised to avoid environmentally sensitive areas (no-go areas), while still retaining a technically and financially viable layout. The current proposed layout comprising 56 turbines is the preferred layout that was assessed by all the specialists on the project team (Figure A.23).
- o Access Road Alternative 1 is the preferred access route alternative.
- o Construction Camp Alternative 2 is the preferred alternative.
- o Substation Alternative 3 is the preferred alternative.

A.11Needs and desirability

It is an important requirement in the BA Process to review the need and desirability of the proposed project. Guidelines on Need and Desirability were published in the Government Gazette of 20 October 2014. These guidelines list specific questions to determine need and desirability of proposed developments. This checklist is a useful tool in addressing specific questions relating to the need and desirability of a project and assists in explaining that need and desirability at the provincial and local context. Need and desirability answer the question of whether the activity is being proposed at the right time and in the right place. Table A.8 includes a list of questions based on the DEA's Guideline to determine the need and desirability of the proposed project. It should be noted this table was informed by the outcomes of the BA Process.

Table A.8: The Guideline on the Need and Desirability's list of questions to determine the "Need and Desirability" of a proposed project

NEED	
Question	**Response**
1. How will this development (and its separate elements/aspects) impact on the ecological integrity of the area)?	
1.1. How were the following ecological integrity considerations taken into account?: 1.1.1. Threatened Ecosystems, 1.1.2. Sensitive, vulnerable, highly dynamic or stressed ecosystems, such as coastal shores, estuaries, wetlands, and similar systems require specific attention in management and planning procedures, especially where they are subject to significant human resource usage and development pressure, 1.1.3. Critical Biodiversity Areas ("CBAs") and Ecological Support Areas ("ESAs"), 1.1.4. Conservation targets, 1.1.5. Ecological drivers of the ecosystem, 1.1.6. Environmental Management Framework, 1.1.7. Spatial Development Framework, and 1.1.8 Global and international responsibilities relating to the environment (e.g. RAMSAR	**The environmental sensitivities present on site were assessed within the Ecological Impact Assessment undertaken as part of this BA Process. The specialist identified all ecological sensitive areas on site that would need to be avoided by the proposed development, as well as how to suitably develop within these areas so that the ecological integrity of the areas is maintained (refer to Section D and Appendix D). Following the recommendations from the specialist, *inter alia*, the avoidance of the placement of the turbines and crane pads on the ecological sensitive rocky sheets on the mountain ridges, the applicant revised the initial layout.** **A sensitivity map produced based on the input obtained from the various specialist studies is included in Section D of this Report, as well as in Appendix B. The overall impact on ecology is low**

NEED	
Question	**Response**
sites, Climate Change, etc.).	**significance.**
1.2. How will this development disturb or enhance ecosystems and/or result in the loss or protection of biological diversity? What measures were explored to firstly avoid these negative impacts, and where these negative impacts could not be avoided altogether, what measures were explored to minimise and remedy (including offsetting) the impacts? What measures were explored to enhance positive impacts?	**The environmental sensitivities present on site were assessed within the ecological impact assessment undertaken as part of this BA Process. The specialist identified all ecological sensitive areas on site that would need to be avoided by the proposed development, as well as how to suitably develop within these areas so that the ecological integrity of the areas is maintained (refer to Section D and Appendix D).** **A sensitivity map produced based on the input obtained from the various specialist studies is included in Section D and Appendix B of this Report.** **Measures to avoid, remedy, mitigate and manage impacts are included within the compiled EMPr, included as Appendix G of the Report, which forms part of this BA Report. The overall impact on ecology is low significance.**
1.3. How will this development pollute and/or degrade the biophysical environment? What measures were explored to firstly avoid these impacts, and where impacts could not be avoided altogether, what measures were explored to minimise and remedy (including offsetting) the impacts? What measures were explored to enhance positive impacts?	**This development has the potential to impact on the ecology of the area, this includes impacts on the natural vegetation, biodiversity, sensitive habitats and ecosystem function. <u>The overall impact to ecology is considered to be of low (negative) impact significance (Please refer to Section D).</u> However, the impact associated with the clearance of natural vegetation remains high within the footprint (following mitigation). However, sufficient crest habitat is available for ecological patterns and processes to continue unaltered. Measures to avoid, remedy, mitigate and manage impacts are included within the Ecology Impact Assessment and the EMPr, which forms part of this BA Report.**
1.4. What waste will be generated by this development? What measures were explored to firstly avoid waste, and where waste could not be avoided altogether; what measures were explored to minimise, reuse and/or recycle the waste? What measures have been explored to safely treat and/or dispose of unavoidable waste?	**The description of the potential waste generation is included in Section A of this BA Report (this Section). It is not anticipated that a significant amount of waste will be generated.** **The EMPr includes measures to avoid, remedy, mitigate and manage impacts are included within the compiled EMPr (Appendix G), which forms part of this BA Report.**
1.5. How will this development disturb or enhance landscapes and/or sites that constitute the nation's cultural heritage? What measures were explored to firstly avoid these impacts, and where impacts could not be avoided altogether, what measures were explored to minimise and remedy (including offsetting) the impacts? What measures were explored to enhance positive impacts?	**A Heritage Impact Assessment was undertaken as part of the assessment for this project. <u>The overall findings of the HIA is that the impact to heritage resources will be of low (negative) significance following mitigation</u>. It is anticipated that the proposed WEF will have a high impact on the cultural landscape. However, the cultural specialist indicates that it should be noted that this area has**

NEED	
Question	**Response**
	been identified as a REDZ and that there are at least four other WEFs approved for the surrounding area. Thus, changes to the current cultural landscape are already in process. A Heritage profile is included in Section B of this Report. The applicable measures to avoid, remedy, mitigate and manage impacts are included in Section D and Appendix D (full specialist study) as well as in the EMPr.
1.6. How will this development use and/or impact on non-renewable natural resources? What measures were explored to ensure responsible and equitable use of the resources? How have the consequences of the depletion of the non-renewable natural resources been considered? What measures were explored to firstly avoid these impacts, and where impacts could not be avoided altogether, what measures were explored to minimise and remedy (including offsetting) the impacts? What measures were explored to enhance positive impacts?	**This project requires water during the construction phase and minimal waster is required during the operational phase. Temporary infrastructure to obtain water from available local sources/ new or existing boreholes including a potential temporary above ground pipeline (approximately 35cm diameter) will be investigated to feed water to the on-site batching plant. Water will potentially be stored in temporary water storage tanks. The necessary approvals from the DWS will be applied for separately.**
1.7. How will this development use and/or impact on renewable natural resources and the ecosystem of which they are part? Will the use of the resources and/or impact on the ecosystem jeopardise the integrity of the resource and/or system taking into account carrying capacity restrictions, limits of acceptable change, and thresholds? What measures were explored to firstly avoid the use of resources, or if avoidance is not possible, to minimise the use of resources? What measures were taken to ensure responsible and equitable use of the resources? What measures were explored to enhance positive impacts? 1.7.1. Does the proposed development exacerbate the increased dependency on increased use of resources to maintain economic growth or does it reduce resource dependency (i.e. de-materialised growth)? (note: sustainability requires that settlements reduce their ecological footprint by using less material and energy demands and reduce the amount of waste they generate, without compromising their quest to improve their quality of life) 1.7.2. Does the proposed use of natural resources constitute the best use thereof? Is the use justifiable when considering intra- and intergenerational equity, and are there more important priorities for which the resources should be used (i.e. what are the opportunity costs of using these resources of the proposed development alternative?)	**The proposed project aims to harness wind energy for the generation of electricity. This project is seen as a source of clean energy and reduces the dependence on non- renewable sources, such as coal fired power plants. The proposed development is located in the Komsberg REDZ. The REDZs represent areas where wind and solar photovoltaic development is being incentivised from resource, socio-economic and environmental perspectives. For more information, <u>please refer to the Alternatives section included in Section A.9 of this report (this section) for an outline of the suitability of this activity.</u>**

NEED	
Question	**Response**
1.7.3. Do the proposed location, type and scale of development promote a reduced dependency on resources?	
1.8. How were a risk-averse and cautious approach applied in terms of ecological impacts?: 1.8.1. What are the limits of current knowledge (note: the gaps, uncertainties and assumptions must be clearly stated)? 1.8.2. What is the level of risk associated with the limits of current knowledge? 1.8.3. Based on the limits of knowledge and the level of risk, how and to what extent was a risk-averse and cautious approach applied to the development?	**The precautionary approach has been adopted for this assessment, i.e. assuming the worst-case scenario will occur and then identifying ways to mitigate or manage these impacts.** **The assessment of cumulative impacts assumed that all proposed projects will be constructed. In reality, only a handful of projects would be constructed and therefore this approach is considered to be precautionary in nature.** **Additionally, based on the specialist findings the layout was amended to avoid sensitive areas.** **Please refer to Appendix D of this report for the full specialist studies. These studies outline the assumptions and limitations that were applicable to the respective studies.** **The risk associated with the limits in knowledge is considered to be low.**
1.9. How will the ecological impacts resulting from this development impact on people's environmental right in terms following: 1.9.1. Negative impacts: e.g. access to resources, opportunity costs, loss of amenity (e.g. open space), air and water quality impacts, nuisance (noise, odour, etc.), health impacts, visual impacts, etc. What measures were taken to firstly avoid negative impacts, but if avoidance is not possible, to minimise, manage and remedy negative impacts? 1.9.2. Positive impacts: e.g. improved access to resources, improved amenity, improved air or water quality, etc. What measures were taken to enhance positive impacts?	**Please refer to Section D and Appendix D for the specialist studies undertaken. The overall negative impact to people's environmental right in terms of social and visual impacts are considered to be low. In addition, the social assessment found that the employment opportunities created would be considered a low positive impact.**
1.10. Describe the linkages and dependencies between human wellbeing, livelihoods and ecosystem services applicable to the area in question and how the development's ecological impacts will result in socio-economic impacts (e.g. on livelihoods, loss of heritage site, opportunity costs, etc.)?	**This is considered and addressed as part of the Socio-Economic Impact Assessment undertaken for this project (included in Appendix D and summarised in Section D of this report).** **The study found that "in light of the overall low significance (post mitigation) rating of identified negative impacts, and having regard to the nature of such impacts, and the status quo socio-economic conditions present in the Witzenberg and Karoo Hoogland Local Municipalities; the socio-economic benefits of the project appear to outweigh its impacts. Should the mitigation measures be**

NEED	
Question	**Response**
	implemented as prescribed in this assessment; it is recommended that the proposed development be awarded environmental authorisation".
1.11. Based on all of the above, how will this development positively or negatively impact on ecological integrity objectives / targets / considerations of the area?	**The proposed Kudusberg project will have a positive impact on the ecological integrity objectives or targets of the area. The Cape Winelands DM's IDP states that the DM plans to move to less carbon-intensive electricity production through procuring at least 20 000MW of renewable energy, increased hydro imports from the region and increased demand-side measures, including solar water heating.** **The IDP of the Namaqua DM states that "Renewable energy is recently one of the cornerstones of the economy of the District and there needs to be engagement on National level to ensure that the District benefit from this resource."** **Output 10 from IDP indicates:** **…To ensure that Environmental assets and natural resources are well protected and continually enhanced, the key partners will focus on the following four key outputs and related sub-outputs:** ▪ **Enhanced quality and quantity of water resources** ▪ **Reduced greenhouse gas emissions, climate change & improved air/atmospheric quality** ▪ **Sustainable environmental management** ▪ **Protected biodiversity…** **The proposed project will also be supportive of the IDP's objective of creating more job opportunities.** **The Witzenberg LM IDP promotes the creation of an enabling environment to attract investment and support local economy. The Karoo Hoogland's IDP calls for economic interventions in sector development (agricultural, tourism and renewable energy).** **The proposed Kudusberg WEF will therefore be aligned with the vision and goals of the DMs and the LMs.**
1.12. Considering the need to secure ecological integrity and a healthy biophysical environment, describe how the alternatives identified (in terms of all the different elements of the development and all the different impacts being proposed), resulted in the	**Please refer to the Alternatives section included in Section A of this report (this section) for an outline of the suitability of this activity.**

NEED	
Question	**Response**
selection of the "best practicable environmental option" in terms of ecological considerations?	
1.13. Describe the positive and negative cumulative ecological/biophysical impacts bearing in mind the size, scale, scope and nature of the project in relation to its location and existing and other planned developments in the area?	**Please refer to the summary of the Ecology Impact Assessment in Section D of this BA Report and the full specialist study in Appendix D of this report.**
2.1. What is the socio-economic context of the area, based on, amongst other considerations, the following considerations?	
2.1.1. The IDP (and its sector plans' vision, objectives, strategies, indicators and targets) and any other strategic plans, frameworks of policies applicable to the area,	**The Witzenberg LM IDP promotes the creation of an enabling environment to attract investment and support local economy. The Karoo Hoogland's IDP calls for economic interventions in sector development (agricultural, tourism and renewable energy).** **The proposed Kudusberg WEF will therefore be aligned with the vision and goals of the LMs.** **The proposed project will also be supportive of the IDPs' objective of creating more job opportunities The proposed project will create job opportunities and economic spin offs during the construction and operational phases (if an EA is granted by the DEA).** **It is estimated that approximately 250 (full-time equivalent) employment opportunities will be created during the construction phase and 20 permanent opportunities during the operational phase.** **It should however be noted that employment during the construction phase will be temporary, whilst being long-term during the operational phase. Therefore, the proposed WEF would help to address the need for increased electricity supply (on a national level) while also be providing advanced skills transfer and training to the local communities and creating contractual and permanent employment in the area.**
2.1.2. Spatial priorities and desired spatial patterns (e.g. need for integration of segregated communities, need to upgrade informal settlements, need for densification, etc.),	**N/A the proposed project is located within a rural area and the site is zoned for agricultural use.**
2.1.3. Spatial characteristics (e.g. existing land uses, planned land uses, cultural landscapes, etc.)	**Please refer to Section B and D of this report for a description of the receiving environment and impact assessment, respectively. The impact of the**

NEED	
Question	**Response**
	proposed project on cultural/heritage areas (archaeology and palaeontology) have been assessed in the form of a Heritage Impact Assessment attached as Appendix D and summarised in Section D. **The proposed project site is currently being used for agricultural purposes, predominantly grazing. Should the proposed project proceed, approximately 126 ha of the land will be developed on and it is not expected that this will significantly threaten the agricultural activities present on site. A Soils and Agricultural Impact Assessment (Appendix D and summarised in Section D) was undertaken as part of this BA and is included within the BA Report to reflect the impact of the proposed project in terms of the land use and agricultural potential. All agricultural impacts of the proposed development are assessed as being of low to very low significance.**
2.1.4. Municipal Economic Development Strategy ("LED Strategy").	**The LEDs of the Cape Winelands District Municipality (Project 14) and the Karoo Hoogland Municipality state that it must investigate opportunities for renewable energy development.**
2.2. Considering the socio-economic context, what will the socio-economic impacts be of the development (and its separate elements/aspects), and specifically also on the socio-economic objectives of the area? 2.2.1. Will the development complement the local socio-economic initiatives (such as local economic development (LED) initiatives), or skills development programs?	**Please refer to the Socio-Economic Impact Assessment summarised in Section D and included in Appendix D for an outline of the social impacts that could occur due to the proposed development of the WEF.**
2.3. How will this development address the specific physical, psychological, developmental, cultural and social needs and interests of the relevant communities?	
2.4. Will the development result in equitable (intra- and inter-generational) impact distribution, in the short- and long term? Will the impact be socially and economically sustainable in the short- and long-term?	
2.5. In terms of location, describe how the placement of the proposed development will:	
2.5.1. result in the creation of residential and employment opportunities in close proximity to or integrated with each other,	**Please refer to the Socio-Economic Impact Assessment summarised in Section D and included in Appendix D for an outline of the positive impacts associated with the creation of employment opportunities that could be created by the solar facility.**
2.5.2. reduce the need for transport of people and goods,	**Not applicable. This is a renewable energy project proposal.**
2.5.3. result in access to public transport or enable non-motorised and pedestrian transport (e.g. will the development result	**Not applicable. This is a renewable energy project proposal.**

NEED	
Question	**Response**
in densification and the achievement of thresholds in terms public transport),	
2.5.4. compliment other uses in the area,	**A Soils and Agricultural Impact Assessment was undertaken to determine the impact on the current land-use. Refer to Section D and Appendix D for a summary of the study and the full study, respectively. The preferred project site is currently being used for agricultural purposes, predominantly grazing. Should the proposed project proceed, approximately 126 ha of the land will be developed on and it is not expected that this will significantly threaten the agricultural activities present on site as it will be undertaken in tandem.**
2.5.5. be in line with the planning for the area,	
2.5.6. for urban related development, make use of underutilised land available with the urban edge,	**Not applicable. The proposed project is located within a rural area and the site is zoned for agricultural use.**
2.5.7. optimise the use of existing resources and infrastructure,	**The proposed project will connect to the Eskom Komsberg Substation, via the Bon Espirange Substation and will make use of existing access roads as far as possible. It will also make use of the excellent onsite wind resource.**
2.5.8. opportunity costs in terms of bulk infrastructure expansions in non-priority areas (e.g. not aligned with the bulk infrastructure planning for the settlement that reflects the spatial reconstruction priorities of the settlement),	**This project is a renewable energy project and not related to bulk infrastructure expansion.**
2.5.9. discourage "urban sprawl" and contribute to compaction/densification,	**Please refer to the Socio-Economic Impact Assessment summarised in Section D and included in Appendix D for management measures on how to manage the impact associated with the "disruption of local social structures as a result of the construction work force and in-migration of job seekers".**
2.5.10. contribute to the correction of the historically distorted spatial patterns of settlements and to the optimum use of existing infrastructure in excess of current needs,	**N/A the proposed project is located within a rural area and the site is zoned for agricultural use.**
2.5.11. encourage environmentally sustainable land development practices and processes,	**Based on the findings of this BA, the proposed project would <u>not</u> have a significant ("high") negative impact on the receiving environment, with the implementation of suitable mitigation measures (Section D) and will therefore not go against sustainable land development practices and processes. In addition, the proposed project will be designed according to relevant national specifications and standards which are regarded as best practice in the renewable energy sector. In addition, the proposed Kudusberg WEF will be located in a REDZ and the development proposal will therefore be aligned with national planning**

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Question		**Response**
		priorities.
2.5.12.	take into account special locational factors that might favour the specific location (e.g. the location of a strategic mineral resource, access to the port, access to rail, etc.),	**Please refer to the Alternatives section included in Section A.9 of this report (this section) for an outline of the selection and suitability of this activity.**
2.5.13.	the investment in the settlement or area in question will generate the highest socio-economic returns (i.e. an area with high economic potential),	**Please refer to the Socio-Economic Impact Assessment summarised in Section D and included in Appendix D. In addition, as noted in this section of the report, the Applicant will ultimately own the project and, if successful, will compile an Economic Development Plan which will be compliant with REIPPPP requirements and will inter alia set out to achieve the following:** • **Create a local community trust or similar (as required by REIPPPP) which has an equity share in the project life to benefit historically disadvantaged communities;** • **Initiate a skills development and training strategy to facilitate future employment from the local community; and** • **Give preference to local suppliers for the construction of the facility.** • **Support local community upliftment projects and entrepreneurship through socio-economic and enterprise development initiatives.**
2.5.14.	impact on the sense of history, sense of place and heritage of the area and the socio-cultural and cultural-historic characteristics and sensitivities of the area, and	**A Heritage Impact Assessment was undertaken as part of the assessment for this project. The overall findings of the HIA is that the impact to heritage resources will be low (negative) significance.**
2.5.15.	in terms of the nature, scale and location of the development promote or act as a catalyst to create a more integrated settlement?	**This facility is proposed in REDZ 2. Several WEFs (refer to Section D for an outline of the WEFs proposed in a 50 km radius) are proposed in the area, which lends itself potentially to a renewable energy development area.**
2.6. How were a risk-averse and cautious approach applied in terms of socio-economic impacts?		
2.6.1.	What are the limits of current knowledge (note: the gaps, uncertainties and assumptions must be clearly stated)?	**Please refer to the Social Impact Assessment summarised in Section D and included in Appendix D.**
2.6.2.	What is the level of risk (note: related to inequality, social fabric, livelihoods, vulnerable communities, critical resources, economic vulnerability and sustainability) associated with the limits of current knowledge?	
2.6.3.	Based on the limits of knowledge and the level of risk, how and to what extent was a risk-averse and cautious approach applied to the development?	

<table>
<tr><th colspan="2">NEED</th></tr>
<tr><th>Question</th><th>Response</th></tr>
<tr><td colspan="2">2.7. How will the socio-economic impacts resulting from this development impact on people's environmental right in terms following:</td></tr>
<tr><td>2.7.1. Negative impacts: e.g. health (e.g. HIV-Aids), safety, social ills, etc. What measures were taken to firstly avoid negative impacts, but if avoidance is not possible, to minimise, manage and remedy negative impacts?</td><td rowspan="7">Please refer to the Socio-Economic Impact Assessment summarised in Section D and included in Appendix D.</td></tr>
<tr><td>2.7.2. Positive impacts. What measures were taken to enhance positive impacts?</td></tr>
<tr><td>2.8. Considering the linkages and dependencies between human wellbeing, livelihoods and ecosystem services, describe the linkages and dependencies applicable to the area in question and how the development's socioeconomic impacts will result in ecological impacts (e.g. over utilisation of natural resources, etc.)?</td></tr>
<tr><td>2.9. What measures were taken to pursue the selection of the "best practicable environmental option" in terms of socio-economic considerations?</td></tr>
<tr><td>2.10. What measures were taken to pursue environmental justice so that adverse environmental impacts shall not be distributed in such a manner as to unfairly discriminate against any person, particularly vulnerable and disadvantaged persons (who are the beneficiaries and is the development located appropriately)? Considering the need for social equity and justice, do the alternatives identified, allow the "best practicable environmental option" to be selected, or is there a need for other alternatives to be considered?</td></tr>
<tr><td>2.11. What measures were taken to pursue equitable access to environmental resources, benefits and services to meet basic human needs and ensure human wellbeing, and what special measures were taken to ensure access thereto by categories of persons disadvantaged by unfair discrimination?</td></tr>
<tr><td>2.12. What measures were taken to ensure that the responsibility for the environmental health and safety consequences of the development has been addressed throughout the development's life cycle?</td></tr>
<tr><td colspan="2">2.13. What measures were taken to:</td></tr>
<tr><td>2.13.1. ensure the participation of all interested and affected parties,</td><td rowspan="4">The Public Participation Process (PPP) for the proposed Kudusberg WEF that will be undertaken is included in the BA Report (Appendix D) and summarised in Section C. This BA Report will be released for a 30-day commenting period to all the relevant authorities and stakeholders. Various methods will be employed to notify potential (I&APs) of the proposed project, namely, through an advert, site notices on site and in Matjiesfontein and Laingsburg and notification letters.</td></tr>
<tr><td>2.13.2. provide all people with an opportunity to develop the understanding, skills and capacity necessary for achieving equitable and effective participation,</td></tr>
<tr><td>2.13.3. ensure participation by vulnerable and disadvantaged persons,</td></tr>
<tr><td>2.13.4. promote community wellbeing and empowerment through environmental</td></tr>
</table>

NEED	
Question	**Response**
education, the raising of environmental awareness, the sharing of knowledge and experience and other appropriate means,	**The BA process has taken cognisance of all interests, needs and values espoused by all interested and affected parties, including occupiers. Opportunity for public participation will be provided to all I&APs throughout the BA process in terms of the 2014 EIA Regulations, as amended.**
2.13.5. ensure openness and transparency, and access to information in terms of the process,	
2.13.6. ensure that the interests, needs and values of all interested and affected parties were taken into account, and that adequate recognition were given to all forms of knowledge, including traditional and ordinary knowledge,	
2.13.7. ensure that the vital role of women and youth in environmental management and development were recognised and their full participation therein was promoted.	
2.14. Considering the interests, needs and values of all the interested and affected parties, describe how the development will allow for opportunities for all the segments of the community (e.g. a mixture of low-, middle-, and high-income housing opportunities) that is consistent with the priority needs of the local area (or that is proportional to the needs of an area)?	**Please refer to the Socio-Economic Impact Assessment summarised in Section D and included in Appendix D.**
2.15. What measures have been taken to ensure that current and/or future workers will be informed of work that potentially might be harmful to human health or the environment or of dangers associated with the work, and what measures have been taken to ensure that the right of workers to refuse such work will be respected and protected?	**An EMPr has been developed to address health and safety concerns. An Environmental Control Officer (ECO) will be appointed to monitor compliance.**
2.16. Describe how the development will impact on job creation in terms of, amongst other aspects:	
2.16.1. the number of temporary versus permanent jobs that will be created,	**Please refer to the Socio-Economic Impact Assessment summarised in Section D and included in Appendix D.**
2.16.2. whether the labour available in the area will be able to take up the job opportunities (i.e. do the required skills match the skills available in the area),	
2.16.3. the distance from where labourers will have to travel,	
2.16.4. the location of jobs opportunities versus the location of impacts (i.e. equitable distribution of costs and benefits),	
2.16.5. the opportunity costs in terms of job creation (e.g. a mine might create 100 jobs, but impact on 1000 agricultural jobs, etc.).	
2.17. What measures were taken to ensure:	
2.17.1. that there were intergovernmental coordination and harmonisation of policies, legislation and actions relating to the environment,	**Legislation, policies and guidelines, which could apply to impacts of the proposed project on the environment, have been considered. The scope and content of this BA Report have been informed by**

NEED	
Question	**Response**
	applicable integrated environmental management legislation and policies. This has been included in Section A.8 of this BA Report.
2.17.2. that actual or potential conflicts of interest between organs of state were resolved through conflict resolution procedures?	**The PPP for the proposed Kudusberg WEF that will be undertaken is included in the BA Report (summarised in Section C. This BA Report will be released for a 30-day commenting period to all the relevant authorities and stakeholders and will be given an opportunity to comment during the 30-day public review period. Various methods will be employed to notify potential (I&APs) of the proposed project, namely, through an advert, site notices on site and in Matjiesfontein and Laingsburg and notification letters.** **The BA process has taken cognisance of all interests, needs and values espoused by all interested and affected parties. Opportunity for public participation will be provided to all I&APs throughout the BA process in terms of the 2014 EIA Regulations, as amended.**
2.18. What measures were taken to ensure that the environment will be held in public trust for the people, that the beneficial use of environmental resources will serve the public interest, and that the environment will be protected as the people's common heritage?	**The outcomes of this BA process and the associated conditions of the EA (should it be granted) will serve to address this question.**
2.19. Are the mitigation measures proposed realistic and what long-term environmental legacy and managed burden will be left?	**The proposed mitigation measures included in the EMPr and summarised in Section D of this report have been informed by the specialist studies undertaken and this includes a detailed assessment of the environment as well as the impacts associated with the proposed development. Wind Energy Facilities can be dismantled and completely removed from the site leased for the development and do not permanently prevent alternative land-uses on the same land parcel. Based on material and socio-economic terms, and measured to the value of the best alternative that is not chosen, the proposed project will result in positive opportunity costs.**
2.20. What measures were taken to ensure that the costs of remedying pollution, environmental degradation and consequent adverse health effects and of preventing, controlling or minimising further pollution, environmental damage or adverse health effects will be paid for by those responsible for harming the environment?	**The EMPr of this proposed project must form part of the contractual agreement and be adhered to by both the contractors/workers and the applicant.**
2.21. Considering the need to secure ecological integrity and a healthy bio-physical environment, describe how the alternatives identified (in terms of all the different elements of the development and all the different impacts being proposed), resulted in the selection of the best practicable environmental option	**Please refer to the Alternatives section included in Section A of this report (this section) for an outline of the selection and suitability of this activity.**

NEED	
Question	**Response**
in terms of socio-economic considerations?	
2.22. Describe the positive and negative cumulative socio-economic impacts bearing in mind the size, scale, scope and nature of the project in relation to its location and other planned developments in the area?	**Please refer to Section D of this report for a summary of the cumulative impacts.**

SECTION B: DESCRIPTION OF THE AFFECTED ENVIRONMENT

This section of the BA Report provides an overview of the affected environment and surrounding region for the proposed Kudusberg WEF and associated infrastructure. The receiving environment is understood to include biophysical, socio-economic and heritage aspects which could be affected by the proposed development or which in turn might impact on the proposed development. The information presented in this section has been derived from:

- Inputs obtained from the various specialist studies undertaken during this BA Process (included in Appendix D of this report);
- Review of information available on the South African National Biodiversity Institute (SANBI) Biodiversity Geographical Information System (BGIS) and Agricultural Geo-Referenced Information System (AGIS); and
- Witzenberg and Karoo Hoogland Local Municipalities and the Cape Winelands and Namakwa District Municipalities IDPs.

It is important to note that this section intends to provide an overview of the receiving environment. Detailed descriptions of the proposed project site focused on significant environmental aspects of this project are provided in the relevant specialist studies which are included in Appendix D and summarised in Section D of this report.

B.1 Property details

The proposed Kudusberg WEF site is located southwest of Sutherland, in the Northern Cape and partly in the Western Cape. The proposed project area falls within the Witzenberg and Karoo Hoogland local municipalities, which fall within the Cape Winelands and Namakwa District Municipalities respectively.

Table B.1 below provides the details of the affected properties for the proposed Kudusberg WEF and associated infrastructure. The application site for the proposed Kudusberg WEF comprises of 16 farms and is approximately 30 000 ha in extent, when considering the extent of affected cadastral units (Figure B.1). The core area where most of the proposed development will occur area is approximately 19 300 ha, excluding properties affected by the potential upgrade of the public road. The topocadastral quarter degree grid references are 3220 CC PIENAARSFONTEIN and 3220 CD OLIVIERSBERG. The site is located between 32° 47’ 18.0” S and 32° 56' 02" S latitude; 20° 11’ 24” E and 20° 24’56” E longitude.

Table B.1: Property details of the farm portions affected by the proposed development

Number	Farm name and number	SG Code
Western Cape:		
1	Portion 1 of 156 Gats Rivier Farm	C01900000000015600001
2	Portion 2 of 156 Gats Rivier Farm	C01900000000015600002
3	Remainder of 156 Gats Rivier Farm	C01900000000015600000
4	Portion 1 of 157 Riet Fontein Farm	C01900000000015700001
5	Portion 1 of 158 Amandelboom Farm	C01900000000015800001
6	Remainder of 158 Amandelboom Farm	C01900000000015800000
7	Portion 1 of 159 Oliviers Berg Farm	C01900000000015900001
8	Remainder of 159 Oliviers Berg Farm	C01900000000015900000
9	Portion 2 of 157 Riet Fontein Farm	C01900000000015700002
10	Remainder of 161 Muishond Rivier Farm	C01900000000016100000
11	Remainder of 395 Klipbanks Fontein Farm	C01900000000039500000
Northern Cape:		
12	Portion 4 of 193 Urias Gat Farm	C07200000000019300004
13	Portion 6 of 193 Urias Gat Farm	C07200000000019300006
14	Remainder of 193 Urias Gat Farm	C07200000000019300000
15	Remainder of 194 Matjes Fontein Farm	C07200000000019400000
16	Remainder of 196 Karree Kloof Farm	C07200000000019600000
Properties affected by public access road:		
17	169 Zeekoegat Farm	C07200000000016900000
18	Portion 1 of 170 Roodeheuvel Farm	C07200000000017000001
19	Remainder of 170 Roodeheuvel Farm	C07200000000017000000
20	Remainder of 190 Wind Heuvel Farm	C07200000000019000000
21	Portion 1 of 190 Wind Heuvel Farm	C07200000000019000001
22	Portion 5 of 193 Urias Gat Farm	C07200000000019300005
23	Remainder of 171 Vinke Kuil Farm	C07200000000017100000
24	Alkant Re/220 Farm	C07200000000022000000
25	Portion 1 of 174 Lange Huis Farm	C07200000000017400001

The proposed development area is located towards the southwest of the main Karoo region, with the centre of the study area some 11 km south of the R356 and 22 km west of the R354, the Sutherland-Matjiesfontein road. The closest towns to the proposed project are Matjiesfontein and Sutherland. The area is on the border of the summer and winter rainfall regions and receives some snow and precipitation in winter as well as summer thunderstorms, although precipitation is limited, and the region is semi-arid. The vegetation is characteristic of the Succulent Karoo biome in the low-lying areas and the Karoo Renosterveld Fynbos in the high-lying portions (Mucina and Rutherford 2006). The development area lies within the foothills of the Great Escarpment, and is characterised by valleys located between long ridges, and flat plains surrounded by hills and mountains. The ridges are largely undeveloped, while the valleys and plains contain several farmsteads comprising varying numbers of buildings.

There are local roads and tracks servicing the area, some of which lead up to the hilltops, with recently created tracks servicing the wind masts scattered across peaks in the region. Together with farm infrastructure such as wire fenced stock camps and farm boundaries, wind pumps and reservoirs, these are the predominant features in an otherwise undeveloped, natural environment.

Several of the affected farms are no longer engaged in active agriculture, have changed ownership in recent times and are held by absentee landlords. Many of the farms are now relying solely on tourist accommodation for income, and high levels of wildlife predation is making sheep farming unsustainable (Smuts 2018).

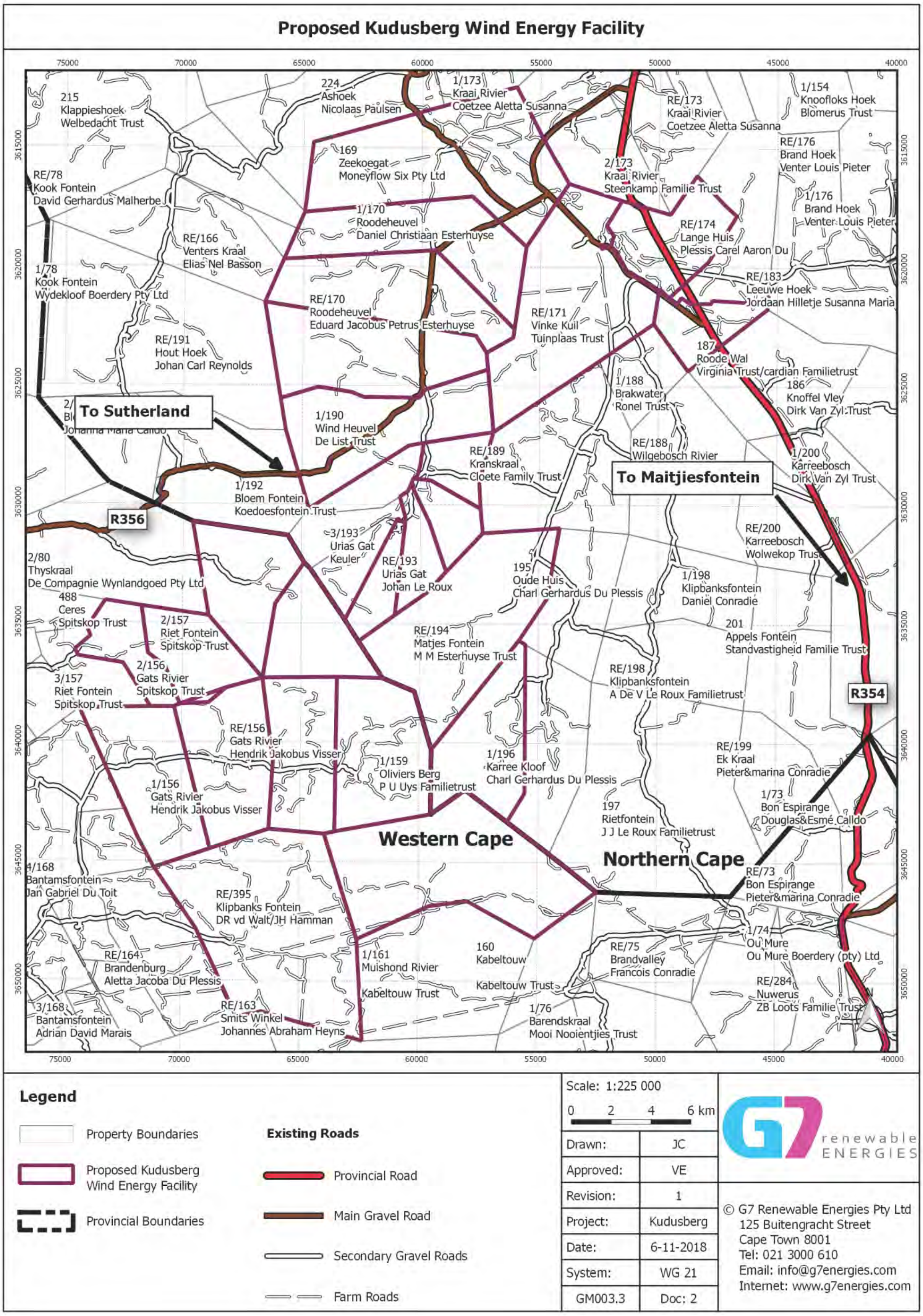


Figure B.1: Site location showing the affected farms of the proposed Kudusberg WEF (Figure as provided by G7 Renewable Energies Pty Ltd).

B.2 Climatic Conditions

The site has an extremely low average rainfall of 125 mm per annum (Lanz, 2018). The average monthly rainfall distribution is shown in Figure B.2. The low rainfall is a very significant agricultural constraint that seriously limits the level of agricultural production (including grazing) which is possible. There are no dams across the project area.

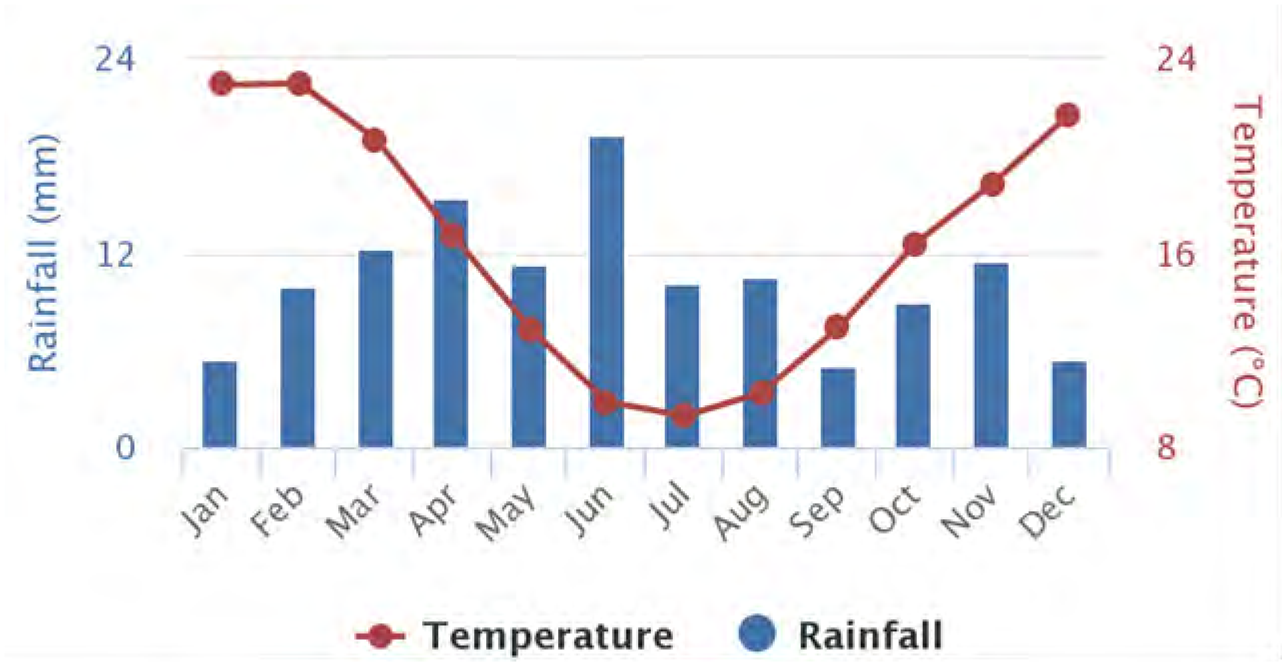


Figure B.2: Average monthly temperature and rainfall for location (-32.88, 20.33), which is in the centre of the project area, from 1991 to 2015 (Lanz 2018).

B.3 Topography and Landscape

The project is located across very hilly terrain. Turbines are to be located along the crests of several east west orientated ridges with valleys between them. The ridges attain a maximum altitude of approximately 1,350 m and the valleys drop down to approximately 850 m. There is a wide range of slopes across the hilly terrain. There are several non-perennial water courses, typical of arid areas, in the valleys (Figure B.3).

The study area is largely dominated by a range of high mountains / hills which traverse various parts of the study area (Figure B.4.)

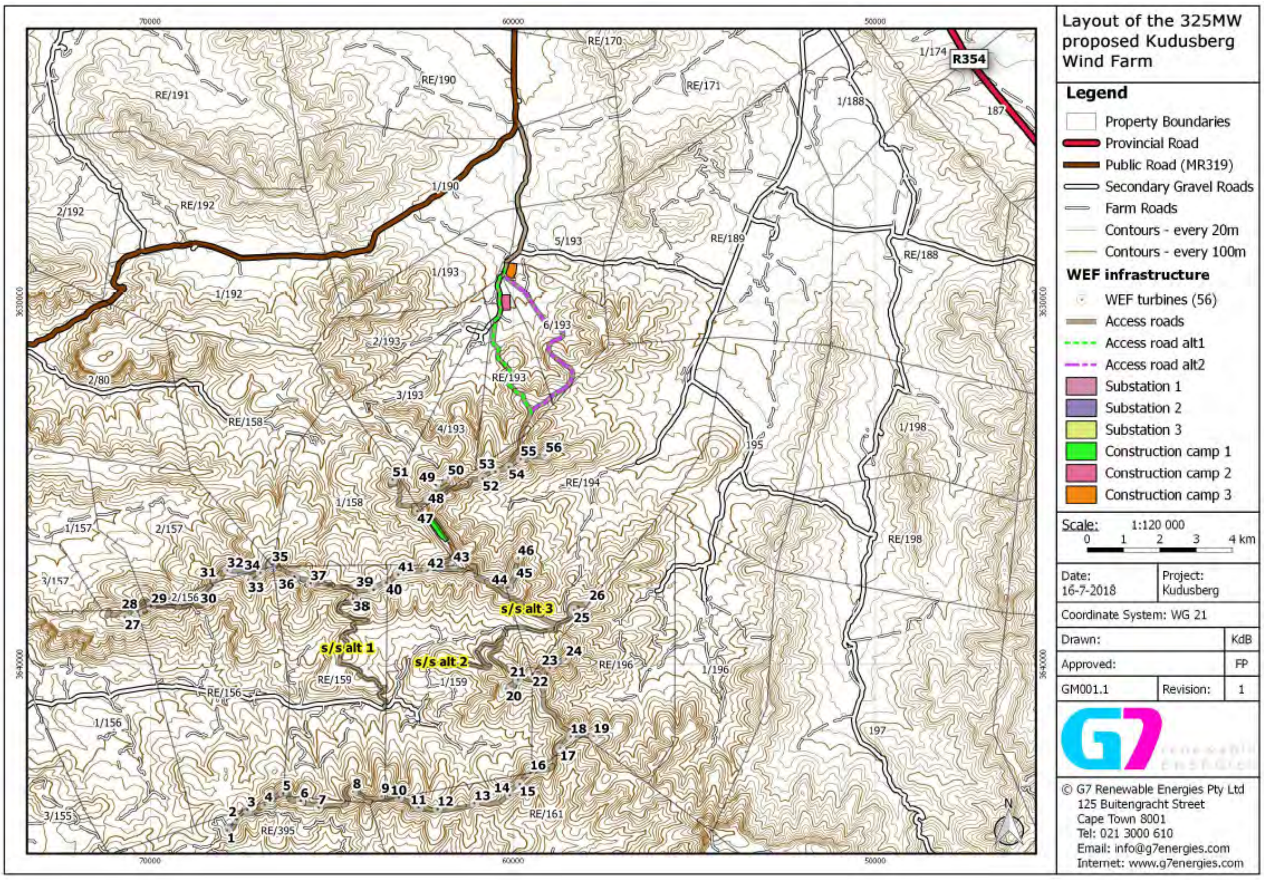


Figure B.3: Topographic map of the Klein Roggeveld project area detailing the main infrastructural components of the proposed Kudusberg WEF (Image prepared by G7)

Figure B.4: View north-east from the Gatsrivier Road, (approximately 3 km outside the application site) showing a typical view of the range of high mountains / hills which dominate the study area (photo courtesy of SIVEST)

Much of the study area is therefore dominated by steep slopes and broad ridges of these high mountains and escarpments, while some surrounding parts are characterised by relatively flat plains (Figure B.5). It should also be noted that several rivers and / or drainage lines traverse various parts the study area.

Figure B.5: View eastwards from the R356 main road, (some 5 km north-west of the application site) showing typical view of the general topography typical of this sector of within the study area (photo courtesy of SIVEST).

The topography and slope of the study area is illustrated in the respective Topography and Slope Classification Maps which have been provided as Figure B.6 and Figure B.7 respectively.

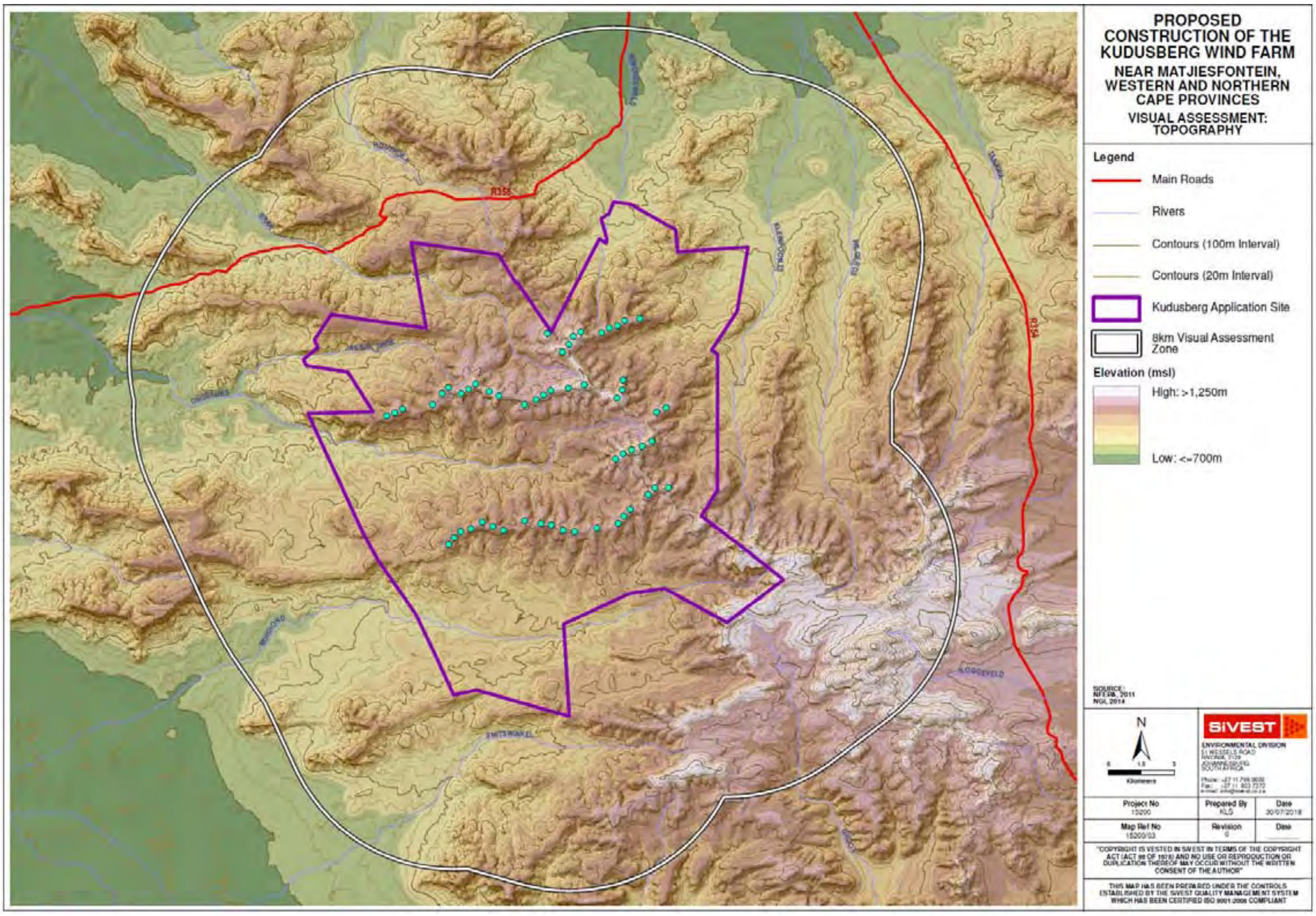


Figure B.6: Topography map of the proposed Kudusberg WEF site (Map as prepared in the VIA)

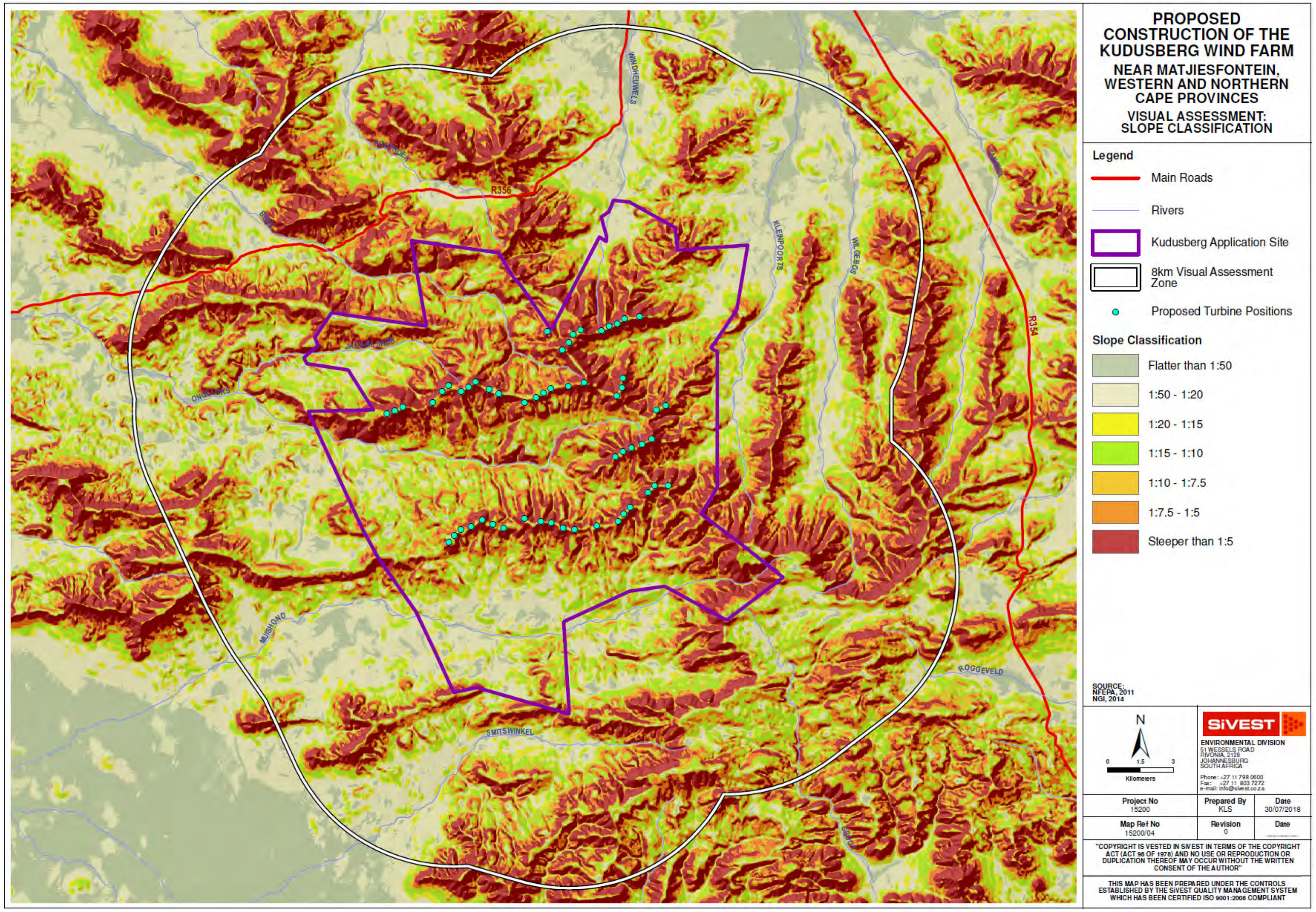


Figure B.7: Slope classification of the proposed Kudusberg WEF site (Map as prepared in the VIA).

B.4 Geology

The geology of the site is depicted in the 1:250 000 geological map 3220 Sutherland (Figure B. 8.). The region is almost entirely covered by greenish-grey mudstone and subordinate sandstone of the Abrahamskraal Formation (Pa) of the Beaufort Group. While the steep upper slopes, cliffs and s of the region consist mainly of sandstone, the middle and lower slopes are dominated by mudstone and subordinate sandstones. Some minor east-west trending fold axes and minor faults occur in the region.

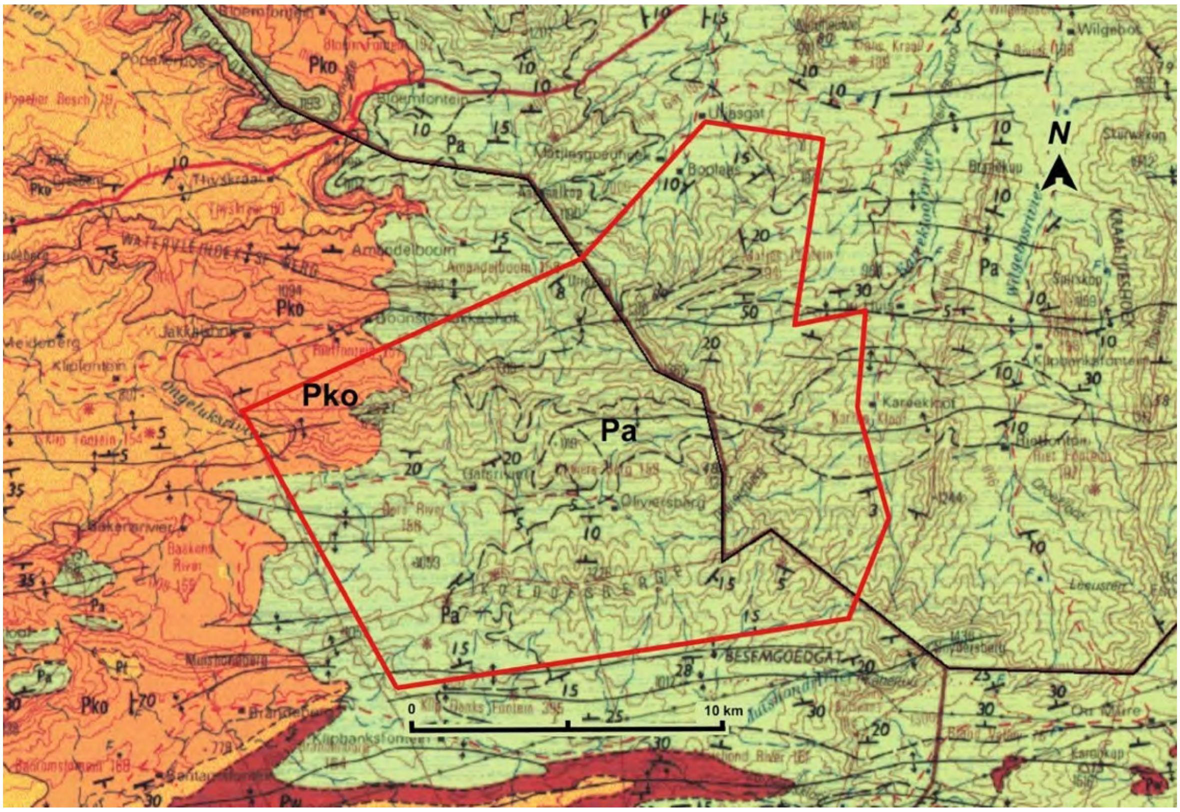


Figure B.8: Geology of the Kudusberg WEF region (approximate site outlined in red).

Legend: Pa (pale green) = Abrahamskraal Formation (Adelaide Subgroup, Lower Beaufort Group) consisting of mudrock and subordinate sandstone. Pko (orange - in northwest of study region) = Koedoesberg Formation and Waterford Formation consisting of grey sandstone with alternating thin siltstone beds and shale.

B.5 Land Types and Soil Potential

The land type classification is a nationwide survey that groups areas of similar soil, terrain and climatic conditions into different land types. A terrain unit within a Land Type is any part of the land surface with homogeneous form and slope. Terrain unit 1 represents a crest, 2 = scarp, 3 = midslope, 4 = footslope and 5 = valley bottom.

The site falls mainly in the Fc 269 Land Type (Figure B. 9.) while smaller portions of the Fc 274, Fc 291 and Fc 293 Land Types are also present on site**.** Other land types in the region include the Fc 295 and Ib 232 Land Types. The Fc 269 Land Type is dominated by rock outcrop (37% of surface area) and extremely shallow soils on underlying rock. Dominant soil forms are Glenrosa and Mispah and lime is generally present. Glenrosa has a low erodibility when occurring on flat or gentle slopes but increases on steeper slopes of ridges, hills and mountains. This is often ameliorated by stony deposits that reduce runoff intensity. Mispah soil is often found in association with Glenrosa and has a low erodibility. It is important to note that crests (where the bulk of the proposed developed will occur) cover only approximately 10% of the landscape. A summary detailing soil data for the land types is provided in Appendix 1 of the Agricultural Specialist Study in Appendix D.

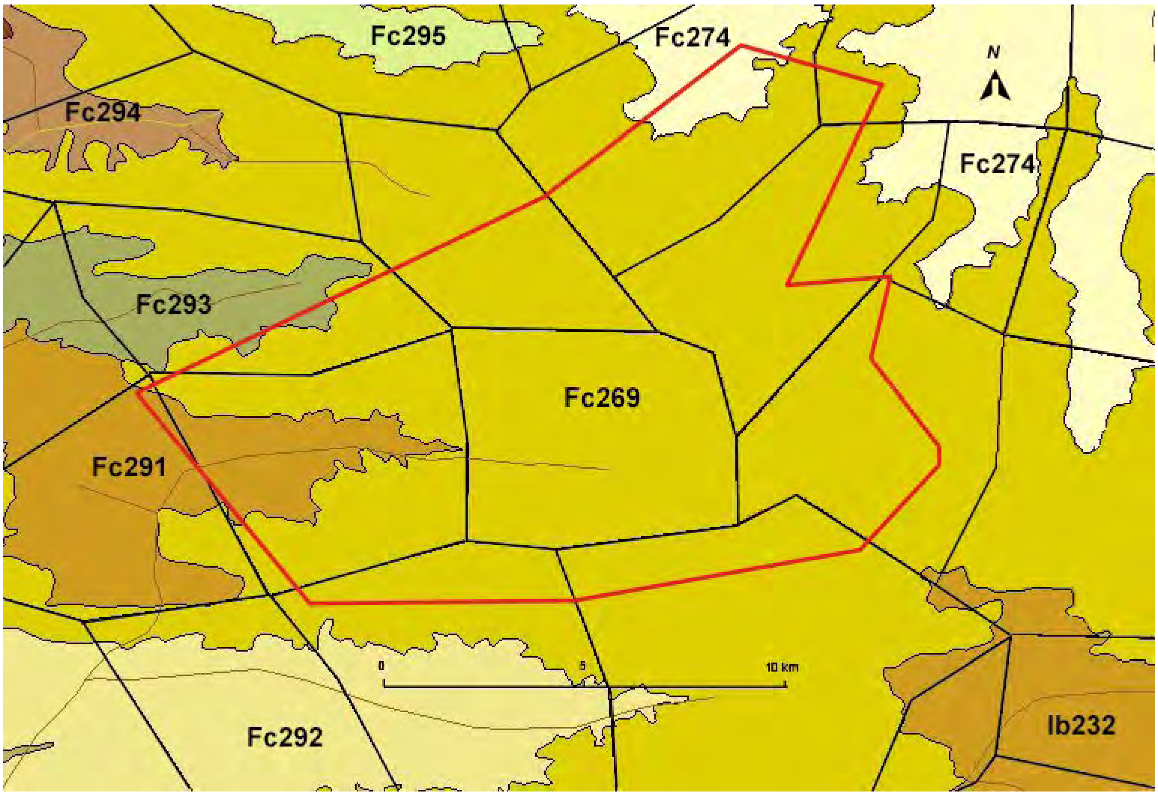


Figure B.9: Land Types in the vicinity of the Kudusberg WEF (site outlined in red).

B.6 Agricultural Land capability

The information provided below has been extracted from the Agricultural Impact Assessment included in Appendix D of this BA Report. Land capability is defined as the combination of soil, climate and terrain suitability factors for supporting rainfed agricultural production. It is an indication of what level and type of agricultural production can sustainably be achieved on any land. The higher land capability classes are suitable as arable land for the production of cultivated crops, while the lower suitability classes are only suitable as non-arable grazing land, or at the lowest extreme, not even suitable for grazing. In 2017 DAFF released updated and refined land capability mapping across the whole of South Africa. This has greatly improved the accuracy of the land capability rating for any particular piece of land anywhere in the country. The new land capability mapping divides land capability into 15 different categories with 1 being the lowest and 15 being the highest. Values of below 8 are generally not suitable for production of cultivated crops. Detail of this land capability scale is shown in Table 2 of the Agricultural Specialist Study in Appendix D of this report.

The proposed infrastructural footprint of the wind farm is classified with land capability evaluation **values of 1 - 4,** which is some of the **lowest land capability in the country** (Figure B.10) **The land capability is limited by the very low climatic moisture availability, the rugged terrain, and the shallow, rocky soils** (Lanz, 2018).

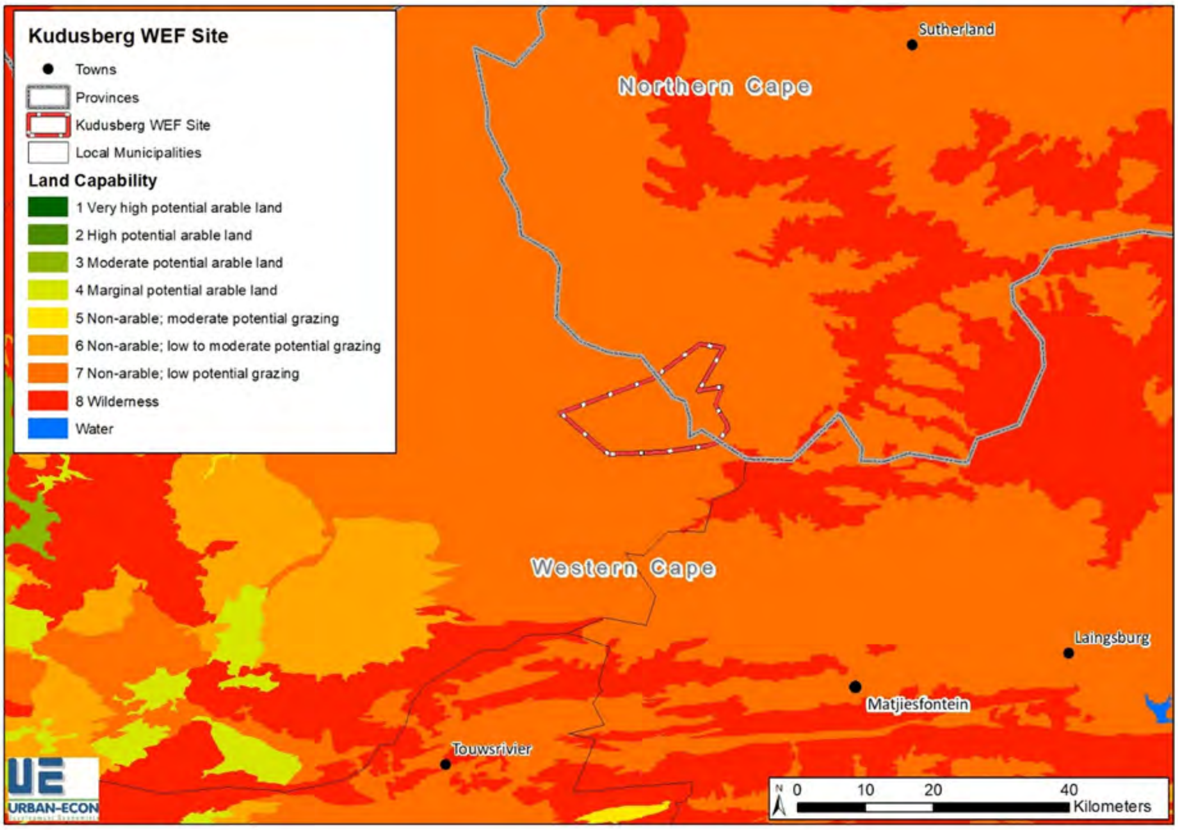


Figure B.10: Land Capability of the Kudusberg WEF site and surrounding area (Agricultural Research Council, 2005)

B.7 Visual character/Landscape

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.

Much of the study area is characterised by rural areas with low densities of human settlement. Agriculture in the form of livestock grazing (Figure B.11) is the dominant land use, with isolated patches of cultivation also present in small parts of the study area. This has therefore transformed the natural vegetation in some areas.

Figure B.11: Evidence of livestock rearing taking place within the study area (photo courtesy of SIVEST)

However, a large portion of the study area has retained a natural appearance due to the presence of the natural vegetation which is dominated by low shrubs. As such, majority of the study area is dominated by largely natural / scenic views (Figure B.12).

Figure B.12: Typical natural rural visual character prevalent in the study area (photo courtesy of SIVEST).

As mentioned, there are no built-up areas present within the visual assessment zone and thus there are very low levels of human transformation and visual degradation. The most prominent anthropogenic elements in the study area include the existing high voltage power lines which traverse the southern section of the study area and other linear elements, such as telephone poles, towers (Figure B.13) and farm boundary fences. The presence of this infrastructure is an important factor in this context, as the introduction of the proposed WEF would result in less visual contrast where other anthropogenic elements are already present. The above-mentioned anthropogenic elements are thus considered to be the only significant elements which would contribute to the degradation of the visual character of the study area to some degree.

Figure B.13: View of a relatively tall tower found within the study area (photo courtesy of SIVEST)

The scenic quality of the landscape is also an important factor contributing to the visual character of an area or the inherent sense of place. Visual appeal is often associated with unique natural features or distinct variations in landform. As such, the hilly / mountainous terrain which occurs within the application site and dominates the wider study area is an important feature that would potentially 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 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. Over the last couple of decades, more tourism routes within the Karoo have been established. In a context of increasing urbanisation in South Africa's major centres, the Karoo is being marketed as an undisturbed getaway, especially as a stop on a longer journey from the northern parts of South Africa to the Western and Eastern Cape coasts. Examples of this may be found in the "Getaway Guide to Karoo, Namaqualand and Kalahari" (Moseley and Naude-Moseley, 2008).

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).

The typical Karoo landscape consisting of wide open plains, 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 farmsteads are 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 towns, such as Matjiesfontein, 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 and would fall into the second category of cultural landscape listed above, that of an organically evolved, “continuing” landscape.

Considering this, the study area, as visible to the viewer, represents a typical Karoo cultural landscape. This is important in the context of potential visual impacts associated with the development of a WEF as introducing this type of development could be considered to be a degrading factor in the context of the natural Karoo character of the study area, as discussed further below.

B.8 Biodiversity

The information provided below has been extracted from the Ecology Specialist Study included in Appendix D of this BA Report.

B.8.1 Biodiversity Conservation Importance

B.8.1.1 Critical Biodiversity Areas, Ecological Support Areas and Other Natural Areas

Critical Biodiversity Areas (CBAs) are areas required to meet biodiversity targets for ecosystems, species or ecological processes. An Ecological Support Area (ESA) is not essential for meeting biodiversity targets but plays an important role in supporting the ecological functioning in a CBA.

Certain sections of the project site fall within CBA’s. The ecologist therefore undertook a detailed site walkthrough to determine the onsite sensitivities within the CBA’s.

In the Northern Cape there is only a small area classified as a CBA, with most of the area classified as an ESA and small sections classified as Other Natural Areas (ONAs) (Namakwa Biodiversity Sector Plan 2016) (Figure B.14).

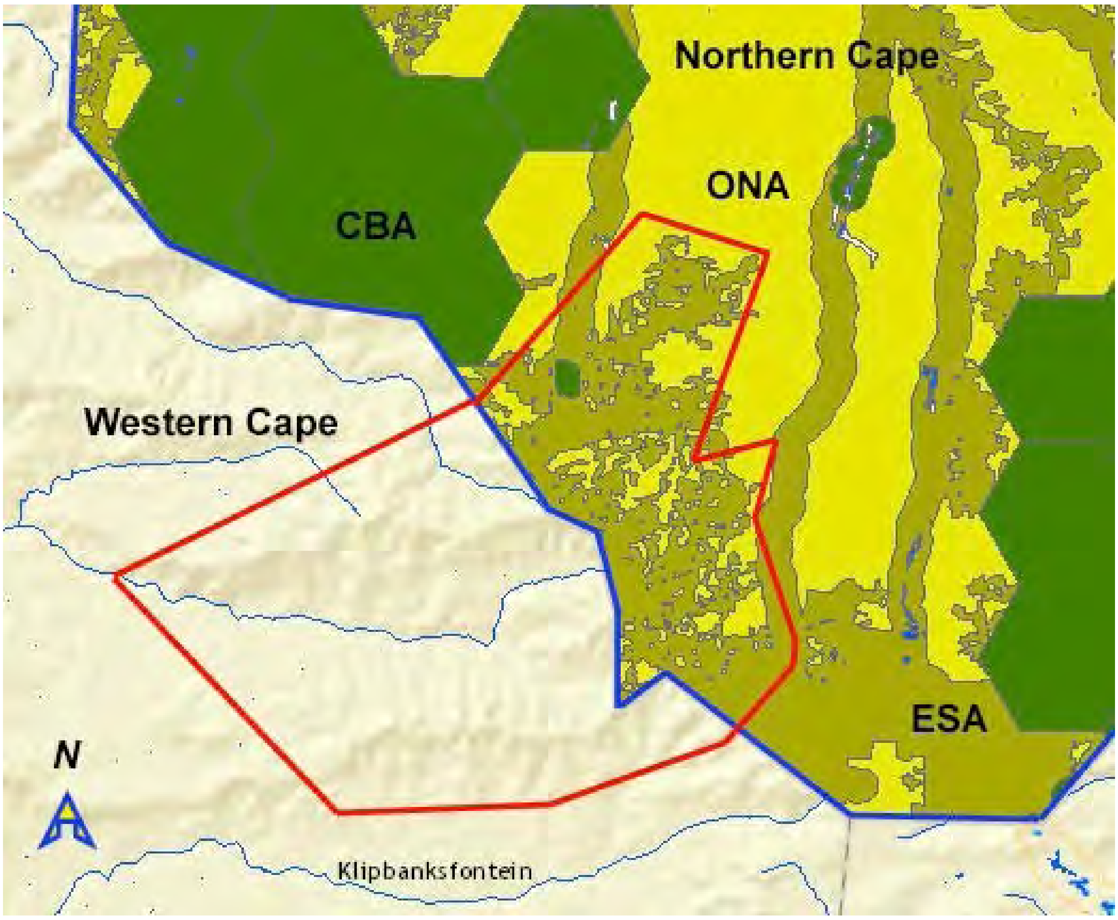


Figure B.14: Critical Biodiversity Areas (dark green), Ecological Support Areas (olive green) and Other Natural Areas identified (yellow) in the study area (Northern Cape) (biodiversityadvisor.sanbi.org).

Mapping of the CBAs in the Western Cape changed quite markedly from 2010 to 2017 (Figure B.15 & B.16). In 2010 almost the entire section of the Kudusberg site, located in the Western Cape, was classified as a CBA (biodiversityadvisor.sanbi.org; Kirkwood et al., 2010), whereas the area covered by a CBA in 2017 is substantially smaller and covers isolated patches in the northern, western and central sections of the site. Rivers and streams were mapped as ESAs in the Western Cape in 2017.

Furthermore, mapping of the Northern Cape and Western Cape CBAs and ESAs do not appear to match and different criteria were obviously applied.

Current mapping of CBAs in the Western Cape in 2017 (biodiversityadvisor.sanbi.org; Pool-Stanvliet et al., 2017):

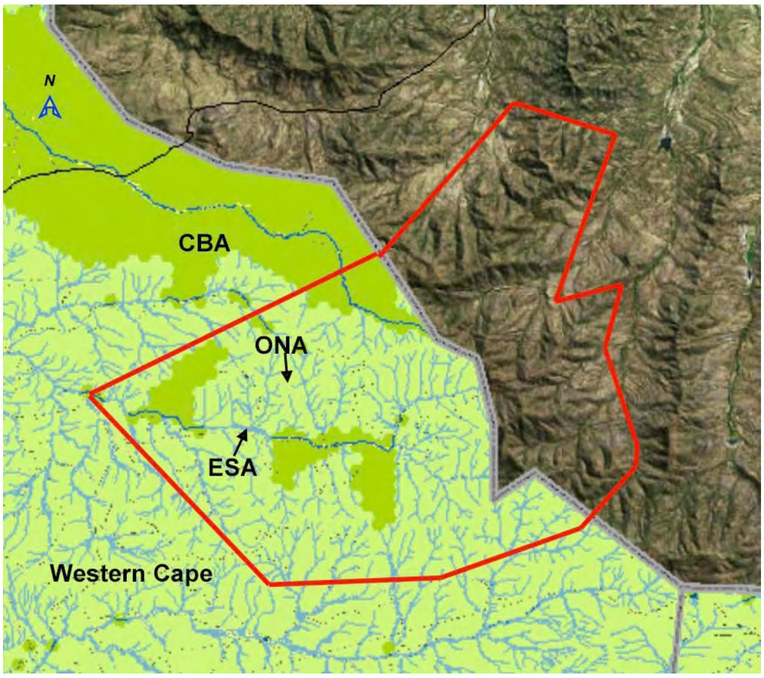


Figure B.15: Critical Biodiversity Areas (dark green), Ecological Support Areas (olive green) and Other Natural Areas identified (yellow) in the study area (Northern Cape) (biodiversityadvisor.sanbi.org).

B.8.1.2 National Protected Areas Expansion Strategy

Only a small portion in the south-western part of the study area falls into an area earmarked for further expansion of Western Karoo National Protected Areas (NPAES 2010) (Figure B.14)

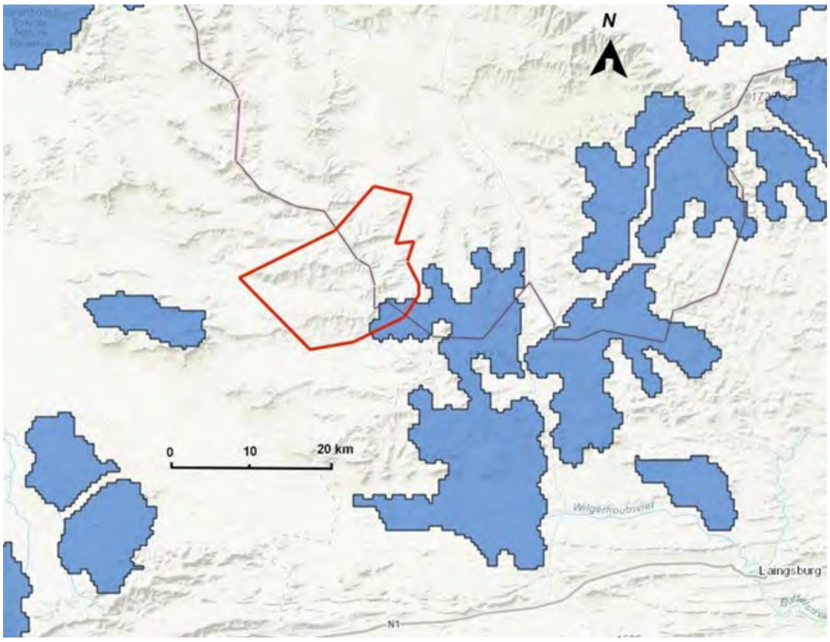


Figure B.16: Areas earmarked for the National Protected Area Expansion Strategy in the vicinity of the Kudusberg WEF (site outlined in red).

B.8.2 Terrestrial Ecology: Flora

B.8.2.1 Groundcover

Phytogeographically, the study area falls in the Cape and the Karoo – Namib Regional Centres of Endemism (White, 1983). The vegetation types in the region fall in the Succulent Karoo and Fynbos Biomes (Rutherford and Westfall, 1986; Mucina and Rutherford, 2006), and specifically in the Karoo Renosterveld Bioregion (F09) and Rainshadow Valley Karoo Bioregion (SKv).

B.8.2.2 Vegetation

Various vegetation types occur in the region of which the Koedoesberge-Moordenaars Karoo (SKv 6) and the Central Mountain Shale Renosterveld (FRs 5) cover the study site (Mucina and Rutherford, 2006) (Figure B.17).

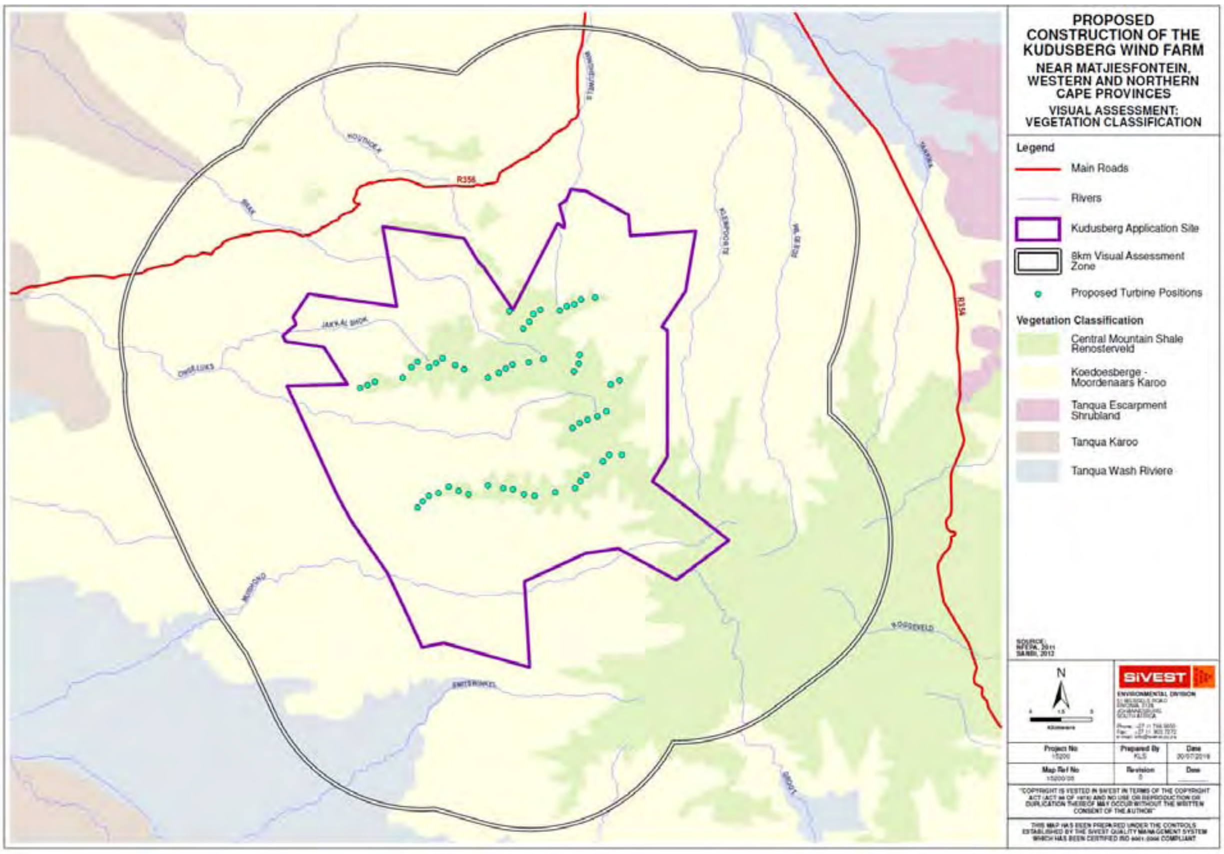


Figure B.17: Vegetation types in the vicinity of the Kudusberg WEF (Map courtesy of SIVEST)

B.8.2.2.1 <u>Koedoesberge - Moordenaars Karoo (SKv 6)</u>

This vegetation type occurs on the low mountain ranges bordering the southern Tanqua Karoo in the vicinity of Laingsburg and Merweville. The slightly undulating to hilly landscape is covered by low succulent scrub and some tall shrubs. The geology consists mainly of mudstone, but also shale and sandstone of the Beaufort and Ecca Groups (Mucina and Rutherford, 2006).

The succulent shrubs are represented by *Hereroa odorata, Antimima fergusoniae, Mesembryanthemum noctiflorum, Crassula nudicaulis, Euphorbia rhombifolia, Hoodia gordonii, Monsonia crassicaule* and *Tylecodon reticulatus.* Dwarf shrubs include *Pteronia incana, Aptosimum spinescens, Asparagus capensis, Chrysocoma ciliata, Eriocephalus africanus, Felicia filifolia, Justicia spartioides, Pteronia glauca* and *Tetraena retrofracta.*

Geophytes are represented by *Drimia intricata, Geissorhiza karooica* and *Romulea eustinii. The grass layer consists of Aristida adscensionis, Aristida diffusa, Ehrharta calycina, Enneapogon scaber, Fingerhuthia africana, Stipagrostis ciliata and Stipagrostis obtusa*. A number of endemic species occur in this vegetation types, e.g. *Antimima karroidea, Calamophyllum teretiusculum, Drosanthemum comptonii, Lachenalia comptonii* and *Strumaria undulata* (Mucina and Rutherford, 2006).

This vegetation type is regarded as "Least Threatened" and only a small portion is conserved in the Gamkapoort Nature Reserve.

B.8.2.2.2 **Central Mountain Shale Renosterveld (FRs 5)**

This vegetation type is located on the southern and southeastern slopes of the Klein-Roggeveldberge and Komsberg below the Roggeveld section of the Great Escarpment, facing the Moordenaars Karoo. The terrain consists of slopes and broad ridges of low mountains and escarpments, with tall shrubs dominated by renosterbos and other non-succulent Karoo shrubs and with a rich geophytic flora. The soils are clayey and derived from mudstones and subordinate sandstone of the Beaufort Group (Mucina and Rutherford, 2006).

The shrubland is dominated by *Dicerothamnus rhinocerotis*. Other shrub and dwarf shrub species include *Amphiglossa tomentosa, Asparagus capensis, Chrysocoma ciliata, Diospyros austro-africana*, various *Eriocephalus* spp., *Euryops imbricatus, Felicia muricata, Galenia africana, Helichrysum dregeanum, Lycium cinereum, Nenax microphylla, Pentzia incana, Osteospermum sinuatum* and *Roepera spinosa.* Succulent shrubs and herbs are represented by *Delosperma subincanum, Euphorbia stolonifera, Tylecodon reticulatus, Tylecodon wallichii, Crassula muscosa* and *Curio radicans*. The forb layer is characterised by *Dianthus caespitosus, Heliophila pendula* and *Osteospermum acanthospermum*. *Bulbine asphodelioides, Drimia intricata, Othonna auriculifolia* and *Oxalis obtusa* are prominent geophytes in this vegetation type. The conspicuous grass species include *Ehrharta calycina, Karroochloa purpurea* and *Tenaxia (=Merxmuellera)* spp. (Mucina and Rutherford, 2006).

This vegetation type is regarded as "Least Threatened" and none is conserved in statutory or private conservation areas. It does not appear to have any endemic species.

B.8.2.3 Checklist and site visits

The study area has been very poorly collected botanically. In the two quarter degree grids in which the study area falls (3220 CC and 3220 DD) only 131 plant taxa are listed on the South African Biodiversity Institute's (SANBI) website (SANBI: newposa.sanbi.org – accessed 25 July 2018). Among the reasons for the poor collection are the lack of access routes and the absence of conservation areas, since most botanical specimens are collected along roads or in conservation areas. A species list provided in Appendix A of the Terrestrial Ecology Study (included in Appendix D of this report), therefore includes the four quarter degree grids 3220 CA; 3220 CB; 3220 CC and 3220 CD to provide a more representative list of species that could potentially occur in the study area. These four grid squares combined, list 255 species.

