MAINSTREAM RENEWABLE POWER

Establishment of Wind Farms in Northern and Eastern Cape Provinces

Draft Environmental Constraints Analysis Report

Issue Date: 19 April 2011
Revision No.: 2
Project No.: 10777

Date:	19 April 2011
Document Title:	Establishment of Wind Farms in Northern and Eastern Cape Provinces
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Revision Number:	2
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1 INTRODUCTION

SIVEST has been appointed by Mainstream Renewable Power to undertake an Environmental Constraint Analysis as part of their feasibility studies for the proposed development of **four** Wind Farms in the Northern and Eastern Cape Provinces of South Africa. Each wind farm is expected to generate a certain amount of energy which is proposed to be linked into the Eskom grid. The size of the wind farm will be dependent on the size of the connection into the Eskom Grid. This report will consider the suitability of the four sites for the proposed development.

The proposed wind farms will include the following;

- Wind Turbines;
- Access Roads;
- Power lines;
- Wind farm control room;
- Temporary construction lay down area

Renewable energy that is produced from sustainable natural sources will provide incremental financial resources to stimulate sustainable development. Furthermore, it will contribute towards the country meeting its international commitments made in respect of green house gas emissions, as well as government's objectives set out in the White Paper on Renewable Energy.

Wind energy is plentiful, renewable, widely distributed, clean and reduces greenhouse gas emissions when it displaces fossil-fuel derived from electricity. It is thus attractive to many governments, organizations, and individuals. As most of the sources are indigenous and naturally available, wind energy is more secure in that it is not subject to disruption by international crisis or limited supplies, being naturally available.

Typical benefits associated with wind farms are:

- Wind energy is renewable, clean and non-polluting, and does not produce byproducts (atmospheric contaminants or thermal pollution) that could be harmful to the environment;
- Wind farms are well suited to rural areas and therefore have a reduced impact on agriculture compared to other electricity generating options. Wind turbines can also contribute to economic growth in these regions;
- Wind turbines make use of relatively simple technology in terms of design and construction;
- Wind energy is competitively priced compared to other renewable energy sources;
- Localized production of energy reduces transmission line losses associated with transmitting electricity over long distances;
- The use of wind turbines displaces the use of coal and other fossil fuels with their associated emissions of greenhouse gases; and
- Wind farms improve energy security for South Africa, reducing dependency on imported fossil fuels.

1.1 Components of a Wind Farm

Wind farms consist of several components that can result in negative environmental impacts of which the following are the most important:

- The construction or upgrade of access roads as wind energy generation use large structures that need to be transported to site as well as the increase in heavy vehicle traffic on public roads especially for the duration of the construction phase.
- The construction of transmission lines to connect to the electricity grid;
- The installation of transformers to enable connection to the electricity grid;
- On-site underground electricity cables that link the turbines with the on-site transformer(s);
- On-site roads and/or routes that may impact on the land use potential of the site;
- Wind turbine foundations are generally of an inverse T shape and between 20m and 30m wide, resulting in footprints of between 400m^2 and 900m^2 each that may impact on the land use potential of the site;
- Wind turbine shafts can be up to 80m high and has to be transported to site on large vehicles and be erected using large cranes;
- The nacelle (generator) that generates the electricity that sits on top of the turbine shaft where it can rotate according to the wind direction, should be designed in such a way to prevent birds from nesting on it and prevent excessive noise from its gearbox; and
- The wind turbine blades are attached to the nacelle and are responsible for converting wind energy into rotation that drives the generator which may be dangerous to birds, bats and other flying fauna and can also cause shadow flickering which may be a nuisance to nearby residents.

2 PROJECT DESCRIPTION

2.1 Project Location

The proposed project is located in the Northern and Eastern Cape Provinces. The total combined area of the study areas is **37 393 hectares** over the four sites. The proposed land to be acquired for the proposed project consists of privately owned farms adjacent to each other (in their respective sites) and has been identified as prime sites for wind energy.

2.1.1 Loeriesfontein

The Loeriesfontein site is situated within the Hantam Local Municipality in the greater Namakwa District Municipality, Northern Cape Province. The study area is approximately **15 295 hectares** in size, approximately 49 km north of the town of Loeriesfontein.

The town of Loeriesfontein is within a basin surrounded by mountains, and it is accessed from the N7 highway (north out of Cape Town), turning off on the R27 at Van Rhynsdorp to Nieuwoudtville, then following the R357 to Loeriesfontein (a further 65 km north).The site can be accessed via a secondary road (Granaatboskolk Rd) from Loeriesfontein Town and a railway line from Cape Town.

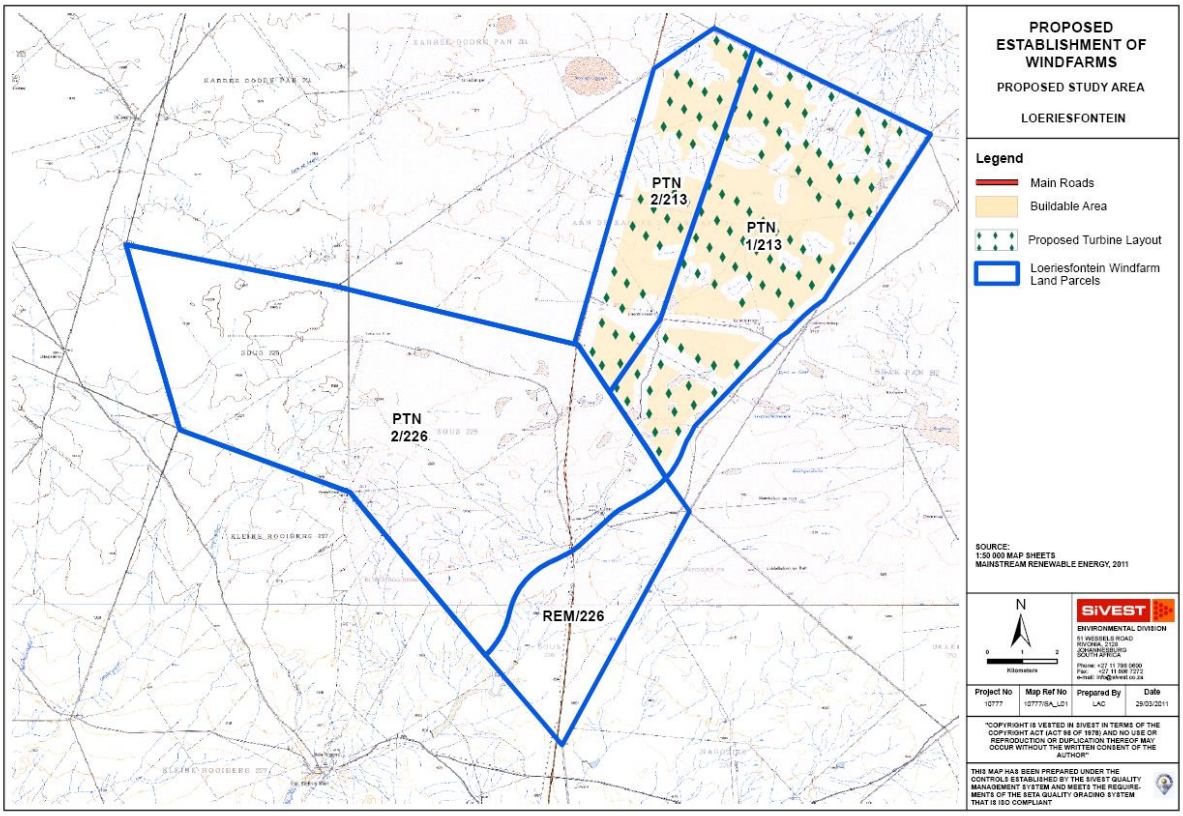

Figure 1: Loeriesfontein Study Area

2.1.2 Prieska

The Prieska site is situated within the Siyathemba Local Municipality in the greater Pixley ka Seme District Municipality, Northern Cape Province. The study area is approximately **12 980 hectares** in size and approximately 68 km and 58 km south west of the town of Prieska via the R357 and R386 respectively. To the north west of the site is a defunct copper mine, Prieska Copper Mine.

The town of Prieska is situated south of the Orange River at the foot of the Doringberg. It is accessible from the N10 highway (south out of Kimberley).

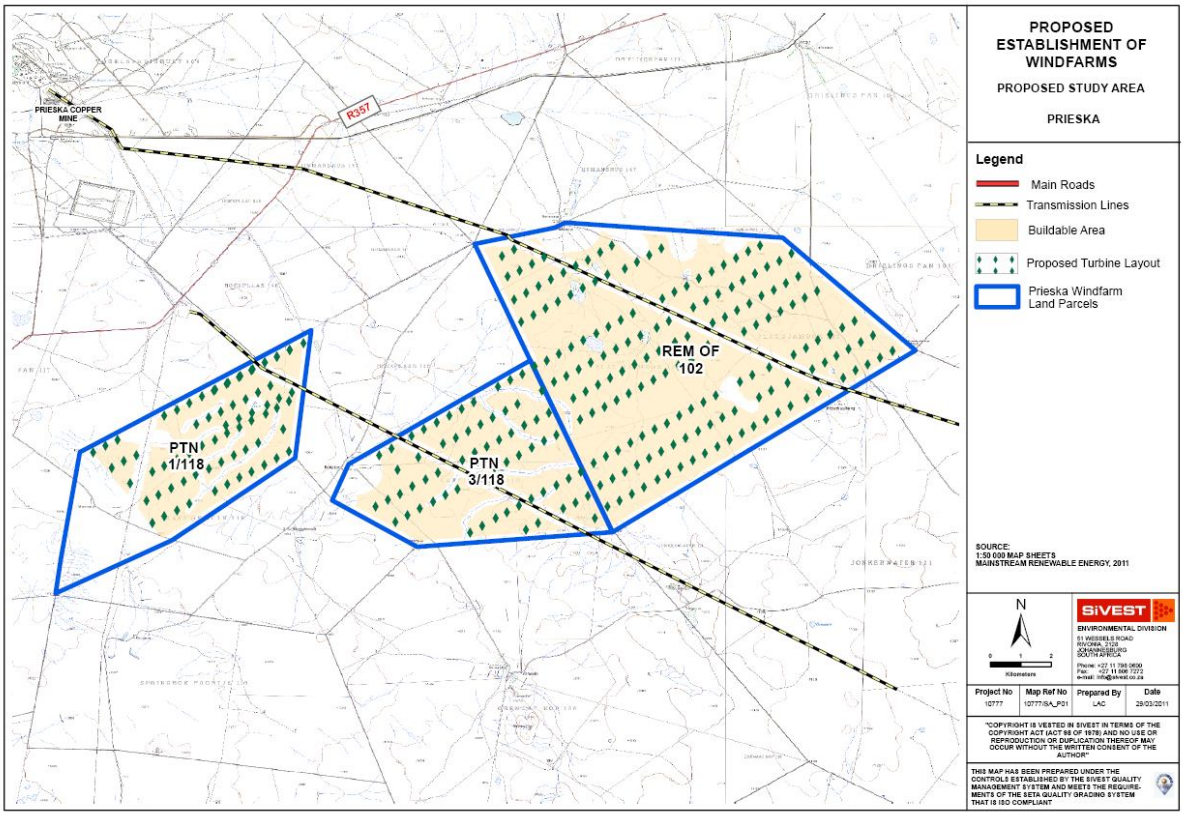

Figure 2: Prieska Study Area

2.1.3 Noupoort

The Noupoort site is situated within the Umsobomvu Local Municipality in the greater Pixley ka Seme District Municipality, Northern Cape Province. The study area is approximately **7 632 hectares** in size and approximately 53 km south east of the town of Colesberg and 55km south west of Hanover town.

The town of Noupoort is situated off the N9 highway on the main route from the Eastern Cape to Colesberg on the N1 route. There is an existing railway line which is centrally placed between many other towns, with its existence entirely dominated by the continual passage of trains.

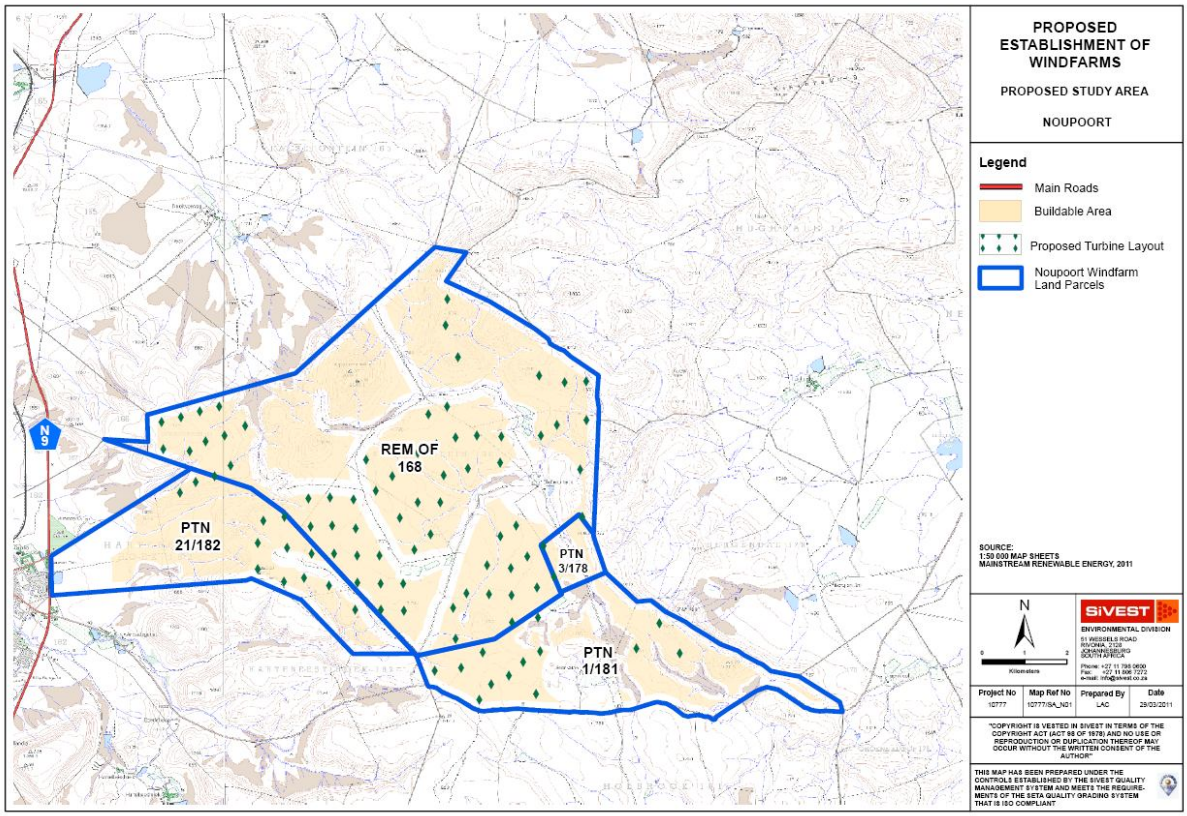

Figure 3: Noupoort Study Area

2.1.4 Lady Grey

The Lady Grey site is situated within the Senqu Local Municipality in the greater Ukhahlamba District Municipality, Eastern Cape Province. The study area is approximately **2 027 hectares** in size and 25 km south east from the town of Lady Grey and 35 km north west from the town of Barkly East along the R58.

Lady Grey is a rural village in the Eastern Cape in South Africa near the border of Lesotho. It is situated in the foothills of the Witteberg Mountains, about 55 kilometers east of Aliwal North and 260 km from Bloemfontein in the Free State Province.

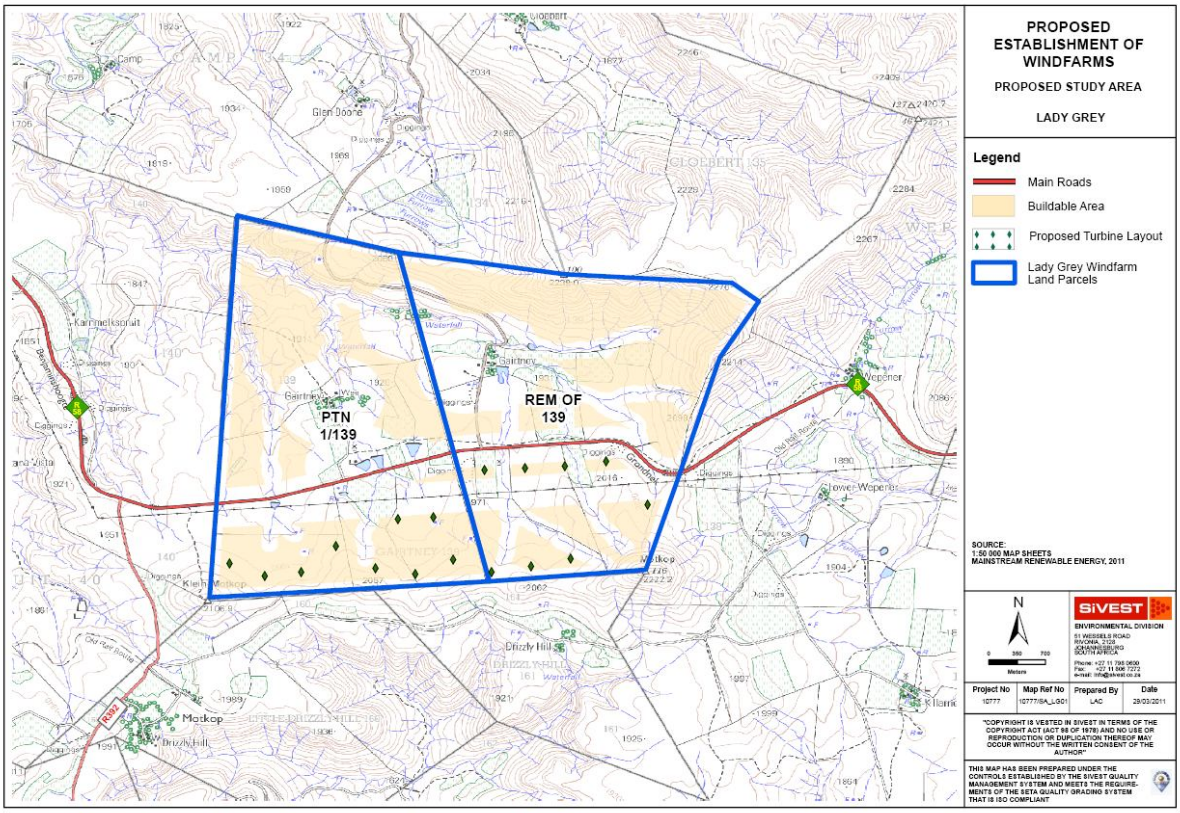

Figure 4: Lady Grey Study Area

2.2 Site Selection

Mainstream has developed a site selection process in line with the best international practice based on extensive experience in the global market keeping in consideration the requirements and limitations from various stakeholders. The identified land parcels making up the proposed wind farm are shown in the table below.

Table 1: Sites and the parcel numbers

SITE	PARCEL NUMBER	AREA (HA)	LAND OWNER
Loeriesfontein	1/213	4 061.67	Brian Lintvelt
	2/213	1 983.14	
	2/226	7 643.84	
	RE/226	1 650.92	
Prieska	RE/102	7 238.42	CL Viljoen
	1/118	2 883.96	
	3/118	2 857.40	
Lady Grey	1/139	1 020.95	Rene du Plessis
	RE/139	1 006.01	
Noupoort	RE/168	4 745.62	Michiel Lessing
	3/178	139.19	
	1/181	1 469.99	Jurie Lessing
	21/182	1 276.80	June Trust

The selection of the sites for the wind farm project will follow various inputs outlined below:

- Estimation of wind energy resource which was derived from Mainstream's propriety information based on national available wind data and advanced theoretical modeling developed in-house and by consultants;
- Proximity to residential areas;
- Proximity to environmentally (social and biophysical environments) and heritage sensitive areas (in consultation with appropriate specialists);
- Potential impacts on fauna and flora (in consultation with appropriate specialists).
- Availability of national wind farm development sensitivity maps such as currently being prepared by Birdlife SA and being finalised by the Western Cape Government for the west coast region. (**Note these maps were not yet developed during the selection process**);
- Potential visual impact;
- Potential impact on aviation;
- Presence of obstacles on the site such as rivers, dams, roads, existing gridlines and current land use;
- Need for grid stabilization in the area;
- Need for energy security in the area;
- Need for rural development through job creation in the area;
- Accessibility of the area as a result of the topography;
- Grid connection options – is connection affordable and in national interest?
- Willingness of land owners in supporting land reform objectives.

After the appropriate site has been selected, the affected land owners would be contacted and options to develop including long term lease agreements negotiated. Once the specific land portions are identified, Mainstream will develop a map of the available area on the specific farm/farms. This area will be referred to as the 'buildable' area and buffer zones will be applied to the sensitive areas identified in the table below.

Table 2: Buffer zones applications to sensitive areas

SENSITIVE AREA	BUFFER
Airports and Military Facilities	15-30km
Privately owned and managed run ways	5km
Public Roads/railway	200m
Houses	800m (Loeriesfontein, Prieska and Noupoort sites) 500m (Lady Grey)
Residential Areas	800m
Rivers/Floodplains/Wetland/Lakes	100m - 200m
Forestry (away from the prevailing wind)	500m
Forestry (non-prevailing wind direction)	200m
Forestry (when turbine is keyholed[1])	500m
Protected and archeological areas	100 – 200m
Communication corridors/radar/Microwave towers	200m
Existing Generation/Wind farms	> 1km
Existing Servitudes	As per servitude + (1.5 x Stop height)
Site Boundary	200m
Electrical grid distribution/transmission lines	200m – 300m
Substation	500m

Consultations with the affected land owners will identify specific areas (areas where extensive farming is practised or future farming is expected to be practised) on their land which is to be excluded from the proposed development.

The area where the proposed development is set to take place will be referred to as "the buildable area". After analysis from Mainstream team, a preliminary turbine layout will be identified. The turbine layout will include a preliminary turbine access road layout which will consist of:

- Turbine connection to the electrical grid;
- Proposed location of electrical substations;
- Operations and maintenance buildings.

During the preliminary design, emphasis will be put in minimizing the impact on local land owners and their faming activities.

[1] Placing the turbine in a forest

2.3 Technical Description

At this stage, it is estimated that the proposed project will encompass the installation of a number of wind turbine generators and their associated components in order to generate electricity that is to be fed into the existing Eskom transmission line that cross or are located nearby the proposed sites. Depending on the size of the site, the power capacity limit, and the number of wind turbines to be accommodated, the existing transmission lines could have a voltage of 66kV (smaller wind farms) or 132kV (larger wind farms).

The key components of the project are;

2.3.1 Turbines

The turbines have a hub height of 60-120m and a rotor diameter of 70-130m

2.3.2 Electrical Connections

The wind turbines will be connected to each other and to the substation using underground 1m medium voltage cables except where a technical assessment of the proposed design suggests that overhead lines are appropriate such as over rivers and gullies.

i. In Noupoort, the electrical connection to the grid will depend on the project size. For a smaller project size, the connections will use a 66kV line while 132kV line will be used for the larger project size.
ii. In Prieska, both connection points exist and one option for the 30MW project will be breaking the 66kV line crossing the site.
iii. In Loeriesfontein, both connections exist and the options for the first phase will include building an overhead 66kV line.
iv. In Lady Grey, only a 66kV connection point exists.

2.3.3 Substations

A new substation (approx. 90 x 120m) and a transformer to the existing 132kV and 66kV Eskom grid will be built preferably close to the transmission lines.

The connection from the substation to the Eskom grid line will be an overhead line and pole. This will be dependent on the location of the substation relative to the 66kV and/or 132kV line.

2.3.4 Roads

The access roads are proposed to be 10m wide gravel roads from the site on to the public road. An internal road network to the turbines and other infrastructure will include;

v. Turning circles for large trucks.
vi. Passing points and culverts over gullies and rivers.

vii. Existing roads will be upgraded.

2.3.5 Temporary construction Area

A 10,000m^2 lay down area will consist of an access route and a 2,250m^2 compound for the installation of turbines including an office for all contractors.

2.3.6 Other infrastructure

viii. Operations and maintenance building: A single storey building, maximum 5,000 m^2, with warehouse/workshop space and access, office, telecoms space, security and ablution facilities as required. These should be situated preferably close to the substation.

ix. Fencing if required.

x. Permanent wind measuring mast of 70 m – 100 m.

2.4 Wind Energy

In this context, wind power is the conversion of wind energy into electricity using modern and highly reliable wind turbines. One characteristic of wind energy is that it has to be captured when it's available. Wind turbines consist of the following major components as seen in the Figure 1;

- The rotor/blades;
- The nacelle/generator;
- The tower; and
- The foundation unit.

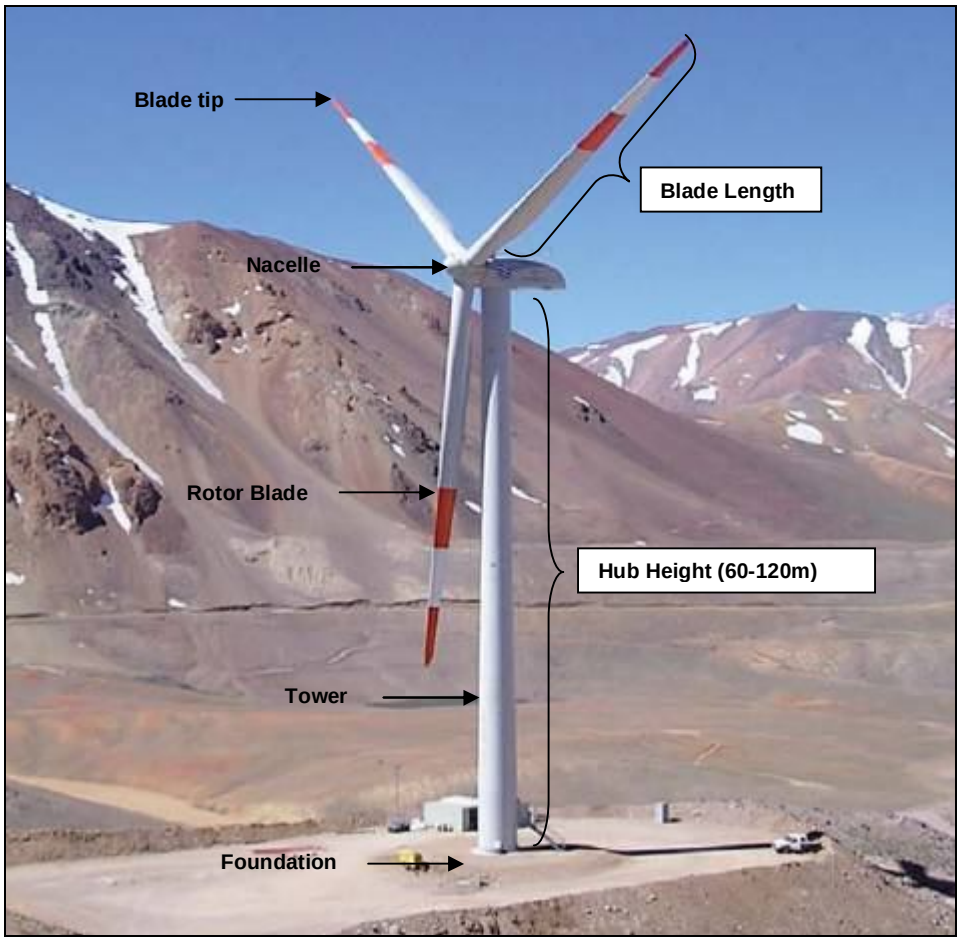

Figure 5: Components of a typical wind turbine

2.4.1 How wind turbines work

Wind turbines are mounted onto a tower to capture wind energy. The kinetic energy generated by the wind is used to turn the blades of the turbines to generate electricity. The wind turbine is erected at a height of 30m or more above the ground and takes advantage of the fastest and less turbulent wind. Usually, 2-3 blades are mounted on a shaft to form a rotor. The nacelle sits on top of the hub and contains the generator, control equipment, gearbox and anemometer for monitoring the wind speed and direction. The mechanical power generated through the rotating blades is transmitted to the generator via a gear box and drive train which converts the turning motion of the blades into electricity.

A wind turbine is generally designed to operate continuously for more than 20 years with minimal maintenance. A wind energy facility can be monitored and controlled remotely with a mobile team for maintenance when required.

2.5 Aims of the study

This study is aimed at detailing findings from a desktop analysis of the receiving environment that may be affected by the proposed development of the Wind Farms. This report will include detailed verifications of issues of concern and will provide recommendations with regard to any environmental constraints that may restrict or limit the activities of the proposed development.

2.6 Advantages of wind energy

- Increased energy security, as the diversity of resources on which South Africa depends is increased;
- Conservation of consumptive mineral resources as strategic assets or for income generation through exports;
- Use of available renewable resources as carbon free energy that is non-consumptive;
- Support international initiatives and standing for South Africa.

2.7 Disadvantages of wind energy

- High cost of energy to consumers;
- Variability of electricity generation as the wind energy source cannot be stored and used as required to the extend as fuel based electricity generation;
- Due to its expansive infrastructure it can have significant impacts on land use depending on the chosen localities;
- As a highly visible type of energy generation it has a significant potential to impact negatively on landscape character, especially as South African perceptions are not yet accustomed to it.

2.8 Approach

Four sites (Loeriesfontein, Prieska, Noupoort and Lady Grey) have currently been selected for the location of the Wind Farms in the Northern and Eastern Cape Provinces. The selection of suitable sites for the location of Wind Farms is central to this project. It is important to note that there are currently two EIA processes in progress in the Prieska Site; these EIAs are for a Concentrated Solar Power (CSP) facility and a Wind farm development.

This report is presented in two primary phases namely:

- Status quo phase
- Analysis and discussion phase

The Environmental Constraints Analysis will examine a wide cross section of the environmental parameters of the two study areas.

A large amount of data has been gathered from the following sources:

- Relevant IDPs and relating planning information;
- Current management plans and associated documentation;
- Conservation Development Framework;
- Management plans;
- GIS Mapping information:
  - Environmental Potential Atlas(ENPAT) database;
  - South African National Biodiversity Institute (SANBI) database;
  - National Freshwater Priority Areas (NFEPA) database;
  - CSIR Land Cover and 1; 50, 000 maps.
- Field research;
- Municipal Environmental Management and Spatial Development Frameworks;
- State of the Environment Reports.

The Status Quo phase will include all data review and data collection that would be required to describe the ambient environment and key impacts / trends within the study areas. In this phase the work shopping of key values and attributes through key stakeholder consultation would occur.

The analysis phase would focus on analysing and interpreting the results of the status quo phase. This phase would include a strategic impact assessment of key issues and impacts based on the status quo phase. The results of this phase would be used as a base to select the most suitable sites for the proposed Wind Farms. That is, for each key environmental issue/ factor a comparative assessment will be done in order to rank the four sites so as to determine the most suitable site alternatives. Details of these will be represented in the analysis and discussion section.

The various phases are presented in more detail under the respective sections.

2.9 Analysis and discussion phase

Based on the identification of key environmental attributes, trends and impacts in the status quo phase, the analysis phase will be undertaken. The main aim of this phase will be to analyse the results of the status quo phase. The analysis stage will mainly be undertaken through use of GIS modelling and results discussed based on existing information.

2.9.1 Identification of and assessment of threats, trends of land use and opportunities.

Patterns of land use and areas of environmental impact and degradation within the study areas will be analysed and assessed. Furthermore, the results of the analysis phase will be discussed in an effort to justify why a site may or may not be suitable for the establishment of the Wind Farms.

2.10 Potential Impacts

Wind Farms normally require large areas of land and therefore their impacts on the environment could be wide spread. Potential impacts of Wind Farms are generally related to impacts on biodiversity, surface water, soils and agricultural potential, tourism, heritage, geotechnical as well as socio-economic impacts. Details of these impacts are reported below.

2.10.1 Flora

Since the establishment of Wind Farms involves clearing of vegetation, potential impacts may include the following:

- Potential loss of habitat for plant species, including red data species (although no red data species were identified during this desk top assessment).
- Potential loss of species richness.

2.10.2 Fauna

Clearing of vegetation for the establishment of Wind Farms may lead to the following potential impacts:

- Potential loss of habitat for red data faunal species (nevertheless, no red data faunal species were identified during desktop studies).
- Potential loss of species richness.

2.10.3 Bats

Establishment of the wind farms in the study area may lead to the following potential impacts:

- Bat mortalities due to blade collisions and barotrauma during foraging
- Bat mortalities due to blade collisions and barotrauma during migration
- Destruction of foraging habitat
- Destruction of roosts

2.10.4 Avifauna

Wind turbines comprise tall physical structures that can be hazardous to avifauna. Possible impacts to avifauna include:

- Potential loss of habitat for red data faunal species (nevertheless, no red data faunal species were identified during desktop studies).
- Potential loss of species richness.
- Bird fatalities and mortalities caused by transmission lines and the rotating wind turbines.

2.10.5 Geotechnical

Wind Turbines require the construction of foundations. Potential geotechnical impacts can include:

- Risk or hazard associated with undermined land;
- Risk or hazard associated with unstable/collapsible ground.

2.10.6 Surface water

Surface water features are often impacted by residential developments where large areas of land are required that may encroach on lakes, wetlands and rivers. Potential impacts can include:

- Destruction, degradation and loss of wetlands;
- Impeding the flow of a river\stream;
- Impacts to water quality of rivers and wetlands.

2.10.7 Soils and agricultural potential

- Where large expanses of land are to be developed by residential structures, there may potentially be a loss to potentially arable land.

2.10.8 Tourism and Heritage

- Destruction or movement of heritage sites and archeological artifacts as a result of the proposed development.

2.10.9 Visual

- Visual exposure of the facility from protected areas or areas with scenic, cultural or historical significance;
- Visibility of the facility to people travelling along major routes that are regarded to have high tourism value as a result of scenic, cultural or historical significance;
- Visibility of the facility to tourism facilities and recreational activities that are largely dependent on the natural scenic or picturesque quality of an area;
- Visual exposure and close proximity of the facility to settlements and towns;
- Visual impact during the construction phase of the wind energy facility;
- Modification to the visual character / sense of place of an area;
- Visibility of operational and security lighting at night.

2.10.10 Socio-economic

A social impact assessment (SIA) is the process of assessing or estimating, in advance, the social consequences or changes that are likely to emanate from a proposed development (IAIA, 2001). Significance is attributed to these consequences or changes, against the background of social impact variables. This section briefly outlines potential impacts of the housing project on populations, communities, and individuals. It further highlights the potential socio-economic issues and/or benefits.

- Population Impacts
  - Inflow of temporary workers
  - Introduction of people dissimilar in demographic profile
  - Relocation of individuals and families.

- Community / institutional arrangements
  - Change in community infrastructure
  - Impact on Local government: This variable relates to projected impacts on local government as a result of the proposed project. This includes potential implications on traffic, zoning and spatial planning and land-use
  - Impacts on land use

- Individual, community and family level impacts
  - Impact on daily living and movement patterns
  - Disruption of social networks and alteration of family structure
  - Introduction of new social classes: The impact of this variable depends on whether locals or outsiders/foreigners will be used at any given time during the construction and operational phases of the project. It is expected that specialists (even foreigners) might be employed during the construction phase, which could create a new social class with different behaviours and lifestyles.

- Socio-economic Impacts
  - Industrial diversification: This variable relates to whether changes in occupational opportunities in the area are expected. The proposed project is expected to result in some changes in occupational opportunities in the area. The proposed development could also stimulate commercial growth and ensure that indirect local economic benefits may increase in the case of the support and services sector.
  - Employment equity and occupational opportunities: The intensity of the impact will depend on the level to which contractors can recruit local skilled persons.
  - Job creation: Construction activities will create a number of temporary employment opportunities.
  - Change in tourism and leisure opportunities: This variable addresses the potential impact on tourism and leisure opportunities. The proposed development could cause changes in tourism and leisure opportunities.

3 STATUS QUO PHASE

This Status Quo phase is a review of the existing data and information pertaining to the four study areas Loeriesfontein, Prieska, Noupoort and Lady Grey. The purpose is to establish an environmental baseline for the study area, identifying key features and sensitivities of the environment within the study areas as well as identifying impacts within the study area that are currently impacting on the ecological integrity and sense of place. This collation of baseline information would be the starting point for the scoping phase.

The status quo assessment entails the review of all existing information. This is mainly a desk top study, with a certain degree of field verification. The purpose of the status quo assessment is to gather and compile data relating to these parameters, so that an understanding of current trends and impacts in respect of these parameters can be acquired. For certain non-biophysical environmental parameters (such as the visual environment) little data currently exists and serves as a limitation for this section.

Information has mostly been sourced in GIS format, from the relevant District Municipalities.

Based on previous experience, the following key environmental issues are considered (to varying degrees) during site selection for the Wind Farms:

- Biodiversity (Flora, fauna esp. bats and avifauna)
- Heritage and tourism
- Surface water
- Groundwater
- Soils and Agricultural Potential
- Geotechnical
- Noise
- Visual
- Social and land use
- Socio economic

A desk top review and assessment has taken place for all but not limited to the above parameters.

3.1 Loeriesfontein site

3.1.1 Social

The site is extremely remote with one occupied dwelling and associated outbuildings located on the site. The surrounding farm infrastructure is not visible from the wind farm site. These landowners are also located far enough away from the site that noise from the turbines will not affect them. The land use is dominated by agriculture namely sheep grazing. Agricultural activities are however of very low intensity given the low yield of the land (see soils and agricultural potential).

Construction staff will need to be housed on the site during construction as the nearest town of Loeriesfontein is approximately 35km's from the site. At present the town of Loeriesfontein does not have capacity to house additional people as they are experiencing a housing backlog.

Refer to the literature review for details from the IDP for the area.

3.1.2 Flora

According to ENPAT (2000), the land cover of study area is predominantly shrubland /fynbos. The Loeriesfontein study area falls under the Bushmanland Basin Shrubland type of the Nama karoo vegetation (SANBI, 2006).

The Bushmanland Arid Grassland is characterised by extensive to irregular plains on a slightly sloping plateau sparsely vegetated by grassland and dominated by white grasses (*Stipagrostis species*) (Mucina and Rutherford, 2006). The conservation status of the study area according to the SANBI Vegmap (2006) is "Least Threatened".

The endemic species found in the Bushmanland Arid Grassland are succulent shrubs (*Dinteranthus pole-evansii, Larrleachia dinteri, L. marlothii* and *Ruschia kenhardetensis*) and herbs (*Lotononis oligocephala* and *Nemesia maxi*.).

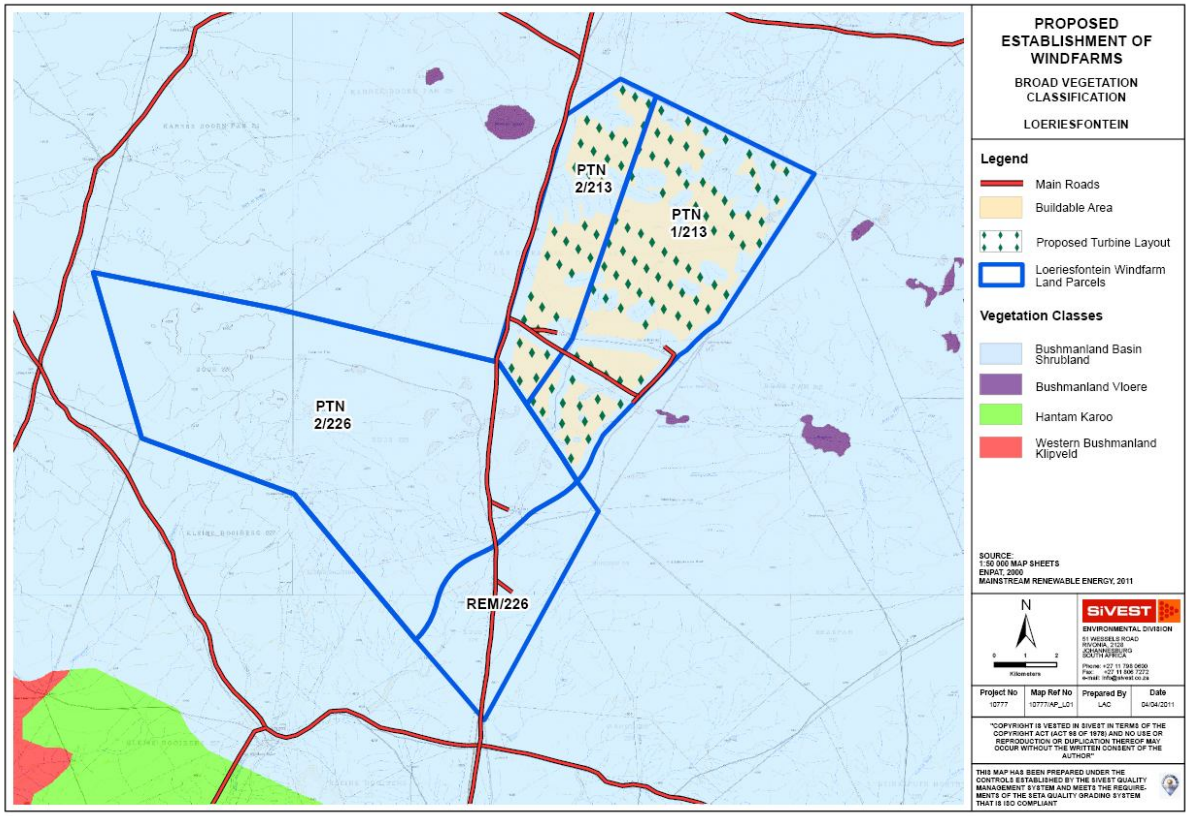

Figure 6: Vegetation Classes Loeriesfontein

3.1.3 Fauna

No Red Data faunal species were noted within the study area. Very little suitable habitat is available for faunal species within the study area due to the level of transformation.

- Invertebrates

There is likely to be a high diversity of invertebrates present associated with the flowering plants (when present). The area is not known for large flowering displays as are noted in the town of Loeriesfontein and further south in Nieuwoudtville. These flowering plants require pollinators, hence the presence of an abundance of insects. Brown locusts (*Locustana pardalina*) were noted during the field trip, which are likely to attract bird and other faunal species. These locusts only occur after a dry winter and are not a regular occurrence. A good population of scorpions and spiders are likely to be present given the expected insect population.

Suitable habitat exists for invertebrate species to move into during construction.

- Mammals (excluding bats)

The arid nature of the study area limits the number of mammal species. Farming activities have resulted in the absence of larger mammal species. Mammals are likely to be dominated by small antelope and small mammals such as rodents and lagamorphs (scrub hares).

Suitable habitat exists for mammal species to move into during construction.

- Reptiles and amphibians

Reptiles adapt well to the arid environment and thus a wide variety is anticipated to be present. The Loeriesfontein area is known for a rich diversity of reptile species as collected for the SARCA programme (Southern African Reptile Conservation Assessment) closer to the town of Loeriesfontein. The area is likely to be too dry for most amphibian species.

3.1.4 Bats

Results show that the following bat species can be found in the study area;

- *Miniopterus natalensis* (Natal long-fingered bat)
  - Low probability of occurrence;
  - Near Threatened status;
  - Roosts gregariously in caves, no known caves close to the study site.
- *Cistugo seabrae* (Angolan wing-gland bat)
  - Medium-High probability of occurrence;
  - Near Threatened status;
  - Endemic to West Coast, restricted to arid climates (semi-desert), netted in dry river beds.

- Rhinolophus capensis (Cape horseshoe bat)
  - Low probability of occurrence
  - Near Threatened status;
  - Roosts gregariously in caves, no known caves close to the study site.

Some pans are present in the north eastern part of the site in addition to dry stream beds in the south western areas. These streams are seasonal however, and can only provide limited surface water for bats. Although, the mountainous terrain in the south west can offer bat roosting space, from a vegetation point of view, the natural vegetation of the site does not offer any roosting space

The Loeriesfontein site displays only one factor of the three important factors relatively strongly, and this is possible roosting space, but also only in the south western part of the site. Surface water and probability of insects are low, suggesting that the site is likely to have a lower bat activity than Lady Grey and Noupoort but possibly higher or equal to Prieska. From a desktop bat sensitivity point of view, the Loeriesfontein site is **recommended** as one of the two best sites for the wind farms.

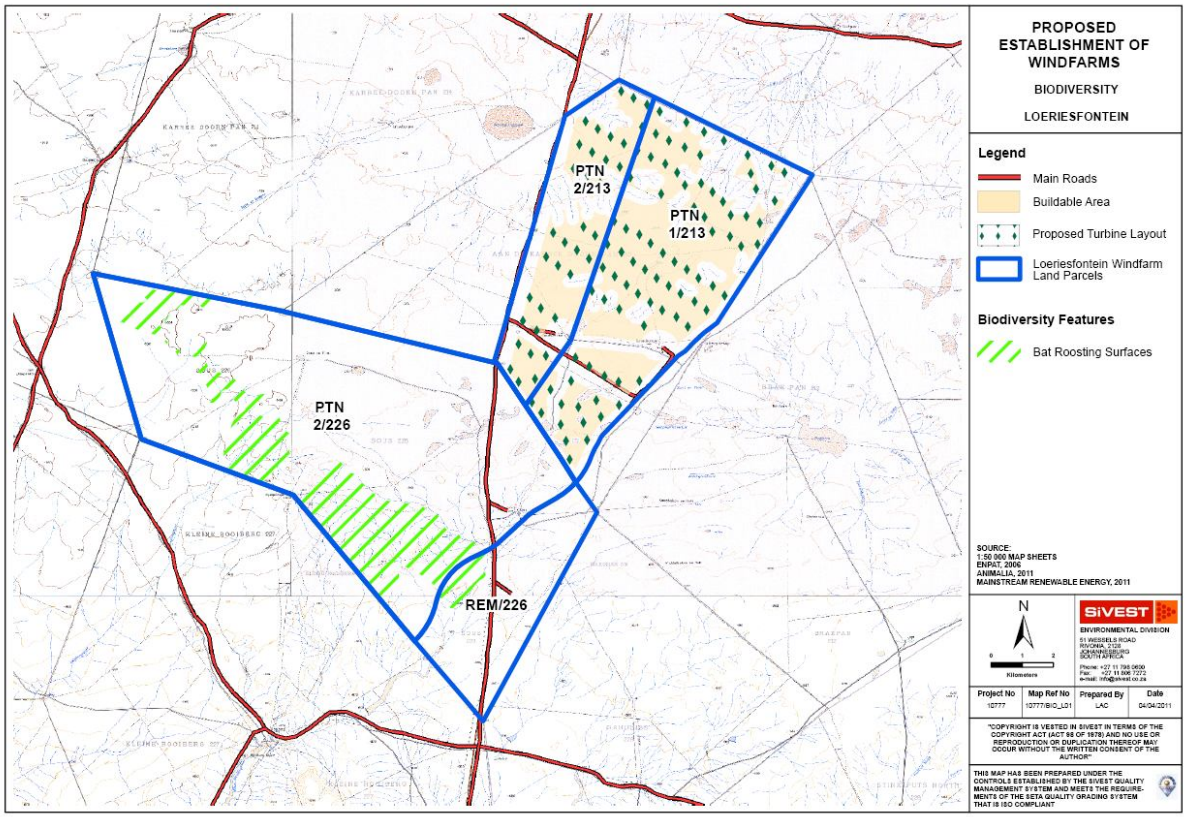

Figure 7: Biodiversity map showing the bat roosting surfaces in Loeriesfontein

3.1.5 Avifauna

The site is not an important Bird Area. No permanent / open water sources of significance are in close proximity to the site (that attracts important bird species). Red Data species that may be present however, are not likely to be common in the area.

3.1.6 Geotechnical

The topography of Loeriesfontein is flat. Geologically, the site comprises shale, dolerite, alluvial deposits and minor aeolian sands. The various types of possible geotechnical constraints and the general locations within the study sites can be described as:

- Potentially collapsible sands (Isolated and limited distribution – areas underlain by aeolian sand deposits);
- Alluvial deposits (Limited distribution – along larger drainage lines);
- Hard excavation conditions (Moderate distribution – particularly areas underlain by dolerite).

The creation of a 200m buffer zone around rivers will reduce the occurrence of poor quality alluvial soils from within the development areas. Lastly, it is recommended that further detailed geotechnical investigations are undertaken at each site to confirm these findings.

Undermining from the nearby Prieska Copper Mine could impact on the foundations of the proposed turbines and further detailed investigation should be undertaken.

3.1.7 Surface Water

Two priority river systems (NFEPA 2011) distanced approximately 5km apart from one another flow to the south of the Loeriesfontein study site. The river systems located to the western most area of the site is identified as the Leeuberg River (Reach number E81). This particular river is classed as a largely natural river system (Class B) according to the Present Ecological State assessment conducted in 1999 (NFEPA 2011). Equally, the river system located in the central southern region of the study site is classed as a largely natural river system (Class B) according to the Present Ecological State assessment conducted in 1999 (NFEPA 2011). This river is identified as the Klein-Rooiberg River (Reach number E61). Numerous associated drainage lines can be evidenced in addition to these systems. A minimum buffer zone of 100metres will need to be applied for each identified river and drainage system.

Wetlands, on the other hand, are relatively prominent and scattered throughout the site. A total of 45 wetlands can be identified from the NFEPA (2011) database, 10 of which are flat\pan wetlands, 26 are depression wetlands and 9 are hillslope seep wetlands. These wetlands will require a minimum buffer of 50metres. The number and density of pans (particularly in the central and northern areas of the study site) in addition to the two priority river systems and associated drainage lines will affect the developable area of the wind farms, but do not constitute a fatal flaw for the study site provided that the site specific location of the wind turbines be situated outside of any surface water resources and

their associated buffer zones. Special mitigation measures will be needed given the state of the priority rivers identified on the study site, should this location be selected for the development of the proposed wind farms.

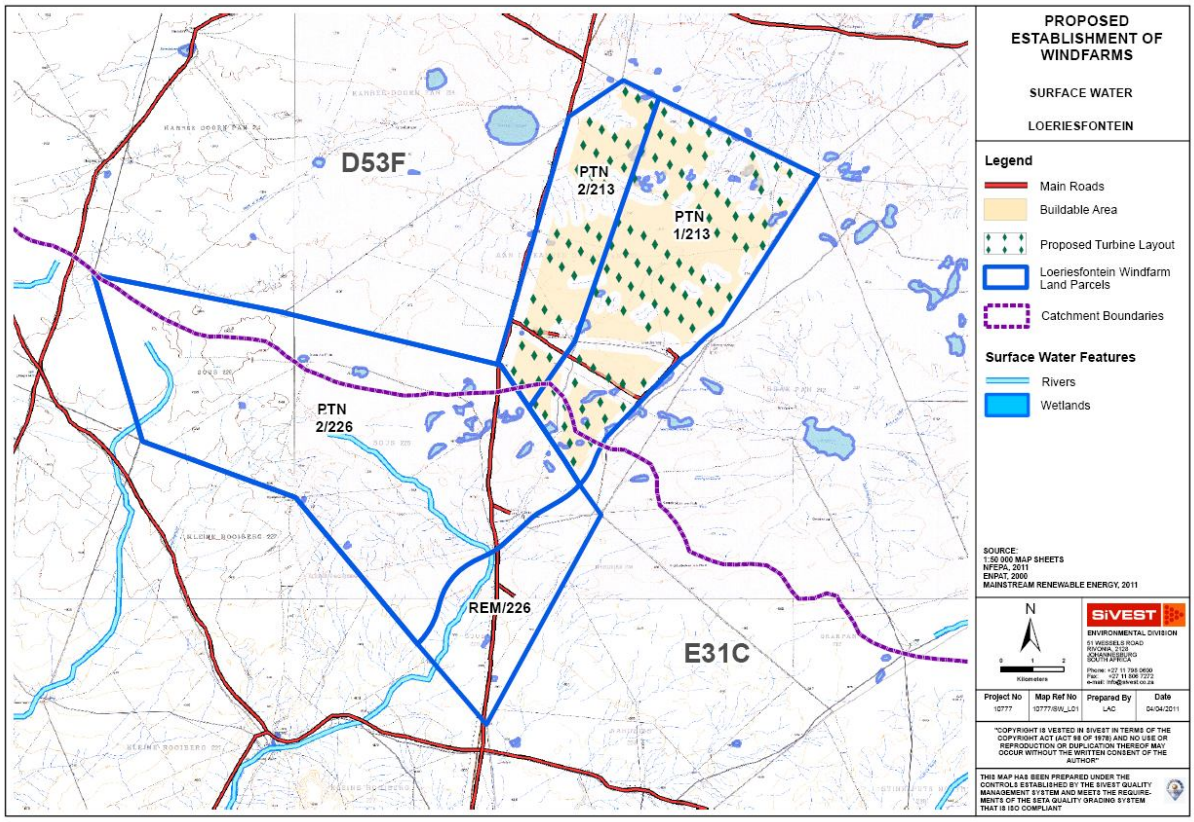

Figure 8: Surface water Features in Loeriesfontein

3.1.8 Heritage and Tourism

Based on database sources and experience in the region, the following heritage sites, features and objects are expected to occur in the proposed development area:

- Stone Age sites located near the foot of hills, with an increased likelihood if there are rock shelters in the vicinity.
- Houses and other structures older than 60 years;
- Farming infrastructure such as irrigation channels;
- Graves and cemeteries, both formal and informal.

3.1.9 Soils and Agricultural Potential

- Desktop Agricultural Assessment Result Summary

By taking all the site characteristics (climate, geology, land use, slope and soils) into account the agricultural potential for the majority of the study area is classified as being extremely low for crop production while moderately low for grazing. This classification is primarily due to climatic and soil depth limitations. According to the Agricultural GIS data the typical GDP / ha for the area is R150 which can be compared against the much larger financial benefit of the proposed development.

- Field Verified Agricultural Potential

According to the ENPAT agricultural dataset the study area is dominated by soils which are not suited for arable agriculture but which can still used as grazing land. These results were confirmed during the site visits, where the highly restrictive soil and climate characteristics contributed to an extremely low agricultural potential in terms of crop production. The majority of the site consists of vast grazing land which can be seen as a non-sensitive land use in terms of agricultural production when assessed within the context of the proposed development.

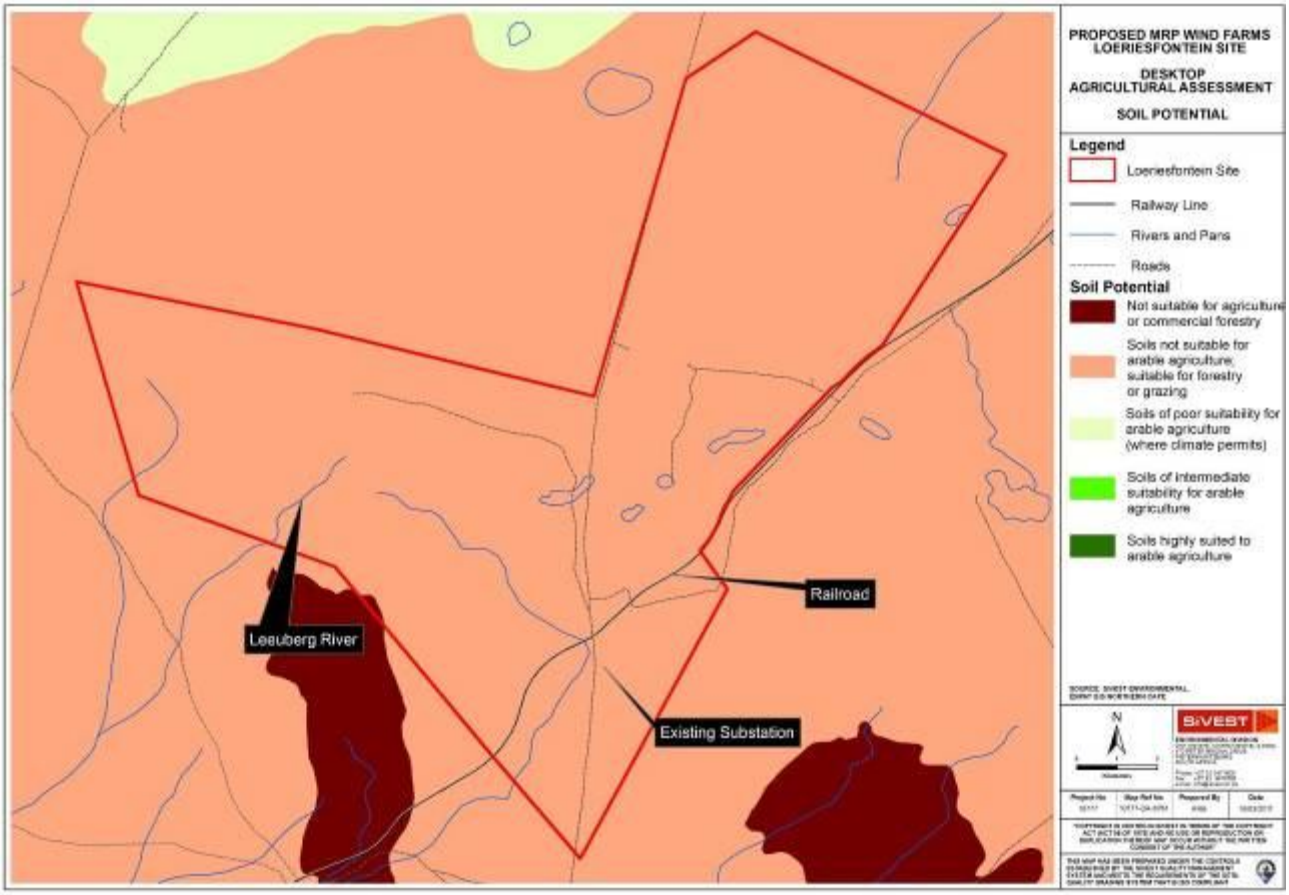

Figure 9: Soils and Agricultural potential in Loeriesfontein

3.1.10 Visual

Results show that the following will be impacted visually

- Visibility from farmhouses on the proposed site;
- Visibility from gravel farm roads and the railway line.