Two previous major botanical studies were conducted in the general area, *viz.* the study by Van der Merwe *et al.* (2008a, 2008b) and the study by Clark *et al.* (2011). Van der Merwe *et al.* (2008a, 2008b) classified the vegetation of the entire Roggeveld, Tanqua and Hantam area and the species list generated for the Koedoesberge and Oliviersberg region (88 taxa) were extracted and included in the list in Appendix A of the Terrestrial Ecology report. In their study Clark *et al.* (2011) provided a checklist of plant species for the Roggeveld – Komsberg Escarpment (486 taxa) and reviewed the endemics and near-endemics of the Hantam – Roggeveld Centre of Endemism.

Including all species/taxa from the above-mentioned degree squares, the studies by Van der Merwe *et al*. (2008a, 2008b), Clark *et al.* (2001) and the current site visit (333 taxa recorded), a total of 792 taxa could be present in the study area (Appendix A of the Terrestrial Ecology Report).

The ecologist undertook two site visits to collect data with a high level of confidence to inform this BA process:

- At the time of the first site visit (17 – 20 July 2018) a relatively small percentage of the species were flowering and consequently the identification of many species was hampered.

- The second site visit was undertaken from 5 - 13 September 2018, and between these two site visits the flowering times of most of the SCC were covered (see section 6.4 f of the Terrestrial Ecology Report for flowering times). Some species, however, only flower from October onwards. The data collected was sufficient to inform this assessment.

The second site walkthrough was a walkthrough of the entire project footprint. The specialist found that very-high sensitive ecology features can be avoided and therefore the layout was amended accordingly as described in section D.1.2.5.3.

B.8.2.4 Threatened and rare plant species

B.8.2.4.1 <u>Threatened species</u>

Twenty-seven plant species are classified as threatened according the IUCN Red List Categories (version 3.1). These species (the term species is used here in a general sense to denote species, subspecies and varieties) are listed in Table B.2, together with the reasons given for the classification by the Threatened Species Programme and an evaluation of the likelihood of occurrence in the study site, based on available knowledge of the distribution pattern of the species. Two of the species are classified as Critically Endangered; five as Endangered; and twenty-one as Vulnerable.

The threatened species listed in Table B.2 are dominated by geophytic species (50% of all threatened species listed for the study area) in particular of the family Iridaceae. With the exception of *Oxalis lineolata* and *Mesembryanthemum tenuiflorum* none of these species have been recorded in the four quarter degree grids closest to the study site (3220 CA; 3220 CB; 3220 CC and 3220 CD). The rest of the threatened species in Table B.2. (except for *Mesembryanthemum tenuiflorum*) were all recorded by Clark et al. (2011) for the Roggeveld – Komsberg escarpment lying to the north of the study area. *Mesembryanthemum tenuiflorum* was listed by Van der Merwe et al. (2008). Due to the poor collection in the vicinity of the study site, knowledge as to whether these species do in fact occur in the study area is currently not available. After considering the known distribution of these species, it was presumed that only one Endangered and 11 Vulnerable species listed in Table B.2 was likely to occur in the study area. None of the IUCN 'threatened' species were encountered during the site visits. The flowering times of most of these species were covered by the field visits to the study area, or alternatively the species could easily be identified without flowers e.g. *Cliffortia arborea*.

Table B.2: List of Critically Endangered, Endangered and Vulnerable species which could possibly occur in the study area (distribution according to Red List of Threatened Plants redlist.sanbi.org; accessed 9 August 2018)

Critically Endangered:	**Justification for classification**	**Flowering time**	**Likelihood of occurrence and whether the species was encountered during the site visits**
Romulea albiflora IRIDACEAE	Known from three collections from one continuous subpopulation. Part of the subpopulation was lost to cereal cultivation and the rest occurs on the edge of a ploughed field. There are fewer than 250 mature individuals extant and decline due to crop cultivation is continuing.	Sep - Oct	Unlikely; known distribution is further north. **Not recorded.**
Secale strictum subsp. *africanum* POACEAE	A range-restricted species that was once common on the Roggeveld, but is now known from one subpopulation on a farm, where there are fewer than 50 mature individuals. This taxon has experienced severe declines due to overgrazing and poor veld management. It is cultivated and several attempts are being made to reintroduce it to other properties on the Roggeveld.	Dec	Unlikely; known distribution is further north. **Not recorded.**
Endangered:			
Daubenya aurea HYACINTHACEAE	Plants at four to five locations continue to decline due to ongoing expansion of crop cultivation and overgrazing.	Sep	Unlikely; known distribution is further north. **Not recorded.**
Ixia thomasiae IRIDACEAE	A rare, and highly restricted species, known from two to three locations and declining due to ongoing habitat loss to crop cultivation.	Sep - Nov	Unlikely; known distribution is further north. **Not recorded.**
Oxalis lineolata OXALIDACEAE	A range-restricted species and only known from three locations, within a small area around Doornbosch. There is continuous decline as a result of habitat loss due to expanding crop cultivation. The species is estimated to have a population size between 150-300 individuals.	May - Jun	Unlikely; known distribution is further northwest. **Not recorded.**
Oxalis marlothii	A range-restricted species, occurring at two to three locations and declining due	Sep - Oct	Possible; known
OXALIDACEAE	to ongoing habitat loss and degradation.		distribution is quite close to study site. **Not recorded.**
Polhillia involucrata FABACEAE	A range-restricted Roggeveld endemic, this species has been recorded from three subpopulations that occur at two locations. Habitat loss in the past has occurred due to crop cultivation and livestock grazing. Being highly palatable, this species continues to experience ongoing decline as a result of overgrazing.	Jan	Unlikely; known distribution is further north. **Not recorded.**
Vulnerable:			
Asparagus mollis ASPARAGACEAE	A rare and poorly known species with a restricted range. There are fewer than 10 locations, and it continues to decline due to ongoing habitat loss in the Overberg. **Subpopulations in the northern part of the range are not**	Jan	Not threatened in current study area. **Not recorded.**

Critically Endangered:	Justification for classification	Flowering time	Likelihood of occurrence and whether the species was encountered during the site visits
	threatened only the population in the Overberg is threatened.		
Carex acocksii CYPERACEAE	One known location is potentially threatened by livestock overgrazing.	Oct – Nov	Unlikely; known distribution quite far north of the study site. **Not recorded.**
Cliffortia arborea ROSACEAE	Fewer than 10 known locations. Continues to decline due to inappropriate fire management and harvesting for firewood.	Oct - Dec	Could possibly occur. **Not recorded.**
Delosperma sphalmanthoides AIZOACEAE	A rare, localized habitat specialist, known from two to three locations and potentially threatened by habitat degradation due to overstocking of rangelands for livestock.	Aug	Could possibly occur; known distribution is further east. **Not recorded.**
Diascia lewisiae SCROPHULARIACEAE	Known from five small subpopulations that together consist of fewer than 1000 mature individuals. Four of the five subpopulations occur on private land and are potentially threatened by crop cultivation and road widening.	Aug - Sep	Unlikely; known distribution far north- west of study site. **Not recorded.**
Geissorhiza spiralis IRIDACEAE	Three known locations are potentially threatened by livestock overgrazing and soil erosion.	Jul - Sep	Could possibly occur; known distribution is further north. **Not recorded.**
Gethyllis pectinata IRIDACEAE	Known from one location. Potentially threatened by overgrazing and illegal bulb collecting.	Dec	Unlikely; known distribution quite far northwest of study site. **Not recorded.**
Helictotrichon barbatum POACEAE	Known from three disjunct locations and potentially threatened by overgrazing.	Nov	Could possibly occur, but preferred habitat is lower mountain slopes, where WEF development is limited. **Not recorded.**
Helictotrichon namaquense POACEAE	Acocks (1990) indicates that this taxon had a very similar distribution to *H. barbatum* occurring on all the Karoo mountains i.e. Bokkeveld, Kamiesberg, Roggeveld and Hantamsberg, but stated that it had disappeared from much of its range due to overgrazing. The species was rediscovered in 1986 in the Roggeveld where it was common along the roadside verges but declining due to being heavily grazed.	Sep	Could possibly occur. **Not recorded.**

Critically Endangered:	Justification for classification	Flowering time	Likelihood of occurrence and whether the species was encountered during the site visits
Hesperantha hantamensis IRIDACEAE	Known from one location. Even though locally common and partly conserved in a nature reserve, it was and remains potentially threatened by dam expansion and road widening.	Jul - Sep	Unlikely, known distribution quite far northwest of the study site. **Not recorded.**
Hesperantha purpurea IRIDACEAE	Known from the type locality. Threatened by livestock overgrazing and trampling.	Sep	Unlikely; known distribution quite far northwest of the study site. **Not recorded.**
Ixia rivulicola IRIDACEAE	A localized habitat specialist, and potentially threatened by habitat degradation and disturbance due to crop cultivation and dam construction.	Oct - Nov	Unlikely; known distribution is further north. **Not recorded.**
Jamesbrittenia incisa SCROPHULARIACEAE	Known from seven locations. Declining in habitat quality and number of mature individuals due to livestock grazing.	Sep	Unlikely; known distribution is further north and east. **Not recorded.**
Lachenalia longituba HYACINTHACEAE	A range-restricted and localized habitat specialist, known from five locations and potentially threatened by habitat loss and degradation.	Apr - Jun	Could possibly occur. However, occurs in seasonally wet, boggy sites – a habitat that would have been
			highlighted in aquatic study. **Not recorded.**
Lachenalia schelpei HYACINTHACEAE	Known from one location. Not currently declining but potentially threatened by crop cultivation and overgrazing by goats.	Jun - Sep	Unlikely; known distribution is further north. **Not recorded.**
Lotononis venosa FABACEAE	Few known locations. Some of the habitat has been transformed for crop cultivation in the past. Further agricultural expansion and overgrazing by livestock are potential threats.	Sep	Could possibly occur. **Not recorded.**
Mesembryanthemum tenuiflorum AIZOACEAE	Habitat at five to 10 locations is declining due to mining.	Aug	Unlikely **Not recorded.**
Octopoma nanum AIZOACEAE	A localized habitat specialist with fewer than 10 known locations and declining due to overgrazing by livestock and game.	Nov	Could possibly occur. Found on flats and gentle slopes with loamy soils and sparse quartz grave. **Not recorded.**
Romulea hallii IRIDACEAE	A Roggeveld endemic known from two locations. It is potentially threatened by road maintenance and expansion and livestock overgrazing.	Jul - Aug	Could possibly occur. **Not recorded.**

Critically Endangered:	Justification for classification	Flowering time	Likelihood of occurrence and whether the species was encountered during the site visits
Romulea membranacea IRIDACEAE	Known from six locations, five of which are threatened by rapidly expanding rooibos tea cultivation.	Jul - Aug	Unlikely; known distribution is further northwest. **Not recorded.**
Romulea multifida IRIDACEAE	Known from three locations. Potentially threatened by crop cultivation.	Aug	Could possibly occur. **Not recorded.**

B.8.2.4.2 Not threatened IUCN categories but of Conservation Concern

Nine species with a Near Threatened status have been recorded in the vicinity of the study area. Among the Near Threatened plant species 80% are geophytic, with most of these geophytes belonging to the Iridaceae. The list of these species is provided in Section 6.4.2 of the Terrestrial Ecology Study (Appendix D of this report).

B.8.2.4.3 Not threatened categories recognized by the South African Threatened Species Programme

The species listed in these two categories are not classified as threatened according to the IUCN classification, but are considered to be of conservation concern in a South African context. Two species were classified as Critically Rare (*Antimima androsacea* and *Moraea marginata*) and 22 as Rare. The 22 species listed as rare are included in Section 6.4.3 of the Terrestrial Ecology Study (Appendix D of this report). Once again geophytes constitute a large proportion of these species.

B.8.2.4.4 Northern Cape Nature Conservation Act 2009 (Act No. 9 of 2009) (NCNCA)

Overall, 356 species were classified as either Schedule 1 (Specially protected species) or Schedule 2 (Protected species). The remainder of the species are classified as Schedule 3 (common indigenous plant species), and 30 species were classified as exotic species although only two species are declared alien invasive species.

- Schedule 1 - Specially protected species: 18 species (2% of all species on site)
- Schedule 2 - Protected species: 38 species (43% of all species on site)

Comment: In the NCNCA (2009) (and to a lesser extent in the Western Cape Nature and Environmental Conservation Ordinance (WCNECO (2000)), a number of families and genera, for example the family Aizoaceae, (formerly Mesembryanthemaceae) and genera such as *Lessertia, Nemesia, Manulea* and *Oxalis* are listed as either Specially Protected Species or Protected Species. This blank classification may be because of the presence of one or two species of vulnerable or higher status in the genus. Unfortunately, this then includes many species that are either common, or even weedy, e.g. *Galenia africana, Cleretum papulosum, Euphorbia mauritanica or Oxalis pes-caprae* that do not need to be awarded special conservation status. Nevertheless, permit applications should be done as required by the Northern Cape Department of Environment and Nature Conservation for all listed species.

B.8.2.4.5 **Western Cape Nature and Environmental Conservation Ordinance, 1974 (No. 19 of 1974, as amended in 2000)**

A total of 222 species (28% of all species on site) (Appendix A of the Terrestrial Ecology study) qualified as protected according to the WCNECO.

B.8.2.4.6 **National Environmental Management: Biodiversity Act (Act No. 10 of 2004 (ToPS Lists)**

Only two plant species are listed as Threatened and Protected Species (ToPS) for the region, *Romulea albiflora* and *Secale strictum* subsp. *Africanum* (Appendix A of the Terrestrial Ecology Study). None of these species were encountered during the site visits.

B.8.2.4.7 **Convention on the International Trade in Endangered Species of Wild Fauna and Flora (CITES) classification (2017 lists)**

Appendix I lists species that are threatened with extinction and CITES prohibits international trade in specimens of these species except when the purpose of the import is not commercial, for instance for scientific research. Appendix II lists species that are not necessarily threatened now with extinction, but that may become so unless trade is closely controlled. Appendix III is a list of species included at the request of a Party that already regulates trade in the species and that needs the cooperation of other countries to prevent unsustainable or illegal exploitation.

Twenty-two of the species on site (Appendix A of the Terrestrial Ecology Study) qualify as CITES Appendix II species, this represents 3% of the species on site.

B.8.2.4.8 **Centre of Endemism**

The term endemic refers to a species that is restricted in its distribution and therefore occurs only in a specific region. The Hantam – Roggeveld Centre of Endemism (Van Wyk and Smith, 2001) comprises the Hantamberge in the Calvinia District; the Roggeveldberge in the Middelpos and Sutherland Districts; the Komsberg in the Sutherland District; and the western and central Nuweveldberge in the Fraserburg and Merweville Districts. This area is a centre of diversity for the Asteraceae, especially for the genus *Euryops*. Annual Scrophulariaceae are also well represented with several endemic species in the genera *Diascia, Cromidon* and *Zaluzianskya*. Numerous *Selago* species are also local endemics. Most of the endemics however belong to the monocotyledons and are geophytes, particularly in the genera *Hesperantha, Ixia, Babiana, Daubenya, Romulea* and *Lachenalia*. Other families that include many endemics are the Aizoaceae, Oxalidaceae and Poaceae.

According to Mucina and Rutherford (2006) the core vegetation types of the Hantam – Roggeveld Centre of Endemism include the Nieuwoudtville Shale Renosterveld, Roggeveld Shale Renosterveld, Nieuwoudtville – Roggeveld Dolerite Renosterveld, Hantam Plateau Dolerite Renosterveld, Hantam Karoo and Roggeveld Karoo. They proposed the inclusion of the Koedoesberge – Moordenaars Karoo vegetation unit, and the areas adjoining the Tanqua Basin, into this centre.

According to the delineation of the Hantam – Roggeveld of Centre of Endemism by Van Wyk and Smith (2001), the study area does not fall in this centre. However, 150 species (20% of all species on site) possibly occurring in the study area are listed as endemic or near-endemic to the Hantam – Roggeveld Centre of Endemism, as delineated by Clark *et al.* (2011). Twenty-six of the listed endemic species were recorded in the study area in the current study (8% of the species recorded on site). The list is likely to expand substantially after the area has been more fully explored botanically and would probably warrant the inclusion of the Koedoesberge, Oliviersberge and other mountains in the study site in the Hantam – Roggeveld Centre of Endemism. A broader delineation of the centre was also proposed by Mucina and Rutherford (2006) who suggested including the Koedoesberge – Moordenaars Karoo vegetation type into the centre.

B.8.2.4.9 **Protected trees (National Forest Act, Act No. 84 of 1998) (NFA 2017)**

There are no nationally protected tree species on site.

B.8.3 Terrestrial Ecology: Fauna

Lists of animals that could occur or possibly occur on site were sourced from the Animal Demography Unit, University of Cape Town (adu.uct.ac.za) and supplemented by literature such as Mills and Hes (1997), Friedmann and Daly (2004), Skinner and Chimimba (2005) and Bates et al. (2014). Animal lists for the full 3220 degree grid were generated. It should be noted that birds, bats and aquatic fauna are not reported on in this report, although a list of the frogs and toads and dragonflies is provided.

B.8.3.1 Mammals

Fifty-seven mammal species occur/could potentially occur on the site (Appendix B of the Terrestrial Ecology Study).

These include:

- 1 golden mole;
- 3 elephant shrews;
- 1 aardvark;
- 1 hyrax; 4 hares and rabbits;
- 15 rodents;
- 2 primates;
- 2 shrews;
- 18 carnivores;
- 9 even-toed ungulates; and
- 1 odd-toed ungulate.

Since the full 3220 grid contains a more diverse array of habitats, not all species are likely to occur in the study area. An estimate of the likelihood of occurrence for the species is indicated in Appendix B of the Terrestrial Ecology Study. Among the listed mammal species only three have a threatened status, i.e. *Bunolagus monticularis* (Riverine Rabit), *Felis nigripes* (Black-footed Cat) and *Panthera pardus* (Leopard).

- The riverine rabbit, *Bunolagus monticularis*, is listed as Critically Endangered, however there is a **low likelihood of it being affected by the development**, since the habitat of the riverine rabbit is in the riparian vegetation, on alluvial soils, along seasonal rivers and **the development is primarily on the crests of the mountains**. Populations of the riverine rabbit occur between Sutherland and Fraserburg, to the north of the study site, and near Touwsriver, to the southwest. It has also been found in the Anysberg Nature Reserve where it preferred plains with cropland that had been abandoned about 10 years previously. Recent surveys on the Anysberg Nature Reserve could however not verify that the riverine rabbit was still on the reserve.
- The leopard *Panthera pardus* (Vulnerable) is known to occur in the area, and
- The black-footed cat *Felis nigripes* (Vulnerable) has a high likelihood of occurrence.

Eleven of the species are classified as Specially Protected Species according to NCNCA (19% of all mammal species) and 32 as Protected Species (56%) (Appendix B of the Terrestrial Ecology Study). The Specially Protected Species are predominantly carnivores, while all moles, elephant shrews, even-toed undulates and most rodents have a Protected Species status.

According to WCNECO only one species (riverine rabbit) is classified as an Endangered Wild Animal (1.8% of all mammal species) and 12 as Protected Wild Animal (21%) (Appendix B of the Terrestrial Ecology Study). Most of the Protected Wild Animals are even-toed ungulates or carnivores.

B.8.3.2 Reptiles

For the 3220 grid, 50 reptiles are listed that could possibly occur at the study site (Appendix B of the Terrestrial Ecology Study).

These include:

- 3 chelonians;
- 28 lizards (comprising):
    - 2 agamas;
    - 1 chameleon;
    - 5 cordylids;
    - 10 gekkos;
    - 3 gerrhosaurids;
    - typical lizards;
    - 3 skinks; and
- 19 snakes.

None of the reptiles have a threatened status and none are classified as Specially Protected Species by NCNCA or Endangered Wild Animals by WCNECO (Appendix B of the Terrestrial Ecology Study). Seventy-two percent of the reptiles are Protected Species in the Northern Cape (36 of all reptile species) and 70% in the Western Cape (35 of all reptile species).

B.8.3.3 Frogs

Six frog species, none of them threatened, could potentially occur in the study area (Appendix B of the Terrestrial Ecology Study).

B.8.3.4 Invertebrates

Lists for butterflies (77 species), lacewings (25 species) and dragonflies (12 species) are provided in Appendix B of the Terrestrial Ecology Study. None of these groups contain any threatened species although *Lepidochrysops bacchus* (butterfly) is classified as Schedule 2 in the WCNECO.

Five scorpion species could potentially occur on site (Appendix B of the Terrestrial Ecology Study).

B.8.4 Aquatic Environment

The information provided below has been extracted from the Freshwater Specialist Study included in Appendix D of this BA Report.

B.8.4.1 Aquatic features

The region is drained by seven rivers, mostly in a westerly and northerly direction. The Muishondrivier in the south, Gatsrivier in the centre, Jakkalsrivier and Brakrivier in the north and northwest of the site, drain the area towards the west and northwest, while the Kareekloofrivier, Uriasgatrivier and Wilgebosrivier drain the region northeast and northwards.

The site falls in primary catchment E, secondary catchment E2, tertiary catchment E22 and E23 and the quaternary catchments E23A, E23B, E23H, E23G and E22B (Figure B.18).

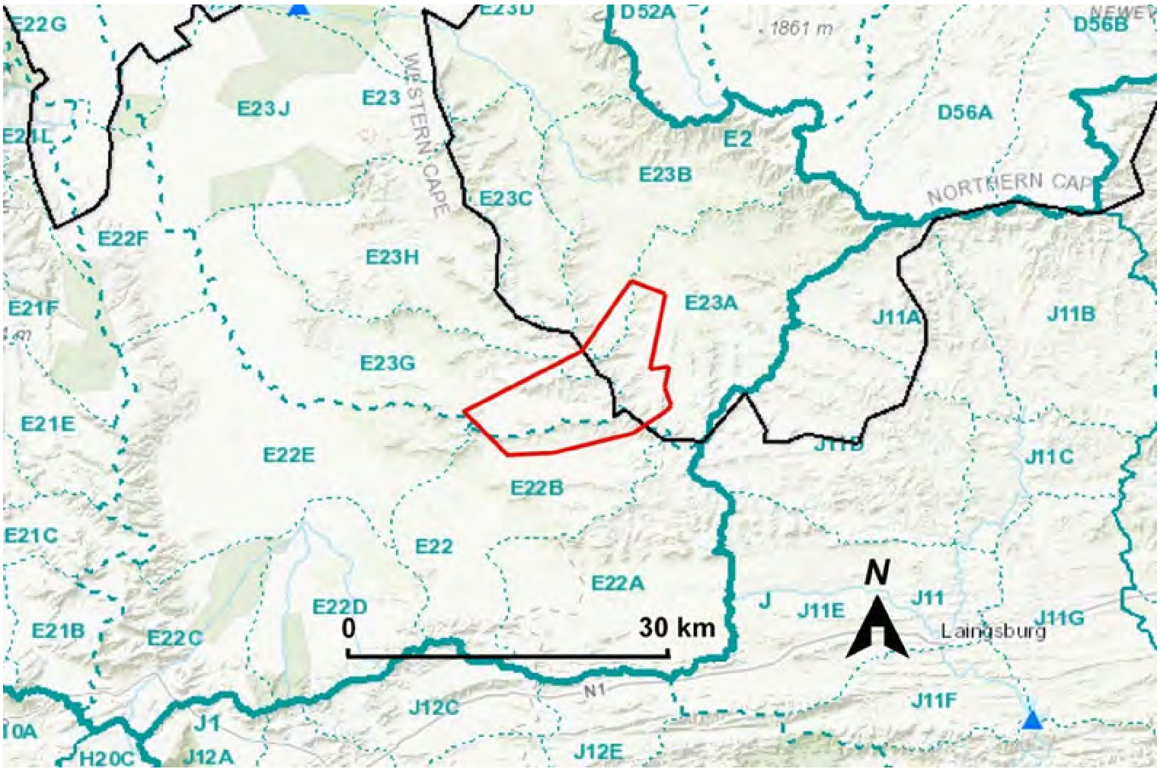


Figure B.18: Catchments in the Kudusberg region (site outlined in red) (daffarcgis.nda.agric.za).

The aquatic features within the study area consist of the upper reaches of the Doring River (Muishond, Ongeluks, Jakkalshok, Brak, Windheuwels, Wilgebos and Kleinpoorts Rivers and their lesser, unnamed tributaries, as well as some valley bottom wetlands associated with the larger watercourses and some small dams, vernal ponds and seeps on the hill tops) (Figure B.19 and B.20).

The ecological habitat integrity of the rivers within the study area is still natural in the upper reaches with few modifications (some roads and very small dams). Downstream, in the middle reaches of the Windheuwels and Ongeluks Rivers, the rivers become largely natural to moderately modified. The riparian habitat is slightly more degraded as a result of direct habitat modification from the surrounding agricultural activities. The hillslope seeps and the vernal pool are in a natural ecological condition while the valley bottom wetlands have been modified but are still in a largely natural ecological condition.

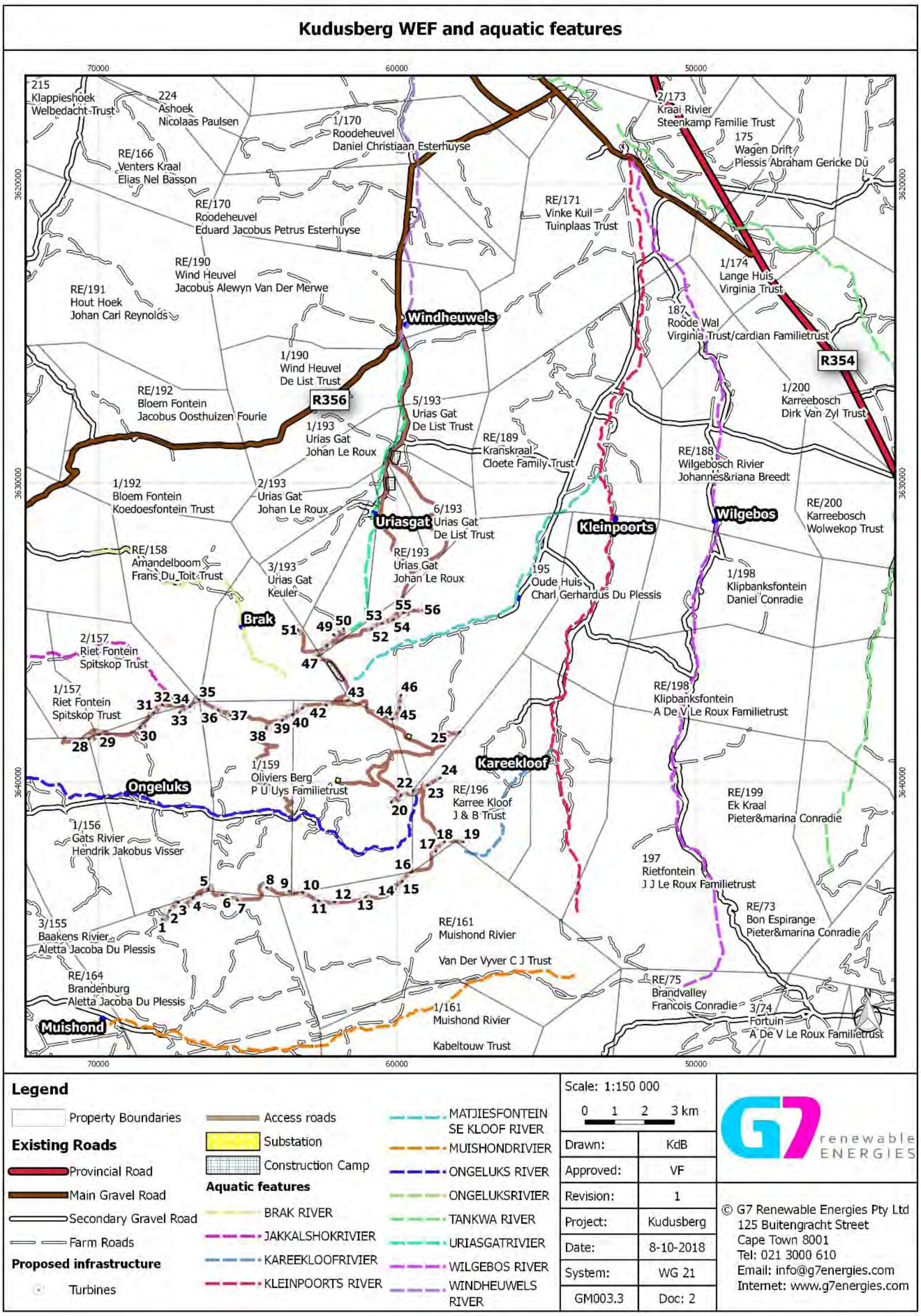


Figure B.19: Orthophotograph (taken in 2014) of the entire study area with the mapped aquatic features within the site

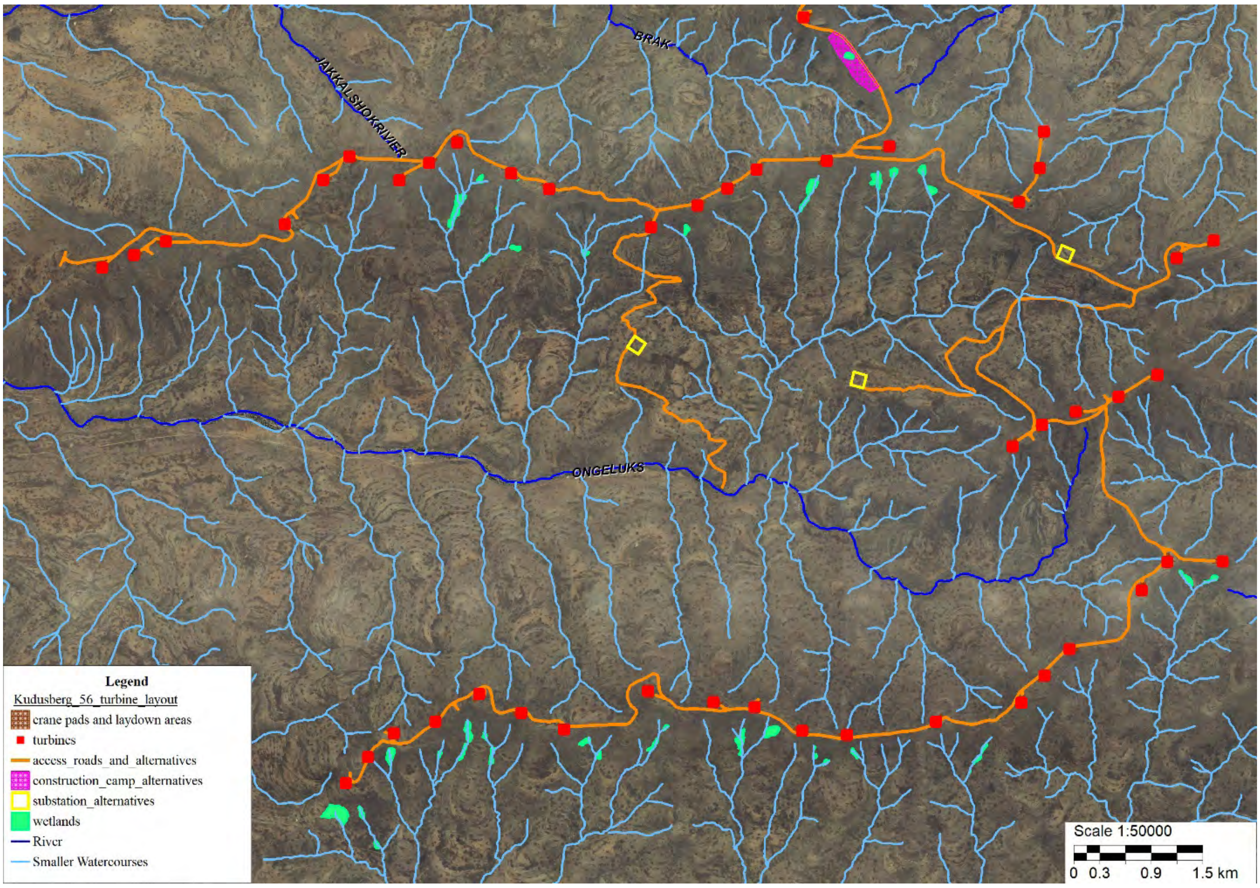


Figure B.20: Orthophotograph (taken in 2014) of the entire study area with the mapped aquatic features within the site

B.8.4.2 Biodiversity Conservation Importance

There are three freshwater biodiversity conservation mapping initiatives of relevance to the study area due to the fact that the site is split over the Western and Northern Cape provinces: the national Freshwater Ecosystem Priority Areas (FEPAs) and the 2017 Western Cape Biodiversity Spatial Plan (WCBSP) for the Witzenberg Local Municipality and the 2016 Northern Cape Critical Biodiversity Area.

FEPAs are intended to provide strategic spatial priorities for conserving South Africa's freshwater ecosystems and supporting sustainable use of water resources. FEPAs were determined through a process of systematic biodiversity planning and were identified using a range of criteria for serving ecosystems and associated biodiversity of rivers, wetlands and estuaries. The study area is located within an Upstream River FEPA (pale green areas in Figure B.21) that is associated with the larger downstream Doring River, a river of high ecological importance in terms of the endemic fish species that it supports. The goal for Upstream River FEPAs is that they should not be allowed to degrade the downstream river ecosystem further. There are several instream wetland areas within the channel of the larger watercourses that form part of the Tankwa River System that have been mapped as FEPA Wetlands (Rainshadow Valley Karoo channelled valley-bottom wetlands). These wetlands are however outside of the study area.

The 2017 WCBSP used available land cover data to identify areas of potential biodiversity importance. The use of land cover data means that data collected by a site visit is still required to confirm the ecological condition of the area. The Witzenberg WCBSP mapping comprises the following categories:

- CBA1- Critical Biodiversity Areas likely to be in a natural condition (terrestrial, forest, river, estuary and wetland);
- CBA2 – Potentially degraded Critical Biodiversity Areas or those that contain secondary vegetation (terrestrial and aquatic);
- ESA1 – Natural or near natural Ecological Support Areas (terrestrial and aquatic);
- ESA2 – Ecological Support Areas degraded and require restoration where feasible; and
- ONA – Other Natural Areas have not been identified as a priority to meet biodiversity targets.

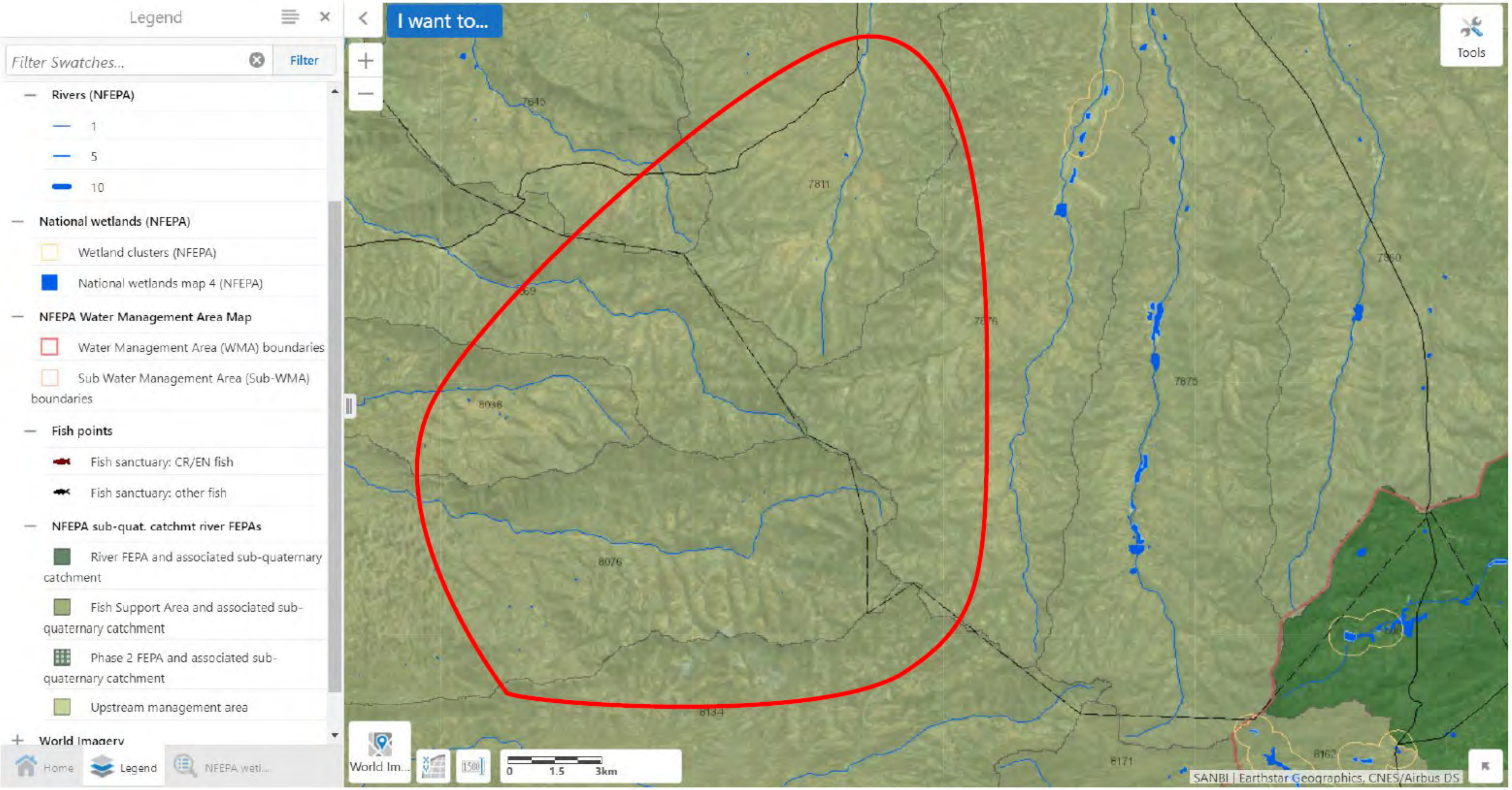


Figure B.21: National Freshwater Ecosystem Priority Areas for the study area (red outline) (SANBI Biodiversity GIS, 2018)

Within the Northern Cape CBA mapping of 2016, most of the watercourses occur within ESAs, with reaches that are on the mid-slopes of the hillsides being mapped as ONAs. The width of the ESA corridor along the Windheuwels River (a tributary of the Tankwa River where the access to the site is located) within the site is 1000 m wide.

In terms of biodiversity importance, the study area is located within an Upstream River FEPA. The Brak River as well as portions of the Jakkalshok and Ongeluks Rivers (rivers in the valleys between the ridges on which the wind turbines are placed) is mapped as aquatic CBAs where they occur within terrestrial CBAs. The remainder of the watercourses are mapped as aquatic ESAs. Very limited aquatic ESAs occur where there is localised disturbance within the watercourses such as at the gravel road crossings. There is also a wetland at the source of the largest southwards flowing tributary of the Ongeluks River that is mapped as an aquatic CBA. Most of the terrestrial areas adjacent to the watercourses in the area are mapped as ONAs. There is a CBA located along the upper Windheuwels River that is avoided by the project infrastructure. There is also a CBA to the west of the study area in the upper Houthoek River (also a tributary of the Tankwa River but further to the west of the study area) that is outside of the study area. A cluster of wetlands in the Kleinpoorts River to the east of the site (and outside of the site) is also mapped as a CBA. The ecological integrity of the CBAs should be preserved while the ecological functionality of the watercourses within the ESAs needs to be retained.

The larger watercourses in the study area, Muishond, Ongeluks, Jakkalshok, Brak, Windheuwels, Wilgebos and Kleinpoorts Rivers, have a high ecological importance and sensitivity while the smaller tributaries/drainage features are of a moderate ecological importance and sensitivity (Figure B.22). The larger watercourses tend to be more ecologically important but less sensitive to impacts while the smaller tributaries are less ecologically important but more sensitive to flow, water quality and habitat modification. The wetland features within the study area are considered of moderate ecological importance and sensitivity. The hillslope seeps and valley bottom wetlands are closely associated with the rivers in the area and the importance of the habitat in providing ecological corridors for the movement of biota.

Along the southern ridge, vernal pools have formed on some of the rock surfaces where water is retained within small basins that have formed on the flat ridge surface (Figure B.22). These pools have a rather unique ecosystem associated with them with very specialised biota that respond quickly to periods when the pools are inundated.

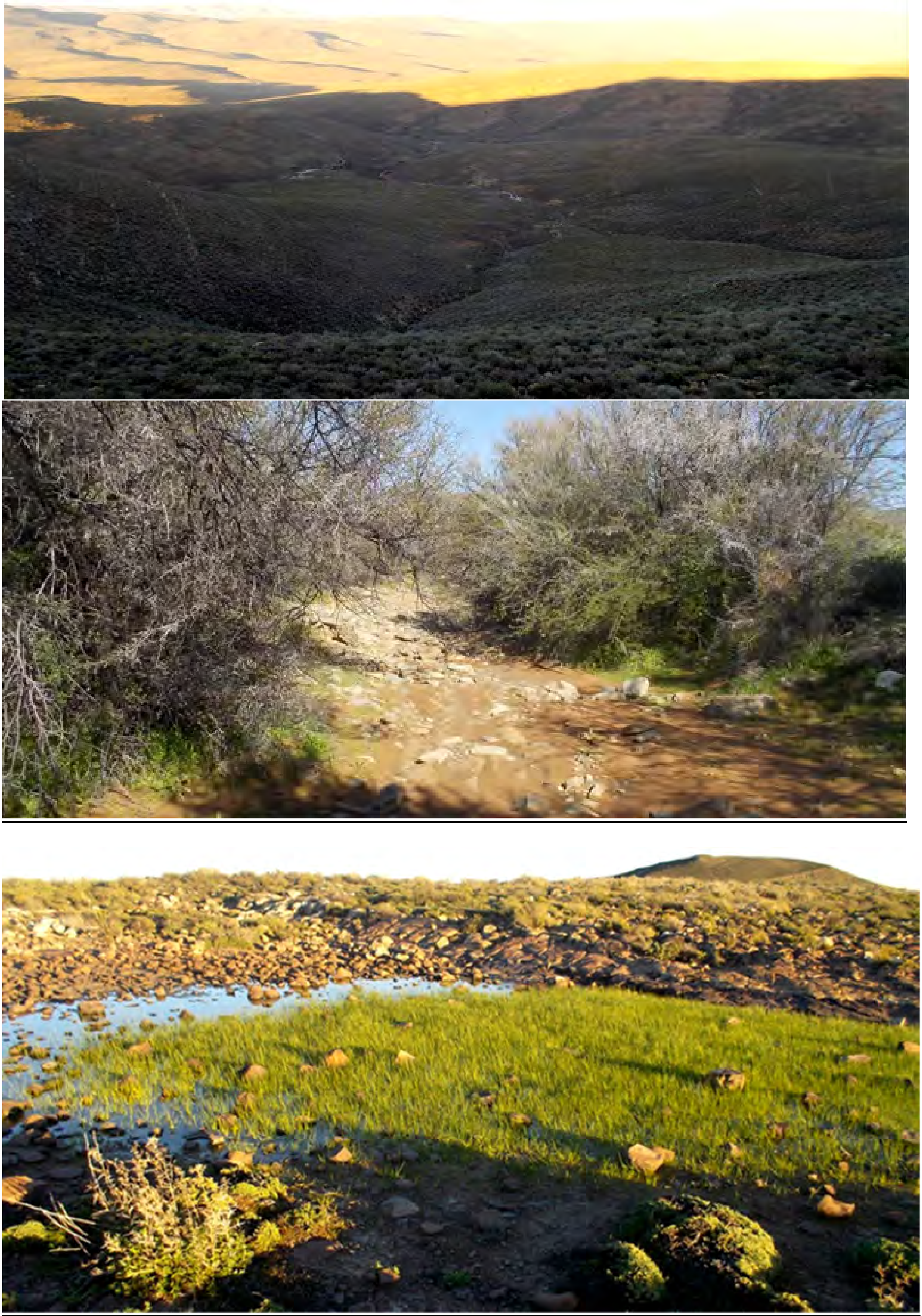


Figure B.22: Views of the larger rivers, smaller tributaries and a vernal pool within the study area

B.8.4.3 **Aquatic Species of Special Concern**

Most of the vegetation associated with the aquatic features within the valley floors in the study area is still largely natural and comprises of a mix of low trees and shrubs such as *Vachellia karroo*, *Searsia lancea*, *Buddleja saligna*, *Euclea undulata*, *Melianthus comosus*, *Sutherlandia frutescens*, *Lycium* spp. and *Asparagus striatus* within the riparian zones. Patches of common *Phragmites australis* reeds, grasses such as *Stipagrostis namaquensis* with *Juncus* rushes within the instream habitat. There is a low density of invasive alien plants such as *Eucalyptus* and pepper trees (*Schinus molle*) occurring in the more disturbed aquatic habitats.

The rock-fields or pavements that occur on the higher-lying ridges in the study area offer a limited and unique habitat that is not found elsewhere. Vernal pools are associated with this shallow, temporarily inundated aquatic habitat that supports very specialised aquatic vegetation that is rooted in the mud, but has floating stems and leaves such as *Romulea aquatica* (Listed as “Endangered” on the IUCN Red List of Threatened Species).

The watercourses in the study area are non-perennial, however some rock pools and dams are likely to contain water for most of the year. As a result, no indigenous fishes occur within the rivers and the amphibian diversity within the study area is likely to be relatively low. No species of conservation concern are known to occur in the study area from an aquatic perspective. The species likely to be present are quite widespread and of low conservation concern. These include the Karoo Dainty Frog, *Cacosternum karooicum* (Data Deficient), the Cape Sand Frog, *Tomopterna delalandii* and the Raucous Toad, *Amietophrynus rangeri*. The latter two amphibian species are listed as “Not Threatened”.

One plant species of conservation concern, the candelabra lily (*Brunsvigia josephinae*) which is listed as “Vulnerable”, is known to occur along the watercourses throughout the study area.

B.9 Avifauna (Birds)

The information provided below has been extracted from the Avifaunal Impact Assessment included in Appendix D of this BA Report.

B.9.1 Overview of the region

At a macro level, there are no nature conservancy areas, to the present knowledge of the bird specialist, within a 30 km radius of the proposed development area. The proposed Kudusberg WEF site is located approximately 55 km south-east of the Tankwa Karoo National Park, 90 km north-east from Swartberg Mountains Important Bird Area (IBA) (SA106), 49 km east of the Cedarberg – Koue Bokkeveld Complex IBA (SA101) and 56 km north from Anysberg Nature Reserve IBA (SA108) (Figure B.23). Considering that these areas are located at a considerable distance from the proposed WEF area it is not expected that the species using them are affected in any way by the implementation of this project. Nonetheless the analysis of the bird species present in these areas, which are of similar nature to the Kudusberg WEF proposed area, may provide an indication on the suite of species likely to be present in the study area.

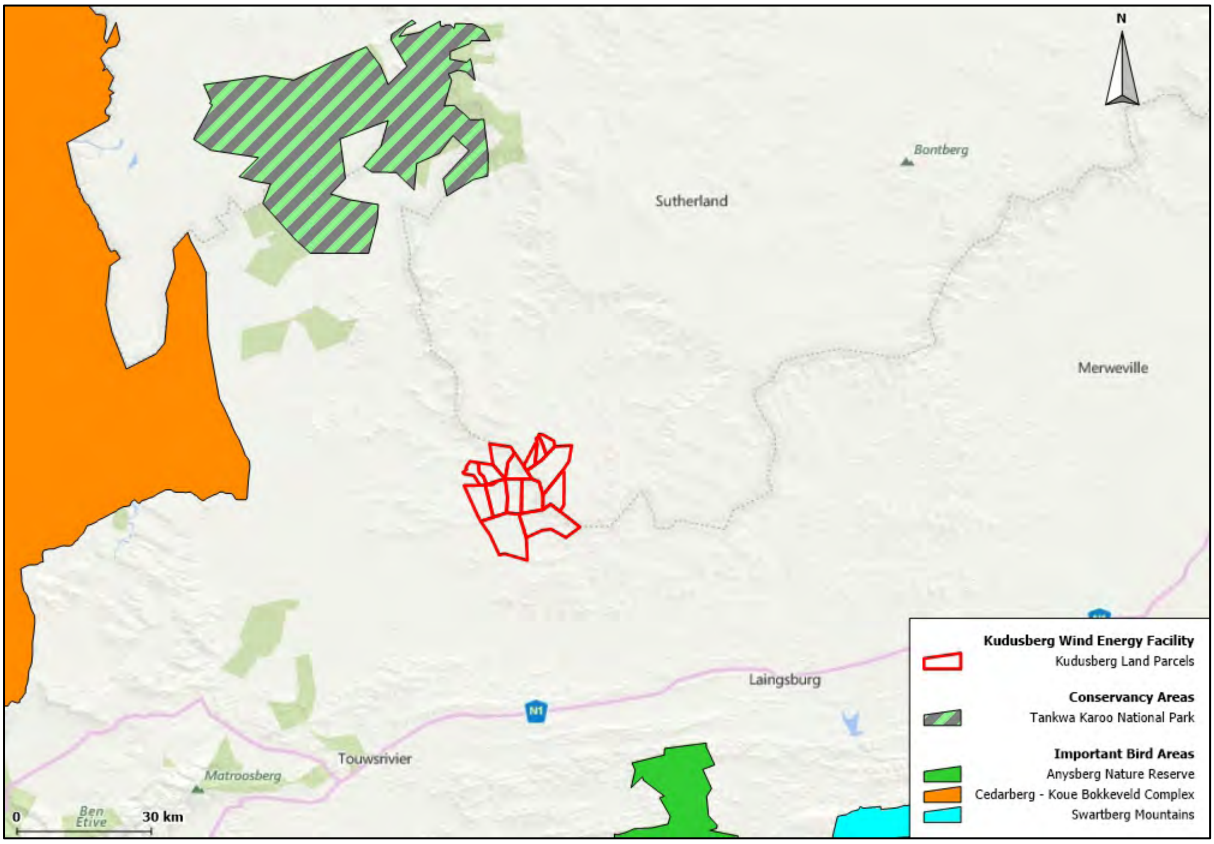


Figure B.23: Location of the Kudusberg WEF in relation to the surrounding conservancy areas (background image source: Google Earth Street Map).

B.9.2 Overview of birds and the Kudusberg Site

At the WEF site level, the site falls within the Succulent Karoo and the Fynbos biome, with the occurrence of two main vegetation types (Mucina & Rutherford, 2006) (Figure B.24) under the Biodiversity section).

The site is characterised by accentuated mountainous areas with very difficult human access and therefore it is in almost pristine natural conditions. Vegetation is adapted to the semi-arid conditions and harsh rocky conditions. Currently the area where Kudusberg WEF is proposed shows no signs of intense disturbance other than that caused by natural impacts on the veld due to a three-year period of drought and grazing. Signs of human disturbance are characterised by the presence of a few farm houses.

Both the Fynbos biome and the Succulent Karoo biome are characteristic of higher altitudes and are present both in the bottom and top of the mountains. There are several species which are dependent on this type of habitat such as: Verreauxs' Eagle *Aquila verreauxii*, Grey-backed Cisticola *Cisticola subruficapilla*, Karoo Prinia *Prinia maculosa* and Grey-winged Francolin *Scleroptila Africana*. Apart from the bird species that are naturally associated with the Fynbos and the Succulent Karoo biome, other species with more widespread distributions and less specific habitat requirements may also occur. These species are likely to be attracted by factors such as land-use, topography and the presence of drainage lines and water features in the surroundings of the site. Within the proposed Kudusberg WEF site, however, the habitat is mostly reserved as low natural vegetation within a mountainous area, with some mostly dry water features. Regardless, species still make use of these habitats occurring on site (Figure B.24). For example, a Western **Barn Owl**, *Tyto alba* roost, was found in a rock-face crevice on site, as well as a few other smaller nests that were found. **However, these other nests were not identified as being in use any more, as they were collapsed and in very poor condition.**

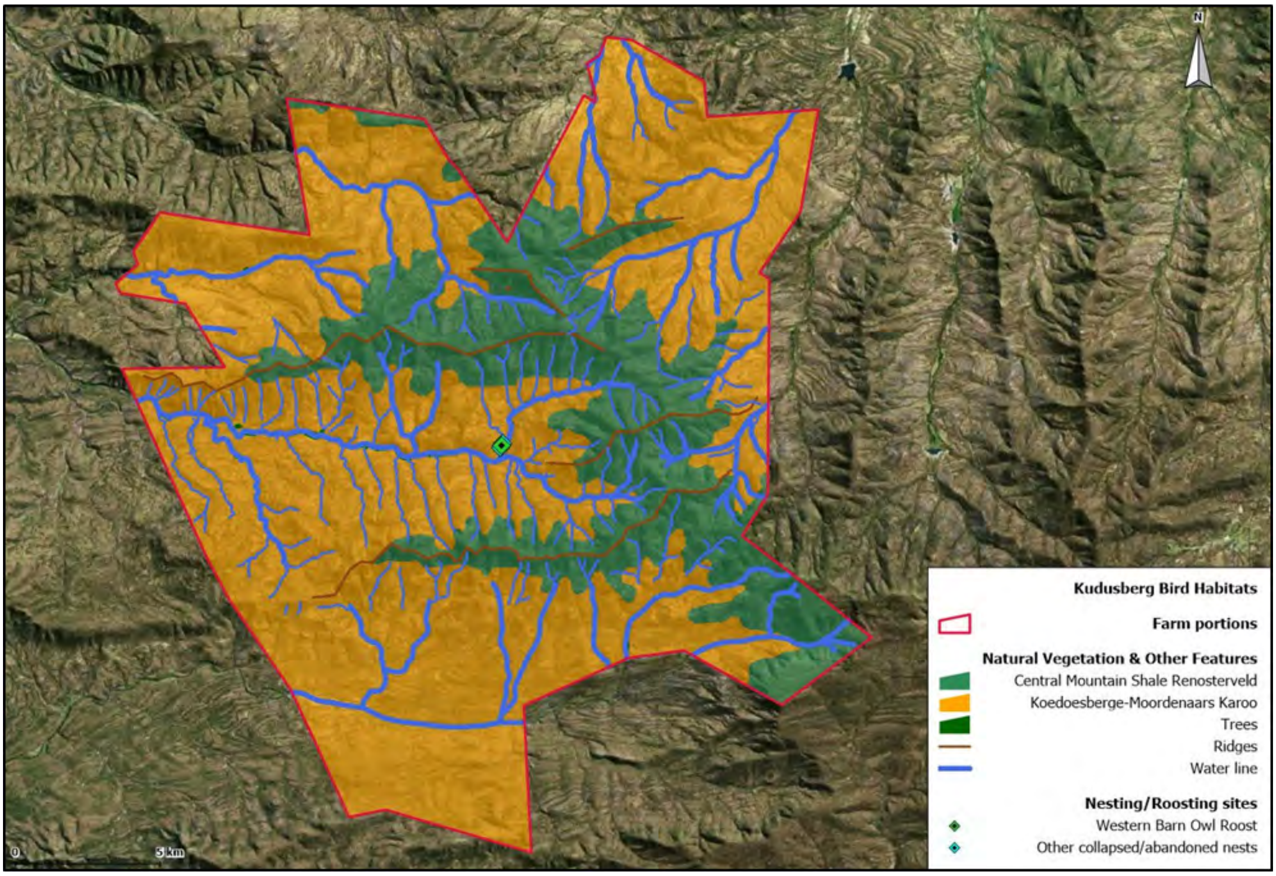


Figure B.24: Bird habitats occurring within the proposed Kudusberg WEF

Rocky hillsides characterise a large portion of the site due to the site being relatively mountainous. These areas may also be important for certain species that use these areas for nesting or thermalling, such as: Rock Martin *Hirundo fuligula*, Rock Kestrel and Verreauxs' Eagle, among others. For this reason, the site has been generally classified as one with **moderate s**ensitivity, with some areas considered to be **very highly sensitive** (i.e. no-go areas that should be avoided from wind turbine installation) (the sensitivity of the site in terms of birds is further discussed in section D. 1.2.7 of this report). The layout respects this requirement to avoid very-high sensitive areas.

B.9.3 Main results of the field study

A 12-month monitoring campaign was undertaken from January 2016 until October 2016 in line with the best practice guideline for preconstruction avifauna monitoring at wind farms (Jenkins *et al.* 2015. From a total of 131 species potentially occurring in the area (Bioinsight, 2018), 67 bird species were detected within the study area (WEF and surrounding area) across all the survey methodologies implemented through the pre-construction monitoring, including eight species that were not identified to occur at the site during the monitoring campaign. Seventeen of the species identified are considered priority species for the monitoring campaign (Table B.3).

Table B.3: Sensitive bird species considered central to the avian impact assessment process for the proposed Kudusberg WEF. Global RLCS (WW) (Red List Conservation Status) (IUCN 2016) and South Africa RLCS (SA) (Taylor, Peacock & Wanless 2015): EN – Endangered; VU – Vulnerable; NT – Near threatened; LC – Least Concern; NA – Not Assessed; Endemism in South Africa (BLSA 2016): * – endemic; (*) – near-endemic; SLS – endemic to South Africa, Lesotho and Swaziland. Likely Impacts: C – Collision; D – Disturbance and/or Displacement; H – Habitat destruction.

Group	Common Name	Scientific Name	Red List Conservation Status (South Africa)	Global Red List Conservation Status (IUCN 2016)	Convention Migratory Species	Endemic to South Africa	Population Trend	Priority species	Likely Impacts
"Ciconids"	Hamerkop	*Scopus umbretta*	-	LC	-	-	Stable	X	D
"Ciconids"	Black Stork	*Ciconia nigra*	VU	LC	II	-	Unknown	X	C, D
"Ciconids"	African Sacred Ibis	*Threskiornis aethiopicus*	-	LC	II (subsp. aethiopicus)	-	Decreasing	X	D
"Waterbirds"	Greater Flamingo	*Phoenicopterus roseus*	NT	LC	II	-	Increasing	X	C; D
"Waterbirds"	Cape Shoveler	*Anas smithii*	-	LC	II	-	Increasing	-	D
"Waterbirds"	Maccoa Duck	*Oxyura maccoa*	NT	NT	II	-	Decreasing	-	D
"Nocturnal Raptors"	Spotted Eagle-Owl	*Bubo africanus*	-	LC	-	-	Stable	X	D, H
"Accipitrids"	Verreauxs' Eagle	*Aquila verreauxii*	VU	LC	II	-	Stable	X	C, D, H
"Accipitrids"	Booted Eagle	*Hieraaetus pennatus*	-	LC	II	-	Decreasing	X	C, D, H
"Accipitrids"	Martial Eagle	*Polemaetus bellicosus*	EN	VU	II	-	Decreasing	X	C; D; H
"Accipitrids"	Black-chested Snake Eagle	*Circaetus pectoralis*	-	LC	II	-	Unknown	X	C; D; H
"Accipitrids"	Jackal Buzzard	*Buteo rufofuscus*	-	LC	II	(*)	Stable	X	C, D, H
"Accipitrids"	Pale Chanting Goshawk	*Melierax canorus*	-	LC	II	-	Stable	X	C, D, H
"Accipitrids"	Black Harrier	*Circus maurus*	EN	VU	II	(*)	Stable	X	C, D, H
"Accipitrids"	African Harrier-Hawk	*Polyboroides typus*	-	LC	II	-	Stable	X	C, D, H
"Falcons"	Rock Kestrel	*Falco rupicolus*	-	NA	II	-	NA	-	C, D, H
"Falcons"	Greater Kestrel	*Falco rupicoloides*	-	LC	II	-	Stable	X	C, D, H
"Bustards"	Ludwig's Bustard	*Neotis ludwigii*	EN	EN	-	-	Decreasing	X	D, H
"Bustards"	Karoo Korhaan	*Eupodotis vigorsii*	NT	LC	-	-	Increasing	X	D, H
"Phasianids"	Grey-winged Francolin	*Scleroptila africana*	-	LC	-	SLS	Stable	X	D, H
"Phasianids"	African Snipe	*Gallinago nigripennis*	-	LC	II	-	Unknown	-	D

Group	Common Name	Scientific Name	Red List Conservation Status (South Africa)	Global Red List Conservation Status (IUCN 2016)	Convention Migratory Species	Endemic to South Africa	Population Trend	Priority species	Likely Impacts
"Passerines"	Common Swift	*Apus apus*	-	LC	-	-	Decreasing	-	C; H
"Passerines"	Cape Clapper Lark	*Mirafra apiata*	-	LC	-	(*)	Decreasing	-	C, D, H
"Passerines"	Karoo Lark	*Calendulauda albescens*	-	LC	-	(*)	Decreasing	-	C; D; H
"Passerines"	Large-billed Lark	*Galerida magnirostris*	-	LC	-	(*)	Increasing	-	C, D, H

From the total species identified, six are of special concern for having an unfavourable conservation status in South Africa: Black Harrier *Circus maurus*, Ludwig's Bustard *Neotis ludwigii*, Martial Eagle *Polemaetus bellicosus* – Endangered; Verreauxs' Eagle *Aquila verreauxii*, Black Stork *Ciconia nigra* – Vulnerable; Greater Flaming *Phoenicopterus roseus* – Near Threatened (Taylor et al., 2015).

Eleven species detected during field work are considered to be endemic or near endemic to South Africa including sensitive species such as Jackal Buzzard, Karoo Lark, Black Harrier, Large-billed Lark and Cape Clapper Lark.

The bird community in the study area (67 total bird species) is mostly comprised of passerine and small bird species (43% of the total species), followed by bird species associated with waterbodies (28% of the total bird species), Accipitrids (10% of species) and Ciconids (10% of species). Representing a smaller proportion, 7% of the species found in the study area were Bustards, Falcon or Crow species. From the aforementioned groups, the Raptors (Accipitrids), Falcons, Waterbirds and "Ciconids" are considered most likely to suffer impacts caused by wind farms (Retief et al., 2012). Passerines might also be sensitive to impacts and collide with wind turbines, especially those which are known to migrate (AWWI, 2015).

A large portion of the species confirmed in the area were observed in both the proposed wind energy facility site and the surrounding area (33 species – 49% of the total species observed). These species may not be severely impacted by the presence of the wind energy facility as they already use the surrounding area, making it possible for them to therefore have an ability to potentially shift their utilisation area slightly. This includes most of the priority species present at the site (12 out of 17 species), of which 7 are Accipitrids and Falcons species, considered to have a higher vulnerability to collision, especially if using the area of development only (AWWI, 2015).

Nineteen of the remaining species were observed using only the WEF site, with most of them being from the Waterbird, Ciconid and Passerine groups. Of these 19 species, only three are considered sensitive to impacts caused by wind energy facilities.

A similar number of species were detected using only the Control area, with similar group characteristics. Such species are considered to be less likely negatively impacted by the Kudusberg WEF as they do not regularly use the area where the WEF will be constructed. They may however be somewhat affected by the disturbance caused by the temporary construction activities which can have repercussions to the broader study area.

B.10 Bats

The information provided below has been extracted from the Bat Specialist Study included in Appendix D of this BA Report.

B.10.1 Overview of the region

At a macro level, there are no known features considered to have relevant importance for bats in the broader area of the proposed Kudusberg WEF development area. The closest known roost is located at approximately 100 km from the site (Montagu Guano Cave) (see Figure B.25). Additionally, there are no nature conservancy areas, to the specialist's present knowledge, within a 30 km radius of the proposed development area. The proposed Kudusberg WEF site is located approximately 55 km south-east of the Tankwa Karoo National Park (Figure B.25). Considering that this area is located at a considerable distance from the proposed WEF area it is not expected that the species using the National Park will be affected in any way by the implementation of this project. Nonetheless the analysis of the bat species present in the area, which are of similar nature to the Kudusberg WEF proposed area, may provide an indication of the suite of species likely to be present in the study area.

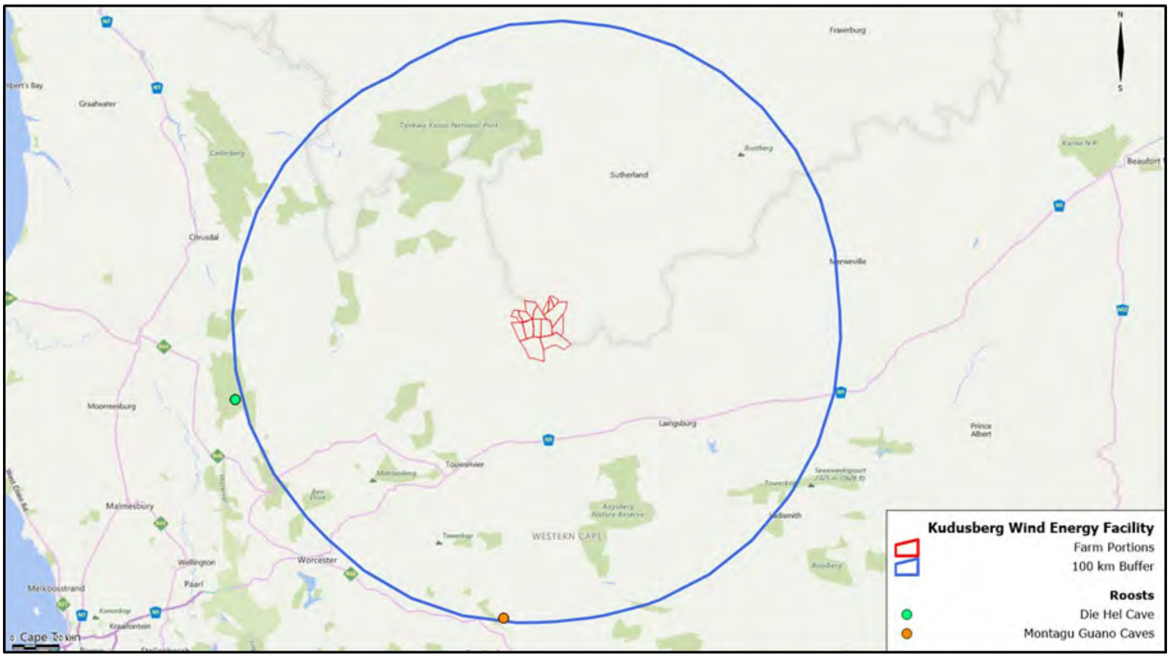


Figure B.25: Confirmed roosts located in the vicinity of the proposed WEF site (background image source: Virtual Earth Street Image).

Vegetation structure is a key determining factor in bat distribution. The proposed Kudusberg WEF site is characterised by accentuated mountainous areas which is located between two vegetation types and major biotopes: the Fynbos biome and the Succulent Karoo biome (Figure B.26). Both are characteristic of higher altitudes and are present both in the bottom and top of the mountains. Within the proposed Kudusberg WEF site the area is mostly comprised of natural vegetation that is adapted to the hot and seasonal climate. This type of habitat is generally associated with the presence of several bat species that occur in these arid and semi-arid habitats. Such species include the Egyptian slit-faced bat (*Nycteris thebaica*), the Lesueur's wing gland bat (*Cistugo lesueuri*), the Cape horseshoe bat (*Rhinolophus capensis*), or the Egyptian free-tailed bat (*Tadarida aegyptiaca*). Other species may be present in the area, not due to the vegetation structure but due to the terrain features, which include mountains, cliffs and ridges. The Long-tailed serotine (*Eptesicus hottentotus*), the Natal long-fingered bat (*Miniopterus natalensis*) and the Temminck's myotis

(*Myotis tricolor*) are examples of species which can be present in these areas due to their preference for roosting in caves and cracks in rocks (Monadjem *et al*., 2010).

The study area is not abundant in water sources at present, and therefore it is expected that the few water features present will have a high attraction factor for bats, especially during the wet season. Their importance is not restricted only to water availability but also to insect abundance due to the associated vegetation present.

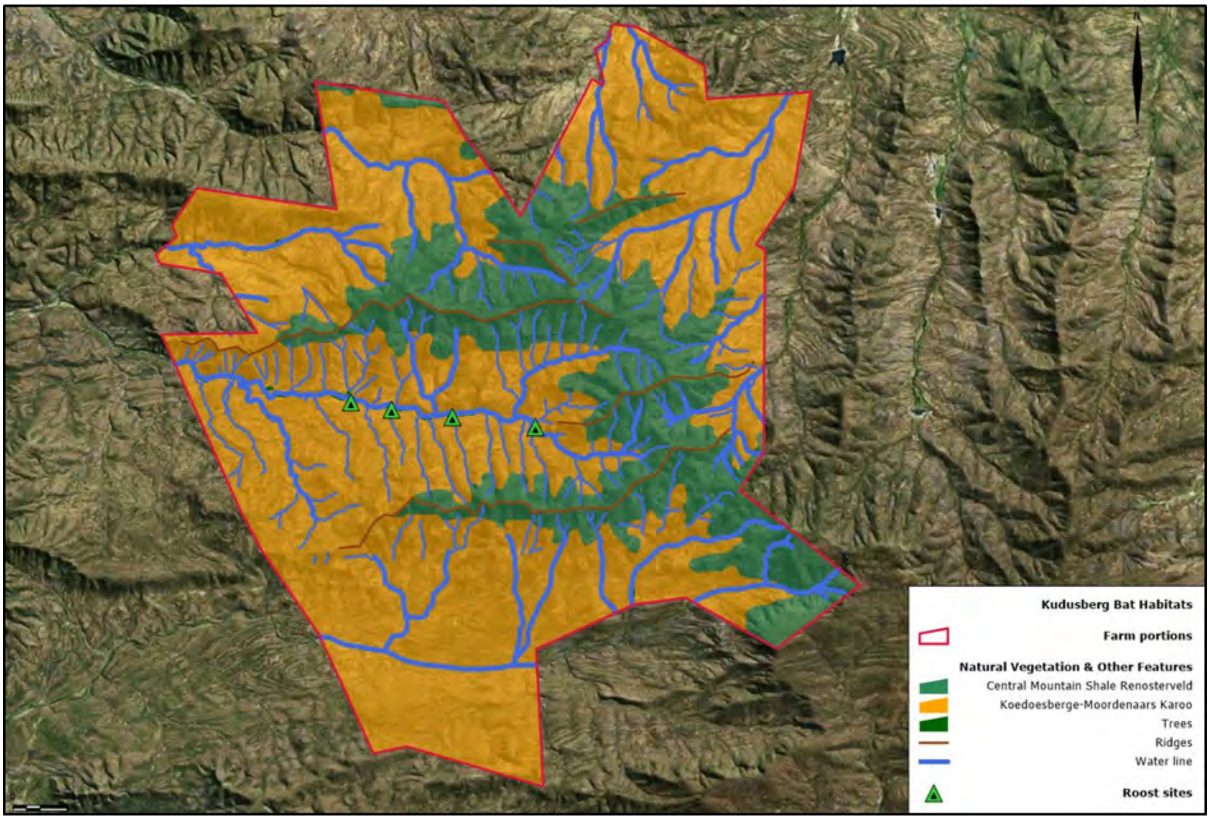


Figure B.26: Bat habitats occurring within the Kudusberg WEF. *watercourses mapped using open source data and not confirmed through a hydrology assessment.

The proposed development area is occupied mainly by natural vegetation. The vegetation provides a very sparse coverage of the soil and does not provide much refugee to any bat species. It is however a good hunting ground for open-air foragers such as the Egyptian free-tailed bat. Natural shrubby vegetation is present both at the top of the mountain ridges and in the slope and flatter plain areas.

Vegetation taller than shrubs is very scarce in the study area and is generally associated with watercourse lines. These locations may have two different utilisations by the different bat species potentially present in the area: they may be used as roosts by tree-dwelling or be used as feeding roosts during the night by other bat species, such as the Geoffroy's horseshoe bat, which then roost during the day at separate locations (usually caves or mines).

B.10.2 Overview of bats and the Kudusberg Site

At a WEF site level, activity in the area is considered to be low at ground and rotor level. The general area of the site is being used by sensitive species, with a medium to high risk of collision with wind turbines (e.g. Natal long-fingered bat, Cape serotine and the Egyptian free-tailed bat). The mountains and ridges present throughout the site supply many rock crevices suitable for bat roosts, however the roosts identified within the proposed WEF area are all buildings identified to have potential to be used as roosts. It has been confirmed that the four roosts located within the proposed Kudusberg WEF area have bat occupation (Figure B.26). However, the roosts are in the valleys and sufficient distance from the proposed turbines.

The general area of the proposed WEF is classified as having a low bat sensitivity due to the very low bat activity observed during the 12-month monitoring. However, considering the presence of medium-high and high collision risk species, some precautionary measures are needed.

Therefore, very high (no-go) areas and other sensitive areas for bats are outlined in the Bat Specialist study follow the recommendation from the South African Bat Assessment Advisory Panel (SABAAP; in Sowler et al., 2016). The very high sensitivity areas (no-go areas) should exclude all new WEF-associated structures (wind turbines, roads, powerlines, substation infrastructures or other associated structures) which is the case with the proposed layout. More information on the bat sensitivity on site is provided in Section D.1.2.8 of this report.

B.10.3 Main results of the field study

From the 67 bat species that may occur within South Africa (Monadjem *et al*., 2010), according to several criteria, only 15 bat species are likely to occur within the Kudusberg WEF study area. From all these 15 species, at least four species had confirmed occurrence in the area. From all these fifteen species, nine of them are considered to be sensitive to the project development (Table B.4).

Table B.4: List of species with possible occurrence at Kudusberg WEF (IUCN, 2018) and South Africa Red List (Friedmann & Daly, 2004b): VU – Vulnerable; NT – Near Threatened; LC – Least Concerned; NE – Not Evaluated; Collision risk according to Sowler *et al*., 2016; Probability of occurrence: High; Low; Mod – Moderate

Species name	Common name	IUCN	SA Red List	Collision risk	Sensitive species	Probability of occurrence	Presence confirmed during campaign
Nycteris thebaica	Egyptian slit-faced bat	LC	LC	Low	X	Low	**Yes**
Miniopterus fraterculus	Lesser long-fingered bat	LC	NT	Med-High	X	Low	No
Miniopterus natalensis	Natal long-fingered bat	LC	NT	Med-High	X	High	**Yes**
Cistugo lesueuri	Lesueur's wing-gland bat	LC	NT	Low	-	Mod	No
Cistugo seabrae	Angolan wing-gland bat	LC	VU	Low	X	Mod	No
Eptesicus hottentotus	Long-tailed serotine	LC	LC	Med	-	Low	No
Laephotis namibensis	Namibian long-eared bat	LC	NE	Low	-	Mod	No

Species name	Common name	IU CN	SA Red List	Collision risk	Sensitive species	Probability of occurrence	Presence confirmed during campaign
Myotis tricolor	Temminck's myotis	LC	NT	Med-High	X	Low	No
Neoromicia capensis	Cape serotine	LC	LC	Med-High	X	High	**Yes**
Scotophilus leucogaster	White-bellied house bat	LC	LC	Med-High	X	Low	No
Rhinolophus capensis	Cape horseshoe bat	LC	NT	Low	-	Low	No
Rhinolophus clivosus	Geoffroy's horseshoe bat	LC	NT	Low	-	Mod	No
Rhinolophus darlingi	Darling's horseshoe bat	LC	NT	Low	-	Low	No
Sauromys petrophilus	Robert's flat-headed bat	LC	LC	High	X	Low	No
Tadarida aegyptiaca	Egyptian free-tailed bat	LC	LC	High	X	High	**Yes**

Results of the 12-month pre-construction bat monitoring indicate that the bat activity at the proposed Kudusberg WEF area is generally **low** considering the Bat Guidelines (Sowler et al., 2016).

B.11 Heritage Profile

The information provided below has been extracted from the Heritage Impact Assessment included in Appendix D of this BA Report. The HIA includes an Archaeological Impact Assessment, Paleontological Assessment and a Cultural Landscape Assessment. The section below describes the affected environment for these areas. The affected environment in terms of Palaeontology is discussed in this section, B.10. Full studies are included in Appendix D of this BA Report.

B.11.1 HIA

As mentioned in Section B.4, the geology of the area comprises the Abrahamskraal Formations of the Lower Beaufort Group. The Abrahamskraal Formation is of very high fossil sensitivity, with local occurrences of significant tetrapod burrows and dispersed teeth and bones, as well as plant debris and trace fossils.

Identified heritage resources identified on site included archaeological and built environment features. Archaeological resources included scattered, isolated Middle and Later Stone Age artefacts, although these were very infrequent. A single cave with finger painted rock art, Later Stone Age artefactual material and a single sherd of indigenous pot was also identified. Several stone-built kraals, either rounded or rectilinear in shape, and dry stacked or mortared, were recorded and are likely of historic age, although some could be pre-colonial. Ruined dwellings and other disused farm buildings that are all likely over 100 years old were also recorded, usually in association with one or more kraals.

Built environment features included farmsteads and associated outbuildings at several farms. A single, fenced grave with marble headstone was recorded (Figure B.27 and B.28), as well as a likely child's grave (Figure B.29).

Almost all features were found along valley bottoms or on open plains near watercourses, with no significant heritage resources of any kind identified at higher elevations.

Figure B.27: A single grave was located on Boplaas Farm (photo courtesy of Katie Smuts)

Figure B.28: Headstone of the grave (photo courtesy of Katie Smuts)

Figure B.29: A likely child burial is located on Urias Gat Farm (photo courtesy of Katie Smuts)

One burial ground was identified (Figure B.30). These graves encountered are directly adjacent, 12 m east, to Common Access Road 1 where it passes Wind Heuvel Farm. This graveyard consists of 10-12 graves, with hand inscribed sandstone headstones, (Figure B.30) and is the family graveyard of the historic – and present – owners of Wind Heuvel, the Stadlers, and most graves date to the late nineteenth and early twentieth centuries. Most of the graves are marked with stone cairns, while some have rectangular stone edging. The graveyard is not fenced, although its perimeter is demarcated by a small furrow that encloses the graves.

Figure B.30: Stadler graveyard (KDB081) at Windheuwel farmstead and Stadler headstone (photos courtesy of Katie Smuts)

Several stone cairns were also noted as likely graves, including one isolated cairn (KDB058) and one group of more than 10 cairns (KDBc6) (Figure B.31). The isolated stone cairn (KDB058) while not positively identifiable as a grave, should be considered a possible grave, and is located within 100 m of Access Alternative 1.

The group of stone cairns is located 300 m northeast of the Urias Gat farmhouse (Figures B.31). These cairns vary in size from just over 1m in length to approximately 1.8 m. It is likely, given the uniformity of appearance and the grouping of these features that they do represent graves. These cairns lie approximately 165 m east of Common Access Road 1 from the north, 190 m northeast of the fork between Access Road Alternatives 1 and 2.


Figure B.31: The group of stone cairns (KDBc6) is located 300 m northeast of the Urias Gat farm house (photos courtesy of Katie Smuts)

B.11.2 Cultural Landscape

The cultural landscape of the region comprises the largely undeveloped ridges and slopes, as well as the cumulative evidence for hundreds of years of continuous patterns of transhumant pastoralism that has left, at most, ephemeral traces on the landscape. The study area and its surrounding landscape is, and has always been, a landscape of movement, meeting, conflict, death and discovery. This cultural landscape is testament to the herds, first wildlife and then stock, and the people following them, moving across the landscape, meeting each other, congregating and going their separate ways, trade, support and conflict over scarce resources, innovation and survival. It is a vast and sparse landscape that pushes its inhabitants to the limits, resulting through history in repeat periods of conflict over scarce resources, such as water, wildlife and grazing. It is a testament to the resilience and skill of the people who chose to inhabit, however transiently, the landscape. Its history and character lend itself to a cultural landscape most valuably experienced by moving through it, seeing its changes in colours and textures, forms and patterns, as visual and visceral reflections of its immense biodiversity, deep history and stark reality.

The proposed Kudusberg WEF is located on the semi-arid ridges and valleys south of the Roggeveld Mountains in the Great Karoo, west of the R354 and south and east of the R356. The area in which the study area is located had various names over time and discipline, with shifting borders depending on the political, social, natural climate of the time. It is in an area that has, as its constant cultural landscape characteristic, flux and change, movement and transference.

The proposed development area can be characterised by 5 main Landscape Character Areas: Ridges, Ridge Slopes, Ridge Saddles, Valleys with River Courses and Farm Roads. A Cultural Landscape Area Map was prepared by the specialist and is shown in Figure B.32.

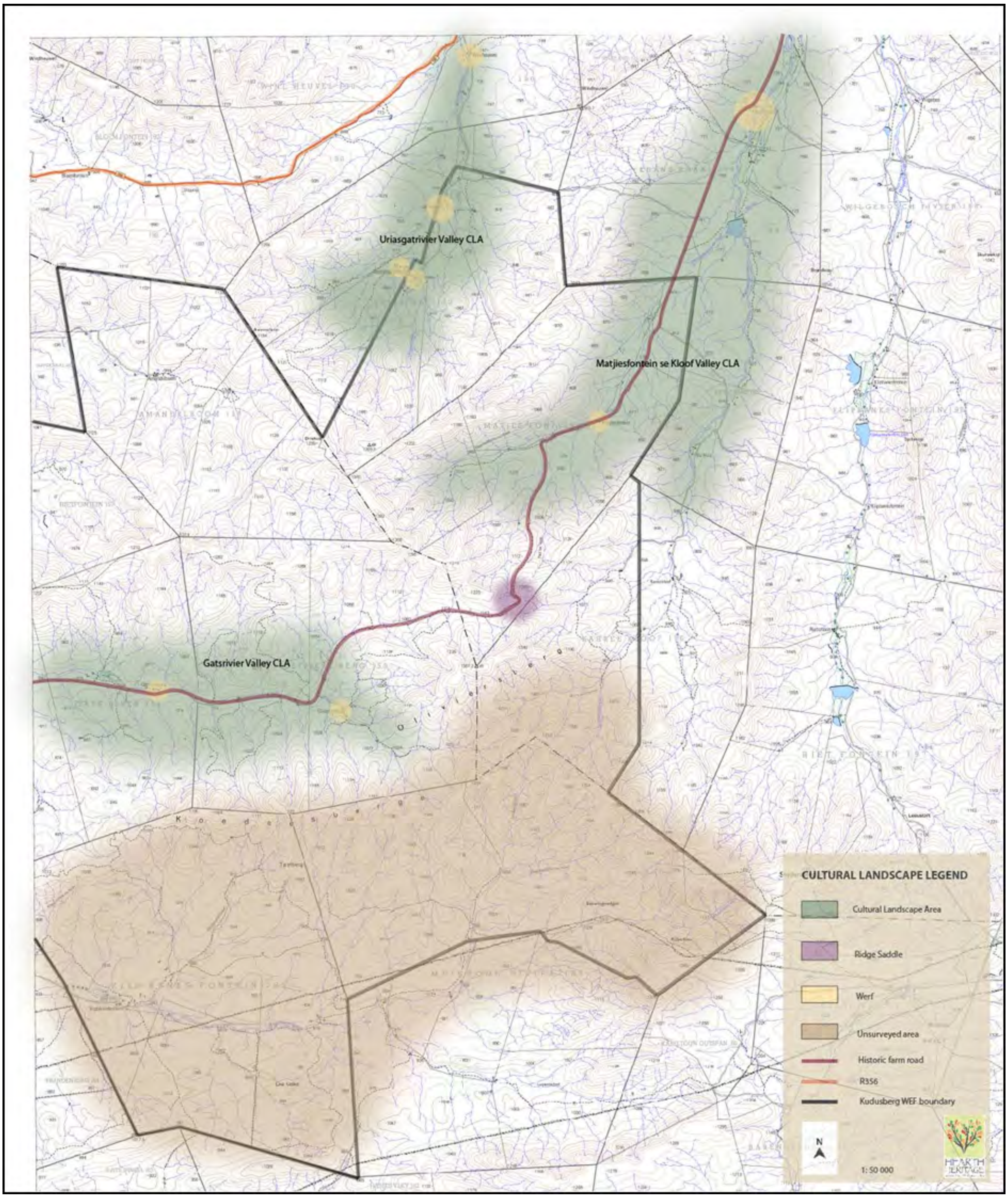


Figure B.32: Cultural Landscape Area map for Kudusberg WEF generated from site inspection (June 2018) by cultural landscape specialist, Hearth Heritage.