The study area is mostly uninhabited with a natural visual character. The flat terrain and short vegetation cover will offer no visual screening; however there are no main roads or towns in close enough proximity to be visually impacted by the proposed development. The wind farm is only expected to be visible from the railway line, gravel farm roads and isolated farmhouses.

The visual study undertaken for the Loeriesfontein site revealed that although the proposed wind farm is expected to be highly visible, there are no sensitive visual receptors present to experience the visual impact. The Loeriesfontein site is therefore considered most preferable from a visual perspective.

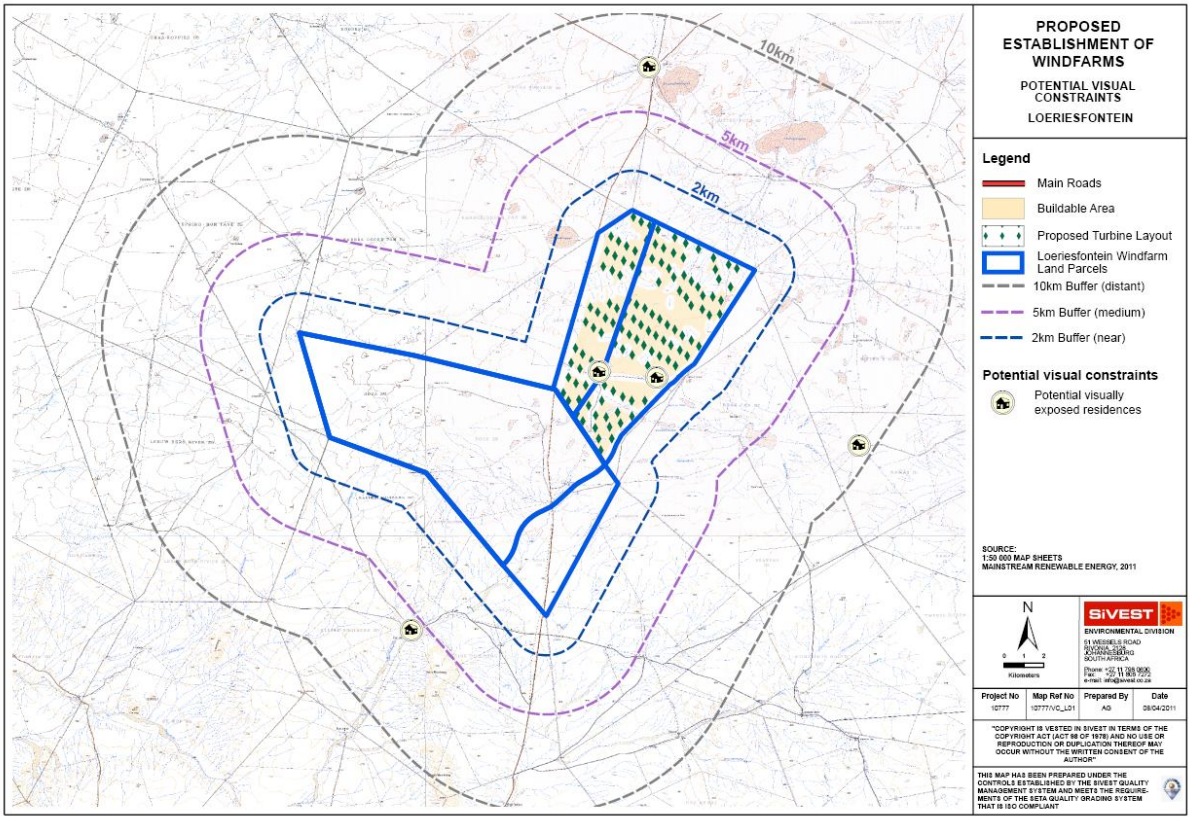

Figure 10: Potential Visual Constraints for the Loeriesfontein Site

3.2 Prieska Site

3.2.1 Social

The Prieska site is located well away from the town of Prieska i.e. approximately 50km. The land use is dominated by sheep grazing. The Prieska area depends heavily on water from the Orange River to sustain crop farming however the site is located well away from the river and hence the dominance of sheep farming.

Surrounding farmers are located well away from the proposed site however they are likely to visualize the infrastructure and be affected during construction. They will however not be directly affected. These landowners are also located far enough away from the site that noise from the turbines will not affect them.

The economic climate is characterized by a high level of poverty and lack of service delivery and it is likely that the construction team will need to be housed on the site due to a very likely lack of housing provision. The use of local labour is thus critical as an influx would result in negative social impacts on the town of Prieska.

Refer to section 4.2 for more information on the social environment according the IDP.

3.2.2 Flora

The Prieska site has three farm portions namely: RE/102, 1/118 and 3/118.

According to ENPAT, 2006, the land cover of the study area is predominantly shrubland/fynbos with a few pockets of thicket and bushland in farm portion 1/118.

3.2.3 Vegetation type

The Prieska study area falls under two distinct vegetation types; the Bushmanland Arid Grassland and Bushmanland Basin Shrubland (SANBI, 2006). Portion 1/118 entirely falls under the Bushmanland Arid Grassland where as RE/102 and 3/118 has a mixture of the two vegetation types.

The Bushmanland Arid Grassland is characterised by extensive to irregular plains on a slightly sloping plateau sparsely vegetated by grassland and dominated by white grasses (*Stipagrostis species*), whereas the Bushmanland Basin Shrubland is characterised by slightly irregular plains with dwarf shrubland dominated by a mixture of low sturdy and spiny shrubs, white grasses and other species of *Gazania* and *Leysera* which are observed after high rainfall (Mucina and Rutherford, 2006).
The conservation status of the study area according to the SANBI Vegmap, 2006 is “Least Threatened”.

The site is very arid with presence of endemic species with an exception of exotic prickly pears. Spring flowers are a common feature occurring when the area has received a good amount of rains. The area is grazed by sheep and is therefore not pristine.

The endemic species found in the Bushmanland Arid Grassland are succulent shrubs (*Dinteranthus pole-evansii, Larrleachia dinteri, L. marlothii and Ruschia kenhardetensis*) and herbs (*Lotononis olihocephala and Nemesia maxi.*)

The endemic species found in the Bushmanland Basin Shrubland are herbs (*Cromidon minutum,* and Geophytic herbs (*Ornithogalum bicornutum and ornithogalum ovatum subspecies oliverorum.*).

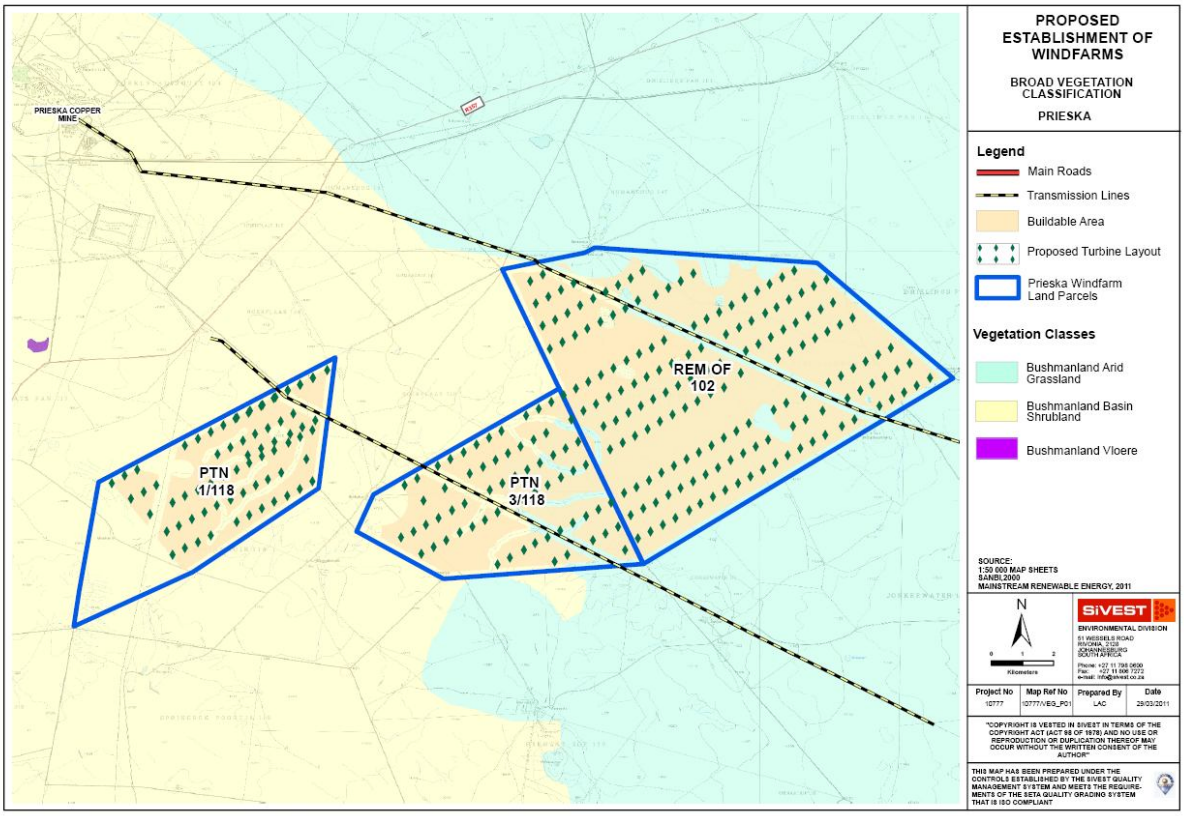

Figure 11: Vegetation Classification for the Prieska Site

3.2.4 Fauna

- Invertebrates

There is likely to be a high diversity of invertebrates present associated with the flowering plants (when present). These flowering plants require pollinators, hence the presence of an abundance of insects. The presence of insects is likely to result in the increased presence of scorpions and spiders which feed on these species. Grazing will reduce the number of invertebrates however the grazing capacity is low in the study area and will thus not have a significant impact on the invertebrate populations.

These species are relatively mobile and will be able to move away into the surrounding habitat during construction. The remaining vegetation will be available for re-colonisation during operation.

- Mammals (excluding bats)

The arid nature of the study area limits the number of mammal species. Farming activities have resulted in the absence of larger mammal species. Mammals may be dominated by small antelope and small mammals such as rodents and lagamorphs (scrub hares). These are likely to feed on the invertebrate species present.

Suitable habitat surrounding the site is present for these species to disperse during construction and re-colonise during operation.

- Reptiles and amphibians

Reptiles adapt well to the arid environment and thus a wide variety is anticipated to be present. The area is likely to be too dry for most amphibian species.

3.2.5 Bats

Only one species of conservation status is of concern:

- *Miniopterus natalensis* (Natal long-fingered bat).
  - Low probability of occurrence;
  - Near Threatened status;
  - Roosts gregariously in caves, no known caves close to the study site.

Overall, no major surface rocks or rock outcrops are visible, rendering the probability for bat roosts on this site as very low. From a vegetation point of view, the natural vegetation of the site does not offer any roosting space. Lastly, the insect numbers are predicted to be very low on this site, and foraging will probably mostly be in the stream beds.

The Prieska site does not display any of the three factors of possible roosting space, surface water and probability of insects strongly, with roosting space very limited and some foraging space in the stream beds.

3.2.6 Avifauna

The site is not an important Bird Area. No permanent / open water sources of significance are in close proximity to the site (that attracts important birds). Orange River is well away from the site. Red Data species may be present, however are not likely to be common in the area.

3.2.7 Geotechnical

Aeolian sand deposits of the Kalahari Group occur in certain areas of the site. These soils are known to have a collapsible soil fabric (Brink, 1985). A collapsible soil fabric is typically associated with sandy soils that have an open-voided grain structure with the individual grains being separated by a bridging material.

When the soil is exposed to increased moisture content under load, the bridging material loses strength and rapid settlement may take place. Specialised foundation preparation or the use of deep foundation methods may be required where collapsible soils are encountered. Further geotechnical investigations must focus on identifying and quantifying the collapse potential of the soils.

Pedogenic calcrete is shown to occur within the partially consolidated Tertiary deposits located in the north eastern section of the eastern site. Calcretes are pedogenic soils which have been cemented or replaced by carbonates. Calcrete may be a problematic founding material due to the variable nature of the cementation. Well cemented, hard calcrete may be underlain by loose, weakly or non-cemented soils. Specialised investigation methods such as rotary core drilling may be required to investigate the founding conditions for sites underlain by calcrete. Deep foundations or specialised foundation preparation may be required in areas underlain by calcrete.

The alluvial deposits shown to occur along the larger drainage lines are likely to consist of loose, unconsolidated sands and gravels. These materials will provide a poor founding medium for wind turbines.

Adequate founding conditions for the construction of shallow foundations are probable in areas underlain by Dwyka Formation tillite and the various rock units of the Namaqua-Natal Metamorphic Province. However, a degree of variability is expected in the ground conditions due to the highly variable rock types.

Excavation conditions will be dependent on the rock type and degree of weathering and the presence of calcrete. It is expected that intermediate to hard excavation conditions will be encountered at relatively shallow depth over a large proportion of the site.

3.2.8 Surface Water

According to the National Freshwater Priority Areas database (2011), no main priority river or stream systems are located on the study site. However, there are several drainage lines that traverse the study site which are apparent from the satellite imagery. With respect to the proposed development, the location of the wind turbines may not be placed within any of these systems. Additionally, a 100m buffer zone will need to be applied to the identified drainage systems affecting the developable area somewhat.

In terms of wetlands, several wetlands are identified on the study site according to the NFEPA (2011) database. A total of seven wetland systems (three depression wetlands and four hillslope seep wetlands) can be found. The size and number of these wetlands relative to the size of the proposed study sites is small and few respectively. A buffer zone of 50metres is to be applied to each wetland system.

Overall, it is anticipated that surface water resources will not be greatly affected by the presence of wind turbines provided that the site specific location of the wind turbines be located outside of any surface water resources and their associated buffer zones. No fatal flaws are identified for the Prieska study site with respect to surface water features.

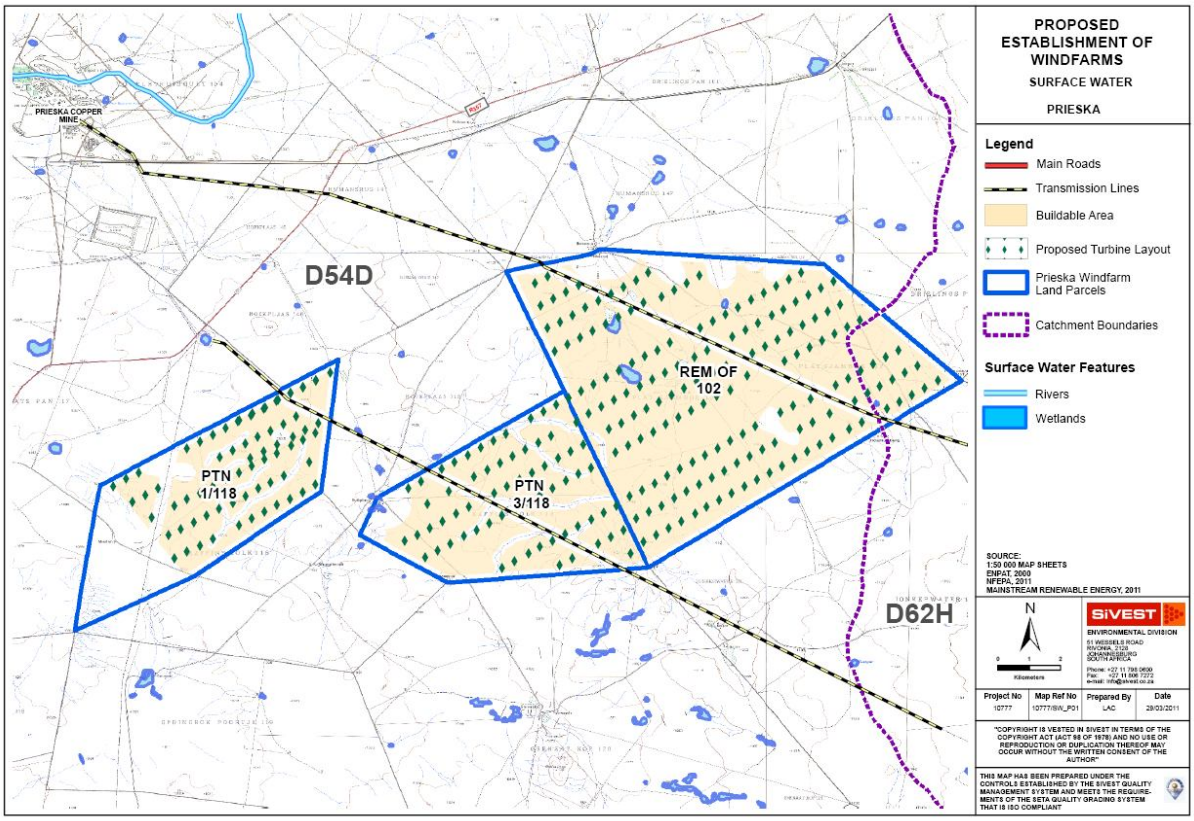

Figure 12: Surface water features for the Prieska Site

3.2.9 Heritage and Tourism

The following heritage sites, features and objects are expected to occur in the proposed development area:

- Stone Age sites located near the foot of hills, with an increased likelihood if there are rock shelters in the vicinity.
- Houses and other structures older than 60 years;
- Graves and cemeteries, both formal and informal;
- Mining heritage.

During the field visit, graves were noted in the north of portion RE/102 (Figure 13). More in-depth heritage studies will be required for this study site.

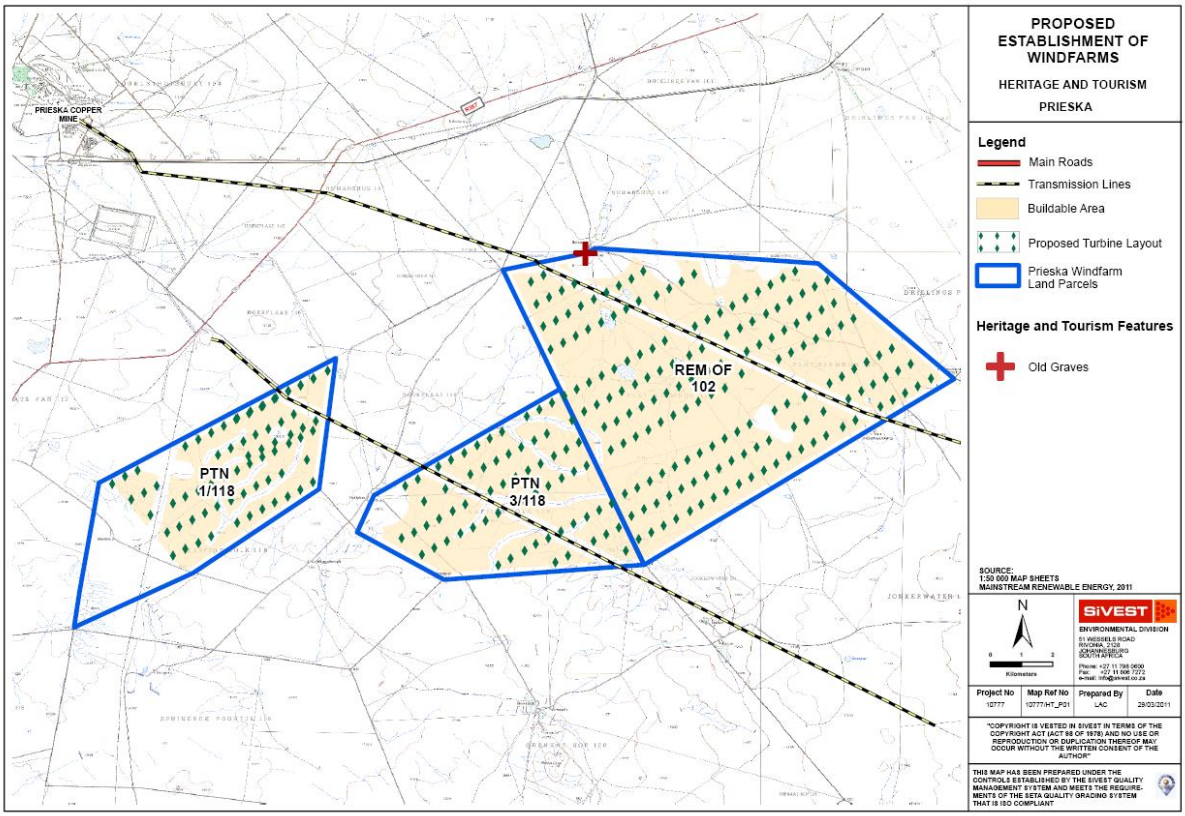

Figure 13. Heritage features for the Prieska Site

3.2.10 Soils and Agricultural Potential

- Desktop Agricultural Assessment Result Summary

By taking all the site characteristics (climate, geology, land use, slope and soils) into account the agricultural potential for the majority of the study area is classified as being extremely low for crop production while moderately low for grazing. This poor agricultural potential rating is primarily due to climatic and soil depth limitations.

- Field Verified Agricultural Potential

According to the ENPAT agricultural dataset the study area is dominated by soils which are not suited for arable agriculture but which can still used as grazing land. These results were confirmed during the site visits where the restrictive soil (shallow, carbonate horizons) and climate characteristics contributed to an extremely low agricultural potential in terms of crop production. The majority of the site consists of vast grazing land which can be seen as a non-sensitive land use in terms of agricultural production when assessed within the context of the proposed development.

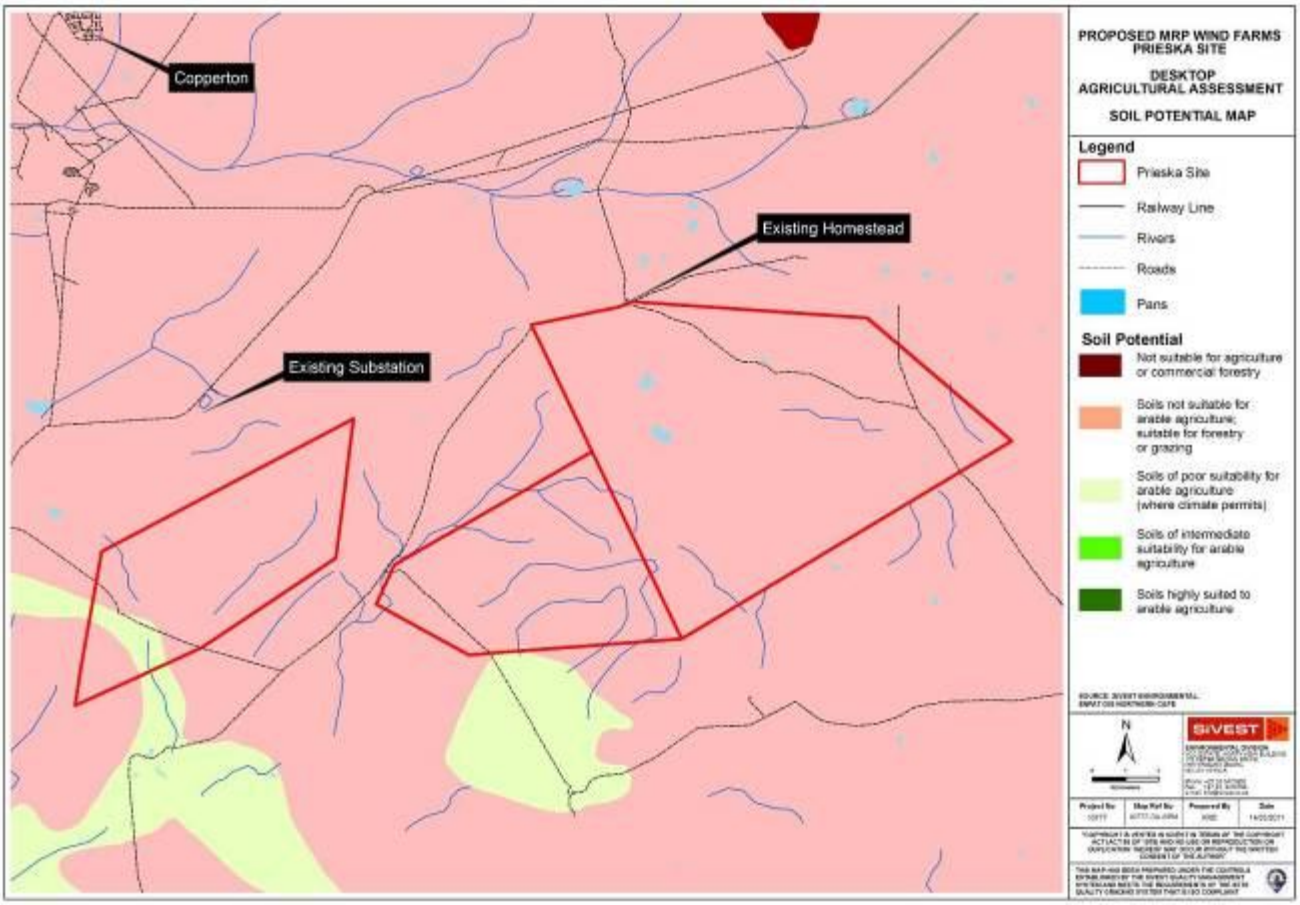

Figure 14: Soil and Agricultural potential for the Prieska Site

3.2.11 Visual

Results from the visual impact assessment study show:

- Day and night-time visual exposure of the proposed wind farm to people travelling along the R375 between Prieska and Vanwyksvlei and on the R386 between Prieska and Carnarvon;
- Day and night-time visual exposure of the proposed wind farm to people residing in farmhouses on the proposed site and in the surrounding area;
- Visibility from gravel farm access roads.
- Potential impact of shadow flicker on people residing within close proximity to proposed wind turbines;

The study area has a rural and pastoral visual character with limited human settlement. The flat terrain and short vegetation cover will result in the proposed wind farm being highly visible for extensive distances. The wind farm will be visible to people travelling along the R375 and R386 as well as from surrounding farm residences. There are no towns or built up areas in close enough proximity to be visually impacted by the proposed development.

The visual study undertaken for the Prieska site revealed that although the proposed wind farm is expected to be highly visible, there are no potentially sensitive visual receptors present to experience the visual impact. The Prieska site is therefore considered preferable from a visual perspective.