The area is **sparsely populated** with a few farmsteads and their associated structures located on the valley floors, usually adjacent to water courses. Sites of habitation are usually layered in their historic signature, with various periods of habitation evident on the same site over time, such as farmsteads, stone kraals and more recent 20th century associated farm structures (sheds and seasonal labourers' residence) (Figure B.33, B.34 and B.35). Many farm buildings in the area contain elements greater than 60 years of age and fall within the general protection of the National Heritage Resources Act (NHRA). These farmsteads are connected to each other through a series of farm tracks, one of which has historic significance, having portered people from the Cape to Sutherland and beyond. Other roads service fenced stock camps and associated small dams and their accompanying wind pumps. These roads usually travel up the river valleys, skirting the ridge slopes, over the ridge saddles and down into the adjacent valley, avoiding the high ridge peaks.

Figure B.33: Gatsrvier Valley CLA showing temporal layers of built form – visual impact (photo courtesy of Hearth Heritage)

Figure B.34: Matjiesfontein historic werf looking east from the stone kraal over the Matjiesfontein se Kloof (photo courtesy of Hearth Heritage)

Figure B.35: Historic stone (foreground) and brick (background) buildings with recent alterations and additions serving as labourers' residence at Boplaas on upper reaches of Uriasgatrivier Valley CLA (photo courtesy of Hearth Heritage)

The historic R356 (Figure B.36) which runs from Karoopoort past the north of the Kudusberg study site and on towards Sutherland is evident in most historic maps and the subject of a well-known non-fiction book, Die Vergete Grootpad (Smuts and Alberts, 1988). Along this historic route, travellers experience the vastness and dramatic sense of place of the surrounding area that has long been the subject of romatic explorers' descriptions, as well as the low saddles and water courses that have been crossed by people with various plans and motives over centuries.

As the tangible elements that embody the ephemeral, intangible and scenic qualities for which the cultural landscape is valued, and which symbolise its sense of place, the aspects of the study site which hold this significant sense of place should be sensitively managed in proposed development.

Figure B.36: Historic route, R356, crossing a shallow ridge saddle, looking north east to escarpment

B.11.3 Palaeontology

The proposed Kudusberg WEF project area is underlain by continental sediments of the Abrahamskraal Formation (Lower Beaufort Group, Karoo Supergroup) of Middle Permian age (c. 256-270 Ma) which are generally considered to be of high palaeontological sensitivity (SAHRA Palaeotechnical Report for the Northern Cape, SAHRIS website, Komsberg REDZ in SEA for Wind & Solar Photovoltaic Energy in South Africa, CSIR 2015) (Figure B.37). However, several previous palaeontological field assessments in the Klein Roggeveld region of the south-western Karoo as well as the six-day palaeontological field survey of the Kudusberg WEF project area suggest that the Beaufort Group bedrocks here are generally fossil-poor, apart from fairly common horizons with plant debris or low-diversity invertebrate trace fossils.

Figure B.37: Good vertical section through the lower Abrahamskraal Formation close to the Uitkyk Pass, Oliviers Berg 159. The lower mudrock-sandstone packages show an upward-coarsening trend with sharp tops, while the upper ones are typical fluvial sharp-based, upward-fining packages (Loc. 017).

None of the fossil sites recorded during the field survey lie within the proposed development footprint. They include two plant fossil sites and one lungfish burrow site (Figure B.38 and B.39) that are of scientific research interest as well as a few equivocal records of vertebrate burrows and tracks. A horizon of thin-bedded, dark grey mudstones of probable lacustrine origin exposed just below the crest of the central turbine ridge contains several dispersed to closely-spaced, subcylindrical burrow casts of lungfish (6-8 cm diameter; Figure B.39) (cf Hasiotis et al. 1993)

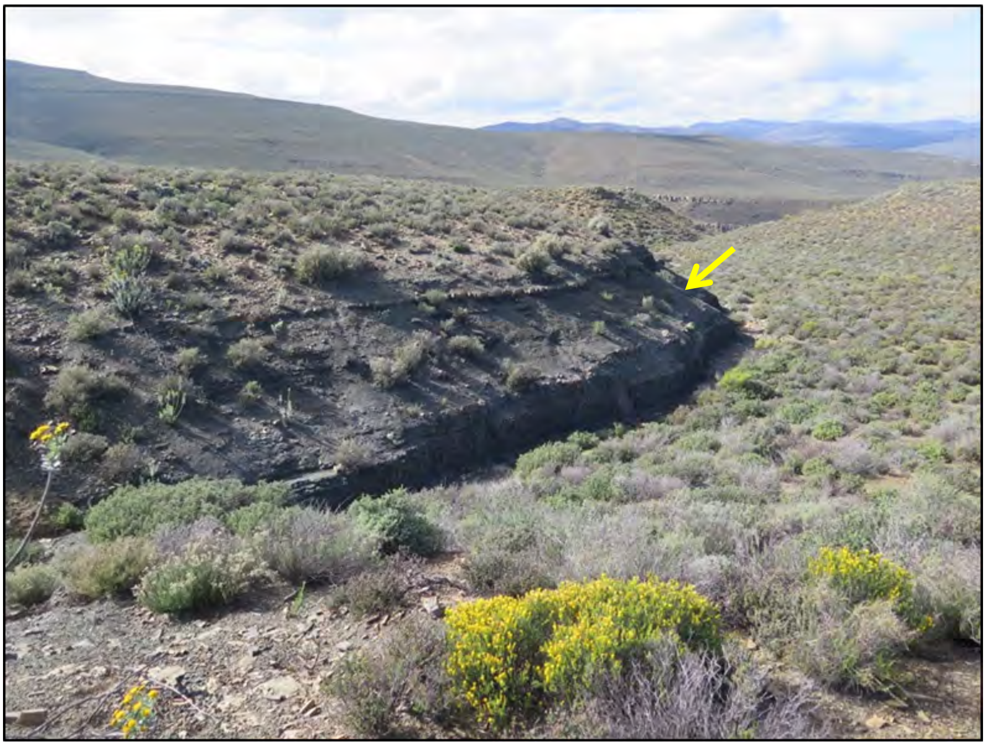


Figure B.38: Geological setting of the fossil lungfish burrow assemblages seen in the previous figure (fossil horizon is arrowed), located close to the crest of the central turbine ridge (Loc. 135).

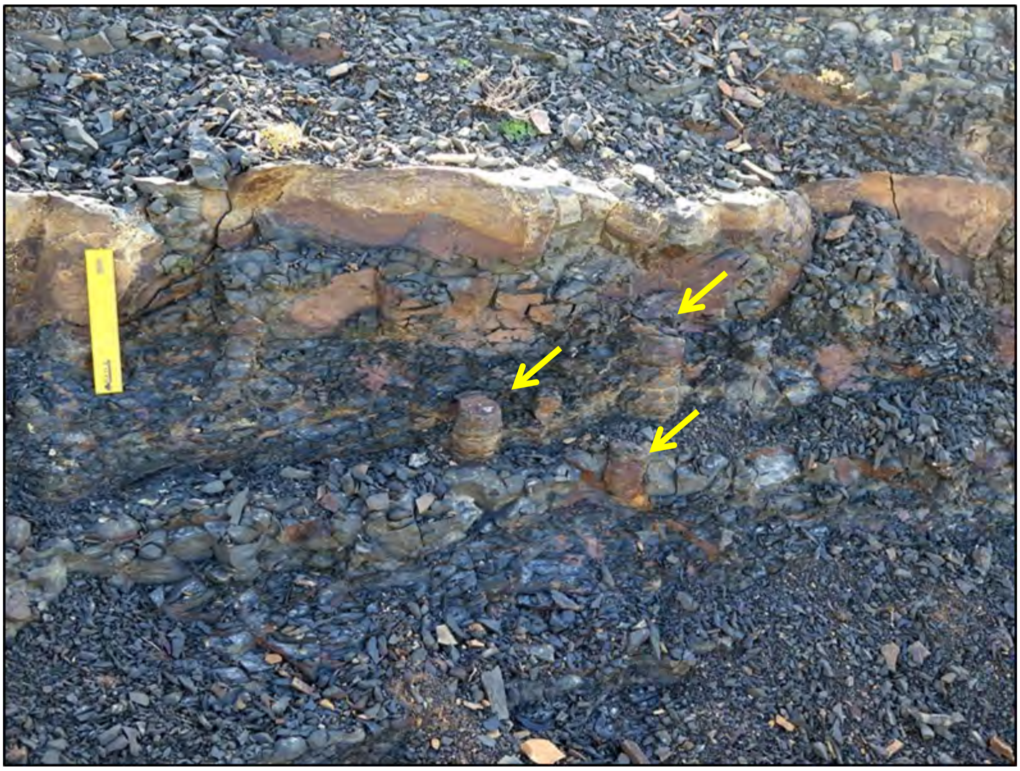


Figure B.39: Array of vertical, subcylindrical casts of lungfish burrows (arrowed) within laminated dark grey lacustrine mudrocks underlying the ferruginised casting sandstone (Scale = 15 cm) (Loc. 135). This locality lies fairly close to the crest of the central turbine ridge crest but outside the development footprint

The Kudusberg WEF study area is embedded within highly-dissected, hilly to mountainous terrain of the Klein-Roggeveld region, spanning the boundary between the Western and Northern Cape. This remote, semi-arid subregion of the Great Karoo of South Africa is situated between the rugged Cape Fold Mountains in the south, the arid *vlaktes* of the Ceres – Tanqua Karoo in the west and the steep Roggeveld Escarpment – part of the Great Escarpment - to the northeast. The R354 tar road between Matjiesfontein and Sutherland runs well to the east of the area while the R356 gravel road skirts it on the northern side. The core project area where most of the WEF infrastructure will be situated is dominated by broadly west-east trending uplands with summit ridges and plateaux at elevations of around 1 200-1 360 m amsl (e.g. Oliviersberg 1367 m amsl). Mountain slopes are generally fairly gentle with prominent-weathering ridges or *kranzes* of Beaufort Group sandstones imparting a distinctive banded appearance that is very pronounced on satellite images (Figs. B.40 to B.43). The slopes are clothed in karroid *bossieveld* vegetation (the spotting on satellite images is due to *heuweltjies)* and incised by numerous small, intermittently flowing streams. The area is drained by westward- and northward-flowing tributaries of the Tanquarivier drainage system such as the Ongeluksrivier, Muishondrivier, Kareekloofrivier and Uriasgatrivier. Away from the numerous drainage lines, dry waterfalls and sandstone ridges (Figs. B.8.44 & B.8.45), levels of bedrock exposure in the study area - notably that of the recessive-weathering mudrock facies - are generally very low. This is largely due to extensive cover by alluvial and colluvial deposits, sandy to gravelly soils as well as karroid *bossieveld* vegetation (Central Mountain Shale Renosterveld, Koedoesberg – Moordenaars Karoo).

Figure B.40: View south-eastwards from the crest of the central turbine ridge (Loc. 011) towards Oliviersberg homestead and the Oliviersberg range with higher ridges of the Klein Rogggeveld in the background.

Figure B.41: View eastwards along the western portion of the southern turbine ridge (Koedoesberge) showing flat-lying, poorly-exposed Abrahamskraal Formation along the ridge crest, coarse colluvial gravels in the foreground (Loc. 119).

Figure B.42: View eastwards along the central turbine ridge from near Loc. 136 showing occasional prominent-weathering, tabular sandstones of the Abrahamskraal Formation.

Figure B.43: View south-westwards towards the main northern turbine ridge showing flat to gently-dipping Abrahamskraal Formation with sheet-like sandstone units in the background and weathered grey-green mudrocks in the foreground (Loc. 056).

Figure B.44: Seasonally dry stream valley on Oliviers Berg 159 that is deeply incised into mudrocks beneath a resistant channel sandstone capping that builds a dry waterfall further upstream (Loc. 003a).

Figure B.45: Good vertical and panel sections through Abrahamskraal Formation mudrocks and channel sandstones along the stream valley due SE of Oliviersberg farmstead (Loc. 103).

The great majority of the Kudusberg WEF project area is assessed as being of low palaeontological sensitivity due to the scarcity of significant fossil vertebrate, plant and other remains here. Sensitive no-go areas within the proposed development footprint itself have not been identified in this study. Scientifically-important fossil plant and lung fish burrow sites as well as the equivocal vertebrate burrows and tracks recorded here all lie well outside (> 50 m) the proposed development footprint (Figs. B.46 & B.47 and Appendix 1 of the PIA in Appendix D) and no mitigation measures regarding them are recom2ended here.

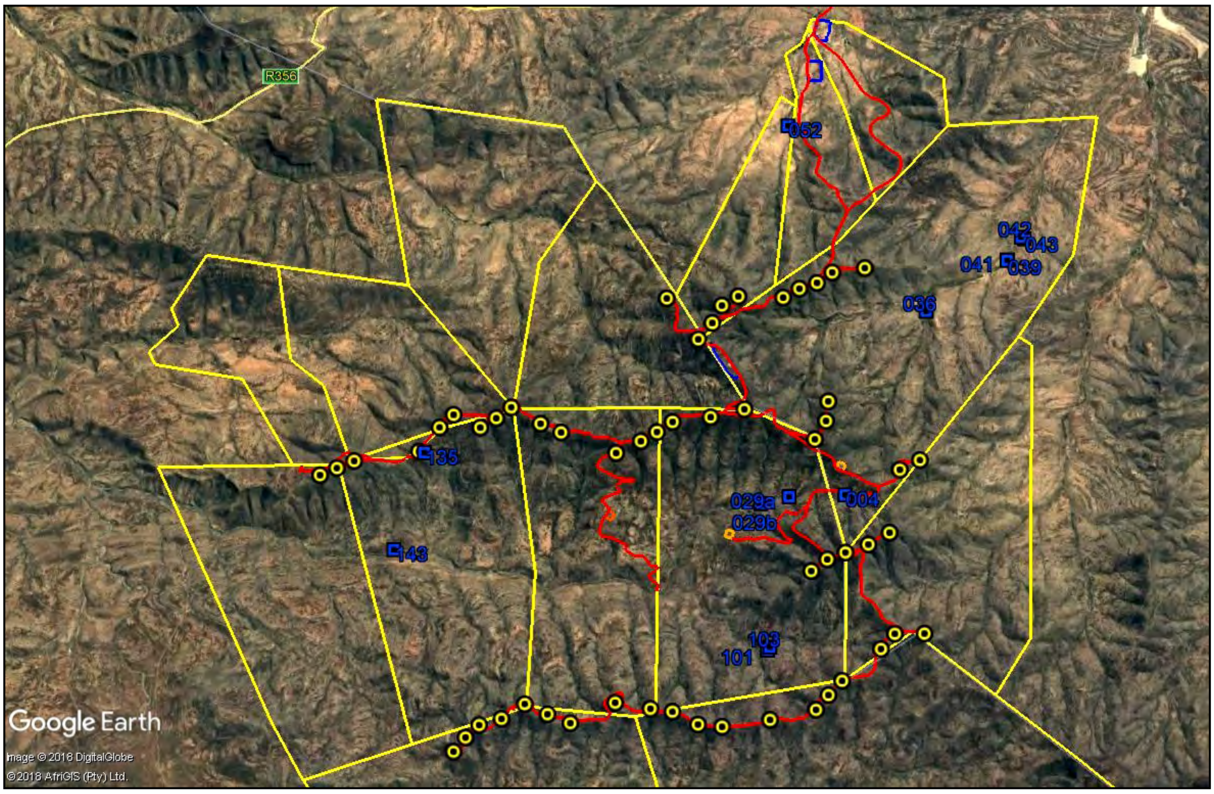


Figure B.46: Google Earth© satellite image of the core Kudusberg WEF project area in the Klein Roggeveld region showing numbered fossil sites recorded during the field survey (blue) in relation to the proposed layout of wind turbines (yellow dots) and access roads (red lines). Note that (1) none of the identified sites lies directly within the development footprint and (2) the majority of sites are of low palaeontological heritage significance (Proposed Field Rating IIIC). Scientifically-important fossil plant and lung fish burrow sites (Locs. 038-041,135 &143) (Proposed Field Rating IIIA) as well as the equivocal vertebrate burrows and tracks (Locs. 29b, 042 & 043) all lie well outside (> 50 m) the proposed development footprint and do not require mitigation as part of the WEF development (See also Fig. B.8.10 and locality details tabulated in Appendix 1 of the PIA in Appendix D of this report).

Scale bar = 7 km. N towards the top of the image

Figure B.47: Close-up satellite image of fossil site Loc. 135 (assemblage of lungfish burrows within lacustrine mudrocks) situated close to the crest of the central turbine ridge on Gats Rivier 156. It lies in an erosion gulley over 50 m from the nearest proposed access road (red) and wind turbine position (yellow dot) (and is therefore unlikely to be impacted by the WEF development. Mitigation is therefore not proposed for this site. Scale bar = 300 m. N towards the top of the image.

B.12 Noise levels in the area

The proposed Kudusberg WEF will be constructed on farmland. The topography surrounding the site is characterised by steep hills and valleys. The main noise sensitive receptors that could be affected by noise pollution are humans, terrestrial fauna and avifauna.

Human Sensitive Receptors

The site is situated in a farming community. Several homesteads are located on the properties where the turbines will be erected as well as on neighboring farms. The sensitive noise receptors have been recorded in Table B.5 below. The noise sensitive areas were mostly identified from Google Earth due to the distance from the project area. It is assumed that the structures listed in Table B.5 below are thus all homesteads and are occupied or could be occupied.

Table B.5: Noise Sensitive Areas in relation to the proposed Kudusberg WEF

NSA No	Longitude	Latitude	Within the Project Area
1	20°19'48.49" E	32°53'44.77" S	Yes
2	20°19'38.07" E	32°53'46.13" S	Yes
3	20°19'04.76" E	32°53'38.85" S	Yes
4	20°18'09.44" E	32°53'34.20" S	Yes
5	20°18'05.89" E	32°53'34.01" S	Yes
6	20°16'56.53" E	32°53'26.60" S	Yes
7	20°16'51.71" E	32°53'26.16" S	Yes
8	20°16'08.06" E	32°53'19.21" S	Yes
9	20°11'11.85" E	32°54'00.50" S	No
10	20°20'59.15" E	32°48'14.26" S	Yes
11	20°20'57.03" E	32°48'09.55" S	Yes
12	20°21'02.30" E	32°48'09.53" S	Yes
13	20°20'48.16" E	32°48'01.63" S	No
14	20°23'47.58" E	32°50'00.78" S	Yes
15	20°21'25.27" E	32°57'21.97" S	Yes
16	20°22'07.75" E	32°58'30.41" S	Yes
17	20°27'23.33" E	32°52'42.15" S	No
18	20°19'04.30" E	33°00'15.86" S	No
19	20°28'03.61" E	32°49'35.63" S	No
20	20°16'15.80" E	32°57'29.91" S	Yes

Natural Environment Receptors

The vegetation around the site is characterised by grassy fynbos with thicket in areas of richer soil. The fauna includes bats, birds, commercial livestock and a variety of buck.

Ambient Noise at Proposed Site

The ambient noise was measured at several locations as described in the methodology and results thereof are contained in Table B.6 below. The author is confident that this represents the ambient noise at the project site at the noise sensitive receptors.

Table B.6: Ambient Noise Results 18th July 2018

DAY

Date:	18/07/2018	18/07/2018	18/07/2018
Position:	NSA 1 (11:00) 32°53'44.07"S 20°19'48.64"E	Between NSA 4 & 5 (11:40) 32°53'34.44"S 20°18'7.25"E	Between NSA 6 & 7 (12:10) 32°53'26.80"S 20°16'54.33"E
Leq dB(A)	50.1	46.0	48.7
Comments	Noise from: Aeroplane flying over; Windmill water pump; Sheep in the distance; Birds	Noise from: grass / bush blowing in the wind; Birds	Noise from: Aeroplane flying over; Grass / bush blowing in the wind; Birds

EVENING

Date:	18/07/2018	18/07/2018	18/07/2018
Position:	NSA 1 (18:10)	Between NSA 4 & 5 (18:40)	Between NSA 6 & 7 (19:10)
Leq dB(A)	46.8	45.3	45.7
Comments	Noise from: Windmill water pump turbine; Sheep in the distance; Birds	Noise from: grass / bush blowing in the wind; Birds	Noise from: Aeroplane flying over; Grass / bush blowing in the wind; Birds

NIGHT

Date:	18/07/2018	18/07/2018	18/07/2018
Position:	NSA 1 (22:00)	Between NSA 4 & 5 (22:40)	Between NSA 6 & 7 (23:20)
Leq dB(A)	45.8	45.7	45.9
Comments	Noise from: Wind noise wind; Grass / bush blowing in the wind	Noise from: Wind noise; Grass / bush blowing in the wind; Crickets	Noise from: Wind noise; Grass / bush blowing in the wind; Crickets

The general ambient noise at each location varies substantially as the ambient sound is influenced by human activities, vehicles, wind noise and animal sounds.

The proposed Kudusberg WEF will not exceed the SANS 10103:2008 which stipulate that ambient noise should not exceed the guideline 35 dB(A) at night and 45 dB(A) during the day. The day / night (24-hour) rating limit is 45 dB(A). These levels can thus be seen as the maximum target levels for any noise pollution sources. If the current ambient (residual) noise exceeds the rating limit, then actual ambient (residual) limit will be used when a noise complaint arises in terms of the Environment Conservation Act - Noise Control Regulations and the Western Cape Noise Control Regulations.

B.13 Roads

The proposed Kudusberg WEF will be located off the R356 between Matjiesfontein in the Western Cape Province and Sutherland in the Northern Cape Province, as shown in Figure A.1. The nearest towns in relation to the proposed WEF sites are Sutherland, Touws River and Laingsburg. It is envisaged that the majority of materials, plant and labour will be sourced from these towns and transport to the WEF will be via the N1 and R354.

The Traffic Impact Assessment (TIA) showed that it will be possible to transport the imported wind turbine components by road to the proposed site. The proposed main route will be along the surfaced R354, which connects Matjiesfontein and Sutherland, turning west onto the district gravel road DR02249 and then turning left onto the R356 to the main access road (MN04469) to the Kudusberg WEF (see Figure A.8). Two access road alternatives branch off the MN04469. For this option, DR02249 would require upgrading and intersections would have to be widened to accommodate the turning movements of heavy vehicles. The watercourse structures along the route are in a poor condition and the load bearing capacity of these structures would need to be assessed. In all likelihood these structures would have to be replaced or upgraded. In addition, farm gates and cattle grids would have to be widened to accommodate abnormal loads.

The R356 could be accessed off the R354, which is approximately 10.8km from the DR02249/R354 intersection, as shown in Figure A.12 below. The section of R356 between the R354/R356 intersection and the R356/DR02249 intersection, however, would also require significant upgrading of the road and the drainage structures along the route. The route was therefore deemed unsuitable as an alternative as the required upgrading would be too extensive.

Access to the proposed WEF will be provided via the MN04469. Two access road alternatives would connect MN04469 to the new wind farm road network between the turbines. These roads are shown in Figure A.12 and described below:

- Access road alternative 1 – An existing jeep track. Approximately 4.6 km in length.
- Access road alternative 2 – New road. Approximately 5.7 km in length.

Both access road alternatives are considered suitable. However, access road alternative 1 is deemed the preferred access road as it is an existing jeep track.

B.14 Socio-Economic Character

The information provided below has been extracted from the Socio-Economic Specialist Study included in Appendix D of this BA Report.

The information presented in the Socio-Economic study is based on the 2001 and 2011 Census; and 2016 Community Survey carried out by Statistics South Africa (Statistics SA).

B.14.1.1 The project area

The study area is composed of portions from two municipalities in two provinces, namely Karoo Hoogland Local Municipality (Northern Cape) and Witzenberg Local Municipality (Western Cape). Figure B.48. below indicates the location of the Kudusberg WEF site in a local context. The closest urban areas to the site are that of Matjiesfontein (35 km), Touws Rivier (74 km), Laingsburg (79 km) and Sutherland (108 km). The site is located west of the R354 between Matjiesfontein and Sutherland. The deductions made are firstly that limited activity is taking place from a regional perspective. The immediate site area is predominantly categorised as low shrubland with limited open woodland and brush covering the site. This is also the status quo for the surrounding region but there are however, some cultivated crops to the north-east and south of the site. The region is undeveloped with limited economic activities present in both the Karoo Hoogland LM portion and Witzenberg LM portion surrounding the site (Department of Environmental Affairs, 2014).

With regard to social facilities, there are limited educational facilities serving the surrounding communities. In terms of healthcare, one hospital is located in Laingsburg, over 79 km south-east from the project site. Additional health facilities such as clinics and community health centres are spread across the region most notably in Matjiesfontein, Touws Rivier and Sutherland. Lastly, a total of three police stations are located in the region namely in Touws Rivier, Laingsburg and Sutherland.

In terms of accessibility, the project site is accessible from the R354 and R356 (gravel) and various smaller unpaved gravel roads.

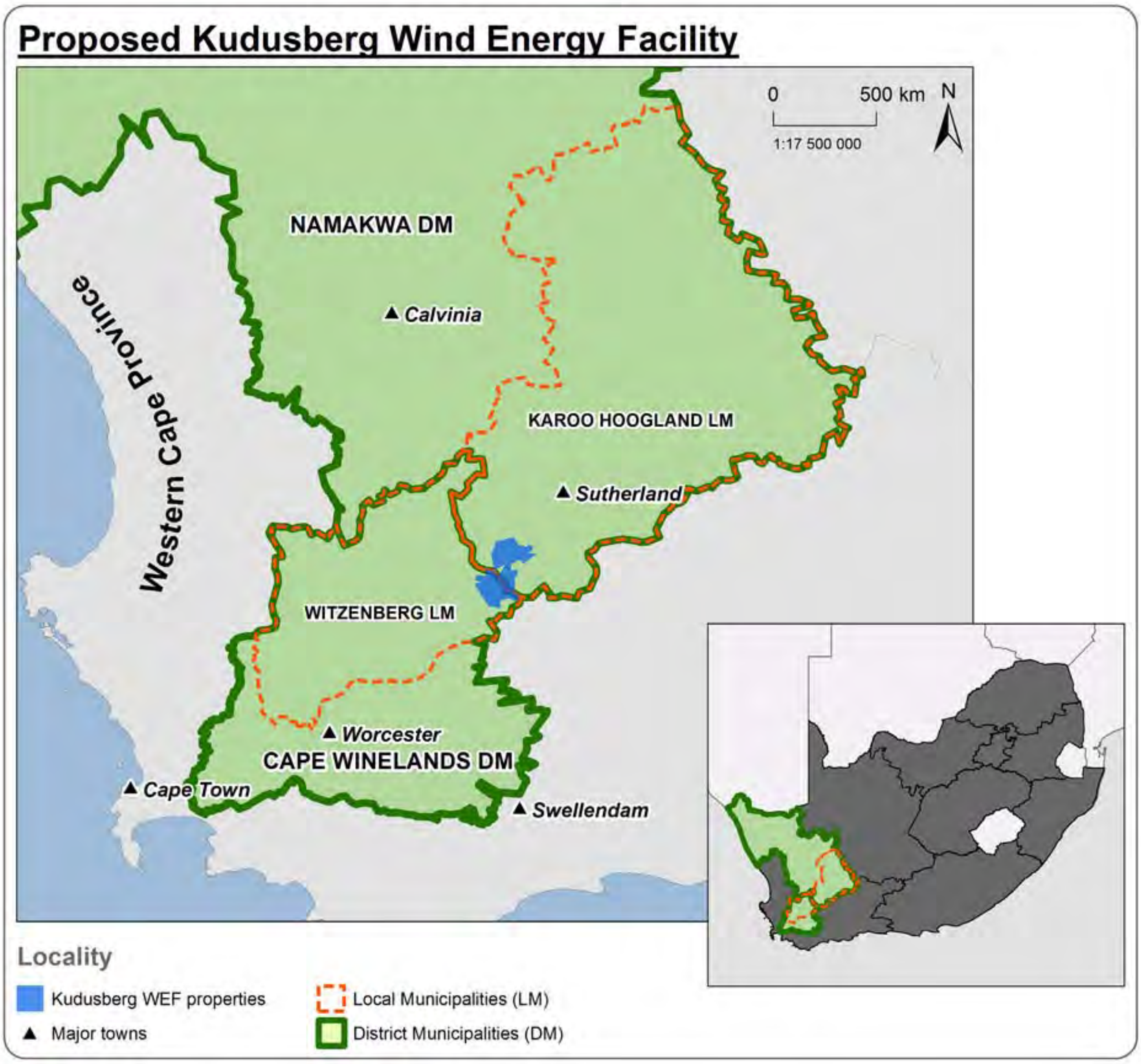


Figure B.48: Location of Kudusberg WEF in relation to the Hoogland and Witzenberg Local Municipalities

B.14.2 Demographic Profile

B.14.2.1 Witzenberg Local Municipality

The Witzenberg LM has a population of approximately 130 175, with a total of 30 904 households (Quantec, 2018) (Table B.7). This is indicative of an average household size of 4.2 in the municipality. Witzenberg LM constitutes 14% of the Cape Winelands DM population. The household density is 2.9 households per square kilometre. The population has shown consistent growth of 2.5% between 2007 and 2017 which is higher than that of Cape Winelands DM (2.2%) over the same period (Quantec, 2018).

B.14.2.2 Karoo Hoogland Local Municipality

Karoo Hoogland LM population (11 785) is far smaller than that of Witzenberg LM and as result has far fewer households (3 564) (Table B.7). Karoo Hoogland makes up 11% of the Namakwa DM population. The area is sparsely populated as is indicated by a population density of 0.4 people per square kilometre and a household density of 0.1 per square kilometre (Quantec, 2018). Statistics have indicated a reduction in the population of Karoo Hoogland between 2007 and 2017 of -0.2% CAGR which aligns to Namakwa's reduction in population of -0.2% over the same period (Quantec, 2018). This is as a result of net out-immigration of people likely searching for better economic opportunities in larger urban areas such as Cape Town, Kimberley, Bloemfontein etc.

Table B.7: Demographic Profile of Witzenberg LM and Karoo Hoogland LM

Category	Witzenberg LM	Karoo Hoogland LM
Population	130 175	11 785
Population growth rate (2007-2017)	2.5%	-0.2%
Population density (People per Km²)	12.1	0.4
Number of households	30 904	3 564
Average household size	4.2	3.3
Household density (Households per Km²)	2.9	0.1
Dependency ratio	41%	56.8%
Female population	48%	49.8%
Male population	52%	50.2%

Urban-Econ Calculations based on (Quantec, 2018)

The Figure B.49 below indicates the age and gender distribution for Witzenberg LM. The most dominant age group is the 15-34 age cohort indicating a younger working age population in the area (38.4% of the population). The male population is also more dominant in the LM with 52% representation compared to 48% for females (Quantec, 2018).

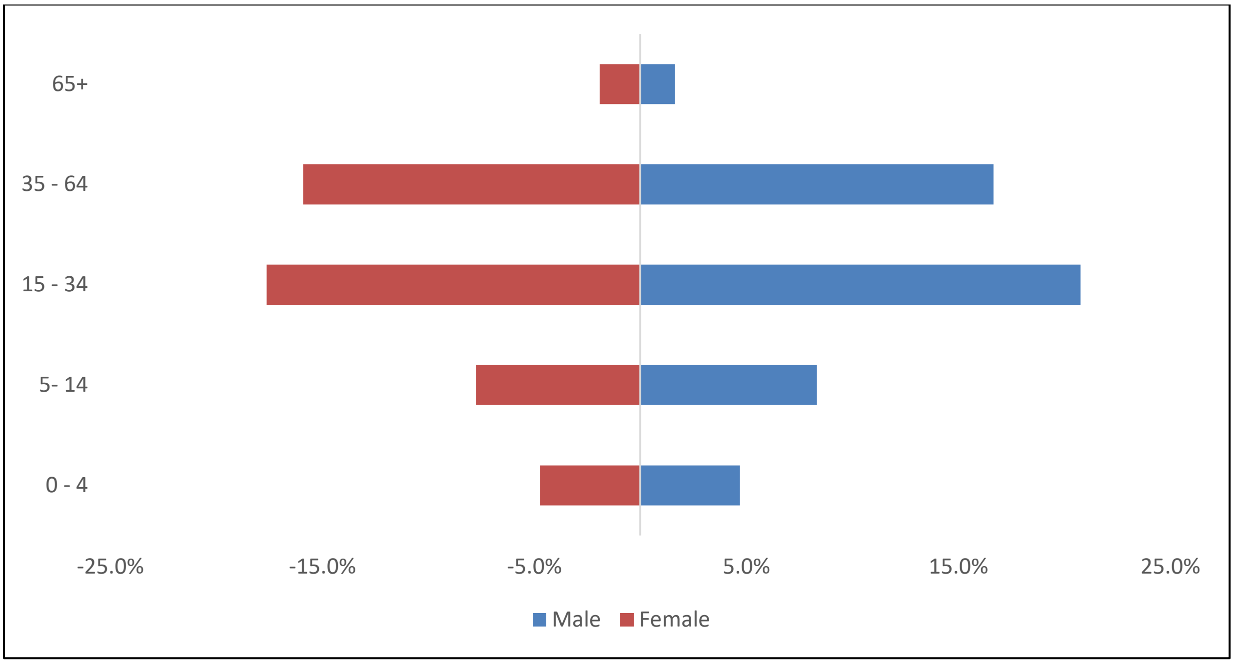


Figure B.49: Population pyramid for Witzenberg Local Municipality (Quantec, 2018)

Compared to Witzenberg LM, Karoo Hoogland LM has an older population (Figure B.50). The 35 – 64 age cohort (35.6%) has a higher representation than other age cohorts. There is also a higher proportion of the population older than 65 in Karoo Hoogland (11.3%) compared to that of Witzenberg (3.5%) (Quantec, 2018). This indicates that out-migration is a significant factor in population demographics in Karoo Hoogland as people search for better economic opportunities in neighbouring areas.

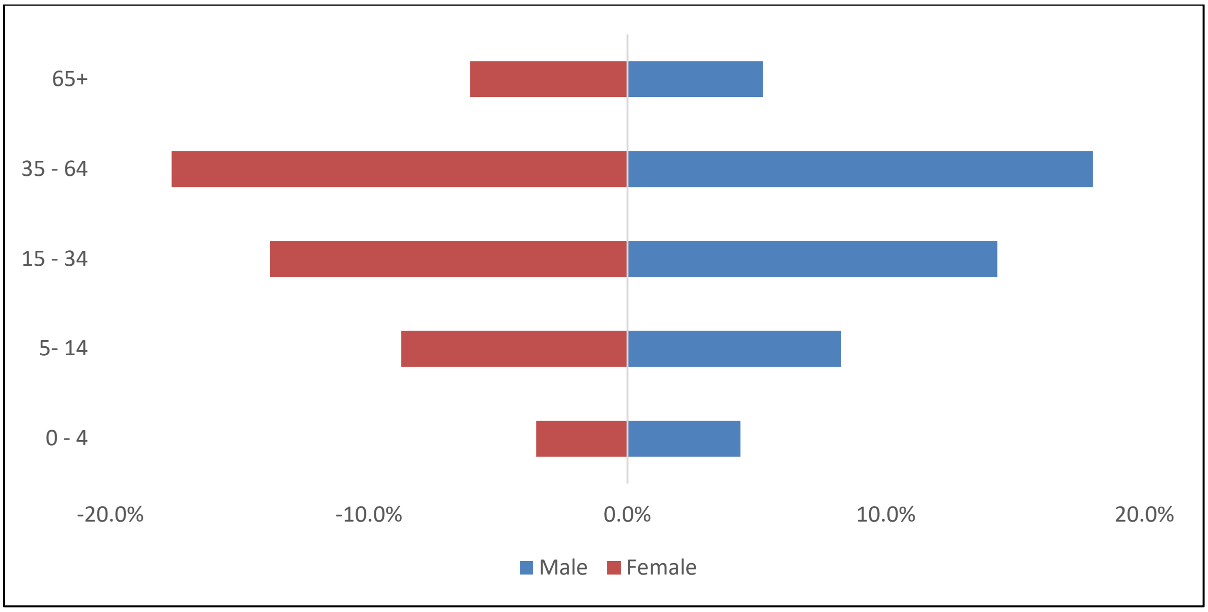


Figure B.50: Population pyramid for Karoo Hoogland Local Municipality (Quantec, 2018)

B.14.3 Income Levels

Overall, 57% of the households within the Witzenberg LM and 65% of the households in Karoo Hoogland LM earned less than R3 200 per month (StatsSA, 2011) Table B.8. In Karoo Hoogland as well as Witzenberg LMs, 6% of the households had no income. In contrast, a much smaller proportion of the population can be classified as middle-income earners and high-income earners, who thus have relatively increased purchasing power, which implies a comfortable livelihood.

Table B.8: Monthly Income levels for Witzenberg LM and Karoo Hoogland LM

Category	Witzenberg LM	Karoo Hoogland LM
No income	6.4%	5.9%
R1 - R4 800	1.7%	2.6%
R4 801 - R 9 600	4.0%	4.1%
R9 601 - R 19 200	18.7%	26.7%
R19 201 - R 38 400	25.8%	26.1%
R38 401 - R 76 800	20.6%	15.1%
R76 801 - R153 600	10.6%	8.3%
R153 601 - R307 200	6.8%	5.6%
R307 201 - R614 400	3.9%	3.5%
R614 401 - R1 228 800	1.1%	1.5%
R1 228 801 - R2 457 600	0.3%	0.1%
R2 457 601 and more	0.2%	0.4%

Urban-Econ Calculations based on (StatsSA, 2011)

B.14.4 Education levels

In the Witzenberg LM there is a lower proportion of the population without schooling (9%) compared to Karoo Hoogland LM (18%) (Figure B.51). The adult population who have completed secondary schooling is also higher (12%) for Witzenberg LM compared to Karoo Hoogland LM. The majority of the residents in Witzenberg LM have some secondary schooling (32%), while the majority of the population in Karoo Hoogland LM have some primary education (26 %) (Quantec, 2018). The proportion of the population that have a higher education however, is higher in Karoo Hoogland LM (5%) than in Witzenberg LM (4%). Overall however, the data indicates that the level of education in Witzenberg LM is higher than Karoo Hoogland LM (Quantec, 2018) (Figure B.51). The education levels for both LM's are therefore considered moderate to poor.

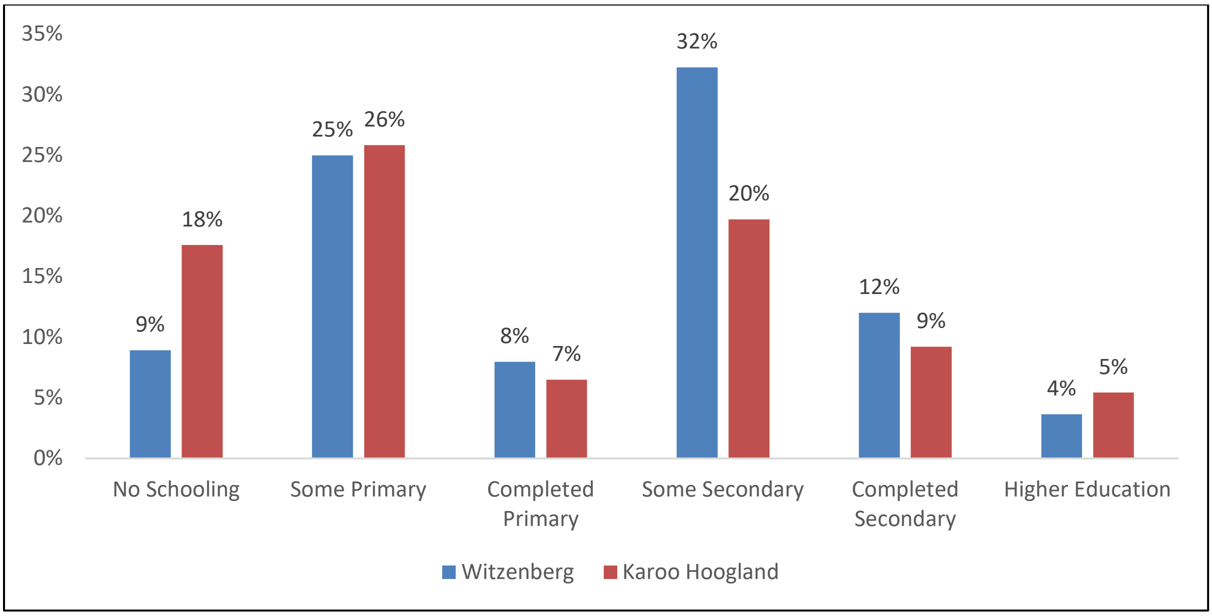


Figure B.51: Education levels for Witzenberg and Karoo Hoogland Local Muncipalities (Quantex, 2018)

B.14.5 Services and Infrastructure

Access to services is vital for the livelihoods of households. Lack of provision and lack of basic services often impact the poorest households in a given area. The Figure B.52 below indicates the energy used for lighting by households. Households in Witzenberg LM (93%) and Karoo Hoogland LM (65%) predominantly use electricity for lighting although the proportion is lower in Karoo Hoogland LM (Quantec, 2018). A significant number of households in Karoo Hoogland LM utilise candles (22%) and solar (12%) as a means of lighting (Quantec, 2018). This indicates a higher level of electrification in Witzenberg LM, while a significant number do not utilise electricity in the Karoo Hoogland LM. This is largely as a result of lack of access to electricity and the cost of utilising electricity compared to candles.

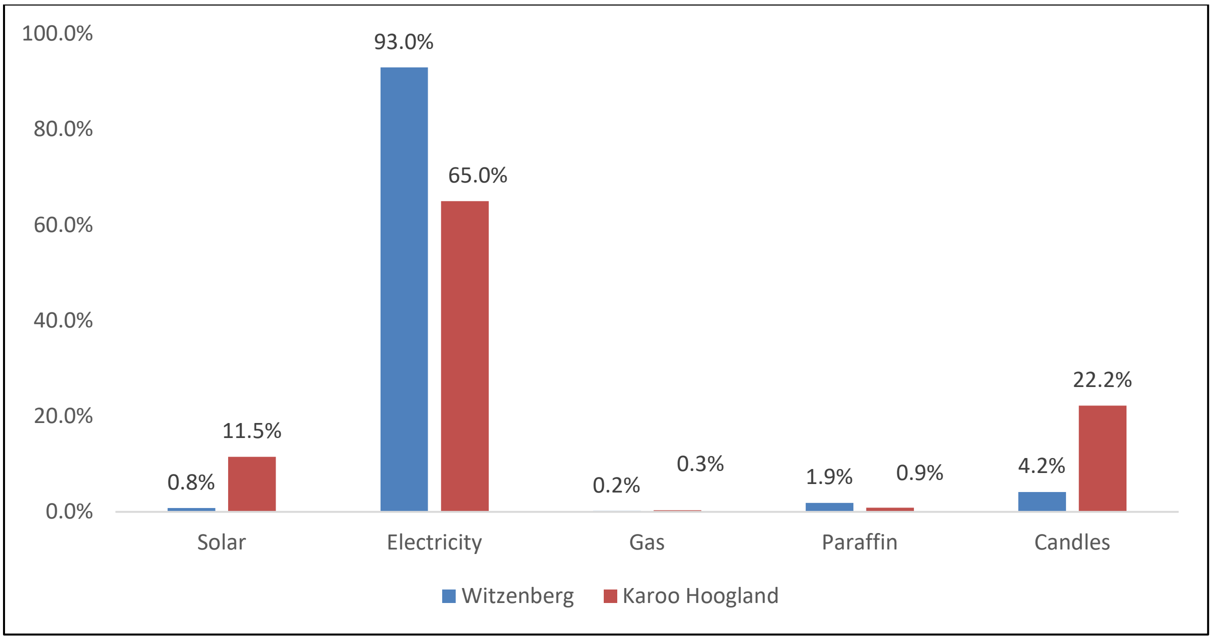


Figure B.52: Access to Electricity for Lighting (Quantec, 2018)

The Figure B.53 below indicates access to piped water in Witzenberg and Karoo Hoogland LMs. The figure indicates that the majority of households in both LMs have access to water in their dwellings and in their yards (90% and 97% respectively) (Quantec, 2018). Witzenberg does however, have a larger proportion or households (8%) which utilise piped water outside their property compared to 1% in Karoo Hoogland. Very few households in either LM utilise dams, boreholes, rivers or tankers for access to water (Quantec, 2018).

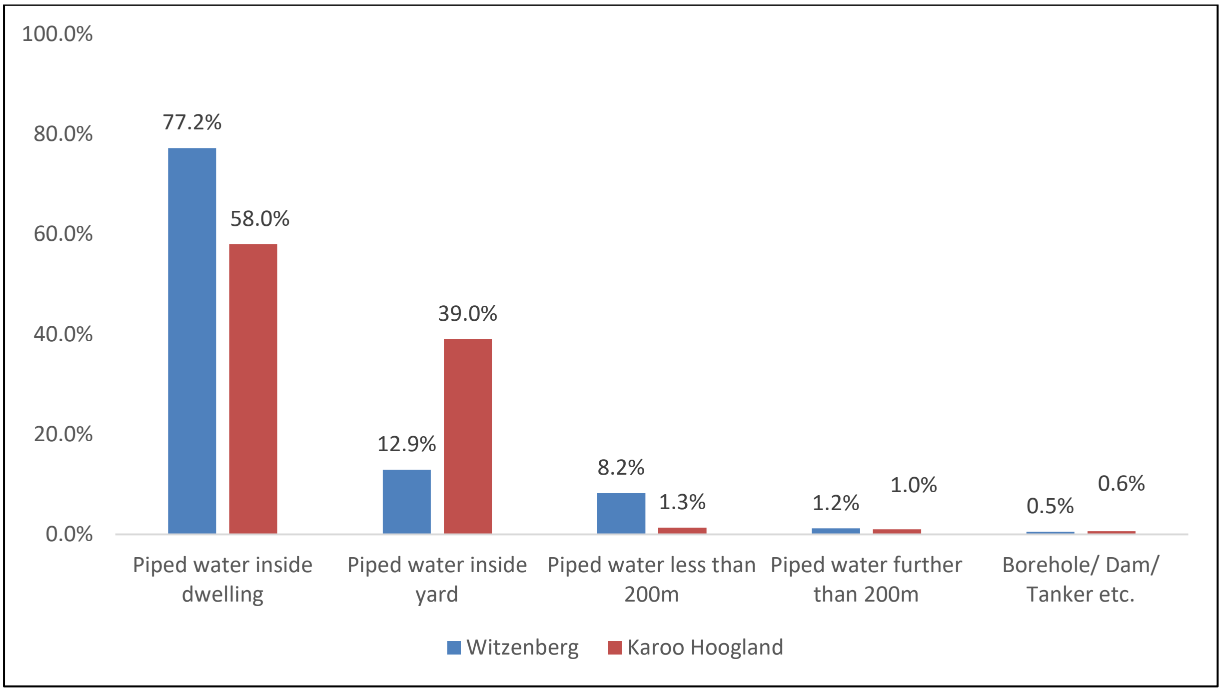


Figure B.53: Access to Piped Water (Quantec, 2018)

The majority of the population in Witzenberg LM have access to flush or chemical toilets (91%) while a much smaller proportion (55%) have access to the same facilities in Karoo Hoogland LM (Quantec, 2018) as seen in Figure B.54 below. A significant proportion of the households in Karoo Hoogland LM (33%) utilise pit latrines, while 2% utilise bucket latrines. 10.1% of the households stated that they did not have access to any of these facilities in Karoo Hoogland LM, while only 6% stated the same in Witzenberg LM (Quantec, 2018) as can be seen in the figure below.

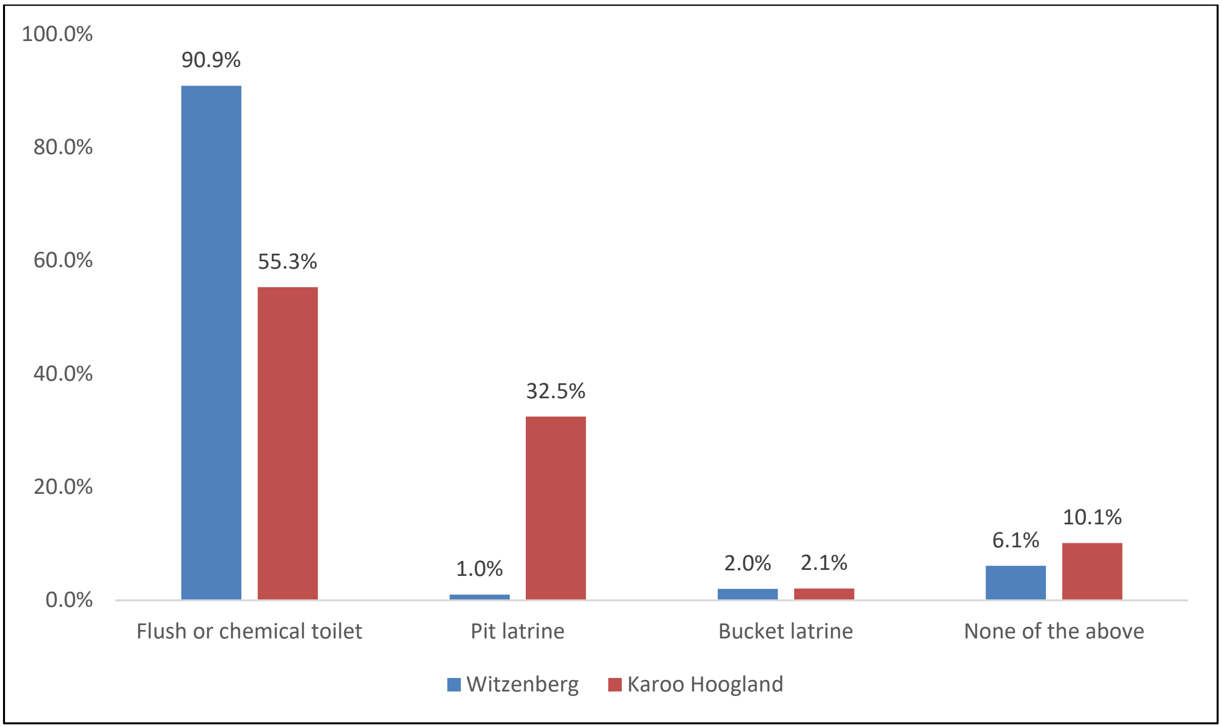


Figure B.54: Access to Sanitation (Quantec, 2018)

One of the key weaknesses identified by the Karoo Hoogland IDP, was that of roads that link towns are predominantly gravel and that these roads lack basic maintenance that is required of them leading to poor conditions of the roads (Karoo Hoogland Local Municipality , 2017). One of the Karoo Hoogland strategic goals is “Accessible and sustainable infrastructure and basic services”. In this goal, the Karoo Hoogland LM has committed to continued construction and maintenance of roads in order to improve their quality and the quality of transport routes in the area (Karoo Hoogland Local Municipality , 2017).

In the Witzenberg LM IDP, there is recognition that some internal roads are in need of upgrade and replacement, but none of the roads are near the study area (Witzenberg Local Municipality , 2017).

B.14.6 Economic Overview

Interpretation of economic impacts requires a sound understanding of the size of the local economy and its dynamics. Several indicators exist that can describe the economy of a region or an area. The most common variables that are used for the analysis include production and Gross Domestic Product per Region (GDP-R) or Gross Value Added (GVA). The former represents the total value of sales of goods and services or the turnover of all economic agents in a region; while the latter, using the output approach, means the sum of value added created by all residents within a certain period, which is typically a year. The trend at which the GDP-R has been changing in the past is also referred to as an economic growth indicator. It is a measure of both the performance of an area and the well-being of the citizens of an area.

In 2017, The Witzenberg and Karoo Hoogland LM’s economies were valued at R 6.1 Billion and R 463 Million in constant prices, respectively. Witzenberg LM contributes 13.5 % to the economy of the Cape Winelands District Municipality. The Karoo Hoogland LM contributes just 5.9 % to the Namakwa District Municipality economy (Quantec, 2018). Over a period of ten years (2007-2017), Witzenberg’s economy grew at a positive Compounded Average Growth Rate (CAGR) of 4 % per year (Figure B.55). Between 2008 and 2009 Witzenberg LM’s GDP growth rate fell from 10 % to 1.3 % as a result of the 2009 global financial crisis but recovered in 2011 to 5.9 % (Quantec, 2018) which can be seen in Figure B.55 below. Between 2016 and 2017 the growth rate grew from 1.6 % to 3.2 % as seen in Figure B.55 Karoo Hoogland LMs economy grew by 2.6% CAGR between 2007 and 2017. The growth rate of Karoo Hoogland LM mirrors certain trends from the Witzenberg LM but is more erratic e.g. between 2011 and 2012 the GDP grew from -0.6 % to 9.2 %. Cape Winelands DM CAGR growth rate was 2.3 %, while Namakwa DMs CAGR growth rate was 0.4 % over the same period (Quantec, 2018). During the same period South Africa’s economic growth rate was 1.68 % between 2007 and 2017 which is lower than both that of the Witzenberg and Karoo Hoogland LMs.

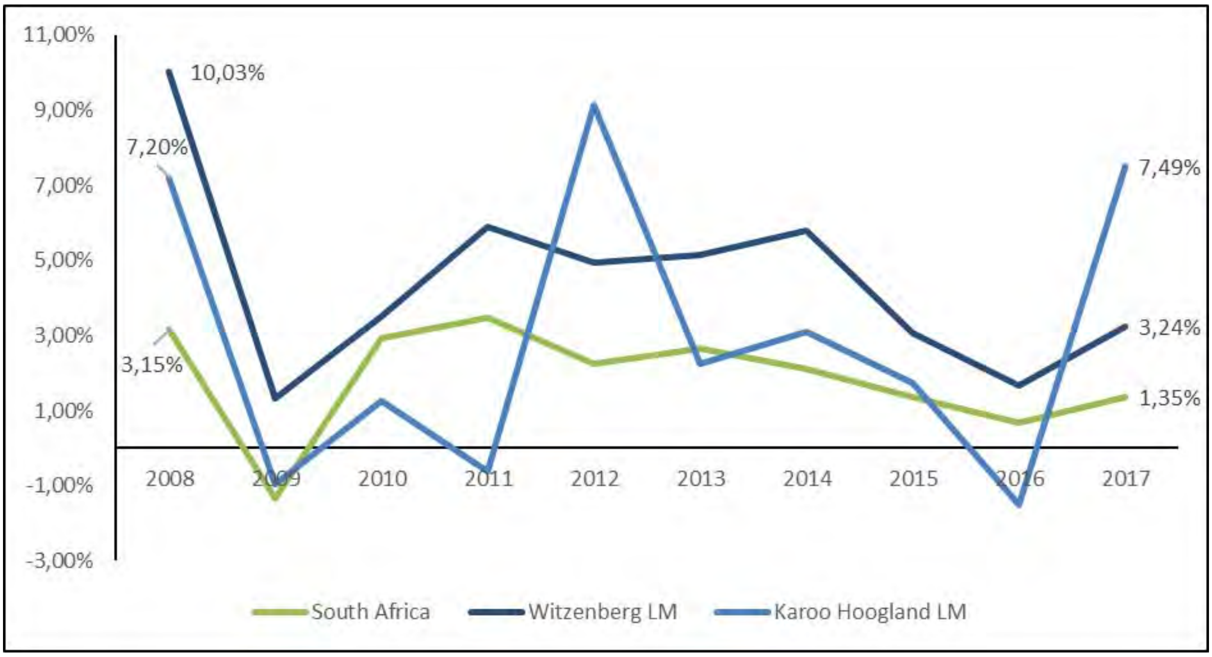


Figure B.55: Economic Growth Rate Witzenberg LM and Karoo Hoogland LM (Quantec, 2018)

The economic sector with the greatest contribution to the GDP-R of Witzenberg LM is that of finance and business services (21 %), while trade has the second highest contribution (17 %) (Table B.9). The agriculture sector also accounts for a large portion of GDP (16 %). The greatest growth between 2007 and 2017 was in the sectors of finance and business services (6.5%) and construction (6.4 %). Electricity, gas and water contribute only 2% to GDP, but has been increasing at 2.3 % between 2007 and 2017 (Quantec, 2018) (Table B.9).

In the Karoo Hoogland LM, the sector with the greatest contribution to GDP is Agriculture (35 %) by a large degree. The second highest contribution is that of general government services (24 %), while trade (13 %) contributes the third highest to GDP. The agriculture sector (4.4 %) has had the highest growth between 2007 and 2017. The second highest growth was in the general government sector for 3.1 %. Electricity, gas and water contribute only 1 % to GDP and has been decreasing at 1.6% between 2007 and 2017 (Quantec, 2018) (Table B.9).

Table B.9: Structure of the Economy

Economic Sector	Witzenberg LM (GDP in 2010 prices)			Karoo Hoogland LM (GDP in 2010 prices)		
	GDP (R'mil)	% of GDP	CAGR (2007-2017)	GDP (R'mil)	% of GDP	CAGR (2007-2017)
Agriculture, forestry and fishing	R 964	16%	2.2%	R 163	35%	4.4%
Mining and quarrying	R 2	0%	4.8%	R 0	0%	0.0%
Manufacturing	R 816	13%	2.3%	R 11	2%	3.4%
Electricity, gas and water	R 138	2%	3.1%	R 4	1%	-1.6%
Construction	R 414	7%	6.4%	R 11	2%	1.6%
Trade	R 1 021	17%	3.8%	R 58	13%	1.3%
Transport and communication	R 386	6%	3.0%	R 39	8%	0.4%
Finance and business services	R 1 278	21%	6.5%	R 30	7%	-0.1%
General government	R 676	11%	4.8%	R 110	24%	3.1%
Community services	R 452	7%	4.3%	R 37	8%	1.8%
TOTAL	**R 6 147**		**4%**	**R 463**		**2.6%**

Urban-Econ Calculations based on (Quantec, 2018)

B.14.7 Labour Force Composition

Employment is the primary means by which individuals who are of working age may earn an income that will enable them to provide for their basic needs and improve their standard of living. As such, employment and unemployment rates are important indicators of socio-economic well-being. The following paragraphs examine the study area's labour market from several perspectives, including the employment rate and sectoral employment patterns.

According to the Standardised Regional dataset, the working age population of Witzenberg LM was close to 90 000 while Karoo Hoogland LM was considerably smaller with 7 600 (Quantec, 2018). The unemployment rate in Witzenberg LM is 7 % compared to the unemployment rate of 13 % in Karoo Hoogland LM (Table B.10) (which is far lower than the national average of 27.7%). The labour force participation rates for both were 74 % and 6 3 %, respectively. The number of employed (both formal and informal) was 62 000 (48 % of the population) for Witzenberg LM and 4 200 (35 % of the population) for Karoo Hoogland LM (Quantec, 2018). Comparatively, South Africa has an unemployment rate of 27.7 % and has only 30 % of the population employed. The labour force participation rate is also lower than the two local municipalities at 57.3 %.

Table B.10: Labour Profile for Witzenberg LM and Karoo Hoogland LM

Category	Cape Winelands DM	Witzenberg LM	Namakwa DM	Karoo Hoogland LM
Population - Total	906 651	**130 175**	110 674	**11 785**
Population - Working age	616 912	**89 754**	74 733	**7 600**
Employed - Formal & informal - Total	384 846	**61 930**	38 394	**4 180**
Employed - Formal - Total	278 803	**48 468**	29 236	**3 061**
Employed - Informal	106 043	**13 462**	9 158	**1 119**
Unemployed	46 024	**4 439**	7 697	**613**
Not economically active	186 042	**23 386**	28 641	**2 807**
Unemployment rate	11%	**7%**	17%	**13%**
Labour force participation rate	70%	**74%**	62%	**63%**

Urban-Econ Calculations based on (Quantec, 2018)

SECTION C: PUBLIC PARTICIPATION

C.1 Introduction to the Public Participation Process

This section provides an overview of the tasks undertaken during the BA Phase, with a particular emphasis on providing a clear record of the Public Participation Process (PPP) to be followed for the proposed Kudusberg WEF. This process is outlined in Figure C.1.

The PPP for this BA Process is driven by a stakeholder engagement process that includes inputs from authorities, I&APs, technical specialists and the project proponent. Guideline 4 on "Public Participation in support of the EIA Regulations" published by the former Department of Environmental Affairs and Tourism (DEAT) in May 2006, states that public participation is one of the most important aspects of the EA Process. This stems from the requirement that people have a right to be informed about potential decisions that may affect them and that they must be afforded an opportunity to influence those decisions. Effective public participation also improves the ability of the CA i.e. the national DEA to make informed decisions and results in improved decision-making as the view of all parties are considered.

An effective PPP could therefore result in stakeholders working together to produce better decisions than if they had worked independently. The DEAT guideline states the following in terms of PPP:

- "Provides an opportunity for I&APs, EAPs and the CA to obtain clear, accurate and understandable information about the environmental impacts of the proposed activity or implications of a decision;
- Provides I&APs with an opportunity to voice their support, concern and question regarding the project, application or decision;
- Enables an applicant to incorporate the needs, preferences and values of affected parties into its application;
- Provides opportunities for clearing up misunderstanding about technical issues, resolving disputes and reconciling conflicting interests;
- Is an important aspect of securing transparency and accountability in decision-making; and
- Contributes toward maintaining a health, vibrant democracy."

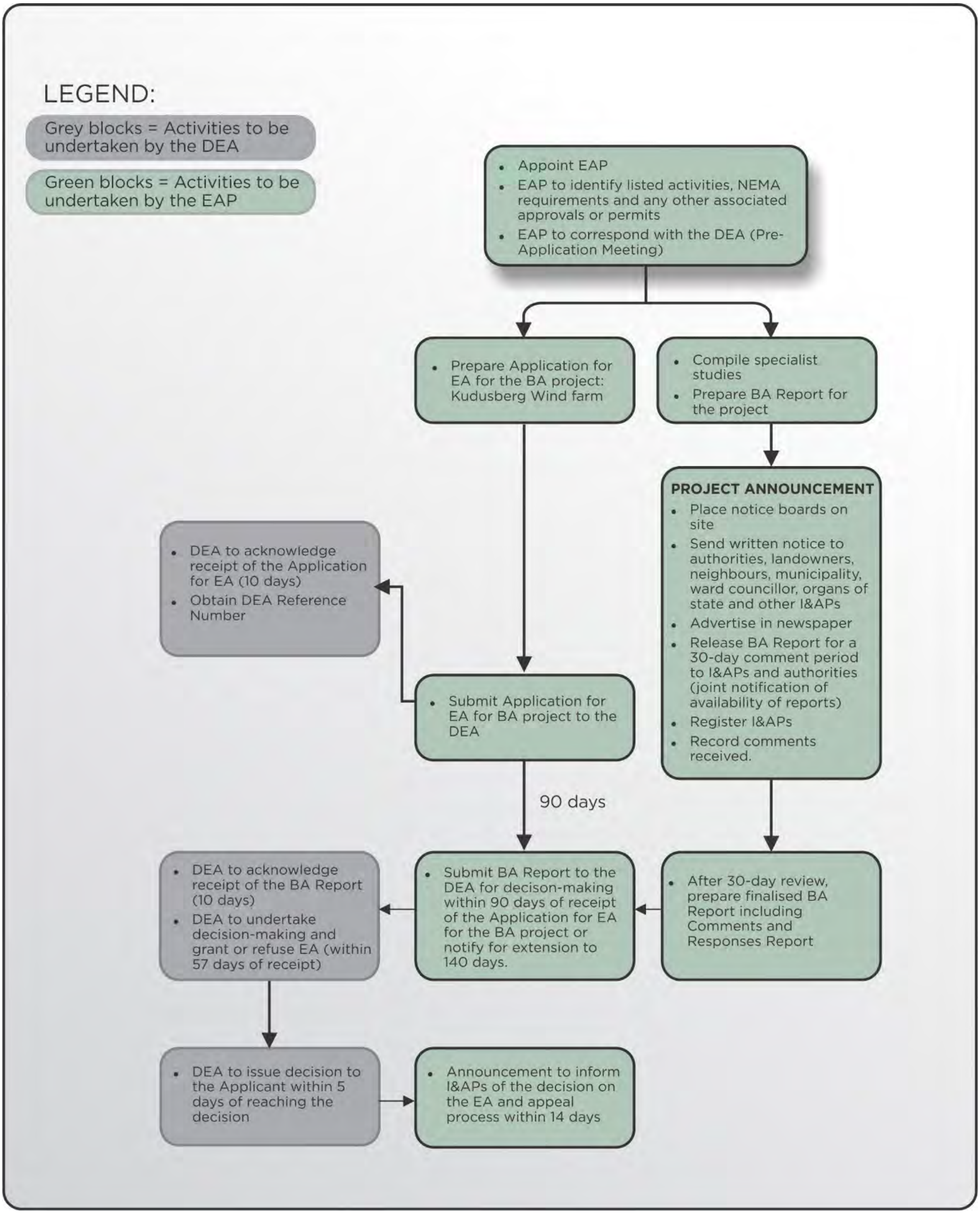


Figure C.1: Proposed Public Participation Process for the proposed Kudusberg WEF BA

To the above, one can add the following universally recognised principles for public participation:

- Inclusive consultation that enables all sectors of society to participate in the consultation and assessment processes;
- Provision of accurate and easily accessible information in a language that is clear and sufficiently non-technical for I&APs to understand, and that is sufficient to enable meaningful participation;
- Active empowerment of grassroots people to understand concepts and information with a view to active and meaningful participation;
- Use of a variety of methods for information dissemination in order to improve accessibility, for example, by way of discussion documents, meetings, workshops, focus group discussions, and the printed and broadcast media;
- Affording I&APs sufficient time to study material, to exchange information, and to make contributions at various stages during the assessment process;
- Provision of opportunities for I&APs to provide their inputs via a range of methods, for example, via briefing sessions, public meetings, written submissions or direct contact with members of the BA team; and
- Public participation is a process and vehicle to provide sufficient and accessible information to I&APs in an objective manner to assist I&APs to identify issues of concern, to identify alternatives, to suggest opportunities to reduce potentially negative or enhance potentially positive impacts, and to verify that issues and/or inputs have been captured and addressed during the assessment process.

At the outset it is important to highlight two key aspects of public participation:

- There are practical and financial limitations to the involvement of all individuals within a PPP. Hence, public participation aims to generate issues that are representative of societal sectors, not each individual. Hence, the PPP will be designed to be inclusive of a broad range of sectors relevant to the proposed project.
- The PPP will aim to raise a diversity of perspectives and will not be designed to force consensus amongst I&APs. Indeed, diversity of opinion rather than consensus building is likely to enrich ultimate decision-making. Therefore, where possible, the PPP will aim to obtain an indication of trade-offs that all stakeholders (i.e. I&APs, technical specialists, the authorities and the development proponent) are willing to accept with regard to the ecological sustainability, social equity and economic growth associated with the project.

The key steps in the PPP for the BA are described below. This approach is structured in line with the requirements of Chapter 6 (PPP) of the 2014 NEMA EIA Regulations (as amended, i.e. GN R326).

The BA Process commenced in July 2018, whereby the specialist studies were commissioned. The BA Report is currently being released to I&APs, Stakeholders and Organs of State (including the National DEA) for a 30-day comment period. The Application for EA has been submitted simultaneously to the National DEA with the Draft BA Report.

C.2 Landowner written consent

Regulation 39 (1) of the 2014 NEMA EIA Regulations (as amended) states that "*if the proponent is not the owner or person in control of the land on which the activity is to be undertaken, the proponent must, before applying for an environmental authorisation in respect of such activity,* *obtain the written consent of the landowner or person in control of the land to undertake such activity on that land*".

Regulation 39 (2) of the 2014 NEMA EIA Regulations (as amended) further states that "*sub-regulation (1) does not apply in respect of: (a) linear activities; (b) activities constituting, or activities directly related to prospecting or exploration of a mineral and petroleum resource or extraction and primary processing of a mineral or petroleum resource; and (c) strategic integrated projects as contemplated in the Infrastructure Development Act, 2014*".

The majority of the proposed Kudusberg WEF project constitutes a non-linear activity, and landowner consent is therefore required for the following land portions:

Project	Affected Farm Portions
Kudusberg WEF	**Western Cape**
	Portion 1 of 156 Gats Rivier Farm
	Portion 2 of 156 Gats Rivier Farm
	Remainder of 156 Gats Rivier Farm
	Portion 1 of 157 Rietfontein Farm
	Portion 1 of 158 Amandelboom Farm
	Remainder of 158 Amandelboom Farm
	Portion 1 of 159 Oliviers Berg Farm
	Remainder of 159 Oliviers Berg Farm
	Portion 2 of 157 Rietfontein Farm
	Remainder of 161 Muishondrivier Farm
	Remainder of 395 Klipbanks Fontein Farm
	Northern Cape
	Portion 4 of 193 Urias Gat Farm
	Portion 6 of 193 Urias Gat Farm
	Remainder of 193 Urias Gat Farm
	Remainder of 194 Matjes Fontein Farm
	Remainder of 196 Karree Kloof Farm

Written consent has been obtained from the landowners of the above farm portions, on which the non-linear infrastructure is proposed to be located. The written consent has been included as Appendix 4 to the Application for EA, which will be submitted to the DEA for consideration, together with the Draft BA Report for comment.

The proposed main access road along the public road are constituted as linear developments; hence written consent is not legally required in terms of Regulation 39 of the 2014 NEMA EIA Regulations (as amended). However, the owners of these affected farm portions will be notified of the proposed development and will also be invited to comment on the Draft BA Report:

Properties affected by the public access road	169 Zeekoegat Farm
	Portion 1 of 170 Roodeheuvel Farm
	Remainder of 170 Roodeheuvel Farm
	Remainder of 170 Roodeheuvel Farm
	Remainder of 190 Wind Heuvel Farm
	Portion 1 of 190 Wind Heuvel Farm
	Portion 5 of 193 Urias Gat Farm
	Remainder of 171 Vinke Kuil Farm
	Alkant 220 Farm
	Portion 1 of 174 Lange Huis Farm

This approach was agreed to by the DEA (see Appendix F for minutes of the pre-application meeting).

C.3 Advertisement and Site Notice board

Newspaper Advertisement:

Regulation 41 (2) (c) of the 2014 NEMA EIA Regulations (as amended) requires the placement of a newspaper advertisement in one local newspaper and one provincial newspaper as the proposed Kudusberg WEF traverses two provinces. In line with this, in order to notify and inform the public of the proposed project, to invite I&APs to register on the project database, as well as to inform I&APs of the release of the BA Report for comment, the BA Process has been arranged to be advertised in one local newspaper and one Provincial newspaper at the commencement of the 30-day comment period for the BA Report. Specifically, the advertisements have been arranged to be placed in "Die Noordwester" (local newspaper) and in "Die Burger" (Provincial newspaper). The newspaper advertisements also provide the details of the project website (i.e. http://data.g7energies.com/eia/kudusberg), where information available on the project could be downloaded from.

Proof of placement of the newspaper advertisements will be included in Appendix E of the finalised BA Report.

Site Notice Board:

Regulation 41 (2) (a) of the 2014 NEMA EIA Regulations (as amended) requires that a notice board providing information on the project and BA Process is fixed at a place that is conspicuous to and accessible by the public at the boundary, on the fence or along the corridor of the site where the application will be undertaken or any alternative site. To this end, notice boards were placed at various locations on the project site.

A copy of the notice boards as well as proof of placement thereof is included in Appendix E of this BA Report.

C.4 Determination of appropriate measures

Refer to the section below which provides a detailed outline of the measures taken to include all potential I&APs, stakeholders and Organs of State during the BA Process (as required by Regulations 41 (2) (e), 41 (6) and 41 (2) (b) of GN R326, in terms of the 2014 NEMA EIA Regulations (as amended)).

In terms of Regulation 41 (2) (e) of GN R326, at this stage of the assessment process no persons have been identified as desiring but unable to participate in the process. Therefore, no alternative methods have been agreed to by the competent authority.

In line with Regulation 41 (2) (b) of GN R326 and prior to the commencement of the BA Process (and advertising the EA Process in the local print media), an initial database of I&APs (including key stakeholders and Organs of State) was developed for the BA Process. This was supplemented with input from the EAP and the Project Applicant. Appendix E.2 of this BA Report contains a detailed copy of the I&AP database which indicates interaction with I&APs, key stakeholders and all I&APs that have been added to the project database. In line with Regulation 41 (2) (b) of the 2014 NEMA EIA Regulations, the database includes the details of the following:

- Landowners of the affected farm portions;
- Landowners of the neighbouring adjacent farm portions;

- Contact details of known occupiers of the affected farm portions and neighbouring adjacent farm portions;
- The municipal councillors of the wards in which the proposed project will be undertaken;
- The municipalities which have jurisdiction in the areas (i.e. the Witzenberg and Karoo Hoogland Local Municipalities and the respective Cape Winelands and Namakwa District Municipalities);
- Relevant Organs of State that have jurisdiction in respect of any aspect of the activity; and
- Any other party as required by the CA.

The above stakeholders, Organs of State and I&APs will accordingly receive written notification of the commencement of the BA Process and release of the BA Report for comment.

The identification and registration of I&APs will be ongoing for the duration of the study. Stakeholders from a variety of sectors, geographical locations and/or interest groups are expected to show an interest in the proposed project, for example:

- Provincial and Local Government Departments;
- Local interest groups, for example, Councillors and Rate Payers associations;
- Surrounding landowners;
- Farmer Organisations;
- Environmental Groups and Non-Government Organisations (NGOs); and
- Grassroots communities and structures.

As per Regulation 42 of the GN 326, in terms of the electronic database, I&AP details will be captured and automatically updated as and when information is distributed to or received from I&APs. This ongoing record of communication is an important component of the PPP. It must be noted that while not required by the regulations, those I&APs proactively identified at the outset of the BA Process will remain on the project database throughout the process and will be kept informed of all opportunities to comment and will only be removed from the database by request.

C.5 Approach to the PPP

In terms of Regulation 41 (6) of GN R326 the section below outlines the PPP for this assessment in order to provide potential I&APs, Stakeholders and Organs of State access to information on the project and the opportunity to comment at the various stages of the assessment process. It should be noted that no deviations from the PPP have been requested.

C.5.1 BA Report Phase - Review of the BA Report

As noted above, the BA Report for the proposed Kuduberg WEF is currently being released to I&APs, Stakeholders and Organs of State for a 30-day review period. The section below summarises the PPP for the review of the BA Report.

- **Database Development and Maintenance**: In line with Regulation 41 (2) (b) of GN R326, an initial database of potential I&APs was developed for the BA Process, and will be updated throughout the process. Refer to Section C (4) for additional information.

- **Site Notice Board**: As noted in Section C (3) above, 4 notice boards were placed for the proposed projects. A copy of the notice boards and proof of placement thereof are included in Appendix E.1 of this BA Report.

- **Letter 1 to I&APs**: Written notification of the availability of the BA Report will be sent to all I&APs and Organs of State included on the project database via Letter 1 sent through email (where email addresses are available) and postage (where email addresses are not available, but postal and/or physical addresses are). The letter will be written in English, and will include notification of the 30-day comment period for the BA Report, and a Comment and Registration Form. Proof of postage and email, as well as copies of the Letter 1 and emails sent will be included in the finalised BA Report (which will be submitted to the DEA for decision-making).

- **Advertisements to Register Interest:** An advertisement will be placed in one local newspaper "Die Noordwester" as well as in a Provincial newspaper "Die Burger" for the release of the BA Report for comment. A copy of these advertisements will be included in the final BA Report.

- **30-day Comment Period**: As noted above, potential I&APs, including authorities and Organs of State, are to be notified via Letter 1, of the 30-day comment and registration period within which to submit comments on the BA Report and/or to register on the I&AP database.

- **Availability of Information:** The BA Report will be made available and distributed to ensure access to information on the project and to communicate the outcome of specialist studies. Copies of the reports will be placed at the Laingsburg and Sutherland local libraries for I&APs and Stakeholders to access for viewing. Key authorities will be provided with either a hard copy and/or CD of the BA Report via courier. Proof of courier (i.e. waybills) will be included in Appendix E of the finalised BA Report. The BA Report will also be uploaded to the project website (i.e. http://data.g7energies.com/eia/kudusberg) and telephonic consultations will take place, as necessary.

- **Comments Received**: A key component of the BA Process is documenting and responding to the comments received from I&APs and the authorities. Copies of all comments received during the review of the BA Report will be included in the Final BA Report and in the Comments and Response Report (Issues and Responses Trail).

C.5.2 Compilation of finalised BA Report for Submission to the DEA

- Following the 30-day commenting period of the BA Report and incorporation of the comments received into the reports, the finalised BA Report (i.e. hard copies and electronic copies) will be submitted to the DEA in line with Regulation 19 (1) (a) of the 2014 NEMA EIA Regulations (as amended). In line with best practice, I&APs on the project database will be notified via email (where email addresses are available) or via post (where email addresses are not available) of the submission of the finalised BA Report to the DEA for decision-making.
- The BA Report that will be submitted for decision-making will include proof of the PPP that has been undertaken to inform Organs of State, Stakeholders and I&APs of the availability of the BA Report for the 30-day review (as explained above). To ensure ongoing access to information, copies of the finalised BA Report that will be submitted for decision-making and the Comments and Response Report (detailing comments received during the BA Phase and responses thereto) will be placed on the project website (i.e. http://data.g7energies.com/eia/kudusberg).

- The DEA will have **57 days** (from receipt of the finalised BA Report) to either grant or refuse EA (in line with Regulation 20 (1) of the 2014 NEMA EIA Regulations (as amended).

C.5.3 Environmental Decision-Making

Environmental Decision-Making and Appeal Period - Subsequent to the decision-making phase, if an EA is granted by the DEA for the proposed project, all registered I&APs, Organs of State and stakeholders on the project database will receive notification of the issuing of the EA and the appeal period. The 2014 NEMA EIA Regulations (as amended) (i.e. Regulation 4 (1)) states that after the Competent Authority has a reached a decision, it must inform the Applicant of the decision, in writing, within 5 days of such decision. Regulation 4 (2) of the 2014 NEMA EIA Regulations (as amended) stipulates that I&APs need to be informed of the EA and associated appeal period within 14 days of the date of the decision. All registered I&APs will be informed of the outcome of the EA and the appeal procedure and its respective timelines. The distribution of the EA (should such authorisation be granted by the DEA), as well as the notification of the appeal period, will include a letter (i.e. Letter 2) to be sent via email or post to all registered I&APs, Stakeholders and Organs of State (where postal, physical and email addresses are available) on the database. The letter will include information on the appeal period, as well as details regarding where to obtain a copy of the EA.

C.6 Issues raised by I&APs and comments and response report

Issues raised by I&APs during the release of the Draft BA Report for comment will be captured in the finalised BA Report, together with responses to the comments from the project team.

C.7 Consultation with the DEA (CA)

A Pre-application meeting was held with the DEA on 1 August 2018 with regards to seeking their feedback on the specialist studies commissioned, as well as the approach to the BA Process in the REDZ and the assessment of cumulative impacts. Copies of the agenda and meeting notes and the attendance register are included in Appendix E.3 of this BA Report.

SECTION D: IMPACT ASSESSMENT

This section includes a summary and anticipated significance of the potential direct, indirect and cumulative impacts that are likely to occur as a result of the construction phase, operational phase and decommissioning phase as identified by the specialists on the project team, in line with the requirements of the 2014 NEMA EIA Regulations (as amended). It also provides a summary of the potential cumulative impacts associated with the proposed Kudusberg WEF.

D.1.1 Approach to the BA: Methodology of the Impact Assessment

The identification of potential impacts includes impacts that may occur during the construction, operational and decommissioning phases of the proposed development. The assessment of impacts includes direct, indirect as well as cumulative impacts. In order to identify potential impacts (both positive and negative) it is important that the nature of the proposed project is well understood so that the impacts associated with the project can be assessed. The process of identification and assessment of impacts includes:

- Determining the current environmental conditions in sufficient detail so that there is a baseline against which impacts can be identified and measured;
- Determining future changes to the environment that will occur if the activity does not proceed;
- Develop an understanding of the activity in sufficient detail to understand its consequences; and
- The identification of significant impacts which are likely to occur if the activity is undertaken.

The impact assessment methodology has been aligned with the requirements for BA Report as stipulated in Appendix 1 (3) (1) (j) of the 2014 NEMA EIA Regulations (as amended), which states the following:

"A BA Report must contain the information that is necessary for the Competent Authority to consider and come to a decision on the application, and must include an assessment of each identified potentially significant impact and risk, including –

- (i) cumulative impacts;
- (ii) the nature, significance and consequences of the impact and risk;
- (iii) the extent and duration of the impact and risk;
- (iv) the probability of the impact and risk occurring;
- (v) the degree to which the impact and risk can be reversed;
- (vi) the degree to which the impact and risk may cause irreplaceable loss of resources; and
- (vii) the degree to which the impact and risk can be mitigated".

As per the DEAT Guideline 5: Assessment of Alternatives and Impacts, the following methodology is applied to the prediction and assessment of impacts and risks. Potential impacts and risks have been rated in terms of the direct, indirect and cumulative:

- **Direct impacts** are impacts that are caused directly by the activity and generally occur at the same time and at the place of the activity. These impacts are usually associated with the construction, operation or maintenance of an activity and are generally obvious and quantifiable.

- **Indirect impacts** of an activity are indirect or induced changes that may occur as a result of the activity. These types of impacts include all the potential impacts that do not manifest immediately when the activity is undertaken or which occur at a different place as a result of the activity.

- **Cumulative impacts** are 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. Cumulative impacts can occur from the collective impacts of individual minor actions over a period of time and can include both direct and indirect impacts.

The cumulative impacts have been assessed by identifying other wind energy and solar PV project proposals in the local area (i.e. within 50 km of the proposed Kudusberg WEF). There are several wind energy projects and one solar PV project within this radius that were considered. These projects are at different stages of planning, ranging from a project that has commenced construction (the Perdekraal (West) WEF) and three other projects that have been awarded Preferred bidder status that will commence construction in 2019. The latter includes the proposed Hidden Valley WEF on a site south of Sutherland (Karusa & Soetwater) and the proposed Roggeveld WEF within the Karoo Hoogland Local Municipality and the Laingsburg Local Municipality.

There are also projects which have received Environmental Authorisation, but not yet Preferred bidder status and other projects which have lodged applications for EA at the time of lodging this application (i.e. by November 2018). All specialists assumed the worst-case scenario i.e. that all projects will be constructed.

Details on the projects within a radius of 50 km that have been considered by the project team in assessing cumulative impacts are provided in Table D.1 as well as in Figure D. 1.