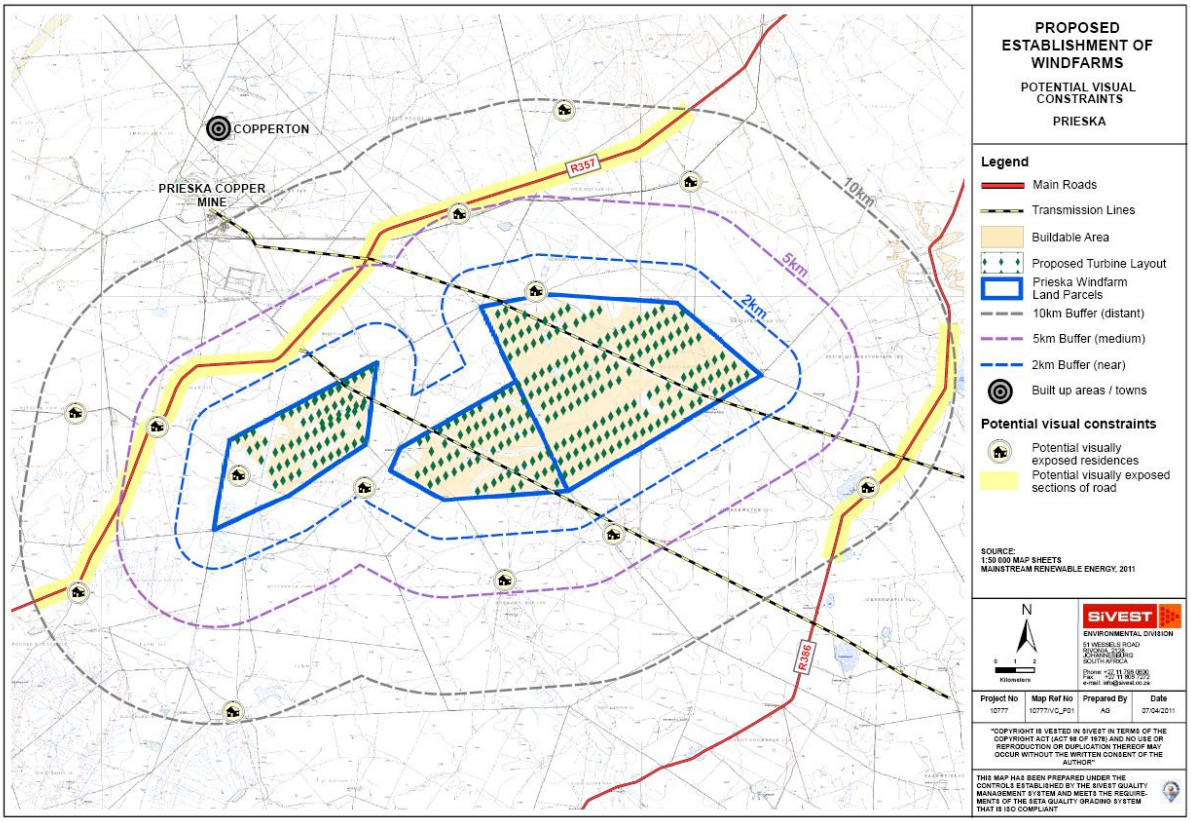

Figure 15: Potential Visual Constraints for the Prieska Site

3.3 Noupoort Site

3.3.1 Social

The Noupoort site is located in close proximity to the town of Noupoort however the topography of the area results in the property being well shielded. Cattle farming dominate the activities on the farms with agricultural fields which are used for winter fodder. No one stays permanently on the property and a caretaker oversees the farm during the week.

The proposed site will not directly affect surrounding landowners however they will be affected during construction when infrastructure etc is brought onto site. These landowners are also located far enough away from the site that noise from the turbines will not affect them.

The economic climate is characterized by a high level of poverty and lack of service delivery and it is likely that the construction team will need to be housed on the site due to a very likely lack of housing provision within the town of Noupoort. The use of local labour is thus critical as an influx would result in negative social impacts on the town of Noupoort.

3.3.2 Flora

According to ENPAT, 2006, the land cover of study area is predominantly grassland and shrubland /fynbos in farm portions 21/182 and RE/168. The Noupoort site has four farm portions in total, namely: RE/168, 1/181, 21/182 and 3/178.

The Noupoort study area falls under three vegetation types; the Tarkastad Montane Shrubland, Eastern Upper Karoo and Karoo Escarpment Grassland (SANBI, 2006).

The Eastern Upper Karoo is characterised by flat and gently sloping plains dominated by dwarf microphyllus shrubs with white grasses of the genera *Aristida* and *Eragrostis* which become prominent after summer rains. The Karoo Escarpment Grassland is characterised by mountain summits usually dominated by *Merxuellera disticha*. The Tarkastad Montane Shrubland is characterised by high surface rock cover consisting of large, round boulders. The vegetation is low with white grasses and dwarf shrubs (Mucina and Rutherford, 2006).

The conservation status of the study area according to the SANBI Vegmap, 2006 is “Least Threatened”.

The endemic species found in the site according to the vegetation types are listed below

- Eastern Upper Karoo; Succculent shrubs (Chasmatophyllum rouxii, Hertia cluytiifolia, Rabiea albinota, salsola tetrandra). Tall shrubs (Phymaspermum scoparium) and Low Shrubs: (Aspalathus acicularis)
- Karoo Escarpment Grassland; Graminoids (Pentaschistis cirrhulosa, P microphylla) Low shrubs (Helichrysm sessile, Pentzia cooperi) and Succulent Shrub (Delosperma congestum), Succulent herb (Duvalia modesta).

- Tarkastad Montane Shrubland; Small tree (Encephalartos friderici-guilielmi) and Low shrubs (Eriocephalus africanus, Senecio acutifolius).

Cattle farming takes place on the site which results in transformation however not on a large scale. Agricultural fields are present with some alien invasive species present. Due to the mountainous nature of the study area, several vegetation types are present. The good summer rains have resulted in the emergence of several uncommon species.

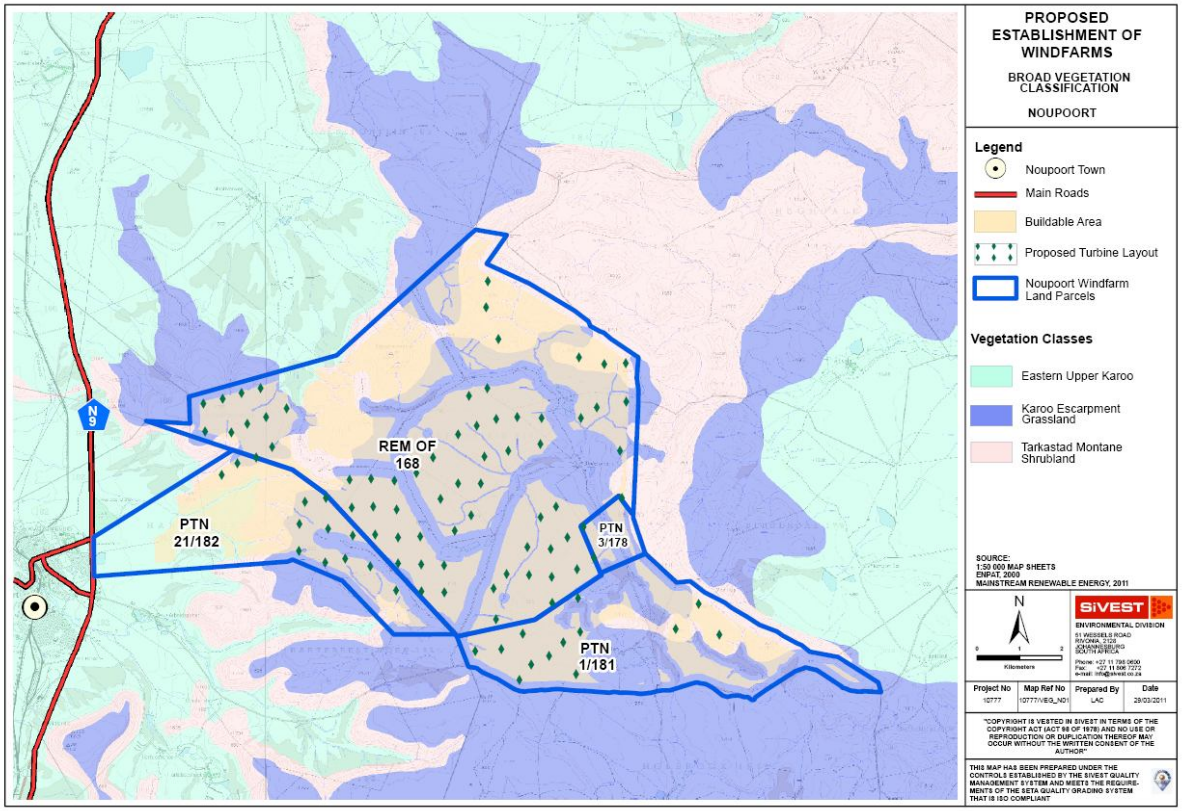

Figure 16: Vegetation Classification for the Noupoort Site

3.3.3 Fauna

- Invertebrates

There is likely to be a high diversity of invertebrates present given the diversity of vegetation present. The different microhabitats present on the site given the diverse topography will result in several different genera of invertebrates.

Suitable surrounding habitat is present for invertebrate species to move into during construction.

- Mammals (excluding bats)

The site is likely to have a good mammalian population. Several antelope species have been reportedly seen by the farm land owners. Smaller mammals like the ground squirrels were noted on site. However, larger mammal species are presumably absent due to anthropogenic activities.

The farm contains various different habitats such as riverine habitat, mountainous habitat and grassy plains. The majority of these habitats will be left untouched by the proposed development and hence the species inhabiting them unaffected. The farm and surrounding areas provides enough habitat for mammal species to move away during construction and re-colonise during operation.

- Reptiles and amphibians

There are likely to be a large variety of these species present on site. The presence of mountain streams is an indication of amphibian species in the study area.

Reptile species are likely to dominate the rocky areas as this is their preferable habitat. Suitable habitat is present for reptiles to move away during construction.

3.3.4 Bats

Three identified bat species are of concern;

- *Miniopterus natalensis* (Natal long-fingered bat)
  - Medium probability of occurrence;
  - Near Threatened status;
  - Roosts gregariously in caves, no known caves close to the study site although mountainous terrain may have caves.
- *Cistugo lesueuri (*Lesueur's Wing-gland bat)
  - Very low probability of occurrence;
  - Vulnerable status;
  - Widespread in Lesotho. Prefers high montane grassland with exposed rock and water in form of marshes, dams, streams. Endemic to SA and Lesotho.
- *Rhinolophus denti* (Dent's horseshoe bat)
  - High probability of occurrence;
  - Data deficient;
  - Caves, hollows, mines, culverts. Some rock hollows offered by mountains, well in distribution.

This central area of the site is encircled by mountainous terrain capable of offering suitable bat roosts. The streams in the central area can offer drinking water as well as elevated insect numbers for foraging of insectivorous bats. From a vegetation point of view the natural vegetation of the site does not offer much roosting space.

The Noupoort site displays the two factors of possible roosting space and surface water strongly, and probability of insects are probably not more likely than the Lady Grey site but still higher than the Prieska and Loeriesfontein sites. It is suggested that it is likely to have a higher bat activity than the Prieska and Loeriesfontein sites, and possibly higher or equal to the Lady Grey site.

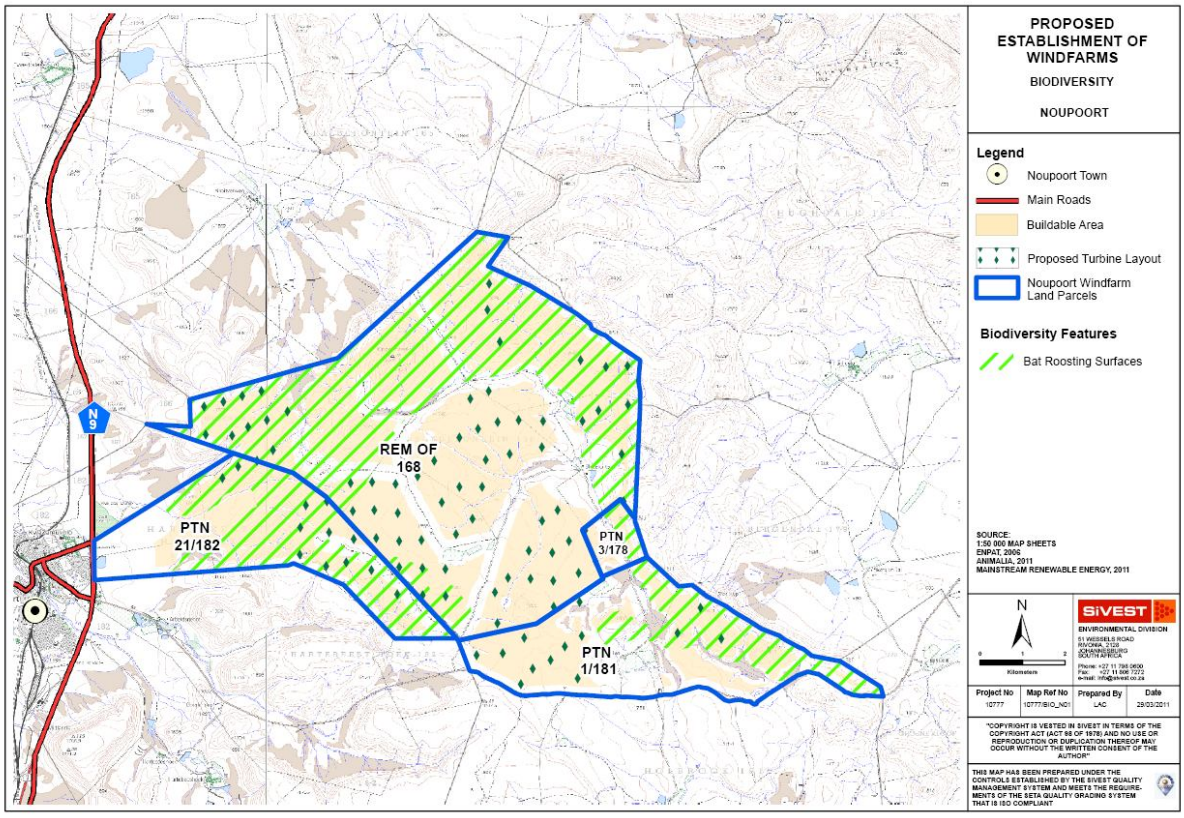

Figure 17: Biodiversity showing the bat roosting surfaces for the Noupoort site

3.3.5 Avifauna

The site is not an important Bird Area. Lack of permanent / open water sources does not attract birds to the site (attracts birds). Red Data species are likely to be present however not likely to be common in the area. Blue Cranes have been seen on the site which will need to be taken into consideration but are not common.

3.3.6 Geotechnical

The mountainous topography of this site will limit the areas that are feasible for development. The construction of turbines and other infrastructure will be problematic where slope gradients exceed approximately 12 degrees. The steep and variable topography will increase the cost of constructing access roads and associated infrastructure. Measures to minimise soil erosion will be required.

Talus deposits will occur over the lower sections of steep slopes. Talus deposits are, by nature, marginally stable and excavations into talus slopes may lead to slope instability problems. These soils may, depending on the nature and thickness of the talus, render some areas unsuitable for development. Delineation of these sections of the site will require further field investigations. However, it is probable that the majority of talus material will be limited to areas with slope gradients of greater than 8 degrees and will be excluded from development.
The alluvial deposits shown to occur along the larger drainage lines are likely to consist of loose, unconsolidated silts, sands and gravels. These materials will provide a poor founding medium for wind turbines. However, the buffer zone around rivers will limit the occurrence of alluvial soils at the actual turbine positions.

Weathered sandstone and mudstone rock is expected to be encountered at shallow depth over the major portion of the site. These materials should provide an adequate founding medium for wind turbines and it is expected that the structures may be founded at shallow depth.

A previous geotechnical investigation undertaken in Noupoort town conducted by Jeffares & Green indicated that the presence of pedogenic calcrete at shallow depth in an area underlain by mudstone of the Adelaide Formation. Intermediate to hard excavation conditions will be encountered at very shallow depth in many areas. Surface rock outcrop will create difficult working conditions and hamper vehicle access. Boulder excavation will be required where dolerite corestone boulders are encountered.

3.3.7 Surface Water

No priority river systems occur on the Noupoort study site according to the NFEPA (2011) database. The Noupoort River runs to the west of the proposed development site which will not affect the development. However, satellite imagery reveals that there are many drainage lines associated with the site. A minimum buffer zone of 100metres will need to be applied for each of the identified river and drainage systems. Few wetlands of relatively minimal extent in proportion to the study area exist on site in terms of the NFEPA (2011) database. A total of 14 wetlands can be evidenced however, four of which are flat\pan wetlands and nine of which are classified as hillslope seep wetlands. These wetlands will require a minimum buffer of 50metres.

Ultimately, the general widespread occurrence of drainage systems and wetlands will affect the developable area of the wind farms, but do not constitute a fatal flaw for the study site provided that the site specific location of the wind turbines are situated outside of any surface water resources and their associated buffer zones.

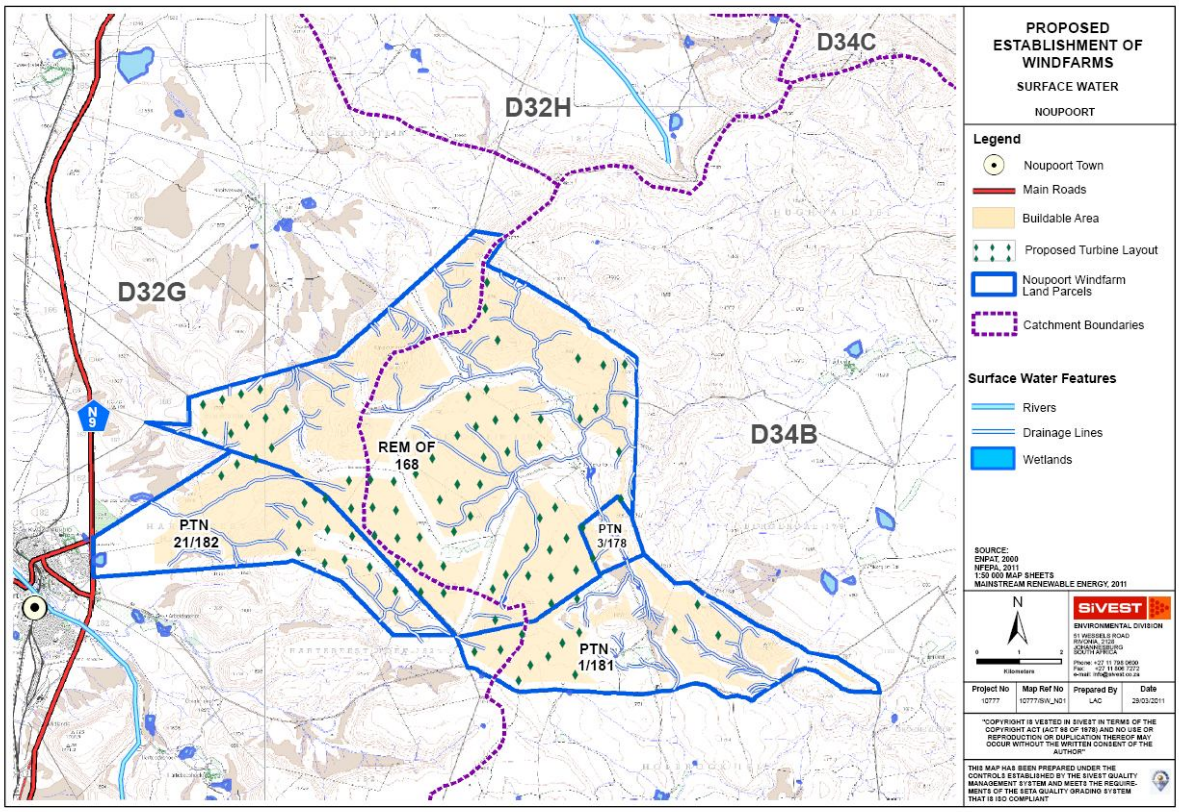

Figure 18: Surface Water features for the Noupoort site

3.3.8 Heritage and Tourism

The following heritage sites, features and objects are expected to occur in the proposed development area:

- Stone Age sites located near the foot of hills, with an increased likelihood if there are rock shelters in the vicinity;
- Houses and other structures older than 60 years;
- Graves and cemeteries, both formal and informal

Rock Art and old structures were identified on the site during the site visit. It is proposed that the rock art and old structures be studied by a qualified archaeologist and registered with the appropriate government departments.

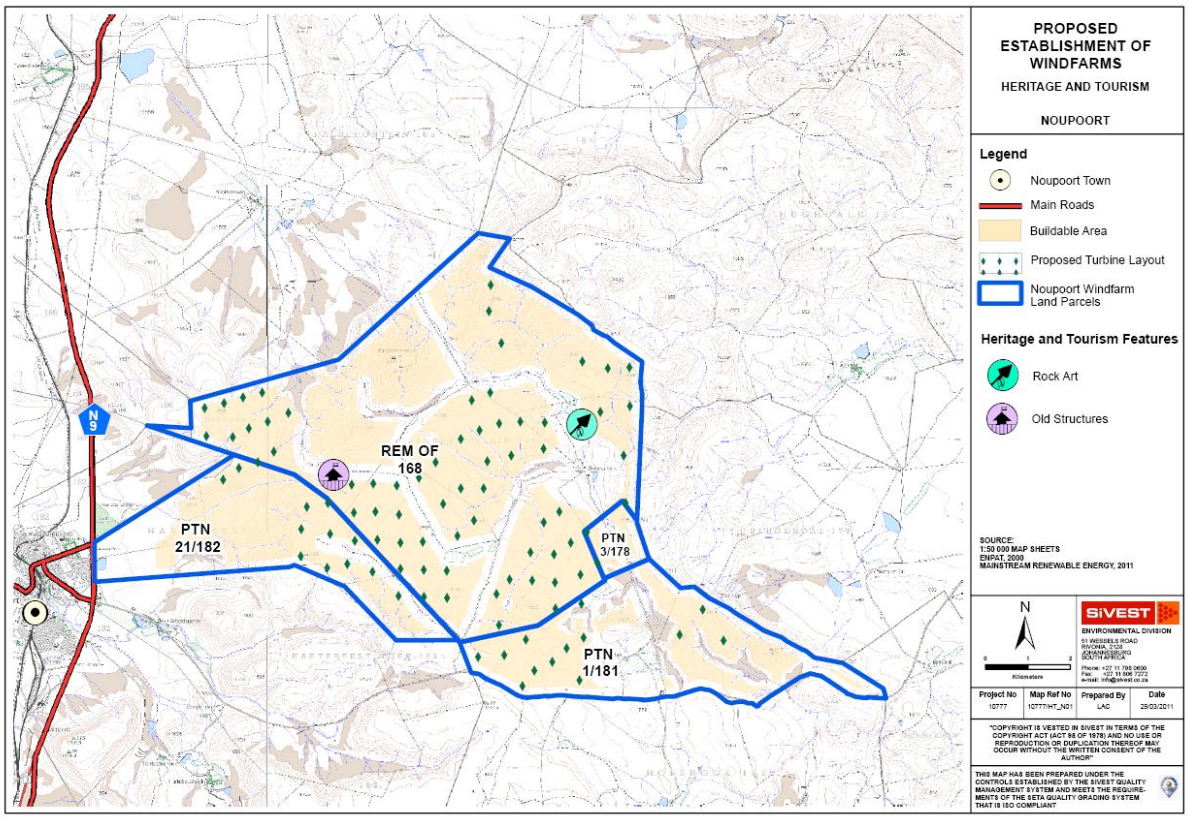

Figure 19: Heritage features for the Noupoort site

3.3.9 Soils and Agricultural Potential

- Desktop Agricultural Assessment Result Summary

By taking all the site characteristics (climate, geology, land use, slope and soils) into account the agricultural potential for the majority of the study area is classified as being low for crop production while moderate to moderately low for grazing. This classification is primarily due to climatic limitations and marginal soil and veld characteristics.

- Field Verified Agricultural Potential

According to the ENPAT agricultural dataset the study area is dominated by soils which are not suited for arable agriculture but which can still used as grazing land. These results were confirmed during the site visits where the restrictive soil (shallow, rocky) and climate characteristics (low rainfall and frost) contributed to an extremely low agricultural potential in terms of crop production. The majority of the site consists of vast grazing land which can be seen as a non-sensitive land use in terms of agricultural production when assessed within the context of the proposed development. Cultivation, in terms of pasture, is possible in valley bottoms were the soils tended to be deeper with higher soil moisture contents due to topographic position.

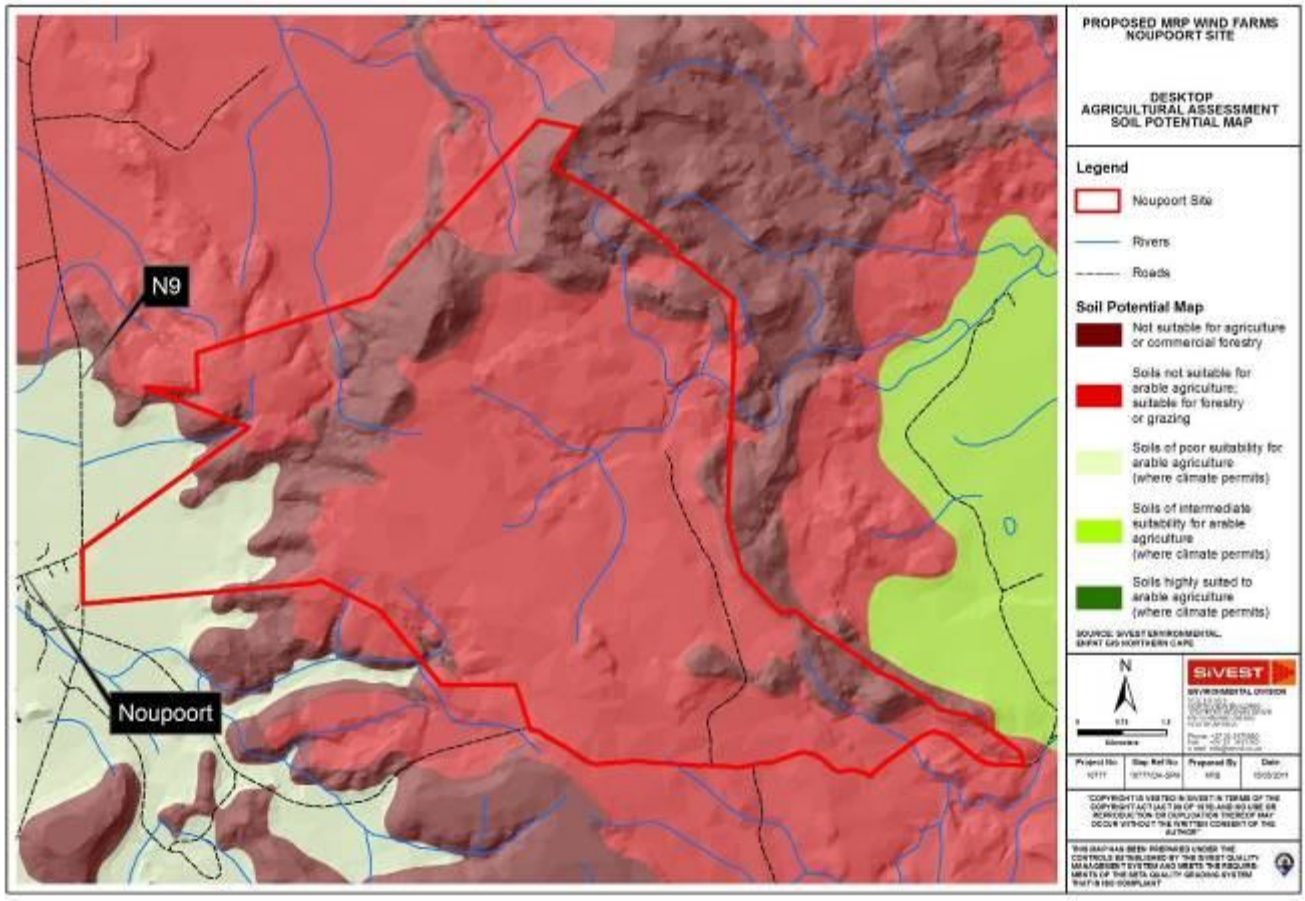

Figure 20: Soils and Agricultural Potential for the Noupoort Site

3.3.10 Visual

Results from the study indicate;

- Potential day and night-time visual exposure of portions of the proposed wind farm (western part of proposed site) to people travelling along the N9 between Colesburg and Middelburg;
- Potential visibility of portions of the proposed wind farm (western part of proposed site) from Noupoort;
- Potential visibility from surrounding farmhouses and gravel farm access roads.

The study area has a natural and pastoral visual character with limited human settlement present. The short vegetation cover will offer limited visual screening; however the hilly and mountainous topography will restrict views toward the proposed site. Potential visual receptors include people travelling along the N9 and the town of Noupoort.

The visual study undertaken for the Noupoort site revealed that although the mountainous terrain will restrict most views toward the proposed wind farm, wind turbines located on the western part of the site are likely to be visible from Noupoort and sections of the N9. The Noupoort site is therefore considered preferable from a visual perspective; however care should be taken to avoid placing turbines in areas of high visibility.