Table D.1: Proposed wind energy projects within 50 km of the proposed Kudusberg WEF according to the DEA's database

DEA REFERENCE NUMBER	EIA PROCESS	APPLICANT	PROJECT TITLE	EAP	TECHNOLOGY	MEGAWATT	STATUS
WIND PROJECTS							
14/12/16/3/3/2/967	Scoping and EIA	Biotherm Energy (Pty) Ltd	Proposed 140 MW Esizayo Wind Energy Facility and its associated infrastructure near Laingsburg within the Laingsburg Local Municipality in the Western Cape.	WSP/Parsons Brinckerhoff	Wind	140 MW	Approved
East -14/12/16/3/3/2/962 West- 14/12/16/3/3/2/693	Scoping and EIA	Biotherm Energy (Pty) Ltd	East: Proposed 140 MW Maralla East Wind Energy Facility within the Laingsburg and Karoo Hoogland Local Municipalities in the Western and Northern Cape Provinces. West: Proposed 140 MW Maralla West Wind Energy Facility within the Karoo Hoogland Local Municipality in the Northern Cape Province.	WSP/Parsons Brinckerhoff	Wind	140 MW	Approved
12/12/20/1966/AM5	Amendment	Witberg Wind Power (Pty) Ltd	Proposed establishment of the Witberg Wind Energy Facility, Laingsburg Local	Environmental Resource Management (Pty) Ltd /	Wind	140 MW	Approved

DEA REFERENCE NUMBER	EIA PROCESS	APPLICANT	PROJECT TITLE	EAP	TECHNOLOGY	MEGAWATT	STATUS
			Municipality, Western Cape Province.	Savannah Environmental Consultants (Pty) Ltd			
12/12/20/1783/2/AM1	Scoping and EIA	South Africa Mainstream Renewable Power Perdekraal West (Pty) Ltd	Proposed development of a Renewable Energy Facility (Wind) at the Perdekraal Site 2, Western Cape Province.	Environmental Resource Management (Pty) Ltd	Wind	110 MW	Under construction
12/12/20/1783/1	Scoping and EIA	South Africa Mainstream Renewable Power Perdekraal East (Pty) Ltd	Proposed development of a Renewable Energy Facility (Wind) at the Perdekraal Site 2, Western Cape Province.	Savannah Environmental Consultants (Pty) Ltd	Wind	150 MW	Approved
14/12/16/3/3/2/899	Scoping and EIA	Rietkloof Wind Farm (Pty) Ltd	Proposed Rietkloof Wind Energy (36 MW) Facility within the Laingsburg Local Municipality in the Western Cape Province.	EOH Coastal & Environmental Services	Wind	36 MW	Approved
TBC	BA		Proposed Rietkloof Wind Energy Facility, Western Cape, South Africa.	WSP	Wind	140 MW	In progress
14/12/16/3/3/2/826	Scoping and EIA	Gunstfontein Wind Farm (Pty) Ltd	Proposed 200 MW Gunstfontein Wind Energy Facility within the Karoo Hoogland Local Municipality in the Northern Cape Province,	Savannah Environmental Consultants (Pty) Ltd	Wind	200 MW	Approved

DEA REFERENCE NUMBER	EIA PROCESS	APPLICANT	PROJECT TITLE	EAP	TECHNOLOGY	MEGAWATT	STATUS
			south of Sutherland.				
12/12/20/1782/AM2	Scoping and EIA	Mainstream Power Sutherland	Proposed development of 140 MW Sutherland Wind Energy Facility, Sutherland, Northern and Western Cape Provinces.	CSIR	Wind	140 MW	Approved
Karusa - 12/12/20/2370/1 Soetwater -12/12/20/2370/2	Scoping and EIA	African Clean Energy Developments Renewables Hidden Valley (Pty) Ltd	Proposed Hidden Valley Wind Energy Facility on a site south of Sutherland, Northern Cape Provinces (Karusa & Soetwater).	Savannah Environmental Consultants (Pty) Ltd	Wind	140 MW each	Preferred bidders. Construction to commence in 2019
12/12/20/2370/3	Scoping and EIA	African Clean Energy Developments Renewables Hidden Valley (Pty) Ltd	Proposed Hidden Valley Wind Energy Facility on a site south of Sutherland, Northern Cape Provinces (Greater Karoo).	Savannah Environmental Consultants (Pty) Ltd	Wind	140 MW	Approved
West -14/12/16/3/3/2/856 East - 14/12/16/3/3/2/857	Scoping and EIA	Komsberg Wind Farm (Pty) Ltd	Proposed 140 MW Komsberg West Wind Energy Facility near Sutherland within the Northern and Western Cape Provinces Proposed 140 MW Komsberg East Wind Energy Facility near Sutherland within the	Savannah Environmental Consultants (Pty) Ltd	Wind	140 MW each	Approved

DEA REFERENCE NUMBER	EIA PROCESS	APPLICANT	PROJECT TITLE	EAP	TECHNOLOGY	MEGAWATT	STATUS
			Northern and Western Cape Provinces.				
12/12/20/1988/1/AM1	Amendment	Roggeveld Wind Power (Pty) Ltd	Proposed Construction of the 140 MW Roggeveld Wind Farm within the Karoo Hoogland Local Municipality and the Laingsburg Local Municipality in the Western and Northern Cape Provinces.	Savannah Environmental Consultants (Pty) Ltd	Wind	140 MW	Preferred bidders. Construction to commence in 2019.
14/12/16/3/3/2/807/AM1	Scoping and EIA Amendment	Karreebosch Wind Farm (Pty) Ltd	Proposed Karreebosch Wind Farm and its associated infrastructure within the Karoo Hoogland and Laingsburg Local Municipalities in the Northern and Western Cape Provinces.	Savannah Environmental Consultants (Pty) Ltd	Wind	140 MW	Approved
14/12/16/3/3/2/900	Scoping and EIA	Brandvalley Wind Farm (Pty) Ltd	Proposed 147 MW Brandvalley Wind Energy Facility North of the Town of Matjiesfontein within the Karoo Hoogland, Witzenberg and Laingsburg Local Municipalities in the Northern and Western	EOH Coastal & Environmental Services	Wind	140 MW	Approved

DEA REFERENCE NUMBER	EIA PROCESS	APPLICANT	PROJECT TITLE	EAP	TECHNOLOGY	MEGAWATT	STATUS
			Cape Provinces.				
TBA	Scoping and EIA	Rondekop Wind Farm (Pty) Ltd	Proposed establishment of the Rondekop WEF, south-west of Sutherland in the Northern Cape.	SiVEST SA (Pty) Ltd	Wind	325 MW	In process
TBC	BA	ENERTRAG SA (Pty) Ltd	Proposed Development of the Tooverberg Wind Energy Facility and the associated grid connection near Touws River, Wester Cape Province).	SiVEST SA (Pty) Ltd	Wind	140 MW	In process
SOLAR PROJECT							
12/12/20/2235	BA	Inca Sutherland Solar (Pty) Ltd	Proposed Photovoltaic (PV) Solar Energy Facility on A Site South Of Sutherland, Within The Karoo Hoogland Municipality Of The Namakwa District Municipality, Northern Cape Province.	CSIR	Solar	10 MW	Approved

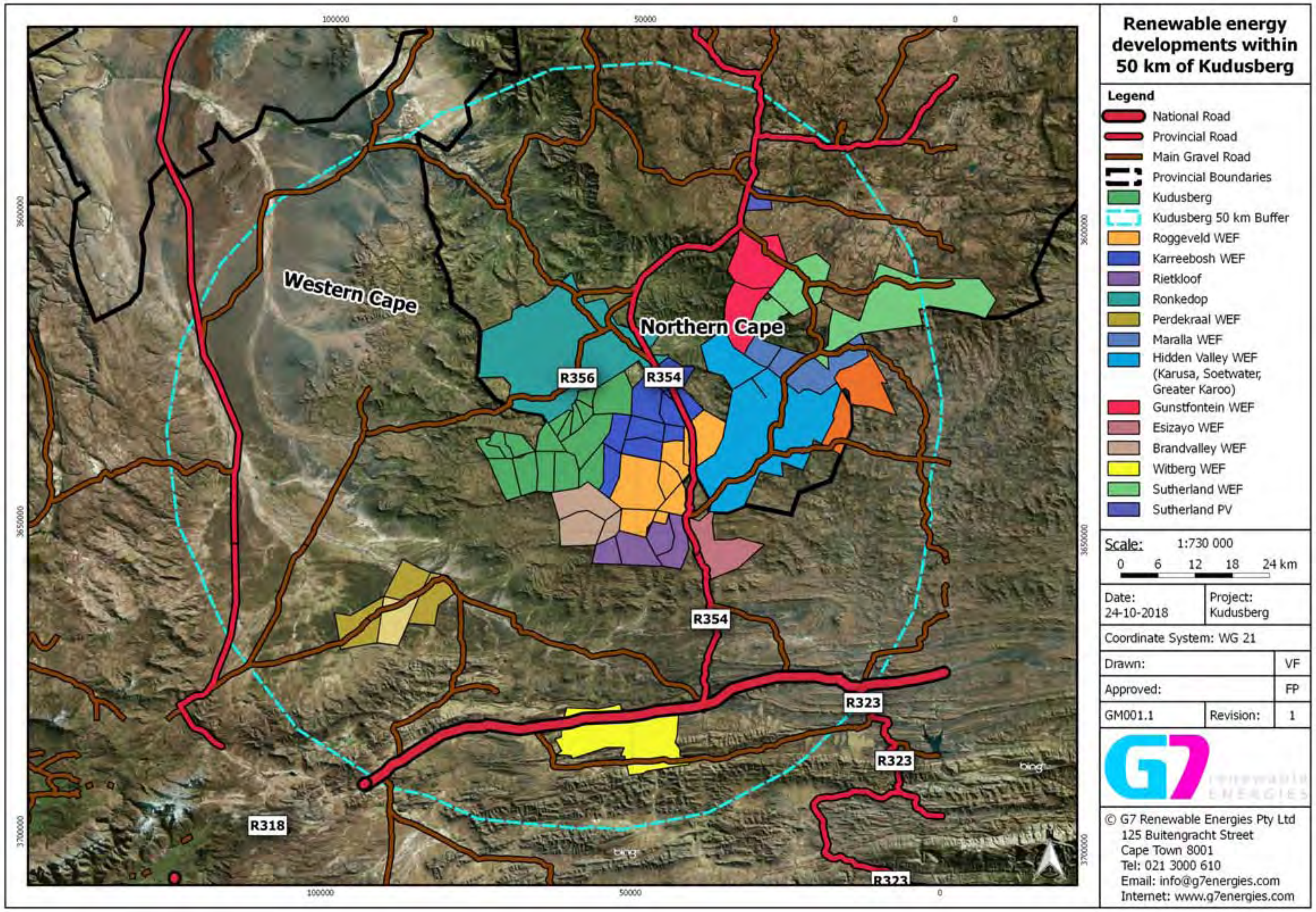


Figure D.1: Other Renewable Energy Developments within a radius of 50 km from the proposed Kudusberg WEF site

In addition to the above, the impact assessment methodology includes the following aspects:

Nature of impact/risk - The type of effect that a proposed activity will have on the environment.

Status - Whether the impact/risk on the overall environment will be:

- Positive - environment overall will benefit from the impact/risk;
- Negative - environment overall will be adversely affected by the impact/risk; or
- Neutral - environment overall not be affected.

Spatial extent – The size of the area that will be affected by the impact/risk:

- Site specific;
- Local (<10 km from site);
- Regional (<100 km of site);
- National; or
- International (e.g. Greenhouse Gas emissions or migrant birds).

Duration – The timeframe during which the impact/risk will be experienced:

- Very short term (instantaneous);
- Short term (less than 1 year);
- Medium term (1 to 10 years);
- Long term (the impact will cease after the operational life of the activity (i.e. the impact or risk will occur for the project duration)); or
- Permanent (mitigation will not occur in such a way or in such a time span that the impact can be considered transient (i.e. the impact will occur beyond the project decommissioning)).

Consequence – The anticipated consequence of the risk/impact:

- Extreme (extreme alteration of natural systems, patterns or processes, i.e. where environmental functions and processes are altered such that they permanently cease);
- Severe (severe alteration of natural systems, patterns or processes, i.e. where environmental functions and processes are altered such that they temporarily or permanently cease);
- Substantial (substantial alteration of natural systems, patterns or processes, i.e. where environmental functions and processes are altered such that they temporarily or permanently cease);
- Moderate (notable alteration of natural systems, patterns or processes, i.e. where the environment continues to function but in a modified manner); or
- Slight (negligible alteration of natural systems, patterns or processes, i.e. where no natural systems/environmental functions, patterns, or processes are affected).

Reversibility of the Impacts - the extent to which the impacts/risks are reversible assuming that the project has reached the end of its life cycle (decommissioning phase) will be:

- High reversibility of impacts (impact is highly reversible at end of project life i.e. this is the most favourable assessment for the environment);
- Moderate reversibility of impacts;
- Low reversibility of impacts; or
- Impacts are non-reversible (impact is permanent, i.e. this is the least favourable assessment for the environment). The impact is permanent.

Irreplaceability of Receiving Environment/Resource Loss caused by impacts/risks – the degree to which the impact causes irreplaceable loss of resources assuming that the project has reached the end of its life cycle (decommissioning phase):

- High irreplaceability of resources (project will destroy unique resources that cannot be replaced, i.e. this is the least favourable assessment for the environment);
- Moderate irreplaceability of resources;
- Low irreplaceability of resources; or
- Resources are replaceable (the affected resource is easy to replace/rehabilitate, i.e. this is the most favourable assessment for the environment).

Using the criteria above, the impacts are further assessed in terms of the following:

Probability – The probability of the impact/risk occurring:

- Extremely unlikely (little to no chance of occurring);
- Very unlikely (<30% chance of occurring);
- Unlikely (30-50% chance of occurring)
- Likely (51 – 90% chance of occurring); or
- Very Likely (>90% chance of occurring regardless of prevention measures).

Significance - To determine the significance of the identified impact/risk, the consequence is multiplied by probability (qualitatively as shown in Figure D.1). This approach incorporates internationally recognised methods from the Intergovernmental Panel on Climate Change (IPCC) (2014) assessment of the effects of climate change and is based on an interpretation of existing information in relation to the proposed activity, to generate an integrated picture of the risks related to a specified activity in a given location, with and without mitigation. Risk is assessed for each significant stressor (e.g. physical disturbance), on each different type of receiving entity (e.g. the municipal capacity, a sensitive wetland), qualitatively (very low, low, moderate, high, and very high) against a predefined set of criteria (i.e. probability and consequence):

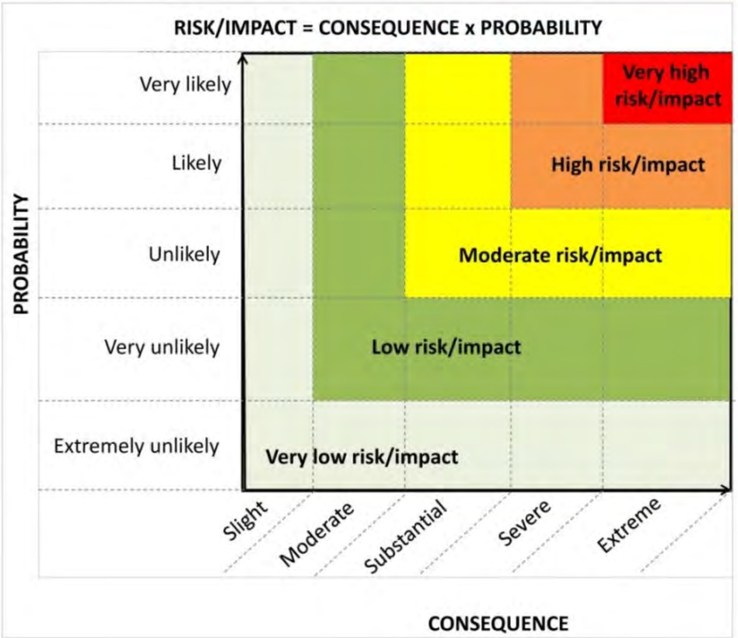


Figure D.2: Guide to assessing risk/impact significance as a result of consequence and probability.

Significance – Will the impact cause a notable alteration of the environment?

- Very low (the risk/impact may result in very minor alterations of the environment and can be easily avoided by implementing appropriate mitigation measures, and will not have an influence on decision-making);
- Low (the risk/impact may result in minor alterations of the environment and can be easily avoided by implementing appropriate mitigation measures, and will not have an influence on decision-making);
- Moderate (the risk/impact will result in moderate alteration of the environment and can be reduced or avoided by implementing the appropriate mitigation measures, and will only have an influence on the decision-making if not mitigated);
- High (the risk/impact will result in major alteration to the environment even with the implementation on the appropriate mitigation measures and will have an influence on decision-making); and
- Very high (the risk/impact will result in very major alteration to the environment even with the implementation on the appropriate mitigation measures and will have an influence on decision-making (i.e. the project cannot be authorised unless major changes to the engineering design are carried out to reduce the significance rating)).

With the implementation of mitigation measures, the residual impacts/risks will be ranked as follow in terms of significance (based on Figure D.2):

- Very low = 5;
- Low = 4;
- Moderate = 3;
- High = 2; and
- Very high = 1.

Confidence – The degree of confidence in predictions based on available information and specialist knowledge:

- Low;
- Medium; or
- High.

Impacts have been collated into the EMPr (Appendix G of the BA Report) and these include the following:

- Quantifiable standards for measuring and monitoring mitigatory measures and enhancements (as applicable). This includes a programme for monitoring and reviewing the recommendations to ensure their ongoing effectiveness;
- Identifying negative impacts and prescribing mitigation measures to avoid or reduce negative impacts. Where no mitigatory measures are possible this is stated; and
- Positive impacts and augmentation measures have been identified to potentially enhance positive impacts where possible.

Other aspects to be taken into consideration in the assessment of impact significance are:

- Impacts are evaluated for the construction and operational phases of the development. The assessment of impacts for the decommissioning phase is brief, as there is limited understanding at this stage of what this might entail. The relevant rehabilitation guidelines and legal requirements applicable at the time will need to be applied;
- Impacts have been evaluated with and without mitigation in order to determine the effectiveness of mitigation measures on reducing the significance of a particular impact;
- The impact evaluation has, where possible, taken into consideration the cumulative effects associated with this and other facilities/projects which are either developed or in the process of being developed in the local area; and
- The impact assessment attempts to quantify the magnitude of potential impacts (direct and cumulative effects) and outline the rationale used. Where appropriate, national standards are used as a measure of the level of impact.

D.1.2 Assessment of environmental risks and impacts

The issues and impacts presented in this Section have been identified via the environmental *status quo* of the receiving environment (environmental, social and heritage features present on site - as discussed in Section B of this BA Report) and input from specialists that form part of the project team. The impact assessments of the specialist studies undertaken to inform this BA have been summarised in this section. It should be noted that unless otherwise stated, impacts identified and their associated significance are deemed to be negative.

Please refer to Appendix D of this report for the full specialist studies undertaken (including the Terms of Reference and full impact assessment table for each study). All proposed mitigation measures, as relevant, have been carried over into the project's EMPr, included in Appendix G of this report.

D.1.2.1 Visual

The Visual Impact Assessment (VIA) was undertaken by SiVEST SA (Pty) Ltd to inform the outcome of this BA. The full VIA (including nature, status, extent, duration, probability,

reversibility, irreplaceability and confidence ratings) is included in Appendix D of this report. The following section provides a summary of the Visual Impact Assessment undertaken by the specialist.

D.1.2.1.1 **Approach and methodology**

This VIA is based on a combination of a desktop-level assessment as well as field-based observation undertaken between 25 until 27 July 2018.

- Physical landscape characteristics

Physical landscape characteristics such as topography, vegetation and land use are important factors influencing the visual character and visual sensitivity of the study area. Baseline information about the physical characteristics of the study area was initially sourced from spatial databases provided by National Geospatial Information (NGI), the South African National Biodiversity Institute (SANBI) and the South African National Land Cover Dataset (Geoterraimage – 2014). The characteristics identified via desktop means were later verified during the site visit.

- Identification of sensitive and potentially sensitive receptor locations

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 WEF into a 'view', which may affect the 'sense of place'. The identification of sensitive receptor locations is typically undertaken based on several 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 setting 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 BA study.

Receptor locations and routes that are sensitive and / or potentially sensitive to the visual intrusion of the proposed development were also identified and assessed to determine the impact of the proposed development on each of the identified receptor locations. The identification of visual receptor locations has been based on a combination of desktop assessment as well as field-based observation. Initially Google Earth imagery, 2018 was used to identify potential visual receptor locations within the study area. There-after a three (3) day site visit was undertaken to verify the sensitive visual receptor locations within the study area and assess the visual impact of the development from these receptor locations. Due to the extent of the study area, it was not possible to visit every potentially sensitive receptor location and as such 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 location in an area potentially affected by the proposed development does not therefore necessarily mean that visual impacts will be experienced.

As previously mentioned, despite the fact that the study area or visual assessment zone encompasses a zone of 8 km from the boundary of the application site, the distance to the nearest proposed turbine position was used when determining the zones of visual impact for the identified visual receptor locations. As such, even though a receptor location will be located within a negligible visual impact zone (i.e. further than 8 km from the nearest turbine), it was still taken into consideration for the purposed of this study.

A distinction must be made between a potentially sensitive receptor location and a sensitive receptor location. A potentially sensitive receptor location is a site from where the proposed WEF may be visible, but the receptor may not necessarily be adversely affected by any visual intrusion associated with the development. Potentially sensitive receptor locations include locations such as residential dwellings, farmsteads / homesteads, as well as locations of commercial activities and certain movement corridors, such as roads that are not tourism routes. 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, scenic sites and certain residential dwellings and / or farmsteads / homesteads in natural settings.

Distance bands were used to delineate zones of visual impact from the nearest proposed turbine position, as the visibility of the development would diminish exponentially over distance. As such, the proposed development would be more visible to receptor locations located within a short distance, and these receptor locations would therefore experience greater adverse visual impact than those located further away. Distance from the nearest proposed turbine position was therefore used to determine zones of visual impact. Based on the height and scale of the project, the radii chosen to assign these zones of visual impact are as follow:

- 0 < 2 km (high impact zone);
- 2 < 5 km (moderate impact zone);
- 5 < 8 km (low impact zone); and
- > 8 km (negligible impact zone)

- <u>Fieldwork and photographic review</u>

A three-day site visit was undertaken between the 25th and the 27th of July 2018 (winter). The study area was visited to:

- verify the landscape characteristics identified via desktop means;
- capture photos of the proposed study area;
- verify the sensitivity of visual receptor locations identified via desktop means;
- eliminate receptor locations that are unlikely to be influenced by the proposed development;
- identify any additional visually sensitive receptor locations within the study area; and
- assist with the impact rating assessment from visually sensitive receptor locations.

- Impact Assessment

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 receptor locations, and the likely value judgements of these receptor locations 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 (Table 2 in the VIA in Appendix D of this report) 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). The 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 several different factors including geographical extent, probability, reversibility, irreplaceable loss of resources, duration and cumulative effect 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 development on each visual receptor location (both sensitive and potentially sensitive), as identified. This matrix is based on three parameters, namely the distance of an identified visual receptor from the proposed development, the presence of screening factors and the degree to which the proposed development would contrast with the surrounding environment.

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 WEF would be likely to be perceived negatively by receptor locations in this area; it would be considered to be a visual intrusion and may elicit opposition from these receptor locations.

- **Moderate** - Presence of receptor locations, but due to the nature of the existing visual character of the area and likely value judgements of receptor locations, 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.

Based on the factors provided in the matrix, the study area is rated as having a **moderate visual sensitivity**. This is mainly owing to the highly natural / scenic character of the area. An important factor contributing to the visual sensitivity of an area is the presence, or absence of visual receptor locations that may value the aesthetic quality of the landscape and depend on it to produce revenue and create jobs. As described above, relatively few sensitive receptors are present in the study area, while many potentially sensitive receptor locations are present. There are however leisure / nature-based tourism activities in the study area, and the area would thus be valued as a typical Karoo cultural landscape.

Although the area is associated with a moderate visual sensitivity, it should be stressed that the concept of visual sensitivity has been utilised indicatively to provide a broad-scale indication of whether the area is likely to be sensitive to visual impacts and is based on the physical characteristics of the study area, economic activities and land use that predominates. This does not mean that high visual impacts could not potentially be experienced in areas of low visual sensitivity. The potential presence and perception of sensitive receptor locations as discussed in the VIA must also be considered.

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 sensitive and potentially sensitive visual receptor locations 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 sensitive and potentially sensitive receptor locations in the study area.

Using GIS-based visibility analysis, it was possible to determine which sectors of the site would be visible to the highest numbers of receptor locations in the study area. This analysis took into account all the sensitive and potentially sensitive receptor locations indicated in the Potentially Sensitive Receptor Locations Map. Based on this analysis, the areas visible to the highest number of receptor locations were initially rated as areas of ‘High Sensitivity’. The resultant Visual Sensitivity Map is shown in Figure D.9). However, as the study area as a whole is rated as having a moderate visual sensitivity, these areas of high sensitivity are not considered to be no-go areas, but rather should be viewed as zones where the number of turbines should be limited, where possible, as the turbines will still be highly visible.

- Visualisation Modelling

Visual simulations were produced from specific viewpoints in order to support the findings of the visual assessment. The proposed WEF development 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 likely 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

Continuous consultation with I&APs undertaken as part of the PPP for the BA will be used to help establish how the proposed development will be perceived by the various receptor locations and the degree to which the impact will be regarded as negative. Although I&APs other than the landowners whose properties form part of the wind farm have not as yet provided any feedback in this regard, the report will be updated to include relevant information as and when it becomes available.

D.1.2.1.2 **Project aspects relevant to visual impacts**

Detailed below is a preliminary list of the key components of the proposed development that have visual implications. Although the associated on-site infrastructure has been included here, the visual impact of associated infrastructure is generally far less significant than the visual impact associated with wind turbines. The infrastructure would however, magnify the visual prominence of the proposed development if located on ridge tops or flat sites in natural settings where there is limited tall wooded vegetation present to conceal the impact.

- Turbines

Wind turbines proposed for the Kudusberg WEF will have a hub height of up to 140 m, a rotor diameter of up to 180 m and a blade length of up to 90 m. At this stage, it is proposed that up to 56 turbines will be constructed. The height of the turbines and their location on higher lying ridges and plateaus would result in the development typically being visible over a large area.

As well as height, "sky space" is an important issue. “Sky space” refers to the area in which the rotors would rotate. Figure D.3. 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).

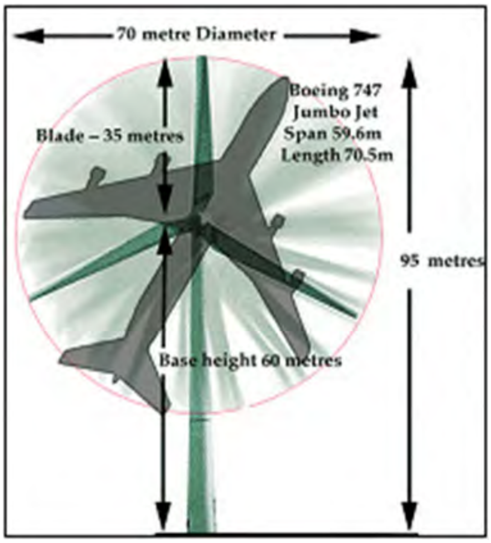


Figure D.3: Indicator of the “sky space” occupied by rotors would be similar to that occupied by a jumbo jet.

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.

- Access roads, maintenance roads and power line servitudes

Linear infrastructure will require clearing of vegetation. Exposure of large tracts of soil or rock will contrast significantly with the existing mottled landscape.

Internal access roads of up to 12 m wide and with a total footprint of approximately 82.44 ha (including structures for storm water control) will be required to access each proposed wind turbine as well as the proposed 33/132 kV on-site substation. Where possible, existing roads will be upgraded. Turns will have a radius of up to 50 m for abnormal loads (especially turbine blades) to access the various proposed wind turbine positions. These access roads could be considered a visual intrusion if they traverse sloping ground on an aspect that is visible to the surrounding area or if they are constructed in visible areas of the site. Roads are likely to be wider than cable trenches and could be even more greatly visible than the cable servitude. In addition, the cutting of 'terraces' into a steep sided slope would increase the visibility and contrast of the road against the surrounding vegetation.

Considering that the proposed access roads are located on sloping terrain, it is likely that there will be some form of visual impact associated with the construction of these access roads. Additionally, if these roads are not maintained correctly during the construction phase, vehicles travelling along the gravel access roads could expose surrounding farmsteads / homesteads to dust plumes.

- 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 500 m) 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).

- 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.

- Other associated infrastructure

Electrical transformers with a capacity of 690V/33 kV are required and will be situated adjacent to each of the proposed wind turbines. Due to the small size of these electrical transformers, as well as their close proximity to the wind turbines, the visual impact associated with this infrastructure will be dwarfed by the wind turbines and will this be far less significant than the visual impact associated with the wind turbines. However, this infrastructure would magnify the visual prominence of the proposed development if located on ridge tops or flat sites in natural settings where there is limited tall wooded vegetation present to conceal the impact.

The transformers at the base of each turbine will be connected to a 33/132 kV on-site substation by way of underground cabling or overhead power lines. It should be noted that underground cabling will only be used where it is feasible along the access roads. Outside of the road footprints and where topography and environmental concerns preclude underground cabling, overhead power lines will be used. Figure D.4. below shows the process typically associated with the generation of electricity from WEFs.

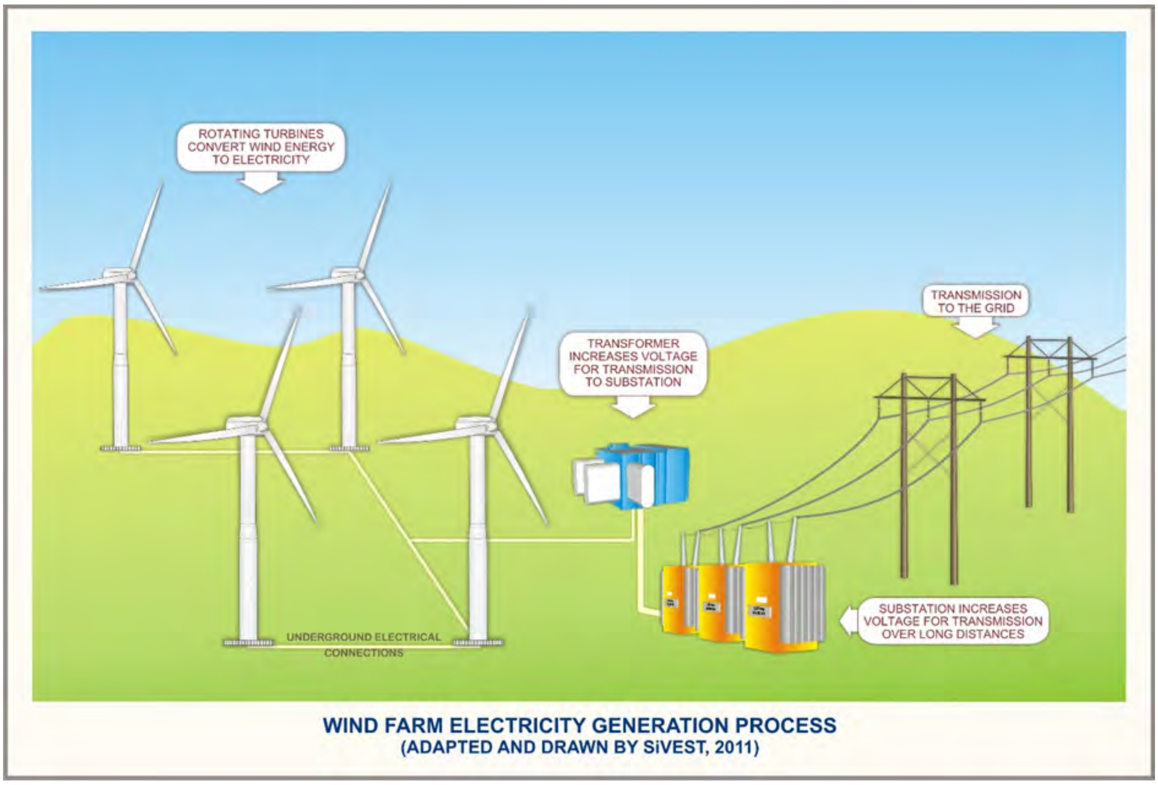


Figure D.4: Conceptual wind farm electricity generation process showing electrical connections.

Underground cabling could leave a 'scar' in the landscape which would create a visual contrast with the largely natural vegetation on the site. As all the turbines will be placed on high ridges / high points on the proposed WEF site, it is expected that underground cabling will result in some form of a visual impact. It is thus strongly recommended that all reinstated cable trenches should be re-vegetated with the same vegetation that existed prior to the cable being laid, in order to reduce the potential for creating unnatural linear features in the environment. In addition, erosion control measures should be employed to prevent the scarring from worsening with time.

Overhead power lines are not features of the natural environment, but are representative of anthropogenic transformation. Thus, when placed in largely natural landscapes, they will be perceived to be highly incongruous in this setting. These power lines may become a visual intrusion if placed in areas of the site that are visible to the surrounding areas, especially those areas that are located on ridges and associated sloping ground. Excavations associated with the power lines may become prominent if they create a linear feature that contrasts with the surrounding vegetation. However, when considering the scale of a wind turbine in comparison to a 33 and or 132kV power line, the wind turbine would be the prominent feature.

A new 33/132 kV on-site substation, with a footprint of approximately 2.25 ha is being proposed. In isolation, the on-site substation may be considered to be visually intrusive, however, it must be assumed that the substation would be built to serve the needs of the proposed WEF and thus, the substation would only be constructed if the proposed WEF was developed as well.

A substation is by nature a large object which will typically be visible for great distances. In the context of a largely natural landscape, the new on-site substation will be perceived to be highly incongruous. However, the on-site substation would likely form part of the proposed WEF complex, as viewed from the surrounding farmsteads / homesteads. Views of the on-site substation would therefore be dwarfed by the large number of turbines that would be visible. As such, the proposed on-site substation is not expected to be associated with a significant visual impact, or even a measurable cumulative impact. In addition, the presence of other anthropogenic objects associated with the built environment, especially other substations, may result in the visual environment being considered to be 'degraded' and thus the introduction of a new on-site substation into this setting may be less of a visual impact than if there was no existing built infrastructure visible.

Temporary infrastructure in the form of a construction camp will be required for the construction phase of the proposed development. The construction camp will have a footprint of approximately 12.6 ha, which will include an on-site concrete batching plant for use during the construction phase. The site will also accommodate offices, administration, operations and maintenance buildings during the operational phase. From a visual perspective, construction camps / yards could result in visual impacts if they are placed in prominent positions such as on ridge tops. In these locations, buildings may break the natural skyline, drawing the attention of the viewer.

Fencing will be required for the proposed WEF development. However, this will be limited around the construction camp, substation and batching plant. The entire proposed WEF would not be fenced off. The height of fences around the construction camp is anticipated to be up to 4 m.

In addition, temporary infrastructure to obtain water from available local sources / new or existing boreholes (including a potential temporary above ground pipeline of approximately 35 cm diameter) to feed water to the on-site batching plant. Water will potentially be stored in temporary water storage tanks.

As mentioned, the visual impact of this associated infrastructure is generally expected to be far less significant than the visual impact associated with the proposed wind turbines. The infrastructure would however, magnify the visual prominence of the proposed development if located on ridge tops or flat sites in natural settings where there is limited tall wooded vegetation present to conceal the impact. It should also be noted that some of this infrastructure is only temporary and will be removed after the construction phase.

- Conversely, the presence of *other anthropogenic elements* associated with the built environment, especially other power lines, may result in the visual environment being considered to be 'degraded' and thus the introduction of a new power line into this setting may be less of a visual impact than if there was no existing built infrastructure visible. It is important to note that there are several existing high voltage power lines in the southern section of the study area. These include two sets of 400 kV power lines and one (1) set of 765 kV power lines which traverse the southern section of the study area in south-west to north-east alignments respectively (Figure D.5). The presence of these high voltage power lines is therefore expected to lessen the visual contrast associated with the introduction of a new power line.

Figure D.5: Typical view of some of the existing high voltage power lines which traverse the southern section of the study area (photo courtesy of SIVEST)

D.1.2.1.3 Sensitivity of the site in relation to the proposed activity

D.1.2.1.3.1 Sensitive visual features

Features at risk of impact in a VIA are the **landscape** and **sensitive visual receptors** in the landscape.

Sensitive Visual Receptor Locations

Preliminary desktop assessment of the study area identified several potentially sensitive visual receptor locations. These mostly appear to be existing farmsteads / farm houses / homesteads. However, relatively few leisure-based or nature-based tourism activities were identified in the assessment area and as such, only two sensitive visual receptor locations were identified within the study area, these being tourism facilities at the Gatsrivier Holiday Farm and Bakensriver.

Although the Gatsrivier Holiday Farm is located within the Kudusberg WEF application site, it is known that the owner intends to keep this facility in operation notwithstanding the WEF development. It is also known however that the owner has consented to the proposed development and as such, would not perceive the WEF in a negative light. Accordingly, the holiday farm is no longer considered to be a sensitive or potentially sensitive receptor.

Furthermore, it was established that Bakensriver comprises accommodation facilities that are part of the Gatsrivier Holiday Farm facility, even though these facilities are located on a different farm some distance from the main Gatsrivier farm. As previously mentioned, the owner of Gatsrivier has consented to the proposed WEF development and as such Bakensrivier has been excluded as a sensitive or potentially sensitive receptor.

The remaining farmsteads / farm houses / homesteads identified within the study area have been classified as potentially sensitive receptor locations as the potential visual impact of the proposed development is subjective to the viewer. For example, one owner of a farm house might not consider the impact as a negative impact, while another owner might. As such, these receptors may potentially be impacted from a visual perspective as a result of the construction and operation of the proposed WEF.

In many cases, roads, along which people travel, are regarded as sensitive receptor locations. The primary thoroughfare in the study area is the R356 Regional Route which traverses the northern section of the study area (Figure D.6). The R356 connects the R46 near Ceres with Loxton by way of Sutherland and Fraserburg. This road is used primarily as an access road into Sutherland to the north of the study area by many of the local farmers / landowners. It should be noted that the section of the R356 which traverses the study area is a gravel road. This road is therefore not valued or utilised for its scenic or tourism potential and as a result it is not classed as a sensitive receptor road – i.e. a road along which motorists may object to the potential visual intrusion of the proposed WEF.

Figure D.6: Typical view of the R356 Regional Route (photo courtesy of SIVEST)

Other thoroughfares in the study area include gravel access roads which are primarily used by local farmers when accessing various properties / farms in the study area, as well as when travelling to and from Matjiesfontein and Sutherland. They are therefore not regarded as visually sensitive as they do not form part of any scenic tourist routes and are not specifically valued or utilised for their scenic or tourism potential.

The field investigation revealed a total number of two sensitive receptor locations and fifty-two (52) potentially sensitive receptor locations in the visual assessment zone. These receptor locations are shown in the Potentially Sensitive Visual Receptor Locations Map (Figure D.7). These locations as well as its approximate distance from the nearest turbine are also included in Table D.2 below and in Table 1 of the VIA (Appendix D of this BA Report). The Preliminary Visibility Analysis is shown in Figure D.8.

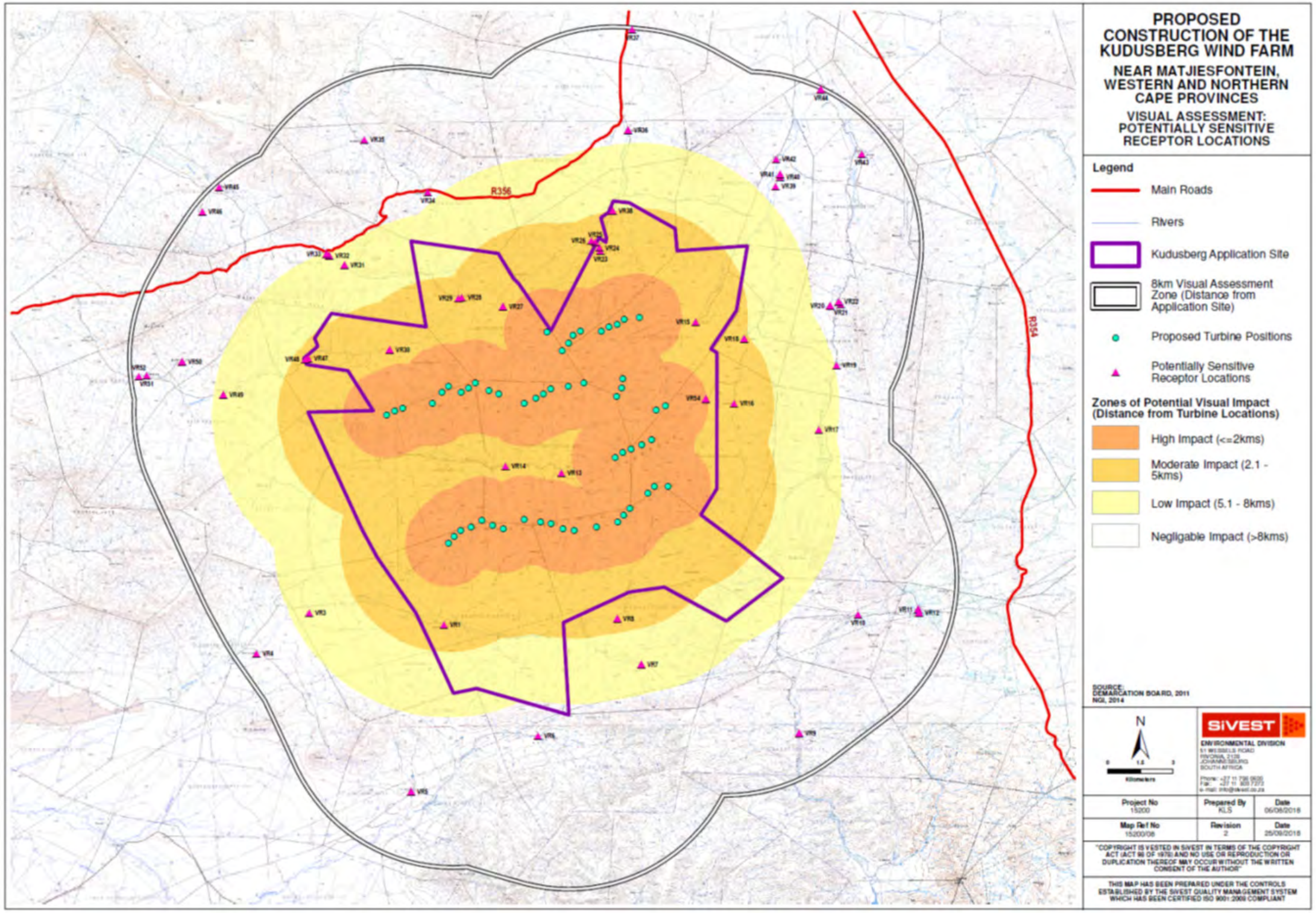


Figure D.7: **Potentially sensitive receptor locations (Map as prepared in the VIA)**

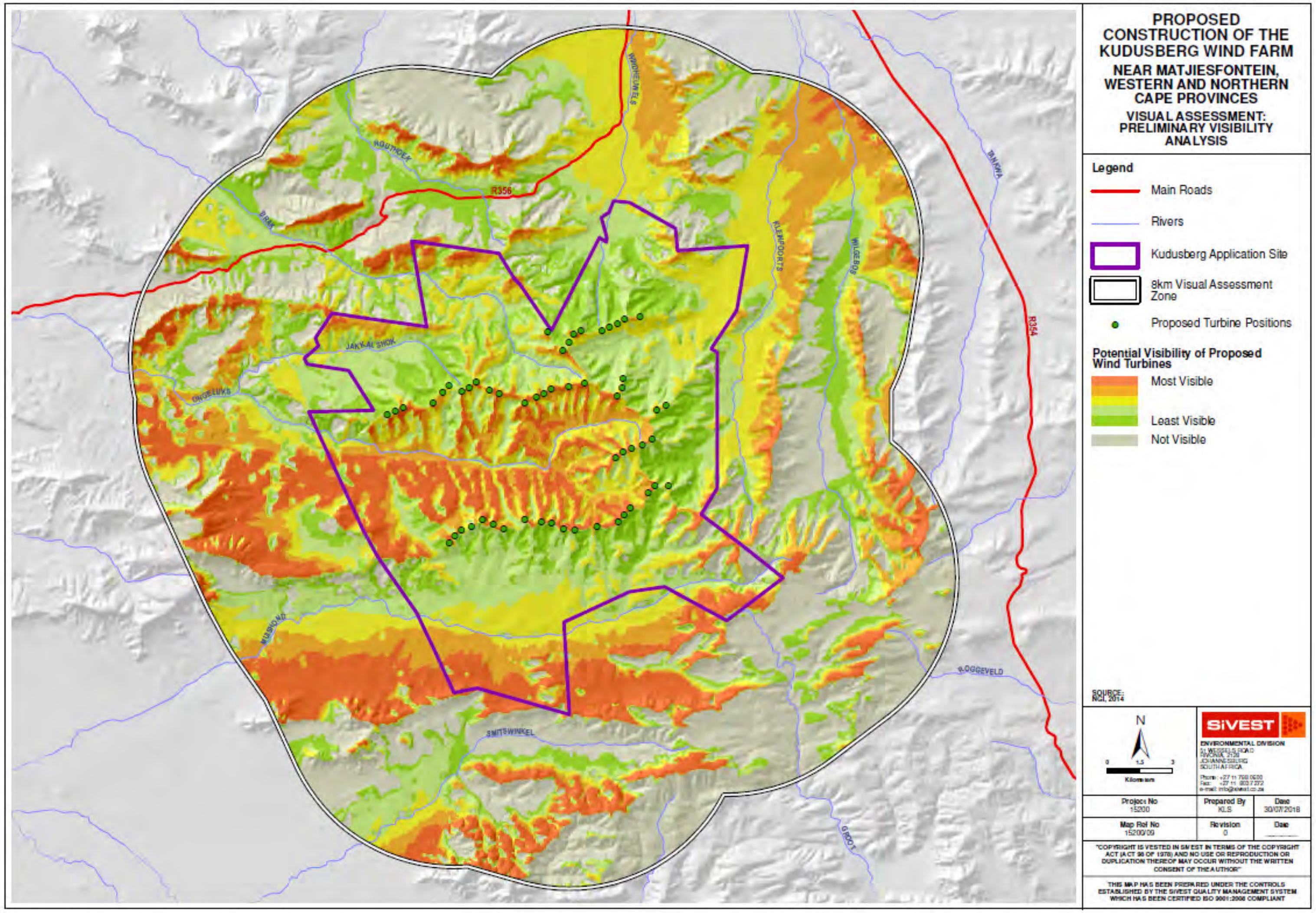


Figure D.8: Preliminary Visibility Analysis Map (Map as prepared in the VIA)

Table D.2: Potentially sensitive visual receptor locations in the study area and visual receptor rating

Name	Details	Approximate distance to nearest proposed turbine	Visual Impact Zone	Overall impact rating
VR1	Farmstead / Homestead	3.76 km	Moderate	**MEDIUM (5)**
VR3	Farmstead / Homestead	7.16 km	Low	**MEDIUM (6)**
VR4	Farmstead / Homestead	*10.17 km	Negligible	**NEGLIGIBLE**
VR5	Farmstead / Homestead	*11.53 km	Negligible	**NEGLIGIBLE**
VR6	Farmstead / Homestead	*9.56 km	Negligible	**NEGLIGIBLE**
VR7	Farmstead / Homestead	6.63 km	Negligible (outside of viewshed)	**NEGLIGIBLE**
VR8	Farmstead / Homestead	4.32 km	Moderate	**MEDIUM (7)**
VR9	Farmstead / Homestead	*12.79 km	Negligible	**NEGLIGIBLE**
VR10	Farmstead / Homestead	*10.53 km	Negligible	**NEGLIGIBLE**
VR11	Farmstead / Homestead	*12.81 km	Negligible	**NEGLIGIBLE**
VR12	Farmstead / Homestead	*12.92 km	Negligible	**NEGLIGIBLE**
VR13	Farmstead / Homestead	2.37 km	Moderate	**MEDIUM (7)**
VR14	Farmstead / Homestead	2.58 km	Moderate	**MEDIUM (7)**
VR15	Farmstead / Homestead	2.6 km	Moderate	**MEDIUM (7)**
VR16	Farmstead / Homestead	3.16 km	Moderate	**MEDIUM (7)**
VR17	Farmstead / Homestead	7.13 km	Negligible	**NEGLIGIBLE**
VR18	Farmstead / Homestead	4.77 km	Moderate	**MEDIUM (7)**
VR19	Farmstead / Homestead	*8.08 km	Negligible	**NEGLIGIBLE**
VR20	Farmstead / Homestead	*8.79 km	Negligible	**NEGLIGIBLE**
VR21	Farmstead / Homestead	*9.28 km	Negligible	**NEGLIGIBLE**
VR22	Farmstead / Homestead	*9.18 km	Negligible	**NEGLIGIBLE**
VR23	Farmstead / Homestead	3.32 km	Moderate	**MEDIUM (7)**
VR24	Farmstead / Homestead	3.48 km	Moderate	**MEDIUM (7)**

Name	Details	Approximate distance to nearest proposed turbine	Visual Impact Zone	Overall impact rating
VR25	Farmstead / Homestead	3.76 km	Moderate	**MEDIUM (7)**
VR26	Farmstead / Homestead	3.9 km	Moderate	**MEDIUM (7)**
VR27	Farmstead / Homestead	2.34 km	Moderate	**MEDIUM (7)**
VR28	Farmstead / Homestead	3.96 km	Moderate	**MEDIUM (7)**
VR29	Farmstead / Homestead	3.96 km	Moderate	**MEDIUM (7)**
VR30	Farmstead / Homestead	2.74 km	Moderate	**MEDIUM (7)**
VR31	Farmstead / Homestead	7.09 km	Low	**MEDIUM (6)**
VR32	Farmstead / Homestead	7.75 km	Low	**MEDIUM (6)**
VR33	Farmstead / Homestead	7.88 km	Low	**MEDIUM (6)**
VR34	Farmstead / Homestead	*8.42 km	Negligible	**NEGLIGIBLE**
VR35	Farmstead / Homestead	*11.95 km	Negligible	**NEGLIGIBLE**
VR36	Farmstead / Homestead	*8.60 km	Negligible	**NEGLIGIBLE**
VR37	Farmstead / Homestead	*13.20 km	Negligible	**NEGLIGIBLE**
VR38	Farmstead / Homestead	5.02 km	Low	MEDIUM (6)
VR39	Farmstead / Homestead	*8.68 km	Negligible	**NEGLIGIBLE**
VR40	Farmstead / Homestead	*9.12 km	Negligible	**NEGLIGIBLE**
VR41	Farmstead / Homestead	*9.22 km	Negligible	**NEGLIGIBLE**
VR42	Farmstead / Homestead	*9.58 km	Negligible	**NEGLIGIBLE**
VR43	Farmstead / Homestead	*12.66 km	Negligible	**NEGLIGIBLE**
VR44	Farmstead / Homestead	*13.38 km	Negligible	**NEGLIGIBLE**
VR45	Farmstead / Homestead	*12.97 km	Negligible	**NEGLIGIBLE**
VR46	Farmstead / Homestead	*12.59 km	Negligible	**NEGLIGIBLE**
VR47	Farmstead / Homestead	4.44 km	Moderate	**MEDIUM (7)**
VR48	Farmstead / Homestead	4.51 km	Moderate	**MEDIUM (7)**

Name	Details	Approximate distance to nearest proposed turbine	Visual Impact Zone	Overall impact rating
VR49	Farmstead / Homestead	7.55 km	Low	**MEDIUM (6)**
VR50	Farmstead / Homestead	*9.70 km	Negligible	**NEGLIGIBLE**
VR51	Farmstead / Homestead	*11.16 km	Negligible	**NEGLIGIBLE**
VR52	Farmstead / Homestead	*11.51 km	Negligible	**NEGLIGIBLE**
VR53	Farmstead / Homestead	N/A	N/A	
VR54	Farmstead / Homestead	1.89 km	High	**HIGH (8)**

As previously mentioned however, the sensitive receptor locations identified as Gatsrivier Holiday Farm and Bakenrivier were subsequently removed from the list of sensitive and potentially sensitive receptors due to the fact that the owner has a vested interest in the WEF development and thus would not view the proposed power line in a negative light.

The potentially sensitive receptor locations were identified as scattered farmsteads / homesteads which house the local farmers as well as their farm workers. These dwellings are regarded as potentially sensitive visual receptor locations as they are located within a natural rural setting and the proposed development will likely alter natural vistas experienced from these dwellings, however their sentiments toward the proposed development are unknown.

Environmental Sensitivity Map

In terms of the potentially sensitive visual receptor locations, the proposed development would result in a negligible visual impact on the majority of the receptor locations (28 in total). The proposed development would however result in a medium visual impact on 23 of the identified potentially sensitive receptor locations. This is since the majority of the potentially sensitive receptor locations are either located outside of the proposed WEF development's viewshed or are situated further than 8 km from the nearest proposed wind turbine. It should however be noted that the proposed development would result in a high visual impact on one (1) of the potentially sensitive receptor locations, namely VR 54 which is located on the application site. Accordingly, it has been assumed that the owner of VR 54 has a vested interest in the development and as such would not perceive the WEF in a negative light.

It should be noted that this sensitivity rating applies to turbine development only. The visual impacts resulting from the associated infrastructure are considered to have far less significance when viewed in the context of multiple wind turbines and as such the infrastructure has been excluded from the sensitivity analysis.

It should be further 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 sensitive and potentially sensitive receptor locations.

In addition to the sensitivity ratings, the Sensitivity Map (Figure D.9) shows 500 m exclusion buffers around the farmsteads / farm houses / homesteads located within the proposed application site. It is recommended that no wind turbines should be allowed to be developed within these buffer zones so as to prevent the impact of shadow flicker on these receptor locations.

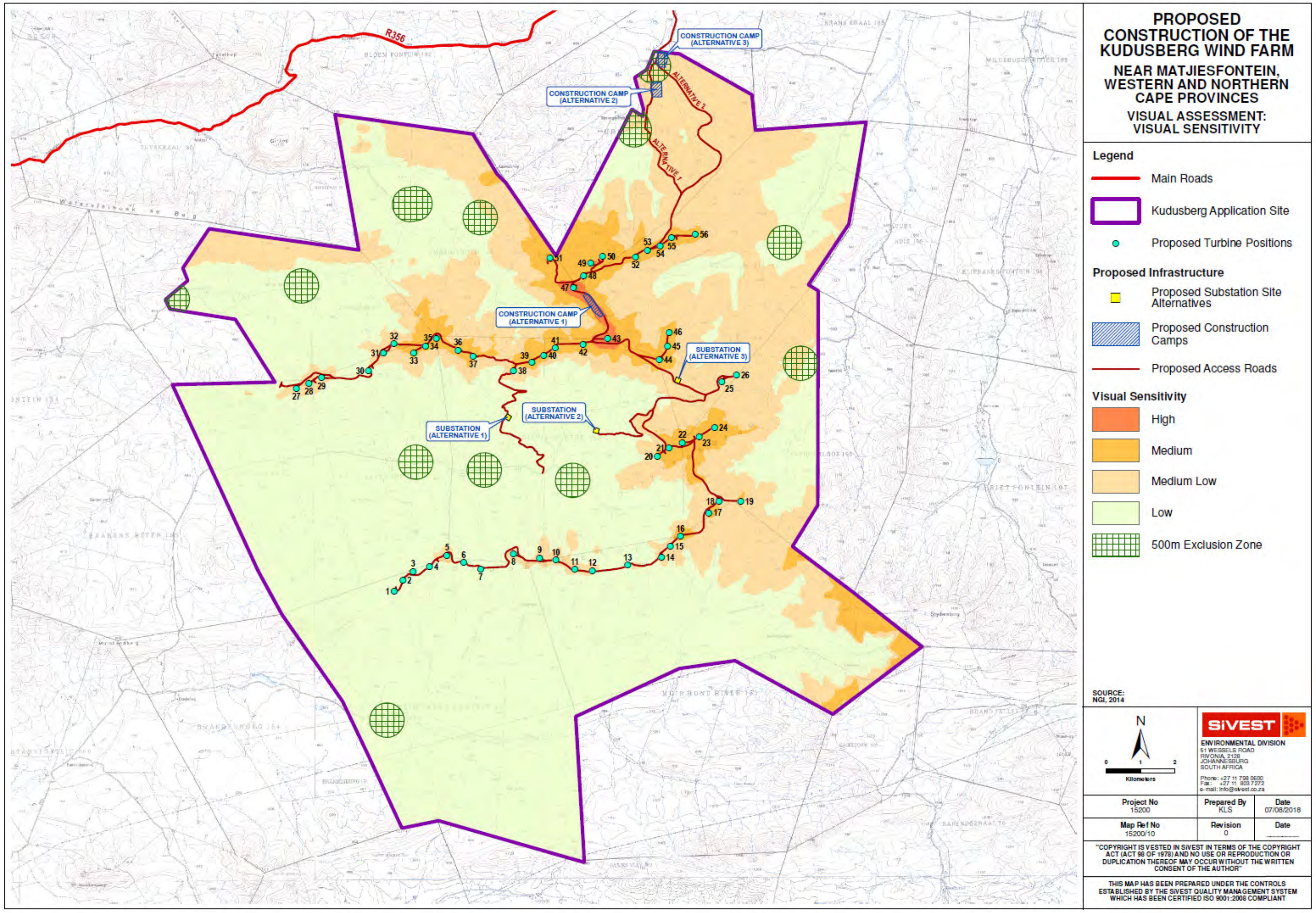


Figure D.9: Visual sensitivity map of the proposed Kudusberg WEF site showing 500 m exclusion zones for wind turbines

D.1.2.1.3.2 **Visual Modelling**

In order to provide an indication of what the proposed WEF development would look like from various chosen viewpoints / vantage points, visual models were created to strengthen the findings of the receptor impact ratings.

As mentioned, an indicative range of locations (referred to as "vantage points" or "viewpoints") were selected for modelling purposes to provide an indication of the possible impacts from different locations within the study area. The models illustrate how views from each selected vantage point will be transformed by the proposed WEF development if the wind turbines are erected on the site as proposed.

- **Vantage Point 1 (-32.888868S; 20.247452E): View towards the proposed Kudusberg WEF Turbines from the Western section of the application site, within 2 km of the nearest proposed turbine position (Figure D.10).**

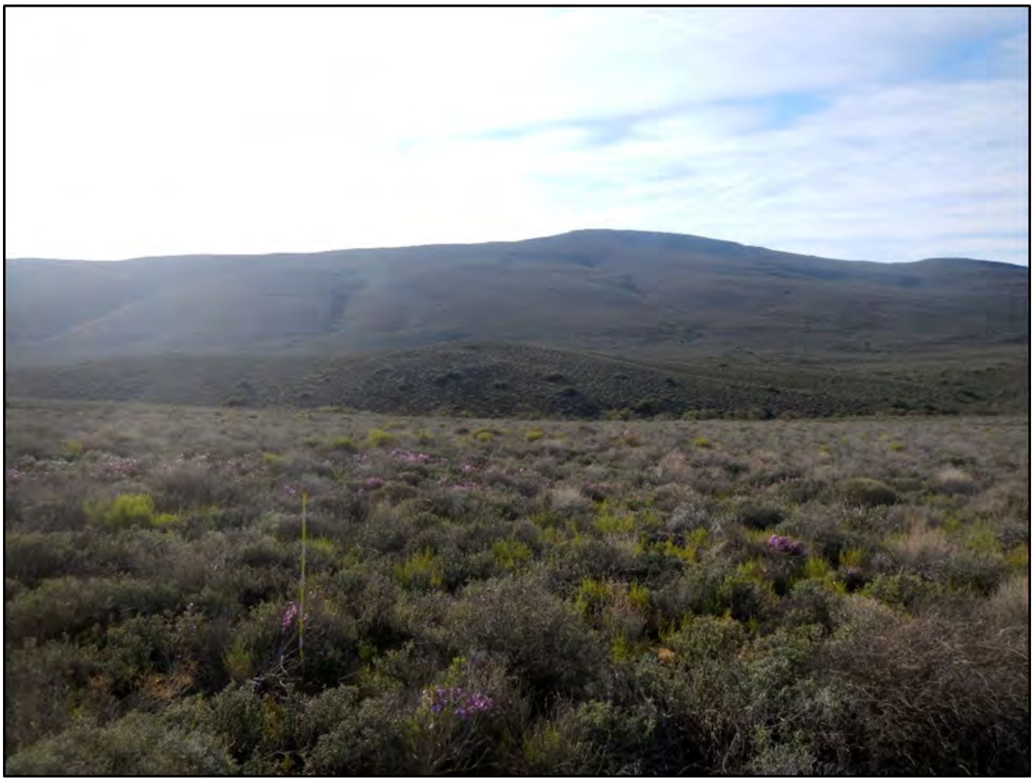


Figure D.10: Existing view (to the N) towards the proposed Kudusberg WEF Turbines from the Western section of the application site, within 2 km of the nearest proposed turbine position.

Figure D.11: Visually modelled post-construction view (to the N) towards the proposed Kudusberg WEF Turbines from the Western section of the application site, within 2 km of the nearest proposed turbine position.

As indicated in Figure D.11 above, the close proximity of the proposed turbines (i.e. within 2 km) is expected to result in the proposed WEF development being highly visible. In addition, the vegetative screening factors are not significant enough to block out most views of the proposed WEF development and therefore the turbines are expected to be highly visible. The hills found to the north and north-east of this viewpoint are also not expected to aid significantly in screening as the wind turbines will be placed on the higher lying plateaus of hills located within the application site and are thus still expected to be largely visible. The visible wind turbines would contrast highly with the dominant natural landscape elements as there are no tall linear elements in view from this viewpoint except for telephone poles and fence poles.

- **Vantage Point 2 (-32.890652S; 20.282364E): View towards the proposed Kudusberg WEF Turbines from the Western section of the application site (from SR1), within 5 km of the nearest proposed turbine position (Figure D.12)**

Figure D.12: Existing view (to the N) towards the proposed Kudusberg WEF turbines from the Western section of the application site (from SR1), within 5 km of the nearest proposed turbine location.

Figure D.13: Visually modelled post-construction view (to the N) towards the proposed Kudusberg WEF turbines from the Western section of the application site (from SR1), within 5 km of the nearest proposed turbine location.

As indicated above, the close proximity of the proposed turbines (i.e. within 5 km) is expected to result in the proposed WEF development being highly visible. In addition, the vegetative screening factors are not significant enough to block out most views of the proposed WEF development and therefore the turbines are expected to be highly visible. The hills found to the north and north-east of this viewpoint are also not expected to aid significantly in screening as the wind turbines will be placed on the higher lying plateaus of hills located within the application site and are thus still expected to be largely visible. The visible wind turbines would contrast highly with the dominant natural landscape elements as there are no tall linear elements in view from this viewpoint except for telephone poles and fence poles.

- **Vantage Point 3 (-32.958423S; 20.271493E): View towards the proposed Kudusberg WEF Turbines from the South-Western section of the application site (from VR1), within 5 km of the nearest proposed turbine position (Figure D.14)**

Figure D.14: Existing view (to the NNE) towards the proposed Kudusberg WEF turbines from the South-Western section of the application site (from VR1), within 5 km of the nearest proposed turbine location.

Figure D.15: Visually modelled post-construction view (to the NNE) towards the proposed Kudusberg WEF turbines from the South-Western section of the application site (from VR1), within 5 km of the nearest proposed turbine location.

As indicated above in Figure D.15, the close proximity of the proposed turbines (i.e. within 5 km) is expected to result in the proposed WEF development being largely visible. In addition, the vegetative screening factors are not significant enough to effectively block out most views of the proposed WEF development and therefore the turbines are expected to be highly visible. It should however ne noted that there are some tall trees and other dense vegetation to the north-east of this viewpoint which are expected to provide some form of screening. The hills found to the north and north-east of this viewpoint are not expected to aid significantly in screening as the wind turbines will be placed on the higher lying plateaus of hills located within the application site and are thus still expected to be largely visible. The visible wind turbines would contrast highly with the dominant natural landscape elements as there are no tall linear elements in view from this viewpoint except for telephone poles and fence poles.

Figure D.16: View of the tall trees and dense vegetation to the north-east which is expected to provide some form of screening.

- **Vantage Point 4 (-32.803192S; 20.214182E): View towards the proposed Kudusberg WEF application site from the North-Western section of the visual assessment zone (along the R356 road), within 8 km of the nearest proposed turbine position (Figure D.17)**

Figure D.17: Existing view (to the SE) towards the proposed Kudusberg WEF application site from the North-Western section of the visual assessment zone (along the R356 road), within 8 km of the nearest proposed turbine location.

Figure D.18: Visually modelled post-construction view (to the SE) towards the proposed Kudusberg WEF application site from the North-Western section of the visual assessment zone (along the R356 road), within 8 km of the nearest proposed turbine location.

Despite the fact that the vegetative screening factors are not significant enough to effectively block out most views of the proposed WEF development, the distance of the proposed turbines (i.e. almost 8 km) will result in the proposed WEF development not being highly visible. In addition, the hills directly east and south-east of this viewpoint are expected to aid to some degree in blocking out views of the proposed wind turbines. It should however be noted that since the wind turbines will be placed on the higher lying plateaus of hills located within the application site, the wind turbines are still expected to be visible to some degree. The visible wind turbines would contrast with the dominant natural landscape elements as there are no tall linear elements in view from this viewpoint except for telephone poles and fence poles. Given the distance of the WEF from the viewing point however, the turbines tend to blend in with the fencing in the foreground.

- **Night-time Impacts**

The visual impact of lighting on the nightscape is largely dependent on the existing lighting present in the surrounding area at night. The night scene in areas where there are numerous light sources will be visually degraded by the existing light pollution and therefore additional light sources are unlikely to have a significant impact on the nightscape. In contrast, introducing light sources into a relatively dark night sky will impact on the visual quality of the area at night.

Much of the study area is characterised by natural rural / pastoral areas with low densities of human settlement and as a result, relatively few light sources are present in the area surrounding the proposed development site. As previously mentioned, the closest built-up area is the town of Matjiesfontein which is situated approximately 35 km to the south-west of the proposed application site. In addition, proposed WEF is located approximately 45 km south-west of the town of Sutherland. These built-up areas are thus situated too far away to have significant impacts on the night scene. At night, the study area is characterised by a picturesque dark starry sky and the visual character of the night environment is considered to be 'unpolluted' and pristine. The most prominent light sources within the study area at night include isolated lighting from surrounding farmsteads / homesteads and transient light from the passing cars travelling along the R356 and gravel access roads.

Operational and security lighting at night will be required for the proposed WEF. As the study area lies within the Sutherland Central Advantage Area, pilot activated lighting methods, as prescribed by the CAA, will be required for obstacle lighting on the turbines. As a result, impacts from aviation lighting on the WEF will be intermittent and of short duration, thus reducing impacts considerably. The type and intensity of any other lighting required was unknown at the time of writing this report and therefore the potential impact of the development at night has been discussed based on the general effect that additional light sources will have on the ambiance of the nightscape.

Although the area is not generally renowned as a tourist destination, the natural dark character of the nightscape will be sensitive to the impact of additional lighting at night. The operational and security lighting required for the proposed WEF development is likely to intrude on the nightscape, and create glare, which will contrast with the dark backdrop of the surrounding area.

D.1.2.1.4 **Visual impacts**

D.1.2.1.4.1 **Impacts Identified for the Construction Phase**

- **Potential visual intrusion resulting from construction vehicles and equipment;**
- **Potential impacts of increased dust emissions from construction activities and related traffic; and**
- **Potential visual scarring of the landscape as a result of site clearance and earthworks.**

During the construction phase, large construction vehicles and equipment will alter the natural character of the study area and expose visual receptor locations 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 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. Additionally, temporarily stockpiling soil during construction may alter the landscape. Wind blowing over these disturbed areas could therefore result in dust which would have a visual impact.

Significance of impacts before mitigation: Moderate

Proposed mitigation measures:

- Carefully plan to minimise the construction period and avoid construction delays.
- Minimise vegetation clearing and rehabilitate cleared areas as soon as possible.
- 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.

- Maintain a neat construction site by removing rubble and waste materials regularly.

Significance of impacts after mitigation: Mitigation measures will result in a reduction of visual impacts during construction from moderate to Low.

D.1.2.1.4.2 **Impacts Identified for the Operational Phase**

- **Potential alteration of the visual character of the area;**
- **Potential visual intrusion resulting from wind turbines located on ridge lines and higher plateaus; and**
- **Potential alteration of the night time visual environment as a result operational and security lighting as well as navigational lighting on top of the wind turbines.**

During the operation phase, the proposed Kudusberg WEF could exert a visual impact by altering the visual character of the surrounding area and exposing sensitive visual receptor locations 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 the gravel 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.

Significance of impacts before mitigation: Moderate

Proposed mitigation measures:

Design Phase:

- In areas of 'High Sensitivity', the number of turbines should be limited, where possible.
- No turbines should be placed within 500 m of the dwellings or farmsteads which are situated within the proposed application (i.e. 500 m exclusion buffers – see Figure D.9).
- 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.
- Turbine colours should adhere to the Civil Aviation Authority (CAA) requirements.

Operational Phase:

- Turbines should be repaired promptly as they are considered more visually appealing when the blades are rotating (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 landscape 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.
- Where practically possible, the operation and maintenance buildings should not be illuminated at night.
- 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.
- Unless there are water shortages, ensure that dust suppression techniques are implemented on all access roads.
- Select the alternatives that will have the least impact on visual receptor locations, as identified in Section 1.8 of the VIA.

Significance of impacts after mitigation: Moderate

D.1.2.1.4.3 **Impacts Identified for the Decommissioning Phase**

- **Potential visual intrusion resulting from vehicles and equipment involved in the decommissioning process;**
- **Potential impacts of increased dust emissions from decommissioning activities and related traffic; and**
- **Potential visual intrusion on farmsteads / homesteads within the visual assessment zone as a result of decommissioning activities.**

During the decommissioning phase, large construction vehicles and equipment will alter the natural character of the study area and expose visual receptor locations to visual impacts associated with decommissioning activities. These activities may be perceived as an unwelcome visual intrusion, particularly in more natural undisturbed settings. Gravel roads will be used to gain access to the WEF and if these roads are not maintained correctly during the decommissioning phase, vehicles travelling along these roads could increase dust emissions and create dust plumes. The increased traffic and the resultant dust plumes could therefore create a visual impact and may evoke negative sentiments from surrounding viewers. The visual intrusion of decommissioning activities associated with the proposed WEF could adversely affect farmsteads / homesteads within the visual assessment zone. Decommissioning activities could also result in surface disturbance which could visually contrast with the surrounding environment. Additionally, the temporary stockpiling of soil during decommissioning may alter the landscape and wind blowing over these disturbed areas could result in dust which would have a visual impact. Any vegetation clearance required for the decommissioning activities is expected to increase dust emissions and alter the natural character of the surrounding area, thus creating a visual impact.

Significance of impacts before mitigation: Moderate

Proposed mitigation measures:

- Carefully plan to minimise the construction period and avoid construction delays.
- Minimise vegetation clearing and rehabilitate cleared areas as soon as possible.
- 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.
- Maintain a neat construction site by removing rubble and waste materials regularly.

Significance of impacts after mitigation: Low

D.1.2.1.4.4 **Cumulative Impacts**

- **Combined visual impacts from several renewable energy facilities in the broader area during the construction and operation phases could potentially alter the sense of place and visual character of the area; and**
- **Combined visual impacts from several renewable energy facilities in the broader area during construction and operations phases could potentially exacerbate visual impacts on visual receptors.**

Large construction vehicles and equipment used during the construction phase of the surrounding renewable energy facilities will contribute further to the alteration of the natural character of the study area and will also expose a greater number of visual receptor locations to visual impacts associated with the construction phase, especially if some of the construction phases coincide. This is also true for the operational phase as the surrounding renewable energy facilities and their associated infrastructure would alter the visual character of the surrounding area further and expose a greater number of sensitive and potentially sensitive visual receptor locations to visual impacts. The construction and operational activities may be perceived as unwelcome visual intrusions, particularly in more natural undisturbed settings. Vehicles and trucks travelling to and from the proposed development sites during the construction phases on gravel access roads are also expected to result in an increase in dust emissions in the greater area. In addition, maintenance vehicles may need to access the surrounding renewable energy facilities and their associated infrastructure via gravel access roads and are also expected to increase dust emissions in the surrounding area in doing so. 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 majority of the existing roads in the vicinity of the project site are also 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 surrounding renewable energy facilities 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. Security and operational lighting will be required for the operation of the surrounding renewable energy facilities and their associated infrastructure. This could therefore result in a greater amount of light pollution and glare within the surrounding area, which could be a significant annoyance to surrounding viewers.

Significance of impacts before mitigation: Moderate

Proposed mitigation measures:

- 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 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 camps (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, such as monochromatic dull colours as long as it is in line with CAA requirements.
- 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).
- 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.
- Areas of high visual sensitivity 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, where feasible, (except for aviation lighting) and prevent light spill.
- The operations and maintenance buildings should not be illuminated at night, if possible.
- Turbine colours should adhere to CAA requirements.
- Turbines should be repaired promptly, as they are considered more visually appealing when the blades are rotating (or at work) (Vissering, 2011).
- If possible and practically feasible, the operation and maintenance buildings should be painted with natural tones that fit with the surrounding environment5. In addition, 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 landscape 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.
- Select the alternatives that will have the least impact on visual receptor locations.

Significance of impacts after mitigation: Moderate

D.1.2.1.4.5 **No-go**

The 'No Go' alternative is essentially the option of not developing a WEF in this area. The area would thus retain its visual character and sense of place and there would be no visual impacts.

Significance of impact without mitigation measures
Not applicable, the visual character of the area would remain as per the status quo.

[5] Depending on the building design, the developer may find it preferable to paint the building white in order to reflect heat and keep the interior of the building cool

D.1.2.1.5 **Impact Assessment Summary: Visual impacts**

Impact	Mitigation measure	Significance before mitigation	Significance after mitigation
CONSTRUCTION PHASE			
Visual intrusion and dust emissions.	• Carefully plan to minimise the construction period and avoid construction delays. • Minimise vegetation clearing and rehabilitate cleared areas as soon as possible. • Make use of existing gravel access roads where possible. • Ensure that dust suppression techniques are implemented on all access roads. • Maintain a neat construction site. • Ensure that visual management measures are included as part of the EMPr and monitored by an Environmental Control Officer (ECO). This will include monitoring activities associated with visual impacts such as the siting of construction camp, management of soil stockpiles, screening and dust suppression. Regular reporting to an environmental management team must also take place during the construction phase.	**Moderate**	**Low**
OPERATIONAL PHASE			
Visual intrusion, dust emissions and light pollution and glare.	Design Phase: • In areas of 'High Sensitivity', the number of turbines should be limited, where possible. • No turbines should be placed within 500 m of the dwellings or farmsteads which are situated within the proposed application site (i.e. 500 m exclusion buffers – see Section 1.6.2 of the VIA; see Figure D.9) • 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. • Turbine colours should adhere to CAA requirements. Operational Phase: • 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	**Moderate**	**Moderate**

Impact	Mitigation measure	Significance before mitigation	Significance after mitigation
	result in unity and lessen the visual impact that would typically be experienced in a chaotic landscape 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. • Unless there are water shortages, ensure that dust suppression techniques are implemented on all access roads where practically possible, the operations and maintenance buildings should not be illuminated at night. • Cables should be buried underground where possible. • If possible, the operation and maintenance buildings should be painted with natural tones that fit with the surrounding environment[6]. In addition, non-reflective surfaces should be utilised where possible. • Select the alternatives that will have the least impact on visual receptor locations. • Ensure that visual mitigation measures are monitored by the management team on an on-going basis. This will include monitoring activities associated with visual impacts such as the control of signage, lighting and dust on the site.		
DECOMMISSIONING PHASE			
Visual intrusion and dust emissions.	• Carefully plan to minimize the decommissioning period and avoid delays. • Minimise vegetation clearing and rehabilitate cleared areas as soon as possible. • Make use of existing gravel access roads where possible. • Unless there are water shortages, ensure that dust suppression techniques are implemented on all access roads. • Maintain a neat construction site. • Ensure that procedures for the removal of structures and stockpiles during decommissioning are implemented, including recycling of materials. In addition, it must be ensured that rehabilitation of the site to a visually acceptable standard is undertaken.	**Moderate**	**Low**

[6] Depending on the building design, the developer may find it preferable to paint the building white in order to reflect heat and keep the interior of the building cool.

Impact	Mitigation measure	Significance before mitigation	Significance after mitigation
CUMULATIVE IMPACTS			
CONSTRUCTION ACTIVITIES			
Visual intrusion and dust emissions	• 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 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, such as monochromatic dull colours. • 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).	**Moderate**	**Moderate**
OPERATIONAL ACTIVITIES			
Visual intrusion, dust emission and light pollution and glare.	• 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. Areas of high visual sensitivity should be viewed as zones where the number of turbines should be limited where possible.	**Moderate**	**Moderate**

Impact	Mitigation measure	Significance before mitigation	Significance after mitigation
	• 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. • Turbine colours should adhere to CAA requirements. • Turbines should be repaired promptly, as they are considered more visually appealing when the blades are rotating (or at work) (Vissering, 2011). • If possible, the operation and maintenance buildings should be painted with natural tones that fit with the surrounding environment[7]. In addition, 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 landscape 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. • Unless there are water shortages, ensure that dust suppression techniques are implemented on all access roads. • Select the alternatives that will have the least impact on visual receptor locations. as identified in Section 1.8 of the VIA.		

[7] Depending on the building design, the developer may find it preferable to paint the building white in order to reflect heat and keep the interior of the building cool.

D.1.2.1.6 Comparative assessment of alternatives and comment on revised layout 1

Access road alternative 1 and 2 are equally preferred, substation 1, 2 and 3 are equally preferred and construction camp alternative 2 and 3 are preferred over construction camp alternative 1. Although construction camp alternative 1 is least preferred, it is not fatally flawed.

Subsequent to the completion of all specialist studies, the applicant refined the proposed WEF layout in line with the recommendations of the various specialists. The refined layout (received on 15th October 2018) incorporated some very minor amendments to the turbine locations, road network and construction camp alternatives. The new layout has been assessed from a visual perspective and it has been concluded that these amendments do not change the findings of this VIA.

D.1.2.1.7 Concluding statement

Due to the low levels of leisure-based or nature-based tourism activities in the assessment area, no sensitive visual receptor locations were identified within the study area. It was further ascertained that, although fifty two (52) potentially sensitive receptors were identified within the visual assessment zone, the proposed WEF development is likely to visually impact only twenty-three (23) of these receptors. In many cases, roads along which people travel, are regarded as sensitive receptors.

The impact rating revealed that overall the proposed WEF is expected to have a **negative moderate visual impact significance rating during both construction and operation**, with relatively few mitigation measures available. It could be argued that the key mitigation measure is to cluster wind energy developments in line with the intended outcome of the recently promulgated Komsberg REDZ – one of eight designated zones for renewable energy development. By clustering developments, the visual impacts are contained in one zone instead of sprawling over vast areas. Cumulative impacts associated with the proposed WEF would have a moderate negative visual impact rating during both construction and operation, with relatively few mitigation measures available. These impacts would however remain moderate after the implementation of the relevant mitigation measures, due to the nature of the impacts.

All 56 wind turbines each with a generation capacity ranging between 3 MW and 6.5 MW, with a hub height of each turbine up to 140 m and its rotor diameter up to 180 m along with associated infrastructure can be authorized on the proposed site. Should the hub height and or rotor diameter decrease in the future, the visual impact is expected to remain the same or potentially reduce from moderate to low. Therefore, from a visual perspective the project is deemed acceptable and the EA should be granted. SiVEST concluded that the impacts associated with the construction, operation and decommissioning phases can be mitigated to acceptable levels provided the recommended mitigation measures are implemented. Overall it can be concluded that the visual impact of the proposed WEF would be reduced due to the lack of sensitive visual receptors present.

D.1.2.2 Heritage

The Heritage Impact Assessment (HIA) was undertaken by Katie Smuts to inform the outcome of this BA. The Cultural Landscape Impact Assessment, which forms part of the HIA, was undertaken by Emmylou Rabe of Hearth Heritage. The full HIA (including nature, status, extent, duration, probability, reversibility, irreplaceability and confidence ratings) is included in Appendix D of this report. The following section provides a summary of the Impact Assessment undertaken for the HIA. The HIA was furthermore informed by a paleontological impact assessment as included below in section D1.2.3.

D.1.2.2.1 Approach and methodology

A site visit was conducted from 17-20 July 2018, with between 30- and 35-hours' survey conducted within this period; the palaeontologist and assistant returned to the field from 4-6 August 2018. The survey team consisted of two archaeologists, a palaeontologist and an assistant. The survey was conducted in a 4x4 vehicle as well as on foot, with existing roads and farm tracks utilised for vehicular access. Heritage resources identified in the field were recorded, mapped and photographed were appropriate. Tracks and waypoints were recorded on a handheld GPS device (Garmin Etrex) and photographs were taken with a digital camera. 1:50k and 1:250k maps were obtained from the Directorate for Surveys and Mapping for use in the field. Maps and overlays were created for the report using Google Earth Imagery and QGIS Software.

The specialists employed a sampling strategy that aimed to characterise areas of proposed development, as it was not feasible to survey the entire development footprint. As a result, a sample of turbine footprints were assessed, all three substation alternatives, two of the three construction camp alternatives and some of the road alignments, representing a sample of ridges, slopes, valleys and plains. Vegetation was relatively sparse, making visibility good, although dense riparian vegetation dominated by thorn and karee trees along the river banks hampered visibility. The season did not affect visibility or the success of the survey.

Background research for the AIA and cultural landscapes assessment was conducted by reviewing HIAs conducted in the immediate surroundings. These reports are freely accessible on the South African Heritage Resources Information System (SAHRIS) and covered work done in the area between 2010 and 2017. This information is, therefore, recent and up to date. While some reports are more comprehensive than others, all were found to be of very high quality. These desktop-based assessments also included review of relevant academic articles and literature, historic and current maps, the REDZ SEA reports (DEA, 2015) and relevant international best practices.

The Cultural Landscapes Assessment utilised a Landscape Character Assessment according to landuse, habitation and natural features to assist in an understanding of the various landscape areas and potential development impact (Swanwick, 2002).

D.1.2.2.2 Project aspects relevant to heritage impacts

Elements of the construction phases that will have a potential heritage impact include the construction of access roads, construction camp, substation and turbines.

- **Construction phase**

Direct impacts to archaeological resources, burial grounds and graves, and built environment may result from construction vehicles in the study area, the building of roads, clearing of land, earthmoving, and similar activities related to construction. Stone Age archaeology is very sparse in this area, with only a very few, isolated artefacts found in the development footprint.

Burial grounds and graves at risk during the construction phase are likely to be subject to very high direct impacts without mitigation.

The significance of the built environment is very low in this area, and it is likely that the significance of impacts to the built environment will be low without mitigation.

Impacts to cultural landscapes are predominantly indirect in nature, given that the resource is largely intangible.

- **Operational Phase**

Impacts to archaeological resources, burial grounds and graves and built environment are unlikely during the operational phase, as no new areas will be disturbed through operational activities.

Impacts to sites of living heritage will be continuous throughout the operational phase as a result of vehicles and personnel on site for maintenance, and the presence of roads, turbines and associated infrastructure in the landscape.

- **Decommissioning Phase**

Impacts to archaeological resources, burial grounds and graves and built environment are unlikely during the decommissioning phase, as no new areas will be disturbed through decommissioning activities. The significance of impacts without mitigation would, therefore be very low. Mitigation should only be to ensure that existing roads are used, and no previously undisturbed areas should be subject to disturbance. With mitigation, impacts will remain very low.

Impacts to sites of living heritage will be continuous throughout the decommissioning phase as a result of vehicles and personnel on site for turbine dismantling and removal, and the remnants of access roads, and locations of turbines and associated infrastructure in the landscape. It should be noted, however, that any resulting impacts will be of a short duration. Should the mitigation measures recommended above be implemented, the significance of these impacts will, however, remain low.

D.1.2.2.3 Sensitivity of the site in relation to the proposed activity

SAHRA's grading system was used in the study. SAHRA uses the term field rating to describe gradings assigned as part of Section 38 processes, while grading is reserved for official significance as designated by authorities. This system grades locally important sites as follows:

- Field Rating/Grade IIIa - high local significance that should be preserved in their entirety;
- Field Rating/Grade IIIb – medium local significance that can be mitigated and preserved in part;
- Field Rating/Grade IIIc sites are recorded as:
  - Field Rating/Grade IVa – high or medium significance requiring mitigation;
  - Field Rating/Grade IVb – medium significance requiring recording; and
  - Field Rating/Grade IVc – low significance not requiring mitigation

While most of the heritage resources identified in this survey are of low intrinsic heritage significance, that is IIIc in terms of the HWC grading system, or IVb or IVc in terms of the SAHRA system, several sites are worthy of higher grading. All burial sites – and in this case, likely burials have been included in this category – have been graded IIIa for their very high cultural significance. Further to this, although it is not likely to be impacted by this development, the shelter with rock art and artefacts has been graded IIIa for its likely scientific importance as a possible research site.

Little of the built environment of this region survives in intact form, and most of the historic structures of interest are in ruins – i.e. archaeological resources, rather than built environment ones. As such, the built environment significance of the study area is also low. Where these elements show evidence for continuing living heritage, as in the case of Wind HeuvelRe/190 and Rooiheuwel 170 farmsteads with their asboskookskerms incorporated into the current farming traditions, these have been graded as Grade IIIb features. Grade IIIb grading has also been proposed for the stone-built towers. These are unusual features that exhibit a high degree of technological significance due to their careful, meticulous construction. This fact, together with their uncertain use and origins supports a grading that is sufficiently high to ensure their protection.