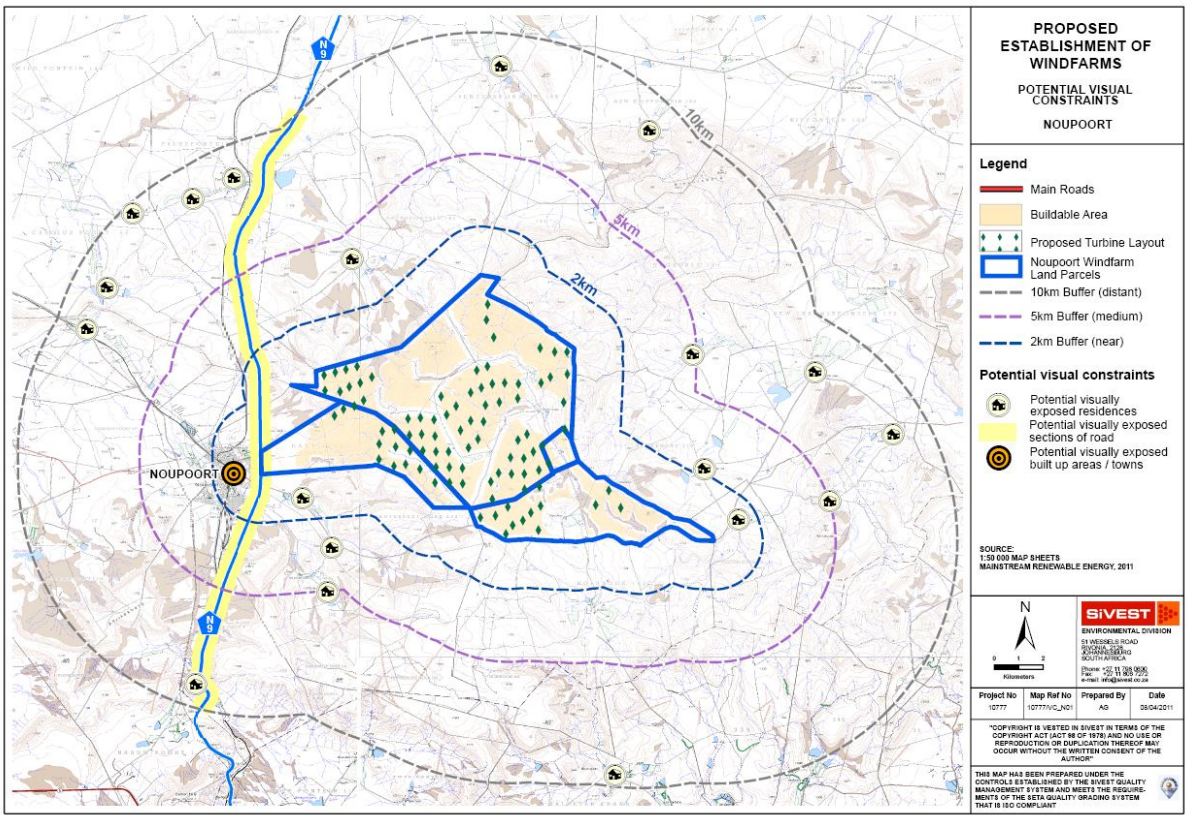

Figure 21: Potential visual Constraints for the Noupoort Site

3.4 Lady Grey Site

3.4.1 Social

The Lady Grey site is located approximately halfway between Lady Grey and Barkly East. Cattle and sheep farming are taking place on the property. Fields are planted for winter fodder. Once permanent dwelling with a small farm worker compliment is present on the site.

The proposed site will not directly affect surrounding landowners and they are not likely to be affected during construction as access will be off the main road to Barkly East. These landowners are also located far enough away from the site that noise from the turbines will not affect them.

The economic climate is characterized by a fast population growth rate. It is critical that local labour is utilized in order to not worsen the pressure already present in terms of population numbers.

3.4.2 Flora

According to ENPAT, 2006, the land cover of study area is predominantly grassland with pockets of commercially cultivated land and bare rock soil with the latter seen in portion 1/139.

The Lady Grey study area falls under three vegetation types; the Lesotho Highland Basalt Grassland and Southern Drakensberg Highland Grassland (SANBI, 2006).

The Southern Drakensberg Highland Grassland is characterised by steeply sloping mountainous area supporting dense tussock grassland on the slopes dominating by various *Festuca species* and a dwarf shrubland on exposed rocky. The Lesotho Highland Basalt Grassland is characterised by many plateaus and high ridges of mountains separated by deep valleys (Mucina and Rutherford, 2006).

The conservation status of the study area according to the SANBI Vegmap, 2006 is “Least Threatened”.

Some of the endemic species found in the site according to the vegetation types are listed below:

- Lesotho Highland Basalt Grassland; Herbs (*Argyrolobium summomontanum, Conium fontanum var.alticola, Cynoglossum alticola*), Geophytic Herbs (*Dryopteris dracomontana, Gladiolus saundersii*), Parasitic herbs (*Harveya pulchra*), Low shrubs (*Clutia alpine, macowania pulvinaris)* and succulent shrubs (*Aloe polyphylla, Delosperma aliwalense*)
- Southern Drakensberg Highland Grassland; Graminoids (*Festuca vulpioides*) Low shrubs (*Erica spp and Lotononis jacottetii*) and Geophytic Herbs (*Aspidonepsis cognate, Disa nivea, Trachyandra smalliana*), Succulent herb (*Duvalia modesta*).

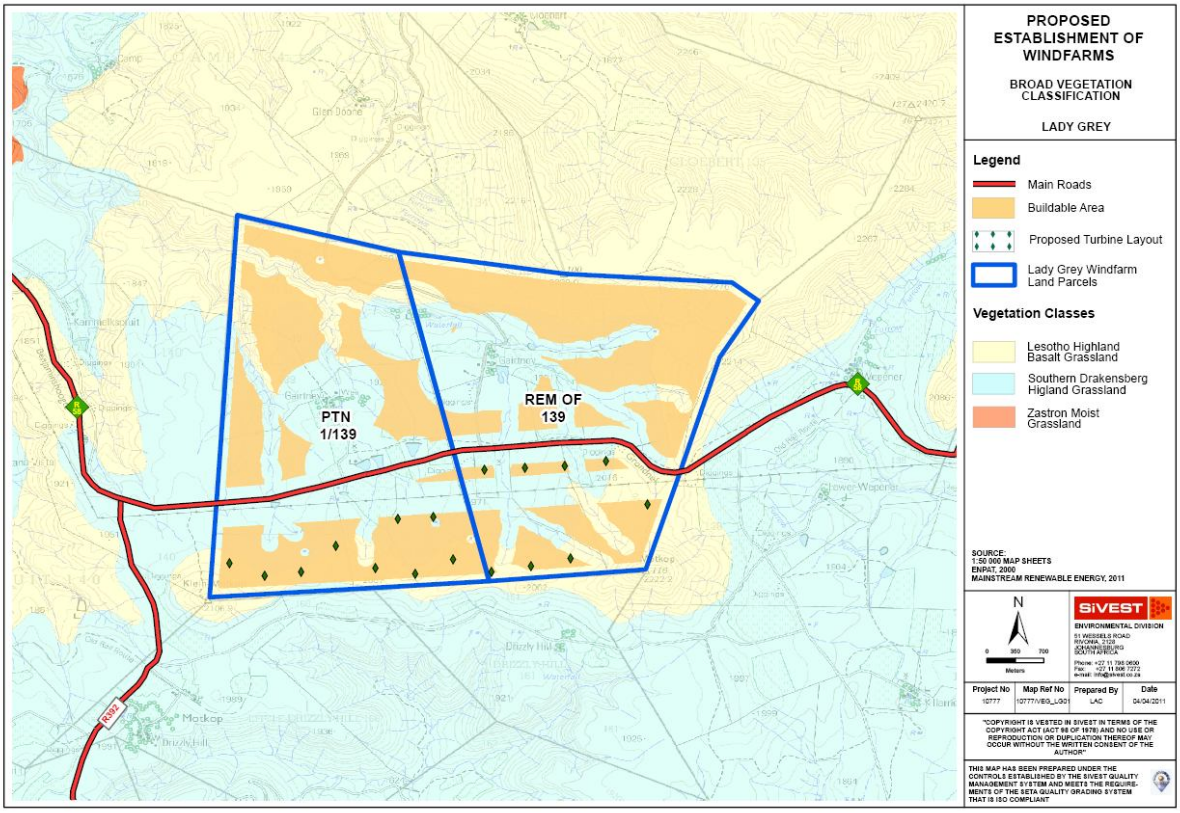

Figure 22: Vegetation Classification for the Lady Grey Site

3.4.3 Fauna

- Invertebrates

There is likely to be a high diversity of invertebrates present that are associated with the grasslands and forb species.

- Mammals (excluding bats)

The site is likely to have a good mammal population. Antelope species were noted on site. Cattle farming has resulted in transformed of the grasslands to a certain extent however the site remains good habitat for small mammals.

- Reptiles and amphibians

There are likely to be a large variety of these species present on site. The presence of mountain streams is an indication of amphibian species in the study area.

3.4.4 Bats

The specialist results show these two species of concern;

- *Miniopterus natalensis* (Natal long-fingered bat)
  - Medium probability of occurrence;
  - Near Threatened status;
  - Roosts gregariously in caves, no known caves close to the study site although mountainous terrain may have caves.
- *Cistugo lesueuri* (Lesueur's Wing-gland bat)
  - Very high probability of occurrence;
  - Vulnerable status;
  - Widespread in Lesotho. Prefers high Montane grassland with exposed rock and water in form of marshes, dams, streams. Endemic to SA and Lesotho.

Numerous small streams drain from the south towards the larger stream in the north of the site, at the foot of the mountain slope marking the northern boundary. These streams are evenly spread throughout the site and consequently make a lot of surface water available to bat fauna. Additionally the large mountain slope on the northern side of the site can offer multiple bat roosting space together with the outcrop of surface rock in the north western corner. From a vegetation point of view, the natural vegetation of the site does not offer much roosting space, but the ploughed lands may be irrigated and tend to attract more insects, which in turn can offer suitable foraging space for bats. The farm buildings on the site can also offer suitable roosting space.

The Lady Grey site displays the three factors of possible roosting space, surface water and probability of insects (due to agricultural practices) strongly, suggesting that it is likely to have a higher bat activity than the Prieska and Loeriesfontein sites, and possibly higher or equal to the Noupoort site. Importantly, *Cistugo lesueuri* has a very high probability of occurring on the site and is listed as Vulnerable. From a desktop bat sensitivity point of view The Lady Grey site is not recommended as one of the two best sites for the wind farms.

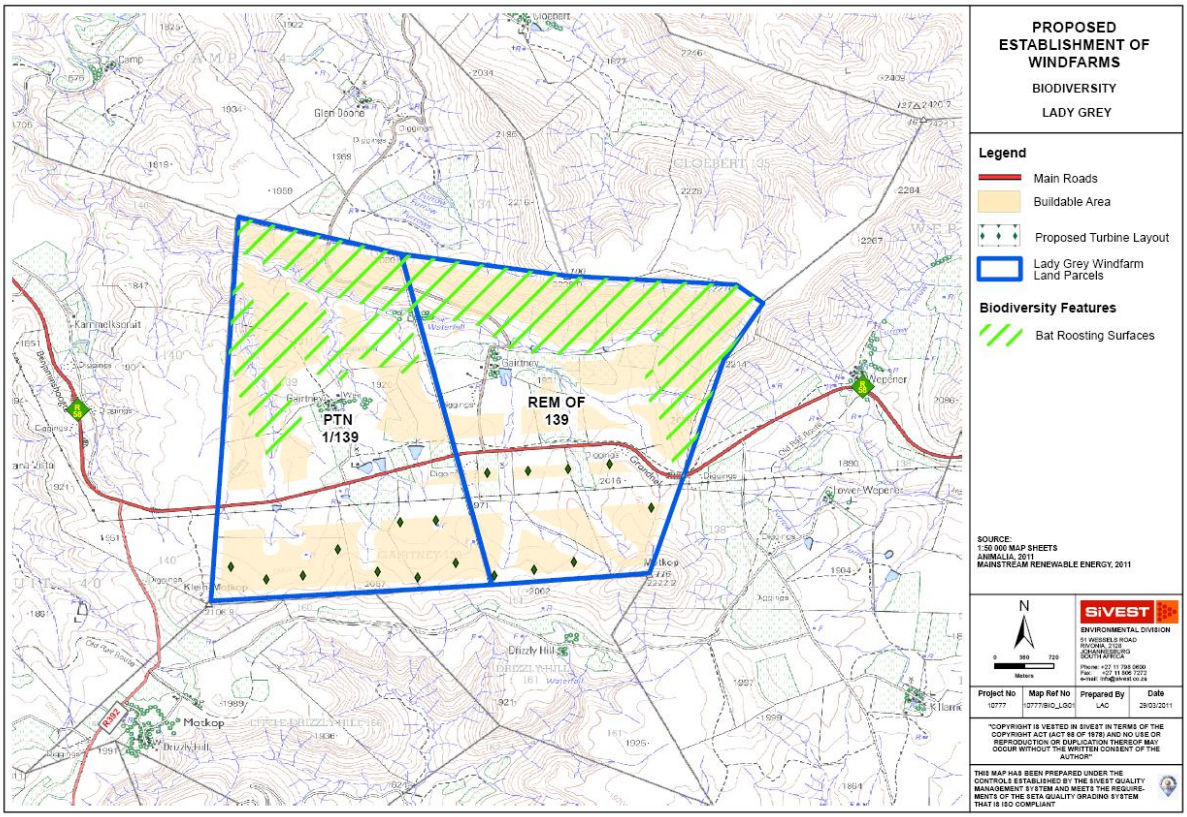

Figure 23: Biodiversity showing bat roosting surfaces in for the Lady Grey Site

3.4.5 Avifauna

The study area is not located in an Important Bird Area and there are no major water bodies located close to the site. The study area is however located in very close proximity to an established breeding colony of Cape Vultures (*Gyps coprotheres*). This endemic species is one of the most threatened birds of prey in Southern Africa with only a few breeding colony's remaining (Boshoff et al in press). The species is listed as Vulnerable in the South African Red Data Book (Barnes 2000) and as Vulnerable globally (IUCN 2010). The transformation of land use from free ranging herds of wild ungulates to stock farming has resulted in a drastic decline in the species. This mainly being due to the loss of large carcasses on which this species depends (Birdlife South Africa).

In addition to the loss of food sources, Cape Vultures are extremely vulnerable to collisions and electrocutions associated with electrical infrastructure such as power lines. This has contributed greatly to their decline (Boshoff *et al* in press). By implication the risks of their collision with the wind farm would thus be great.

Hence the presence of the colony so close to the site, places a very valid risk to the birds. Species were noted during the site visit and the land owner informed the team that the birds were often seen on the farm.

The colony is not only nationally important but is also utilised as a tourist draw card for the town of Lady grey.

In addition to the vultures, a large number of other nationally important birds species are also present in the area including the Verreaux's Eagle, Bald ibis and crowned cranes.

The introduction of a wind farm into the study area is thus likely to negatively affect these bird species and the site is thus not preferable.

Dr. Andre Boshoff from the Centre for African Conservation Ecology (Nelson Mandela Metropolitan University) was further consulted in this regard and he concurred with the opinion of SiVEST.

3.4.6 Geotechnical

Weathered basalt rock is expected to be encountered at depths varying from surface to approximately 3 m below ground level in all but the flattest areas of the site. This material should provide an adequate founding medium for wind turbines and shallow foundation options should be suitable.

The depth to bedrock in areas underlain by basalt may be highly variable over short distances. Depending on the degree of variability, this may lead to differential settlements beneath foundations and specialised foundation preparation may be required. Hard excavation conditions will be encountered from surface or at very shallow depth in the steeper sections of the site. Shallow bedrock is also expected in the flatter areas of the north western section of the site as soil cover appears very shallow in this area. Boulder excavation is also expected due to the presence of hard core stone boulders that are typically formed during the weathering of basalt rock.

The aerial photography indicates the presence of numerous seeps and small springs and shallow groundwater conditions will be encountered in many areas.
Basalts are known to weather to potentially expansive clayey soils. However, these soils will be restricted to the flatter areas of the site and are expected to be limited in thickness (encountered to less than 2m below ground level).

3.4.7 Surface Water

No priority river systems occur on the Lady Grey study site according to the NFEPA (2011) database. Although, a priority river system does run to the east of the proposed development site, the presence and location of the river system will not affect the development. Satellite imagery does, however, reveal that several drainage lines can be found on the study site. A minimum buffer zone of 100metres will need to be applied for each of the identified river and drainage systems. The NFEPA (2011) database does however indicate that eight hillslope seep wetlands and one depression wetland can be found on site. These wetlands will require a minimum buffer of 50metres. The presence of wetlands and drainage systems will affect the developable area of the wind farms somewhat, but do not constitute a fatal flaw for the study site provided that the site specific location of the wind turbines are situated outside of any surface water resources and their associated buffer zones.

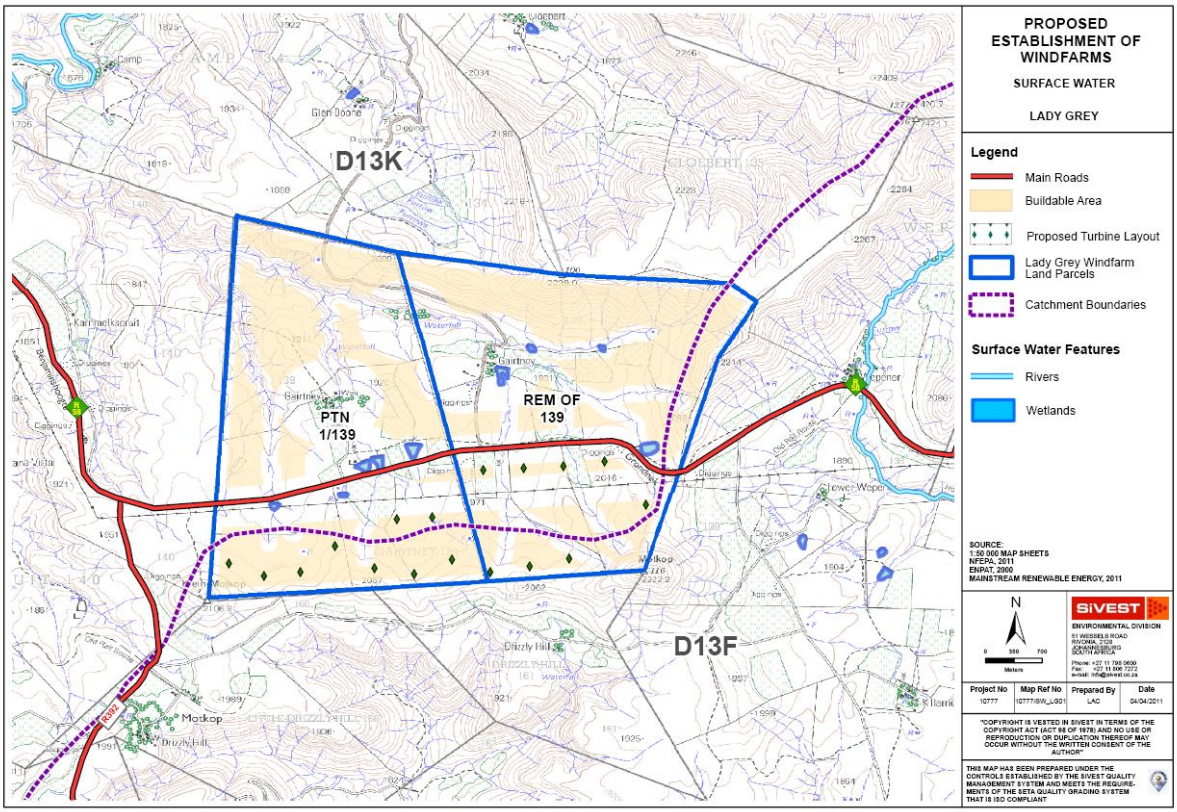

Figure 24: Surface Water Features for the Lady Grey Site

3.4.8 Heritage and Tourism

The following heritage sites, features and objects are expected to occur in the proposed development area:

- Stone Age sites located near the foot of hills, with an increased likelihood if there are rock shelters in the vicinity;
- Houses and other structures older than 60 years;
- Graves and cemeteries, both formal and informal.

Old graves were observed during site visits to the study area. It is proposed that the graves be studied by a qualified archaeologist and registered with the appropriate government departments.

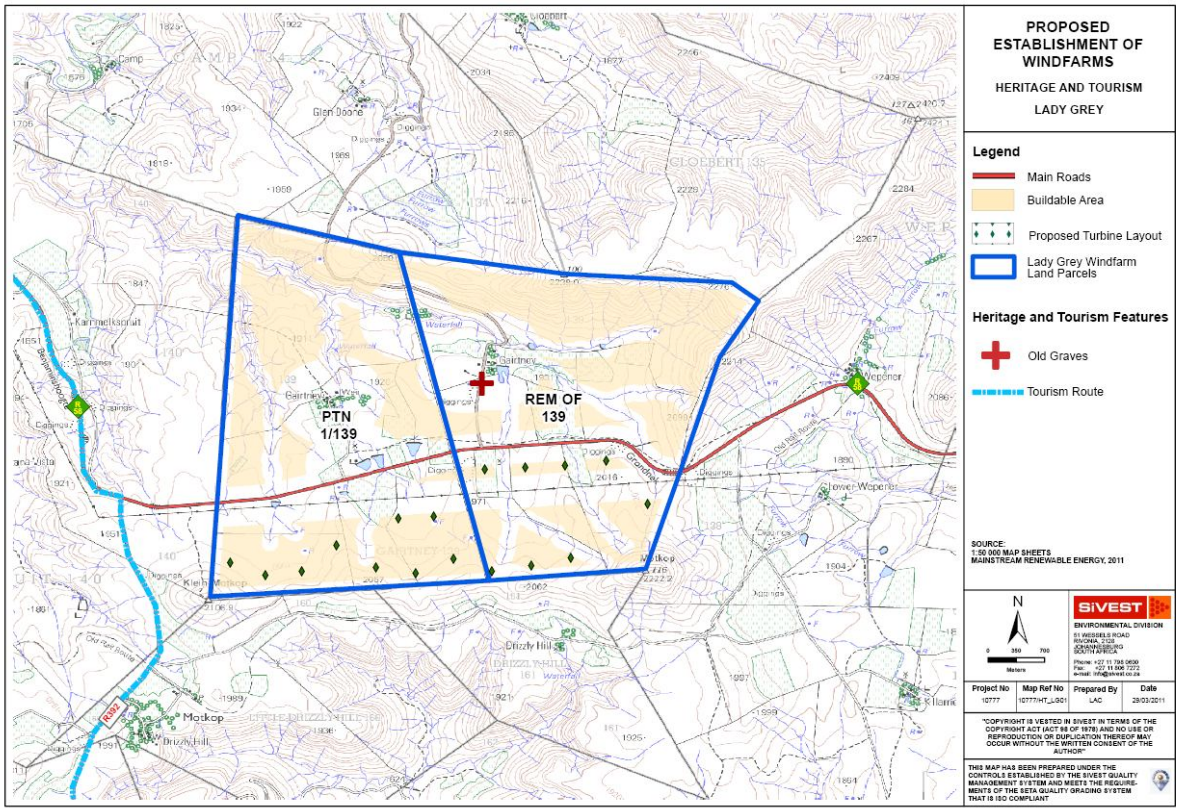

Figure 25: Heritage and Tourism Features for the Lady Grey Site

3.4.9 Soils and Agricultural Potential

- Desktop Agricultural Assessment Result Summary

According to the ENPAT agricultural dataset the study area is dominated by soils which are not suited for arable agriculture but which can still used as grazing land which has moderate to moderately high potential. These results were confirmed during the site visits where the restrictive soil and climate characteristics contributed to a low agricultural potential in terms of crop production. The majority of the site consists of grazing land and pasture which can be seen as a non-sensitive land use in terms of agricultural production when assessed within the context of the proposed development.

- Field Verified Agricultural Potential

According to the ENPAT agricultural dataset the study area is dominated by soils which are not suited for arable agriculture but which can still used as grazing land which has moderate to moderately high potential. These results were confirmed during the site visits where the restrictive soil and climate characteristics contributed to a low agricultural potential in terms of crop production. The majority of the site consists of grazing land and pasture which can be seen as a non-sensitive land use in terms of agricultural production when assessed within the context of the proposed development.

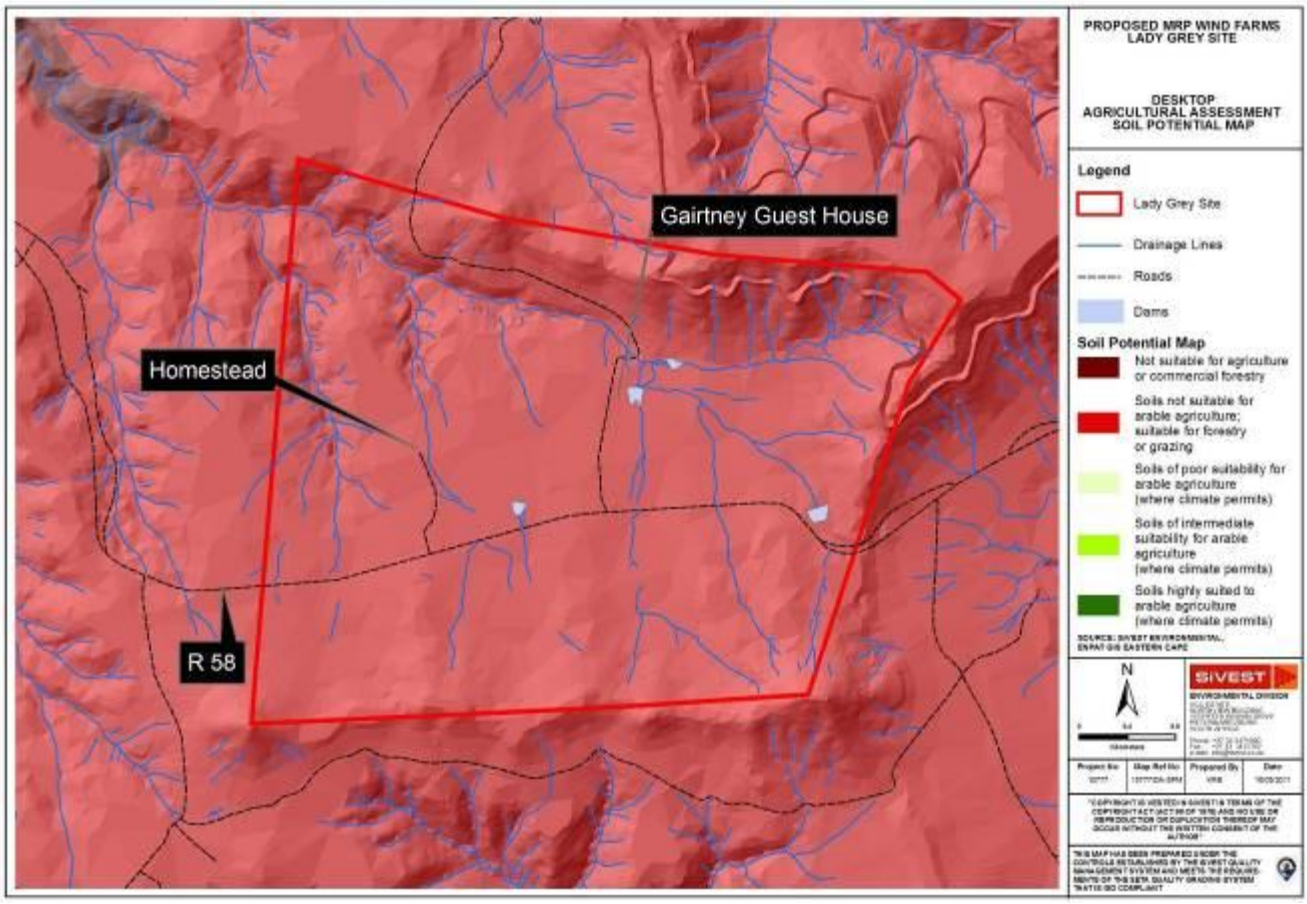

Figure 26: Soils and Agricultural Potential for the Lady Grey site

3.4.10 Visual

The results from the visual assessment show the following;

- Day and night-time visual exposure of the proposed wind farm to tourists and people travelling along the R58 between Lady Grey and Barkley East;
- Visibility from farmhouses within the boundaries of the proposed site;
- Potential visibility of portions of the wind farm from farmsteads in the surrounding area;
- Potential visibility from localized areas of high lying ground in areas surrounding the proposed site.
- Potential impact of shadow flicker on people travelling along the R58.

The study area has a scenic quality with a natural and pastoral visual character. Human settlement is limited to isolated farmers residing on the proposed site and in the surrounding area. Although the short vegetation will offer immaterial visual screening, the surrounding hills will restrict views toward the site. Short section of the R58 as it passes through the proposed site is regarded as a potentially sensitive visual receptor, as this road forms part of the Maloti Drakensburg Route which is enjoyed for its scenic views, birdlife and historical significance. There are no towns or built up areas in close enough proximity to be visually impacted by the proposed development.

The visual study undertaken for the Lady Grey site revealed that although the topography will limit the visual exposure of the proposed wind farm from surrounding farmstead, the visual impact from the R58 cannot be avoided. The site does not present any visual fatal flaws, however it is the least preferable from a visual perspective.

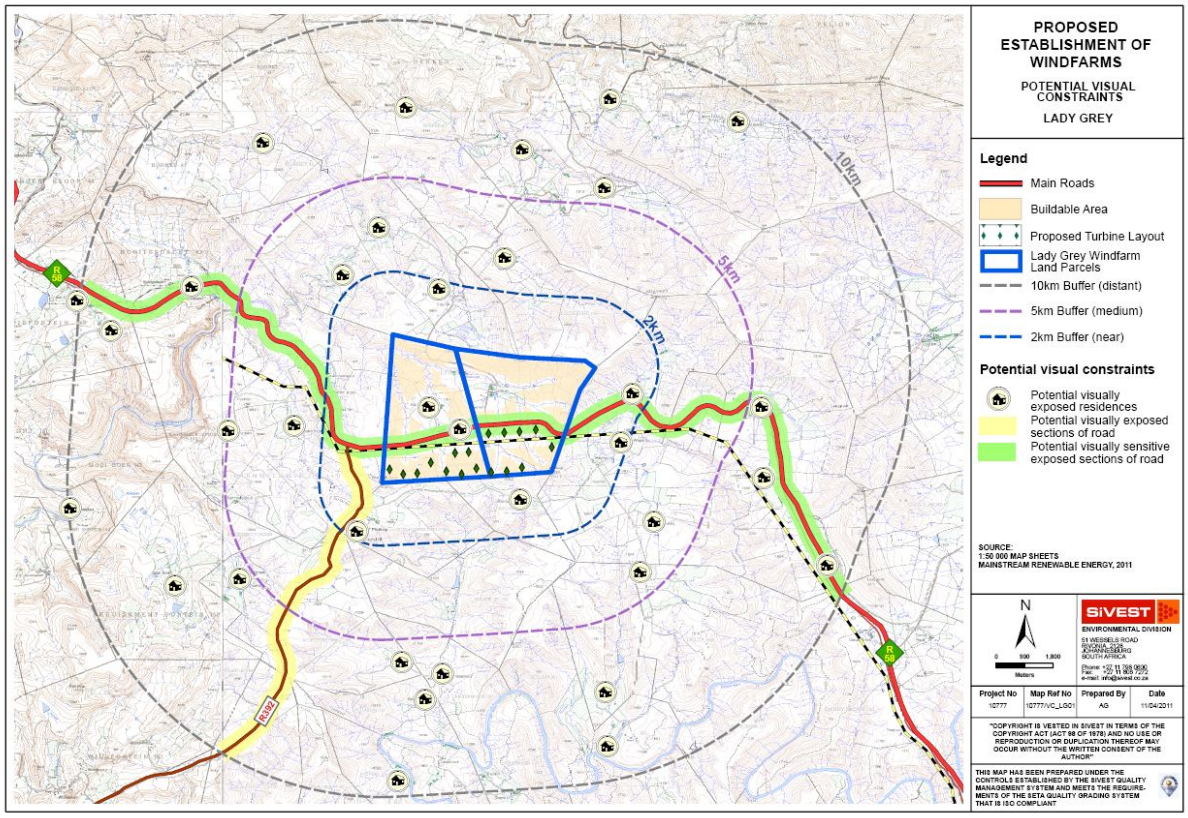

Figure 27: Potential Visual Constraints for the Lady Grey Site

4 LITERATURE REVIEW FROM OTHER SOURCES

This section deals with literature from other sources including academic research reports, SDFs, IDPs biodiversity plans among other sources. The information derived from these sources gives an understanding of the general status quo of the proposed study in both a locally and district level.

4.1 Loeriesfontein Site

4.1.1 Namakwa District Municipality Biodiversity Sector Pan 2008

The Namakwa District Municipality (NDM) Biodiversity Sector Plan 2008 describes the profile of Loeriesfontein under the following subheadings;

- Fauna

The Hantam-Roggeveld mountain range that runs through the Hantam Local Municipality (HLM) contains a large variety of endemic and unusual invertebrate life that is distinctive from species found in the rest of the NDM. Particularly, it is known that many key pollinators such as monkey beetles, bees and wasps are present – invertebrates critical for the continuation of numerous endemic plant species. Blue cranes and black harriers are also characteristic of the area, and a diversity of other small faunal creatures are also found. Most notably, Visagie's Golden Mole, an endangered species is found within the HLM. Heuweltjies appear as distinctive markings and occur on deeper soil in part of the western area of the HLM, and presents as circular patches contrasting with the landscape around them as a consequence of its distinct plants communities. These fertile circular patches of soil are old termite mounds – most now vacant for thousands of years but consisting of a unique habitat by virtue of the plant material gathered by the termite colony in past years. Termites, the most numerous and important decomposers and nutrient cyclers in arid regions of the world have permanently altered the physical properties of the soil, leading animals to target it as a grazing area which means that the area is often quite disturbed.

- Aquatic environment

The Doring River system that flows across part of the Hantam municipality is a critical water source for the region. Many of its tributaries undergo extensive abstraction for agriculture which impacts upon its natural patterns. Alien fish have also impacted upon the natural fish population, causing the smaller indigenous species to disappear. In addition, the effect of agriculture along the river banks in the form of extensive vegetation clearance and overgrazing has paved the way for the incursion of alien trees (red river gum, black wattle, oleander, mesquite, grasses), which clog up the catchment area and use up much of the meagre water resources. It is important for the HLM to focus upon its river systems and water catchment areas that are found in high lying region, in order to safeguard water availability for all who depend upon it.

- Land cover in the municipality

Although proportions of land transformation are not huge in the HLM, they are significant in that they often occur in areas that are important for conservation for the region such as along rivers, or in high lying areas with elevated rainfall levels. Within the HLM, development around the town of Nieuwoudtville is a significant threat to local biodiversity, and is the only example of 'urban' development presenting a threat to unique vegetation in the municipality.

- Flora - The HLM is home to an amazing array of bulbs, a feature for which it is world renowned. Other special plants that are endemic/near endemic or characteristic of the area can be considered flagship include:
    - Star tree (*Cliffortia arborea*) – classified as Endangered in the Red Data List
    - Kokerboom (*Aloe Dichotoma*) – in the form of uncharacteristic 'Kokerboom forests' found near Nieuwoudtville
    - Golden Clivia (*Clivia mirabilis*) - only recently discovered along the Oorlogskloof River valley and considered as Vulnerable
    - March Lily (*Brunsvigia bosmaniae*) – this LM is renowned for mass displays of this lily in March and the emblem of Nieuwoudtville

A CDS Research report written by the University of the Free State describes Hantam Local Municipality as a place of special interest to botanists and horticulturalists as Loeriesfontein alone has about 4 000 plant species.

4.1.2 Namakwa IDP 2005

The population of the Hantam Local Municipality was 19 091 in 1996 and 19 213 in 2001.

HLM projects Include;

- Sifting/moving of dumping site in Calvinia.
- New residential area (250 ervens).
- Middelpos upgrading to acceptable standard
- Upgrading and establishing the facilities in Akkerendam Nature Reserve

Identified Priorities in terms of Infrastructure encompass:

- Water – Potable water is one of the greatest needs for the HLM;
- Housing – Huge backlog in formal housing exists;
- Sanitation – Lack of proper sanitation is not only a health hazard but can also be detrimental to the environment;
- Roads – Poor maintenance of the roads.

Economical identified priorities include:

- Tourism – Different tourist attractions should be utilised to their full potential;
- Environment – The unique environment creates opportunities for biodiversity conservation linked with economic development and job creation;
- Natural resources – processing of natural resources has huge potential and should be exploited;
- Planned projects;
- Building of streets in B –Municipality Areas;
- Upgrading gravel roads and re-gravelling of rural roads;
- Construction of dry sanitation facilities to replace the bucket system;
- Upgrading of an existing oxidation pond in Loeriesfontein.

4.1.3 Hantam Local Municipality IDP

The HLM concerns include municipal transformation and development, service delivery and infrastructural development. With regards to the latter, electricity, amongst other municipal services, is highlighted as a priority issue warranting attention, in particular the provision of access to electricity to affected communities and the improvement of the electricity infrastructure (mini-subs, cables). These objectives are anticipated to be achieved through the following strategies:

- Upgrade the electricity networks
- Building of 150 houses which will therefore require the provision of electricity
- Electricity installations at SAPS offices
- Upgrading of Grootmaat electricity provision
- Developing a Master and Maintenance plan for electricity

4.2 Prieska and Noupoort Sites

4.2.1 Integrated Development Plan for the Pixley ka Seme District Municipality 2009-2010

These two sites fall under the greater Pixley ka Seme District Municipality. The Prieska Site is located in the Siyathemba Local Municipality which has an area of 11 388km². The Noupoort Site is located in Umsobomvu Local Municipality which has an area of 9 813km². A summary of issues from the District Integrated Development Plan 2009-2010 are discussed below:

- Cultural and historical sites:

This aspect of the district is fully described in the Integrated Environmental Management Programme. It is summarized as follows:

The available literature shows that the region is richly endowed within cultural and heritage sites. Rock Art is found throughout the area with. These rock paintings should be conserved. Various battle grounds and cemeteries dating the Anglo-Boer War are also found in the region.

In and around the towns, there are several buildings with particular environmental, architectural or historical value which form part of the national heritage. A ground survey conducted shows that the general condition of some buildings is not satisfactory and are in some desperate need for rehabilitation. As these buildings play a vital role in the tourism conservation and preservation of them is recommended as one way or the other, spill-off effects from such planning practice would significantly contribute to the development of tourism industry in the region.

- Threatened and unusual species:

As noted in the Integrated Environmental management programme, the only known critically endangered species is the Riverine Rabbit (not located near Prieska or Noupoort). Riverine Areas have already been transformed to a large degree because of impoundments (dams) which in turn reduces the ecological reserve of these systems. Issues identified from the Pixely ka Seme IDP 2009-2010 that impact the mammalian species are:

  - Destruction of habitat
  - Insufficient distribution data and poorly compiled EIA's contribute to lack of knowledge.

- Birds (Avifauna):

No data available but some of the issues observed that have threatened these species are:

  - Power lines
  - Destination of habitats
  - Indiscriminate use of pesticides
  - Intolerance towards raptors
  - Insufficient knowledge and habitats destruction.

- Reptiles and Amphibians (Herpetofauna)

This category represents reptiles of which only the Giant Bullfrog is listed as threatened. Bullfrog can potentially occur within pan and seepage areas.

- Invertebrates:

No Lepidoptera (butterflies) are listed threatened in the district. Insufficient knowledge and habitat destruction are some of the issues observed that have threatened these species.

- Agriculture and Forestry:

Agriculture varies from typical extensive arable use to more intensive irrigation use, particularly along the two main rivers. The farms are intensively cultivated, and the farmers are clearly far more able to control erosion in the small parcels of land under their control than the farmers who are farming more extensively.

Many rural households have no access to wood and forced to purchase paraffin and gas in towns. The most important constraint affecting woodlot (tree plantation) development is the lack of unused land as almost 98% of the land is used for arable and irrigation farming in the region.

- Aesthetic Resource:

The aesthetic problems in the region concern the question of waste and litter.

In the rural areas (farms), the absence of a waste collection system has resulted in indiscriminate dumping, particularly along the main roads and in river dongas, which give many of these areas an air of decay and neglect. In the urban areas, the lack of priority given to the prevention of littering and the absence of any attempt to encourage greater civic responsibility in this regard has resulted in degraded conditions with litter strewn throughout the CBD (Central Business District).

- Wetlands and springs:

On the basis of available literature, no significant wetlands occur in the district. Many of the non-perennial tributaries and river beds function as wetlands and riparian zones, providing important habitat in the arid region.

With regard to springs, severe grazing pressure and arable farming has destroyed most of the perennial springs which would be abundant in an undisturbed ecosystem in this environment.

- Economic Resources

Agriculture: Wheat, Maize and Lucerne are the main crops grown. Farms are sustained through irrigation with production of healthiest produce. Small stock farming is also practiced. Municipality has a history of wool farming but there is a possibility of diversifying into more lucrative ventures like cashmere production.

Game Farming: History of game farming which provides opportunities for reasonable income.

Industrial: Presence of light industries.

Mineral resource: Modest mineral wealth with majority of mining institutions closed down (E.g. the copper mine at Copperton in Prieska was closed down due to uneconomic use).

Development Challenges: The developmental challenges in the municipality include a rising level of poverty, economic stagnation, unemployment and geographically imbalanced settlement structure.

In addition to the above-mentioned development challenges, local municipalities and the IDP representative forum have also identified the following as development challenges in the region:

- Lack of diversification of the local economy.
- Lack of investment in the region.
- Lack of employment opportunities.
- Lack of skills.
- Lack of entrepreneurship.
- Small number of SMME's active in the region.
- Underutilization of the regions natural resources and economic opportunities.
- Lack of water for irrigation farming.

- Demographics:

The average household size is 4.52 persons per household. There are approximately 0.72 children aged 6 years and younger per household and 0.35 persons aged 60 years and older in households.
Population, households and % females

- Population Growth:

Because water and sanitation supply is provided at a household level, the growth in households is more relevant than population growth. In many instances the population may be static (i.e. no population growth) but the settlement is increasing with the formation of new households. Household size has decreased over time. The farms have experienced negative population growth and this is predicted to continue. Most of the towns have also experienced low growth rates.

- Population density:

The population density for Emthanjeni and Umsobomvu Municipalities is 4 persons per square kilometre between 2001 and 2002. This really suggests that Emthanjeni and Umsobomvu have a population density being well above the average population density of 2.0 persons per square

kilometre for the District. From the planning point of view, this inequitable population distribution within the district will require formulation and implementation of regional development policies so as to remove the imbalance

- Socio Economic Conditions

Safety and Security: Even though crime in the region is very low if compared with other areas in South Africa, some issues were raised regarding safety and securities by Local municipalities and members of the IDP representative forum. The issues that were identified by Local Municipalities and members of the IDP representative forum regarding safety and securities are as follows:

- Police are not visible
- Police stations are not accessible to many people
- Shortage of police resources
- Not enough police stations
- Shortage of human resource in courts
- High levels of domestic violence and rape
- High level of unemployment
- Youth delinquency due to lack of recreation activities
- High levels of domestic violence
- Substance and alcohol abuse
- Theft and illegal activities
- Low crime rate, but high levels of drug and alcohol abuse with related family abuse occur in the region.

4.3 Lady Grey Site

Information for this site was derived from the Senqu Local Municipality (SLM) Integrated Development Plan 2007/2008 – 2011/2012, Senqu Spatial Development Framework 2005 and the Ukhahlamba District Municipality (UDM) (Joe Gqabi) Integrated Development Plan 2010.

4.3.1 Senqu LM Integrated Development Plan 2007/2008 – 2011/2012 & Senqu Spatial Development Framework 2005

The following issues which may influence the Environmental Constraints Analysis were derived from the Senqu LM Integrated Development Plan 2007/2008 – 2011/2012

- Topography

Much of Senqu has slopes steeper than 1:8 as it forms part of the southern Drakensberg range. This area, due to its high altitude, is unsuitable for farming. Topography dictates/ influences the type of agricultural activities that occur. Agriculture is limited to specific land pockets. The mountainous terrain also limits accessibility and therefore hampers service and infrastructure delivery in the region (Senqu LM IDP 2007/2008 – 2011/2012) The Southern Drakensberg creates a scenic environment conducive

to adventure and nature tourism activities such as mountain biking, hiking, skiing etc (Senqu LM IDP 2007/2008 – 2011/2012).

- Temperature

The region is well known for its temperature fluctuations with temperatures ranging between -11°C and 42°C. On average there are 150 days of frost during the year, usually between March and November and there is snow, usually in Barkly East and Lady Grey (Senqu LM IDP 2007/2008 – 2011/2012).

- Hydrology

The Southern Drakensberg Mountains form a watershed and separate the eastern and western parts of the Ukhahlamba district. The Orange River is the most important source of water in the District, and the Orange River catchments area covers most of Senqu area. This catchments area drains towards the Atlantic Ocean (Senqu LM IDP 2007/2008 – 2011/2012). Smaller dams also provide the Municipality with water, both for agricultural purposes and human consumption. Dams have a secondary usage and potential for recreational and other economic purposes. Boreholes are also used at Lady Grey to augment supplies (Senqu LM IDP 2007/2008 – 2011/2012).

- Vegetation

Vegetation types represent an integration of the climate, soils and biological factors in a region and as such, are a useful basis for land use and conservation planning. There are nine vegetation types found in the District covering 3 biomes. Two of these biomes are of some national significance namely the Alpine and Maluti mountain-type (Senqu LM IDP 2007/2008 – 2011/2012)

- Land Capability

There is only 233 hectares of high potential arable land (class 1) in the Ukhahlamba District. Although Senqu has the lowest percentage of arable land in the district, its agricultural sector has the highest percentage contribution in the GGP (Senqu LM IDP 2007/2008 – 2011/2012)

According to the Senqu LM Spatial Development Framework - June 2005, the following sections summarised the issues that will influence environmental constraints analysis for the site

- Soil Stability

The proliferation of invader plant species on the mountain slopes above the town threatens indigenous plants and affects soils stability. The pine tree covered slopes pose a potential threat to residents in form of rock and mud slides (Senqu LM SDF, 2005).

- Invader Species

Invader species and exotics such as the black wattle proliferate along the major watercourses in the town's main water catchment area and threaten the already meagre bulk water supply (Senqu LM SDF, 2005).

- Residential Expansion

Most of the area is mountainous and therefore, cannot be developed. This limits possible new development to a westerly and/or north westerly direction (Senqu LM SDF, 2005).

- Tourism node

With limited resources and access to commercial and industrial development, tourism opportunities exist in Lady Grey. The town enjoys a scenic setting and along with the Aliwal North, Barkley East and the Rhodes/Tiffandel area, forms part of a potential tourism node in the Eastern Cape. The likely focus of such a node would be in catering for niche markets such as eco-tourism (fly fishing, birding etc) and adventure tourism (hiking, biking and skiing) (Senqu LM SDF, 2005).

4.3.2 Ukhahlamba DM (Joe Gqabi) Integrated Development Plan 2010

The Natural Environmental Analysis of the study area derived from the Ukhahlamba DM (Joe Gqabi) Integrated Development Plan 2010 which are set to influence the Environmental Constraints Analysis is summarised under the following points.

- Rainfall

The District can be divided into four rainfall zones. Some of the higher mountain peaks have between 0.8 meters (m) and 1.2 m of rainfall a year. The eastern part of the District has between 0.6m and 0.8m a year; the central area has between 0.4 m and 0.5 m; and the western area (Venterstad, Steynsburg and most of Burgersdorp) has less than 0.5m a year. Half a meter of rain a year is regarded as the minimum amount required for sustainable (dry land) crop production (Ukhahlamba DM IDP, 2010).

- Temperature

The District is well known for its temperature fluctuations, with temperatures ranging between 42 C and minus 11 C. On average, there are 150 days of frost during the year, usually between March and November and there is snow, usually in Senqu and Elundini, but the snow has also been known to fall on the higher lying areas of Maletswai and Gariep. The District is affected by unseasonal frost and cold that has a negative impact on agriculture. The area is only suitable for less sensitive crops due to this harsh climate. Elundini is lower in altitude and experiences warmer winters; this enables this part of the District to be more suitable for cultivation (Ukhahlamba DM IDP, 2010).

- Topography

Approximately 12% of the District area has slopes steeper than 1:8. From Aliwal North large flat plains of land are interspersed with steep mountains and hills. Topography influences the type of agricultural activities that occur. The open flat areas in the west allow for extensive agriculture whereas in the east, agriculture is limited to specific land pockets. Although very little land is suitable for cultivation, grazing for farming stock is feasible. The altitude of the District lies between 1000m and 1500m above sea level. Parts of Senqu and Elundini form part of the southern Drakensberg range. This area, due to its high altitude, is less suitable for farming. From Lady Grey the landscape flattens out towards the west. The mountainous terrain also limits accessibility and therefore hampers service and infrastructure delivery in the region. The southern Drakensberg creates a scenic environment conducive to adventure and nature tourism activities such as mountain biking, hiking, skiing etc (Ukhahlamba DM IDP, 2010).

- Hydrology

The southern Drakensberg Mountains form a watershed that separates the eastern and western parts of the Joe Gqabi District. The Orange River is the most important source of water in the District, and the Orange River catchment area covers most of Gariep, Maletswai and Senqu Local Municipalities. This catchment area drains towards the Atlantic Ocean. Elundini falls within the Umzimvubu catchment area, draining towards the Indian Ocean. The Gariep dam is the largest dam in South Africa and is a major source of water for irrigation in the District as well as for the Fish River scheme (to the south west of the District). Smaller dams also provide the District with water, both for agricultural purposes and human consumption. Dams have a secondary usage and potential for recreational and other economic purposes. Boreholes are used by Barkly East, Burgersdorp and Steynsburg to augment supplies, and Jamestown and Mount Fletcher use boreholes for all their water requirements. Many commercial irrigation ventures are fed from groundwater. A study conducted for the DM concluded that many places in Senqu and Elundini have very high groundwater development potential (Ukhahlamba DM IDP, 2010).

- Soils

Soils are generally shallow and weakly developed. Soils in the District are mainly sandy loam and clayey loam. As a broad generalization, there is an increase in soil depth and areas occupied by arable soils from west to east. Crop and horticultural production in Gariep LM and in most of Maletswai LM is severely limited (even with irrigation) due to the dominant soil types. Elundini local municipality is the only area with soils suitable for cultivation. The Senqu area is one of the most degraded areas in the country due to communal grazing lands not being well maintained or protected under the previous dispensation. Degradation is also high in the communal land areas of Elundini, and in small pockets within the Maletswai and Gariep local municipalities, with the primary cause found to be the overstocking of livestock and inappropriate grazing methods. The Department of Agriculture estimates that between 300 and 400 tonnes per hectare of soil are lost annually in the District. In addition to the provision of infrastructure to enable the practice of controlled grazing, it is necessary to prioritize the rehabilitation of severely degraded areas, in particular in the Senqu area (Ukhahlamba DM IDP, 2010).

- Vegetation

Vegetation types represent an integration of the climate, soils and biological factors in a region and are a useful basis for land-use and conservation planning. There are nine vegetation types found in the District covering three biomes. Two of these biomes are of some national significance, namely the Alpine/Maloti mountain-type grasslands in the east and Eastern Mixed Nama Karoo in the west and all provide an interest for tourism development. The different biomes also have an impact on the type of agriculture practiced in the area (Ukhahlamba DM IDP, 2010).

- Land capability

There is only 233 hectares of high potential arable land (class 1) in Joe Gqabi District. Elundini has the highest percentage of arable land (with limitations) in its coverage (42.9%), and this is followed by Maletswai (32.9%). With the low levels of rain-fed arable land for crop production in the District, irrigation schemes and stock farming will play a significant role in agriculture. This is evident in Gariep where only 0.8% of the land is suitable for rain-fed crop production; however, agriculture contributed

38% to the GGP in 2001, in the form of sheep farming and irrigation-based agriculture along the Orange River and Fish River Tunnel. It is important to note that although Elundini has the highest percentage of arable land, its agricultural sector has the lowest (4%) of GGP contribution. This is due to the subsistence nature of agriculture in the area and highlights the physical potential for commercial agriculture growth (Ukhahlamba DM IDP, 2010).

There is limited land available that can sustain intensive agricultural practices. Land identified as prime and unique agricultural land should be preserved for agricultural use in order to enhance food security and therefore economic welfare. It is therefore important that residential and industrial development does not expend these areas (Ukhahlamba DM IDP, 2010).

- Biodiversity

The Joe Gqabi District Municipality is characterized by a diversity of vegetation types and land features. The eastern and northern areas (Senqu and Elundini) are featured by high lying mountainous terrain associated with high species diversity and unique wetlands. These areas are more specifically, covered by Southern Drakensberg and Lesotho Highland Basalt Grasslands (in the east) as well as Zastron Moist Grassland and Senqu Montane shrubland (in the north). The western parts of JGDM are dominated by Karoo Escarpment Grassland, Aliwal North Dry Grassland, Besemkaree Koppies Shrubland and Eastern Upper Karoo vegetation. All of these vegetation covers are classified as “Least threatened” but are for the most part poorly conserved. Scattered in the north and east are Eastern Temperate Freshwater Wetlands, while in the west small patches of Lower Gariep Alluvial vegetation, which are classified as vulnerable, can be found (Ukhahlamba DM IDP, 2010).

An opportunity exists to formally protect the remaining intact grasslands, especially those classified as vulnerable and endangered, to ensure the important ecological functions they play in this area are preserved, and to build on the attractive and ecologically important landscape for tourism. One of the most important ecological ecosystem services provided by the study area is the provision of good quality water, and the large numbers of wetlands found in the upper elevations within a range of vegetation types are critically important in this regard. An opportunity to apply “Payment for Ecosystem Principles” for water resource protection therefore exists to ensure the protection of vegetation types dominated by wetlands (Ukhahlamba DM IDP, 2010).

- Threats to biodiversity

Unsuitable agricultural practices such as increasing irrigation in areas of poor soils and cash crop cultivation in marginal areas, is another threat to biodiversity in JGDM. The continuation of degradation of the District’s land cover increases erosion throughout the district. This is especially evident in Senqu and Elundini, but also prevalent in Gariep and Maletswai where there is an increase of the Karoo scrubland. Unsustainable agricultural practices such as increasing irrigation in area of erosive/loose soils also contribute to erosion and undermine cash crop cultivation in marginal areas. Very little is being invested into land-care in proportion to the amount of degraded land. Ongoing urbanization and the growth of informal settlements around urban centres is increasing pressure on the environment and stretching infrastructure beyond capacity limits. The municipal area has no dedicated persons looking at environmental issues. Fire, especially in the grassland areas to the east

of the District is another factor affecting the environment. In addition, plantations continue to threaten wetlands and indigenous forest patches (Ukhahlamba DM IDP, 2010).

- Environmental opportunities

Some areas of the District area are endowed with scenic beauty that has significant potential for agriculture and tourism sectors. In addition, a number of endemic species contributes to the potential of the District. In addition, climatic, soil and topographic aspects show that Elundini has an environment more suited to a variety of agricultural activities.

Environmental opportunities could present themselves in the form of aquaculture where farming aquatic species should be investigated. In addition, the production of clean-energy (solar and wind) and the feasibility thereof needs to be determined as it would result in the production of sustainable energy for the district. Opportunities also exist for clean development mechanism projects, directly related to sewage treatment and waste resource management (Ukhahlamba DM IDP, 2010).

- Demographics

Population figures for the Senqu LM indicate a population of approximately 135 141 people residing in 34 044 households. The population has grown relatively fast from 1996 (18 836) to 2001 (135 141) at 84.2%, at an average of 16.8% per annum. This population accounts for 39.59% of the total population residing in the Ukhahlamba District, making it the second most populated local municipalities behind Elundini Municipality in the district.

Population projections are based on the modelling done by the Dept of Health (District Health Information System) and using the statistical models provided by StatsSA, the projected population of Senqu Municipality is as follows:

- *Rural vs. Urban Population*: According to the 2001 Census 49.6% of households are rural in nature, this includes rural villages and farm households. This dynamic is shifting with the phenomenon of urban In-migration occurring in Senqu Municipality. This is especially evident in the Sterkspruit area, where the population has increased from 6181 in 1996 to approximately 110 223 in 2001. This figure will further increase due to the number of houses being built the area.
- *Age and Gender*: Approximately 53.13% of the municipal population falls in the 15-65 age categories which can be seen as the economically active sector of the population, with 41% of the population below the age of 15. This suggests continuing population growth in the area with a need for educational facilities and a focus on education and skills training.
- The gender split, with 46.85% of the population being male and 53.15% female. This may be ascribed to migrant and commuter labour which has resulted in many households having a woman as the head of the household and the chief breadwinner living away from the home. This will also impact on the type of development that may occur, especially with regards to manual labour-type employment.

5 ANALYSIS OF FATAL FLAWS AND DISCUSSION

The analysis phase is undertaken based on the identification of key environmental attributes, trends and impacts in the status quo phase. The main aim of this phase is to analyse the results of the status quo phase. This analysis phase is mainly undertaken through use of GIS modelling and results are discussed based on existing information.

- **Identification of, and assessment of threats, trends of land use and opportunities**

Patterns of land use and areas of environmental impact and degradation within the study areas will be analysed and assessed. Furthermore results of the analysis phase will be discussed in an effort to justify why a site may or may not be suitable for the establishment of Wind Farms.

- **GIS Analysis**

The fatal flaw analysis included the examination of spatial and temporal aspects which require specialised analysis tools. Such tools are inherent in a Geographic Information System with its unique ability to:

- collate, integrate and store data from different sources;
- link spatial features to database information;
- analyse spatial relationships and trends over time;
- evaluate the spatial impacts caused by existing and potential development; and
- present data relatively quickly in an easily understandable graphic format.