Cultural landscapes are a significant factor in the evaluation of the impact of proposed development on cultural heritage resources, tangible (e.g. Historic settlements, landscapes, technological) and intangible (eg. language, indigenous knowledge systems, oral traditions). The area investigated for the proposed Kudusberg WEF, situated in the Karoo Hoogland Local Municipality and Witzenberg Local Municipality, is considered as having moderate to high cultural heritage significance as a cultural landscape, with elements proposed as Grade IIIb and IIIa. With four windfarms approved for development in early 2019, it is likely that this grading would need to be reviewed for those areas within close proximity to these facilities, and therefore experiencing high visual impacts from them. The scenic qualities and heritage significance of the R356, running from Karoopoort to Sutherland, should be considered for recognition as a scenic drive in order to afford it some protection going forward.

Heritage sensitivity maps have been prepared by the Heritage specialist (Katie Smuts) (see Figures D.19-D.24.

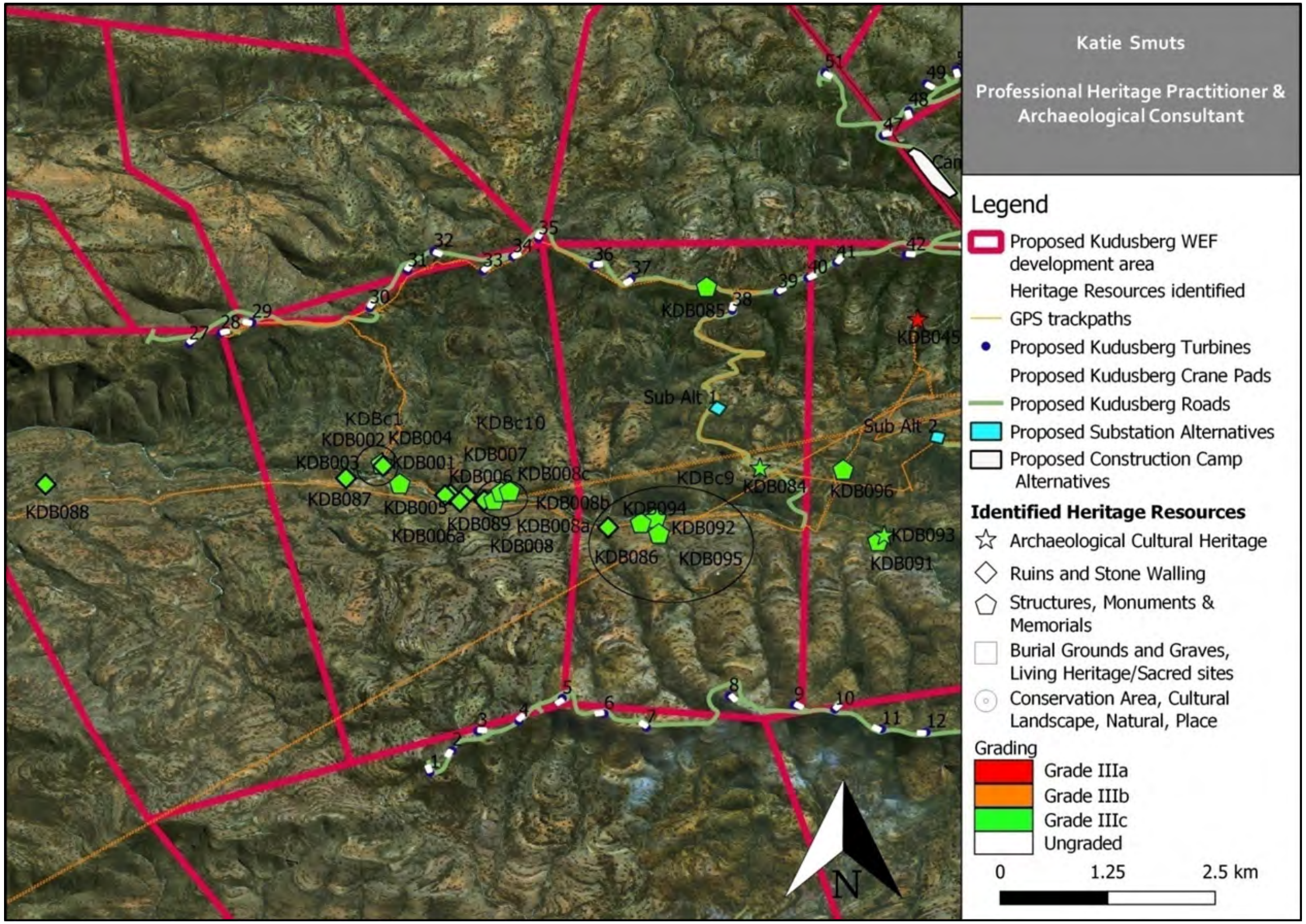


Figure D.19: Heritage resources in Sector 1 Inset Map and relevant site complex numbers; all sites in Western Cape. (Map courtesy of Katie Smuts)

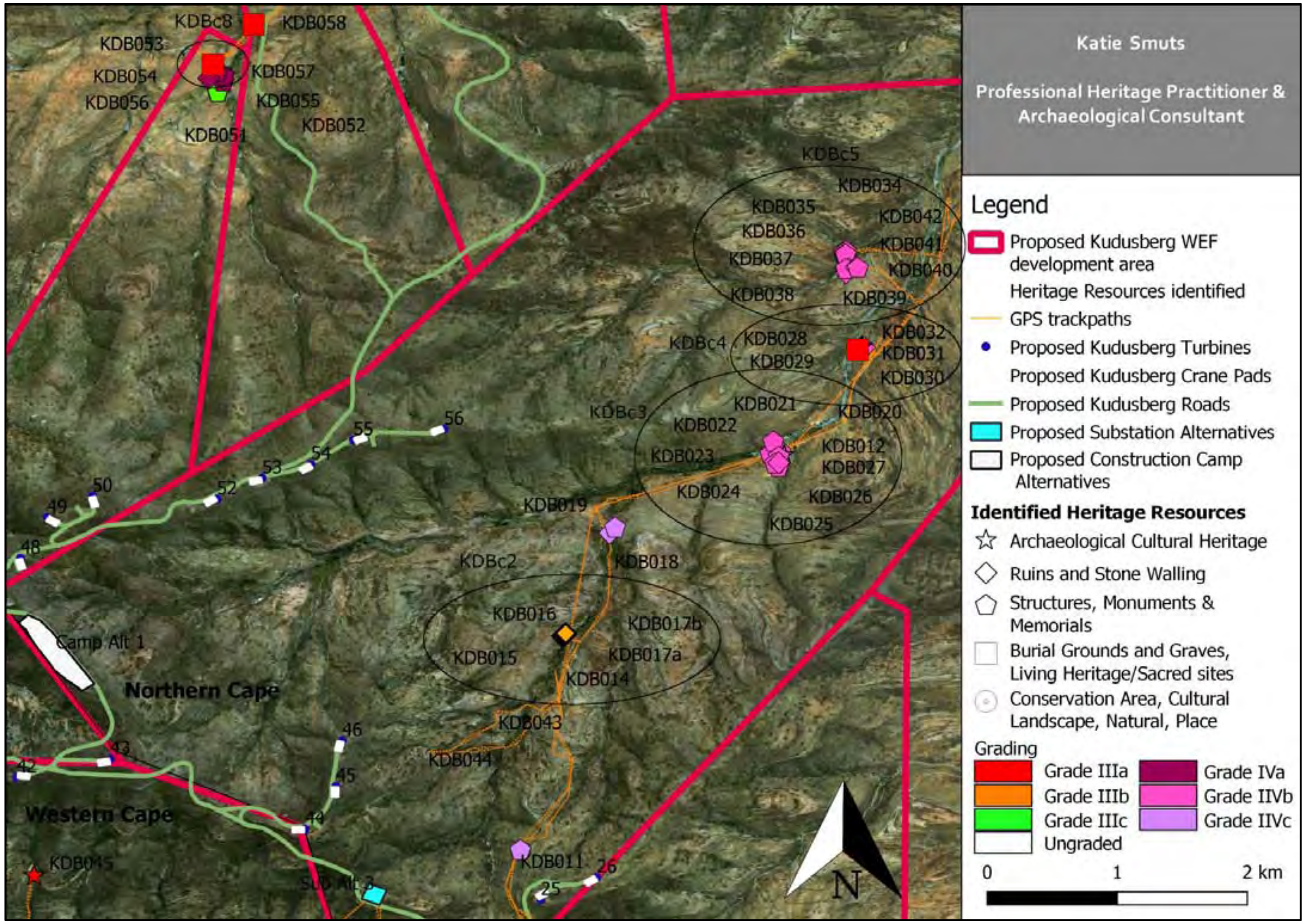


Figure D.20: Heritage resources in Sector 2 Inset Map and relevant site complex numbers; all sites in Northern Cape except KDB045. (Map courtesy of Katie Smuts)

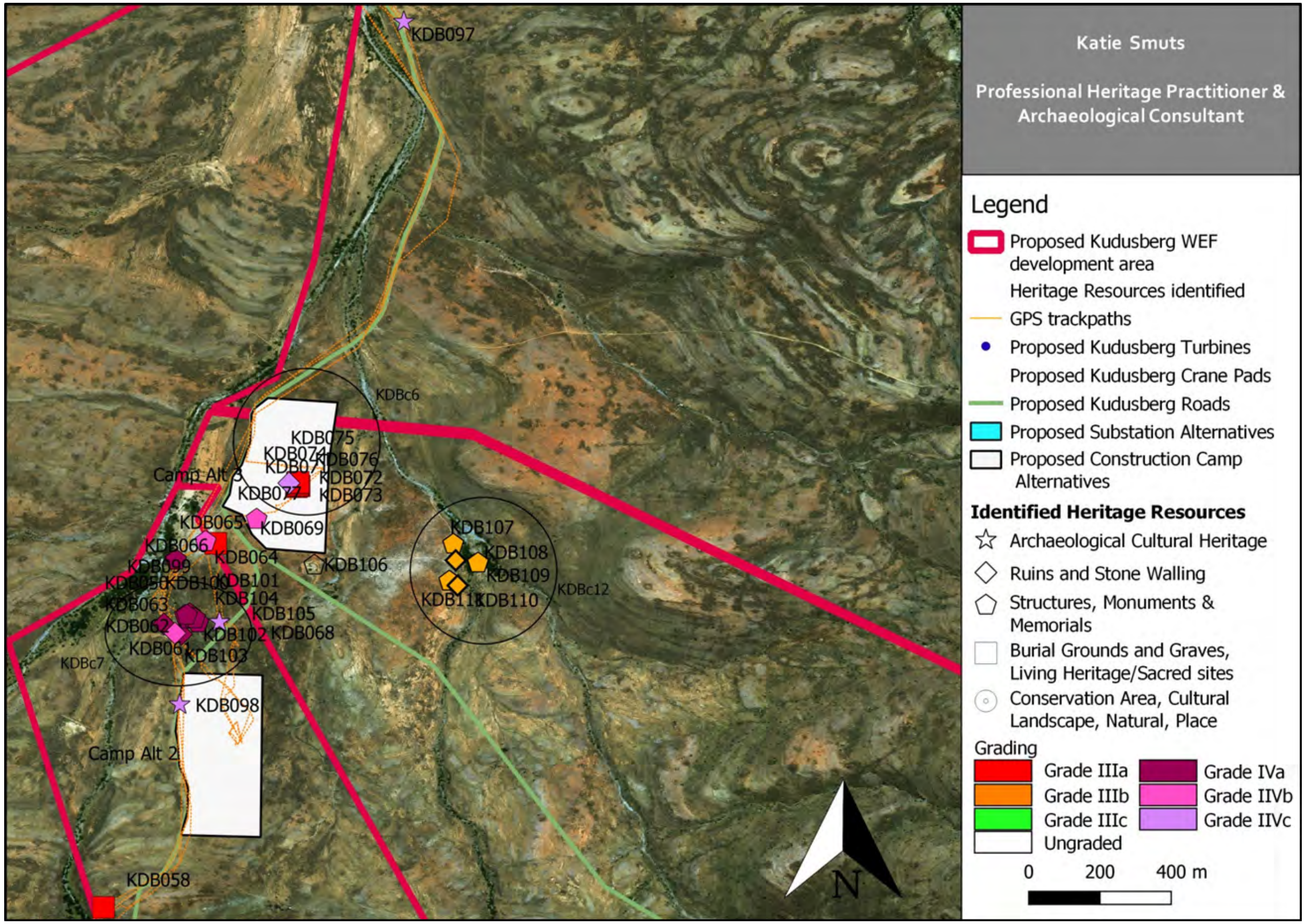


Figure D.21: Heritage resources in Sector 3 Inset Map and relevant site complex numbers; all sites in Northern Cape. (Map courtesy of Katie Smuts)

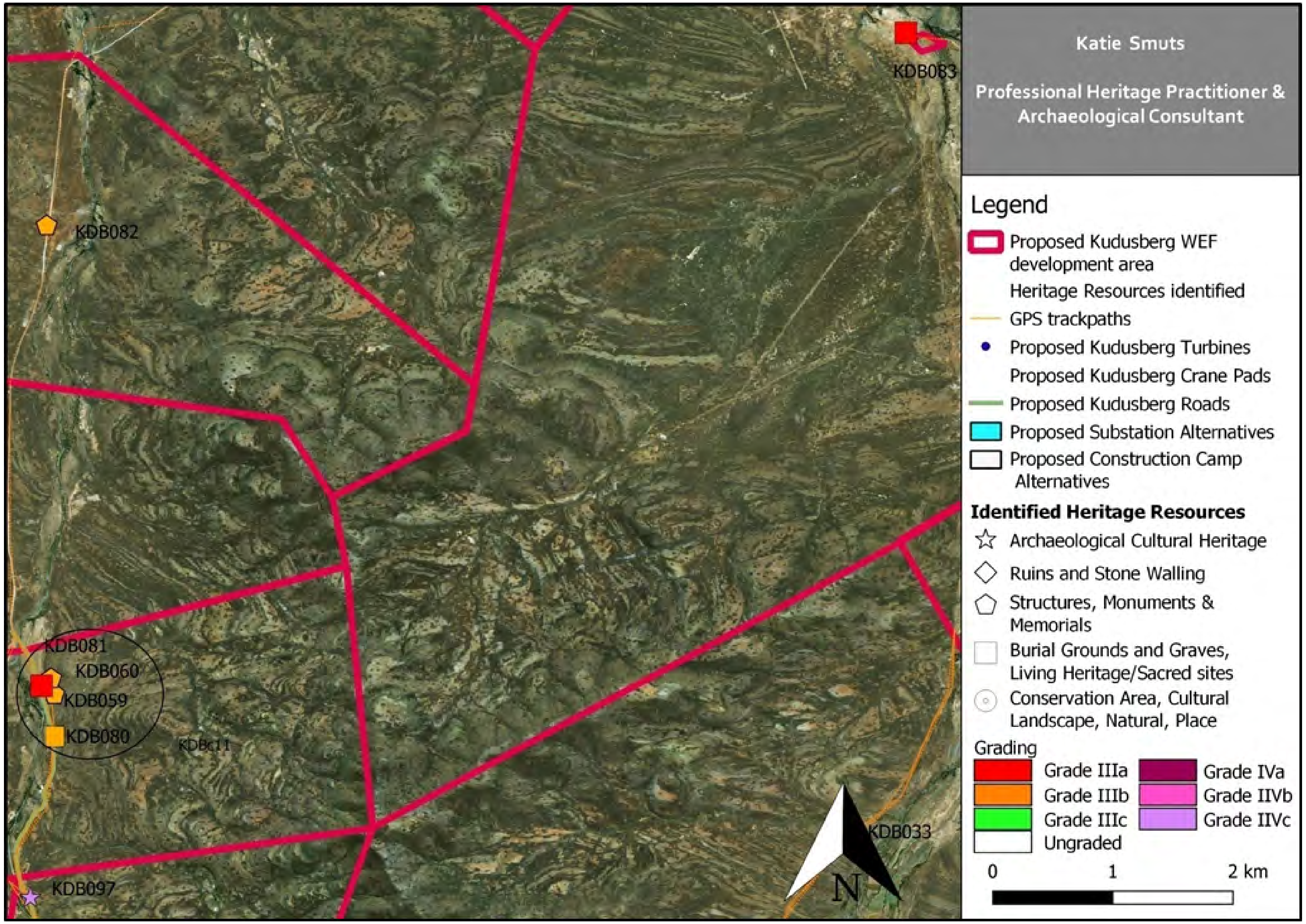


Figure D.22: Heritage resources in Sector 4 Inset Map and relevant site complex numbers; all sites in Northern Cape. (Map courtesy of Katie Smuts)

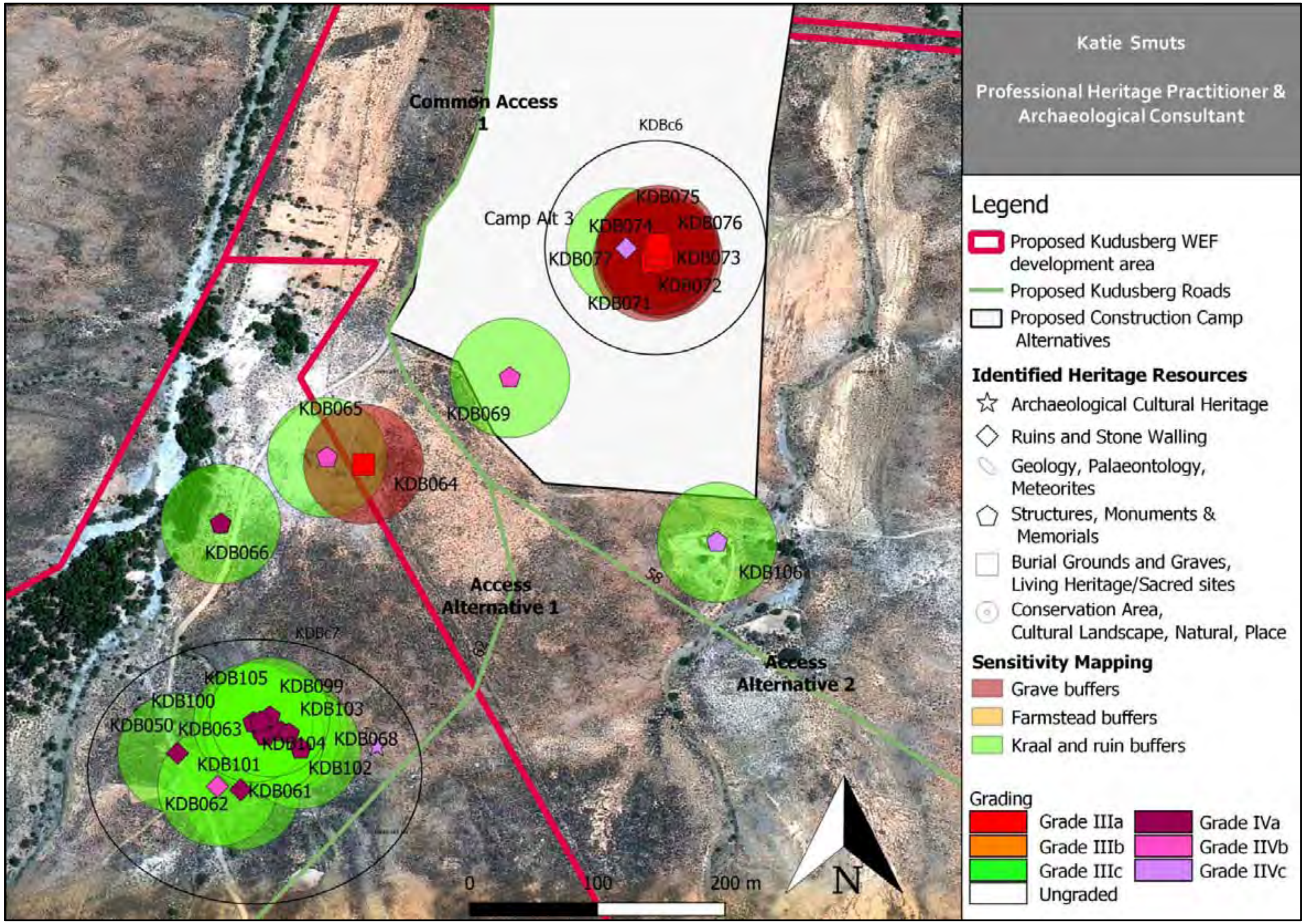


Figure D.23: Proximity of affected heritage resources in Sector 3 (KDB6 and 7) to revised infrastructure layout. (Map courtesy of Katie Smuts)

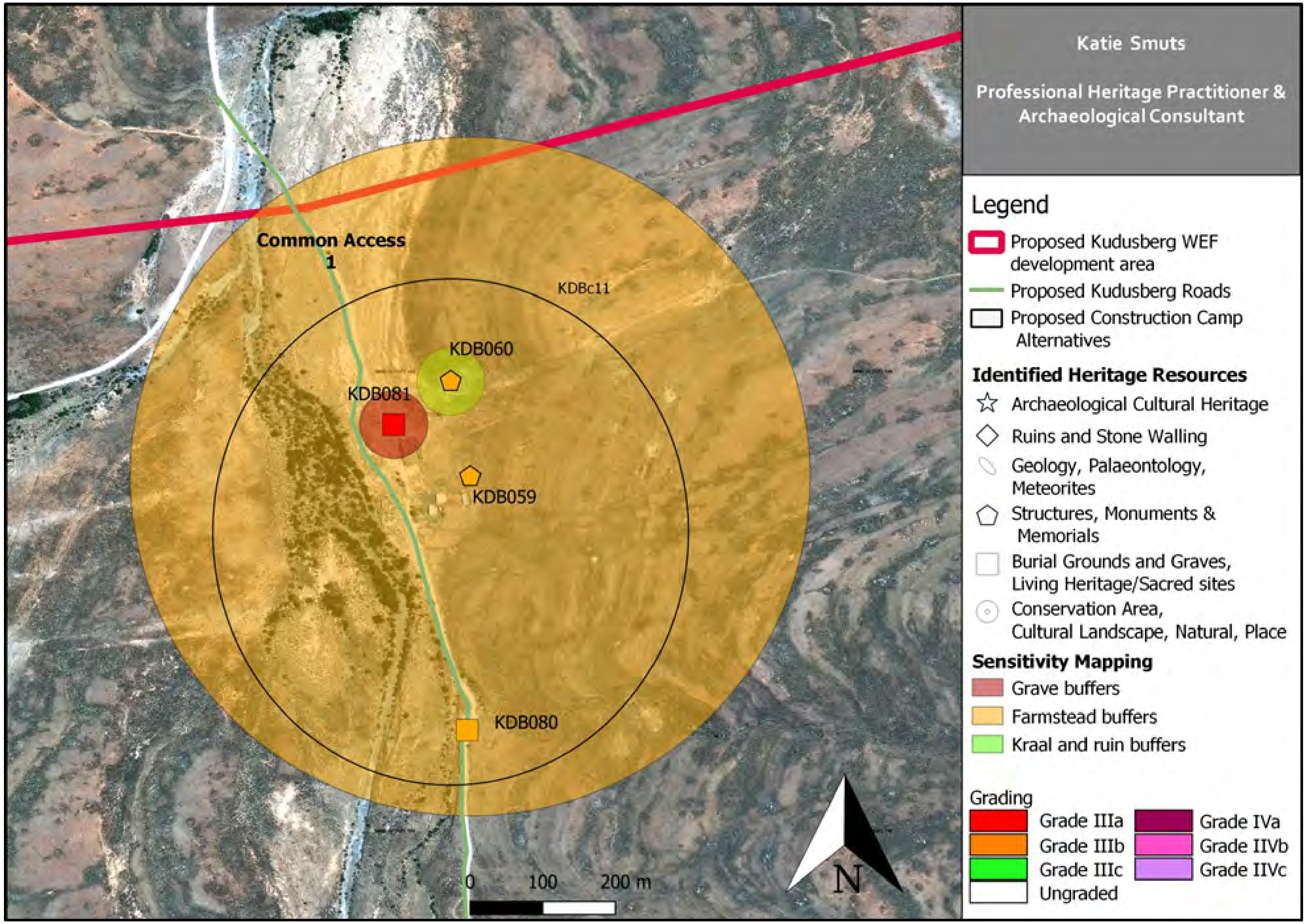


Figure D.24: Map of proximity of affected heritage resources in Sector 4 (KDB11) to revised infrastructure layout. (Map courtesy of Katie Smuts)

D.1.2.2.4 **Impact Assessment Summary**

D.1.2.2.4.1 **Impacts Identified for the Construction Phase**

Direct impacts to archaeological resources, burial grounds and graves, and built environment may result from construction vehicles in the study area, the building of roads, clearing of land, earthmoving, and similar activities related to construction. Stone Age archaeology is very sparse in this area, with only a very few, isolated artefacts found in the development footprint (KDB068, KDB084, KDB097, KDB098).

Burial grounds and graves at risk during the construction phase are likely to be subject to very high direct impacts without mitigation. Revised Layout 1 has taken this into account, and avoids Grave 057 and possible grave KDB058 as well as the graveyard at KDB081 by adequate buffers.

Impacts to cultural landscapes are predominantly indirect in nature, given that the resource is largely intangible. These impacts are discussed below. An exception to this is the potential for significant remains at sites that arise from their importance as cultural landscapes. An example of this is the historic road over Pad se Hoek, where physical remains of the road endure as stone retaining walls, and other physical evidence for the historic passage of people through the area might also be prevalent.

DIRECT IMPACT:

❖ **Destruction of palaeontological material, archaeological remains, graves and built environment features.**

Significance of impacts before mitigation: Low

Proposed mitigation measures:

- ECO to conduct checks of surface clearance and excavations > 1 m for fossil material and report finds to PHRA or SAHRA for recording by professional palaeontologist.
- Revised Layout 1 makes Access Alternative 1 preferred choice and Common Access Road 1 acceptable.
- Use Construction Camp 2.
- Adhere to the following buffers:
    - Graves: no development should be permitted within 50 m of graves and cemeteries; existing roads within this buffer should not be altered or widened;
    - Cave site (KDB045): construction staff should not be permitted within 200 m of the site;
    - Farmsteads: no turbines should be located within 500 m of farmsteads;
    - Kraals, stone walling and ruins > 100 years: construction staff should not be permitted within 50m of these sites and no development should take place within 15m;
    - Archaeological finds: no buffers are recommended for the isolated artefacts identified in this survey.
    - **The revised layout 1 adheres to the recommended buffers.**

Significance of impacts after mitigation: Low

INDIRECT IMPACTS:

- **Loss of significance through erosion of visual qualities and integrity of cultural landscape.**
- **Destruction of archaeological remains, graves and built environment.**

Significance of impacts before mitigation: High

Proposed mitigation measures:

- Placement of turbines and associated infrastructure to observe buffers as described above.
- Inform site crew of heritage sensitivity of landscape.
- Cordon off vulnerable sites as no-go areas.

Significance of impacts after mitigation: Moderate

D.1.2.2.4.2 **Impacts Identified for the Operational Phase**

Impacts to archaeological resources, burial grounds and graves and built environment are unlikely during the operational phase, as no new areas will be disturbed through operational activities. The significance of impacts without mitigation would, therefore be very low. Mitigation should only be to ensure that existing roads are used and no previously undisturbed areas subject to disturbance. With mitigation, impacts will remain of very low significance. The realignment proposed for Common Access Road 1 further ensures that the Stadler graveyard at KDB081 is avoided by an appropriate buffer (as implemented in revised layout 1). This realignment ensures that impacts from heavy vehicle traffic for maintenance of turbine locations and roads are unlikely to cause impacts to the graveyard, and the likelihood of significant impacts is very low.

Impacts to sites of living heritage will be continuous throughout the operational phase as a result of vehicles and personnel on site for maintenance, and the presence of roads, turbines and associated infrastructure in the landscape. Should the mitigation measures recommended below be implemented, the significance of these impacts will, however, remain Low.

DIRECT IMPACT:

- **Destruction of archaeological remains, graves and built environment features**

Significance of impacts before mitigation: Very Low

Proposed mitigation measures:

- Use existing roads for maintenance purposes
- Keep all disturbance within development footprint

Significance of impacts after mitigation: Very Low

INDIRECT IMPACTS:

- **Loss of significance through erosion of visual qualities and integrity of cultural landscape.**
- **Destruction of archaeological remains, graves and built environment.**

Significance of impacts before mitigation: High

Proposed mitigation measure:
- Keep site crew informed of heritage sensitivity of landscape.

Significance of impacts after mitigation: Moderate

Impacts to archaeological resources, burial grounds and graves and built environment are unlikely during the decommissioning phase, as no new areas will be disturbed through decommissioning activities. The significance of impacts without mitigation would, therefore be very low. Mitigation should only be to ensure that existing roads are used, and no previously undisturbed areas should be subject to disturbance. With mitigation, impacts will remain very low.

Impacts to sites of living heritage will be continuous throughout the decommissioning phase as a result of vehicles and personnel on site for turbine dismantling and removal, and the remnants of access roads, and locations of turbines and associated infrastructure in the landscape. It should be noted, however, that any resulting impacts will be of a short duration. Should the mitigation measures recommended above be implemented, the significance of these impacts will, however, remain Low.

D.1.2.2.4.3 **Impacts Identified for the Decommissioning Phase**

DIRECT IMPACT:

- **Destruction of archaeological remains, graves and built environment features.**

Significance of impacts before mitigation: Low

Proposed mitigation measures:
- Use existing roads
- Keep all disturbance within development footprint

Significance of impacts after mitigation: Very Low

INDIRECT IMPACTS:

- **Loss of significance through erosion of visual qualities and integrity of cultural landscape.**
- **Destruction of archaeological remains, graves and built environment.**

Significance of impacts before mitigation: Low

Proposed mitigation measures:

- Keep site crew informed of heritage sensitivity of landscape.
- Keep vulnerable sites cordoned off as no-go areas.

Significance of impacts after mitigation: Low

D.1.2.2.4.4 **Cumulative Impacts**

- **Destruction of palaeontological material within the Abrahamskraal Formation, archaeological remains, graves and built environment features (from direct and indirect impacts).**
- **Loss of significance through erosion of visual qualities and integrity of cultural landscape.**

There are currently multiple applications being made for the development of WEFs in the area surrounding the Kudusberg proposed WEF development site (within a radius of 50 km). Four of these have been approved to commence construction in early 2019 (see Table D.1 for a list of these projects, and Figure D.1 for the map of their distribution).

Due to the likely low impacts to the sparse, low density Stone Age archaeological heritage anticipated in this region, the significance of cumulative impacts is similarly expected to be low. The significance of cumulative impacts to archaeological built heritage, in the form of stone walling, kraals and ruined stone-built structures, however, is anticipated to be high without mitigation. Mitigation, which should include protection and avoidance of these features, can be easily implemented across the wider REDZ and, should that occur, direct cumulative impacts to these features will likely be very low.

Burial grounds and graves can occur throughout this region, and are not always easily recognised as graves, making possible impacts to them from cumulative developments very high. These features, both formal graves and stone cairns should be avoided where they are encountered in the landscape, such that the need for relocation does not arise. Should this mitigatory approach be adopted throughout the REDZ, the significance of cumulative impacts to graves will be low.

Where significant built environment features do occur, these should be avoided, with buffers implemented to protect them from encroachment and impact from roads, infrastructure and turbines which will result in very high impacts. No turbines should be placed within 500 m of farmsteads. Despite these mitigation measures, the significance of cumulative impacts to these structures, which are often the only structures in the landscape for many kilometres, will remain **moderate to high**.

Turbines and construction roads, particularly where they are prominently visible along the ridge slopes and ridges, have a cumulative visual impact of high negative significance on the highly significant cultural landscape. This effect is unavoidably exacerbated in REDZ and is essentially unmitigable. The existence of the REDZ does, however, serve to consolidate infrastructure, limiting impacts to one area, which is preferable to isolated, dispersed installations across the wider region. The vast landscape can potentially accommodate a limited number of wind turbines located in areas of minimal visual intrusion without much negative impact on the scenic value of the landscape. This factor is enhanced by the low numbers of people living in and travelling through the region and therefore experiencing the impacts, while the distances between and within installations reduces the amount of infrastructure visible at any given time. The VIA indicates that the significance of the **cumulative visual impacts on the landscape is of moderate significance.**

While much attention has been given in previous HIAs to the scenic qualities of the N1 and the R354, the cultural landscape assessment (Rabe Bailey 2018) suggests that the cultural significance of the R356 rivals that of those routes, and that cumulative impacts on the R356 should not be underestimated.

Similarly, cumulative impacts to living heritage sites will be unavoidably high without mitigation, with losses including to physical expressions of cultural heritage as well as to sense of place and cultural landscapes. While mitigation in the form of avoidance and protection of these sites can go some way to reducing cumulative impacts, the significance of these impacts is likely to remain moderate to high. Again, here the creation of the REDZ serves to limit the extent of impacts to living heritage to smaller areas, thereby limiting the extent of the damage.

Significance of impacts before mitigation: High

Proposed mitigation measures:

- ECO or Site Officer reporting to ECO to conduct checks during surface clearance and excavations > 1 m for fossil material and report finds to PHRA or SAHRA for recording by professional palaeontologist.
- Protect and avoid archaeological sites wherever possible.
- Avoid graves and graveyards by 50 m.
- Keep turbines > 500 m from homesteads.

Significance of impacts after mitigation: Moderate

D.1.2.2.4.5 **No-go alternative**

The no-go would mean that the status quo would proceed i.e. no additional impacts to heritage features. The no-go is not preferred considering that the impacts to heritage features can be mitigated appropriately and the benefits of the project outweighs the negative heritage impacts.

This project will be of economic benefit to South Africans generally, through the enhancement of renewable energy sources to feed clean energy into the national grid. At the local level, it is likely that short-term employment opportunities will arise during the construction phase. The socio-economic impact was assessed separately to inform the BA process.

D.1.2.2.5 **Impact Assessment Summary: Heritage impacts**

Impact	Mitigation measure	Significance before mitigation	Significance after mitigation
CONSTRUCTION PHASE			
Direct impacts			
Destruction of palaeontological material, archaeological remains, graves and built environment features.	• ECO to conduct checks of surface clearance and excavations > 1 m for fossil material and report finds to PHRA or SAHRA for recording by professional palaeontologist. • Revised Layout 1 makes Access Road Alternative 1 preferred choice and Common Access 1 acceptable. • Use Construction Camp 2. • If any archaeological material or human burials are uncovered during the course of development, then work in the immediate area should be halted at once. The find should be reported to the heritage authorities (SAHRA in the Northern Cape and HWC in the Western Cape) and may require inspection by an archaeologist to determine whether mitigation should take place and what form that mitigation should take.	**Low**	**Low**
Indirect impacts			
Loss of significance through erosion of visual qualities and integrity of cultural landscape. Destruction of archaeological remains, graves and built environment.	• Placement of turbines and associated infrastructure to observe buffers. • Inform site crew of heritage sensitivity of landscape. • Cordon off vulnerable sites as no-go areas.	**High**	**Moderate**
OPERATIONAL PHASE			
Direct impacts			
Destruction of archaeological remains,	• Use existing roads for maintenance purposes. • Keep all disturbance within development footprint.	**Very Low**	**Very Low**

Impact	Mitigation measure	Significance before mitigation	Significance after mitigation
graves and built environment features.			
Indirect impacts			
Loss of significance through erosion of visual qualities and integrity of cultural landscape. Destruction of archaeological remains, graves and built environment.	• Keep site crew informed of heritage sensitivity of landscape.	**High**	**Moderate**
DECOMMISSIONING PHASE			
Direct impacts			
Destruction of archaeological remains, graves and built environment features.	• Use existing roads. • Keep all disturbance within development footprint.	**Low**	**Very Low**
Indirect impacts			
Loss of significance through erosion of visual qualities and integrity of cultural landscape; Destruction of archaeological remains, graves and built environment.	• Keep site crew informed of heritage sensitivity of landscape. • Keep vulnerable sites cordoned off as no-go areas.	**Low**	**Low**
CUMULATIVE IMPACTS			
Destruction of palaeontological material within the Abrahamskraal Formation, archaeological remains, graves and built environment features (from direct and indirect impacts).	• ECO or Site Officer reporting to ECO to conduct checks during surface clearance and excavations > 1 m for fossil material and report finds to PHRA or SAHRA for recording by professional palaeontologist. • Protect and avoid archaeological sites wherever possible. • Avoid graves and graveyards by 50m. • Keep turbines > 500 m from homesteads.	**High**	**Moderate**

Impact	Mitigation measure	Significance before mitigation	Significance after mitigation
Loss of significance through erosion of visual qualities and integrity of cultural landscape.			

D.1.2.2.6 Comparative assessment of alternatives and comment on revised layout

The revised layout 1 adheres to the proposed buffers around heritage features. Impacts to the Uria's Gat River CLA have been ameliorated in revised layout 1.

In summary, recommendations are as follow:

- Substation Alternative 1 is the recommended substation alternative, although Substation Alternatives 2 and 3 are not considered to be a no-go option;
- Construction Camp 2 is the recommended construction camp alternative, although Construction Camp 1 is likely to be an acceptable alternative. Construction Camp 3 should be considered a no-go option;
- The realignment of Access Road Alternative 1 renders it an acceptable choice, while Access Road Alternative 2 is likely to be an acceptable alternative. The proposed alignment for Access Road Alternative 2 should be subjected to a walkdown by an archaeologist prior to commencement of development to identify any areas or sites that require protection or mitigation, should it be selected;
- Common Access Road 1 has been realigned to the east to avoid Wind Heuvel farmstead and is considered an acceptable route. The road should not be widened or altered at this point and a proper fence should be erected around the Stadler graveyard (KDB081).

D.1.2.2.7 Concluding statement

The study area is largely devoid of heritage resources at elevation, and entirely devoid of significant heritage resources above 1200 masl. As such, it is not anticipated that turbines located on ridges will negatively impact on heritage resources. This applies to other high lying infrastructure, such as Construction Camp Alternative 1, any of the substations, and access roads at altitudes above that height. From a heritage point of view, it is recommended that the development be allowed to continue on acceptance of the measures proposed in this section. Should archaeological sites or graves be exposed during construction work, it must immediately be reported to a heritage practitioner so that an investigation and evaluation of the finds can be made.

D.1.2.3 Palaeontological Assessment

The Palaeontological Impact Assessment (PIA) was undertaken by Dr John Almond of Natura Viva cc to inform the outcome of this BA. The full PIA is included in Appendix D of this report. The following section provides a summary of the Impact Assessment undertaken for the PIA.

D.1.2.3.1 Approach and methodology

The National Heritage Resources Act (No. 25 of 1999) of South Africa stipulates that fossils and fossil sites may not be altered or destroyed. The PIA for the proposed Kudusberg WEF is based on geological and palaeontological data acquired (1) during a preliminary desktop analysis of the broader study region combined with (2) a six-day field survey of key sectors of the project area by the palaeontologist (Dr Almond), focusing on potentially fossiliferous sites with informative bedrock exposure.

D.1.2.3.2 **Project aspects relevant to palaeontological impacts**

Activities associated with the development of the proposed WEF that are likely to impact on palaeontological resources include:

- Vegetation clearing;
- Road construction;
- Excavation and dredging activities; and
- Infrastructure construction activities.

The construction phase of the proposed WEF will entail extensive surface clearance as well as excavations into the superficial sediment cover and underlying bedrock, e.g. for new access roads, wind turbine placements, on-site substation, underground cables, laydown areas and construction yards. Construction of the WEF may adversely affect potential fossil heritage within the development footprint by damaging, destroying, disturbing or permanently sealing-in fossils preserved at or beneath the surface of the ground that are then no longer available for scientific research or other public good. The planning, operational and de-commissioning phases of the WEF are unlikely to involve further adverse impacts on local palaeontological heritage and are therefore not separately assessed in this report.

D.1.2.3.3 **Sensitivity of the site in relation to the proposed activity**

The great majority of the Kudusberg WEF project area is assessed as being of **low palaeontological sensitivity** due to the scarcity of significant fossil vertebrate, plant and other remains here (Figure D.25). There are no sensitive no-go areas within the proposed development footprint. Scientifically-important fossil plant and lung fish burrow sites as well as the equivocal vertebrate burrows and tracks recorded here all lie well outside (> 50 m) the proposed development footprint and therefore no mitigation measures regarding them are recommended here. Pending the potential discovery of significant new fossil remains during the construction phase - in which event the Chance Fossil Finds Protocol (Appendix 2 of the PIA included in Appendix D of this report) should be applied– no specialist palaeontological mitigation or monitoring is recommended for the Kudusberg WEF project.

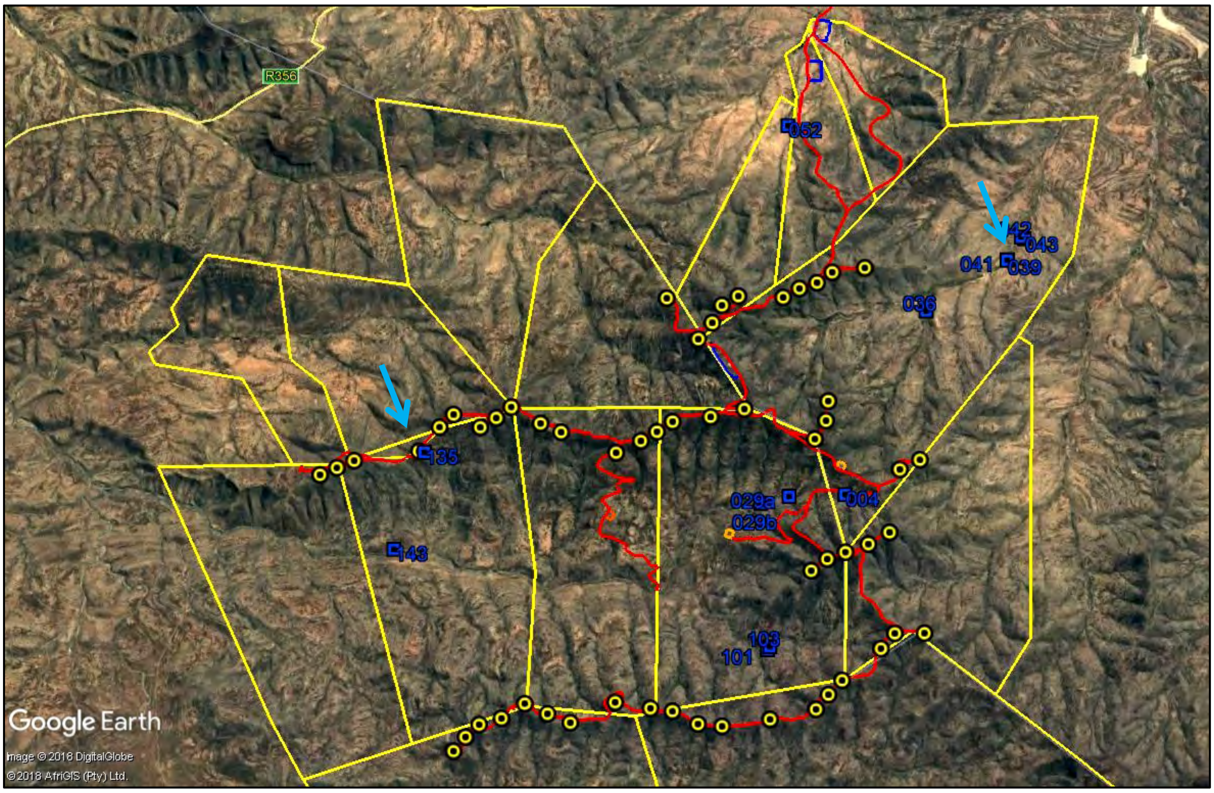


Figure D.25: Google Earth© satellite image of the core Kudusberg WEF project area in the Klein Roggeveld region showing numbered fossil sites recorded during the field survey (blue) in relation to the proposed layout of wind turbines (yellow dots) and access roads (red lines). Note that (1) none of the identified sites lies directly within the development footprint and (2) the majority of sites are of low palaeontological heritage significance (Proposed Field Rating IIIC). Scientifically-important fossil plant and lung fish burrow sites (Locs. 038-041,135 &143) (Proposed Field Rating IIIA) as well as the equivocal vertebrate burrows and tracks (Locs. 29b, 042 & 043) all lie well outside (> 50 m) the proposed development footprint and do not require mitigation as part of the WEF development. Scale bar = 7 km. N towards the top of the image.

D.1.2.3.4 <u>Palaeontology impacts</u>

D.1.2.3.4.1 Impacts Identified for all phases of the development

The proposed Kudusberg WEF study area is located in a region of the Great Karoo that is underlain by potentially-fossiliferous sedimentary rocks of Late Palaeozoic and younger, Late Tertiary or Quaternary, age. In particular, these include (1) Middle Permian continental deposits of the Abrahamskraal Formation (Lower Beaufort Group, Karoo Supergroup) that may contain scientifically important fossils of Permian vertebrates and terrestrial plants as well as (2) Late Caenozoic alluvium that may contain important mammalian remains such as teeth and bones (These rock units and fossils are described in more detail in Section 1.3 of the PIA in Appendix D of this report).

The high palaeontological heritage sensitivity of the Palaeozoic bedrocks in the Komsberg REDZ 2 focus area has been emphasized by Fourie *et al.* (2015) as well as on the SAHRIS palaeosensitivity map maintained by SAHRA.

The construction phase of the proposed WEF will entail extensive surface clearance as well as excavations into the superficial sediment cover and underlying bedrock, e.g. for new access roads, wind turbine placements, on-site substation, underground cables, laydown areas and construction yards. Construction of the WEF may adversely affect potential fossil heritage within the development footprint by damaging, destroying, disturbing or permanently sealing-in fossils preserved at or beneath the surface of the ground that are then no longer available for scientific research or other public good. The planning, operational and decommissioning phases of the WEF are unlikely to involve further adverse impacts on local palaeontological heritage and are therefore not separately assessed in the PIA.

D.1.2.3.4.2 **Impacts Identified for the Construction Phase**

❖ **Disturbance, damage or destruction of fossils**

The destruction, damage or disturbance out of context of legally-protected fossils preserved at the ground surface or below ground that may occur during construction of the WEF entail *direct negative* impacts to palaeontological heritage resources that are confined to the development footprint (*site specific*). These impacts can often be mitigated but cannot be fully rectified (*i.e.* they are *permanent / non-reversible*). All of the sedimentary formations represented within the study area contain fossils of some sort, so impacts at some level on fossil heritage are definite. However, most (but not all) of the fossils concerned are probably of widespread occurrence elsewhere within the outcrop areas of the formations concerned (*low irreplaceability*), while unique, well-preserved fossils are rare in this region of the Karoo. The probability of loss of *unique or rare, scientifically-important fossil heritage* is therefore rated as *very unlikely*. Because of the generally sparse occurrence of scientifically important, well-preserved, unique or rare fossil material within the bedrock formations concerned here - notably those underlying the proposed wind turbine sites and access roads - as well as within the overlying superficial sediments (soil, alluvium, colluvium etc), the consequence of the anticipated palaeontological impacts is conservatively rated as *slight*.

Significance of impacts before mitigation: Very Low

Mitigation measures:

- The Environmental Control Officer (ECO) should be made aware of the possibility of important fossil remains (bones, teeth, petrified wood, plant-rich horizons etc) being found or unearthed during the construction phase.
- Monitoring of all major surface clearance and deeper (> 1 m) excavations for fossil material by the Environmental Site Officer (ESO) on an on-going basis during the construction phase is therefore recommended. Significant fossil finds should be safeguarded and reported at the earliest opportunity to Heritage Western Cape (Western Cape sites) or SAHRA (Northern Cape sites) for recording and sampling by a professional palaeontologist. A protocol for Chance Fossil Finds is appended Appendix 2 of the PIA (in Appendix D of this report). These recommendations must be included within the EMPr for the Kudusberg WEF development.
- Recording and sampling of important new fossil finds and relevant geological data.

Significance of impacts after mitigation: Very Low

D.1.2.3.4.3 **Impacts Identified for the Operational Phase**

❖ **No significant impacts on palaeontological heritage are anticipated.**

D.1.2.3.4.4 **Impacts Identified for the Decommissioning Phase**

❖ **No significant impacts on palaeontological heritage are anticipated.**

D.1.2.3.4.5 **Cumulative Impacts**

- **Potential loss of a significant fraction of fossil heritage preserved within the lower Abrahamskraal Formation of the SW Karoo through multiple wind farm developments in the Klein Roggeveld – Sutherland region.**

Cumulative impacts addressed here concern the potential loss of a significant fraction of scientifically valuable fossil heritage preserved within the lower Abrahamskraal Formation of the SW Karoo through multiple alternative energy developments in the Klein Roggeveld – Sutherland region.

Cumulative impacts inferred for the various alternative energy developments in the Klein-Roggeveld region between Matjiesfontein and Sutherland have been assessed here based on desktop and field-based palaeontological impact assessment reports for these projects, the great majority of which were submitted by the present author (See projects listed in Table D.1 and references provided in the full PIA under Almond and SAHRIS website). Several of the projects concerned lie within a radius of some 50-70 km of the proposed Kudusberg WEF project area (Figure D.1) Relevant published palaeontological literature for the region has also been taken into account (e.g. Loock *et al*. 1994, Day & Rubidge 2014). This assessment applies only to the construction phases of the WEF developments, since significant additional impacts on palaeontological heritage during the operational and de-commissioning phases are not anticipated.

It should be emphasized that, in the case of palaeontological heritage, it only makes sense to consider cumulative impacts on comparable fossil assemblages present in the same formations that are represented in the present study area as well as in the broader study region. WEF projects in the SW Karoo close to the Kudusberg WEF project area that share comparable fossil assemblages in the lower Abrahamskraal Formation include the following: Kareebosch WEF (Almond 2014), Karusa WEF (Almond 2015c), Rietkloof WEF (Almond 2016b), Brandvalley WEF (Almond 2016c), Esizayo WEF (Almond 2016f), Maralla West WEF (Almond 2016h) and Maralla East WEF (Almond 2016i). Additional PIAs (palaeontological impact assessments) of relevance include those for the Eskom Gamma-Omega 765kV transmission line (Almond 2010a) and the Komsberg Substation (Almond 2015b).

Unavoidable residual negative impacts may be partially offset by the improved understanding of Karoo palaeontology resulting from appropriate professional mitigation. This is regarded as a positive impact for Karoo palaeontological heritage. However, without mitigation the magnitude or consequence of cumulative (negative, direct) impacts of such a large number of WEFs affecting the same (albeit sparsely) fossiliferous rock successions would be significantly higher (moderate consequence) and probable (likely). The cumulative impact significance without mitigation is accordingly assessed as low.

<u>Significance of impacts before mitigation</u>: Very Low

<u>Mitigation measures</u>:

- Monitoring of all major surface clearance and deeper (> 1 m) excavations for fossil material by the ESO on an on-going basis during the construction phase is recommended.
- Significant fossil finds should be safeguarded and reported at the earliest opportunity to Heritage Western Cape (Western Cape sites) or SAHRA (Northern Cape sites) for recording and sampling by a professional palaeontologist.

- Proposed monitoring and mitigation recommendations made for all these various projects are followed through.

Significance of impacts after mitigation: Very Low

D.1.2.3.4.6 **No-go Impacts**

- **No significant impacts on palaeontological heritage are anticipated.**

D.1.2.3.5 **Impact Assessment Summary: Palaeontology impacts**

Impact	Mitigation measure	Significance before mitigation	Significance after mitigation
CONSTRUCTION PHASE			
Disturbance, damage or destruction of fossils.	Monitoring of major excavations for fossil material by the ESO on an on-going basis during construction phase Significant fossil finds to be reported to Heritage Western Cape (Western Cape sites) or SAHRA (Northern Cape sites) for recording and sampling by a professional palaeontologist. Recording and sampling of important new fossil finds and relevant geological data.	**Very low**	**Very low**
CUMULATIVE IMPACT			
Disturbance, damage or destruction of significant fraction of fossil heritage within the lower Abrahamskraal Formation (Karoo Supergroup).	Monitoring of major excavations for fossil material by the ESO on an on-going basis during construction phase Significant fossil finds to be reported to Heritage Western Cape (Western Cape sites) or SAHRA (Northern Cape sites) for recording and sampling by a professional palaeontologist. Proposed monitoring and mitigation recommendations made for all these various projects are followed through.	**Very low**	**Very low**

D.1.2.3.6 Comparative assessment of alternatives and comment on revised layout 1

As a consequence of (1) the paucity of irreplaceable, unique or rare fossil remains within the development footprint, as well as (2) the extensive superficial sediment cover overlying most potentially-fossiliferous bedrocks within the Kudusberg WEF study area, **the overall impact significance of the construction phase of the proposed wind energy project is assessed as *Very Low* (*negative status*).** This assessment applies to the wind turbines, laydown areas, access roads (including both alternatives on Urias Gat 193), on-site substation (all three site options), construction camps (all three site options) and associated infrastructure within the WEF project area. A comparable very low impact significance is inferred for all project infrastructure alternatives and layout options under consideration that are outlined in Section 1.2 of the PIA (Appendix D of this report) and the revised layout shown in Figure D.41 and D.42, This includes different options for routing of access roads, turbine layouts and siting of construction camp(s) and the on-site substation. **There are no preferences on palaeontological heritage grounds for any particular layout among the various options under consideration.**

D.1.2.3.7 Concluding statement

Provided that the recommended monitoring and mitigation measures outlined and tabulated in Section 1.8 of the PIA (Appendix D of this report) and in the summary impact assessment table above are followed through, residual impacts for the Kudusberg WEF are rated as **very low**. Inevitable loss of some fossil heritage during the construction phase may be - at least partially - offset by an improved understanding of local palaeontological heritage through professional recording and mitigation of any significant new fossil finds (positive impact).

It is concluded that the cumulative impact significance of the Kudusberg WEF and other regional projects is **very low** (negative), provided that the proposed monitoring and mitigation recommendations made for all these various projects are followed through. Unavoidable residual negative impacts may be partially offset by the improved understanding of Karoo palaeontology resulting from appropriate professional mitigation. This is regarded as a positive impact for Karoo palaeontological heritage. However, without mitigation the magnitude or consequence of cumulative (negative, direct) impacts of such a large number of WEFs affecting the same (albeit sparsely) fossiliferous rock successions would be significantly higher (moderate consequence) and probable (likely). The cumulative impact significance without mitigation is accordingly assessed as Very Low.

No significant further impacts on fossil heritage are anticipated during the operational and decommissioning phases of the WEF. The no-go alternative (i.e. no WEF development) will have a neutral impact on palaeontological heritage.

There are no fatal flaws in the Kudusberg WEF development proposal as far as fossil heritage is concerned. Provided that the proposed recommendations for palaeontological monitoring and mitigation are fully implemented, there are no objections from the palaeontologist on palaeontological heritage grounds to authorization of the Kudusberg WEF project.

D.1.2.4 Soils and Agriculture

The Agricultural Impact Assessment was undertaken by Johann Lanz to inform the outcome of this BA. The full Agricultural study is included in Appendix D of this report. The following section provides a summary of the Impact Assessment undertaken for the Agricultural Impact Assessment.

D.1.2.4.1 **Approach and methodology**

The area in which the development is proposed is of extremely low land capability and severely limited by climatic moisture availability. A field investigation was not therefore considered necessary. The assessment was based on a desktop analysis of existing soil and agricultural potential data for the site, as well as satellite imagery of the site available on Google Earth. This level of assessment is considered entirely adequate for a thorough assessment of all the agricultural impacts of the proposed development.

The potential impacts identified in this specialist study were assessed based on the criteria and methodology common to the whole impact assessment. The ratings of impacts were based on the specialist's knowledge and experience of the field conditions of the environment in which the proposed development is located, and of the impact of disturbances on that agricultural environment.

D.1.2.4.2 **Project aspects relevant to soil and agricultural impacts**

The components of the project that can impact on soils, agricultural resources and productivity are:

- Occupation of the land by the total physical footprint of the proposed project.
- Construction activities that may disturb the below surface soil profile, for example for levelling, excavations, etc.

The facility will comprise wind turbines with foundations, internal roads, buildings, a construction camp and a substation. For agricultural impacts, the exact nature of the different infrastructure within the facility has very little bearing on the significance of impacts. What is of most relevance is simply the occupation of the land, and whether it is being occupied by a turbine foundation, a hardstand, a building or a substation makes no difference. What is of most relevance therefore is simply the total footprint of the facility. The actual footprint of disturbance of the wind farm constitutes only a very small proportion of the available land. The wind farm infrastructure will only occupy approximately 2% of the surface area, based on typical figures for wind farms in South Africa (CSIR, 2015).

D.1.2.4.3 **Sensitivity of the site in relation to the proposed activity**

Agricultural sensitivity is directly related to the capability of the land for agricultural production. This Agricultural sensitivity is directly related to the capability of the land for agricultural production. This is because a negative impact on land of higher agricultural capability is more detrimental to agriculture than the same impact on land of low agricultural capability. Arable land is a scarce resource in South Africa and is therefore preservation worthy, and as a result has a high sensitivity. Land that is only suitable as grazing land, however, is not a particularly scarce resource and therefore has a low sensitivity. In terms of the sensitivity categories used in the REDZ sensitivity analysis, this site was assessed as low sensitivity (DEA, 2015).

The significance of all potential agricultural impacts is **kept low by three important factors**:

1. The actual footprint of disturbance of the wind farm (including associated infrastructure and roads) is very small in relation to the surface area of the affected farms. Therefore, the impact of erosion will not be widespread and can at worse only affect a very limited proportion of the surface area. All grazing will be able to continue unaffectedly across the farms.

2. The proposed site is on land of extremely limited agricultural potential that is only viable for low intensity grazing.

3. The proposed infrastructural footprint is concentrated on the crests of ridges, which are the rockiest parts of the landscape and the least suitable for any agricultural use.

Agricultural conditions and potential are uniform across the proposed footprint and the choice of placement of infrastructure therefore has no influence on the significance of agricultural impacts. No agriculturally sensitive areas occur within the investigated site and no parts of it therefore need to be avoided by the development. There are no required buffers.

D.1.2.4.4 **Soils and agriculture impacts**

D.1.2.4.4.1 **Impacts Identified for the Construction Phase**

❖ **Minimal soil and land degradation (erosion and topsoil loss) as a result of land disturbance.**

This is caused by soil disturbance and changes to the land surface and run-off characteristics, particularly due the establishment of roads and hardstands.

Significance of impacts before mitigation: Low

Proposed Mitigation Measure:

- Implement and maintain an effective system of storm water run-off control in all places where run-off accumulation poses an erosion risk. The system must effectively collect and safely disseminate any run-off water from all hardened surfaces and it must prevent any potential down slope erosion.

Significance of impacts after mitigation: Very Low

D.1.2.4.4.2 **Impacts Identified for the Operational Phase**

DIRECT IMPACT

❖ **Minimal soil and land degradation (erosion and topsoil loss) as a result of land disturbance.**

This is caused by soil disturbance and changes to the land surface and run-off characteristics, particularly due the establishment of roads and hardstands.

Significance of impacts before mitigation: Low

Proposed Mitigation Measure:

- Implement and maintain an effective system of storm water run-off control in all places where run-off accumulation poses an erosion risk. The system must effectively collect and safely disseminate any run-off water from all hardened surfaces and it must prevent any potential down slope erosion.

Significance of impacts after mitigation: Very Low

INDIRECT IMPACT:

❖ **Additional land use income (positive impact).**

Payment of rental to farmers by the WEF.

Significance of impacts before mitigation: Low (Positive)

Proposed Mitigation Measures:

- None

Significance of impacts after mitigation: N/A as there is no possible mitigation.

D.1.2.4.4.3 **Impact Identified for the Decommissioning Phase**

❖ **Minimal soil and land degradation (erosion and topsoil loss) as a result of land disturbance.**

This is caused by soil disturbance and changes to the land surface and run-off characteristics, particularly due the establishment of roads and hardstands.

Significance of impacts before mitigation: Low

Proposed Mitigation Measure:

- Implement and maintain an effective system of storm water run-off control in all places where run-off accumulation poses an erosion risk. The system must effectively collect and safely disseminate any run-off water from all hardened surfaces and it must prevent any potential down slope erosion.

Significance of impacts after mitigation: Very Low

D.1.2.4.4.4 **Cumulative Impacts**

❖ **Regional loss of agricultural land.**

This is caused by soil disturbance and changes to the land surface and run-off characteristics, particularly due the establishment of roads and hardstands associated with all the WEFs.

Significance of impacts before mitigation: Very Low

Proposed Mitigation Measures:

- Implement and maintain an effective system of storm water run-off control in all places where run-off accumulation poses an erosion risk. The system must effectively collect and safely disseminate any run-off water from all hardened surfaces and it must prevent any potential down slope erosion.

Significance of impacts after mitigation: Very Low

The formal assessment of the cumulative impact of the Kudusberg WEF has been assessed by consideration of other wind and solar PV projects located within a 50 km radius from the Kudusberg WEF (Table D.1 and Figure D.1). All of these developments have very similar impacts within a very similar agricultural environment, within the same REDZ.

The potential cumulative impact is a regional loss of agricultural land which was assessed to be of **very low significance before and after mitigation**. What is important in assessing this impact is that the cumulative impact is affecting an agricultural environment that has been declared a REDZ precisely because it is an environment that can accommodate numerous renewable energy developments without exceeding acceptable levels of agricultural land loss. This is primarily because of the low agricultural capability of land across the REDZ, and the fact that such land is not a scarce resource in South Africa. It is far more preferable to incur a cumulative loss of agricultural land in such a region, without cultivation potential, than to lose agricultural land that has a higher potential, to renewable energy development, elsewhere in the country.

Another important factor which renders the cumulative impact very low, is the fact that the footprint of disturbance of wind farms is very small in relation to available land (approximately 2% of surface area). Therefore, even if every single farm portion across the entire REDZ contained wind farms, the total cumulative footprint would never exceed 2% of the land surface, which would still be below acceptable levels of change. In reality the cumulative impact across the landscape is much lower because only a small percentage of farms is ever likely to contain wind farms.

D.1.2.4.4.5 **No-go alternative**

The no-go alternative considers impacts that will occur to the agricultural environment in the absence of the proposed development. The one identified potential such impact is that due to continued low rainfall in the area, in addition to other economic and market pressures on farming, the agricultural enterprises will come under increased pressure in terms of economic viability.

Because of the very low negative impacts of the development and its one positive economic impact (also low), the development is assessed, from an agricultural impact perspective, as the preferred alternative over the no-go alternative.

D.1.2.4.5 **Impact Assessment Summary: Agriculture impacts**

Impact	Mitigation measure	Significance before mitigation	Significance after mitigation
CONSTRUCTION PHASE			
Erosion by water and topsoil loss. Changes to the surface that lead to accumulation and channelling of run-off water can cause erosion. Because of the slopes, the aridity and the shallow soils, erosion risk is high.	Implement and maintain an effective system of storm water run-off control in all places where run-off accumulation poses an erosion risk. The system must effectively collect and safely disseminate any run-off water from all hardened surfaces and it must prevent any potential down slope erosion. Undertake a periodic site inspection to verify and inspect the effectiveness and integrity of the storm water run-off control system and to specifically record the occurrence of any erosion on site or downstream. Corrective action must be implemented to the run-off control system in the event of any erosion occurring. Corrective action must be implemented to the run-off control system in the event of any erosion occurring.	**Low**	**Very Low**
OPERATIONAL PHASE			
Direct impact			
Erosion by water and topsoil loss. Changes to the surface that lead to accumulation and channelling of run-off water can cause erosion. Because of the slopes, the aridity and the shallow soils, erosion risk is high.	Implement and maintain an effective system of storm water run-off control in all places where run-off accumulation poses an erosion risk. The system must effectively collect and safely disseminate any run-off water from all hardened surfaces and it must prevent any potential down slope erosion. Undertake a periodic site inspection to verify and inspect the effectiveness and integrity of the storm water run-off control system and to specifically record the occurrence of any erosion on site or downstream. Corrective action must be implemented to the run-off control system in the event of any erosion occurring.	**Low**	**Very Low**

Impact	Mitigation measure	Significance before mitigation	Significance after mitigation
	Corrective action must be implemented to the run-off control system in the event of any erosion occurring.		
Indirect impact			
Additional land use income will be generated by the farming enterprise through the lease of the land to the energy facility. This will provide the farming enterprise with increased cash flow and rural livelihood, and thereby improve its financial sustainability.	None	**Low (+)**	**N/A**
DECOMMISSIONING PHASE			
Erosion by water and topsoil loss. Changes to the surface that lead to accumulation and channelling of run-off water can cause erosion. Because of the slopes, the aridity and the shallow soils, erosion risk is high.	Implement and maintain an effective system of storm water run-off control in all places where run-off accumulation poses an erosion risk. The system must effectively collect and safely disseminate any run-off water from all hardened surfaces and it must prevent any potential down slope erosion. Undertake a periodic site inspection to verify and inspect the effectiveness and integrity of the storm water run-off control system and to specifically record the occurrence of any erosion on site or downstream. Corrective action must be implemented to the run-off control system in the event of any erosion occurring. Corrective action must be implemented to the run-off control system in the event of any erosion occurring.	**Low**	**Very Low**
CUMULATIVE IMPACT			
Cumulative impacts are likely to occur as a result of the loss of agricultural land on a regional basis because of other developments on agricultural land in the region.	Implement and maintain an effective system of storm water run-off control in all places where run-off accumulation poses an erosion risk. The system must effectively collect and safely disseminate any run-off water from all hardened surfaces and it must prevent any potential down slope erosion.	**Very Low**	**Very Low**

D.1.2.4.6 <u>**Comparative assessment of alternatives and comment on revised layout 1**</u>

There are no recommended alterations to the proposed layout. From an agricultural impact perspective there is no difference between any of the proposed alternatives and all of them are therefore preferred alternatives.

D.1.2.4.7 <u>**Concluding statement**</u>

All negative impacts were assessed as having **very low significance after mitigation**. The recommended mitigation measure is to implement an effective system of storm water run-off control.

Due to the low agricultural potential of the site, and the consequent very low, negative agricultural impact, there are no restrictions relating to agriculture which preclude authorisation of the proposed development (including all alternatives) and therefore, **from an agricultural impact point of view, the development should be authorised.**

D.1.2.5 Terrestrial Ecology

The Terrestrial Ecology Impact Assessment was undertaken by Ekotrust cc to inform the outcome of this BA. The full Ecology study (including nature, status, extent, duration, probability, reversibility, irreplaceability and confidence ratings) is included in Appendix D of this report. The following section provides a summary of the Impact Assessment undertaken for the Ecology study.

D.1.2.5.1 <u>**Approach and methodology**</u>

The study commenced as a desktop study, followed by field-based surveys from 17 to 20 July 2018 and a follow-up survey from 5 to 13 September 2018. The focus of the first site visit (17-20 July 2018) was to conduct surveys for the classification of the vegetation into plant associations (plant communities) and at the same time to search for Species of Conservation Concern (SCC). **The second site visit (5-13 September 2018) focused on searching for SCC and walk the entire project footprint to determine exact no-go areas and ground truth the CBA areas**. To accomplish this, most of the planned roads, turbine locations, crane pads, construction camps and substations (as indicated in the layout of July 2018) was traversed on foot. Both site visits were undertaken within the flowering seasons.

Hard copy and digital information from spatial databases, such as the geological survey maps (3220 Sutherland), Land Type maps (3220 Sutherland), daffarcgis.nda.agric.za, topocadastral maps (3220 CC Pienaarsfontein and 3220 CD Oliviersberg), vegetation types (Mucina & Rutherford 2006), NewPosa database of SANBI, and databases of the Animal Demography Unit, University of Cape Town, were sourced to provide information on topography, geology, land types, broad vegetation types, flora and fauna of the study area. Information on the climate was sourced from the Weather Bureau (1988, 1998).

Satellite images (Google Earth) were used to identify broad habitat types on site. The vegetation survey consisted of visiting the habitat types and systematically recording plant species on site, and estimating their cover- abundance. Physical habitat features were noted. A checklist of the plant species on site was compiled (see appendix A of the Terrestrial Ecology Report included in Appendix D of this BA Report). During the site visit, digital photographs were taken, and representative photographs of the different plant associations are included in the report. The site was also surveyed for rare, threatened and/or endemic plant species during the site visit.

The animal survey was limited to day-time visual assessments of the site. Animal species present on the site were mainly attained by means of direct or indirect sighting methods (animals, spoor, burrows, scats, sounds), whilst traversing the site by vehicle or on foot. Threatened species are generally uncommon and/or localised and the survey may have been insufficient to record their presence at or near the development.

Data analyses

A classification of the vegetation data was done with the TURBOVEG and JUICE computer programmes (Hennekens and Schaminee, 2001, Tichy *et al*., 2011). A differential table of the vegetation was compiled (Appendix C of the Terrestrial Ecology Report) and the different plant associations were described.

Plant species checklists

The checklist in appendix A of the Terrestrial Ecology Report was compiled from various sources. All plant species (the term species is used here in a general sense to denote species, subspecies and varieties) recorded during the site visit are listed in the checklist. A plant species checklist of the 3220CA, CB, CC and CD quarter degree grids was obtained from the NewPosa database of the South African National Biodiversity Institute (newposa.sanbi.org) and is also included in Appendix A of the Terrestrial Ecology Report. Additionally, the species listed by Van der Merwe et al. (2008a, 2008b) and Clark *et al*. (2011) are incorporated in the species list.

The checklist in appendix A of the Terrestrial Ecology Report is considered to represent the most up to date information on the species that could potentially occur on site.

Red Data plant species

The Red Data status, conservation and protected status of all plant species provided in Appendix A of the Terrestrial Ecology Report were determined from available literature and Acts, e.g. NEM:BA (2013), NCNCA (2009), WCNECO (1974, as amended 2000) and CITES (2017). The two site visits covered the flowering times of most of the SCC.

Fauna

Species lists (the term species is used here in a general sense to denote species, subspecies and varieties) of the faunal component were sourced from the Animal Demography Unit, University of Cape Town website (adu.uct.ac.za) and consulting of available databases and/or relevant literature, e.g. Skinner and Chimimba (2005) and Alexander and Marais (2007), to determine the diversity, conservation status and distribution of relevant faunal species. Bird and bat species are assessed by other specialists.

Sensitivity assessment

A sensitivity assessment of each plant association was done and a rating awarded. A sensitivity map was drawn based on a number of criteria discussed (see Section 8 of the Terrestrial Ecology Report for Ecological Sensitivity Analysis for full methodology.

Six physiognomic terrain types were identified that are floristically identifiable, i.e. (1) cliffs; (2) the mountain crests, upper plateaux and upper slopes; (3) the midslopes and mid-plateaux; (4) footslopes and lower plateaux; (5) plains; and (6) drainage lines (mountain streams and rivers in the valleys).

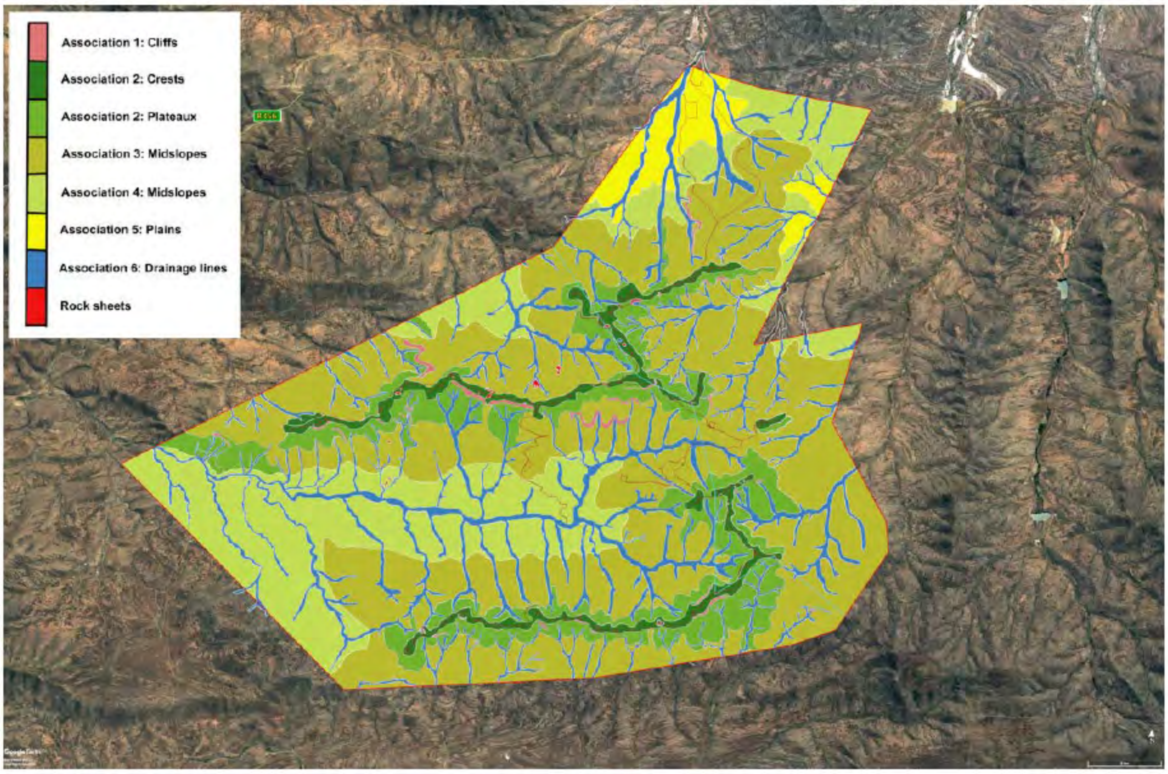


Figure D.26: Vegetation map and plant associations of the Kudusberg WEF.

D.1.2.5.2 **Project aspects relevant to ecological impacts**

The aspect of the project that will, from an ecological point of view, have the most important impacts is the clearance of the vegetation. Natural vegetation will be cleared for new access roads, upgrading of existing tracks, construction site, substation, turbines and crane pads. The removal of natural vegetation, in most instances near pristine vegetation, will result in many negative effects. The loss of the vegetation may cause a loss of individuals of threatened, protected and endemic species and it will also be accompanied by a loss of faunal habitat and possibly faunal species. Overall, this may lead to a loss of biodiversity. Vegetation loss is also invariably associated with increased water run-off and water and wind erosion. The clearance of the vegetation could also possibly cause alien vegetation to establish.

The construction of roads will not only cause a loss of vegetation, but also changes to the terrain. Changes in local habitat features, may change ecological processes at the proposed substation, construction camp and crane pads. The presence of the roads will also increase road traffic and concomitant faunal road kills. Faunal mortalities may be caused by groundworks at the footprint of the infrastructure, construction vehicles or other operational activities and waste material. In particular, slow-moving species such as tortoises, might be prone to these mortalities. Faunal mortalities may also be caused by electrical fences, should they be erected around the construction site and substation. Fatalities might also arise when animals ingest waste material or become ensnared in wires.

Construction activities will increase noise and light levels at the site. The elevated noise and light levels may alter the behavioural patterns of some animals. Construction activities will also increase dust levels.

D.1.2.5.3 Sensitivity of the site in relation to the proposed activity

Sensitivity of the site as determined by the Terrestrial Ecological study

Sensitivity is the vulnerability of a habitat to any impact, for example a dune, wetland or ridge system would be more vulnerable to development than would a sandy plain. Several features of the site were identified and assessed to derive a sensitivity score:

- threatened status of the regional vegetation type wherein the proposed site is situated;
- percentage of red list plant species per association;
- sensitivity according to the percentage of the association contained in a CBA, ESA and ONA;
- percentage of provincially protected plant species per association;
- percentage of endemic plant species per association (endemic to vegetation type or centre of endemism);
- conservation value of association (habitat) or site;
- degree of connectivity and/or fragmentation of the habitat;
- soil erosion potential; and
- resilience (this is a measure of the ability of a particular habitat/plant community to recover after an impact, i.e. high resilience infers low rating).

An **overall sensitivity model** was developed for each plant association on site (Table 8 of the Terrestrial Ecology study). This was achieved by weighting each criterion and calculating the sum for the association, which reflects the sensitivity and sensitivity ranking.

In general, these sensitivity ratings are interpreted as follow:

- **Very low** sensitivity means that a minimum score is allocated to almost all the sensitivity criteria used. It is usually applicable to habitats that have been transformed, especially by human activities. New WEF structures can be placed here.
- **Low** sensitivity means the sensitivity should not have an influence on the decision about the project. However, any protected species may not be removed/destroyed without a permit. New WEF structures can be placed here, subject to the relevant mitigation measures being implemented.
- **Moderate** means a sensitivity rating that is real and sufficiently important to require management,

  e.g. mitigation measures, management or protection of the rare/threatened fauna and flora, protection of a specific habitat on the property and/or rehabilitation.
- **High** means a sensitivity rating where the habitat should be excluded from any development. This would imply no turbines, crane pads, construction camps or substations. Roads should be restricted to a minimum, but are essential to reach the mountain crests where the bulk of the development will occur. Wherever possible, existing roads should be used, but if new roads are essential, it is imperative that the mitigation measures are implemented.
- **Very high** means a sensitivity rating that should influence the decision whether or not to proceed with the project. These areas exclude all turbines, crane pads, construction camp, substation and roads.

The study site is located in a remote area and covers the mountains and valleys of the Koedoesberg – Oliviersberg region. The area in general is in good condition with minimal disturbance. The high sensitivity rankings are largely the result of the high levels of protected species.

- **Association 1: Cliffs** – This association had a **Moderate** sensitivity. The cliffs however, represent essential habitat (refugia) for many faunal species and should not form part of the development (see section on impacts). The development should be able to proceed by avoiding the cliff habitat.
- **Association 2: Crest** – This association had a **Moderate** sensitivity. The WEF (roads and turbines) will primarily occupy this habitat.
- **Association 3: Midslopes** – The association had a **High** sensitivity. The roads leading to the mountain crests will inevitably pass through Association 3.
- **Association 4: Footslopes** – The association had a **Moderate** sensitivity. Some roads leading to the mountain crests will pass through this association.
- **Association 5: Plains** – This association had a **Low** sensitivity. Some roads leading to the mountain crests will pass through this association and the preferred construction site lies in this association.
- **Association 6**: **Rivers and streams** – This association had a **High** sensitivity. The roads leading to the mountain crests will have to cross some rivers and streams. A buffer of 32 m from the water course should always be applied when planning the roads. The recommendations of the aquatic specialists should be followed where rivers and streams and their buffer zones are concerned.

Sensitivity of the site associated with the initial project layout provided by the project applicant

Considering the CBA map of the Western Cape (Figure B.15); and the NPAES (Figure B.16), the sensitivity map provided in the SEA Report (CSIR, 2015), **the sensitivity map of the study site (Figure D.27) as ground truthed**; some turbines of the initial layout required realignment:

- Turbines 1, 3, 31, 35, 37, 42 lie partially on rocky sheets (Figure D.27). A slight re-alignment of the turbines should be possible.
- Turbine 22 lies on the peak of Oliviersberg, where the trigonometric beacon is situated. A slight re- alignment of turbine 22 should avoid the beacon.
- Turbine 36 lies in the buffer area of one of the vernal pools and should be shifted.
- Construction Camp site 1 includes a rocky sheet and would therefore not be a preferred option (Figure D.27).
- Turbines 9, 10 (partially), 27, 28, 29, 34 and 51 lie in a CBA (Western Cape).
- Furthermore, turbines 17 and 19 lie in an NPAES zone. These turbines however lie on the boundary of the area earmarked for NPAES and are located in a cadastral unit with a very small proportion being part of the NPAES.

The required changes would merely imply micro-siting. Since the distance between the Kudusberg WEF turbines is generally quite large, the adjacent turbine locations will probably not be affected. Similarly, the high sensitivity zones of the other specialist studies, should be taken into consideration, when designing the final layout. <u>NOTE: These turbines have all been repositioned in the revised layout (15 October 2018) to avoid the very high sensitivity areas-as indicated below.</u>

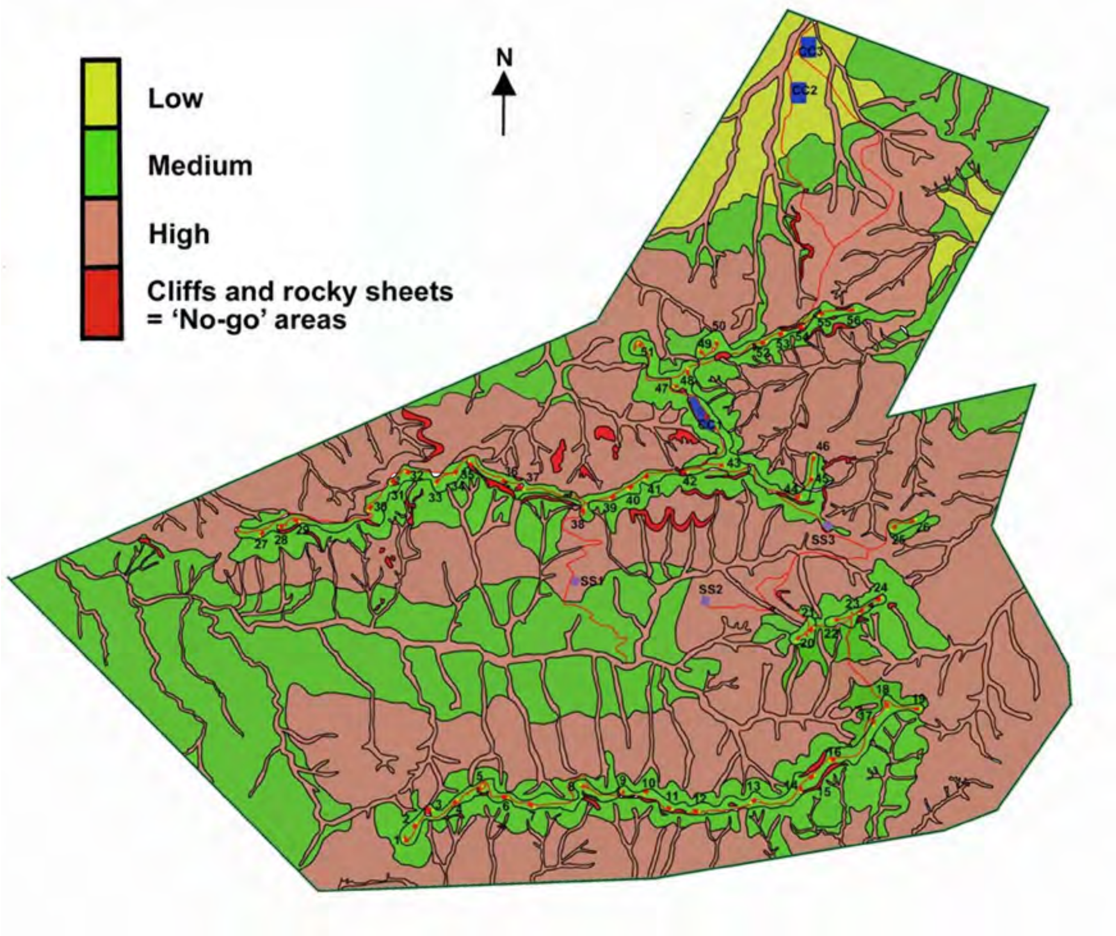


Figure D.27: Sensitivity map of the proposed Kudusberg WEF as determined in the Terrestrial Ecological Study

D.1.2.5.3.1 **Sensitivity of the site associated with the <u>revised project layout</u> provided by the project applicant.**

The project applicant revised the initial project layout based on sensitivities identified by the specialists on the project team.

Based on the revised layout, all turbines that were partially or entirely located on rocky sheets or cliffs were moved to avoid the 'Very High' sensitive feature. The changes that were effected in the revised layout are included in the introduction section of Section D above.

In four instances the revised road layout still either crossed or touched on a feature with very high sensitivity. These cases are explained in section 14 of the Ecology Impact Assessment (Appendix D) (colour codes; blue = buffers around small drainage lines; green = buffer around rivers; brown lines = rerouted roads; red lines = old road routes; red fill = very high ecology feature). The ecologist confirmed this to be acceptable. The access road corridor of 200 m will allow for further micro-sitting of access roads in order to optimise the design.

D.1.2.5.4 **Ecological impacts**

An assessment of the ecological impacts and their significance on the terrestrial system, is discussed and mitigation measures proposed. Overall, the roads will have the largest negative impact on the site.

D.1.2.5.4.1 **Sensitivity of vegetation to climate change**

Information as to how the vegetation in the study area will respond to climate change is currently still lacking. Higher temperatures and reduced rainfall would probably negatively affect SCC. In mountainous landscapes, such as the Kudusberg site, there are generally many small microhabitats where a favourable microclimate for a particular species might be available. For example, Scherrer and Körner (2011) found that local plant distribution patterns were associated with topographically induced mosaics of micro-climates. In afromontane regions, they suggested that suitable topohabitats can provide microclimate refugia over relative short distances and in spatially small areas for a species. This would imply that vegetation change due to climate change will be a fairly slow process in such regions.

D.1.2.5.4.2 **Impacts Identified for the Construction Phase**

DIRECT IMPACTS:

- **The clearing of natural vegetation.**

Natural vegetation will be cleared for new access roads, upgrading of existing tracks, construction site, substation, turbines and crane pads. The removal of natural vegetation, in most instances near pristine vegetation, will result in many negative effects. The loss of the vegetation may cause a loss of individuals of threatened, protected and endemic species, it will also be accompanied by a loss of faunal habitat. Overall, this may lead to a loss of biodiversity. Vegetation loss is also invariably associated with increased water run-off and erosion, both water and wind erosion.

Vegetation clearance will inevitably occur at the turbine locations, crane pads, roads, construction and substation sites and the loss of vegetation at these sites will be permanent with no mitigation possible. At the footprint, the severity of the impact is therefore extreme. **Beyond the footprint, environmental functions and processes should however, not be altered.**

Some destruction of the vegetation adjacent to the footprint will also inevitably occur when preparing the sites. Unnecessary clearing of vegetation beyond the footprint of the development can however, largely be avoided.

Significance of impacts before mitigation: High to Very High

Proposed mitigation measures:

- Vegetation clearance should be confined to the footprint of the development and unnecessary clearance should be avoided.
- Footprints of the turbines, crane pads, roads, construction and substation locations should be clearly demarcated.
- No collection of ‘fuelwood’ should be allowed on site.

Significance of impacts after mitigation: High

❖ The loss of Species of Conservation Concern (SCC)

The loss of the vegetation for new access roads, upgrading of existing tracks, construction site, substation, turbines and crane pads may cause a loss of individuals of SCC. The two site visits (during the design phase) did not reveal the presence of any species with a IUCN threatened status, although some SCC with a non-threatened status (NT or DD species and those classified by SANBI as Rare or Critically Rare) were observed. Most of these non- threatened SCCs occur as scattered individuals and cannot be avoided. Permits need to be obtained for their destruction.

Significance of impacts before mitigation: Low

Proposed mitigation measures:

- Placement of infrastructure should be done in such a way that no species with a **IUCN threatened status** are affected.
- A site visit or walk-through prior to construction of the access roads, construction site, substation, turbines and crane pads (final layout) to assess the presence of threatened SCC is proposed.

Significance of impacts after mitigation: Low

❖ The loss of faunal habitat.

The loss of the vegetation for new access roads, upgrading of existing tracks, construction site, substation site, turbines and crane pads will also be accompanied by a loss of faunal habitat.

Significance of impacts before mitigation: Moderate

Proposed mitigation measures:

- Vegetation clearance should be confined to the footprint of the development and unnecessary clearance should be avoided. However, at the footprint vegetation clearance is inevitable and cannot be mitigated.
- Footprints of the turbines, crane pads, roads, construction and substation locations should be clearly demarcated prior to clearing to limit the impact of loss of faunal habitat.
- The cliffs and rocky sheets are no-go areas and should be avoided entirely (see very-high sensitive areas mapped in Figure D.27. The revised layout adheres to this mitigation measure.

Significance of impacts after mitigation: Low

❖ Direct faunal mortalities

Faunal mortalities may be caused by groundworks at the footprint of the infrastructure, construction vehicles or other operational activities and waste material. In particular, slow-moving species such as tortoises, might be prone to these mortalities. Faunal mortalities may also be caused by electrical fences, should they be erected around the construction site and substation. Fatalities might also arise when animals ingest waste material or become ensnared in wires.

Significance of impacts before mitigation: Low to Moderate

Proposed mitigation measures:

- Construction crew, in particular the drivers, should undergo environmental training to increase their awareness of environmental concerns. All construction contractors and crew should attend and pass an induction course. Although all road kills cannot be avoided, the increased awareness of drivers should be able to reduce the number of fatalities.
- Proper waste management procedures should be in place to avoid waste lying around and where possible to remove all waste material from the site.
- Electrical fences should be erected according to the norms and standards of the Nature Conservation Authorities in the Western and Northern Cape.
- Night driving should be limited.
- Speed limits should be set on all roads on site.
- No dogs or other pets should be allowed on site with the exception of those belonging to the landowners.

Significance of impacts after mitigation: Low

- **Loss of animal refugia**

Animal refugia in some specialized habitats may be compromised by access routes. The cliffs, rocky outcrops and rock sheets are favoured habitat for many of the reptiles since they offer protection from predators. Destruction of these habitats will be associated with a reduction in the populations of these species.

Significance of impacts before mitigation: Moderate

Proposed mitigation measures:

- Development should avoid cliffs, rocky outcrops and rock sheets.

Significance of impacts after mitigation: Very Low

- **Increased dust depression.**

Increased dust deposition may harm physiological processes of plants and a reduction in the photosynthetic capacity of the plants may occur.

Significance of impacts before mitigation: Low

Proposed mitigation measures:

- Excessive dust can be reduced by spraying water onto the soil to control dust generation. Other suitable dust control mitigation measures can also be considered.
- Increased dust levels are largely temporary and primarily applicable to the construction (and decommissioning) phases.

Significance of impacts after mitigation: Very Low

- **Loss of certain plant and animal species due to collection (poaching)**

Some plant and animal species in the region are sought after by plant and animal collectors. As a result of the improved access (roads) to the area, illegal collection of plant and animal species may occur.

Significance of impacts before mitigation: Low

Proposed mitigation measures:

- Construction crew should undergo environmental training, by way of an induction course, to increase their awareness of environmental concerns.
- All instances of illegal collection should be reported to the Nature Conservation Authorities.
- Access to the site could be strictly regulated.

Significance of impacts after mitigation: Very Low

- **Increased noise and light levels**

Construction activities will increase noise and light levels at the site. The elevated noise and light levels may alter the behavioural patterns of some animals.

Significance of impacts before mitigation: Moderate

Proposed mitigation measures:

- Suitable mitigation to reduce construction noise as per recommendations of the noise specialist, should be implemented.
- The SANS standards should be adhered to.
- Appropriate lighting should be installed to minimize negative effects on nocturnal animals.
- No construction should be done at night.

Significance of impacts after mitigation: Low

INDIRECT IMPACTS:

- **Establishment of alien vegetation.**

As a result of the loss of indigenous vegetation and resulting degradation, alien species might invade the area. Alien invasive species are currently not common in the area, with only two declared invasive species recorded (*Salsola kali* and *Atriplex lindleyi* subsp. *inflata*). Increased vehicle traffic, and import of soil may however facilitate the introduction of seeds of alien species. Infestation by invasive alien species may cause changes to the structure and functioning of the ecosystem and often exacerbates the further loss of indigenous vegetation.

Significance of impacts before mitigation: Low

Proposed mitigation measures:

- Implement a monitoring program for the early detection of alien invasive plant species and a control program to combat declared alien invasive plant species should be employed.
- No alien species should be used in rehabilitation.

Significance of impacts after mitigation: Very Low

❖ Changes in animal behaviour.

The increased human presence and/or construction operations will increase noise levels as well as light levels at night. The increased human presence, elevated noise and light levels, loss of animal habitat and compaction of soils may alter the behavioural patterns of some animals. Some of these changes may favour certain species and negatively affect others and consequently change the composition of the animal communities. Some of these changes could possibly increase levels of predation. Territorial species such as steenbok, grey duiker and klipspringer will be negatively affected as well as species that live or move in the soil. These species might undergo a reduction in their population size.

Significance of impacts before mitigation: Moderate

Proposed mitigation measures:

- Development should avoid cliffs and rocky sheets as indicated in Figure D.27. The locations of the cliffs and rocky sheets have been identified and provided as a .kmz file.
- Soil compaction should be kept to a minimum by restricting driving to designated roads.
- Construction crew should undergo environmental training, by way of an induction course, to increase their awareness of environmental concerns.
- Appropriate lighting should be installed to minimize negative effects on nocturnal animals.
- No construction should be done at night, as far as possible.
- Suitable mitigation to reduce construction noise as per recommendations of the noise specialist, should be implemented.
- Both increased noise and light levels are temporary and should normalize once all construction has ceased.

Significance of impacts after mitigation: Low

❖ Changes in community structure of plants.

The vegetation clearance, soil compaction and high levels of disturbance will alter the physical character of a habitat. Some species will be more negatively affected than others and competitive hierarchies may change and consequently the composition of the plant communities may change. Pioneer species could increase.

Significance of impacts before mitigation: Moderate

Proposed mitigation measures:

- Soil compaction should be kept to a minimum by restricting driving to designated roads.
- Vegetation clearing and other disturbance should be restricted to the footprint of the development.
- Construction crew should undergo environmental training, by way of an induction course, to increase their awareness of environmental concerns.

Significance of impacts after mitigation: Low

❖ **Increased erosion and water run-off.**

Increased erosion (water and wind) and water run-off will be caused by the clearing of the indigenous vegetation and compaction of soil. The roads up the mountain slopes will be the main source of disturbance and erosion if not properly constructed and provided with water run-off structures. The construction site, substation site and crane pads will furthermore be levelled and compacted causing additional run-off and erosion. Increased run-off and erosion could affect hydrological processes in the area and will change water and silt discharge into the streams.

Significance of impacts before mitigation: High

Proposed mitigation measures:

- Clearing of vegetation, compaction and levelling should be restricted to the footprint of the proposed development.
- A suitably qualified person should plan, design and supervise the proper construction of roads to minimize the impact on the environment.
- Roads should be provided with run-off structures.
- Roads should be designed to reduce the risk of erosion, in particular on 'High' sensitivity midslopes.

Significance of impacts after mitigation: Low

D.1.2.5.4.2 Impacts Identified for the Operational Phase

DIRECT IMPACTS:

❖ **The clearing or disturbance of natural vegetation.**

Clearing or disturbance of natural vegetation should be limited during the operational phase, although some removal might still arise due to maintenance activities.

Significance of impacts before mitigation: Low

Proposed mitigation measures:

- Vegetation clearance should be avoided wherever possible and new areas should not be denuded.
- Driving should be restricted to designated roads.

Significance of impacts after mitigation: Very Low

❖ Direct faunal mortalities

Faunal mortalities may be caused by maintenance vehicles or other maintenance activities and waste. Faunal mortalities may also be caused by electrical fences, should they be erected around the construction site and substation. In particular, slow-moving species such as tortoises, might be prone to road mortalities. Fatalities might also arise when animals ingest waste material or become ensnared in wires.

Significance of impacts before mitigation: Low

Proposed mitigation measures:

- Maintenance crew should undergo environmental training, by way of an induction course, to increase their awareness of environmental concerns.
- All excess wires and waste material should be removed from the site.
- Electrical fences should be erected according to the norms and standards of the Nature Conservation Authorities in the Western and Northern Cape.
- Night driving should be limited as far as possible.
- Speed limits should apply on all roads on site.

Significance of impacts after mitigation: Very Low

❖ Increased noise levels

Turbines will increase noise levels on site during the operational phase. The elevated noise levels may alter the behavioural patterns of some sensitive animal species.

Significance of impacts before mitigation: Low

Proposed mitigation measures:

- Follow mitigation measures proposed by noise specialist and adhere to SANS standards.

Significance of impacts after mitigation: Low

❖ Loss of certain plant and animal species due to collection (poaching)

Some plant and animal species in the region are sought after by plant and animal collectors. As a result of the improved access to the area, illegal collection of plant and animal species may occur.

Significance of impacts before mitigation: Low

Proposed mitigation measures:

- Limit or control access to the site from the north.
- Maintenance crews and operational staff should undergo environmental training, by way of an induction course, to increase their awareness of environmental concerns.
- All instances of illegal collection should be reported to the Nature Conservation Authorities.

Significance of impacts after mitigation: **Very Low**

INDIRECT IMPACTS:

❖ Establishment of alien vegetation

As a result of the loss of indigenous vegetation and resulting degradation, alien species might invade the area. Increased vehicle traffic and import of soils may facilitate the introduction of seeds of alien species. Infestation by invasive alien species may eventually cause changes to the structure and functioning of the ecosystem and often exacerbates the further loss of indigenous vegetation.

Significance of impacts before mitigation: Low

Proposed mitigation measures:

- Implement a monitoring program for the early detection of alien invasive plant species.
- A control program to combat declared alien invasive plant species should be employed.
- No alien species should be used in rehabilitation.

Significance of impacts after mitigation: Very Low

❖ Changes in animal behaviour

The loss of vegetation cover, compacting of soils, increased noise levels and the increased human presence will alter animal behavioural patterns by making certain sites unavailable, making roads difficult to traverse, and increasing levels of predation. Some animal species will be more severely affected than others. See examples under construction. These species might undergo a reduction in their population size. However, no new vegetation loss is anticipated during the operational phase and impacts on animal behaviour that are relevant during the operational stage are the residual impacts that could not be mitigated during the construction phase. Many of the smaller animals might return after the construction phase.

Significance of impacts before mitigation: Moderate

Proposed mitigation measures:

- Development should avoid cliffs and rocky sheets demarcated as no-go areas in the accompanying .kmz file as mapped in Figure D.27.
- Soil compaction should be kept to a minimum by restricting driving to designated roads.
- Operation crew should undergo environmental training, by way of an induction course, to increase their awareness of environmental concerns.
- Appropriate lighting should be installed to minimize negative effects on nocturnal animals.

Significance of impacts after mitigation: Low

❖ **Increased erosion and water run-off**

Increased erosion and water run-off will be caused by the clearing of the indigenous vegetation and soil disturbance during the construction phase. Where compaction occurred, the vegetation will not re-establish easily and increased run-off and erosion will continue. Increased run-off and erosion could affect hydrological processes in the area and will change water discharge into the streams and increase silt load. However, no new roads are to be constructed in the operational phase as part of the wind farm and impacts due to increased erosion and water run-off during the operational stage will largely be the residual impacts that could not be mitigated.

Significance of impacts before mitigation: Moderate

Proposed mitigation measures:

- Proper road maintenance procedures should be in place.
- Should new sections of the road be needed a suitably qualified person should plan, design and supervise the proper construction of roads.

Significance of impacts after mitigation: Low

D.1.2.5.4.3 Impacts Identified for the Decommissioning Phase

DIRECT IMPACTS:

❖ **The clearing of natural vegetation**

Natural vegetation will be cleared for a new ‘construction’ camp. Some roads verges might also have to be cleared again.

Significance of impacts before mitigation: Low

Proposed mitigation measures:

- Vegetation clearance should be confined to the decommissioning camp and unnecessary clearance should be avoided.
- The site of the decommissioning camp should be the same as the original construction camp.
- Furthermore, no new access routes should be established but existing roads should be used.
- No collection of 'fuelwood' should be allowed on site.
- Areas where infrastructure was removed should be rehabilitated.

Significance of impacts after mitigation: Very Low

❖ **Direct faunal mortalities**

Faunal mortalities may be caused by vehicles or other decommissioning activities and waste. In particular, slow-moving species such as tortoises, might be prone to road mortalities. Fatalities might also arise when animals ingest waste material or become ensnared in it.

Significance of impacts before mitigation: Low

Proposed mitigation measures:

- Decommissioning crew should undergo environmental training, by way of an induction course, to increase their awareness of environmental concerns. Although all faunal mortalities by construction vehicles cannot be avoided, the increased awareness of drivers should be able to reduce the number of fatalities.
- Night driving should be restricted as far as possible.
- Speed limits should be set on all roads on site.
- Proper waste management procedures should be in place and no material should be left on site. Proper waste management should reduce the instances of ensnarement or ingestion of foreign material.
- All material brought in for the construction of the WEF should be removed.

Significance of impacts after mitigation: Very Low

❖ **Increased dust deposition**

Increased dust deposition may harm physiological processes of plants. Increased dust levels are largely temporary.

Significance of impacts before mitigation: Low

Proposed mitigation measure:

- Excessive dust can be reduced by spraying water onto the soil to control dust. Other suitable dust control mitigation measures can also be considered.

Significance of impacts after mitigation: Very Low

INDIRECT IMPACTS:

❖ **Changes in animal behaviour**

The increased human presence and decommissioning operations will increase road traffic, noise levels as well light levels at night. The influences may alter the behavioural patterns of some animals. These will be transient impacts and will discontinue as soon as the decommissioning is completed. See construction and operational phases for examples.

Significance of impacts before mitigation: Moderate

Proposed mitigation measures:

- Decommissioning crew should undergo environmental training to increase their awareness of environmental concerns.
- Soil compaction should be kept to a minimum by restricting driving to designated roads.
- Appropriate lighting should be installed to minimize negative effects on nocturnal animals.
- No decommissioning should be done at night.
- Noise levels due to decommissioning cannot be mitigated. Both increased noise and light levels are temporary and should normalize once all decommissioning has ceased.

Significance of impacts after mitigation: Low

❖ **Increased erosion and water run-off.**

Some of the existing roads might have to be upgraded and increased erosion and water run-off will be caused by the clearing of the indigenous vegetation and soil disturbance during the decommissioning phase. Increased run-off and erosion could affect hydrological processes in the area and will change water discharge into the streams and increase silt load.

Significance of impacts before mitigation: Low

Proposed mitigation measure:

- No new roads should be built as part of the decommissioning of the wind farm.
- Proper road maintenance procedures should be in place.

Significance of impacts after mitigation: Very Low

D.1.2.5.4.4 Cumulative Impacts

Cumulative impacts were evaluated in the light of the large number of proposed wind energy facilities in a 50 km radius of the Kudusberg WEF.

❖ **Vegetation loss and habitat destruction.**

Vegetation loss and habitat destruction of particularly the mountain crest vegetation, around which most of the developments are centred, will occur. The habitat destruction will lead to changes in the physical features of the habitat, with concomitant changes in ecological processes. Secondary vegetation will develop at sites where the vegetation was cleared or the soil compacted. The species composition of the associations may change and alien species might invade. Vegetation loss will also constitute the loss of animal habitat. A rough estimate indicates that within the Kudusberg WEF site the mountain crest habitat covers only approximately 10% of the total area (according to land type data). Considering all the developments in the region, the WEFs will cause a severe impact on the mountain crest habitat and its associated fauna and flora.

Possibilities for mitigation are limited because the vegetation loss is essential for the construction of roads, turbines, construction and substation sites and crane pads.

Significance of impacts before mitigation: High

Proposed mitigation measure:

- All projects should adhere to the site-specific recommendations of the ecologists to ensure that all facilities mitigate impacts where possible. The Kudusberg WEF is to adhere to the mitigation measures proposed in this report.

Significance of impacts after mitigation: Moderate

❖ **Loss of Species of Conservation Concern (SCC)**

The loss of vegetation might cause the loss of SCC especially since the WEF developments occur over such a large area. This would primarily be applicable to threatened and rare plant species that have a restricted distribution range. No threatened SCCs were recorded during the two site visits. Some individuals classified as Near Threatened, Data Deficient or those classified as Rare by SANBI will however be lost.

Significance of impacts before mitigation: Moderate

Proposed mitigation measure:

- Once the final layout is available, a site visit or walk-through prior to construction of the access roads, construction site, substation, turbines and crane pads to assess the presence of threatened SCC is proposed. Placement of infrastructure should be done in such a way that no threatened SCCs are affected.

Significance of impacts after mitigation: Low

❖ **Dissection of mountain crest habitat**

Dissection of the mountain crest habitat by a network of roads. Some burrowing animal species will find traversing these compacted roads difficult and levels of predation on these species might increase.

Possibilities for mitigation are limited because the road network is essential for the development.

Significance of impacts before mitigation: Moderate

Proposed mitigation measures:

- Do not place fences along the roads.
- Use existing roads as much as possible.

Significance of impacts after mitigation: Moderate

Turbine noise

Turbines will increase noise levels above current levels. These increased noise levels might affect animal behaviour and might result in changes in faunal composition. The turbine noise would affect the entire mountain crest habitat in the region, reducing the possibilities of migration for animal species sensitive to the noise.

Significance of impacts before mitigation: Low

Proposed mitigation measure:

- The mitigation measures as indicated by the noise specialist must be adhered to.

Significance of impacts after mitigation: Low

Compromising integrity of CBA, ESA and NPAES

According to the 2017 mapping of CBAs in the Western Cape, the site is contained largely within an ESA and partly in a CBA. Development within CBAs is typically not encouraged as such development may result in biodiversity loss and therefore compromise the integrity of the CBA. Development is only permitted in a CBA on condition approval is granted by the relevant competent authority. The loss of the area might also have an effect on the future suitability of the terrain as protected area, although only a small portion of the site is contained in an area earmarked for the National Protected Area Expansion Strategy. Considering the large number of developments in the region, all CBAs in the region could be compromised and consequently the biodiversity target for ecosystems could be affected.

Significance of impacts before mitigation: High

Proposed mitigation measure:

- The turbines falling within CBAs could possibly be moved to alternative locations that are outside the CBAs. Implement revised layout 1 instead of the initial layout.

Significance of impacts after mitigation: Low

❖ **Increased erosion and water run-off**

Increased water run-off and erosion will alter hydrological processes and might affect catchments and downstream habitats especially since increased erosion and water run-off will occur on all mountain slopes in the area.

Significance of impacts before mitigation: Moderate

Proposed mitigation measures:

- A suitably qualified person should plan, design and supervise the proper construction of roads to minimize the impact on the environment.
- Roads should be provided with run-off structures.
- Roads should be designed to reduce the risk of erosion, in particular in the midslope habitat that has a 'High' sensitivity.

Significance of impacts after mitigation: Low

D.1.2.5.4.3 **No-go Impacts**

The "no-go" development alternative option assumes the site remains in its current state, i.e. there is no construction of a WEF and associated infrastructure in the proposed project area.

Provided all mitigation measures are applied and all very high sensitivity zones identified by the specialists are avoided, the project could be approved and therefore the no-go is not preferred.

D.1.2.5.5 **Impact Assessment Summary: Terrestrial Ecology impacts**

Impact	Mitigation measures	Significance before mitigation	Significance after mitigation
CONSTRUCTION PHASE			
Direct Impacts			
Clearing of natural vegetation	• Confine clearance to footprint of development. • Demarcate all footprints clearly. • No fuelwood collection.	High – Very High (it should be noted that the overall significance of the project is considered to be **low)**	High (within the footprint, but sufficient crest habitat available for ecological patterns and processes to continue unaltered)
Loss of Species of Conservation Concern	• Location of footprint such that no threatened SCC are affected. • A walk-through prior to construction of the access roads, construction site, substation, turbines and crane pads to assess the presence of threatened SCC is proposed.	Low	Low
Loss of faunal habitat	• Confine clearance to footprint of development. • Demarcate all footprints clearly. • The cliffs and rocky sheets are no- go areas and should be avoided entirely. • No pets on site, except those of landowners.	Moderate	Low
Direct faunal mortalities	• Environmental training of construction crew. • Proper waste management procedures. • Electrical fences to standards of conservation authorities. • Limited night driving. • Speed limits.	Low - moderate	Low
Loss of animal refugia	• Development should avoid cliffs and rocky sheets.	Moderate	Very low
Increased dust deposition	• Apply suitable dust control measures	Low	Very low
Loss of animal and plant species by illegal collecting	• Strict access control. • Report instances to nature conservation authorities. • Environmental training of construction crew.	Low	Very low

Impact	Mitigation measures	Significance before mitigation	Significance after mitigation
Increased noise and light levels	• Apply suitable mitigation as recommended by noise specialist • Appropriate lighting should be installed to minimize negative effects on nocturnal animals • Adhere to SANS lighting and noise standards • No construction at night.	Moderate	Low
Indirect Impacts			
Establishment of alien vegetation	• Initiate an Invasive Alien Species Programme. • No alien species should be used for rehabilitation.	Low	Very low
Changes in animal behaviour	• No development on cliffs and rocky sheets. • Restrict soil compaction to footprint. • Environmental training of construction crew. • Appropriate lighting should be applied. • No construction at night.	Moderate	Low
Changes in community composition of plants	• Restrict soil compaction and vegetation clearance to footprint. • Environmental training of construction crew.	Moderate	Low
Increased erosion and water run-off	• Planning, design and supervision of all roads by suitably qualified person. • Roads must have water run-off structures. • Roads to be planned to avoid risk of erosion. • Restrict activities to footprint	High	Low
OPERATIONAL PHASE			
Direct Impacts			
Clearing and disturbance of natural vegetation	• Driving should be restricted to existing roads. • Avoid clearance of new areas.	Low	Very low
Direct faunal mortalities	• Restrict driving at night. • Environmental training of maintenance crew. • All waste material removed from site. • Maintain electrical fences according the accepted standards. • Apply speed limits on roads.	Low	Very low

Impact	Mitigation measures	Significance before mitigation	Significance after mitigation
Increased noise levels	• Follow mitigation measures proposed by noise specialist and adhere to the SANS standards	Low	Low
Loss of animal and plant species by illegal collecting	• Strict access control. • Report instances to nature conservation authorities. • Environmental training of maintenance and operational crew.	Low	Very low
Indirect Impacts			
Establishment of alien vegetation	• Initiate an Invasive Alien Species Programme. • No alien species should be used for rehabilitation.	Low	Very low
Changes in animal behaviour	• No development on cliffs and rock sheets. • Restrict soil compaction to footprint. • Environmental training of maintenance and operational crew. • Appropriate lighting.	Moderate	Low
Increased erosion and water run-off	• Planning, design and supervision of all roads by suitably qualified person. • Roads must have water run-off structures. • Proper road maintenance procedures should be in place	Moderate	Low
DECOMMISSIONING PHASE			
Direct Impacts			
Clearing and disturbance of natural vegetation	• Clearance should be limited to decommissioning camp. • Decommissioning camp should be at same location as construction camp. • Driving should be restricted to existing roads. • Rehabilitation of areas where infrastructure was removed. • No fuelwood collection.	Low	Very low
Direct faunal mortalities	• Environmental training of decommissioning crew. • All material brought in for WEF should be removed again.	Low	Very low
Increased dust deposition	• Apply suitable dust control measures.	Low	Very low

Impact	Mitigation measures	Significance before mitigation	Significance after mitigation
Indirect Impacts			
Changes in animal behaviour	• Driving only on designated roads. • Restrict soil compaction to footprint. • Environmental training of decommissioning crew. • Appropriate lighting. • Apply mitigation measures proposed by noise specialist.	Moderate	Low
Increased erosion and water run-off	• No new roads to be constructed. • Proper road maintenance	Low	Very low
CUMULATIVE IMPACT			
Direct Impacts			
Vegetation loss and habitat destruction	• All projects should adhere to the site-specific recommendations of the ecologist to ensure that all facilities mitigate impacts where possible. The Kudusberg WEF is to adhere to the mitigation measures proposed in this report.	High	Moderate
Loss of Species of Conservation Concern	• Once the final layout is available, a site visit or walk- through prior to construction to the access roads, construction site, substation, turbines and crane. pads to assess the presence of threatened SCC is proposed.	Moderate	Low
Dissection of mountain crest habitat	• No fences along roads. • Use existing roads where possible.	Moderate	Moderate
Turbine noise	• SANS standards must be adhered to.	Low	Low
Compromising integrity of CBA, ESA and NPAES	• The relocation of those turbines falling in a CBA could be investigated.	High	Low
Increased erosion and water run-off	• A suitably qualified person should plan, design and supervise the proper construction of roads to minimize the impact on the environment. • Roads should be provided with run-off structures. • Roads should avoid steep slopes.	Moderate	Low

D.1.2.5.6 **Comparative assessment of alternatives and comment on revised layout 1**

The preferred option for the construction camp is option 2. Option 3 was found to be flawed by the heritage specialists and option 1 was in a visual very high sensitivity zone and furthermore contained a rocky sheet. The preferred option for the substation is option 3, followed by option 1 (option 2 was withdrawn by the landowner). The preferred northern access route is the western one (Alternative 1), which could follow an existing track and is also shorter than the eastern route (Alternative 2). None of the options are flawed.

The revised layout 1 adheres to the recommendations made by the ecologist and are therefore supported.

D.1.2.5.7 **Concluding statement**

The current layout lies predominantly in a **moderate sensitivity zone** (see Sensitivity analysis in Figure D.27). After mitigation measures have been applied, most of the impacts had a low or very low score. In spite of the total loss of the vegetation within the 126 ha footprint, large portions of the crest and midslope habitats still remain unaffected to ensure that ecological patterns or processes continue without being adversely **affected.**

It is imperative that the turbines (1, 3, 31, 35, 37, 42, 22 and 36) falling partially or entirely in no-go areas (very high sensitivity) identified in the current study should be repositioned so as to avoid these areas. **NOTE: These turbines have all been repositioned in the revised layout (15 October 2018) to avoid the very high sensitivity areas**.

There is therefore no prohibitive distinct reason or objection from an ecological perspective for the project being granted EA.

D.1.2.6 Freshwater Ecology

The Freshwater Impact Assessment was undertaken by BlueScience (Pty) Ltd to inform the outcome of this BA. The full Freshwater Impact Assessment (including nature, status, extent, duration, probability, reversibility, irreplaceability and confidence ratings) is included in Appendix D of this report. The following section provides a summary of the Impact Assessment undertaken for the Freshwater Assessment.

D.1.2.6.1 **Approach and methodology**

Input into this report was informed by a combination of desktop assessments of existing freshwater ecosystem information for the study area and surrounding catchments, as well as by a more detailed assessment of the freshwater features on the various farm portions that comprise the study area.

The site was visited in the rainy season for two days in July 2018 (21-22 July 2018), as well as in the spring for a single day (10 October 2018) to further verify an aquatic feature. No additional site visits were deemed necessary. During the field visits, the characterisation and integrity assessments of the freshwater features were undertaken. Mapping of the freshwater features was undertaken using a GPS Tracker and mapped in PlanetGIS and Google Earth Professional.

The following techniques and methodologies were utilised to undertake this study:

1. The guideline document, "A Practical Field Procedure for the Identification and Delineation of Wetlands and Riparian Areas" document, as published by DWAF (2005) was followed for the delineation of the wetland areas. According to the delineation procedure, the wetlands were delineated by considering the following wetland indicators: terrain unit indicator; soil form indicator; soil wetness indicator; and vegetation indicator;

2. The wetlands were subsequently classified according to their hydro-geomorphic determinants based on a classification system devised by Kotze et al (2004) and SANBI (2009). Notes were made on the levels of degradation in the wetlands based on field experience and a general understanding of the types of systems present;

3. A Present Ecological State (PES) assessment was conducted for each hydro-geomorphic wetland unit identified and delineated within the study area;

4. The functional wetland assessment technique, WET-EcoServices, developed by Kotze et al (2009) was used to provide an indication of the ecological benefits and services provided by delineated wetland habitat. This technique consists of assessing a combination of desktop and infield criteria to identify the importance and level of functioning of the wetland units within the landscape;

5. The present ecological condition of the watercourses was determined using national River Health Programme methodologies as described in this report;

6. The ecological importance and ecological sensitivity (EI&ES) assessment of the wetlands and watercourses were conducted according to the guidelines as developed by DWAF (1999); and

7. Recommendations are made with respect to the adoption of buffer zones within the development site, based on the wetlands functioning and site characteristics.

D.1.2.6.2 **Project aspects relevant to ecological impacts**

The project infrastructures as described in Section A would be in place for the operational phase of the project and could potentially impact on aquatic features over the longer term. No site or layout alternatives are being considered as part of the assessment however the proposed layout will be amended where necessary, based on specialist input.

Most of the potential aquatic ecosystem impacts of the proposed WEF are likely to take place during the construction phase. These potential impacts and the associated issues identified include:

- Disturbance of aquatic habitats within the watercourses and wetland areas with the associated impacts to sensitive aquatic biota;
- The removal of indigenous riparian and instream vegetation that will reduce the ecological integrity and functionality of the watercourses;
- Demand for water for construction could place a stress on the existing available water resources;
- Alien vegetation infestation within the aquatic features due to disturbance; and
- Increased sedimentation and risks of contamination of surface water runoff during construction.

During the operational phase of the proposed WEF, potential impacts would include:

- Ongoing disturbance of aquatic features and associated vegetation along access roads or adjacent to infrastructure that needs to be maintained;
- Modified runoff characteristics from hardened surfaces that has the potential to result in erosion of hillslopes and watercourses; and
- Water supply (and possibly sanitation services) required for the operation of the facility.

D.1.2.6.3 <u>**Sensitivity of the site in relation to the proposed activity**</u>

In terms of biodiversity importance, the study area is located within an Upstream River Freshwater Ecosystem Priority Area. The Brak River as well as portions of the Jakkalshok and Ongeluks Rivers (rivers in the valleys between the ridges on which the wind turbines are placed) is mapped as aquatic CBAs where they occur within terrestrial CBAs. The remainder of the watercourses are mapped as aquatic ESAs. Very limited aquatic ESAs occur where there is localised disturbance within the watercourses such as at the gravel road crossings. There is also a wetland at the source of the largest southwards flowing tributary of the Ongeluks River that is mapped as an aquatic CBA. Most of the terrestrial areas adjacent to the watercourses in the area are mapped as ONAs.

Within the Northern Cape CBA mapping, most of the watercourses occur within ESAs, with reaches that are on the mid-slopes of the hillsides being mapped as ONAs. The width of the ESA corridor along the Windheuwels River (a tributary of the Tankwa River where the proposed access to the WEF is located) within the site is 1000 m wide. There is a CBA located along the upper Windheuwels River that is avoided by the project activities.

The larger watercourses in the study area, Muishond, Ongeluks, Jakkalshok, Brak, Windheuwels, Wilgebos and Kleinpoorts Rivers, have a high ecological importance and sensitivity while the smaller tributaries/drainage features are of a moderate ecological importance and sensitivity. The larger watercourses tend to be more ecologically important but less sensitive to impacts while the smaller tributaries are less ecologically important but more sensitive to flow, water quality and habitat modification. The wetland features within the study area are considered of moderate ecological importance and sensitivity. The hillslope seeps and valley bottom wetlands are closely associated with the rivers in the area and the importance of the habitat in providing ecological corridors for the movement of biota. The vernal pools are small but contain a unique aquatic habitat and specific associated biota.

The risk assessment undertaken by the Freshwater specialist determined that the proposed development of the Kudusberg WEF poses a low risk of impacting aquatic habitat, water flow and water quality. With these findings of the risk assessment, the water use activities associated with the proposed project could potentially be authorised by means of the general authorisations for the Section 21(c) and (i) water uses. A Water Use Licence (WUL) may however be required for the abstraction of water for the WEF which would require that an application for a WUL be submitted to the Department of Water and Sanitation (DWS) for the entire project related activities.

The recommended ecological condition of the aquatic features in the area would be that they remain in their current ecological condition and should not be allowed to degrade further. The recommended buffer area between the aquatic features and the project components (turbines, crane pads, substations and construction camps) (please note this excludes roads) to ensure these aquatic ecosystems are not impacted by the proposed activities, is as follows:

- Smaller streams and drainage lines, together with their seeps: at least 50 m from the centre of these streams or the delineated wetland edge (whichever is the furthest);

- The larger rivers within the valley floor, together with their valley bottom wetlands: at least 100 m, measured from the top of bank of the river channels or the delineated wetland edge (whichever is the furthest); and

- The vernal pool and other wetland areas: at least 50 m, measured from the top of bank of the delineated wetland edge.

These recommended buffers are in line with the watercourse and wetland buffers that have been recommended in the Strategic Environmental Assessment for Wind and Solar Photovoltaic Energy in South Africa (CSIR, 2015) and are deemed appropriate to the aquatic features and the proposed activities within the study area. The buffers are shown in Figure D.28 and Table D.3. Table D.3 shows the initial project layout with an explanation of how this layout was revised to avoid the freshwater sensitive areas.

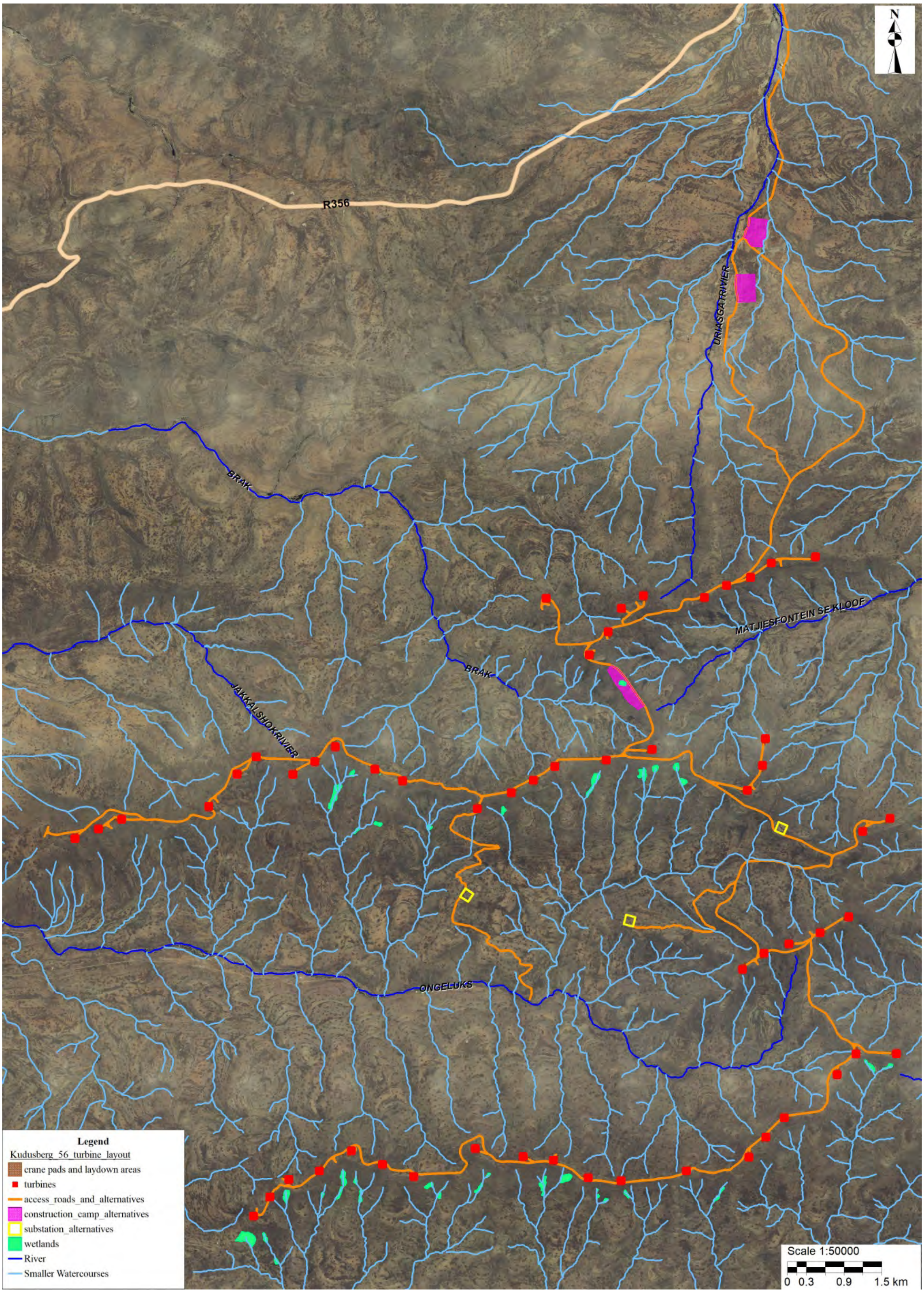
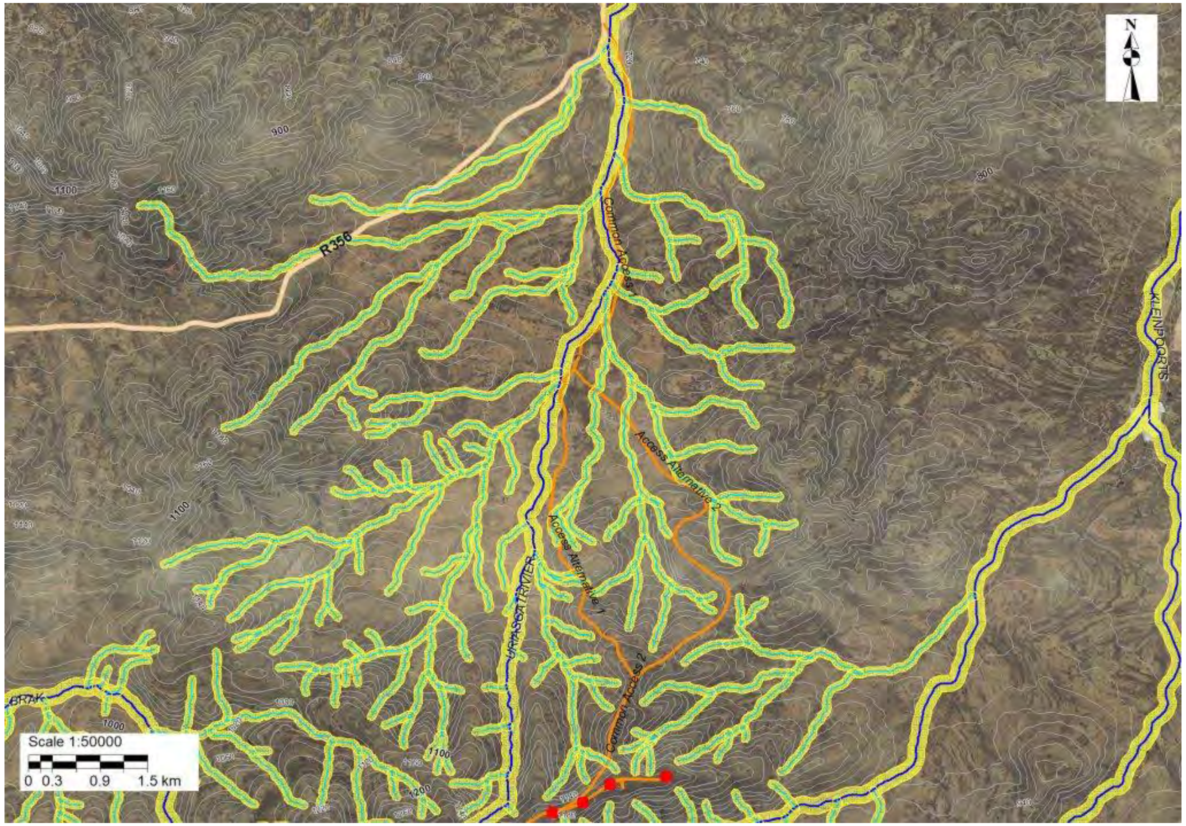
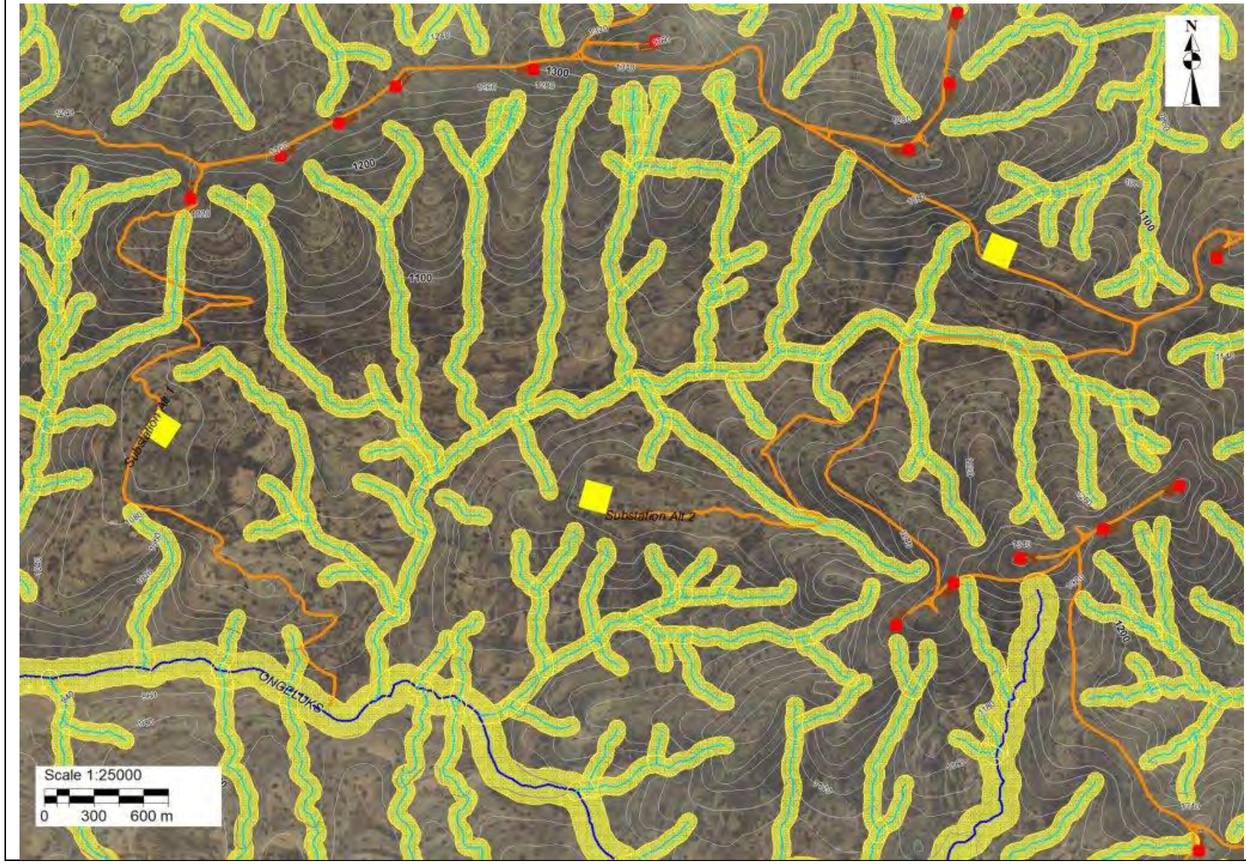


Figure D.28: Orthophotograph (taken in 2014) of the entire study area with the mapped aquatic features within the site

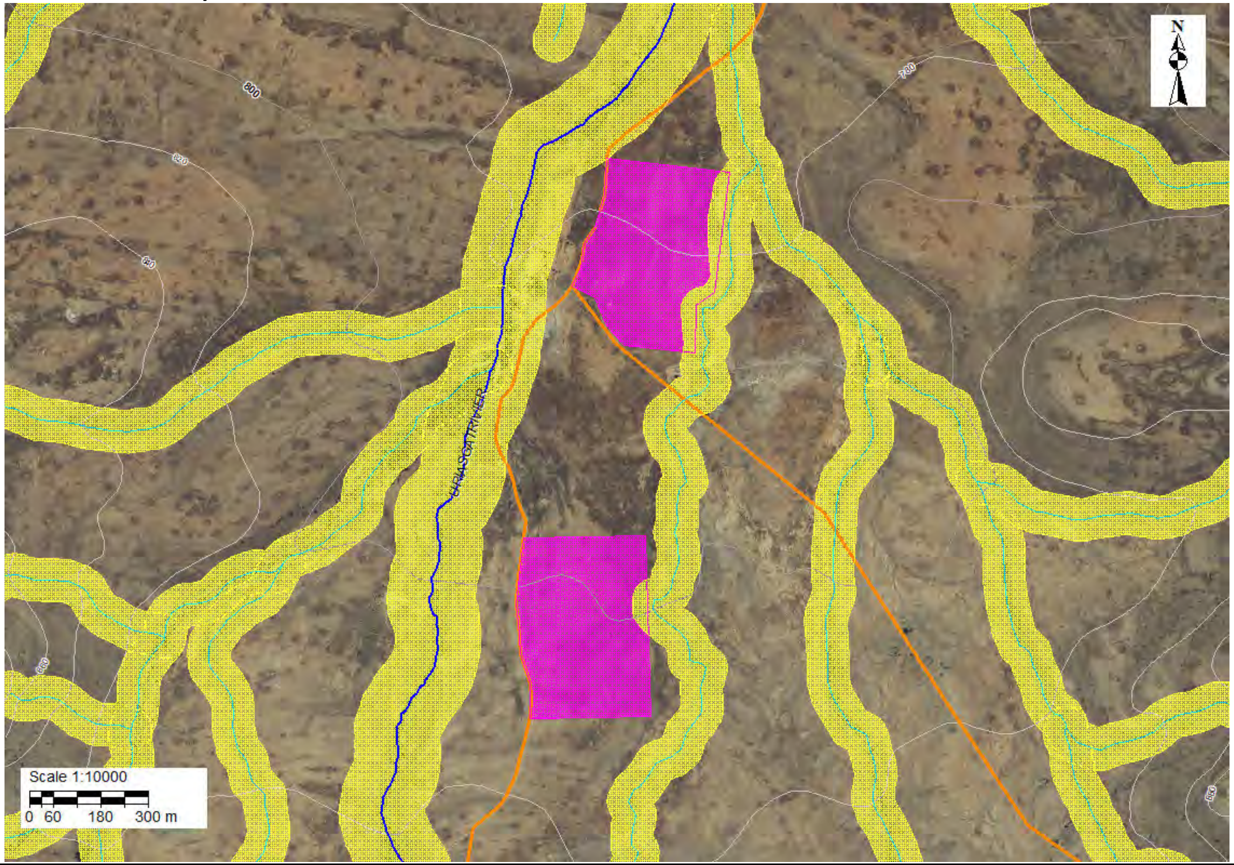
Table D.3: Freshwater constraints associated with the project components and alternatives

Mapped Freshwater Constraints	Comments and Recommendations
Access road Alternatives: 	The northern portion of the common access road is an existing road that will need to be upgraded. It is located adjacent to the larger Uriasgat River and crosses the river at the entrance to the property. It is likely that the existing low water crossing would need to be upgraded. Considering the volume of sediment, the river is still in a largely natural to moderately modified ecological condition. The main river of the channel flows within a wide braided channel. The existing road is largely located along the edge of the recommended 100m buffer. Access Alternative 1 route continues along the existing internal farm road within the site and along Uriasgat River. The extension of the road up the slope (the existing road crosses the Uriasgat River) and crosses some smaller drainage channels that could potentially be avoided with a slight realignment of the road. Access Alternative 2 would be located near an existing internal road but follows a more direct route that would need to be established. In addition, it will need to cross two larger streams and will thus have the greater potential impact on the aquatic habitat and flow in the watercourses. The remainder of the common access road follows the hilltop and could be slightly realigned to avoid crossing the top of the drainage features in that area. Thus, should the Access Alternative 1 route be selected, with a slight realignment there should no need to have any watercourse crossings, only an upgrade to the existing crossing over the river. The potential upgrades required to the existing public road crossings over the rivers are also likely to have a very limited impact due to the fact that there are already existing structures in place. The opportunity exists to improve on the current hydraulic capacity of these structures. The structures should be designed so that they do not require significant maintenance (cleaning of blockages) and should not constrict or change the channel shape or direction.

Substation Alternatives:	Three substation alternatives are proposed that are all located on hilltops or ridges. The substation alternatives are thus not located within the watercourses or the recommended buffers. The access roads to two of the substation alternatives will however need to cross watercourses. Substation Alternative 1 is located along the existing track to the lookout point at Gatrivier. This road will however need to be upgraded and is on relatively steep hillslopes that have a high erosion potential. Appropriate erosion control measures will need to be put in place to prevent the road from forming a preferential flow path and resulting in erosion of the hillslope, especially where it intercepts the drainage feature. Substation Alternative 2 would result in additional disturbance of natural terrestrial vegetation cover as well as cross a smaller drainage feature. It can thus be expected that this alternative would have the highest potential freshwater impacts of all the substation alternatives. Substation Alternative 3 is located along a proposed internal access road and thus would not require an additional access road to be constructed. This alternative is likely to have the lowest potential freshwater impacts of the three alternatives proposed.
	

Construction Camp 1	Construction Camp Alternative 1 is located on a ridge and along a proposed internal access road. The campsite is placed outside of any watercourses or their proposed buffers. The closest drainage feature is approximately 90m away from the edge of the camp. The area is also relatively flat therefore runoff to the watercourses would be low. The camp will however need to be established in an area that comprises of natural vegetation cover and would need to be rehabilitated after the construction phase is completed.
	

Construction Camp 2 and 3



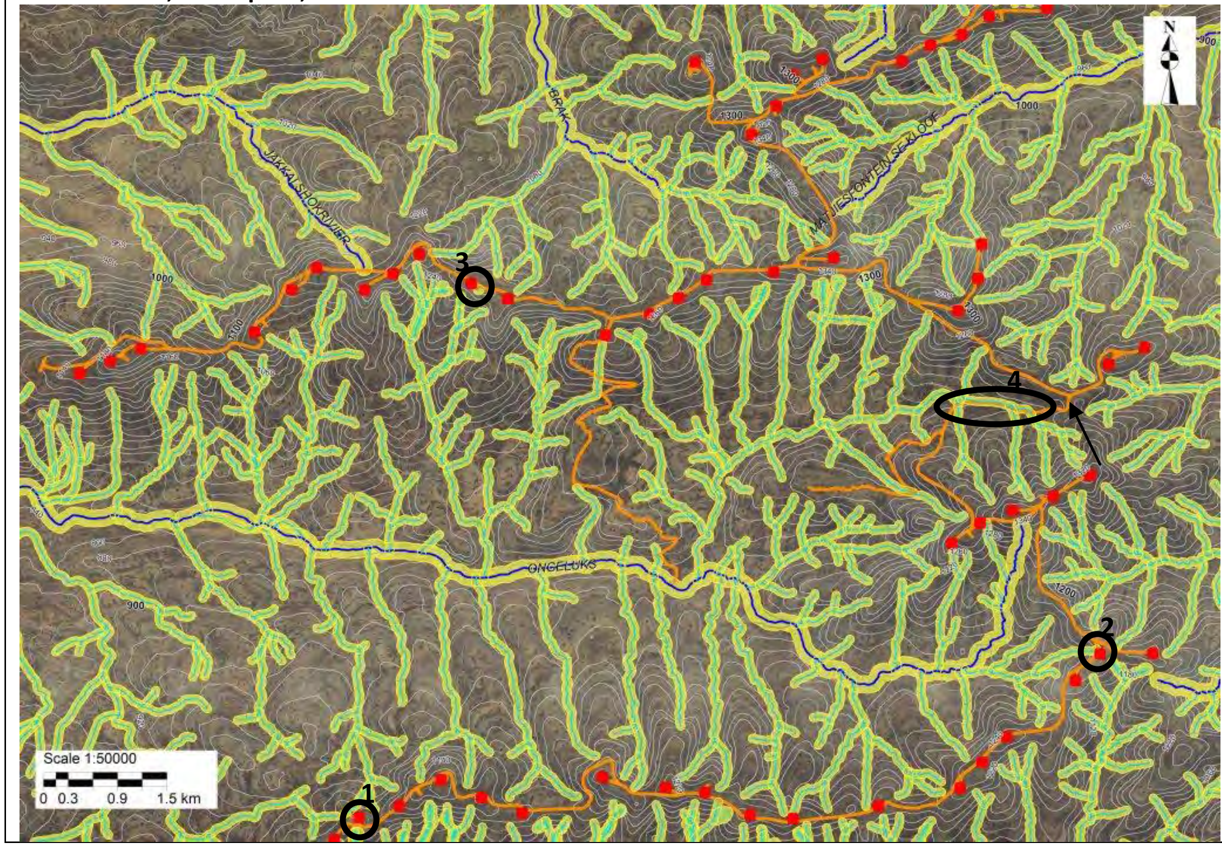
Construction Camp Alternatives 2 and 3 are located adjacent to the larger Uriasgat River, on a small rise between the river and one of its larger tributaries. Both areas extend into the recommended buffer areas and would need to be set back further.

In the revised layout these areas have been altered to accommodate the recommended buffers.

These areas have both been previously disturbed but have some minor drainage features crossing them. Should either of these areas be utilised for the construction camp, adequate stormwater management measures will need to be put in place to ensure there is no contaminated runoff to the adjacent tributary to the east.

From a freshwater perspective these construction camp alternatives have a lower potential freshwater impact than Construction Camp Alternative 1. In addition, the potential impacts can easily be mitigated as mentioned above to reduce the potential impact.

WEF turbines, crane pads, access roads and electrical transformers and cables



The proposed WEF turbines, crane pads, access roads and electrical transformers and cables are located along the hill tops and ridges of the study area where there are largely no aquatic features. A slight shift of the internal access roads may in cases be necessary to allow for more than 50m between the road and watercourses. Locations where a crane pad and WEF turbine need to be shifted are indicated in the adjacent image by ovals numbered 1 to 3. The WEF turbine and crane pad at number 3 in particular should be moved further west and away from the vernal pool. The oval number 4 is an internal road that is located in and adjacent to a watercourse on a slope with an average gradient of approximately 4%, increasing to about 7.5%. It is recommended that this route be moved slightly upslope and away from the watercourse or an alternative route be sought such as where the arrow is located.

With these small alterations to the proposed layout plan, the potential impacts of the turbines and associated infrastructure would be very limited and of a low significance.

In the revised layout plan, the locations of the WEF turbines and crane pads at numbers 1 to 3 have been moved further away from the aquatic features as indicated. The road by number 4 in the image is an existing road along the watercourse that could not be moved due to the adjacent slope. Use of the existing road would have a low potential impact however any widening of the road should not take place closer to the watercourse.

D.1.2.6.4 **Freshwater impacts**

D.1.2.6.4.1 **Impacts Identified for the Construction Phase**

DIRECT IMPACTS:

❖ **Disturbance of aquatic habitat**

This is due to construction activities in or adjacent to aquatic features.

Significance of impacts before mitigation: Moderate

Proposed mitigation measure:

- A buffer of at least 100 m between the delineated aquatic ecosystems and all the proposed project activities should be maintained adjacent to the river in which valley bottom wetlands occur.
- A buffer of at least 50 m adjacent to the vernal pool and other wetland areas (as measured from the outer edge of the wetland area).
- Monitoring and clearing of indigenous vegetation within or adjacent to the watercourses should occur in a phased manner to minimise erosion and/or run-off. Mitigation of erosion on steeper slopes.
- An ECO or an appropriate specialist with knowledge and experience of the local flora to be appointed during the construction phase to be able to make clear recommendations with regards to the revegetation of disturbed areas.
- During the construction phase, site management must be undertaken at the laydown area, batching plant and the individual turbine construction area.
- This should specifically address on-site stormwater management and prevention of pollution measures from any potential pollution sources during the construction activities such as hydrocarbon spills. Any stormwater that does arise within the construction sites must be handled in a suitable manner to trap sediments and reduce flow velocities.
- Utilise disturbed areas.

Significance of impacts after mitigation: Low

INDIRECT IMPACT:

❖ **Modification to flow and water quality due to the proposed activities in or adjacent to aquatic ecosystems.**

Altered run off characteristics as a result of construction activities.

Significance of impacts before mitigation: Moderate to Low

Most of the potential aquatic ecosystem impacts of the proposed WEF are likely to take place during the construction phase. A WEF requires high intensity disturbance of a limited surface area at the site of each wind turbine. Concrete foundations for the turbine towers will need to be constructed as well as permanent hard standing bases of compacted gravel adjacent to each turbine location for the cranes used to construct the turbines. The internal substation would also need to be constructed within the site. A construction camp with a temporary laydown area and concrete batching plant would need to be placed within the site for the construction works. All three of the construction camp alternatives are located closer than 100 m from watercourses with the two northern alternatives being of greater concern as they are also adjacent to valley bottom wetland areas. This concern has been addressed in the revised layout for the WEF and therefore is no longer of concern.

Activities during the construction phase of the project could thus be expected to result in some disturbance of vegetation cover for clearing and preparation of the turbine and substation footprints. There is also the potential for some water quality impacts associated with the batching of concrete, from hydrocarbon spills or associated with the other construction activities on the site. Only a limited amount of water is utilised during construction for the batching of cement for wind turbines and other construction activities.

According to the layout plan for the proposed 56 turbines, as discussed in the previous section, some of the proposed turbines and the associated infrastructure have been moved to ensure that they are all placed outside of the recommended buffer areas of 100 m from the delineated edge of the watercourses and valley bottom wetland areas and seeps as well as the 50 m buffer from the vernal pool and other wetland areas. The substation alternatives are all located more than 100 m away from the aquatic features.

A localised short-term impact of low intensity could be expected that has a low to very low overall significance in terms of its impact on the identified aquatic ecosystems in the area.

The internal access roads and underground 33 kV cabling will need to cross some watercourses, some of which will be on existing gravel roads. The major impacts associated with the internal roads relate to loss of habitat within the rivers, riparian areas and wetland habitats, loss of indigenous vegetation within the riparian zones and potential invasive alien plant growth as well as the potential for flow and water quality impacts and the direct impacts on the soil (erosion of watercourse channels).

A localised short- and longer-term impact of low significance is expected on the identified aquatic ecosystems in the area at the points at which the infrastructure will need to cross of rivers/drainage lines or wetland areas, during and after the construction phase. The disturbance would largely take place during the construction phase

Proposed Mitigation Measures:

- A buffer of at least 100 m between the delineated aquatic ecosystems and all the proposed project activities should be maintained adjacent to the river in which valley bottom wetlands occur.
- A buffer of at least 50 m adjacent to the vernal pool and other wetland areas (as measured from the outer edge of the wetland area).
- Monitoring and clearing of indigenous vegetation within or adjacent to the watercourses should occur in a phased manner to minimise erosion and/or run-off.
- Mitigation of erosion on steeper slopes.
- An ECO or an appropriate specialist with knowledge and experience of the local flora to be appointed during the construction phase to be able to make clear recommendations with regards to the revegetation of disturbed areas.
- During the construction phase, site management must be undertaken at the laydown area, batching plant and the individual turbine construction area.
- This should specifically address on-site stormwater management and prevention of pollution measures from any potential pollution sources during the construction activities such as hydrocarbon spills. Any stormwater that does arise within the

construction sites must be handled in a suitable manner to trap sediments and reduce flow velocities.

- **Significance of impacts after mitigation:** Low to very low

D.1.2.6.4.2 **Impacts Identified for the Operational Phase**

DIRECT IMPACTS:

- **Disturbance of aquatic habitat; and**
- **Modification to flow and water quality due to the proposed activities in or adjacent to aquatic ecosystems.**

These impacts are due to the operation activities in or adjacent to aquatic features.

INDIRECT IMPACT:

- **Invasive alien plant growth in riparian zones and wetland areas and potential for erosion of watercourses due to the disturbance of aquatic habitat and modification of runoff characteristics.**

These are secondary impacts as a result of disturbance and removal of riparian vegetation.

During the operation phase the turbines will operate continuously, unattended and with low maintenance required for more than 20 years. The WEF is likely to be monitored and controlled remotely, with maintenance only taking place when required.
The hard surfaces created by the development may lead to increased runoff, in particular on surfaces with a steeper gradient. This may lead to increased erosion and sedimentation of the downslope areas. A localised long-term impact (more than 20 years) of low intensity (depending on the distance between the turbines and the freshwater features) could be expected that would have a very low overall significance post-mitigation in terms of its impact on the identified aquatic ecosystems in the area.
The only potentially toxic or hazardous materials which would be present in relatively small amounts would be of lubricating oils and hydraulic and insulating fluids. Therefore, contamination of surface or ground water or soils is highly unlikely. There is no water consumption impact associated with the operation of wind turbines.

A long-term disturbance of the aquatic habitat at the road crossings could also be expected during the operation phase.

Significance of all impacts before mitigation: Moderate

Proposed mitigation measures:

- Limit disturbance to project areas that are outside of watercourses and buffers a far as possible.
- Invasive alien plant growth and signs of erosion should be monitored on an ongoing basis to ensure that the disturbed areas do not become infested with invasive alien plants.

- Storm water run-off infrastructure must be maintained to mitigate both the flow and water quality impacts of any storm water leaving the WEF site.
- No stormwater runoff must be allowed to discharge directly into the watercourses. The runoff should rather be dissipated over a broad area covered by natural vegetation or managed using appropriate channels and swales when located within steep embankments. Should any erosion features develop, they should be stabilised as soon as possible.
- Any water supply, sanitation services as well as solid waste management services that should be required for the site should preferably be provided by an off-site service provider.

Significance of all impacts after mitigation: Low

D.1.2.6.4.3 **Impacts Identified for the Decommissioning Phase**

DIRECT IMPACT:

❖ **Disturbance of aquatic habitat.**

INDIRECT IMPACTS:

❖ **Modification to flow and water quality due to the proposed activities in or adjacent to aquatic ecosystems.**

❖ **Invasive alien plant growth in riparian zones and wetland areas and potential for erosion of watercourses due to the disturbance of aquatic habitat and modification of runoff characteristics.**

During decommissioning, the potential freshwater impacts will be very similar to that of the Construction Phase, although the potential for water quality and flow related risks will be lower.

Significance of all impacts before mitigation: Moderate to Low

Proposed mitigation measures:

- Disturbance to the freshwater ecosystems should be limited as far as possible.
- Disturbed areas may need to be rehabilitated and revegetated.
- Mitigation and follow up monitoring of residual impacts (alien vegetation growth and erosion) may be required.

Significance of all impacts after mitigation: Low to Very Low

D.1.2.6.4.4 **Cumulative Impacts**

DIRECT IMPACTS:

❖ **Disturbance of aquatic habitat.**

This is due to decommissioning activities in or adjacent to aquatic features.

Significance of impact before mitigation: Low

Mitigation Measure:

Limit disturbance of watercourses through avoiding recommended buffers and utilising existing disturbed areas.

Significance of impact after mitigation: Low

- **Modification to flow and water quality as a result of proposed activities in or adjacent to aquatic ecosystems.**

Altered runoff characteristics as a result of decommission activities.

Significance of impact before mitigation: Low

Mitigation Measure:

Stormwater planning and management; design of crossings

Significance of impact after mitigation: Low

INDIRECT IMPACT:

- **Invasive alien plant growth in riparian zones and wetland areas and potential for erosion of watercourses as a result of disturbance of aquatic habitat and modification of runoff characteristics.**

This is caused by secondary impacts as a result of disturbance and removal of riparian vegetation.

The Brandvalley; Gunstfontein; Hidden Valley; Karreebosch; Perdekraal; Rietkloof; Roggeveld; and Sutherland WEFs were selected as the only ones that lie within the same catchments (Upper Doring and Tankwa Rivers in the Olifants Doring River System). The other WEFs all occur in the upper Touws and Dwyka Rivers in the Gouritz River System. Of the above-mentioned WEFs within a 50 km radius of the Kudusberg WEF, Gunstfontein, Sutherland and Hidden Valley are the only ones likely to have a cumulative impact on the upper Tankwa and Doring Rivers. However, these WEF only contain relatively small portions of their properties within the very upper reaches of the Tankwa River that are unlikely to have cumulative impacts of any significance on the river system. For this reason, only the Brandvalley; Karreebosch; Perdekraal; Rietkloof and Roggeveld WEFs are considered further.

Land use in the area currently consists of low-density livestock farming due to the limited water supply and poor carrying capacity of the cover vegetation. Current land and water use impacts on the tributaries of the Doring and Tankwa Rivers within the larger study area is therefore very low. The nature of the proposed WEF projects allows them to have minimal impact on the surface water features, since the turbines can be placed far enough away from the freshwater features so as to not impact on them.

The largest potential impact of these projects is as a result of the associated infrastructure which can be mitigated such that its impact on the aquatic ecosystems will be of a low significance. For the project concerned, the road layouts have been revised in such a manner that all of the important wetland areas / rivers were avoided and where possible existing roads have been used. This further reduced the impacts on the aquatic ecosystems, but also provided an opportunity to improve the current road crossings, by providing better erosion protection measures and through the construction of low water crossings or properly sized box culverts instead of pipe culverts that are prone to blocking. Thus, the project designs post mitigation will prove to have a net benefit to the river and catchment. 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 the cumulative impact could be seen as a net benefit.

One could thus expect that the cumulative impact of the proposed project would not be significant provided mitigation measures are implemented. Availability of water is however a limiting factor on the further development of this area, although the water requirements during the operation phase will be low.

Significance of impacts before mitigation: Low

Proposed mitigation measures:

- Placement of turbines and associated WEF infrastructure to minimise disturbance of aquatic features within the site and allow for adequate buffers to ensure protection of the aquatic features.
- The potential stormwater impacts of the proposed developments areas should be mitigated on-site to address any erosion or water quality impacts.
- Good housekeeping measures as stipulated in the EMPr for the project should be in place where construction activities take place to prevent contamination of any freshwater features.
- Where possible, infrastructure should coincide with existing infrastructure or areas of disturbance (such as existing roads).
- Disturbed areas should be rehabilitated through reshaping of the surface to resemble that prior to the disturbance and vegetated with suitable local indigenous vegetation.
- Any new road crossings through the watercourses should cross perpendicular to the channels and should not impede or concentrate flow in the channels.
- Undertake ongoing and long-term monitoring and management of aquatic features to prevent the impacts of erosion and invasive alien vegetation growth.

Significance of impacts after mitigation: Low

D.1.2.6.4.5 **No-go alternative**

The No-go Alternative implies that no WEF would be established within the area and that low-level agricultural practices would continue. The existing agricultural practices within the study area have had a very low impact on the freshwater features in the area. Should the WEF not be developed, it is likely that the aquatic features would remain in a natural to largely natural ecological condition. Water is however a limiting factor on the future development of the area. Invasive alien plant growth within the riparian areas of the rivers, as well as erosion of the watercourses within the area should be continually managed to reduce any impacts on the freshwater features.

D.1.2.6.5 **Impact Assessment Summary: Freshwater impacts**

Impact	Mitigation measure	Significance before mitigation	Significance after mitigation
CONSTRUCTION PHASE			
Direct impacts			
Disturbance of aquatic habitat.	• The existing road infrastructure should be utilised as far as possible to minimise the overall disturbance created by the proposed project. Where new roads need to be constructed, the existing road infrastructure should be rationalised and any unnecessary temporary roads decommissioned and rehabilitated to reduce the disturbance of the area and within the river beds. For new roads to the turbines, these should be located at least 100 m outside of the drainage / river beds. Where access routes need to be constructed through the watercourses, the disturbance of the channels should be limited. Wetland areas should be avoided and any road adjacent to a wetland feature should also remain outside of the 50 m buffer zone. • All crossings over watercourses should be such that the flow within the drainage channel is not impeded and should be constructed perpendicular to the river channel, where possible based on the contours. Road infrastructure and cable alignments should coincide as far as possible to minimise the impact. • Any indigenous vegetation clearing within or adjacent to the watercourses should occur in a phased manner to minimise erosion and/or run-off. An Environmental Control Officer or a specialist with knowledge and experience of the local flora, should be appointed during the construction phase to be able to make clear recommendations with regards to the revegetation of disturbed areas. • During the construction phase, site management must be undertaken at the laydown area, batching plant and the individual turbine construction areas. This should specifically address on-site stormwater management and prevention of pollution measures from any potential pollution sources during the construction activities such as hydrocarbon spills. Any stormwater that does arise within the construction sites must be handled in a suitable manner to trap sediments and reduce flow velocities.	**Moderate**	**Low**
Indirect impacts			
Modification to flow and water quality	• Stormwater planning and management; design of crossings.	**Moderate-Low**	**Low-Very low**

Impact	Mitigation measure	Significance before mitigation	Significance after mitigation
due to the proposed activities in or adjacent to aquatic ecosystems			
OPERATIONAL PHASE			
Direct impacts			
Disturbance of aquatic habitat; modification to flow and water quality due to the proposed activities in or adjacent to aquatic ecosystems.	• Limit disturbance to project areas that are outside of watercourses and buffers. • Invasive alien plant growth and signs of erosion should be monitored on an ongoing basis to ensure that the disturbed areas do not become infested with invasive alien plants. • Storm water run-off infrastructure must be maintained to mitigate both the flow and water quality impacts of any storm water leaving the WEF site. • No stormwater runoff must be allowed to discharge directly into the watercourses. The runoff should rather be dissipated over a broad area covered by natural vegetation or managed using appropriate channels and swales when located within steep embankments. Should any erosion features develop, they should be stabilised as soon as possible. • Any water supply, sanitation services as well as solid waste management services that should be required for the site should preferably be provided by an off-site service provider.	**Moderate**	**Low**
Indirect impacts			
Invasive alien plant growth in riparian zones and wetland areas and potential for erosion of watercourses due to the disturbance of aquatic habitat and modification of runoff characteristics.	• Monitoring and clearing alien vegetation; mitigation of erosion on steeper slopes.	**Moderate**	**Low**
DECOMMISSIONING PHASE			
Direct			
Disturbance of aquatic habitat	• The existing road infrastructure should be utilised as far as possible to minimise the overall disturbance created by the proposed WEF. Where new roads need to be	**Moderate-Low**	**Low-Very Low**

Impact	Mitigation measure	Significance before mitigation	Significance after mitigation
	constructed, the existing road infrastructure should be rationalised and any unnecessary roads decommissioned and rehabilitated to reduce the disturbance of the area within the river beds. For new roads to the turbines, these should be located at least 100 m outside of the drainage / river beds. Where access routes need to be constructed through the watercourses, the disturbance of the channels should be limited. Wetland areas should be avoided and any road adjacent to a wetland feature should also remain outside of the 50 m buffer zone. • All crossings over watercourses should be such that the flow within the drainage channel is not impeded and should be constructed perpendicular to the river channel. Road infrastructure and cable alignments should coincide as far as possible to minimise the impact. Any disturbed areas should be rehabilitated and monitored to ensure that these areas do not become subject to erosion or invasive alien plant growth. • During decommissioning, disturbance to the freshwater ecosystems should be limited as far as possible. Disturbed areas may need to be rehabilitated and revegetated. Mitigation and follow up monitoring of residual impacts (alien vegetation growth and erosion) may be required.		
Indirect			
Modification to flow and water quality due to the disturbance activities in or adjacent to aquatic ecosystems	• Same as above. • Stormwater planning and management; design of crossings.	**Moderate-Low**	**Low-Very Low**
Invasive alien plant growth and potential for erosion of watercourses due to the disturbance of aquatic vegetation.	• Monitoring and clearing alien vegetation; mitigation of erosion on steeper slopes.	**Moderate-Low**	**Low-Very Low**
CUMULATIVE IMPACT			
Disturbance of aquatic habitat; modification to flow and water quality as a result of proposed activities in or adjacent to aquatic ecosystems. Invasive alien plant growth in riparian zones and	• Allow for adequate buffers; mitigate stormwater impacts on-site. • Good housekeeping measures as stipulated in the EMPr. • Infrastructure should coincide with existing infrastructure as far as possible. • Disturbed areas should be rehabilitated and vegetated with suitable local indigenous vegetation.	**Low**	**Low**

Impact	Mitigation measure	Significance before mitigation	Significance after mitigation
wetland areas and potential for erosion of watercourses as a result of disturbance of aquatic habitat and modification of runoff characteristics	• New road crossings through the watercourses should cross perpendicular to the channels and should not impede or concentrate flow in the channels. • Undertake ongoing and long term monitoring and management of aquatic features to prevent the impacts of erosion and invasive alien vegetation growth.		

D.1.2.6.6 **Comparative assessment of alternatives and comment on revised layout 1**

In terms of the proposed project and its alternatives:

- Access road: Alternative 1 would have the lesser freshwater impact as, with a slight realignment, it would not need to cross any watercourse and only an upgrade to the existing crossing over the river would be required. Alternative 2 would however still be acceptable, with mitigation;
- Substation: Alternative 3 is located along a proposed internal access road and thus would not require an additional access road to be constructed. This alternative is likely to have the lowest potential freshwater impacts of the three alternatives proposed. Alternatives 1 and 2 would however still be acceptable, with mitigation
- Construction camp: Alternative 1 is located outside of any watercourses or their proposed buffers. The area is also relatively flat therefore runoff to the watercourses would be low. The camp will however need to be established in an area that comprises of natural vegetation cover and would need to be rehabilitated after the construction phase. Construction Camp Alternatives 2 and 3 are located adjacent to the larger Uriasgat River, on a small rise between the river and one of its larger tributaries. From a freshwater perspective these Construction Camp Alternatives 2 and 3 have a higher potential freshwater impact than Construction Camp Alternative 1 but these impacts could be mitigated such that the potential freshwater impacts associated with the use of either of these sites would be acceptable.
- WEF turbines, crane pads, access roads and electrical transformers and cables: With these small alterations to the proposed layout plan, the potential impacts of the turbines and associated infrastructure would be very limited and of a low significance.

With regards to the aquatic ecosystem related recommendations, the following changes have been made which resulted in the revised layout:

- Moving Camp Alternatives 2 and 3 outside of the recommended buffer area of the adjacent watercourses;
- Minor changes to the road alignments to avoid watercourses and the recommended buffer areas, where possible; and
- Some of the locations of the turbines and associated crane pads were moved slightly to ensure that they are located outside of the aquatic features and their associated buffer areas.

The revised layout reduced any potential impacts to the aquatic ecosystems in the area and thereby has improved the acceptability of the proposed WEF from an aquatic ecosystem point of view.

<u>No-go Alternative</u>

The No-go Alternative implies that no WEF would be established within the area and that low-level agricultural practices would continue. The existing agricultural practices within the study area have had a very low impact on the freshwater features in the area. Should the WEF not be developed, it is likely that the aquatic features would remain in a natural to largely natural ecological condition. Water is however a limiting factor on the future development of the area. Invasive alien plant growth within the riparian areas of the rivers, as well as erosion of the watercourses within the area should be continually managed to reduce any impacts on the freshwater features.

D.1.2.6.7 Concluding statement

The aquatic ecosystems have been moderately modified by the surrounding agricultural activities. The cumulative impacts of the proposed WEFs and their associated infrastructure are not expected to alter the current ecological status of the watercourses and wetland areas in the larger area. The recommended mitigation measures should be implemented. Based on the findings of the Freshwater Impact Assessment, there is no reason from a freshwater perspective, why the proposed activity (with implementation of the mitigation measures below) should not be authorized. The revised layout has further reduced any potential impacts to the aquatic ecosystems in the area and thereby has improved the acceptability of the proposed WEF from an aquatic ecosystem point of view.

D.1.2.7 Avifauna (Birds)

The Avifauna Impact Assessment was undertaken by Bioinsight (Pty) Ltd to inform the outcome of this BA. The full study (including nature, status, extent, duration, probability, reversibility, irreplaceability and confidence ratings) is included in Appendix D of this report. The following section provides a summary of the Impact Assessment undertaken for the Avifauna Impact Assessment.

D.1.2.7.1 Approach and methodology

Prior to the initiation of field surveys, a desktop survey was conducted to compile the best information possible, in order to provide a better evaluation of all conditions present within the study area. Therefore, data sources were consulted in order to assess the species likely to occur within the study area. The following steps were taken:

- Based on a desktop study and considering all literature references available, a list of all bird species considered to potentially occur within, or in close proximity to the site was compiled.
- Abundance of all species listed from the aforementioned process was assessed at a national level in terms of endemism, population trend, habitat preferences and conservation status.
- The sensitivity of these species towards the potential impacts from wind energy developments was evaluated using the Avian Wind Sensitivity Map (Retief et al., 2012). Other species not listed in the referred document were also considered sensitive because of their abundance, flight characteristics, ecological role, population trend and conservation status.
- A short list of sensitive species for this study species, to which the assessment and monitoring programme should pay special attention to, was compiled and supplemented with sensitive species identified in the previous steps.
- A desktop study, based on all the available information such as topographic South Africa maps, Google Earth imagery, and Geographical Information System (GIS) software was conducted for a preliminary evaluation of the area.
- Micro habitats and vegetation units were characterised using Google Earth imagery and refined during the field visits conducted to the site through the monitoring programme.

Sampling Period

The surveys of the bird community preconstruction monitoring programme were conducted between January and October 2016 and included all four seasons in compliance with the requirements of the Best Practice Guidelines (Jenkins et al., 2015). Therefore, the monitoring programme included a total of eight visits to the site where all methodologies were implemented in each season: walked transects and vantage points, as well as other methodologies, spread over the pre-construction monitoring year.

During the 12 months of pre-construction bird monitoring at the site, several methodologies were implemented to study the local bird communities and inform the assessment of potential risks from the construction and operation of the proposed project. The following techniques were applied at the proposed WEF area and its immediate surroundings: vantage point monitoring, walked and vehicle based transects, incidental observations, waterbody and breeding evidence surveys and incidental observations.

These techniques are discussed below:

- *Vantage points* – to allow for the detection of large bird species present in the study area, the estimation of their abundance, seasonality and the characterisation of their flights, and to gain a general idea of their use of the habitats.

- *Walked linear transects* – designed to survey passerines and other small to medium sized birds. Using this technique, densities and composition of these groups of birds are estimated for the different habitats, seasons and sampling sites.

- *Vehicle based transects* – implemented to detect other large bird species less prone to flight (such as Bustards) and allows covering greater areas in the WEF surroundings. This technique was used to complement nest and roost surveys and for defining the distribution of sensitive species.

- *Waterbodies monitoring* – used for characterising the use of these features by Waterbirds. Several waterbodies were identified within the proposed WEF site and the surrounding area. Therefore, these were mapped on a GIS by using 1:50 000 topographic maps and aerial photos and later surveyed in order to determine their level of utilisation by Waterbirds.

- *Breeding evidences* - Surveys were conducted in the area in order to detect breeding evidences and/or roosting locations of sensitive species. These surveys took place in every season. The habitats located within the impact zone are likely to support key species, such as cliffs, power lines, stands of large trees, marshes and drainage lines (Malan, 2009) which were surveyed by the combination of different inspection techniques according to the specifics of each site.

- *Incidental observations* - All contacts of sensitive species during the driving and/or walking transects of the observers in the study area were recorded as incidental observations and were used as complementary data to characterise the bird community and its utilisation of the site, as recommended by the Best Practice Guidelines (Jenkins et al., 2015) and the previous stages of the monitoring programme.

Control Area

A Control area was considered for this project, located approximately 2 km north of the proposed WEF site (Figure D.29). This area was selected due to its extreme similarities to the study site, in terms of vegetation and topography. Both sites are equally comprised of Central Mountain Shale Renoserveld and Koedoesberge-Moordenaars Karoo vegetation (Mucina & Rutherford, 2006). Additionally, both sites also exhibit mountainous regions with shallow valleys. As such, very similar bird micro-habitats are expected to occur in both areas. Data gathered at this similar area will allow a comparison of the results obtained with a reference, non-affected area, in order to distinguish between impacts produced by the project and background effects produced by natural processes (SNH 2009; Atienza et al. 2011; Strickland et al. 2011; USFWS 2012; Jenkins et al. 2015).