The GIS tasks involved the collation and integration of all existing spatial data to provide a spatial information platform which comprised several layers of relevant physical, environmental, land use, demographic and infrastructural data. This data was supplied by the Client and as datasets expanded, the existing data was amended.

The spatial analysis techniques used to inform the project were the map overlay and multi-criteria analysis. The spatial analysis enabled the abstraction, simplification and combination of the existing data to determine spatial relationships and trends over time and identified driving forces, pressures and impacts. This level of analysis assisted in the formulation of environmental indicators and the identification of key environmental issues. This was particularly important in the assessment of existing and potential impacts at a local scale as well as providing a powerful means of visualising these impacts.

All GIS work was undertaken in ArcGIS 9.3 in conjunction with the Spatial Analyst and 3D Analyst extensions. Outputs in the form of maps were prepared in ArcGIS.

- **Analyses: Site Ranking**

A comparative assessment was done in order to rank the site alternatives so as to determine the most suitable alternative. The comparative assessment was done based on factors such as Biodiversity/ conservation importance (presence of species habitats); proximity to any sensitive areas (i.e. visual, tourism/ heritage areas), geotechnical characteristics of the sites, proximity to surface water features soils and agricultural potential, proximity to any proposed future developments as well as potential for mitigation.

- Biodiversity/ conservation importance (presence of species habitats)

Table 3: Biodiversity/ conservation importance (presence of species habitats)

BIODIVERSITY/ CONSERVATION IMPORTANCE			
Factor	**Description**	**Mitigation potential**	**score**
Biodiversity/ conservation importance (presence of species habitats)	Development in an area of high biodiversity	Low	**3**
	Development in an area of medium biodiversity	Medium	**2**
	Development in an area of low biodiversity	High	**1**

- Geotechnical Characteristics

Table 4: Geotechnical characteristics of the site

GEOTECHNICAL CHARACTERISTCS			
Factors	**Description**	**Mitigation potential**	**score**
• Presence of collapsible soils on the site • Presence of unweathered rock on site • Hard excavation conditions • Presence of alluvial deposits	Site unfavourable for founding conditions	Low	**3**
	Site relatively favourable for founding conditions	Medium	**2**
	Site favourable for founding conditions	High	**1**

- Proximity to any surface water features

Table 5: Proximity to surface water features

PROXIMITY TO SURFACE WATER FEATURES			
Factor	**Description**	**Mitigation potential**	**score**
Proximity to Surface water features	Very close to wetlands and surface water features	Low	**3**
	In relatively close proximity to wetlands and surface water features	Medium	**2**

	Distant from any wetlands and surface water features	High	**1**

- Proximity to any sensitive areas (visual, tourism/ heritage)

Table 6: Proximity to sensitive areas (visual, tourism/ heritage)

PROXIMITY TO SENSITIVE AREAS			
Factor	**Description**	**Mitigation potential**	**score**
Residential area/ sensitive area (visual, tourism/ heritage)	Very close to sensitive areas	Low	**3**
	In relatively close proximity to sensitive areas	Medium	**2**
	Distant from any sensitive areas	High	**1**

- Soils & Agricultural potential

Table 7: Soils & Agricultural potential

SOILS AND AGRICULTURAL POTENTIAL			
Factor	**Description**	**Mitigation potential**	**score**
Soils and Agricultural Potential	Presence of soils with high agricultural potential	Low	**3**
	Presence of soils with medium agricultural potential	Medium	**2**
	Presence of soils with low agricultural potential	High	**1**

- Socio economic Inputs

Table 8: Socio-economic inputs

SOCIAL ECONOMIC INPUTS			
Factors	**Description**	**Mitigation potential**	**score**
• Proposed future developments • Commercial Farming • Tourism	Very close to sensitive areas	Low	**3**
	In relatively close proximity to sensitive areas	Medium	**2**
	Distant from any sensitive areas	High	**1**

- **Analyses: Site Preference Ratio (SPR)**

The total scores for the criteria detailed above were used to determine the preference ranking order for the different alternatives (Table 9).

Table 9: Preference ranking of sites

SPR	General site description	Site score equating to SPR class
PREFERRED	The site is characterized by very few or no potential fatal flaws. Any existing potential fatal flaws can be fully mitigated. It is not an important biodiversity/ conservation area and there are no habitats for red data species. The site is very far from any sensitive areas (visual, tourism/ heritage) as well as proposed future developments.	**1-7**
ACCEPTABLE	There are a relatively insignificant number of potential fatal flaws with a medium potential for mitigation. The site is a relatively important biodiversity/ conservation area. There are a few habitats for red data species (e.g. wetlands). The site is relatively close to a residential / sensitive area (visual, tourism/ heritage) as well as proposed future developments.	**8-14**
NOT PREFERRED	There are a number of potential fatal flaws which cannot be easily mitigated. The site is a very important biodiversity/ conservation area. It is characterized by high habitat diversity (e.g. wetlands which are potential habitats for red data species). The site is also very close to a number of proposed future developments.	**15-21**

5.1 Loeriesfontein site

Table 10: Summary of fatal flaws for the Loeriesfontein site

FARM PORTION	POTENTIAL FATAL FLAWS								
	Fauna	**Flora**	**Avifauna**	**Heritage**	**Surface water**	**Visual**	**Soils and Agricultural Potential**	**Socio-economic input**	**Geotechnical**
Portion 2/226	Sheep farming is the main activity practised in the area. This activity will not affect the proposed development however. No areas of exclusion have been included. The site is sensitive in terms of potential	The land cover is classified as fynbos and shrubland. The vegetation is classified as Bushmanland Basin Shrubland. These vegetation types are classified as Least Threatened and not protected. It will not affect	There are no important bird areas that fall onto the study site. No areas of exclusion have been highlighted.	Possibility of stone age sites located near the foot of the hills, as well as possible occurrence of 60 year old buildings, heritage farming infrastructure, graves and cemeteries. Site specific studies are required in order to determine the occurrence of	Numerous ephemeral water bodies spread across the farm portion, particularly in the north east. Numerous drainage lines traverse this portion to the south. Areas of exclusion have been identified.	The wind farm is only expected to be visible from the railway line, gravel farm roads and isolated farmhouses. The visual study undertaken for the Loeriesfontein site revealed that although the proposed wind farm is expected to be highly	Study area classified as low for crop production and moderately low for grazing. The soils are not suitable for arable agriculture. Forestry and grazing can be practised if the climate permits. Small portion to the west of this site has	Surrounding land uses show the study area as vacant/ unspecified. There are no specific areas of exclusion in terms of socio-economic issues.	Presence of collapsible soils on the sites. Presence of alluvial deposits along the larger drainage features Small isolated patches of windblown sands which are prevalent to the central and north eastern portions of the

FARM PORTION	POTENTIAL FATAL FLAWS								
	Fauna	**Flora**	**Avifauna**	**Heritage**	**Surface water**	**Visual**	**Soils and Agricultural Potential**	**Socio-economic input**	**Geotechnical**
	occurrence of bat species. Three species of Near threatened status may potentially occur on site based on the typical type of habitat that exists on the study site. Areas of exclusion have been identified in this respect.	the proposed development.		the aforementioned features. Therefore, the listed heritage features will not affect the proposed development at this stage. No areas of exclusion identified.		visible, there are no sensitive visual receptors present to experience the visual impact.	soils suitable for conservation, recreation and water catchment. These areas are not considered areas of high sensitivity. No exclusion areas were identified.		sites. Hard excavation conditions in areas underlain with dolerite in small areas of the sites. More in-depth studies are required to determine the precise location of problematic areas for construction. At a desktop level, no areas have been identified for exclusion.
Remainder of 226	Sheep farming is the main	The land cover is classified as	There are no important	Possibility of stone age sites located near	Numerous drainage lines traverse	The wind farm is only expected to	Study area classified as low for crop	Surrounding land uses show the	

FARM PORTION	POTENTIAL FATAL FLAWS								
	Fauna	**Flora**	**Avifauna**	**Heritage**	**Surface water**	**Visual**	**Soils and Agricultural Potential**	**Socio-economic input**	**Geotechnical**
	activity practised in the area. This activity will not affect the proposed development however. No areas of exclusion have been included. The site is sensitive in terms of potential occurrence of bat species. Three species of Near threatened	fynbos and shrubland The vegetation is classified as Bushmanland Basin Shrubland. This vegetation is Least Threatened and is not protected. It will not affect the proposed development.	bird areas that fall onto the study site. No areas of exclusion have been highlighted.	the foot of the hills, as well as possible occurrence of 60 year old buildings, heritage farming infrastructure, graves and cemeteries. Site specific studies are required in order to determine the occurrence of the aforementioned features. Therefore, the listed heritage features will not affect the	this portion. Areas of exclusion have been identified.	be visible from the railway line, gravel farm roads and isolated farmhouses. The visual study undertaken for the Loeriesfontein site revealed that although the proposed wind farm is expected to be highly visible, there are no sensitive visual receptors present to experience	production and moderately low for grazing. The soils are not suitable for arable agriculture. Forestry and grazing can be practised if the climate permits. Small portion to the west of this site has soils suitable for conservation, recreation and water catchment. These areas	study area as vacant/ unspecified. There are no specific areas of exclusion in terms of socio-economic issues.	

FARM PORTION	POTENTIAL FATAL FLAWS								
	Fauna	**Flora**	**Avifauna**	**Heritage**	**Surface water**	**Visual**	**Soils and Agricultural Potential**	**Socio-economic input**	**Geotechnical**
	status may potentially occur on site based on the typical type of habitat that exists on the study site. Areas of exclusion have been identified in this respect.			proposed development at this stage. No areas of exclusion identified.		the visual impact.	are not considered areas of high sensitivity. No exclusion areas were identified.		
Portion 2/213	Sheep farming is the main activity practised in the area. This activity will not affect the proposed	The land cover is classified as fynbos and shrubland. The vegetation is classified as Bushmanland Basin	There are no important bird areas that fall onto the study site. No areas of exclusion	Possibility of stone age sites located near the foot of the hills, as well as possible occurrence of 60 year old buildings, heritage	Ephemeral water bodies spread across the farm portion. Several drainage lines traverse this portion.	The wind farm is only expected to be visible from the railway line, gravel farm roads and isolated farmhouses. The visual	Study area classified as low for crop production and moderately low for grazing. The soils are not suitable	Surrounding land uses show the study area as vacant/ unspecified. There are no specific areas of exclusion in	

FARM PORTION	POTENTIAL FATAL FLAWS								
	Fauna	**Flora**	**Avifauna**	**Heritage**	**Surface water**	**Visual**	**Soils and Agricultural Potential**	**Socio-economic input**	**Geotechnical**
	development however. No areas of exclusion have been included for these animals as these species are not sensitive species.	Shrubland. This vegetation is Least Threatened and is not protected. It will not affect the proposed development.	have been highlighted.	farming infrastructure, graves and cemeteries. Site specific studies are required in order to determine the occurrence of the aforementioned features. Therefore, the listed heritage features will not affect the proposed development at this stage. No areas of exclusion identified.	Areas of exclusion have been identified.	study undertaken for the Loeriesfontein site revealed that although the proposed wind farm is expected to be highly visible, there are no sensitive visual receptors present to experience the visual impact.	for arable agriculture. Forestry and grazing can be practised if the climate permits. Small portion to the west of this site has soils suitable for conservation, recreation and water catchment. These areas are not considered areas of high sensitivity. No exclusion areas were identified.	terms of socio-economic issues.	

FARM PORTION	POTENTIAL FATAL FLAWS								
	Fauna	**Flora**	**Avifauna**	**Heritage**	**Surface water**	**Visual**	**Soils and Agricultural Potential**	**Socio-economic input**	**Geotechnical**
Portion 1/213	Sheep farming is the main activity practised in the area. This activity will not affect the proposed development however. No areas of exclusion have been included.	The land cover is classified as fynbos and shrubland The vegetation is classified as Bushmanland Basin Shrubland. This vegetation is Least Threatened and is not protected. It will not affect the proposed development.	There are no important bird areas that fall onto the study site. No areas of exclusion have been highlighted.	Possibility of stone age sites located near the foot of the hills, as well as possible occurrence of 60 year old buildings, heritage farming infrastructure, graves and cemeteries. Site specific studies are required in order to determine the occurrence of the aforementioned features. Therefore, the	Numerous ephemeral water bodies spread across the farm portion. Numerous drainage lines traverse this portion. Areas of exclusion have been identified.	The wind farm is only expected to be visible from the railway line, gravel farm roads and isolated farmhouses. The visual study undertaken for the Loeriesfontein site revealed that although the proposed wind farm is expected to be highly visible, there are no sensitive visual	Study area classified as low for crop production and moderately low for grazing. The soils are not suitable for arable agriculture. Forestry and grazing can be practised if the climate permits. Small portion to the west of this site has soils suitable for conservation, recreation	Surrounding land uses show the study area as vacant/ unspecified. There are no specific areas of exclusion in terms of socio-economic issues.	

FARM PORTION	POTENTIAL FATAL FLAWS								
	Fauna	Flora	Avifauna	Heritage	Surface water	Visual	Soils and Agricultural Potential	Socio-economic input	Geotechnical
				listed heritage features will not affect the proposed development at this stage. No areas of exclusion identified.		receptors present to experience the visual impact.	and water catchment. These areas are not considered areas of high sensitivity. No exclusion areas were identified.		

5.1.1 Site specific results and discussion (Loeriesfontein)

Figure 28 represents the fatal flaw analysis map for the Loeriesfontein study site. Each portion is evaluated below.

- **Farm portion 2/226**

Table 11: Farm portion 2/226

	Low	Medium	High
Environmental issue			
Biodiversity assessment (flora, fauna)	1		
Biodiversity assessment (bats)		2	
Socio Economic Issues	1		
Proximity to sensitive features (Heritage, wetlands and surface water features)			3
Visual	1		
Geology/geotechnical		2	
Soils and Agricultural Potential	1		
Total	**11 (Acceptable)**		
Mitigation potential		2	

This farm portion is approximately 7 644Ha in size. Results show that the site is **acceptable** (Table 11). The site is not considered to be sensitive from a biodiversity perspective as clearing will not take place on a large scale. The majority of vegetation will remain in place. Bird diversity is considered to be low. However, there is roosting habitat available for bats which indicate probable occurrence. The alluvial deposits that are expected to occur along the larger drainage lines are likely to consist of loose, unconsolidated sands and gravels which provide a poor founding medium for wind turbines. Surface water bodies and drainage systems can also be found in and across the site affecting the developable area of the wind turbines.

Although a number of environmental issues would be affected, most impacts can be mitigated. The information attained at a desktop level indicates that the design of the proposed development may need to be altered in provision of environmental features. However, this will need to be confirmed with more in-depth studies and groundtruthing in the EIA phase of the project. The farm portion is not considered highly sensitive and can accommodate the proposed development.

- **Remainder of portion 226**

Table 12: Remainder of farm portion 226

	Low	Medium	High
Environmental issue			
Biodiversity assessment (flora, fauna)	1		
Biodiversity assessment (bats)		2	
Socio Economic Issues	1		
Proximity to sensitive features (Heritage, wetlands and surface water features)			3
Visual	1		
Geology/geotechnical		2	
Soils and Agricultural Potential	1		
Total	**11 (Acceptable)**		
Mitigation potential		2	

This farm portion is approximately 1 651Ha in size. Results show that the site is **acceptable** (Table 12). The site is not considered to be sensitive from a biodiversity perspective as clearing will not take place on a large scale. The majority of vegetation will remain in place. Bird diversity is considered to be low. However, there is roosting habitat available for bats which indicate probable occurrence. The alluvial deposits that are expected to occur along the larger drainage lines are likely to consist of loose, unconsolidated sands and gravels which provide a poor founding medium for wind turbines. Surface water bodies can also be found in and across the site.

Although a number of environmental issues would be affected, most impacts can be mitigated. The information attained at a desktop level indicates that the design of the proposed development may need to be altered in provision of environmental features. However, this will need to be confirmed with more in-depth studies and groundtruthing in the EIA phase of the project. The farm portion is not considered highly sensitive and can accommodate the proposed development.

- **Farm Portion 2/213**

Table 13: Farm portion 2/213

	Low	Medium	High
Environmental issue			
Biodiversity assessment (flora, fauna)	1		
Biodiversity assessment (bats)	1		
Socio Economic Issues	1		
Proximity to sensitive features (Heritage, wetlands and surface water features)			3
Visual	1		
Geology/geotechnical		2	
Soils and Agricultural Potential	1		
Total	**11 (Acceptable)**		
Mitigation potential		2	

This farm portion is approximately 1 983Ha in size. Results show that the site is **acceptable** (Table 13). The site is not considered to be sensitive from a biodiversity perspective as clearing will not take place on a large scale. The majority of vegetation will remain in place. Bird diversity is considered to be low. The alluvial deposits that are expected to occur along the larger drainage lines are likely to consist of loose, unconsolidated sands and gravels which provide a poor founding medium for wind turbines. Surface water bodies can also be found in and across the site.

Although a number of environmental issues would be affected, most impacts can be mitigated. The information attained at a desktop level indicates that the design of the proposed development may need to be altered in provision of environmental features. However, this will need to be confirmed with more in-depth studies and groundtruthing in the EIA phase of the project. The farm portion is not considered highly sensitive and can accommodate the proposed development.

- **Farm portion 1/213**

Table 14: Farm portions 1/213

	Low	**Medium**	**High**
Environmental issue			
Biodiversity assessment (flora, fauna)	1		
Biodiversity assessment (bats)	1		
Socio Economic Issues	1		
Proximity to sensitive features (Heritage, wetlands and surface water features)			3
Visual	1		
Geology/geotechnical		2	
Soils and Agricultural Potential	1		
Total	**11 (Acceptable)**		
Mitigation potential		2	

This farm portion is approximately 4 062Ha in size. Results show that the site is **acceptable** (Table 14). The site is not considered to be sensitive from a biodiversity perspective as clearing will not take place on a large scale. The majority of vegetation will remain in place. Bird diversity is considered to be low. The alluvial deposits that are expected to occur along the larger drainage lines are likely to consist of loose, unconsolidated sands and gravels which provide a poor founding medium for wind turbines. Surface water bodies can also be found in and across the site.

Although a number of environmental issues would be affected, most impacts can be mitigated. The information attained at a desktop level indicates that the design of the proposed development may need to be altered in provision of environmental features. However, this will need to be confirmed with more in-depth studies and groundtruthing in the EIA phase of the project. The farm portion is not considered highly sensitive and can accommodate the proposed development.

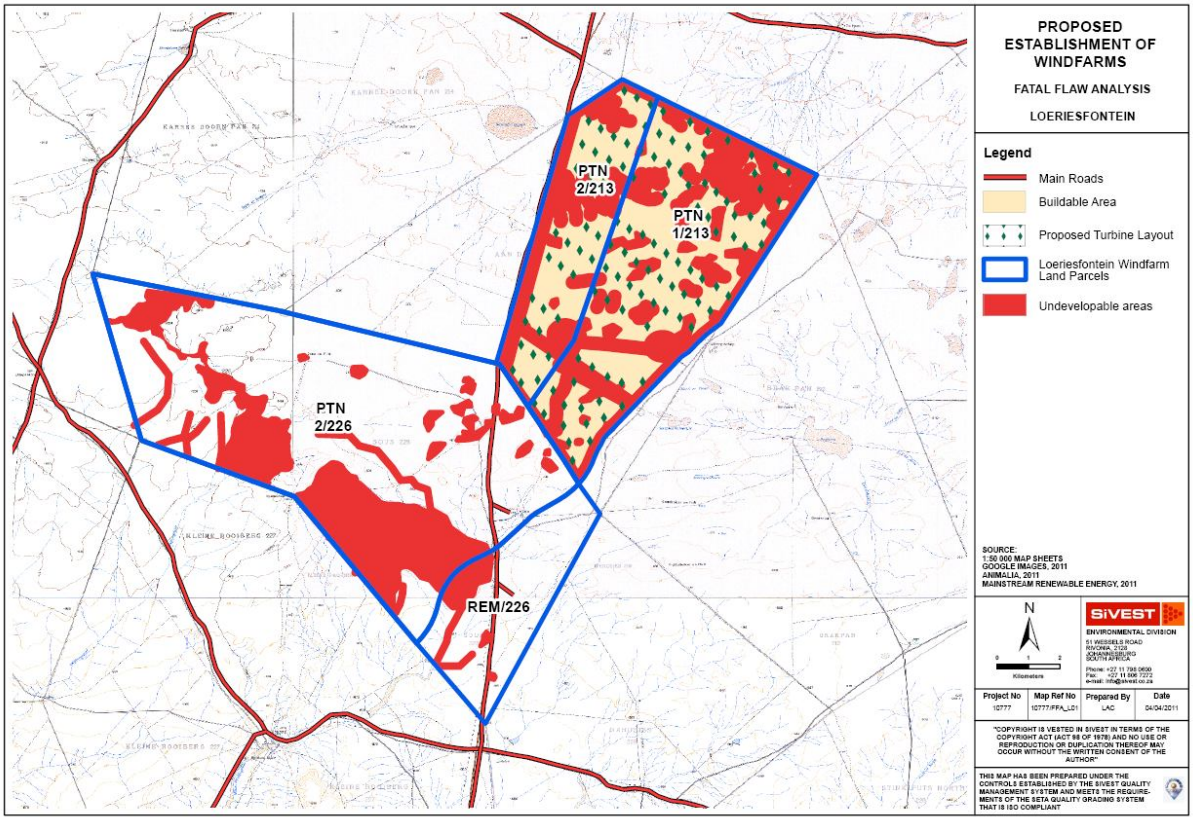

Figure 28: Site Preference Rating for Loeriesfontein Site

5.2 Prieska site

Table 15: Summary of fatal flaws for the Prieska Site

FARM PORTION	POTENTIAL FATAL FLAWS								
	Fauna	**Flora**	**Avifauna**	**Heritage**	**Surface water**	**Visual**	**Soils and Agricultural Potential**	**Socio-economic input**	**Geotechnical**
Portion 1/118	Sheep farming is the main activity practised in the area. This activity will not affect the proposed development however. No areas of exclusion have been included. Possible occurrence of small mammals	Majority of land cover classified as shrubland and fynbos. A small portion of this site is covered by thicket and Bushland. Majority of the vegetation is classified as Bushmanland basin Shrub land. This vegetation is classified as "least	Presence of Marshall Eagles observed during site visits. There are no important bird areas that fall onto the study site. No areas of exclusion have been highlighted.	Possible occurrence of stone age sites, 60 year old buildings, graves and cemeteries, and mining heritage. No areas of exclusion identified for this portion from a heritage perspective.	Several drainage lines traverse this portion. Areas of exclusion have been identified.	Day and night-time visual exposure of the proposed wind farm to people travelling along the R375 between Prieska and Vanwyksvlei and on the R386 between Prieska and Carnarvon. Day and	Site has extremely low agricultural potential in terms of crop production while moderately low for grazing. Majority of the site has soils that are not suitable for agriculture but can be suitable for forestry or	Surrounding land uses show the study area as vacant/ unspecified To the north west is a defunct Copper mine. Tourist spots include Die Bos Nature Reserve and Prieska: Ria Huysamen Aloe	Presence of collapsible sands at limited areas underlain by Kalahari Group deposits. Pedogenic calcrete are limited to areas underlain by tertiary deposits. Alluvial deposits along larger drainage lines Moderately

FARM PORTION	POTENTIAL FATAL FLAWS								
	Fauna	**Flora**	**Avifauna**	**Heritage**	**Surface water**	**Visual**	**Soils and Agricultural Potential**	**Socio-economic input**	**Geotechnical**
	and antelopes which similarly do not require areas of exclusion as the species expected to occur are not sensitive species.	threatened". The site is very arid with presence of endemic species with an exception of exotic prickly pears. The area is grazed by sheep and is therefore not pristine.				night-time visual exposure of the proposed wind farm to people residing in farmhouses within the boundaries of the proposed site and surrounding area. Visibility from gravel farm access roads.	grazing where climate permits. To the west of the site, the site is of poor suitability for arable agriculture where the climate permits. No areas of exclusion have been highlighted fort his portion.	Garden. No areas of exclusion have been highlighted on the portions of the study site from a socio-economic perspective however.	hard excavation conditions. More in-depth studies are required to determine the precise location of problematic areas for construction. At a desktop level, no areas have been identified for exclusion.
Portion 3/118		Majority of land cover classified as shrubland and		Possible occurrence of stone age sites,	Few wetlands identified on this portion in addition to the several	Potential impact of shadow flicker on	Site has extremely low agricultural	Surrounding land uses show the study area	

FARM PORTION	POTENTIAL FATAL FLAWS								
	Fauna	Flora	Avifauna	Heritage	Surface water	Visual	Soils and Agricultural Potential	Socio-economic input	Geotechnical
		fynbos Approximately half of the portion is covered by vegetation classified as Bushmanland basin Shrub land (west) whilst the other half of this portion is classified as Bushmanland Arid Grassland (east). Both vegetation types are classified as "Least Threatened". The site is		60 year old buildings, graves and cemeteries, and mining heritage. No areas of exclusion identified at a desktop level for this portion from a heritage perspective.	drainage lines. Areas of exclusion have been identified.	people residing within close proximity to proposed wind turbines. Although the proposed wind farm is expected to be highly visible, there are no potentially sensitive visual receptors present to experience the visual impact and no areas of exclusion	potential in terms of crop production while moderately low for grazing. Majority of the site has soils that are not suitable for agriculture but can be suitable for forestry or grazing where climate permits. No areas of exclusion have been highlighted	as vacant/ unspecified To the north west is a defunct Copper mine. Tourist spots include Die Bos Nature Reserve and Prieska: Ria Huysamen Aloe Garden. No areas of exclusion have been highlighted on the portions of the study	

FARM PORTION	POTENTIAL FATAL FLAWS								
	Fauna	**Flora**	**Avifauna**	**Heritage**	**Surface water**	**Visual**	**Soils and Agricultural Potential**	**Socio-economic input**	**Geotechnical**
		very arid with presence of endemic species with an exception of exotic prickly pears. The area is grazed by sheep and is therefore not pristine.				have therefore been highlighted.	fort his portion.	site from a socio-economic perspective however.	
Reminder of 102		Majority of land cover classified as shrubland and fynbos Majority of the vegetation is classified as Bushmanland Arid Grassland. A small portion		Possible occurrence of stone age sites, 60 year old buildings, graves and cemeteries, and mining heritage. Old graves were	Several wetlands identified on this portion in addition to the several drainage lines. Areas of exclusion have been identified.		Site has extremely low agricultural potential in terms of crop production while moderately low for grazing Majority of	Surrounding land uses show the study area as vacant/ unspecified To the north west is a defunct Copper mine. Tourist	

FARM PORTION	POTENTIAL FATAL FLAWS								
	Fauna	Flora	Avifauna	Heritage	Surface water	Visual	Soils and Agricultural Potential	Socio-economic input	Geotechnical
		of the north west of this portion is classified as Bushmanland Basin Shrubland which is also classified as "Least threatened". The site is very arid with presence of endemic species with an exception of exotic prickly pears. The area is grazed by sheep and is therefore not pristine.		observed on site. More in-depth field studies will be required by an appropriate heritage specialist in order for additional sites to be identified and the applicable buffer zones to be applied.			the site has soils that are not suitable for agriculture but can be suitable for forestry or grazing where climate permits. No areas of exclusion have been highlighted fort his portion.	spots include Die Bos Nature Reserve and Prieska: Ria Huysamen Aloe Garden. No areas of exclusion have been highlighted on the portions of the study site from a socio-economic perspective however.	

5.2.1 Site specific results and discussion (Prieska)

Figure 29 represents the fatal flaw analysis map for the Prieska study site. Each portion is evaluated below.

- **Farm portion 1/118**

Table 16: Farm portion 1/118

	Low	Medium	High
Environmental issue			
Biodiversity assessment (flora, fauna)	1		
Biodiversity assessment (bats)	1		
Socio Economic Issues	1		
Proximity to sensitive features (Heritage, wetlands and surface water features)			3
Visual	1		
Geology/geotechnical		2	
Soils and Agricultural Potential	1		
Total	**10 (Acceptable)**		
Mitigation potential			3

This farm portion is approximately 2 884Ha in size. Results show that the site is **acceptable** (Table 16). No major sensitivities from a biodiversity perspective were identified. Bird sensitivity was determined to be low. There is no presence of roosting surfaces which indicate a habitat for bats. The alluvial deposits that are expected to occur along the larger drainage lines are likely to consist of loose, unconsolidated sands and gravels which provide a poor founding medium for wind turbines. Problematic areas in terms of geotechnical instability are expected in areas but do not affect the whole site. No wetlands were observed to occur on this portion. However, several drainage lines were prominent which will affect the developable area for this portion somewhat. Wind turbines will need to be strategically placed to avoid impacts to these resources. In general, a good number of environmental issues would not be affected and most impacts can easily be mitigated. The farm portion is not considered highly sensitive and can accommodate the proposed development.