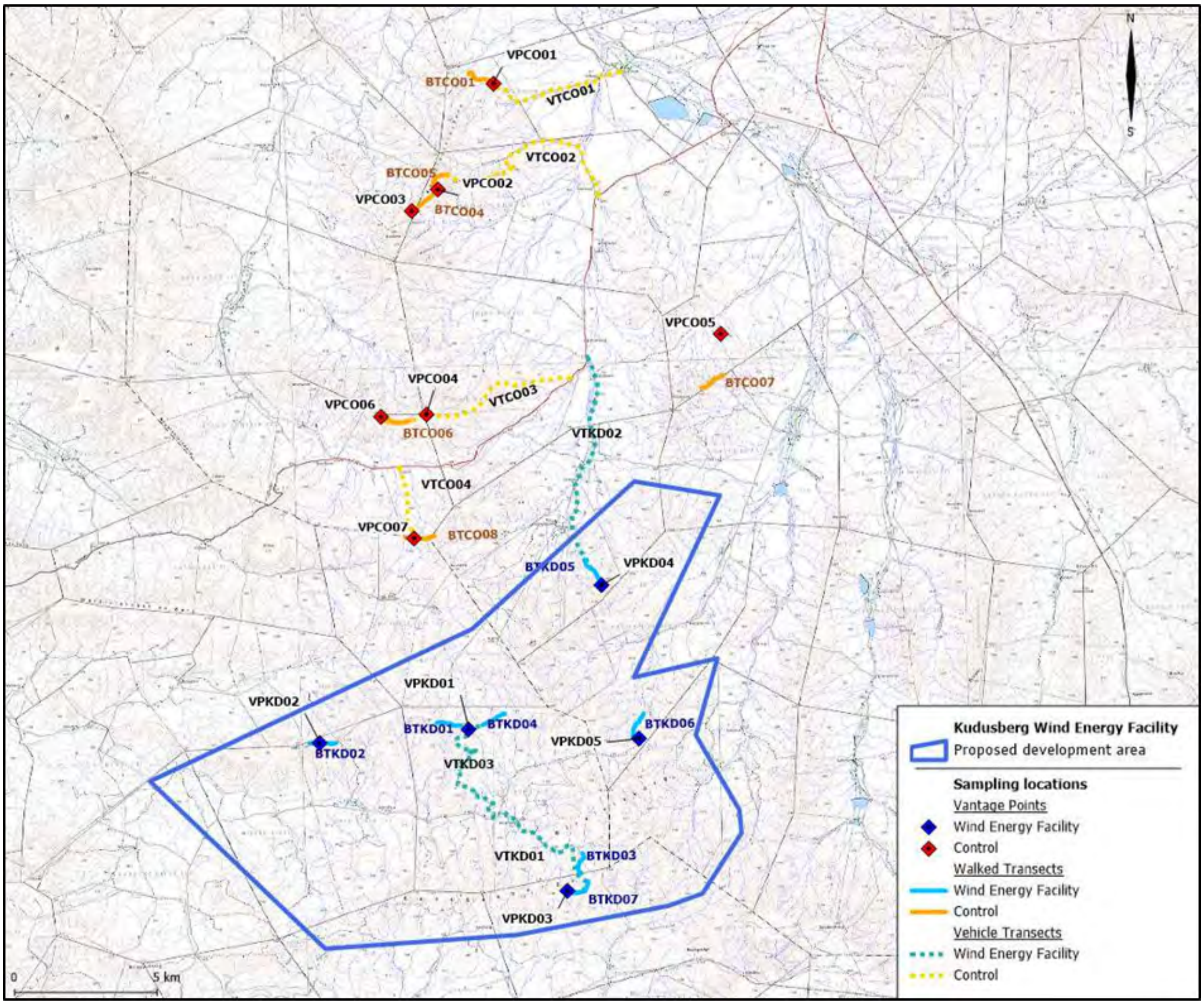


Figure D.29: Sampling locations at Kudusberg WEF site during the pre-construction bird monitoring programme.

D.1.2.7.2 Project aspects relevant to avifaunal impacts

- **Presence of Wind Turbines**

The presence of wind turbines, in general, can result in certain avifaunal impacts such as fatalities due to collision, as well as disturbance / displacement effects. It is very important that turbines are sited correctly, to avoid and/or minimise these potential impacts. Careful planning and avoidance measures are therefore crucial to achieve this.

- **Turbine machine specifications**

In terms of turbine specifications, the most relevant aspect to consider is the machine size, in terms of rotor diameter and lower tip height. The turbines proposed for the Kudusberg project have a hub height of up to 140 m, with a rotor diameter of up to 180 m, making it a relatively large machine. Larger machines with bigger rotor diameters are generally considered better for avifauna, as they would restrict the project to have fewer wind turbines – due to their increased generating capacity. As a result of a larger machine, the lower tip height is also higher than that of smaller machines. This is considered relatively safer for smaller passerine species, as well as some medium-large terrestrial birds that are not known to frequently use the higher air spaces – subsequently reducing the risk of collision with turbine blades.

- **Wind measurement masts**

The presence of four wind measurement masts may pose a risk to several avifauna species, due to the presence of guyed wires that are used to anchor the masts in place. These guyed wires are known to cause bird fatalities due to the collision of birds with these wires. Several measures can, however, be used to minimise the risk of collision. These mitigation measures have been included in the EMPr.

- **Underground 33 kV cabling and Overhead 33 kV Power Lines**

The use of underground cabling is preferred to overhead power lines. However, it is important to note that underground cabling may also result in habitat destruction. Regardless, this impact is only considered to be short-term and is likely to only occur during the installation process. More relevant to the Kudusberg Project is the proposed use of a 33 kV overhead power line that will be used to group turbines to crossing valleys and ridges outside of the road footprints, in order to reach the 33/132kV onsite substation. This overhead line may potentially serve as a source for bird collision fatalities, if not managed correctly.

- **Other associated Infrastructure**

Other sources of disturbance and habitat destruction can be the presence of other associated infrastructures, such as electrical transformers, access roads, a substation, temporary construction camp, fencing around the batching plant and construction camp, and temporary infrastructure to obtain water from available sources. These infrastructures are however not expected to have a significant impact on the avifaunal community due to some of the structures only being temporary, and also due to the fact that the area required for construction only represents a small percentage of the total area available with the same habitat characteristics.

D.1.2.7.3 Sensitivity of the site in relation to the proposed activity

Rocky hillsides characterise a large portion of the site due to the site being relatively mountainous. These areas may also be important for certain species that use these areas for nesting or thermalling, such as: Rock Martin *Hirundo fuligula*, Rock Kestrel and Verreauxs' Eagle, among others. For this reason, the site has been generally classified as one with **moderate** sensitivity, with some areas considered to be **very highly** sensitive (i.e. no-go areas that should be avoided from wind turbine installation). The sensitive areas identified for birds at the proposed Kudusberg WEF site are indicated in Figure D.30).

- **Moderate sensitivity (Acceptable for turbine placement, but with mitigation measures)**

- *Hillside and Ridges*: This type of biotope is frequently used by Accipitrids and Falcons, for soaring and hunting flights, in which a lot of potential collision risk movements (flight at rotor height) are observed.
- *Natural vegetation*: Within the proposed Kudsberg WEF site the area is mostly comprised of natural vegetation. Avifaunal community, especially raptors usually will forage in natural veld, as well as the passerine community use this biotope for nesting and foraging.

- **Very High Sensitivity (No-Go areas)** (i.e. no-go areas that should be avoided from wind turbine installation):

  - *Riverine thickets*: This type of biotope showed a high importance for passerine species as well as for Raptors and soaring birds. Considering the scarceness and sensitivity of this vegetation type to land modifications, a 200 m protection buffer is considered around the margins of the waterlines with this type of vegetation. No turbine placement or substation placement is allowed to occur within these buffered zones. Overhead powerlines are allowed to be built within these buffered areas, as long as they only cross these areas perpendicularly and don't run in parallel with them. Existing roads should be used/upgraded as far as possible, within these areas.

  - *Water bodies*: As these supply important sources of water, nesting and resting locations for many bird species (not only waterbirds), a 200 m protection buffer is considered around any potential margins of water present within the study area.

  - *Sensitive Flight Paths*: a grid analysis was conducted to determine the use of geographical space by certain bird species. Only sensitive species with >0.25 contacts per hour were considered in each 500 x 500 m no-go square. A 200 m buffer was then applied around each square to account for potential sensitive flight paths occurring on the inner border of each square.

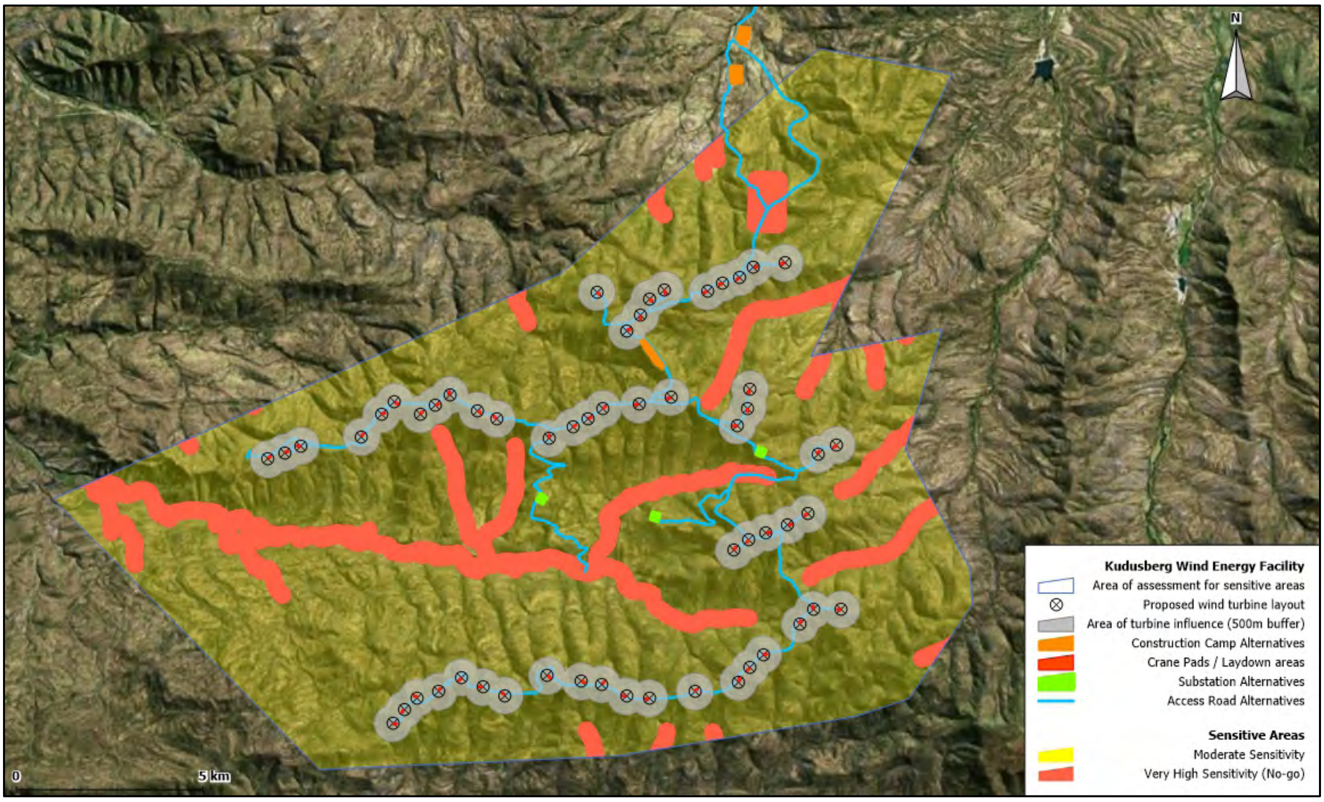


Figure D.30: Sensitive areas identified for birds during the pre-construction monitoring campaign at Kudusberg WEF site, overlaid with the proposed development features.

D.1.2.7.4 Avifaunal (Bird) impacts

From a total of 131 species potentially occurring in the area (Bioinsight, 2018), a total of 67 bird species were detected within the study area (WEF and surrounding area) across all the survey methodologies implemented through the pre-construction monitoring, including eight species that were not identified to occur at the site during the monitoring campaign. Seventeen of the species identified are considered priority species for the monitoring campaign (Please refer to Table B.3 of this report).

From the total species identified, six are of Special Concern for having an unfavourable conservation status in South Africa: Black Harrier *Circus maurus*, Ludwig's Bustard *Neotis ludwigii*, Martial Eagle *Polemaetus bellicosus* – Endangered; *Verreauxs'* Eagle *Aquila verreauxii*, Black Stork *Ciconia nigra* – Vulnerable; Greater Flaming *Phoenicopterus roseus* – Near Threatened (Taylor *et al.*, 2015).

Eleven species detected during field work are considered to be endemic or near endemic to South Africa including sensitive species such as Jackal Buzzard, Karoo Lark, Black Harrier, Large-billed Lark and Cape Clapper Lark.

The bird community in the study area (67 total bird species) is mostly comprised of passerine and small bird species (43 % of the total species), followed by bird species associated with waterbodies (28% of the total bird species), Accipitrids (10 % of species) and Ciconids (10 % of species). Representing a smaller proportion, 7 % of the species found in the study area were Bustards, Falcon or Crow species. From the aforementioned groups, the Raptors (Accipitrids), Falcons, Waterbirds and "Ciconids" are considered most likely to suffer impacts caused by wind farms (Retief et al., 2012). Passerines might also be sensitive to impacts and collide with wind turbines, especially those which are known to migrate (AWWI, 2015).

A large portion of the species confirmed in the area was observed in both the proposed WEF site and the surrounding area (33 species – 49 % of the total species observed). These species may not be severely impacted by the presence of the WEF as they already use the surrounding area, making it possible for them to therefore have an ability to potentially shift their utilisation area slightly. This includes most of the priority species present at the site (12 out of 17 species), of which seven are Accipitrids and Falcons species, considered to have a higher vulnerability to collision, especially if using the area of development only (AWWI, 2015).

Nineteen of the remaining species were observed using only the WEF site, with most of them being from the Waterbird, Ciconid and Passerine groups. Of these 19 species, only three are considered sensitive to impacts caused by WEFs.

A similar number of species was detected using only the Control area, with similar group characteristics. Such species are considered to be less likely negatively impacted by the proposed Kudusberg WEF as they do not regularly use the area where the WEF will be constructed. They may however be somewhat affected by the disturbance caused by the temporary construction activities which can have repercussions to the broader study area.

D.1.2.7.4.1 **Impacts Identified for the Construction Phase**

<u>DIRECT IMPACTS</u>

❖ **Habitat Loss**

Destruction of natural vegetated areas due to platforms construction, workstation and substation construction, internal access roads construction, and turbines, underground cabling and overhead power lines installation.

<u>Significance of impact without mitigation measures</u>: Low

<u>Proposed mitigation measures</u>:

- Avoidance of new infrastructure siting (especially wind turbines) in very high (no-go) areas in the design phase.
- In affected areas, activities of clearance and removal of vegetation should be kept to a minimum.
- The use of existing access roads should be used to the maximum extent possible.
- If large portions of very high sensitive areas are affected during the construction phase, then measures should be taken to restore vegetation as soon as possible after construction has completed.
- The area of intervention should be identified and delimitated prior to the beginning of the work.

<u>Significance of impact after mitigation</u>: Very Low

❖ **Disturbance Effects**

Disturbance of the bird community due to the increase of people and vehicles in the area.

Significance of impact without mitigation measures: Low

Proposed mitigation measures:

- Avoid or minimise the presence of people and vehicles in the very high (no-go) areas as much as possible.
- Noise levels should be kept to a minimum as far as possible.

Significance of impact after mitigation: Very Low

❖ **Displacement Effects**

Displacement of the bird community due to the increase of disturbances in the area

Significance of impact without mitigation measures: Low

Proposed mitigation measures:

- In order to minimise this impact, certain measures can be taken, such as to avoid or minimise the presence of people and vehicles in the very high (no-go) areas as much as possible.
- Noise levels should be kept to a minimum as far as possible.

Significance of impact after mitigation: Very Low

D.1.2.7.4.2 **Impacts Identified for the Operational Phase**

INDIRECT IMPACTS

❖ **Fatalities due to collision.**

Fatalities due to collision with the wind turbines and other project infrastructure.

Significance of impact without mitigation measures: Moderate

Proposed mitigation measures:

- Avoidance of turbine installation in very high sensitive areas for birds, and avoidance of overhead powerlines being built to run in parallel with sensitive linear features. These powerlines are however allowed to be built within sensitive locations, as long as they only cross these areas perpendicularly.
- Powerlines should be fitted with bird flight diverters, to allow them to be more visible to bird species.
- Considering the bird movements observed, it is recommended that the turbine minimum height of the rotor swept area is not lower than 40 m.
- A monitoring plan is recommended during the construction and operational phase to improve the understanding of the real impact caused by the WEF on local bird populations, as well as to validate the success of the mitigation measures proposed.

Significance of impact after mitigation: Low

❖ **Disturbance Effects**

Disturbance of bird community due to noise and movement generated by turbines, as well as an increase of people and vehicles in the area during maintenance activities.

Significance of impact without mitigation measures: Low

Proposed mitigation measures:
- Lower levels of noise disturbance are recommended whenever possible.

Significance of impact after mitigation: Very Low

INDIRECT IMPACTS

❖ **Displacement**

Displacement of the bird community due to the increase of disturbances in the area.

Significance of impact without mitigation measures: Low

Proposed mitigation measures:
- Lower levels of noise disturbance are recommended whenever possible.

Significance of impact after mitigation: Very Low

❖ **Population decline**

Population decline of the bird community over time due to long-term increasing fatality events.

Significance of impact without mitigation measures: Low

Proposed mitigation measures:
- Avoidance of turbine placement in very high (no-go) areas in the design phase.
- Caution should also be taken not to disrupt or destroy important bird habitats during the construction phase, particularly in very high sensitive areas.
- It is recommended that a construction and operational phase monitoring programme be implemented to validate the effectiveness of the proposed mitigation measures, and if need be, propose new measures – should the need arise.

Significance of impact after mitigation: Very Low

D.1.2.7.4.3 Impacts Identified for the Decommissioning Phase

DIRECT IMPACTS

❖ **Disturbance effects**

Disturbance of the bird community due to the increase of people and vehicles in the area, while dismantling wind turbines and associated infrastructures.

Significance of impact without mitigation measures: Low

Proposed mitigation measures:

- Lower levels of noise disturbance are recommended whenever possible

Significance of impact after mitigation: Very Low

INDIRECT IMPACTS

❖ **Displacement**

Displacement of the bird community due to the increase of disturbances in the area, while dismantling wind turbines and associated infrastructure.

Significance of impact without mitigation measures: Low

Proposed mitigation measures:

- Lower levels of noise disturbance are recommended whenever possible

Significance of impact after mitigation: Very Low

D.1.2.7.4.4 **Cumulative Impacts**

❖ **Increased habitat loss**

Mitigation measure:

- Avoid placement of infrastructures (especially wind turbines) in very high sensitive areas (i.e. no-go areas).
- Use existing roads as far as possible during construction.
- If large portions of sensitive areas are affected, then vegetation restoration should take place.
- Keep all noise disturbance to a minimum, especially near areas that have been defined as being sensitive.

❖ **Increased fatalities due to collision with wind turbines and other project infrastructure,**

Mitigation measure:

- Lower the noise levels as far as possible.
- Considering the likelihood of displaying passerines in the Karoo area, it is recommended that the turbine minimum rotor swept height is not lower than 40 m.
- A monitoring plan is recommended during the construction and operational phase to improve the understanding of the real impact caused by the WEF on local bird populations, as well as to validate the success of the mitigation measures proposed.

❖ **Increased disturbance/displacement effects.**

Mitigation measure:

- Lower the noise levels as far as possible.

- The use of existing access routes must be used as far as possible during construction

❖ **Population decline.**

Mitigation measure:

- Avoid turbine placement in very high sensitive areas. Bird habitats should not be severely destroyed, particularly in sensitive areas.
- A monitoring plan is recommended during the construction and operational phase to improve the understanding of the real impact caused by the WEF on local bird populations, as well as to validate the success of the mitigation measures proposed.

Significance of all cumulative impacts: Moderate (before mitigation measures) and Low (after mitigation measures)

The effects of the Kudusberg WEF, considering other projects, will produce impacts that are likely to impact on the bird communities, on a broader scale – negative impacts. Although wind energy facilities' footprints are not that intense, the construction of roads and building platforms can affect relatively large portions of natural vegetation. Also, it is important to consider that other renewable energy facilities therefore lead to increased destruction of habitats. Such facilities have also been planned and approved in the proximities of the Kudusberg WEF (Figure D.1).

D.1.2.7.4.5 **No-Go Alternative**

Should the Kudusberg Wind Farm not be constructed, then all impacts (whether it be negative or positive) identified within the impact analysis will not take place. As a result, it is expected that the present environmental characteristics relevant for the bird community on site will remain unchanged, relative to that which is being observed at present, under current land-use practices.

D.1.2.7.5 Impact Assessment Summary: Bird impacts

Impact	Mitigation measure	Significance before mitigation	Significance after mitigation
CONSTRUCTION PHASE			
Direct Impacts			
Destruction of important habitat areas (natural vegetation & water features etc.) due to the construction of wind turbines and associated infrastructures.	• Avoidance of new infrastructure siting (especially wind turbines) in very high areas. • Clearance and removal of vegetation should be kept to a minimum. • Vegetation restoration should take place after construction, if significant sensitive areas are affected.	Low	Very Low
Disturbance of the bird community due to the increase of people and vehicles in the area.	• Avoid/minimise the presence of people and vehicles in very high sensitive areas as much as possible. • Low levels of noise disturbance are recommended wherever possible. • An avifaunal monitoring campaign is recommended for at least one year during the construction phase.	Low	Very Low
Indirect Impacts			
Displacement of bird community due to increased disturbances in the area.	• Avoid/minimise the presence of people and vehicles in very high sensitive areas as much as possible. • Low levels of noise disturbance are recommended wherever possible.	Low	Very Low
OPERATIONAL PHASE			
Direct impacts			
Fatalities due to collision with wind turbine blades or associated infrastructures,	• Avoid turbine placement in no-go areas. • Overhead powerlines must be fitted with bird flight diverters and may not run in parallel with very high sensitive features (within the no-go buffers). • Lower blade tip should not be lower than 40 m. • A monitoring programme (including carcass searches and bias/scavenger trials) is recommended for a minimum of two years during the operational phase.	Moderate	Low
Disturbance of bird community due to noise and movement generated	• Lower the noise levels as far as possible.	Low	Very low

Impact	Mitigation measure	Significance before mitigation	Significance after mitigation
by turbines and people/vehicles operating in the area			
Indirect impacts			
Displacement of bird species due to increased disturbances	• Lower the noise levels as far as possible.	**Low**	**Very low**
Population decline due to long-term increasing fatality events	• Avoid turbine placement in very high sensitive areas. • Bird habitats should not be severely destroyed, particularly in sensitive areas.	**Low**	**Very Low**
DECOMMISSIONING PHASE			
Direct impacts			
Disturbance of bird community due to the increase of people and vehicles in the area, when dismantling wind turbines and associated infrastructures.	• Lower the noise levels as far as possible.	**Low**	**Very low**
Indirect impacts			
Displacement of bird community due to the increase in disturbances in the area, while dismantling wind turbines and associated infrastructures.	• Lower the noise levels as far as possible.	**Low**	**Very low**
CUMULATIVE IMPACT			
Destruction of important habitat areas (natural vegetation & water features etc.) at multiple renewable energy facilities.	• Avoid placement of infrastructures (especially wind turbines) in very high sensitive areas. • Use existing roads as far as possible. • If large portions of sensitive areas are affected, then vegetation restoration should take place.	**Moderate**	**Low**
Disturbance of bird community due to the increase of wind turbine	• Avoid placement of infrastructures (especially wind turbines) in very high sensitive	**Moderate**	**Low**

Impact	Mitigation measure	Significance before mitigation	Significance after mitigation
infrastructures, people and vehicles at multiple renewable energy facilities.	areas. • Lower the noise levels as far as possible.		
Displacement of bird communities due to the increase in disturbances at multiple renewable energy facilities.	• Lower the noise levels as far as possible. • Use existing roads as far as possible. • Avoid placement of infrastructures (especially wind turbines) in very high sensitive areas.	**Moderate**	**Low**
Fatalities as a result of increased collisions with wind turbine blades at multiple renewable energy facilities.	• Avoid placement of infrastructures (especially wind turbines) in very high sensitive areas. • Lower blade tip of turbines should not be lower than 40 m. • A monitoring plan is recommended during the construction and operational phase to improve the understanding of the real impact caused by the WEF on local bird populations, as well as to validate the success of the mitigation measures proposed.	**Moderate**	**Low**
Decline in the broader population of avifauna due to long-term fatality events at multiple renewable energy facilities.	• Avoid turbine placement in very high sensitive areas. • Bird habitats should not be severely destroyed, particularly in sensitive areas. • A monitoring plan is recommended during the construction and operational phase to improve the understanding of the real impact caused by the WEF on local bird populations, as well as to validate the success of the mitigation measures proposed.	**Moderate**	**Low**

D.1.2.7.6 Comparative assessment of alternatives and comment on revised layout 1

Regarding the available layout options that were provided for consideration, it can be confirmed that all updated layouts, as well as the preferred options and all of their alternatives were thoroughly analysed to further inform the broader environmental authorisation process. The alternatives considered included:

- Access Roads: two alternatives to connect the public MN004469 road to the new wind farm road network between the turbines on the ridges. One of these roads is the western route (alternative 1) of approximately 4.6 km in length. The other is an eastern route (alternative 2) and is approximately 5.7 km in length.

- Construction Camps: three alternatives (including batching plants), of which one is located between turbines 43 and 47 (alternative 1), while another is located adjacent to the east of the MN4469 public road (south of construction camp 3) (alternative 2), and another also being located adjacent to the east of the MN4469 public road (but north of construction camp 2) (alternative 3).

- Substations: three alternatives (33/132kV), of which alternative 1 is located south of turbine 38 and north of turbine 39. Alternative 2 is located south of turbine 42 and north of turbine 33. Alternative 3 is located southeast of turbine 44.

After analysing all the above alternatives, it was found that all proposed layout options are deemed acceptable for development.

D.1.2.7.7 Concluding statement

Kudusberg WEF is considered to be located in an area of medium bird sensitivity with some habitat features of very high sensitivity in terms of the bird community present. It is considered that the impacts can be minimised to the maximum extent possible, mostly through the avoidance of very high sensitive areas for turbine placement, and through mitigation measures within areas of moderate sensitivity.

Presently, the potential impacts to birds is not anticipated to be of a high significance, provided that the aforementioned avoidance/mitigation measures are followed. As such, no fatal flaws were identified for this project, and the project may be authorised from a bird’s perspective, subject to the proposed mitigation measures listed in the Avifauna Impact Assessment being implemented.

D.1.2.8 Bats

The Bat Impact Assessment was undertaken by Bioinsight (Pty) Ltd to inform the outcome of this BA. The full study (including nature, status, extent, duration, probability, reversibility, irreplaceability and confidence ratings) is included in Appendix D of this report. The following section provides a summary of the Impact Assessment undertaken for the Bat Impact Assessment.

D.1.2.8.1 **Approach and methodology**

A 12-month pre-construction bat monitoring programme was undertaken by BioInsight between December 2015 and December 2016 in accordance with the "South African Good Practice Guidelines for Surveying Bats in Wind Farm Developments" (Sowler *et al*., 2016). The monitoring included the following techniques:

- Active acoustic bat surveys, by means of vehicle-based transects and point-based monitoring with an ultrasound automatic bat detector;
- Passive acoustic surveys by means of installation of five automatic acoustic detectors (rotor height and ground level in various habitats) and roost searches/inspection and monitoring; and
- Roost searches and inspections - any structure thought to be used as a roosting location by bats was inspected, following the "South African Best Practice Guidelines for Surveying Bats in Wind Farm Developments" that were available at the time that the pre-construction monitoring programme initiated (Sowler & Stoffberg, 2014).

Sampling Period

The surveys of the bat community monitoring programme were conducted between December 2015 and December 2016. The field surveys were conducted so that the area was surveyed throughout all seasons of the year, in compliance with the requirements of the Best Practice Guidelines (Jenkins et al., 2015). Passive detection was conducted continually during the 12-month period and active detection surveys were conducted twice per season, starting in January 2016, covering all seasons.

For passive monitoring, five automated detection recorded continuously in order to achieve a total of 100% and a minimum of 75% of the total nights of the year, as recommended on the guidelines (Sowler et al., 2016). Five different locations and five detectors were used: all the detectors were placed on meteorological masts (PQKDA01, PQKDA02, PQKDA03, PQKDA04 and PQKDA05) (Figure D.31).

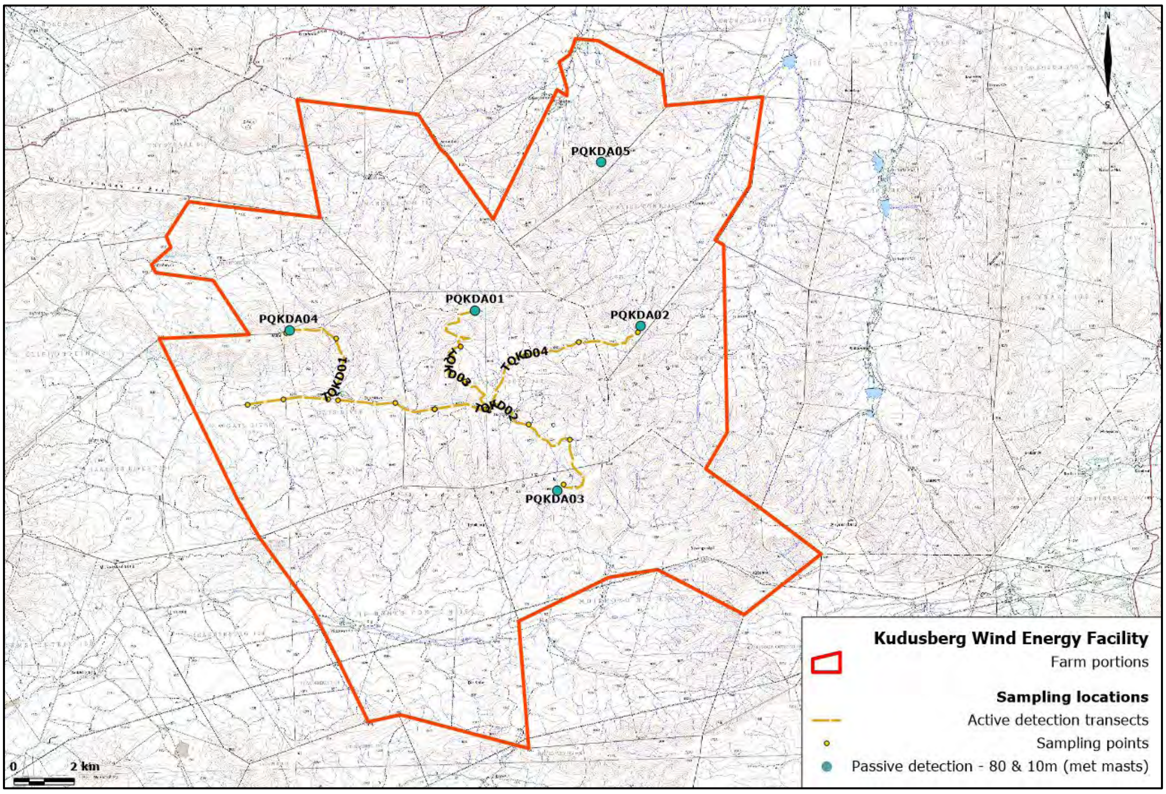


Figure D.31: Bat sampling locations at the proposed Kudusberg WEF site.

D.1.2.8.2 **Project aspects relevant to bat impacts**

The project aspects relevant to bats include:

Presence of Wind Turbines

The presence of wind turbines, in general, can result in certain bat impacts such as fatalities due to collision, and/or barotrauma as well as disturbance / displacement effects. It is very important that turbines are sited correctly, to avoid and/or minimise these potential impacts. Careful planning and avoidance measures are therefore crucial to achieve this.

Turbine machine specifications

In terms of turbine specifications, the most relevant aspect to consider is the machine size, in terms of rotor diameter and lower tip height. The turbines proposed for the Kudusberg project have a hub height of up to 140 m, with a rotor diameter of up to 180 m, making it a relatively large machine. Larger machines with bigger rotor diameters are generally considered better for bats, as they would restrict the project to have fewer wind turbines – due to their increased generating capacity. As a result of a larger machine, the total affected airspace would be less and the lower tip height is also higher than that of smaller machines. This is considered relatively safer for the clutter & clutter-edge foragers species (due to a higher 'lowest rotor swept height') – subsequently reducing the risk of collision with turbine blades.

However, in terms of migratory species, it is not uncommon for bat activity to be higher at increased heights during the autumn and spring migration months (namely March, April and October). It is therefore possible that higher mortality rates may be associated with the use of larger machines during migratory periods (Barclays et al., 2007; Kunz et al., 2007). However, studies also suggest that nocturnal migrants have the tendency to fly at heights ranging from <100 m to 1 km in height.

Wind measurement masts

The presence of wind measurement masts usually poses no risk to bat species. Four monitoring masts have been erected on the project site.

Underground 33 kV cabling and Overhead 33 kV Power Lines

The use of underground cabling is preferred over overhead power lines. However, it is important to note that underground cabling may also result in habitat destruction. Regardless, this impact is only considered to be short-term and is likely to only occur during the installation process. More relevant to the proposed Kudusberg WEF project is the proposed use of a 33 kV overhead power line that will be used to group turbines to crossing valleys and ridges outside of the road footprints, in order to reach the 33/132 kV onsite substation. According to the Bat Guidelines (Sowler et al., 2016), no powerline infrastructure should be constructed within 2 km of any large known confirmed roosts and 500 m from smaller confirmed roosts. There are no large confirmed roosts within the Kudusberg wind farm project site. **As discussed in Section 1.3 of the Bat Impact Assessment, there are four confirmed buildings that serve as roosts and therefore no turbines, 33 kV or 132 kV powerlines may be placed within 500 m thereof.**

Other associated Infrastructure

Other sources of disturbance and habitat destruction can be the presence of other associated infrastructures, such as electrical transformers, access roads, a substation, temporary construction camp, fencing around the batching plant and construction camp, and temporary infrastructure to obtain water from available sources. These infrastructures are however not expected to have a significant impact on the bat community due to some of the structures only being temporary, and also due to the fact that the area required for construction only represents a small percentage of the total area available with the same habitat characteristics.

D.1.2.8.3 **Sensitivity of the site in relation to the proposed activity**

The general area of the proposed WEF is classified as having a low bat sensitivity due to the very low bat activity observed during the 12-month monitoring. However, considering the presence of medium-high and high collision risk species, some precautionary measures are needed.

Therefore, very high (no-go) areas and other sensitive areas for bats are outlined in Figure D.32 and follow the recommendation from the South African Bat Assessment Advisory Panel (SABAAP; in Sowler et al., 2016). The very high sensitivity areas (no-go areas) should exclude all new WEF-associated structures (wind turbines, roads, powerlines, substation infrastructures or other associated structures).

Considering the Best practice recommendations, the sensitivity areas were delineated according to the buffer areas indicated in the “Bat Sensitivity Buffer Zone Recommendations” of the South African Bat Assessment Advisory Panel (SABAAP) (SABAAP, 2013) and the fourth edition of the South African Good Practice Guidelines for Surveying Bats at Wind Energy Facility Developments - Pre-construction:

- **High sensitivity – 200 m around all potentially bat important features:**

  Along water lines and associated riverine vegetation. Such features are important for bats, since they are likely to act as commuting routes, providing food resources, likely to be associated with higher bat activity, and likely to favour the occurrence of dispersion routes, besides local commuting routes. A 200 m buffer was considered around those features. It is recommended that should new infrastructures (including roads and electrical infrastructures) cross these features (including buffers), then they should not be routed to run parallel with them, but rather cross them perpendicularly, as far as possible. Additionally, this avoidance recommendation will not include the use of existing roads, as long as they are not upgraded in such a manner that will re-route them (to be more parallel with the feature) within those buffered areas. However, no wind turbines or substations may be permanently placed within any of these buffered areas.

- **Very High sensitivity (No-Go):**

  Confirmed Roosts. There are four confirmed roosts within the proposed Kudusberg WEF. During ultrasound monitoring and inspection of the roosts (red circles in figure D.32), it was confirmed that bats are using the identified buildings as roosts. While the number of individuals using the roosts remain relatively uncertain, we estimate that there are at least about 1-50 individuals, resulting in a 500 m buffer, considering the known occurrence species with medium-high and high risk of collision with wind turbines. As such, no wind turbines, electrical infrastructure, substations or new roads may be permanently placed within the buffered areas. However, the use of existing roads may be used, as long as they are not upgraded in such a manner that will cause them to be re-routed and subsequently run more perpendicular to the roosts (and their buffered areas).

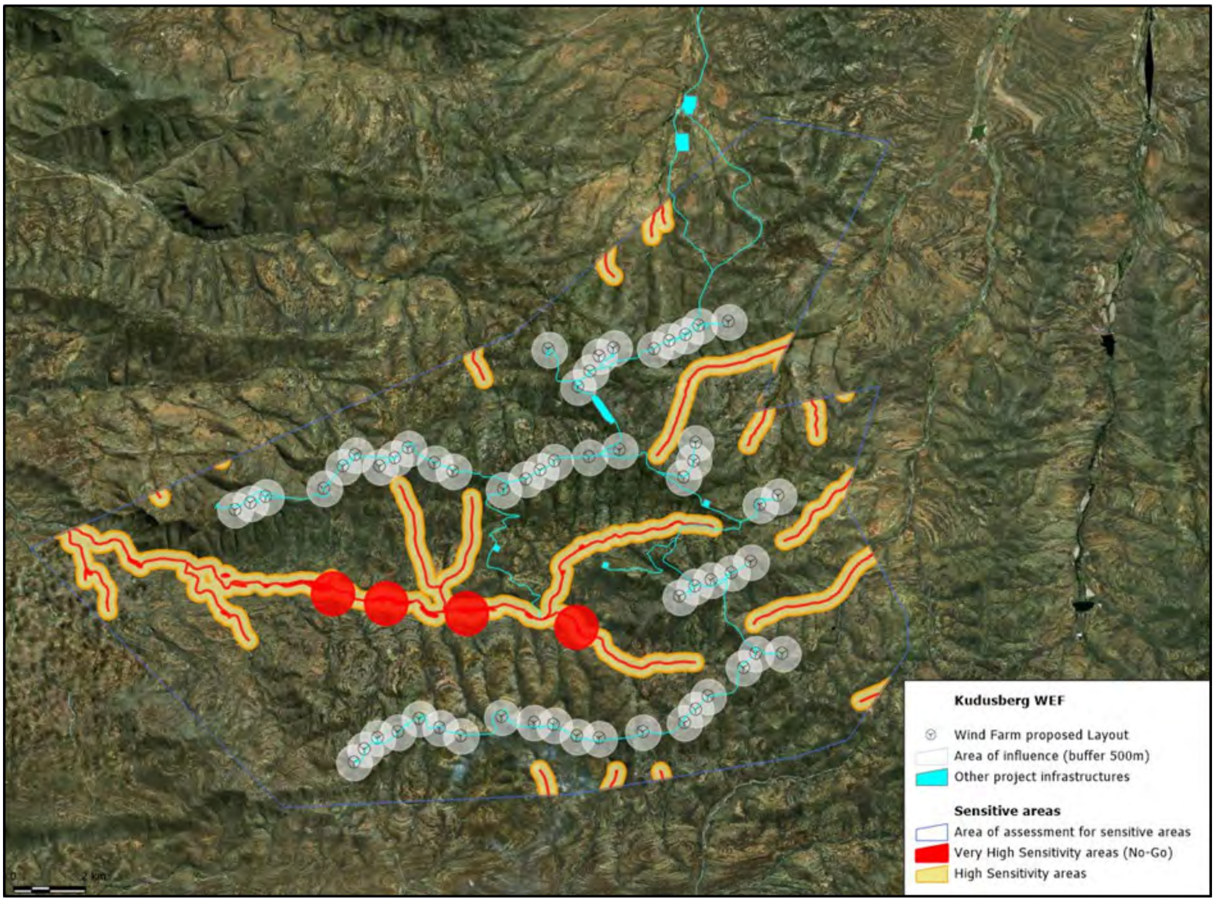


Figure D.32: Sensitive areas identified for bats during the pre-construction monitoring campaign at Kudusberg WEF, overlaid with the proposed development features.

D.1.2.8.4 **Bat impacts**

From the 67 bat species that may occur within South Africa (Monadjem et al., 2010), according to several criteria, only 15 bat species are likely to occur within the Kudusberg WEF study area. From all these 15 species, at least four species had confirmed occurrence in the area. From all these fifteen species, nine of them are considered to be sensitive to the project development (please refer to Table B.4).

Results of the 12-month pre-construction bat monitoring indicate that the bat activity at the proposed Kudusberg WEF area is **generally low** considering the Bat Guidelines (Sowler *et al.*, 2016).

One species with confirmed occurrence is perceived as having a potential high risk of collision with wind turbines (according to Sowler *et al*., 2016) due to their behaviour, i.e. *Tadarida aegyptiaca*. Two other species with confirmed presence in the area raise concerns regarding their probability of fatalities, as they have a medium-high risk of collision with wind turbines: *Neoromicia capensis* and *Miniopterus natalensis*. Additionally, *Miniopterus natalensis* is a migrant species that can use air space at rotor level during migration periods being prone to collision during these events. These are all “Near Threatened” or “Least Concern” species, according to the South African Red List (Friedmann & Daly, 2004b).

D.1.2.8.4.1 **Impacts Identified for the Construction Phase**

DIRECT IMPACTS

❖ **Habitat Loss.**

Destruction of natural vegetated areas due to the construction of crane platforms, workstation, substation, internal access roads, and turbines, underground cabling and overhead power lines installation – negative impacts.

Significance of impact without mitigation measures: Moderate

Proposed mitigation measures:

- Avoidance of infrastructure siting in very high (no-go) areas; clearance and removal of vegetation should be kept to minimum extent possible.
- Avoid destruction or disturbance of roosts.
- Roads crossing watercourses must do so perpendicularly and not be routed parallel to it, unless agreed to by the aquatic specialist.
- Use existing access roads where feasible.

Significance of impact with mitigation measures: Low

❖ **Disturbance Effects:**

Disturbance of bat community due to the increase of people and vehicles in the area, and destruction of roost locations – negative impacts.

Significance of impact without mitigation measures: Low

Proposed mitigation measures:

- Lower the levels of noise around very high and highly sensitivity areas, where possible.

- Avoid construction works during the night and destruction or disturbance of roosts due to the movement of machinery.
- A bat monitoring campaign is recommended for at least one year during the construction phase.
- Movement of machinery, vehicles and persons should be restricted to the existing or new roads and avoid the existing natural areas.

Significance of impact with mitigation measures: Very Low

INDIRECT IMPACT

❖ **Displacement to other areas which may or may not have the ability to support the influx of species.**

Displacement of the bat community due to the increase of disturbances in the area and destruction of roost locations – negative impacts.

Significance of impact without mitigation measures: Low.

Proposed mitigation measures:

- Lower the levels of noise around high and very-highly sensitivity areas, where possible;
- Avoid construction works during the night and destruction or disturbance of roosts;
- Movement of machinery, vehicles and persons should be restricted to the existing roads.

Significance of impact with mitigation measures: Very Low

D.1.2.8.4.2 **Impacts Identified for the Operational Phase**

DIRECT IMPACTS

❖ **Fatalities due to collision with wind turbines or barotrauma.**

Fatality of individuals due to collision with turbine blades or barotrauma caused by turbines operation – negative impacts.

Significance of impact without mitigation measures: Moderate.

Proposed mitigation measures:

- Avoidance of turbines installation in very high sensitive areas for bats (no-go areas).
- A monitoring plan is recommended during operation phase (including carcass searches and bias/scavenger trials) is recommended for a minimum of two years during the operational phase - if high levels of mortality are observed, management actions should be put into action to mitigate fatality.
- No tall vegetation should be allowed within the 200 m buffer around the wind turbines.
- Utilisation of red lights in the turbines, instead of white or whatever is in line with the requirements of the CAA.

Significance of impact with mitigation measures: Low

- **Disturbance Effects.**

Disturbance of bat community due to noise and movement generated by turbines operation and increase of people and vehicles in the area associated with maintenance activities – negative impacts.

Significance of impact without mitigation measures: Low.

Proposed mitigation measures:
- Lower levels of noise disturbance are recommended whenever possible.

Significance of impact with mitigation measures: Very Low

INDIRECT IMPACTS

- **Displacement to other areas which may or may not have the ability to support the influx of species.**

Displacement of the bat community due to the increase of disturbances in the area – negative impacts.

Significance of impact without mitigation measures: Low

Proposed mitigation measures:
- Lower levels of noise disturbance are recommended whenever possible.

Significance of impact with mitigation measures: Very Low

- **Population decline over time.**

Population decline of the bat community due to long-term increasing fatality events – negative impacts.

Significance of impact without mitigation measures: Low

Proposed mitigation measures:
- Bat habitats (including roosts) should not be severely destroyed, particularly in sensitive areas (very-high sensitive areas).
- A construction and operational phase monitoring programme is recommended to validate the effectiveness of the proposed mitigation measures, and if need be, propose new measures.

Significance of impact with mitigation measures: Very Low

D.1.2.8.4.3 **Impacts Identified for the Decommissioning Phase**

DIRECT IMPACT

- **Disturbance Effects.**

Disturbance of bat community due to noise and movement generated by dismantling of turbines and associated infrastructure, as well as the dismantling of power lines – **negative impacts**.

Significance of impact without mitigation measures: Low

Proposed mitigation measures:

- Lower the levels of noise around highly sensitivity areas where possible.
- Avoid dismantling works during the night and disturbance of roosts.
- Movement of machinery, vehicles and persons should be restricted to the existing roads.

Significance of impact with mitigation measures: Very Low

INDIRECT IMPACT

❖ **Displacement to other areas which may or may not have the ability to support the influx of species.**

Displacement of the bat community due to the increase of disturbances in the area, while dismantling wind turbines and associated infrastructure – negative impacts.

Significance of impact without mitigation measures: Low

Proposed mitigation measures:

- Lower the levels of noise around highly sensitivity areas where feasible.
- Avoid dismantling works during the night and disturbance of roosts.
- Movement of machinery, vehicles and persons should be restricted to the existing roads.

Significance of impact with mitigation measures: Very Low

D.1.2.8.4.4 **Cumulative Impacts**

❖ **Destruction of important habitat areas (natural vegetation, water features, roosts, etc.) due to the construction of wind turbines and associated infrastructures Increased fatalities due to collision with various projects' infrastructures and/or barotrauma.**

Mitigation measures:

- Avoidance of infrastructure siting in very high (no-go) areas.
- Clearance and removal of vegetation should be kept to minimum extent possible.
- Avoid destruction or disturbance of roosts.

❖ **Disturbance of the bat community due to the increase of people and vehicles in the area, high levels of noise and machinery movements.**

- Lower the levels of noise around highly sensitivity areas.
- Avoid construction/dismantling works during the night and destruction or disturbance of roosts.
- Movement of machinery, vehicles and persons should be restricted to the existing roads.

❖ **Displacement of bat community due to increased disturbances in the area.**

- Lower the levels of noise around highly sensitivity areas.

- Avoid construction/dismantling works during the night and destruction or disturbance of roosts.
- Movement of machinery, vehicles and persons should be restricted to the existing roads.

❖ **Fatalities due to collision with turbine blades or barotrauma.**

- Avoidance of turbines installation in very high sensitive areas for bats (no-go areas);
- A monitoring plan is recommended during operation phase (including carcass searches and bias/scavenger trials) is recommended for a minimum of two years during the operational phase - if high levels of mortality are observed, management actions should be put into action to mitigate fatality.
- No tall vegetation should be allowed within the 200 m buffer around the wind turbines.
- Utilisation of red lights in the turbines instead of white or as per the requirements of the CAA.

❖ **Population decline due to long-term increasing fatality events**

- Avoid turbine placement in very high sensitive (no-go) areas; bat habitats (including roosts) should not be severely destroyed, particularly in sensitive areas.

The effects of the Kudusberg WEF considering other projects, will produce impacts that are likely to accumulate on the bat communities – negative impacts. Although wind energy facilities' footprint is not intense, the construction of roads and building platforms can affect significant portions of natural vegetation. Also, it is important to consider that besides the WEF, other renewable energy facilities, are also being planned and approved in the proximities of the Kudusberg WEF (Figure D.1)

Significance of all cumulative impacts: Moderate (without mitigation measures) and Low (with mitigation measures)

It is however important to note that the quantification or even evaluation of cumulative impacts is uncertain as there is not a generalized knowledge of the large-scale movements or connection between bat populations within the region. If present, cumulative impacts will be reflected by a very rapid decline of bat populations, i.e. above that expected from a single wind energy facility operation. Further monitoring and meta-analysis of the results of the monitoring programmes of all operational phase WEFs and Solar PV facilities will help validate and determine these types of impacts.

D.1.2.8.4.5 **No-go alternative**

Should the Kudusberg Wind Farm not be constructed, then all impacts (whether it be negative or positive) identified within the impact analysis will not take place. As a result, it is expected that the present environmental characteristics relevant for the bat community on site will remain unchanged, relative to that which is being observed at present, under current land-use practices.

D.1.2.8.5 **Impact Assessment Summary: Bat impacts**

Impact	Mitigation measure	Significance before mitigation	Significance after mitigation
CONSTRUCTION PHASE			
Direct impacts			
Destruction of important habitat areas (natural vegetation, water features, roosts, etc.) due to the construction of wind turbines and associated infrastructures.	• Avoidance of infrastructure siting in high and very high (no-go) areas; • Clearance and removal of vegetation should be kept to minimum extent possible; • Avoid destruction or disturbance of roosts; • Roads crossing watercourses must do so perpendicularly and not be routed parallel to it unless agreed to by the aquatic specialist.	Moderate	Low
Disturbance of the bat community due to the increase of people and vehicles in the area, high levels of noise and machinery movements.	• Lower the levels of noise around highly sensitivity areas where possible; • Avoid construction works during the night and destruction or disturbance of roosts; • Movement of machinery, vehicles and persons should be restricted to the existing roads and new roads; • A bat monitoring campaign is recommended for at least one year (year 1) during the construction phase.	Low	Very Low
CONSTRUCTION PHASE			
Indirect impact			
Displacement of bat community due to increased disturbances in the area.	• Lower the levels of noise around very-high and highly sensitivity areas where possible; • Avoid construction works during the night and destruction or disturbance of roosts; • Movement of machinery, vehicles and persons should be restricted to the existing roads and new roads.	Low	Very Low
OPERATIONAL PHASE			
Direct impacts			
Fatalities due to collision with turbine blades or barotrauma.	• Avoidance of turbines installation in very high sensitive areas for bats (no-go areas); • A monitoring plan is recommended during the operation phase (including carcass	Moderate	Low

Impact	Mitigation measure	Significance before mitigation	Significance after mitigation
	searches and bias/scavenger trials) is recommended for a minimum of two years during the operational phase - if high levels of mortality are observed, management actions should be put into action to mitigate fatality; • No tall vegetation should be allowed within the 200 m buffer around the wind turbines; utilisation of red lights in the turbines, instead of white as per the requirements of the CAA.		
Disturbance of bat community due to high levels of noise and movement generated by turbines operation and increase of people and vehicles associated with maintenance activities	• Lower levels of noise disturbance are recommended whenever possible.	**Low**	**Very low**
OPERATIONAL PHASE			
Indirect impacts			
Displacement of bat community due to increased disturbances in the area.	• Lower levels of noise disturbance are recommended whenever possible.	**Low**	**Very low**
Population decline due to long-term increasing fatality events.	• Bat habitats (including roosts) should not be severely destroyed, particularly in sensitive areas; • A construction and operational phase monitoring programme is recommended to validate the effectiveness of the proposed mitigation measures, and if need be, propose new measures.	**Low**	**Very Low**
DECOMMISSIONING PHASE			
Direct impact			
Disturbance of bat community due to the increase of people and vehicles in the area, high levels of noise and machinery movements when dismantling wind turbines and	• Lower the levels of noise around highly sensitivity areas; • Avoid dismantling works during the night and disturbance of roosts; • Movement of machinery, vehicles and persons should be restricted to the existing roads.	**Low**	**Very low**

Impact	Mitigation measure	Significance before mitigation	Significance after mitigation
associated infrastructures.			
DECOMMISSIONING PHASE			
Indirect impact			
Displacement of bat community due to increased disturbances in the area.	• Lower the levels of noise around highly sensitivity areas; • Avoid dismantling works during the night and destruction or disturbance of roosts; movement of machinery, vehicles and persons should be restricted to the existing roads.	**Low**	**Very low**
CUMULATIVE IMPACTS			
Destruction of important habitat areas (natural vegetation, water features, roosts, etc.) due to the construction of wind turbines and associated infrastructures.	• Avoidance of infrastructure siting (excluding roads) in high and very high (no-go) areas; • Clearance and removal of vegetation should be kept to minimum extent possible; • Avoid destruction or disturbance of roosts.	**Moderate**	**Low**
Disturbance of the bat community due to the increase of people and vehicles in the area, high levels of noise and machinery movements.	• Lower the levels of noise around highly sensitivity areas; • Avoid construction/dismantling works during the night and destruction or disturbance of roosts; movement of machinery, vehicles and persons should be restricted to the existing roads.	**Moderate**	**Low**
Displacement of bat community due to increased disturbances in the area.	• Lower the levels of noise around highly sensitivity areas; • Avoid construction/dismantling works during the night and destruction or disturbance of roosts; movement of machinery, vehicles and persons should be restricted to the existing roads.	**Moderate**	**Low**
Fatalities due to collision with turbine blades or barotrauma.	• Avoidance of turbines installation in very high sensitive areas for bats (no-go areas); • A monitoring plan is recommended during operation phase (including carcass searches and bias/scavenger trials) is recommended for a minimum of two years during the operational phase - if high levels of mortality are observed, management actions should be put into action to mitigate fatality; • No tall vegetation should be allowed within the 200 m buffer around the wind turbines; and Utilisation of red lights in the turbines, instead of white.	**Moderate**	**Low**

Impact	Mitigation measure	Significance before mitigation	Significance after mitigation
Population decline due to long-term increasing fatality events.	• Avoid turbine placement in very high sensitive (no-go) areas; and • Bat habitats (including roosts) should not be severely destroyed, particularly in sensitive areas.	**Moderate**	**Low**

D.1.2.8.6 Comparative assessment of alternatives and comment on revised layout 1

The alternatives considered included:

- Access Roads: two alternatives to connect the public MN004469 road to the new wind farm road network between the turbines on the ridges. One of these roads is the western route (alternative 1) of approximately 4.6 km in length. The other is an eastern route (alternative 2) and is approximately 5.7 km in length.
- Construction Camps: three alternatives (including batching plants), of which one is located between turbines 43 and 47 (alternative 1), while another is located adjacent to the east of the MN4469 public road (south of construction camp 3) (alternative 2), and another also being located adjacent to the east of the MN4469 public road (but north of construction camp 2) (alternative 3).
- Substations: three alternatives (33/132kV), of which alternative 1 is located south of turbine 38 and north of turbine 39. Alternative 2 is located south of turbine 42 and north of turbine 33. Alternative 3 is located southeast of turbine 44.

After analysing all the above alternatives, it was found that all proposed layout options are deemed acceptable for development.

D.1.2.8.7 Concluding statement

The overall significance of impacts expected to occur during the construction, operation, and decommissioning phases, is expected to be **low before mitigation, and very low after mitigation**. The overall significance of cumulative impacts expected to occur is estimated to be **moderate before mitigation, and low after mitigation.**

Therefore, no fatal flaws were identified for the project from a bats perspective, only very high (no-go) areas were identified which should be excluded from development due to the high sensitivity of the environmental features located within these areas.

It is recommended that the proposed Kudusberg WEF may be authorised from a bats perspective, subject to the implementation of the recommendations proposed in the Bat Impact Assessment.

D.1.2.9 Socio-Economic Impact Assessment

The Socio-Economic Impact Assessment was undertaken by Urban-Econ Development Economists to inform the outcome of this BA. The full study (including nature, status, extent, duration, probability, reversibility, irreplaceability and confidence ratings) is included in Appendix D of this report. The following section provides a summary of the Impact Assessment undertaken for the Socio-Economic Assessment.

D.1.2.9.1 Approach and methodology

- Data gathering

Impact assessments require the knowledge of the socio-economic environment that will be potentially affected by the proposed project. To create a comprehensive understanding of the socio-economic environment that might be affected by the proposed development, a socio-economic profile of the study areas as well as the zone of influence was developed incorporating both primary and secondary data collection. Primary data collection was done through telephonic interviews with land owners of the affected properties.

- Data analysis

A description of the study area and the zone of influence is given in terms of selected socio-economic variables. The developed profile is later used to interpret the impacts and measure the extent of socio-economic impacts that could be derived from the proposed activities in the context of the local, provincial, and national economies.

- Impact identification, evaluation and alternative recommendation

This step included the description and evaluation of socio-economic impacts that could be expected during the construction and maintenance phases of the proposed WEF and supporting infrastructure. The assessment of impacts is done following the methodology prescribed by CSIR.

Seasonality is not relevant in this study as data gained from the interviews is representative of all seasons throughout the year (i.e. economic activity during different seasons is obtained).

Impact Assessment

The relevant impact assessment methodology was provided by CSIR (the legally appointed EAP) so as to ensure uniformity of assessment across the entire suite of specialist studies commission as part of the EIA process undertaken for the proposed development.

D.1.2.9.2 **Project aspects relevant to social impacts**

The socio-economic impacts are triggered by aspects emanating from the proposed development of the WEF and associated infrastructure. These include the following:

- During construction:
  - Procurement of goods and services required for the construction and development of the WEF and supporting infrastructure;
  - Transportation of machinery, equipment and other components from various locations in South Africa to the project site;
  - Site/path clearance;
  - Heavy machinery movement on site;
  - Electrical infrastructure mounting and installation;
  - Hiring of labour - locally and outside the local area;
  - Presence of vehicles and personnel on farms; and
  - Influx of migrants/job seekers to the area.

- During operation:
  - Hiring of labour to support operations and maintenance; and
  - Periodic presence of maintenance personnel.

- During decommissioning:
  - Procurement of goods and services required for the decommissioning of WEF; and
  - Hiring of labour.

D.1.2.9.3 **Socio-Economic impacts**

D.1.2.9.3.1 **Impacts Identified for the Construction Phase**

DIRECT IMPACTS:

Positive impacts

❖ **Stimulation of the local economy through increase in production and GDP-R due to capital expenditure**

The establishment of the proposed Kudusberg WEF will be associated with numerous capital expenses. Expenses would usually include expenditure on transport and installation of wind turbines, electrical and grid connection, foundation, civil works, and construction of supporting structures. If goods and services are procured locally, i.e. within South Africa, it increases the production of the respective industries. This has a positive impact on the national economy and economies of the municipalities where inputs are procured. The construction sector in Karoo Hoogland LM experienced a 1.6% increase between 2007 and 2017.The Witzenberg LM experienced a 6.4% increase of this sector in the same period. The proposed project can stimulate this sector even further among other sectors such as the manufacturing, transport and retail trade sector.

It is expected that any capital investment that will be spent in South Africa, will resultantly stimulate the national economy, although for a temporary period of about 18-24 months.

The size of the Witzenberg LM's economy was estimated at R6.1 billion in current prices and primarily comprises of the finance, trade and agriculture sectors. Karoo Hoogland LM's economy was estimated at R463 million and is even smaller than Witzenberg LM's. Considering the small economic base of Karoo Hoogland LM, the opportunities for the procurement of goods and services within the local economy will be very limited. Witzenberg LM, while larger is unlikely to cater for all of the broad needs of the development. It is likely however, that some of the local businesses could benefit from sub-contracting opportunities, if the construction companies appointed by the developer implement a local community procurement policy, and consumer expenditure of the construction crew. Furthermore, the demand for hospitality services including accommodation and catering in the nearby towns of Matjiesfontein, Sutherland, Laingsburg and Touws Rivier is expected to increase and provide for much needed stimulus for the local economy.

Significance of impact before mitigation: High (+)

Proposed mitigation measure:

- Procure goods and services, as far as practically possible, from the local municipality

Significance of impact after mitigation: High (+)

❖ **Temporary creation of employment**

The construction of the WEF and associated infrastructure will require temporary employment of construction workers, foremen, and engineers on site. The review of the local skills set, though suggests that it is unlikely that the local area will be able to supply all of the skilled and most of the highly skilled workers for the project. Unskilled and semi-skilled workers can however, be recruited from the local area as they will be required for the work involved on site. Therefore, some improvement in the employment situation in the local municipalities could be expected, albeit it will be for a temporary period. Employment of the individuals, albeit temporary, will increase their household income, improve their standard of living and benefit their families. It is assumed that approximately 250 jobs will be directly created during construction of the WEF.

In addition to those benefitting from direct employment created at the project, various multiplier effects will assist in temporarily supporting existing jobs in the businesses offering services and goods that will be procured during construction activities. The increased temporary income earned by these businesses will in turn stimulate consumption spending, creating another round of multiplier effect. The unemployment rate of 17% will thus to a certain extent be curbed.

As an enhancement measure, a local skills desk, wherein skills of interested and prospective employees are captured, ought to be implemented. This will assist the Human Resource (HR) process of identifying skills at a local level and recruiting at a local level. Therefore, the awareness of the skills desk to the local communities is salient.

Significance of impact before mitigation: Low (+)

Proposed mitigation measures:

- Advise on the set-up of a skills desk and where it will be situated.
- Offer training to increase employability

Significance of impact after mitigation: Low (+**)**

- **Skills development and enhancement due to construction activities**

The Kudusberg WEF project represents an important opportunity for locals to increase their participation in the labour market and to acquire critical skills and technical qualifications. A variation of skill sets is required ranging from semi-skilled construction workers to highly skilled engineers.

To employ local labour, it is recommended that a focused training programme and skills transfer occur. This will adequately equip employed individuals to effectively conduct required tasks and develop a local skilled construction labour force. All those employed will either develop new skills or enhance current skills. This insinuates that inexperienced workers will have the opportunity to attain and develop new skills, whilst experienced workers will further enhance their current skills.

As production and consumption effects filter through the economy creating a demand for more labour, human resources will be trained and skilled within aligned industries. Ultimately, the WEFs construction will lead to enhanced skills through training and experience in the wider national economy.

In the case where skills development programmes and training take place, the significance of skills development will be high, whereas without focused training, the significance will be moderate.

Significance of impact before mitigation: Low (+)

Proposed mitigation measure:

- Devise and implement skills training and skills transfer

Significance of impact after mitigation: Moderate (+)

Negative impact

- **Impact on agricultural activities on the directly affected farm portions.**

With an increase in the number of workers and construction related traffic on the directly affected farms it is possible that the agricultural activities may be impacted. This could result in reduced ranges for livestock, stress on livestock, and potential livestock theft because of an increased number of workers on the farms. Negative impacts on the livestock in the area could lead to a decrease in on-farm incomes for the land owners.

It is suggested that the mitigations suggested in the Agricultural Impact Assessment be adhered to.

Significance of impact before mitigation: Low (-)

Proposed mitigation measure:

- Adhere to recommendations by Agricultural specialist

Significance of impact after mitigation: Very Low (-)

INDIRECT IMPACTS

Positive impacts

- ❖ **Household income attainment and standard of living due to employment opportunities**

Over half of the households in Witzenberg and Karoo Hoogland LMs are classified as low-income earners. The proposed project provides an opportunity to improve the standard of living for benefitting households, albeit temporary. Numerous households would likely benefit from employment provided by the Kudusberg WEF development. The income earned also results in increased purchasing power in the local community. Therefore, the local business owners and individuals employed at these businesses will also likely experience some improvement in their income and pass this benefit onto their households.

Significance of impact before mitigation: Low (+)

Proposed mitigation measure:

- Hire majority of local residents who will boost local economy through expenditure that empowers local businesses and economy

Significance of impact after mitigation: Low (+)

- ❖ **Increase in government revenue due to rates and taxes**

In 2017/18, government revenue experienced a considerable shortfall with the revenue gap growing from R30.7 experienced in 2016/17 to R48.2 billion (NT, 2018). The shortfall was largely attributed to lower income tax, VAT and customs duties collected as a result of slowing wage increases, weaker consumer spending, and lower import growth (NT, 2018). The situation therefore is considerably grimmer than that observed during the 2008 financial crisis with the gross debt-to-GDP ratio increasing from 26.0% in 2008/09 to unprecedented 53.3% (NT, 2018).

Although, collection of tax is also dependent on tax morality in the country, a vibrant growth stimulated by investment into the economy contributes to the growth of the tax base and leads to increase in gross tax revenue. The project will see an investment of R2.4 billion, some of which will be spent on imported goods and services, and some will be spent on goods and services procured in the country. As a result, the project is likely to lead to the increase in import tax collections, VAT collections, and personal and company tax collection.

Although the spending of the money earned by government through tax collection is difficult to associate with a specific budget item, any revenue received by national government is allocated towards certain budget items, provinces or local municipalities to support and assist with the improvement of their service delivery. This revenue will thus assist government in the improvement of socio-economic conditions for residents.

Significance of impact before mitigation: Low (+)

Proposed mitigation measures:

- No enhancement measures applicable

Significance of impact after mitigation: Low (+)

Negative impacts

- **Increased demand for housing, services and social facilities due to influx of migrant labour and job seekers and associated social ills**

In a country with an unemployment rate of 26.6%, job seekers are continuously in search of employment prospects (Quantec, 2018). Consequently, the knowledge of the proposed project will attract job seekers into the region. In addition, migrant labour (labour demand which was not met by the local area) will be temporarily accommodated in the area. This influx, depending on its magnitude, can place pressure on local government to provide housing, services and social facilities. Additionally, in the case where employment expectations are not met, the possibility of informal settlement proliferation is high. Therefore, it is recommended that the recruitment process is well communicated and managed. Furthermore, accommodation options for migrant labour should be given due consideration, in order to avoid the imposition of additional pressure on the local housing market.

A male-dominated influx tends to exacerbate social ills such as prostitution and alcohol abuse which tarnish the social fabric. This may place a strain on public social facilities such as health care facilities and education facilities, as well as lead to long-term negative effects such as unwanted pregnancies, spread of disease and addictions. Consultation during the planning phase should be undertaken with the local government to effectively plan for the provision of housing, services and social facilities to meet the potential change in demographics (even if temporary).

Significance of impact before mitigation: Low (-)

Proposed mitigation measures:

- Manage recruitment process to control expectations and unnecessary in-migration.
- Ongoing consultation should be undertaken with the local government to effectively plan for the influx.
- Adequate education for workers on the dangers of substance abuse.

Significance of impact after mitigation: Very Low (-**)**

- **Potential increase in theft related crimes due to increased movement of people in area in area**

As established, crime incidents have been reported at the Sutherland and Ceres precincts particularly those of drug related crimes, theft and assault. The influx of labour may exacerbate this status if job expectations are not met. Furthermore, inequality, social ills and insufficient job opportunities have a positive correlation with the increase in incidents of various crimes.

The construction phase will create additional movement of people and vehicles to the site, which can also increase the chances of theft in the surrounding properties. This negative impact is moderate and can cause the loss of livestock or valuables. As a counter-action, access to the project site should be controlled wherein only authorised staff are permitted entry. Moreover, movement to and from the project site should be controlled where construction workers are transported to and from the pick-up area and project site.

Potential affected parties have indicated their concerns over their safety and the safety of their property. Therefore, it would also be advisable to set up regular engagements with the surrounding community and land owners on issues of safety and crime in the area. It is proposed that the developer considers forming a local safety forum, which will develop solutions suitable to immediate community members regarding safety and address any concerns related to possible crime escalation. A community watch could also be set up.

Significance of impact before mitigation: Moderate (-)

Proposed mitigation measures:

- Implement controlled access to project site and monitor activity in immediate surrounding sites.
- Set up local community safety forum.

Significance of impact after mitigation: Low (+)

- **Increased social ills such as substance abuse and the spread of communicable diseases**

An increase in the number of people in the area seeking work or working on the WEF is likely to cause an increase in the number of social ills that are present in the area. It is likely that substance abuse and the spread of communicable diseases will be increased in the area. This is likely to cause a certain degree of social upheaval in existing communities and can lead to tensions between the WEF and the surrounding communities. This impact is likely to persist throughout the duration of the construction.

It is suggested that the contractor and developer mitigate this impact by establishing communicating with workers on what behaviour is expected and by managing the amount of time spent off site away from their living areas. It is also suggested that the developers be aware and regularly engage with the surrounding community.

Significance of impact before mitigation: Moderate (-)

Proposed mitigation measures:

- Implement controlled access to project site.
- Set up local community safety forum.
- Maintain contact with major community stakeholders.

Significance of impacts after mitigation: Low (+)

❖ **Impact on agricultural activities on the directly affected farms**

With an increase in the number of workers and construction related traffic on the directly affected farms it is possible that the agricultural activities may be impacted. This could result in reduced ranges for livestock, stress on livestock, and potential livestock theft because of an increased number of workers on the farms. Negative impacts on the livestock in the area could lead to a decrease in on-farm incomes for the land owners.

It is suggested that the mitigations suggested in the Agricultural Impact Assessment be adhered to.

Significance of impact before mitigation: Low (-)

Proposed mitigation measure:

- Adhere to recommendations by Agricultural specialist.

Significance of impact after mitigation: Very Low (-)

D.1.2.9.3.2 **Impacts Identified for the Operational Phase**

DIRECT IMPACTS

Positive impacts

❖ **Stimulation of the economy - Increase in production and GDP-R due to operation expenditure**

In order to keep the Kudusberg WEF operational, certain costs will be allocated to operations and maintenance. These costs will be spent on procurement of spares, maintaining the facilities, security, and other line items. Additional and new business sales will be created as a result of the indirect multiplier effect stimulated by the operating activities of the wind farm. The long-term number of business sales and production will have moderate significance as an increase in business sales will take place. To enhance the positive impact on the local area, procurement of goods and services from local business will serve to boost the local economy. Nonetheless, the enhancement measure will not alter the significance rating but rather concentrate benefits to the local area, which needs the consistent injection of expenditure.

Significance of impacts before mitigation: Moderate (+)

Proposed mitigation measure:

- Maximise benefit for local economy through local procurement.

Significance of impacts after mitigation: Moderate (+)

❖ **Long-term employment creation due to operation and maintenance activities**

Operations and maintenance of WEF will need to be conducted by staff. These positions will likely be technical in nature. It is advisable that as many of these jobs as possible are filled by individuals from the local communities to stimulate the local economy. This may require identifying prospective candidates at the construction phase and up-skilling them in time for the project to start operations. Sending these employees for on-job training or internships could be considered. Alternatively, skills transfer programmes should be put in place to ensure that all jobs created on site during operations are eventually passed onto the individuals from the local communities.

Significance of impacts before mitigation: Very Low (+)

Proposed mitigation measure:

- Offer skills development programme to serve energy market in region and create local employability.

Significance of impacts after mitigation: Very Low (+)

❖ **Skills development and enhancement due to operation activities**

Skills are imperative for satisfying job requirements and adequately performing tasks that ultimately boost the economy. Employees who are new to the market will develop and attain new skills, whilst workers adept in particular skills will sharpen their abilities. In addition, the employees will improve their marketability for future employment and will be perceived positively by future employers. Successful training and development programmes will develop labour capability in wind farm skills within the region.

Significance of impacts before mitigation: Very Low (+)

Proposed mitigation measure:

- Offer skills development programme to serve energy market in region and create local employability.

Significance of impacts after mitigation: Very Low (+)

❖ **Local upliftment initiative will increase the local communities' access to basic services**

Significance of impacts before mitigation: Moderate (+)

Proposed mitigation measures:

- Establishment of upliftment initiatives need to be effectively managed with direct input from relevant stakeholders.

Significance of impacts after mitigation: Moderate (+)

INDIRECT IMPACTS

Positive impacts

- **Household income attainment and standard of living due to employment opportunities**

Household earnings are linked closely with trends in employment and, as such, will be affected positively by the envisaged temporary increase in employment. The creation of employment during the operation period will provide sustainable earnings for the benefitting households. Resultantly, an improvement in the standard of living based on the additional income will accrue. A portion of this income will be earned by households residing in the local communities, thus positively impacting the local economy. This will improve the current income profile of the Witzenberg and Karoo Hoogland LMs, which is dominated by low income earners and could lessen the dependence of selected local households on social grants.

Significance of impacts before mitigation: Very Low (+)

Proposed mitigation measure:

- Employing locally will increase benefit to local households and inadvertently the local economy.

Significance of impacts after mitigation: Very Low (+)

- **Increase in local government revenue due to rates and taxes.**

The continual operation of the WEF will likely lead to an increase in the amount of government revenue due to rates and taxes. As mentioned in section 1.5.2.5 the South African government experienced a considerable shortfall with the revenue gap growing from R30.7 experienced in 2016/17 to R48.2 billion (NT, 2018). It is thus assumed that any additional investment that can revenue for the government will be beneficial for the country as a whole. The operation of the WEF will see constant revenue generation for the duration of the operation of the development which will benefit the economy.

Although the spending of the money earned by government through tax collection is difficult to associate with a specific budget item, any revenue received by national government is allocated towards certain budget items, provinces or local municipalities to support and assist with the improvement of their service delivery. This revenue will thus assist government in the improvement of socio-economic conditions for residents.

Significance of impacts before mitigation: Very Low (+)

Proposed mitigation measures:

- No enhancement measures applicable.

Significance of impacts after mitigation: Very Low (+)

D.1.2.9.3.3 **Impacts Identified for the Decommissioning Phase**

DIRECT IMPACTS

Positive impacts

❖ **Local economy stimulation due to decommissioning costs.**

Significance of impacts before mitigation: Very Low (+)

Proposed mitigation measure:

- Develop and implement a material recovery strategy to optimise use of valuable material.

Significance of impacts after mitigation: Very Low (+)

❖ **Temporary employment and income from recycling of metals and other components.**

After the lifespan of the WEF has been reached, termination of the project will take place if the facility cannot be refurbished and a new power purchase agreement signed. A certain amount of funds will be allocated towards the dismantling and decommissioning of the wind farm. This expenditure on decommissioning activities will generate positive impacts on production, GDP, employment and household income, albeit relatively small and for a temporary period. Decommissioning activities will stimulate demand for services of transport and construction companies, amongst others. Resultantly, the local economy will be stimulated for the duration of the decommissioning phase. Decommissioning expenditure such as the disassembly of components will increase the demand for construction services and services offered by other industries.

Some of the project components will be of recyclable value and therefore will also bring some income to the owner. Importantly, the recovery of valuable metallic and non-metallic materials will lead to the generation of revenue for the owner and allow for savings in production costs of companies that will use the recovered materials in their processes.

Significance of impacts before mitigation: Very Low (+)

Proposed mitigation measure:

- Advise on the set-up of a skills desk and where it will be situated.

Significance of impacts after mitigation: Very Low (+)

D.1.2.9.3.4 **Cumulative Impacts**

Positive impacts

❖ **Employment creation due to numerous developments**

The exact number of employment opportunities to be made available by the other proposed WEF projects in the area is currently not known (estimated at 250 jobs per WEF during construction), but it can be stated with confidence that the combined figure would contribute to a notable increase in employment figures. This positive impact can be augmented in the case that the majority of labour is sourced locally.

Significance of impacts before mitigation: High (+)

Proposed mitigation measure:

- Offer skills development programme to serve energy market in region and create local employability.

Significance of impacts after mitigation: High (+)

❖ **Stimulation of economy due to capital and operating expenditure from projects**

The injection of investment from all proposed projects will have a multiplier effect on the economy, wherein numerous economic sectors such as the transport and manufacturing will benefit. The combined expenditure will be colossal and will have a notable impact on GDP and production. Local business will not have the capacity to supply all required services and materials; therefore, the local economy will only benefit to a limited extent. Nonetheless, the GDP of the Witzenberg LM, Karoo Hoogland LM and surrounding municipalities will increase as a result of these projects.

Significance of impacts before mitigation: High (+)

Proposed mitigation measure:

- Procure goods and services, as far as practically possible, from the local municipality.

Significance of impacts after mitigation: High (+)

❖ **Improved access to rural areas.**

Investment in road infrastructure will take place for vehicle and people movement for new projects.

Significance of impacts before mitigation: Low (+)

Proposed mitigation measure:

- Ensure that routes are regularly maintained.

Significance of impacts after mitigation: Low (+)

❖ **Increase in government revenue due to rates and taxes - Local upliftment initiatives**

The cumulative impacts of the projects surrounding this development will see an increase in goods and services procured in the country. As a result, the project is likely to lead to the increase in import tax collections, VAT collections, and personal and company tax collection. This revenue will thus assist government in the improvement of socio-economic conditions for residents.

Significance of impacts before mitigation: Moderate (+)

Proposed mitigation measure:

- Establishment of upliftment initiatives need to be effectively managed with direct input from relevant stakeholders.

Significance of impacts after mitigation: Moderate (+)

Negative impacts

❖ **Influx of migrant labour and job seekers placing pressure on government to provide housing, services and social facilities**

In the case that the WEF projects currently proposed within a radius of 50 km from the Kudusberg WEF site are constructed and operate at a similar time period, a large number of migrant labours will have to be accommodated in the area. Further to this, job seekers will be drawn to the area due to the numerous job opportunities anticipated from the many developments. This influx of people could lead to a notable shift in demographics in the region. As a result, additional housing, services and the use of social facilities will be required (even if temporary). Given the current backlog in the municipality, it can be said that a significant pressure will be placed on local government to adequately provide for the increased demand. The situation could be exacerbated if the municipalities continue experiencing challenges with the collection of revenue.

Significance of impacts before mitigation: Moderate (-)

Proposed mitigation measures:

- Manage recruitment process to control expectations.
- Engage with local government during planning stages for adequate preparation to take place.

Significance of impacts after mitigation: Low (-)

D.1.2.9.3.5 **No-go Alternative**

Under the No-Go option the Kudusberg WEF would not be developed. As such, all the proposed impacts outlined above would be "neutral" i.e. should the development not occur none of the negative or positive impacts identified during the construction, operational and decommissioning phases would arise.

Furthermore, should the Kudusberg WEF not be developed, the potential job opportunities, and associated improvement in livelihoods, that could be created are forgone. Improvements in energy supply would likewise also be foregone.

The no-go alternative is assessed to have a neutral significance.

D.1.2.9.4 **Impact Assessment Summary: Socio-Economic Impacts**

Impact	Mitigation measure	Significance before mitigation	Significance after mitigation
CONSTRUCTION PHASE			
Direct impacts			
Economy will be stimulated due to capital investment and resultant increased production.	• Procure goods and services, as far as practically possible, within the local municipality. • Keep record of companies and businesses supplying goods and services. • Calculate split percentage of local and national/international companies.	**High (+)**	**High (+)**
Unemployment figures will slightly decrease due to jobs created.	• Create awareness of skills desk through posters and media announcements. • Skills desk should serve to record local job seeker skills. • Identify potential candidates and fill vacancies. • Run a supplier day in neighbouring towns and identify prospective companies to engage with during construction • Offer training to increase employability.	**Low (+)**	**Low (+)**
Skills levels in municipalities and for benefitting individuals will improve due to employment created.	• Devise and implement skills training and skills transfer.	**Low (+)**	**Moderate (+)**
Movement of vehicles and workers may change livestock habits and ranges	• Adhere to recommendations by Agricultural specialist.	**Low**	**Very Low**
Indirect impacts			
Employment due to wind farm construction work will result in household income earnings for benefitting households.	• Hire majority of local residents who will boost local economy through expenditure that empowers local businesses and economy.	**Low (+)**	**Low (+)**
The in-migration of migrant labour and job seekers will place pressure	• Manage recruitment process to control expectations and unnecessary in-migration. • Ongoing consultation should be undertaken with the local government to effectively plan	**Low**	**Very Low**

Impact	Mitigation measure	Significance before mitigation	Significance after mitigation
on local government to adequately provide housing, services and social facilities.	for the influx. • Adequate education for workers on the dangers of substance abuse.		
The increased number of people on site creates potential for theft, particularly livestock theft.	• Implement controlled access to project site and monitor activity in immediate surrounding sites. • Each employee ought to have an access card/ apparel for identification purposes • Security should be located at the entrance to only permit authorised personnel and landowners. • A pick-up point ought to be established wherein, employees will be transported to and from the site. • Develop a local community safety forum to establish monitoring methods for surrounding community.	**Moderate**	**Low**
The rates, payroll taxes and Value Added Tax paid to local government will increase government revenue.	• No enhancement measures applicable.	**Low (+)**	**Low (+)**
Diseases, substance abuse and other social ills could increase leading to increased community dissatisfaction.	• Implement controlled access to project site. • Set up local community safety forum. • Maintain contact with major community stakeholders.	**Moderate**	**Low**
OPERATIONAL PHASE			
Direct impacts			
Expenditure associated with the operation of the wind farm will impact on production in the economy.	• Maximise benefit for local economy through local procurement	**Moderate (+)**	**Moderate (+)**
Operation and maintenance activities will create long term job opportunities.	• Offer skills development programme to serve energy market in region and create local employability.	**Very Low (+)**	**Very Low (+)**
Skills levels in municipality and for	• Offer skills development programme to serve energy market in region and create local	**Very Low (+)**	**Very Low (+)**

Impact	Mitigation measure	Significance before mitigation	Significance after mitigation
benefitting individuals will improve due to employment created.	employability.		
Upliftment initiative will increase the local communities' access to basic services	• Establishment of upliftment initiatives need to be effectively managed with direct input from relevant stakeholders	**Moderate (+)**	**Moderate (+)**
Indirect impacts			
Employment in operations and maintenance of the windfarm will result in household income earnings for benefitting households.	• Employing locally will increase benefit to local households and inadvertently the local economy.	**Very Low (+)**	**Very Low (+)**
The rates, payroll taxes and Value Added Tax paid to local government will increase government revenue.	• No enhancement measures applicable.	**Very Low (+)**	**Very Low (+)**
DECOMMISSIONING PHASE			
Direct impacts			
The cost of the removal and disconnection of the wind turbines will stimulate economic activity.	• The Applicant must consider retraining and redeployment of local employees in an attempt to keep them in its employ.	**Very Low (+)**	**Very Low (+)**
Unemployment figures will slightly decrease due to jobs created for a short period of time.	• Advise on the set-up of a skills desk and where it will be situated.	**Very Low (+)**	**Very Low (+)**
CUMULATIVE IMPACTS			
The influx into the region will possibly be immense due to the numerous projects in the area attracting migrant job seekers. This will increase the demand for services.	• Manage recruitment process to control expectations. Engage with local government during planning stages for adequate preparation to take place.	**Moderate**	**Low**

Impact	Mitigation measure	Significance before mitigation	Significance after mitigation
The numerous projects will create a notable number of jobs.	• Offer skills development programme to serve energy market in region and create local employability.	**High (+)**	**High (+)**
Capital and operating expenditure of numerous projects will increase production in the economy.	• Procure goods and services, as far as practically possible, from within the local municipality.	**High (+)**	**High (+)**
Local roads upgraded as a result of numerous WEFs in the area.	• Ensure that routes are regularly maintained.	**Low (+)**	**Low (+)**
Numerous upliftment initiatives will increase the local communities' access to basic services.	• Establishment of upliftment initiatives need to be effectively managed with direct input from relevant stakeholders.	**Moderate (+)**	**Moderate (+)**

D.1.2.9.5 Comparative assessment of alternatives and comment on revised layout 1

From a socio-economic perspective therefore, no objections are made with regard to the proposed project or its alternatives.

The impact assessed above are relevant to the revised layout 1.

D.1.2.9.6 Concluding statement

The overall rating of identified negative socio-economic impacts are of low and very low significance (post mitigation). The proposed Kudusberg WEF will result in many positive impacts – some of very high significance (positive) before and after mitigation. Overall, the benefits of the project outweigh the negative socio-economic effects that the development of the proposed Kudusberg WEF could create; thus, **no objections from a socio-economic perspective can be raised with respect to the proposed project and the alternatives. It is therefore recommended that the proposed Kudusberg WEF can be authorised.** However, the recommended mitigation measures will need to be considered and implemented.

D.1.2.10 Noise

The Noise Impact Assessment was undertaken by Safetech to inform the outcome of this BA. The full study (including nature, status, extent, duration, probability, reversibility, irreplaceability and confidence ratings) is included in Appendix D of this report. The following section provides a summary of the Impact Assessment undertaken for the NIA.

D.1.2.10.1 Approach and methodology

The methodology used in the Noise Impact Assessment (NIA) consisted of three approaches to determine the noise impact from the proposed project and associated infrastructure:

- A desktop study to model the likely noise emissions from the site;
- Field measurements of the existing ambient noise at different locations in the vicinity of the project during the day and night-time; and
- The identification of potential noise sensitive areas (NSAs).

The desktop study was done using the available literature on noise impacts from wind turbines as well as numerical calculations of the possible noise emissions. A Danish modelling program, EMD WindPro Software Version 3 was used which has been developed specifically for wind turbine noise. This program is used extensively worldwide and has been developed and validated in Denmark. The method described in SANS 10357:2004 version 2.1 (The calculation of sound propagation by the Concawe method) was used as a reference for further calculations where required.

WindPro uses the methods described in ISO 9613-2 (Acoustics – Attenuation of sound during propagation outdoors. Part 2 – General method of calculation). This method is very similar to SANS 10357:2004 and is used worldwide for modelling noise from various sources including wind turbine generators (Wind turbines). Where a tonal character is identified in the noise emitted from the turbines, a 5 dB(A) penalty is included in the modelling result.

The numerical results were then used to produce “noise maps” that visually indicate the extent of the noise emissions from the site. The noise emissions were modelled for various wind speeds from 3 m/s to 12 m/s. The direction of the wind was not taken into consideration as the wind could blow from any direction at the speeds that were modelled. The modelling is thus for worst-case scenarios and takes the topography around the turbine and noise sensitive area (NSA) into account.

The site elevation data was sourced from the NASA STRM database and imported into WindPro. A comparison was done using the digital elevation data and the contour heights from a 1:50 000 topographical map. The comparison showed that the digital data and the map corresponded well. Furthermore, the digital data provided a better resolution.

A wind turbine with a maximum sound power level of 108.1dB was used to model the noise impact. A wind turbine with an equal or lower maximum sound power level would be acceptable for the site without re-modelling. If a higher or lower final hub height is chosen, the noise impacts could be reduced or increase depending on the sound power of the turbine.

D.1.2.10.2 **Project aspects relevant to noise impacts**

The sources of sounds operating wind turbines can be divided into two categories namely:

. Mechanical sounds from the interaction of the turbine components

Mechanical sounds originate from the relative motion of mechanical components and the dynamic response among them. Sources of such sounds include the gearbox, generator, yaw drives, cooling fans and auxiliary equipment (e.g. hydraulics):

Since the emitted sound is associated with the rotation of mechanical and electrical equipment, it tends to be tonal (of a common frequency), although it may have a broadband component. For example, pure tones can be emitted at the rotational frequencies of shafts and generators, and the meshing frequencies of the gears.

In addition, the hub, rotor, and tower may act as loudspeakers, transmitting the mechanical sound and radiating it. The transmission path of the sound can be air-borne or structure-borne. Air-borne means that the sound is directly propagated from the component surface or interior into the air. Structure-borne sound is transmitted along other structural components before it is radiated into the air.

. Aerodynamic sound produced by the flow of air over the blades.

Aerodynamic broadband sound is typically the largest component of wind turbine acoustic emissions. It originates from the flow of air around the blades. A large number of complex flow phenomena occur, each of which might generate some sound. Aerodynamic sound generally increases with rotor speed. The various aerodynamic sound generation mechanisms that have to be considered are divided into three groups:

- Low Frequency Sound: Sound in the low frequency part of the sound spectrum is generated when the rotating blade encounters localized flow deficiencies due to the flow around a tower, wind speed changes, or wakes shed from other blades;
- Inflow Turbulence Sound: Depends on the amount of atmospheric turbulence. The atmospheric turbulence results in local force or local pressure fluctuations around the blade; and
- Airfoil Self Noise: This group includes the sound generated by the air flow right along the surface of the airfoil. This type of sound is typically of a broadband nature, but tonal components may occur due to blunt trailing edges, or flow over slits and holes.

Modern airfoil design takes all of the above factors into account and is generally much quieter that the first generation of bade design.

D.1.2.10.3 **Noise sensitive areas**

The Table D.4 and Figure D.33 below indicate the isopleths for the noise generated by the turbines at wind speeds from 3 m/s to 12 m/s. It must be remembered that as the wind speed increases, so too does the background noise. Therefore, the predicted noise levels below 8 m/s are of more concern those above 8m/s.

The modelling results are contained in Table D.4 below.

Table D.4: Table of Results of the Noise Impacts at the NSAs

NSA Number	Wind speed [m/s]	From WTGs [dB(A)]	Noise Limit (Night) [dB(A)]	Noise Limit complied with?
1	3	22.6	35	Yes
	4	24.0	35	Yes
	5	28.5	35	Yes
	6	32.5	35	Yes
	7	33.2	35	Yes
	8	33.3	35	Yes
	9	33.3	35	Yes
	10	33.3	35	Yes
	11	33.3	35	Yes
	12	33.3	35	Yes
2	3	22.1	35	Yes
	4	23.5	35	Yes
	5	28.0	35	Yes
	6	32.0	35	Yes
	7	32.7	35	Yes
	8	32.8	35	Yes
	9	32.8	35	Yes
	10	32.8	35	Yes
	11	32.8	35	Yes
	12	32.8	35	Yes
3	3	21.8	35	Yes
	4	23.2	35	Yes
	5	27.7	35	Yes
	6	31.7	35	Yes
	7	32.4	35	Yes
	8	32.5	35	Yes
	9	32.5	35	Yes
	10	32.5	35	Yes
	11	32.5	35	Yes
	12	32.5	35	Yes

NSA Number	Wind speed [m/s]	From WTGs [dB(A)]	Noise Limit (Night) [dB(A)]	Noise Limit complied with?
4	3	21.3	35	Yes
	4	22.7	35	Yes
	5	27.1	35	Yes
	6	31.1	35	Yes
	7	31.8	35	Yes
	8	31.9	35	Yes
	9	31.9	35	Yes
	10	31.9	35	Yes
	11	31.9	35	Yes
	12	31.9	35	Yes
5	3	21.3	35	Yes
	4	22.7	35	Yes
	5	27.1	35	Yes
	6	31.1	35	Yes
	7	31.8	35	Yes
	8	31.9	35	Yes
	9	31.9	35	Yes
	10	31.9	35	Yes
	11	31.9	35	Yes
	12	31.9	35	Yes
6	3	20.8	35	Yes
	4	22.2	35	Yes
	5	26.7	35	Yes
	6	30.7	35	Yes
	7	31.4	35	Yes
	8	31.5	35	Yes
	9	31.5	35	Yes
	10	31.5	35	Yes
	11	31.5	35	Yes
	12	31.5	35	Yes
7	3	20.8	35	Yes
	4	22.2	35	Yes
	5	26.6	35	Yes
	6	30.6	35	Yes
	7	31.3	35	Yes
	8	31.4	35	Yes
	9	31.4	35	Yes
	10	31.4	35	Yes
	11	31.4	35	Yes
	12	31.4	35	Yes

NSA Number	Wind speed [m/s]	From WTGs [dB(A)]	Noise Limit (Night) [dB(A)]	Noise Limit complied with?
8	3	20.8	35	Yes
	4	22.2	35	Yes
	5	26.7	35	Yes
	6	30.7	35	Yes
	7	31.4	35	Yes
	8	31.5	35	Yes
	9	31.5	35	Yes
	10	31.5	35	Yes
	11	31.5	35	Yes
	12	31.5	35	Yes
9	3	8.1	35	Yes
	4	9.5	35	Yes
	5	13.4	35	Yes
	6	17.4	35	Yes
	7	18.1	35	Yes
	8	18.2	35	Yes
	9	18.2	35	Yes
	10	18.2	35	Yes
	11	18.2	35	Yes
	12	18.2	35	Yes
10	3	16.8	35	Yes
	4	18.2	35	Yes
	5	22.6	35	Yes
	6	26.6	35	Yes
	7	27.3	35	Yes
	8	27.4	35	Yes
	9	27.4	35	Yes
	10	27.4	35	Yes
	11	27.4	35	Yes
	12	27.4	35	Yes
11	3	16.4	35	Yes
	4	17.8	35	Yes
	5	22.1	35	Yes
	6	26.1	35	Yes
	7	26.8	35	Yes
	8	26.9	35	Yes
	9	26.9	35	Yes
	10	26.9	35	Yes
	11	26.9	35	Yes
	12	26.9	35	Yes

NSA Number	Wind speed [m/s]	From WTGs [dB(A)]	Noise Limit (Night) [dB(A)]	Noise Limit complied with?
12	3	16.4	35	Yes
	4	17.8	35	Yes
	5	22.1	35	Yes
	6	26.1	35	Yes
	7	26.8	35	Yes
	8	26.9	35	Yes
	9	26.9	35	Yes
	10	26.9	35	Yes
	11	26.9	35	Yes
	12	26.9	35	Yes
13	3	15.8	35	Yes
	4	17.2	35	Yes
	5	21.4	35	Yes
	6	25.4	35	Yes
	7	26.1	35	Yes
	8	26.2	35	Yes
	9	26.2	35	Yes
	10	26.2	35	Yes
	11	26.2	35	Yes
	12	26.2	35	Yes
14	3	17.2	35	Yes
	4	18.6	35	Yes
	5	23.0	35	Yes
	6	27.0	35	Yes
	7	27.7	35	Yes
	8	27.8	35	Yes
	9	27.8	35	Yes
	10	27.8	35	Yes
	11	27.8	35	Yes
	12	27.8	35	Yes
15	3	14.1	35	Yes
	4	15.5	35	Yes
	5	19.6	35	Yes
	6	23.6	35	Yes
	7	24.3	35	Yes
	8	24.4	35	Yes
	9	24.4	35	Yes
	10	24.4	35	Yes
	11	24.4	35	Yes
	12	24.4	35	Yes

NSA Number	Wind speed [m/s]	From WTGs [dB(A)]	Noise Limit (Night) [dB(A)]	Noise Limit complied with?
16	3	9.3	35	Yes
	4	10.7	35	Yes
	5	14.6	35	Yes
	6	18.6	35	Yes
	7	19.3	35	Yes
	8	19.4	35	Yes
	9	19.4	35	Yes
	10	19.4	35	Yes
	11	19.4	35	Yes
	12	19.4	35	Yes
17	3	8.3	35	Yes
	4	9.7	35	Yes
	5	13.6	35	Yes
	6	17.6	35	Yes
	7	18.3	35	Yes
	8	18.4	35	Yes
	9	18.4	35	Yes
	10	18.4	35	Yes
	11	18.4	35	Yes
	12	18.4	35	Yes
18	3	5.9	35	Yes
	4	7.3	35	Yes
	5	11.1	35	Yes
	6	15.1	35	Yes
	7	15.8	35	Yes
	8	15.9	35	Yes
	9	15.9	35	Yes
	10	15.9	35	Yes
	11	15.9	35	Yes
	12	15.9	35	Yes
19	3	5.7	35	Yes
	4	7.1	35	Yes
	5	10.9	35	Yes
	6	14.9	35	Yes
	7	15.6	35	Yes
	8	15.6	35	Yes
	9	15.6	35	Yes
	10	15.6	35	Yes
	11	15.6	35	Yes
	12	15.6	35	Yes

NSA Number	Wind speed [m/s]	From WTGs [dB(A)]	Noise Limit (Night) [dB(A)]	Noise Limit complied with?
20	3	13.7	35	Yes
	4	15.1	35	Yes
	5	19.3	35	Yes
	6	23.3	35	Yes
	7	24.0	35	Yes
	8	24.1	35	Yes
	9	24.1	35	Yes
	10	24.1	35	Yes
	11	24.1	35	Yes
	12	24.1	35	Yes

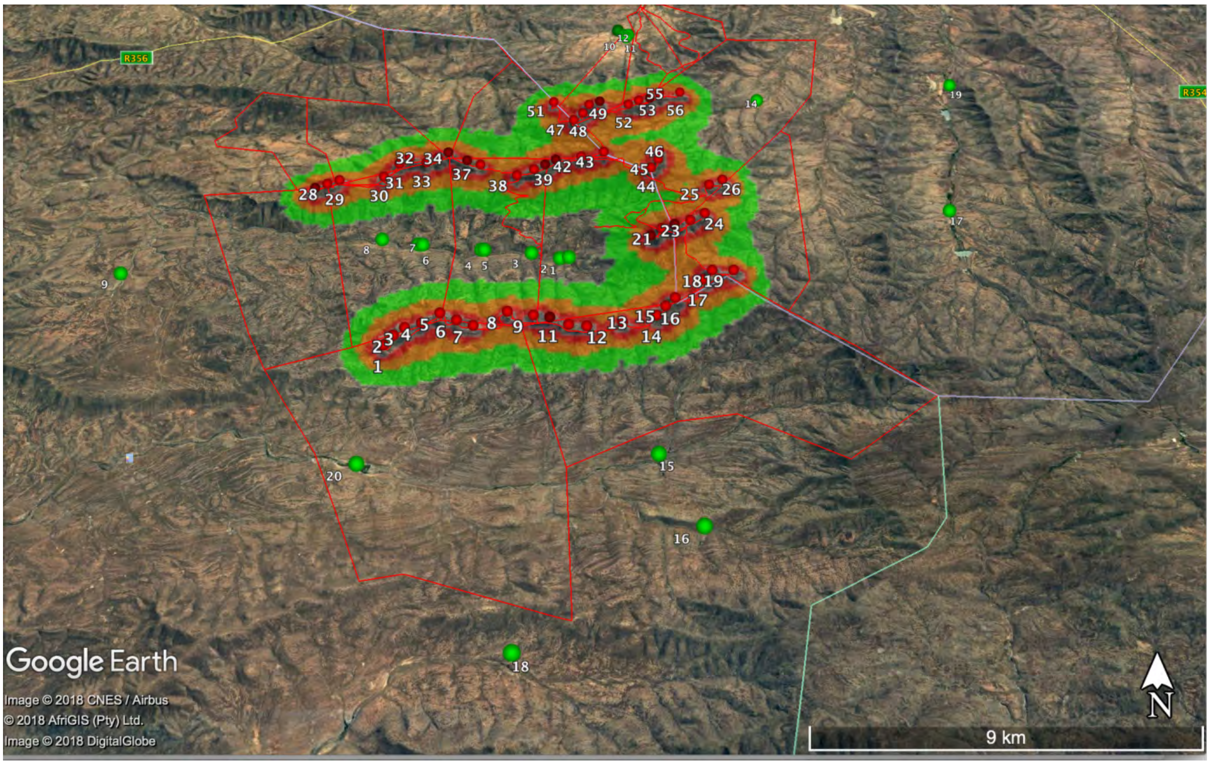


Figure D.33: Raster image of Noise Isopleths and Noise Sensitive Areas

Green Dot = Noise Sensitive Area
Green Shading = 35-45 dB(A)
Orange Shading = >45 dB(A)

D.1.2.10.4 Noise impacts

The key issues regarding the noise impact are as follow:

- What is the current noise ambient noise in the vicinity of the proposed Kudusberg WEF?

- What is the likely noise impact during construction and operation of the site and associated infrastructure?
- Where are local sensitive human receptors located and how is the noise going to affect them?
- Could low frequency sound and infra sound be a problem?

The results of the NIA indicate that the following conclusions can be drawn:

a) There will be a short-term increase in noise in the vicinity of the site during the construction phase as the ambient noise level will be exceeded by vehicle operations.
b) The area surrounding the construction sites will be affected for short periods of time in all directions, should numerous construction equipment be used simultaneously.
c) The number of construction vehicles that will be used in the project will add to the existing ambient levels and will most likely cause a disturbing noise for a limited time. The exact number of construction vehicles is not known at present. The duration of impact will however be short-term.
d) The day/night time SANS 10103:2008 noise limit of 45 dBA will not be exceeded at any of the noise sensitive areas.
e) The night time guideline noise limit of 35 dBA will not be exceeded at any of the noise sensitive areas.
f) All turbine positions met the 500 m setback distance from noise sensitive receptors.
g) The cumulative impacts will not exceed the day/night time SANS 10103:2008 noise limit of 45 dBA.
h) The cumulative impacts will not exceed the night time SANS 10103:2008 noise limit of 35 dBA.

D.1.2.10.4.1 **Impacts Identified for the Construction Phase**

❖ **Noise impact from the construction of the WEF.**

There will be a short-term increase in noise in the vicinity of the site during construction as the ambient level will be exceeded. The impact during construction will be difficult to mitigate.

The impact of low frequency noise and infra-sound will be negligible and there is no evidence to suggest that adverse health effects will occur as the sound power levels generated in the low frequency range are not high enough to cause physiological effects.

Significance of impact before and after mitigation: Very Low

Proposed mitigation measures:

- Staff to receive noise sensitivity training before construction commences;
- Monitoring of noise;
- Limit high noise activities to daytime operations when possible, noting that operational requirements might not allow this due to various factors e.g. Crane use optimization, weather conditions etc.
- Ambient noise monitoring to be conducted at the NSAs within the project area. As per the requirements of SANS 10103 four times during the construction phase.

D.1.2.10.4.2 **Impacts Identified for the Operational Phase**

❖ **Noise impact from the operation of the wind turbines.**

Significance of impact before and after mitigation: Very Low

Proposed mitigation measure:

- Ensure that noise monitoring is conducted during the commissioning phase to determine the actual noise impact during operations as per the requirements of SANS 10103. Ambient noise monitoring to be conducted at the onsite at the noise sensitive area closest to a wind turbine when operations commence to verify the noise emissions meet the noise rating limit. Mitigation measures to be implemented if the noise impact exceeds the 35dB(A) noise rating limit.
- No further noise monitoring to be conducted if noise complaints are not received.

D.1.2.10.4.3 **Impacts Identified for the Decommissioning Phase**

❖ **Noise emissions from the decommissioning of the turbines.**

Significance of impact before and after mitigation: Very Low

Proposed mitigation measures:

- Staff to receive noise sensitivity training;
- Monitoring of noise; and
- Limit high noise activities to daytime operations when possible, noting that operational requirements might not allow this due to various factors e.g. crane use optimization, weather conditions etc.

D.1.2.10.4.4 **Cumulative Impact**

❖ **Noise impact from the operation of the wind turbines.**

The proposed windfarm is located adjacent to several other windfarms within 20 km of Kudusberg. This distance is appropriate from a noise impact perspective. There are other windfarms in the region (within 50 km), but they are not listed below and were not taken into account due to their distance from the proposed development.

This is thus a worst-case scenario, as it is highly unlikely that all turbines will be operational simultaneously even if all the sites obtain the required regulatory approval.

The modelling indicates that the cumulative impact will not exceed the night limit of 35 dB(A) or the day limit of 45 dB(A).

Significance of impact before and after mitigation: Very Low

Mitigation measure:

- Ensure that noise monitoring is conducted during the commissioning phase to determine the actual noise impact during operation.

D.1.2.10.4.5 **No-go Alternative**

No-go would result in no further noise impacts. No-go is not the preferred alternative.

D.1.2.10.5 **Impact Assessment Summary: Noise impacts**

Impact	Mitigation measure	Significance before mitigation	Significance after mitigation
CONSTRUCTION PHASE			
Noise impact from the construction of the WEF.	• Limit high noise activities to daytime operations when possible, noting that operational requirements might not allow this due to various factors e.g. crane use optimization, weather conditions etc. • No construction piling should occur at night. Piling should only occur during the hottest part of the day to take advantage of unstable atmospheric conditions. • Construction staff should be given "noise sensitivity" training to mitigate the noise impacts caused during construction. • Ambient noise monitoring to be conducted at the NSAs within the project area as per the requirements of SANS 10103. It should be conducted four times during the construction phase and as per the requirements of SANS 10103 (as per Table 17 in the NIA in Appendix D of this BA Report).	**Very low**	**Very low**
OPERATIONAL PHASE			
Noise impact from the operation of the wind turbines.	• Ambient noise monitoring to be conducted onsite at the noise sensitive area closest to a wind turbine when operations commence to verify the noise emissions meet the noise rating limit (as per Table 18 in the NIA in Appendix D of this BA Report). • Monitoring to be done as per the requirements of SANS 10103. • Mitigation measures to be implemented if the noise impact exceeds the 35dB(A) noise rating limit. • No further noise monitoring to be conducted if noise complaints are not received.	**Very low**	**Very low**
DECOMMISSIOING PHASE			
Noise impact from the	• Staff to receive noise sensitivity training.	**Very low**	**Very low**

decommissioning of the wind turbines.	• Monitoring of noise. • Limit high noise activities to daytime operations when possible, noting that operational requirements might not allow this due to various factors e.g. Crane use optimization, weather conditions etc.		
CUMULATIVE IMPACT			
Noise impact from the operation of the wind turbines	Ensure that noise monitoring is conducted during the commissioning phase to determine the actual noise impact during operation.	**Very low**	**Very low**

D.1.2.10.6 Comparative assessment of alternatives and comment on revised layout 1

All alternatives can proceed and revised layout 1 does not change the findings of the noise impact assessment.

D.1.2.10.7 Concluding statement

Provided that the mitigation measures presented in the NIA are implemented effectively, the noise from the turbines at the identified NSAs is predicted to be less than the 35 dB(A) night limit and 45 dB(A) day/night limit for rural areas presented in SANS 10103:2008. The overall noise impact with recommended mitigation is expected to be negative and of **very low significance** before and after mitigation. It is therefore recommended that based on the results presented in the NIA, an EA can be granted from a noise impact perspective irrespective of the alternatives that have been considered.

D.1.2.11 Traffic

The Traffic Impact Assessment (TIA) was undertaken by JG AFRIKA (Pty) Ltd to inform the outcome of this BA. The full study (including nature, status, extent, duration, probability, reversibility, irreplaceability and confidence ratings) is included in Appendix D of this report. The following section provides a summary of the Impact Assessment undertaken for the TIA.

It is assumed that the wind turbine components will be imported to South Africa via the Port of Saldanha, although the Port of Ngqura is a viable alternative. The preferred route from the Port of Saldanha utilizes existing National and Provincial Roads as far as possible. Alternative routes were assessed but these routes have geometrical constraints and includes large sections of gravel roads that will require upgrading.

Two site access routes have been proposed and both alternatives were considered acceptable. However, the Access Road Alternative 1 is the preferred access alternative as it is an existing jeep track.

D.1.2.11.1 Approach and methodology

The TIA was informed by the following:

Site Visit and Project Assessment

- Site visit and initial meeting with the client to gain sound understanding of the project; and
- Research of all available documentation and information relevant to the proposed facility.

Correspondence with Authorities

- Correspondence with the relevant Authorities dealing with the external road network, such as SANRAL and the relevant provincial government departments.

The transport study considered and assessed the following:

- Estimation of trip generation;
- Discussion on potential traffic impacts;
- Assessment of possible haul routes between port of entry / manufacturing location;
- Construction, operational (maintenance) and decommissioning vehicle trips;
- Description of the surrounding road network;

- Description of site layout;
- Assessment of the proposed access points;
- Assessment of the proposed internal roads on site; and
- Assessment of internal circulation of trucks and proposed roads layout regarding turbine positions and turbine laydown areas.

D.1.2.11.2 **Project aspects relevant to traffic impacts**

The report deals with the traffic impact on the surrounding road network in the vicinity of the site during the construction of the access roads, construction and installation of the turbines, during maintenance in the operational phase as well during the decommissioning phase. The following aspects of the proposed Kudusberg WEF are relevant to this TIA:

Port of entry:

It is assumed that the wind turbine components will be imported to South Africa via the Port of Saldanha, which is located in the Western Cape. The Port of Saldanha is the largest and deepest natural port in the Southern Hemisphere able to accommodate vessels with a draft of up to 21.5 m. The port covers a land and sea surface of just over 19,300 hectares within a circumference of 91 km with maximum water depths of 23.7 m. Unique to the port is a purpose-built rail link directly connected to a jetty bulk loading facility for the shipment of iron ore. The Port is operated by Transnet National Ports Authority.

Alternatively, wind turbine components could be imported via the Port of Ngqura in Coega, Port Elizabeth. The Port of Ngqura is a world class deep water transhipment hub offering an integrated, efficient and competitive port service for containers on transit. The Port forms part of the Coega Industrial Development Zone and is operated by Transnet National Ports Authority.

Selected candidate turbine:

The possible range of wind turbines varies widely with various wind turbine manufacturers operating worldwide. The project information states that a turbine with a maximum hub height of up to 140 m and a blade length of approximately 90 m (rotor diameter up to 180 m) is to be considered.

In general, each turbine unit consists of a tower, a Nacelle (final weight dependent on the supplier and whether the nacelle has gears or not) and three rotor blades.

The impact on transport is also dependent on the type of turbine namely steel towers vs concrete towers. The steel and concrete towers generally consist of 20 m sections. Steel cylindrical tower sections are delivered to the site and do not require assembly on site to form the sections. The concrete tower sections, however, are delivered in 2 – 4 precast segments which are assembled on site to form a 20 m tower section. Concrete towers can require 18 truckloads per turbine, whereas steel towers can require four truckloads per turbine.

Transportation requirements: Abnormal load considerations:

Permits for abnormal loads are required for vehicles exceeding the permissible maximum dimensions on road freight transport in terms of the Road Safety Act (Act No. 93 of 1996) and the National Road Traffic Regulations, 2000.

Any dimension / mass outside these permissible dimensions stipulated in the said Act will be classified as an Abnormal Load and will necessitate an application to the Department of Transport and Public Works for a permit that will give authorisation for the conveyance of said load. A permit is required for each Province that the haulage route traverses. G7 will apply for all applicable permits.

Route to site

Main route for the transportation of the wind turbine components

The investigation showed that it will be possible to transport the imported wind turbine components by road to the proposed site. The proposed main route will be along the surfaced R354, which connects Matjiesfontein and Sutherland, turning west onto the district gravel road DR02249 and then turning left onto the R356 to the main access road (MN04469) to the Kudusberg WEF (see Figure D.34). Two access road alternatives branch off the MN04469.

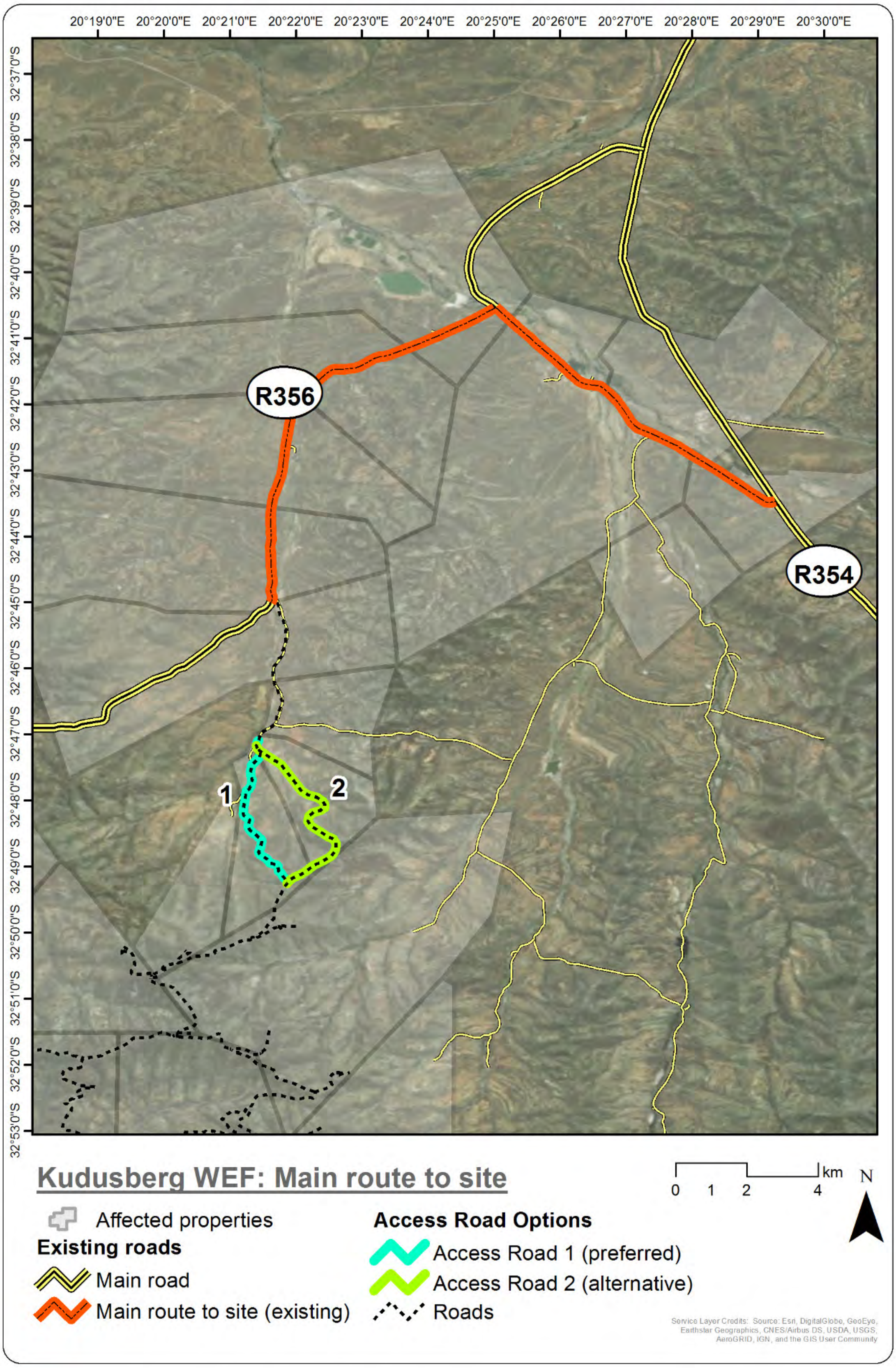


Figure D.34: Proposed Main Route

For this option, DR02249 would require upgrading and intersections would have to be widened to accommodate the turning movements of heavy vehicles (Figure D.35). The watercourse structures along the route are in a poor condition and the load bearing capacity of these structures would need to be assessed. In all likelihood these structures would have to be replaced or upgraded. In addition, farm gates and cattle grids (Figure D.36) would have to be widened to accommodate abnormal loads.

Figure D.35: Narrow bridge on DR02249

Figure D.36: Narrow cattle grid

The R356 could be accessed off the R354, which is approximately 10.8km from the DR02249/R354 intersection, as shown in Figure D.37 below. The section of R356 between the R354/R356 intersection and the R356/DR02249 intersection, however, would also require significant upgrading of the road and some of the drainage structures along the route. The route was therefore deemed unsuitable as an alternative as the required upgrading would be too extensive.

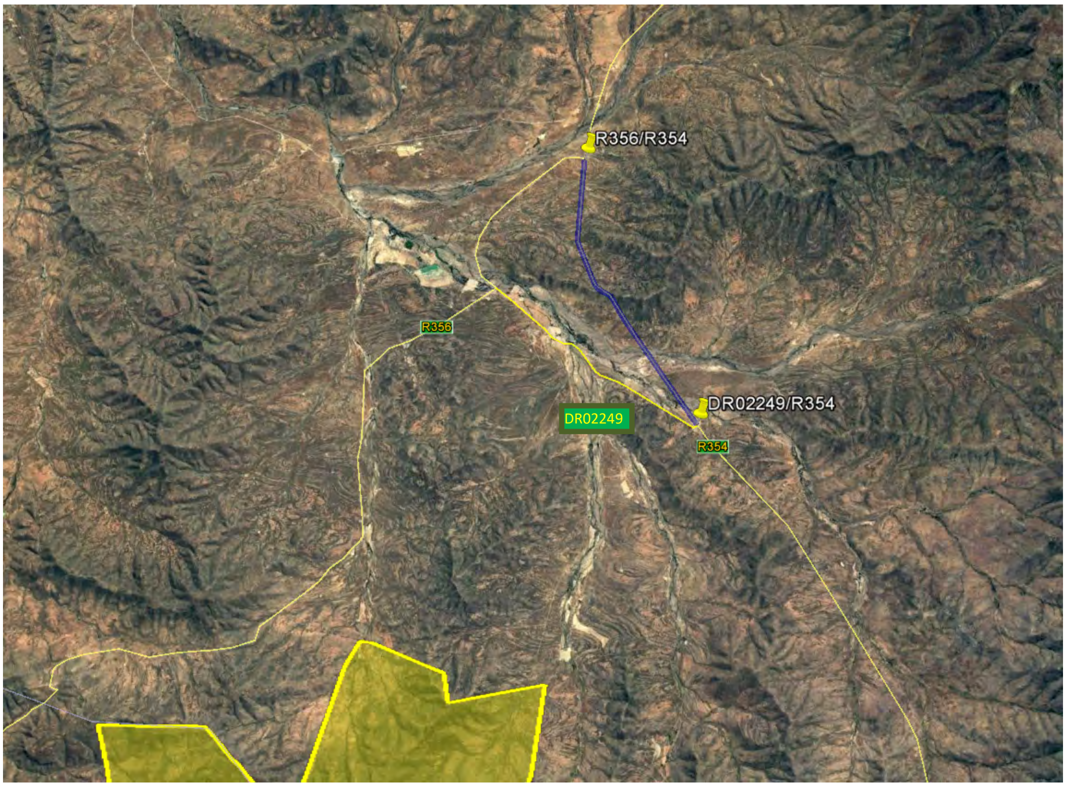


Figure D.37: Alternative access off R354

It should be noted that any low hanging overhead lines (lower than 5.1 m) e.g. Eskom and Telkom lines, along the proposed routes will have to be moved to accommodate the abnormal load vehicles.

More information of the national route to the site is included in Section A.5.2.1 of this BA Report.

Proposed main access road to the proposed WEF:

Access to the proposed WEF will be provided via the MN04469. Two access road alternatives would connect MN04469 to the new wind farm road network between the turbines. These roads are shown in Figure D.38 below and described below:

- Access road alternative 1 – An existing jeep track. Approximately 4.6 km in length.
- Access road alternative 2 – New road. Approximately 5.7 km in length.

Both access road alternatives are considered suitable. However, access road alternative 1 is deemed the preferred access road as it is an existing jeep track.

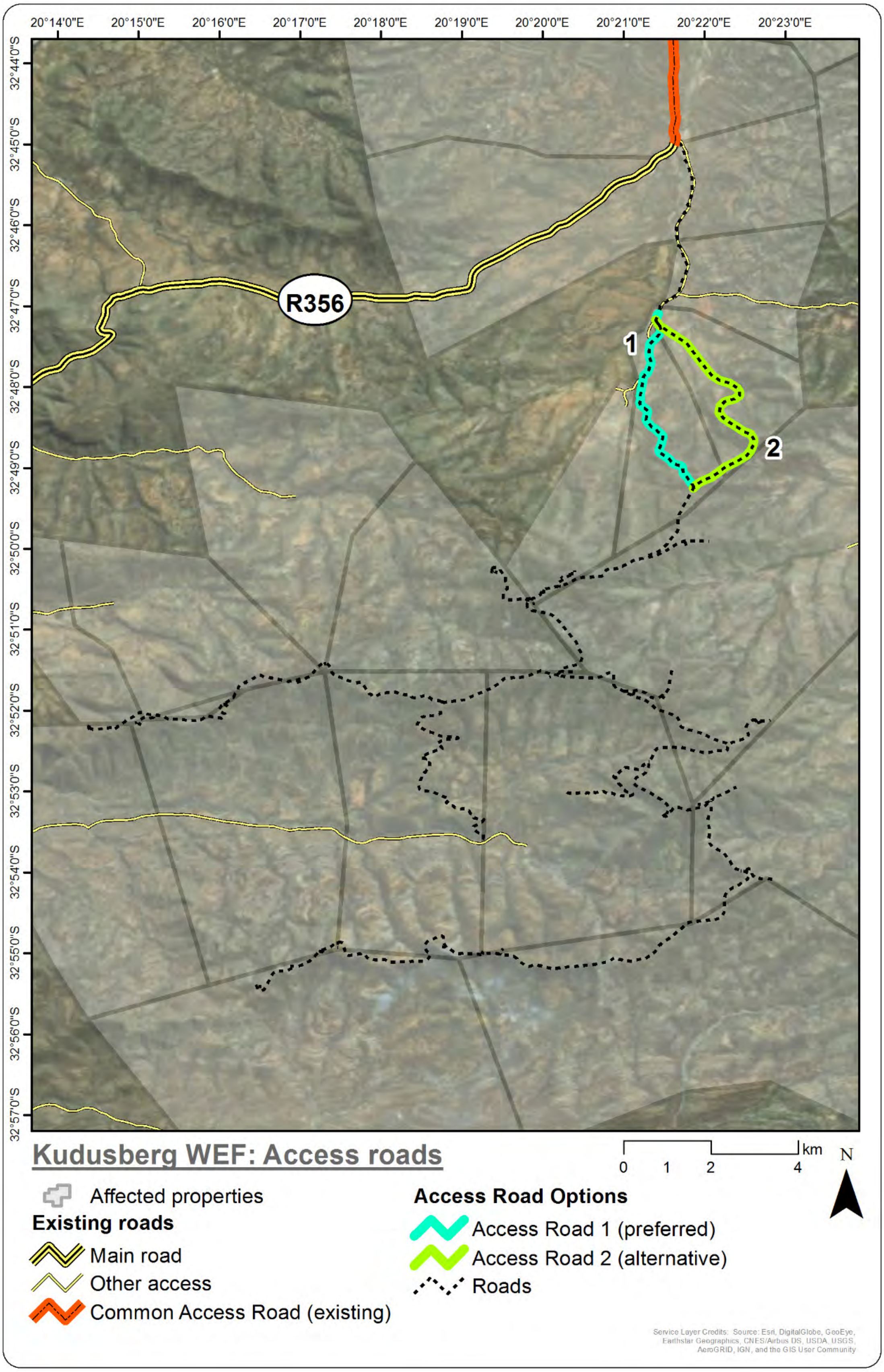


Figure D.38: Access Roads

A minimum required road width of 4 meters needs to be kept and all turning radii must conform with the specifications needed for the abnormal load vehicles and haulage vehicles. It needs to be ensured that the gravel sections of the haulage routes remain in good condition and will hence need to be maintained during the additional loading of the construction phase and then reinstated after construction finishes. The gravel roads will require grading with a road grader to obtain a flat even surface and the geometric design of these gravel roads needs to be confirmed at detailed design stage. Geometric design constraints might be encountered due to the rolling, hilly topography of the area, as shown in the photographs below (Figure D.39 and Figure D.40). The road designer should take cognizance that the turbines are to be positioned at the top of the hills, therefore roads need to be designed with smooth, relatively flat gradients to allow an abnormal load vehicle to ascend to the top of the hill.

Figure D.39: MN0449

Figure D.40: Hills at proposed WEF site

Main route for the transportation of materials, plants and people to the proposed WEF

The nearest towns in relation to the proposed WEF sites are Sutherland, Touws River and Laingsburg. It is envisaged that the majority of materials, plant and labour will be sourced from these towns and transport to the WEF will be via the N1 and R354.

Concrete batch plants and quarries in the vicinity could be contracted to supply materials and concrete during the construction phase, which would reduce the impact on traffic on the surrounding road network. Alternatively, mobile concrete batch plants and temporary construction material stockpile yards could be commissioned on vacant land near the proposed WEF site. Delivery of materials to the mobile batch plant and the stockpile yard could be staggered to minimise traffic disruptions.

It is envisaged that most materials, water, plant, services and people will be procured within a 100 km radius from the proposed WEF, however, this would be informed by the REIPPPP requirements.

D.1.2.11.3 Traffic impacts

The main traffic impacts will be during the construction and decommissioning phases of a WEF where the delivery of the infrastructure will generate significant traffic. The duration of these phases is however short term i.e. the impact of the traffic on the surrounding road network is temporary and when the WEF is operational, do not add any significant traffic to the road network. The traffic impact on the surrounding network is therefore deemed low.

D.1.2.11.3.1 Construction phase

For the transportation of the turbines to the WEF site, it was assumed that the turbine blades will be transported to site individually due to the size of the blades being 90 m.

Consequently, for each steel wind turbine three abnormal loads will be required for the blades, seven abnormal loads for the tower sections and another abnormal load for the nacelle. All further components will be transported with normal limitations haulage vehicles. With approximately 11 abnormal loads trips, the total trips to deliver the components of 56 turbines to the WEF site will be around 616 trips. This would amount to less than 2 vehicle trips per day for a typical construction period of 18-24 months.

As concrete towers required up to 18 abnormal load trips per turbine, the total number of abnormal load trips for a concrete turbine is approximately 22 trips. The total trips to deliver the components of 56 turbines to the WEF site will be around 1 232 trips.

This would amount to approximately 3 vehicle trips per day for a typical construction period of 18-24months.

The constructions of roads and concrete footings will also have a significant impact on the surrounding road network as vehicles deliver materials to the site. A concrete footing (approximately 500 m^3) adds over 80 trips by concrete trucks to the surrounding road network.

The traffic impacts identified to occur during the construction phase are:

- **Traffic congestion.**
- **The construction traffic would also lead to noise and dust pollution.**

Traffic generated by the construction activities of the WEF will have a significant impact on the road infrastructure, albeit of a short-term nature. Additionally, the construction of the WEF will create dust and noise pollution that will have an impact of low significance (short term) during the construction and decommissioning phases.

Significance of impacts before mitigation: High

Proposed Mitigation Measures:

- The delivery of wind turbine components to the site can be staggered and trips can be scheduled to occur outside of peak traffic periods.
- Dust suppression of gravel roads during the construction and decommissioning phases, as required.
- Reduce the construction period where possible.
- Regular maintenance of gravel roads by the Contractor during the construction and decommissioning phases.
- The use of mobile batch plants and quarries in close proximity to the site would decrease the impact on the surrounding road network.
- Staff and general trips should occur outside of peak traffic periods as far as possible.
- Any low hanging overhead lines (lower than 5.1m) e.g. Eskom and Telkom lines, along the proposed routes will have to be moved to accommodate the abnormal load vehicles.
- The preferred route should be surveyed to identify problem areas e.g. intersections with limited turning radii and sections of the road with sharp horizontal curves or steep gradients, that may require modification. After the road modifications have been implemented, it is recommended to undertake a "dry-run" with the largest abnormal load vehicle, prior to the transportation of any turbine components, to ensure that the delivery of the turbines will occur without disruptions. This process is to be undertaken by the haulage company transporting the components and the contractor, who will modify the road and intersections to accommodate abnormal vehicles. It needs to be ensured that the gravel sections of the haulage routes remain in good condition and will need to be maintained during the additional loading of the construction phase and reinstated after construction is completed.
- Design and maintenance of internal roads. The internal gravel roads will require grading with a road grader to obtain a flat even surface and the geometric design of these gravel roads needs to be confirmed at detailed design stage. This process is to be undertaken by a civil engineering consultant or a geometric design professional. Geometric design constraints might be encountered due to the rolling, hilly topography of the area, as shown in the photographs below. The road designer should take cognizance that the turbines are to be positioned at the top of the hills, therefore roads need to be designed with smooth, relatively flat gradients to allow an abnormal load vehicle to ascend to the top of the hill.

Significance of impacts after mitigation: Moderate

D.1.2.11.3.2 Operational phase

The traffic generated during this phase will be minimal and will have very little, if any impact.

D.1.2.11.3.3 Decommissioning phase

The traffic impacts identified to occur during the decommissioning phase are:

- **Traffic associated with the decommissioning activities.**
- **Noise and dust pollution.**

This phase will result in the same impacts as those which are anticipated to occur during the construction phase as similar trips are expected.

Significance of impacts before mitigation: Moderate

Proposed Mitigation Measures:

- Maintenance of gravel roads.
- Dust Suppression.
- Stagger turbine component removal from the site.
- Reduce the construction period.
- Staff and general trips should occur outside of peak traffic periods.

Significance of impacts after mitigation: Moderate

This is considering the fact that the impact is temporary and short term in nature, the impact can be mitigated to an acceptable level.

D.1.2.11.3.4 **Cumulative impact**

- **Noise and dust pollution.**

To assess the cumulative impact, it was assumed that all wind farms within 50 km currently proposed and authorized, would be constructed at the same time (see Table D.1). This is the precautionary approach as in reality; these projects would be subject to a highly competitive bidding process. Only a handful of projects would be selected to enter into a power purchase agreement with Eskom.

The construction and decommissioning phases of a WEF are the only traffic generators. The duration of these phases is short term i.e. the impact of the WEF traffic on the surrounding road network is temporary and WEFs, when operational, do not add any significant traffic to the road network. Even if all wind farms are constructed and decommissioned at the same time, the roads authority will consider all applications for abnormal loads and work with all project companies to ensure that loads on the public roads are staggered and staged to ensure that the impact will be acceptable.

Significance of impact before mitigation: High

Proposed Mitigation Measures:

- Dust suppression.
- Stagger turbine component delivery to site.
- Reduce the construction period.
- The use of mobile batch plants and quarries in close proximity to the site would decrease the impact on the surrounding road network.
- Staff and general trips should occur outside of peak traffic periods.
- A “dry run” of preferred route.
- Design and maintenance of internal roads.
- Overhead lines to be moved.

Significance of impact after mitigation: Moderate

D.1.2.11.3.5 **No-go Alternative**

The no-go alternative implies that the proposed development of the Kudusberg WEF will not proceed. This would mean that there will be no negative environmental impacts and no traffic impact on the surrounding network. However, this would also mean that there would be no socio-economic benefits to the surrounding communities and it will not assist government in meeting the targets for renewable energy. Hence, the no-go alternative is not a preferred alternative.

D.1.2.11.4 **Impact Assessment Summary: Traffic Impacts**

Impact	Mitigation measure	Significance before mitigation	Significance after mitigation
CONSTRUCTION PHASE			
Traffic congestion Noise and dust pollution	• The delivery of wind turbine components to the site can be staggered and trips can be scheduled to occur outside of peak traffic periods. • Dust suppression of gravel roads during the construction and decommissioning phases, as required. • Regular maintenance of gravel roads by the Contractor during the construction and decommissioning phases. • The use of mobile batch plants and quarries in close proximity to the site would decrease the impact on the surrounding road network. • Staff and general trips should occur outside of peak traffic periods as far as possible. • Any low hanging overhead lines (lower than 5.1 m) e.g. Eskom and Telkom lines, along the proposed routes will have to be moved to accommodate the abnormal load vehicles. • The preferred route should be surveyed to identify problem areas e.g. intersections with limited turning radii and sections of the road with sharp horizontal curves or steep gradients, that may require modification. After the road modifications have been implemented, it is recommended to undertake a "dry-run" with the largest abnormal load vehicle, prior to the transportation of any turbine components, to ensure that the delivery of the turbines will occur without disruptions. This process is to be undertaken by the haulage company transporting the components and the contractor, who will modify the road and intersections to accommodate abnormal vehicles. It needs to be ensured that the gravel sections of the haulage routes remain in good condition and will need to be maintained during the additional loading of the construction phase and reinstated after construction is completed. • Design and maintenance of internal roads. The internal gravel roads will require grading with a road grader to obtain a flat even surface and the geometric design of these gravel roads needs to be confirmed at detailed design stage. This process	High	Moderate

	is to be undertaken by a civil engineering consultant or a geometric design professional. Geometric design constraints might be encountered due to the rolling, hilly topography of the area, as shown in the photographs below. The road designer should take cognizance that the turbines are to be positioned at the top of the hills, therefore roads need to be designed with smooth, relatively flat gradients to allow an abnormal load vehicle to ascend to the top of the hill.		
OPERATIONAL PHASE			
The traffic generated during this phase will be minimal and will have very little, if any impact on the surrounding road network.			
DECOMMISSIOING PHASE			
Noise and dust pollution	• Maintenance of gravel roads. • Dust suppression. • Stagger turbine component removal from the site. • Reduce the construction period. • Staff and general trips should occur outside of peak traffic periods.	**Moderate**	**Moderate**
CUMULATIVE IMPACT			
Noise and dust pollution with the delivery of equipment, material and staff to site.	• Dust suppression. • Stagger turbine component delivery to site. • Reduce the construction period. • The use of mobile batch plants and quarries in close. • Staff and general trips should occur outside of peak traffic periods. • Dry Run of preferred route. • Design and maintenance of internal roads. • Overhead lines to be moved.	**High**	**Moderate**

D.1.2.11.5 **Comparative assessment of alternatives and comment on revised layout 1**

It should be noted that there is no preference between the construction camp and substation alternatives presented as these do not affect or have any impact on the traffic on the surrounding road network.

A revised layout was provided by G7 which contained minor changes to the turbine layout, access road alternative 1, construction camps and crane pads. The small changes in the layout, specifically the small change in the alignment of access road alternative 1 as this is related to the Transport Study, does not have any impact on the finding of the original report.

D.1.2.11.6 **Concluding statement**

Based on the findings of this assessment, any Access Road Alternative (Alternative 1 and 2) considered by Kudusberg wind farm is considered acceptable. The potential increase in traffic and the associated noise and dust pollution have been rated as high before mitigation during the construction and decommissioning phases of the proposed Kudusberg WEF. However, the phases will be short-term and the traffic volumes are expected to be low. Therefore, the significance of the impacts can be reduced to moderate after mitigation. The traffic impacts are therefore acceptable from a transport perspective and the proposed project can be authorised.

D.1.2.12 Environmental sensitivity map

It should be noted that the initial project layout (Figure A.4) provided by the project applicant was revised following recommendations from the specialists to avoid no-go areas as well as areas of very-high sensitivity as far as possible. The revised layout is shown in Figure D.41.

The following updates were made to the initial project layout as recommended by the specialists:

- Turbine #1: The crane pad has been moved north of the turbine to avoid the very high ecological sensitive rocky sheet area. The turning roads have the same configuration than previously but due to the rotation of the crane pad, it doesn't overlap with the sensitive area. No move to the turbine.

- Turbine #3: The crane pad is now on the right of the turbine and the road has been shifted south of the sensitive area.

- Turbine #31: The crane pad has been rotated towards the north and the access road shifted north to avoid crossing the sensitive area.

- Turbine #35: The crane pad has been rotated in order to avoid the sensitive area, but due to the complexity of the topography on the peak, its surface has been slightly increased to accommodate the turn for trucks. The turbine has been shifted west of the area.

- Turbine #37: The crane pad was shifted south west of the turbine as well as the road.

- Turbine #42: The crane pad was moved east of the turbine and the road slightly shifted south to accommodate the new crane pad.

- Turbine #22 has been shifted by 12 m south. Road and crane pad have not been modified.

- Access Road Alternative 1 was rerouted to avoid heritage buffers.

- Adjusted the layout of construction camp Alternatives 1 and 2.

- Common road rerouted to the west to avoid the farmstead buffer.
- Construction camp 3 was considered a no-go on recommendation of the heritage specialist.

The revised layout was assessed by all the specialists on the project team. All the specialists confirmed that there were **no fatal flaws associated with the revised layout** that would preclude the development of the proposed Kudusberg WEF.

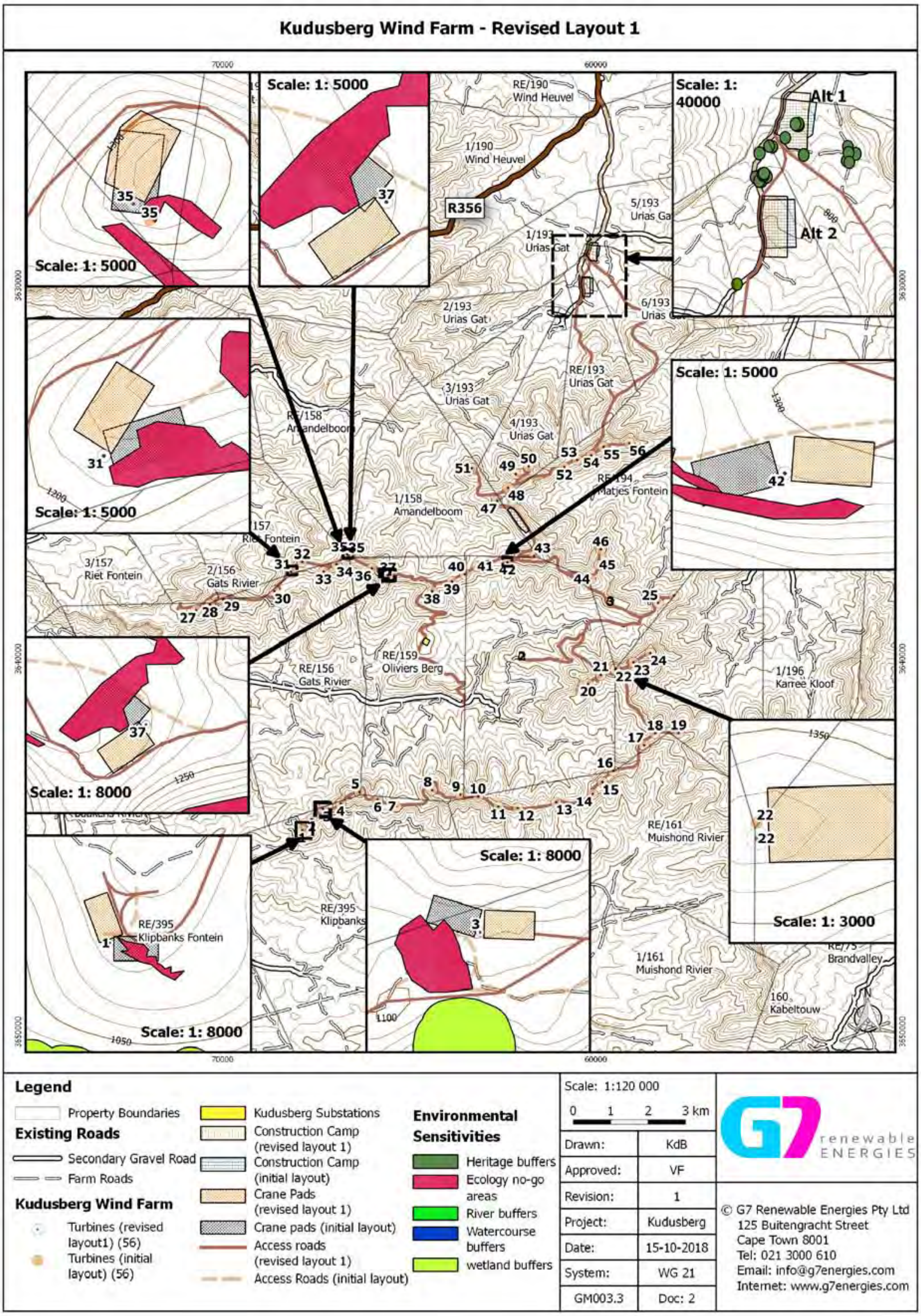


Figure D.41: The revised preferred layout of the proposed Kudusberg WEF and associated infrastructure

The following recommendations or buffers were proposed by the specialists. The revised layout has applied these buffers to make sure that sensitivity areas are avoided. The updated project sensitivity map for the Kudusberg WEF site is indicated in Figure D.42.

The recommended buffers are indicated below:

- **Heritage sensitivity**:
  - Graves: no development should be permitted within **50 m** of identified graves and cemeteries; existing roads within this buffer should not be altered or widened;
  - Cave site (KDB045): construction staff should not be permitted within **200 m** of the site;
  - Farmsteads: no turbines should be located within **500 m** of farmsteads; and
  - Kraals, stone walling and ruins > 100 years: construction staff should not be permitted within **100 m** of these sites and no development should occur within 15m of these sites.
- **Freshwater sensitivity**:
  - For new roads to the turbines, these should be located at least **100 m** outside of the drainage / river beds. Where access routes need to be constructed through the watercourses it must cross perpendicular;
  - Smaller streams and drainage lines, together with their seeps: at least **50 m** from the centre of these streams or the delineated wetland edge (whichever is the furthest);
  - The larger rivers within the valley floor, together with their valley bottom wetlands: at least **100 m**, measured from the top of bank of the river channels or the delineated wetland edge (whichever is the furthest); and
  - The vernal pool and other wetland areas: at least **50 m**, measured from the top of bank of the delineated wetland edge.
- **Avifauna sensitivity (Birds):**
  - Riverine thickets: Considering the scarceness and sensitivity of this vegetation type to land modifications, a **200 m** protection buffer is considered around the margins of the waterlines with this type of vegetation. No turbine placement or substation placement is allowed to occur within these buffered zones. Overhead Powerlines and roads are allowed to be built within these buffered areas, as long as they only cross these areas perpendicularly and don't run in parallel with them. Existing roads should be used/upgraded as far as possible, within these areas.
  - Water bodies: As these supply important sources of water, nesting and resting locations for many bird species (not only waterbirds), a **200 m** protection buffer is considered around any potential margins of water present within the study area.
  - Sensitive Flight Paths: a grid analysis was conducted to determine the use of geographical space by certain bird species. Only sensitive species with >0.25 contacts per hour were considered in each 500 x 500 m no-go square. A **200 m** buffer was then applied around each square to account for potential sensitive flight paths occurring on the inner border of each square.

- **Bat sensitivity:**

  High sensitivity – 200 m around all potentially bat important features:

  Along water lines and associated riverine vegetation. Such features are important for bats, since they are likely to act as commuting routes, providing food resources, likely to be associated with higher bat activity, and likely to favour the occurrence of dispersion routes, besides local commuting routes. A **200 m** buffer was considered around those features. It is recommended that should new infrastructures (including roads and electrical infrastructures) cross these features (including buffers), then they should not be routed to run parallel with them, but rather cross them perpendicularly, as far as possible. Additionally, this avoidance recommendation will not include the use of existing roads, as long as they are not upgraded in such a manner that will re-route them (to be more parallel with the feature) within those buffered areas. However, no wind turbines or substations may be permanently placed within any of these buffered areas.

  Very High sensitivity (No-Go):

  Confirmed Roosts. There are four confirmed roosts within the proposed Kudusberg WEF. During ultrasound monitoring and inspection of the roosts, it was confirmed that bats are using the identified buildings as roosts. While the number of individuals using the roosts remain relatively uncertain, we estimate that there are at least about 1-50 individuals, resulting in a **500 m buffer**, considering the known occurrence species with medium-high and high risk of collision with wind turbines. As such, no wind turbines, electrical infrastructure, substations or new roads may be permanently placed within the buffered areas. However, the use of existing roads may be used, as long as they are not upgraded in such a manner that will cause them to be re-routed and subsequently run more perpendicular to the roosts (and their buffered areas).

- **Ecological sensitivity**: The cliffs and rocky sheets mapped as very-high sensitive areas are no- go areas and should be avoided entirely.

- **Visual and Noise**
  No wind turbines to be placed within 500 m of a homestead.

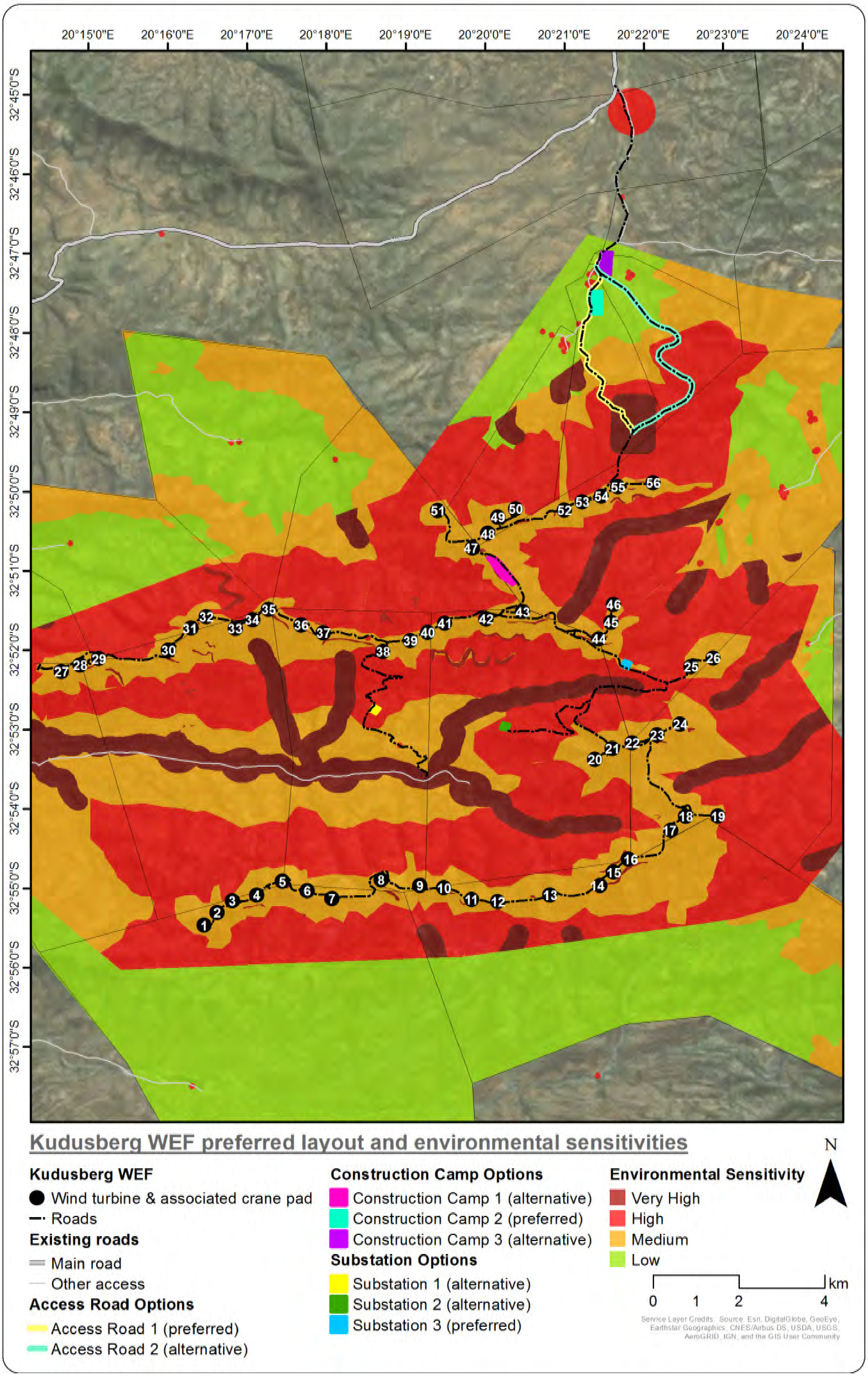


Figure D.42: **The environmental sensitivities on site overlain with the site layout (showing all the project alternatives) of the proposed Kudusberg WEF. *Note*: At the scale of this map some of the turbine locations may appear to be in high sensitivity areas. However, all turbines avoid high sensitivities.**

***Note*: Please note that the very-high sensitive areas are not necessarily no-go areas for all infrastructure and therefore all specialist assessments in Appendix D must be consulted.**

SECTION E: RECOMMENDATION OF PRACTITIONER

This BA Report has investigated and assessed the significance of potential positive and negative direct, indirect and cumulative impacts associated with the proposed Kudusberg WEF. **No negative impacts** have been identified within this BA that, in the opinion of the EAP who have conducted this BA Process, i.e. none are considered "fatal flaws" from an environmental perspective, and thereby does not necessitate substantial re-design or termination of the project.

Section 24 of the Constitutional Act states that "everyone has the right to an environment that is not harmful to their health or well-being and to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures, that prevents pollution and ecological degradation; promotes conservation; and secures ecologically sustainable development and use of natural resources while promoting justifiable economic and social development." Based on this, this BA was undertaken to ensure that these principles are met through the inclusion of appropriate management and mitigation measures, and monitoring requirements. These measures will be undertaken to promote conservation by avoiding the sensitive environmental features present on site and through appropriate monitoring and management plans (refer to the EMPr in Appendix G of this BA Report).

It is understood that the information contained in this BA Report and appendices is sufficient to make an informed decision in respect of the activity applied for.

E.1 Preferred Alternatives

As noted in Section A of this report, the preferred activity on site was determined to be the development of a renewable energy facility on site using wind energy as the preferred technology. In terms of the preferred location of the site, the farm portions indicated in Table A.1 are preferred.

Table E.1: Preferred alternatives for Kudusberg WEF

Specialist	Turbines	Construction camp	Substation	Access road
Visual	Support all 56	Camp 1 – least preferred Camp 2 and 3 - preferred	Alternative 1, 2 and 3 preferred	Alternative 1 and 2 preferred
Heritage	Support all 56	Alternative 1, 2 and 3 preferred	Alternative 1, 2 and 3 preferred	Alternative 1 and 2 preferred
Palaeontology	Support all 56	Alternative 1, 2 and 3 preferred	Alternative 1, 2 and 3 preferred	Alternative 1 and 2 preferred
Agriculture	Support all 56	Alternative 1, 2 and 3 preferred	Alternative 1, 2 and 3 preferred	Alternative 1 and 2 preferred
Terrestrial Ecology	Support all 56	Construction camp 2 preferred	Alternative 3 preferred	Alternative 1 preferred
Freshwater	Support all 56	Construction camp 1 preferred, construction camp 2 and 3 not fatally flawed	Alternative 3 preferred	Alternative 1 preferred
Avifauna	Support all 56	Alternative 1, 2 and 3 preferred	Alternative 1, 2 and 3 preferred	Alternative 1 and 2 preferred
Bats	Support all 56	Alternative 1, 2 and 3 preferred	Alternative 1, 2 and 3 preferred	Alternative 1 and 2 preferred
Socio-economic	Support all 56	Alternative 1, 2 and 3 preferred	Alternative 1, 2 and 3 preferred	Alternative 1 and 2 preferred
Noise	Support all 56	Alternative 1, 2 and 3 preferred	Alternative 1, 2 and 3 preferred	Alternative 1 and 2 preferred
Traffic	Support all 56	Alternative 1, 2 and 3 preferred	Alternative 1, 2 and 3 preferred	Alternative 1 and 2 preferred

Project location:

Kudusberg wind farm

Technology:

Wind energy facility

Project layout:

The revised layout 1 comprising 56 turbines is the preferred layout alternative-see section below for more details.

In terms of associated project infrastructure, the following alternatives are preferred (preferred alternatives are shown in Figure A.1):

Access route: Alternative 1

The preferred northern access route is the western one (Alternative 1), which could follow an existing track and is also shorter than the eastern route (Alternative 2). None of the route alternatives are flawed.

<u>Construction Camp: Alternative 2</u>

The preferred option for the construction camp is Alternative 2. Alternative 3 was found to be flawed by the heritage specialists and option 1 was in a visual very high sensitivity zone and furthermore contained a rocky sheet.

<u>Substation: Alternative 3</u>

The preferred Alternative for the substation is Alternative 3, followed by Alternative 1 (Alternative 2 was withdrawn by the landowner).

Project Layout

Considering the sensitivity of the site and based on the specialist studies undertaken for this project, the initial layout has been revised by the project applicant and a preferred layout for the proposed Kudusberg WEF was determined. **This revised layout avoids the features on site that have been identified to be no-go areas.**

The current layout lies predominantly in a moderate sensitivity zone as indicated in E.1.

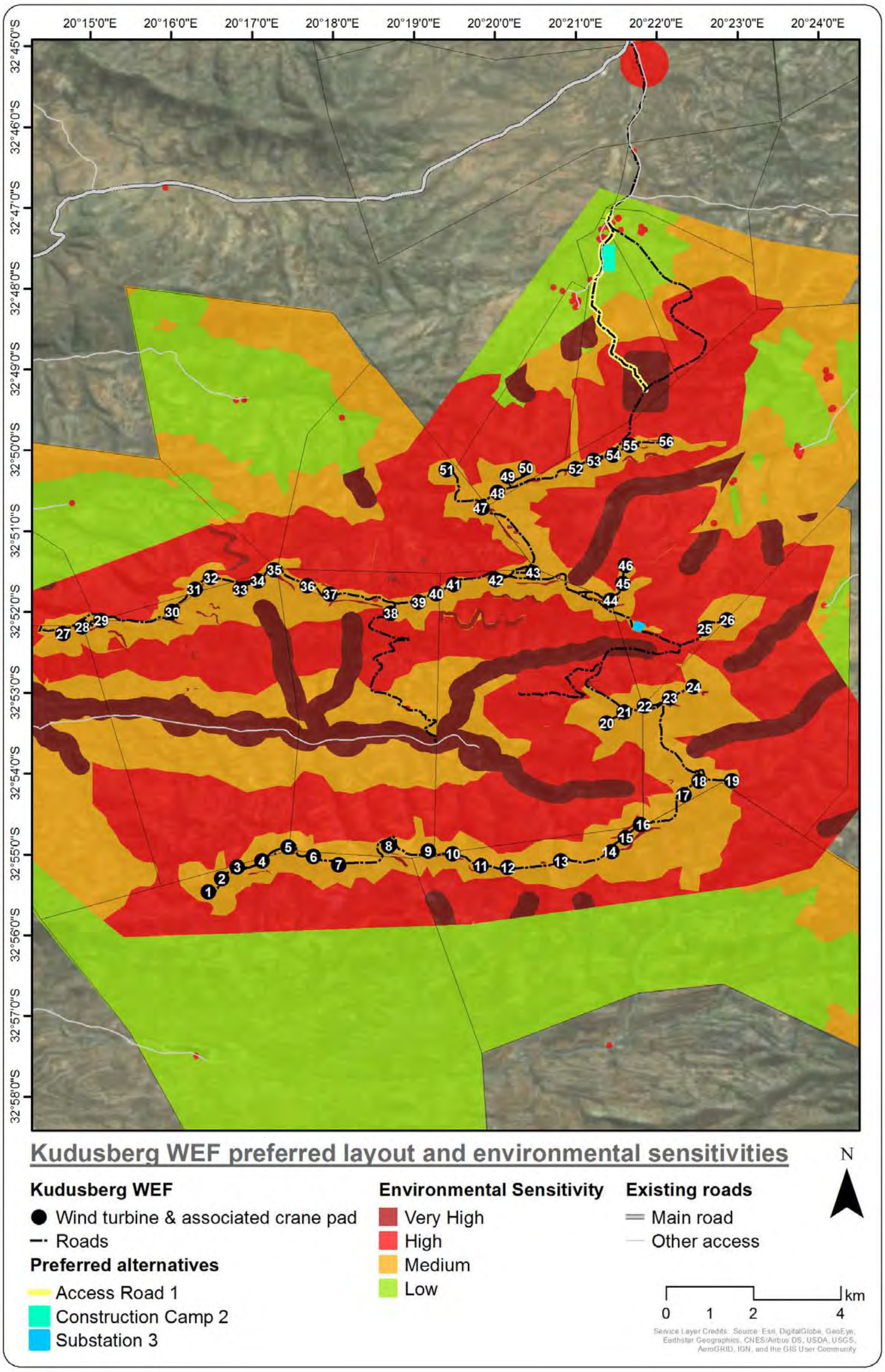


Figure E.1: Preferred layout map (showing only the preferred project alternatives) with the environmental sensitivities overlain on site for the proposed Kudusberg WEF. *Note*: At the scale of this map some of the turbine locations may appear to be in high sensitivity areas. However, all turbines avoid high sensitivities.

***Note*: Please note that the very-high sensitive areas are not necessarily no-go areas for all infrastructure and therefore all specialist assessments in Appendix D must be consulted.**

E.2 Need and desirability of the project

This BA considered the nature, scale and location of the proposed development as well as the wise use of land (i.e. is this the right time and place for the development of this proposed project). This project is located in the Komsberg REDZ 2 which is a geographical area that has been identified on a strategic planning level to have reduced negative environmental impacts but high commercial attractiveness (due to its proximity to, *inter alia*, the national grid) and socio-economic benefit to the country. The development of wind energy is therefore important for South Africa to reduce its overall environmental footprint from power generation (including externality costs), and thereby to steer the country on a pathway towards sustainability.

On a municipal planning level, the proposed project supports the objectives of the Witzenberg and Karoo Hoogland Local Municipality's Integrated Development Plans (IDPs) (2017-2022) which identifies renewable energy as a key economic sector. The Witzenberg LM IDP promotes the creation of an enabling environment to attract investment and support local economy. The Karoo Hoogland's IDP calls for economic interventions in sector development (agricultural, tourism and renewable energy). The IDP of the Namaqua DM (2017-2022) states that "Renewable energy is recently one of the cornerstones of the economy of the District and there needs to be engagement on National level to ensure that the District benefit from this resource." The IDP of the Cape Winelands DM (2017-2022) is also promoting renewable energy development as it states "The District Plans to move to less carbon-intensive electricity production through procuring at least 20 000MW of renewable energy, increased hydro imports from the region and increased demand-side measures, including solar water heating".

The proposed Kudusberg WEF is therefore aligned with the vision and goals of the DMs and the LMs. It will also stimulate the creation of employment which is much needed in the municipal areas. It will therefore be supportive of the IDP's objective of creating more job opportunities.

E.3 Impact assessment findings

Based on the findings of the specialist studies, the proposed project is considered to have an overall low negative environmental impact and an overall low positive socio-economic impact (with the implementation of respective mitigation and enhancement measures). The overall ratings for the specialist studies are summarised below.

Study	Overall assessment rating after mitigation
Visual	Moderate
Heritage	Moderate
Heritage: Palaeontology	Very Low
Agriculture	Very Low
Terrestrial Ecology	Low to Very Low
Avifauna (Birds	Low to Very Low
Bats	Low to Very Low
Socio-Economic	Low (-)
	Low (+)
Noise	Very Low
Traffic	Moderate

All of the specialists have recommended that the proposed project receive EA if the recommended mitigation measures are implemented. Taking into consideration the findings of the BA Process, as well as the fact that the proposed Kudusberg WEF will be located within the

Komsberg REDZ 2, it is the opinion of the EAP, that the project benefits outweigh the costs and that the project will make a positive contribution to sustainable infrastructure development in the Matjiesfontein and Sutherland regions. Provided that the specified mitigation measures are applied effectively, it is recommended that the proposed project receives EA in terms of the EIA Regulations promulgated under the NEMA.

E.4 Conditions to be included in the Environmental Authorisation

In order to ensure the effective implementation of the mitigation and management actions, an EMPr has been compiled and is included in Appendix G of this BA report. The mitigation measures necessary to ensure that the project is planned and carried out in an environmentally responsible manner are listed in this EMPr. The EMPr includes the mitigation measures noted in this report and the specialist studies. The EMPr is a dynamic document that should be updated as required and provides clear and implementable measures for the proposed project. Listed below are the main recommendations that should be considered (in addition to those in the EMPr and BA Report) for inclusion in the EA (should such authorisation be granted by the DEA):

- **Visual**
    - A lighting plan should be prepared which will minimise impacts on the nightscape.

  The following buffer must be applied:

    - ❖ No turbines should be placed within 500 m of the dwellings or farmsteads which are situated within the proposed application be prepared which will minimise impacts on the nightscape.

- **Heritage**
    - Should archaeological sites or graves be exposed during construction work, it must immediately be reported to a heritage practitioner so that an investigation and evaluation of the finds can be made.
    - A Chance Find Procedure must be followed if fossils are uncovered in the areas marked as High and Medium Palaeontological Sensitivity during the construction phase.
    - It is preferable to cluster the development along routes/ areas of other development, such as the R354, where impacts are already present and in so doing reduce impact in more unchanged landscapes such as along the historic R356. The R356 is a significant historic route and should be considered for recognition as such to protect it from negative impact due to future development.
    - New construction work, construction camps, substations or access roads should not impact negatively or threaten any of the historic built form, which is part of the history and land use evolution of the cultural landscape. To achieve this, a reasonable distance should be kept from all historic built features on the landscape, as has been addressed by the revised layout proposal.
    - Impact of the proposed WEF on local inhabitants (of permanent and seasonal habitation, owners and labourers) should be monitored by the Holder of the Environmental Authorisation through a grievance mechanism described in the EMPr. Such a grievance mechanism should take into account economic and social

inequality and be made accessible and known to all inhabitants of the CLAs, not just the land owners. Such a grievance mechanism should be in place for the duration of the development process through to the end of the decommissioning phase.

The following buffers must be applied:

- ❖ Graves: no development should be permitted within **50 m** of identified graves and cemeteries; existing roads within this buffer should not be altered or widened;
- ❖ Cave site (KDB045): construction staff should not be permitted within **200 m** of the site;
- ❖ Farmsteads: no turbines should be located within **500 m** of farmsteads; and
- ❖ Kraals, stone walling and ruins > 100 years: construction staff should not be permitted within **100 m** of these sites and no development should occur within 15m of these sites.

- **Agriculture**
  - o The recommended mitigation measure is for implementation of an effective system of storm water run-off control.
- **Terrestrial Ecology**
  - o Confine clearance to footprint of development and demarcate all footprints clearly.
  - o No fuelwood collection.
  - o Location of footprint such that no threatened Species of Special Concern (SCC) are affected.
  - o A walk-through prior to construction of the access roads, construction site, substation, turbines and crane pads to assess the presence of threatened SCC is proposed

The following buffer must be applied:

- ❖ The cliffs and rocky sheets as delineated by the ecologist are no- go areas and should be avoided entirely.

- **Freshwater**
  - o The existing road infrastructure should be utilised as far as possible to minimise the overall disturbance created by the proposed project. Where new roads need to be constructed, the existing road infrastructure should be rationalised and any unnecessary temporary roads decommissioned and rehabilitated to reduce the disturbance of the area and within the river beds. the disturbance of the channels should be limited.
  - o Wetland areas should be avoided and any road adjacent to a wetland feature should also remain outside of the 50 m buffer zone.
  - o All crossings over watercourses should be such that the flow within the drainage channel is not impeded and should be constructed perpendicular to the river channel, where possible based on the contours. Road infrastructure and cable alignments should coincide as far as possible to minimise the impact.

- Any indigenous vegetation clearing within or adjacent to the watercourses should occur in a phased manner to minimise erosion and/or run-off.
- An ECO or a specialist with knowledge and experience of the local flora, should be appointed during the construction phase to be able to make clear recommendations with regards to the revegetation of disturbed areas.
- During the construction phase, site management must be undertaken at the laydown area, batching plant and the individual turbine construction areas. This should specifically address on-site stormwater management and prevention of pollution measures from any potential pollution sources during the construction activities such as hydrocarbon spills. Any stormwater that does arise within the construction sites must be handled in a suitable manner to trap sediments and reduce flow velocities.
- Any disturbed areas should be rehabilitated and monitored to ensure that these areas do not become subject to erosion or invasive alien plant growth.
- Invasive alien plant growth and signs of erosion should be monitored on an ongoing basis to ensure that the disturbed areas do not become infested with invasive alien plants.
- Stormwater run-off infrastructure must be maintained to mitigate both the flow and water quality impacts of any storm water leaving the WEF site. No stormwater runoff must be allowed to discharge directly into the watercourses. The runoff should rather be dissipated over a broad area covered by natural vegetation or managed using appropriate channels and swales when located within steep embankments. Should any erosion features develop, it should be stabilised as soon as possible.
- Any water supply, sanitation services as well as solid waste management services that should be required for the site should preferably be provided by an off-site service provider.
- During decommissioning, disturbance to the freshwater ecosystems should be limited as far as possible. Disturbed areas may need to be rehabilitated and revegetated. Mitigation and follow up monitoring of residual impacts (alien vegetation growth and erosion) may be required.
- The recommended buffer area between the aquatic features and the project components (turbines, crane pads, substations and construction camps) (please note this excludes roads) to ensure these aquatic ecosystems are not impacted by the proposed activities should be applied as indicated below:

The following buffers must be applied:

- For new roads to the turbines, these should be located at least **100 m** outside of the drainage / river beds. Where access routes need to be constructed through the watercourses it must cross perpendicular;
- Smaller streams and drainage lines, together with their seeps: at least **50 m** from the centre of these streams or the delineated wetland edge (whichever is the furthest);
- The larger rivers within the valley floor, together with their valley bottom wetlands: at least **100 m**, measured from the top of bank of the river channels or the delineated wetland edge (whichever is the furthest); and
- The vernal pool and other wetland areas: at least **50 m**, measured from the top of bank of the delineated wetland edge.

- **Avifauna (Birds)**

  - A Construction and operational phase bird monitoring programme is to be implemented in line with the best practice monitoring guidelines to confirm and determine the extent of the impacts predicted as well as to validate the success of the mitigation strategies proposed.

  - Prior to construction, an avifaunal specialist should conduct a site walkthrough, covering the final power line route, to identify any nests/breeding/roosting activity of Red List species, the results of which may inform the final construction schedule in close proximity to that specific area, including abbreviating construction time where possible, scheduling activities around avian breeding and/or movement schedules where possible, and lowering levels of associated noise.

  - Internal 33 kV lines must be placed underground as far as possible, excluding sections where there may be geotechnical or other physical obstacles. The overhead 33 kV must utilise structures which have been approved as raptor friendly by the Endangered Wildlife Trust's Wildlife and Energy Programme.

<u>The following buffers must be applied:</u>

- ❖ Riverine thickets: Considering the scarceness and sensitivity of this vegetation type to land modifications, a **200 m** protection buffer is considered around the margins of the waterlines with this type of vegetation. No turbine placement or substation placement is allowed to occur within these buffered zones. Overhead Powerlines and roads are allowed to be built within these buffered areas, as long as they only cross these areas perpendicularly and don't run in parallel with them. Existing roads should be used/upgraded as far as possible, within these areas.

- ❖ Water bodies: As these supply important sources of water, nesting and resting locations for many bird species (not only waterbirds), a **200 m** protection buffer is considered around any potential margins of water present within the study area.

- ❖ Sensitive Flight Paths: a grid analysis was conducted to determine the use of geographical space by certain bird species. Only sensitive species with >0.25 contacts per hour were considered in each 500 x 500 m no-go square. A **200 m** buffer was then applied around each square to account for potential sensitive flight paths occurring on the inner border of each square.

- **Bats**

  - It is recommended that a construction and operational phase bat monitoring programme is implemented in line with the best practice monitoring guidelines to confirm and determine the extent of the impacts predicted as well as to validate the success of the mitigation strategies proposed.
  - It is recommended that the very high (no-go) areas identified for the bat community should be excluded from turbine placement and the areas considered as high sensitivity avoided as much as possible.

<u>The following buffers must be applied:</u>

- ❖ High sensitivity – 200 m around all potentially bat important features:

Along water lines and associated riverine vegetation. Such features are important for bats, since they are likely to act as commuting routes, providing food resources, likely to be associated with higher bat activity, and likely to favour the occurrence of dispersion routes, besides local commuting routes. A **200 m** buffer was considered around those features. It is recommended that should new infrastructures (including roads and electrical infrastructures) cross these features (including buffers), then they should not be routed to run parallel with them, but rather cross them perpendicularly, as far as possible. Additionally, this avoidance recommendation will not include the use of existing roads, as long as they are not upgraded in such a manner that will re-route them (to be more parallel with the feature) within those buffered areas. However, no wind turbines or substations may be permanently placed within any of these buffered areas.

- Very High sensitivity (No-Go):

Confirmed Roosts. There are four confirmed roosts within the proposed Kudusberg WEF. During ultrasound monitoring and inspection of the roosts, it was confirmed that bats are using the identified buildings as roosts. While the number of individuals using the roosts remain relatively uncertain, we estimate that there are at least about 1-50 individuals, resulting in a **500 m buffer**, considering the known occurrence species with medium-high and high risk of collision with wind turbines. As such, no wind turbines, electrical infrastructure, substations or new roads may be permanently placed within the buffered areas. However, the use of existing roads may be used, as long as they are not upgraded in such a manner that will cause them to be re-routed and subsequently run more perpendicular to the roosts (and their buffered areas).

- **Noise**
  - The noise impacts should be re-modelled when the final turbine layout and turbine type is determined only if the chosen turbine has a higher sound power level than the type modelled in this report or if a turbine is moved substantially closer to a noise sensitive receptor (< 100 m).

    Construction activities:

  - All construction operations should only occur during daylight hours if possible.
  - No construction piling should occur at night. Piling should only occur during the hottest part of the day to take advantage of unstable atmospheric conditions.
  - Noise monitoring should be conducted during the construction phase: Four times during the construction phase.
  - Noise monitoring to be conducted as per the requirements of SANS 10103.
  - Ensure that construction staff is given "noise sensitivity" training prior to construction commencing.

    Operational activities:

  - Ambient noise monitoring to be conducted on site at the NSA closest to a wind turbine when operations commence to verify the noise emissions meet the noise rating limit. Mitigation measures to be implemented if the noise impact exceeds the 35dB(A) noise rating limit.
  - Noise monitoring to be conducted as per the requirements of SANS 10103.

The following buffer must be applied:

- ❖ No wind turbines to be placed within 500 m of a homestead.

- **Traffic**
  - Temporary construction phase road signage be provided at the Reivilo/N14 intersection. The planning and approval of this signage must be obtained from SANRAL.
  - The applicant must apply for Abnormal Load permits in terms of Section 81 of the National Road Traffic Act (Act 29 of 1989) as applicable prior to commencement of construction.

Basic Assessment for the Proposed Development of the 325MW Kudusberg Wind Energy Facility and associated infrastructure, between Matjiesfontein and Sutherland in the Western and Northern Cape Provinces

DRAFT BASIC ASSESSMENT REPORT






SECTION F: APPENDICES