- **Farm portion 3/118**

Table 17: farm portion 3/118

	Low	Medium	High
Environmental issue			
Biodiversity assessment (flora, fauna)	1		
Biodiversity assessment (avifauna especially bats)	1		
Socio Economic Issues	1		
Proximity to sensitive features (Heritage, wetlands and surface water features)			3
Visual	1		
Geology/geotechnical		2	
Soils and Agricultural Potential	1		
Total	**10 (Acceptable)**		
Mitigation potential		2	

This farm portion is approximately 2 857Ha in size. Results show that the site is **acceptable** (Table 17). No major sensitivities from a biodiversity perspective were identified. Bird sensitivity was determined to be low. There is no presence of roosting surfaces which indicate a habitat for bats. The alluvial deposits that are expected to occur along the larger drainage lines are likely to consist of loose, unconsolidated sands and gravels which provide a poor founding medium for wind turbines. Problematic areas in terms of geotechnical instability are expected in areas but do not affect the whole site. Few wetlands were observed to occur on this portion in addition to several drainage lines which were prominent. The presence of these surface water features will affect the developable area for this portion somewhat. Wind turbines will need to be strategically placed to avoid impacts to these resources. In general, a good number of environmental issues would not be affected and most impacts can easily be mitigated. The farm portion is not considered highly sensitive and can accommodate the proposed development.

- **Remainder of 102**

Table 18: Remainder of 102

	Low	Medium	High
Environmental issue			
Biodiversity assessment (flora, fauna)	1		
Biodiversity assessment (avifauna especially bats)	1		
Socio Economic Issues	1		
Proximity to sensitive features (Heritage, wetlands and surface water features)			3
Visual	1		
Geology/geotechnical		2	
Soils and Agricultural Potential	1		
Total	**10 (Acceptable)**		
Mitigation potential		2	

This farm portion is approximately 7 238Ha in size and the largest of the three portions. Results show that the site is **acceptable** (Table 18). No major sensitivities from a biodiversity perspective were identified. Bird sensitivity was determined to be low. There is no presence of roosting surfaces which indicate a habitat for bats. The alluvial deposits that are expected to occur along the larger drainage lines are likely to consist of loose, unconsolidated sands and gravels which provide a poor founding medium for wind turbines. Problematic areas in terms of geotechnical instability are expected in areas but do not affect the whole site. Few wetlands were observed to occur on this portion in addition to few drainage lines which were also prominent. The presence of these surface water features will affect the developable area for this portion somewhat. Wind turbines will need to be strategically placed to avoid impacts to these resources. Site visits revealed the presence of old graves to the north west of this portion. In general, a good number of environmental issues would not be affected and most impacts can be mitigated. The farm portion is not considered highly sensitive and can accommodate the proposed development.

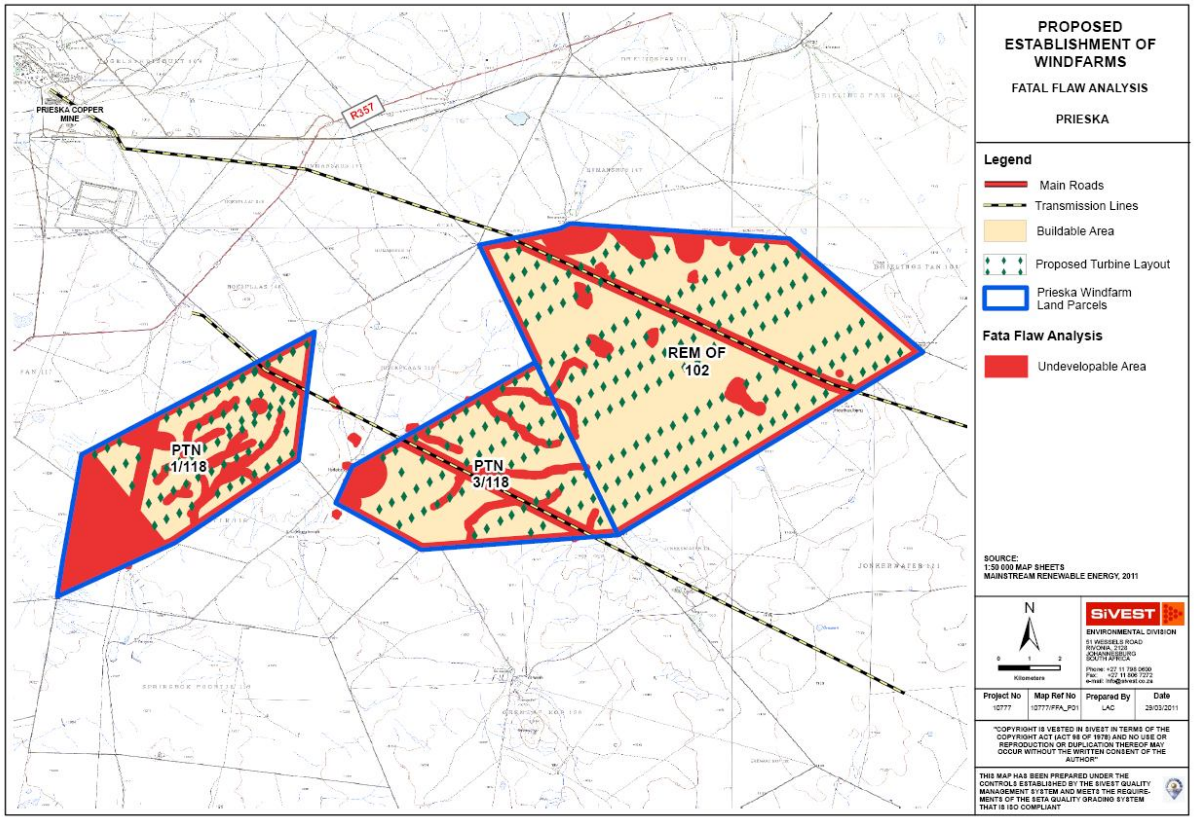

Figure 29: Site Preference rating for Prieska Site

5.3 Noupoort site

Table 19: Summary of fatal flaws for the Noupoort Site

FARM PORTION	POTENTIAL FATAL FLAWS								
	Fauna	**Flora**	**Avifauna**	**Heritage**	**Surface water**	**Visual**	**Soils and Agricultural Potential**	**Socio-economic input**	**Geotechnical**
Portion 1/182	Presence of Steenbok, blesbok, Kudu, Rooi Rhebok. Rearing of domestic animals (sheep, cattle and goats). Jackal and caracal, mongoose, ground squirrel and meerkats. No areas of exclusion have been	Site land cover is categorized as grassland. The classes of vegetation dominant on this portion are: The Karoo Escarpment Grassland. A minimal area is covered by Tarkastad Montane Shrubland. Each vegetation type is classified as least threatened and do not require	There are no important bird areas that fall onto the study site. No areas of exclusion have been highlighted.	Possible occurrence of stone age sites, 60 year old buildings, graves and cemeteries. No areas of exclusion identified at a desktop level for this portion from a heritage perspective. More in-depth field studies will be required	There are several drainage lines that are associated with valley bottom wetlands throughout the portion. These areas have been earmarked as exclusion areas.	Potential day and night-time visual exposure of wind farm to people travelling along the N9 between Colesburg and Middelburg. Potential visibility from surrounding farmhouses and gravel	Site has extremely low agricultural potential in terms of crop production while moderately low for grazing Majority of the site has soils that are not suitable for agriculture but can be suitable for forestry or	Surrounding land uses show the study area as vacant/ unspecified. Proximity to the Noupoort town and commercial area indicates source of income to the residents. Tourism spots from the CDS report 2007 are; Blockhouse and Hospital Hill, Garden of	The portion is characterized by mountainous terrain, talus deposits, alluvial deposits, calcrete, and hard excavation conditions in areas. These may pose problematic areas where identified. However, these areas

FARM PORTION	POTENTIAL FATAL FLAWS								
	Fauna	**Flora**	**Avifauna**	**Heritage**	**Surface water**	**Visual**	**Soils and Agricultural Potential**	**Socio-economic input**	**Geotechnical**
	included for these animals as these species are not considered endangered. Presence of surfaces for roosting seen in all farm portions. Three species of concern may potentially occur within the study area, identified at a desktop	protection. No specific areas have been identified for exclusion from a desktop level.		by an appropriate heritage specialist in order for additional sites to be identified and the applicable buffer zones to be applied.		farm access roads. No specific areas have been identified for exclusion however.	grazing where climate permits. This site also has soils that are not suitable for agriculture or commercial forestry but can be suitable for conservation, recreation and water catchments. There are no exclusion areas as far as soil and agricultural potential are concerned.	Remembrance. There are no exclusion areas as far as socio-economic issues are concerned at this stage.	can only be determined by more in-depth studies. As such, no areas have been zoned for exclusion.

FARM PORTION	POTENTIAL FATAL FLAWS								
	Fauna	Flora	Avifauna	Heritage	Surface water	Visual	Soils and Agricultural Potential	Socio-economic input	Geotechnical
Remainder of 168	level and that require exclusion. These species include: *Miniopterus natalensis* (Natal long-fingered bat), *Cistugo lesueuri* (Lesueur's Wing-gland bat) and *Rhinolophus denti* (Dent's horseshoe bat). Areas of exclusion have been identified.			Possible occurrence of stone age sites, 60 year old buildings, graves and cemeteries. Rock art (located to the eastern part of this farm portion) and old structures (located to the western part of this farm portion) were observed on site.					

FARM PORTION	POTENTIAL FATAL FLAWS								
	Fauna	Flora	Avifauna	Heritage	Surface water	Visual	Soils and Agricultural Potential	Socio-economic input	Geotechnical
Portion 3/178		Site land cover is categorized as grassland. The classes of vegetation dominant on this portion are: The Karoo Escarpment Grassland. A minimal area is covered by Tarkastad Montane Shrubland. Each vegetation type is classified as least threatened and do not require protection. No specific areas		Presence of stone age sites located on the foot of the hills, 60 year old buildings, graves and cemeteries may be present. More in-depth studies will be required to ascertain site specific areas of exclusion. As such, no areas have		Potential day and night-time visual exposure of wind farm to people travelling along the N9 between Colesburg and Middelburg. Potential visibility from surrounding farmhouses and gravel farm access	Site has extremely low agricultural potential in terms of crop production while moderately low for grazing Majority of the site has soils that are not suitable for agriculture but can be suitable for forestry and grazing where	Surrounding land uses show the study area as vacant/ unspecified. Proximity to the Noupoort town and commercial area indicates source of income to the residents. Tourism spots from the CDS report 2007 are; Blockhouse and Hospital Hill, Garden of Remembrance. There are no	

FARM PORTION	POTENTIAL FATAL FLAWS								
	Fauna	Flora	Avifauna	Heritage	Surface water	Visual	Soils and Agricultural Potential	Socio-economic input	Geotechnical
		have been identified for exclusion from a desktop level.		been excluded from a heritage perspective at a desktop level.		roads. No specific areas have been identified for exclusion however.	climate permits. This site also has soils that are not suitable for agriculture or commercial forestry but can be suitable for conservation, recreation and water catchments. There are no exclusion areas as far as soil and agricultural potential are concerned.	exclusion areas as far as socio-economic issues are concerned at this stage.	
Portion 21/181		Site land cover is categorized as		Presence of stone age		Potential day and	Site has extremely	Surrounding land uses	

FARM PORTION	POTENTIAL FATAL FLAWS								
	Fauna	Flora	Avifauna	Heritage	Surface water	Visual	Soils and Agricultural Potential	Socio-economic input	Geotechnical
		grassland with few portions as shrubland/fynbos. The classes of vegetation dominant on this portion are: Tarkastad Montane Shrubland and Karoo Escarpment Grassland. The two dominant vegetation types are classified as least threatened and do not require protection. No specific areas have been identified for		sites located on the foot of the hills, 60 year old buildings, graves and cemeteries may be present. More in-depth studies will be required to ascertain site specific areas of exclusion. As such, no areas have been excluded from a heritage		night-time visual exposure of wind farm to people travelling along the N9 between Colesburg and Middelburg. Potential visibility of the western portion of the proposed wind farm from Noupoort. Potential visibility from	low agricultural potential in terms of crop production while moderately low for grazing Majority of the site has soils that are not suitable for agriculture but can be suitable for forestry of grazing where climate permits. This site also has soils that	show the study area as vacant/ unspecified. Proximity to the Noupoort town and commercial area indicates source of income to the residents Tourism spots from the CDS report 2007 are; Blockhouse and Hospital Hill, Garden of Remembrance. There are no exclusion areas as far as socio-economic	

FARM PORTION	POTENTIAL FATAL FLAWS								
	Fauna	Flora	Avifauna	Heritage	Surface water	Visual	Soils and Agricultural Potential	Socio-economic input	Geotechnical
		exclusion from a desktop level.		perspective at a desk top level.		surrounding farmhouses and gravel farm access roads. No specific areas have been identified for exclusion however.	are not suitable for agriculture or commercial forestry but can be suitable for conservation, recreation and water catchments. There are no exclusion areas as far as soil and agricultural potential are concerned.	issues are concerned at this stage.	

5.3.1 Site specific results and discussion (Noupoort)

Figure 30 represents the fatal flaw analysis map for the Noupoort study site. Each portion is evaluated below.

- **Farm portion 21/182**

Table 20: Farm portion 21/182

	Low	Medium	High
Environmental issue			
Biodiversity assessment (flora, fauna)	1		
Biodiversity assessment (bats)			3
Socio Economic Issues		2	
Proximity to sensitive features (Heritage, wetlands and surface water features)			3
Visual		2	
Geology/geotechnical		2	
Soils and Agricultural Potential	1		
Total	**14 (Acceptable)**		
Mitigation potential		2	

This farm portion is approximately 1 277Ha in size. Results show that the site is **acceptable** (Table 20). Biodiversity on the site is not considered to be particularly sensitive. However, there is the presence of bat roosting surfaces which indicate a habitat for bats. Three species on concern may potentially be found on site. The area has a several geotechnical issues that may pose problematic conditions for construction of the wind turbines. Although, the specific areas will need to be identified and no exclusion areas have been identified at a desktop level. There is very little presence of water bodies on the site. However, the portion contains a relatively high amount of drainage systems which have been excluded as undevelopable area. From a visual perspective, residential areas and the gravel roads will be impacted somewhat.

Overall, a good number of environmental issues would be affected thereby impacting on the amount of developable area. This may impact on the number of wind turbines that the portion can accommodate. Nonetheless, at this stage, exclusion areas have been identified at a high level and on-site in-depth studies would be needed in order to confirm findings before areas are totally excluded.

- **Remainder of portion 168**

Table 21: Remainder of farm portion 168

	Low	Medium	High
Environmental issue			
Biodiversity assessment (flora, fauna)	1		
Biodiversity assessment (bats)			3
Socio Economic Issues		2	
Proximity to sensitive features (Heritage, wetlands and surface water features)			3
Visual	1		
Geology/geotechnical		2	
Soils and Agricultural Potential	1		
Total	**13 (Acceptable)**		
Mitigation potential		2	

This farm portion is approximately 4 746Ha in size and is the largest of the four farm portions. Results show that the site is **acceptable** (Table 21). Biodiversity on the site is not considered to be particularly sensitive. However, there is the presence of bat roosting surfaces which indicate a habitat for bats. Three species on concern may potentially be found on site. The area has a several geotechnical issues that may pose problematic conditions for construction of the wind turbines. Although, the specific areas will need to be identified and no exclusion areas have been identified at a desktop level. There is a very little presence of open water bodies on the site. However, the portion contains a relatively high amount of drainage systems which have been excluded as undevelopable area. Rock art and old structures were identified in the field with respect to heritage concerns. Finally, from a visual perspective, residential areas and the gravel roads will be impacted somewhat.

Overall, a good number of environmental issues would be affected thereby impacting on the amount of developable area. This may impact on the number of wind turbines that the portion can accommodate. Nonetheless, at this stage, exclusion areas have been identified at a high level and on-site in-depth studies would be needed in order to confirm findings before areas are totally excluded.

- **Farm Portion 3/178**

Table 22: Farm portion 3/178

	Low	Medium	High
Environmental issue			
Biodiversity assessment (flora, fauna)		2	
Biodiversity assessment (bats)			3
Socio Economic Issues	1		
Proximity to sensitive features (Heritage, wetlands and surface water features)			3
Visual	1		
Geology/geotechnical		2	
Soils and Agricultural Potential	1		
Total	**13 (Acceptable)**		
Mitigation potential		2	

This farm portion is approximately 139Ha in size and is the smallest of the four farm portions. Results show that the site is **acceptable** (Table 22). Biodiversity on the site is not considered to be particularly sensitive. However, there is the presence of bat roosting surfaces which indicate a habitat for bats. Three species on concern may potentially be found on site. The area has a several geotechnical issues that may pose problematic conditions for construction of the wind turbines. Although, the specific areas will need to be identified and no exclusion areas have been identified at a desktop level. There is a very little presence of open water bodies on the site. However, the portion contains a relatively high amount of drainage systems which have been excluded as undevelopable area. Rock art and old structures were identified in the field with respect to heritage concerns. Finally, from a visual perspective, residential areas and the gravel roads will be impacted somewhat.

Overall, a good number of environmental issues would be affected thereby impacting on the amount of developable area. This may impact on the number of wind turbines that the portion can accommodate. Nonetheless, at this stage, exclusion areas have been identified at a high level and on-site in-depth studies would be needed in order to confirm findings before areas are totally excluded.

- **Farm portion 1/181**

Table 23: Farm portions 1/181

	Low	Medium	High
Environmental issue			
Biodiversity assessment (flora, fauna)	1		
Biodiversity assessment (bats)			3
Socio Economic Issues	1		
Proximity to sensitive features (Heritage, wetlands and surface water features)			3
Visual	1		
Geology/geotechnical		2	
Soils and Agricultural Potential	1		
Total	**12 (Acceptable)**		

Mitigation potential		2	

This farm portion is approximately 1 470Ha in size. Results show that the site is **acceptable** (Table 23). Biodiversity on the site is not considered to be particularly sensitive. However, there is the presence of bat roosting surfaces which indicate a habitat for bats. Three species on concern may potentially be found on site. The area has a several geotechnical issues that may pose problematic conditions for construction of the wind turbines. Although, the specific areas will need to be identified and no exclusion areas have been identified at a desktop level. There is a very little presence of open water bodies on the site. However, the portion contains a relatively high amount of drainage systems which have been excluded as undevelopable area. Rock art and old structures were identified in the field with respect to heritage concerns. Finally, from a visual perspective, residential areas and the gravel roads will be impacted somewhat.

Overall, a good number of environmental issues would be affected thereby impacting on the amount of developable area. This may impact on the number of wind turbines that the portion can accommodate. Nonetheless, at this stage, exclusion areas have been identified at a high level and on-site in-depth studies would be needed in order to confirm findings before areas are totally excluded.

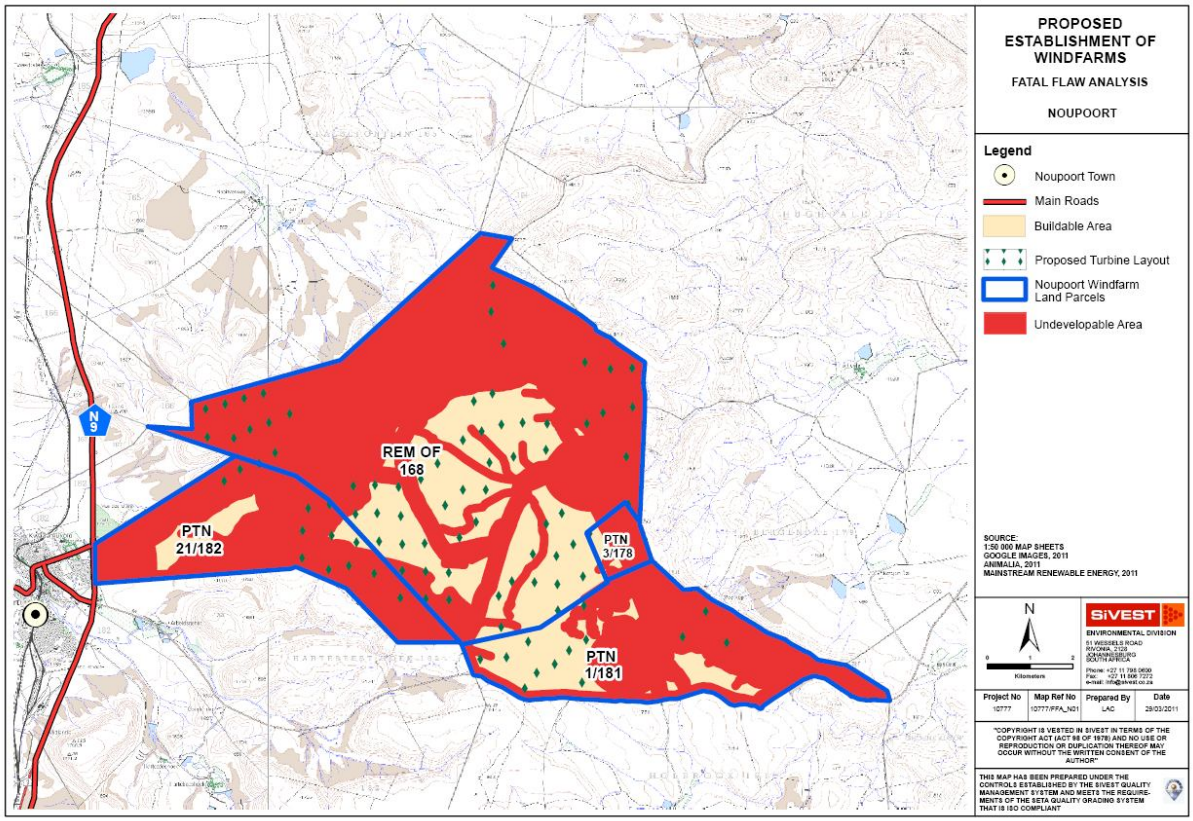

Figure 30: Site Preference Rating for Noupoort Site

5.4 Lady Grey site

Table 24: Summary of fatal flaws for the Lady Grey Site

FARM PORTION	POTENTIAL FATAL FLAWS								
	Fauna	**Flora**	**Avifauna**	**Heritage**	**Surface water**	**Visual**	**Soils and Agricultural Potential**	**Socio-economic input**	**Geotechnical**
Portion 1/139	Presence of domesticated animals (sheep and cattle) on the sites. Wild animals include Rheebok, caracal, jackal and blesbok. No areas of exclusion have been included for these animals as these	Vegetation on the site is the Southern Drakensberg Highland Grassland which is Least threatened and poorly protected as well as the Lesotho Highland basalt grassland which is hardly protected	Presence of roosting surfaces on the northern parts of the farm portions. Storks, barn owls, grey winged partridge and Cape Vultures have been seen in the area. A breeding colony of this species is	Possible occurrence of stone age sites, 60 year old buildings, graves and cemeteries. More in-depth studies will be required to ascertain site specific areas of exclusion. As such, no areas have been	Water bodies spread across the farm portions with small tributaries and streams seen in both farm portions. Wetlands are located in valley bottoms as channelled valley bottom wetlands. All these areas as identified at a desktop level have been	Day and night-time visual exposure of the proposed wind farm to tourists and people travelling along the R58 between Lady Grey and Barkley East; Visibility from	The agricultural potential for the study area is classified as being low agricultural potential, in terms of crop production while moderate to moderately high for grazing Soils are not suitable for	Surrounding land uses of the site indicate commercial agriculture as a source of income and livelihood. The Maloti Drakensberg tourist route to swartfontein to the	Moderately steep topography near the northern and south eastern parts of the site boundaries. Moderate shallow groundwater conditions. Limited expansive soils. Hard excavation conditions are likely to be

FARM PORTION	POTENTIAL FATAL FLAWS								
	Fauna	**Flora**	**Avifauna**	**Heritage**	**Surface water**	**Visual**	**Soils and Agricultural Potential**	**Socio-economic input**	**Geotechnical**
	species are not considered endangered. The site is sensitive in terms of potential occurrence of bat species particularly Lesueur's wing gland bat. Areas of exclusion have been identified in this respect.	and least threatened. No areas of exclusion have been included for flora as these vegetation types are not highly sensitive. A large amount of transformation is also present.	located in close proximity to the site in the Karnmelkskloof. The Cape Vulture is an extremely sensitive species. Given the proximity and the type of proposed development, the Lady Grey site is viewed as a fatal flaw in terms of the risks posed to the	excluded from a heritage perspective at a desk top level.	zoned as areas of exclusion (undevelopable area).	farmhouses within the boundaries of the proposed site; Potential visibility of portions of the wind farm from farmsteads in the surrounding area; Potential visibility from localized areas of high lying ground surrounding the	arable agriculture. However, can be suitable for forestry and grazing where the climate permits. The areas of moderate potential in terms of agricultural potential are not viewed as sensitive. Therefore, there are no areas of exclusion on the basis of soil	vulture breeding colony. No specific areas on the study site need be excluded from a socio-economic perspective.	encountered. More in-depth studies are required to identify problem specific areas. Hence, no areas of exclusion have been identified in this respect at this stage.

FARM PORTION	POTENTIAL FATAL FLAWS								
	Fauna	Flora	Avifauna	Heritage	Surface water	Visual	Soils and Agricultural Potential	Socio-economic input	Geotechnical
			Vulture colony.			proposed site. Potential impact of shadow flicker on people travelling along the R58. The visual impact in relation to the R58 significant, although the exact areas that will exert this intrusion cannot be ascertained from a	potential.		

FARM PORTION	POTENTIAL FATAL FLAWS								
	Fauna	Flora	Avifauna	Heritage	Surface water	Visual	Soils and Agricultural Potential	Socio-economic input	Geotechnical
						desktop level alone. Hence, no areas of exclusion have been included.			
Remainder of 139				Possible occurrence of stone age sites, 60 year old buildings, graves and cemeteries. Old graves (located in the western region of this farm portion) were observed on site. More in-		Day and night-time visual exposure of the proposed wind farm to tourists and people travelling along the R58 between Lady Grey and Barkley East;		Surrounding land uses of the site indicate commercial agriculture as a source of income and livelihood. The Maloti Drakensberg tourist route to	

FARM PORTION	POTENTIAL FATAL FLAWS								
	Fauna	Flora	Avifauna	Heritage	Surface water	Visual	Soils and Agricultural Potential	Socio-economic input	Geotechnical
				depth studies will be required to ascertain site specific areas of exclusion. As such, no areas have been excluded from a heritage perspective at a desk top level.		Visibility from farmhouses within the boundaries of the proposed site; Potential visibility of portions of the wind farm from farmsteads in the surrounding area; Potential visibility from localized areas of high lying ground		swartfontein to the vulture breeding colony	

FARM PORTION	POTENTIAL FATAL FLAWS								
	Fauna	Flora	Avifauna	Heritage	Surface water	Visual	Soils and Agricultural Potential	Socio-economic input	Geotechnical
						surrounding the proposed site. Potential impact of shadow flicker on people travelling along the R58;			

5.4.1 Site specific results and discussion (Lady Grey)

Figure 31 represents the fatal flaw analysis map for the Lady Grey study site. Each portion is evaluated below.

- **Farm portion 1/139**

Table 25: Farm portion 1/139

	Low	Medium	High
Environmental issue			
Biodiversity assessment (flora, fauna, avifauna)			3
Biodiversity assessment (bats)			3
Socio Economic Issues		2	
Proximity to sensitive features (Heritage, wetlands and surface water features)			3
Visual		2	
Geology/geotechnical			3
Soils and Agricultural Potential	1		
Total	**17 (Not preferred)**		
Mitigation potential	1		

This farm portion is approximately 1 021Ha in size. Results show that the site is **not preferred** (Table 25). In terms of floral biodiversity, the site is not considered to be sensitive due to existing transformation. However, there are roosting surfaces present which indicate habitat for bats (with specific concern to Lesueur's wing gland bat which is a vulnerable species). In addition, the confirmed presence of the Cape Vultures and the proximity of the site to the breeding colony to the west of the study area has been identified as a fatal flaw on this site. The area has a steep topography and extensive hard excavations. Weathered basalt provides an adequate founding medium for wind turbines and shallow foundation options where prevalent. The weathering of this rock typically forms hard core stone boulders. The site may experience problematic areas associated with shallow groundwater conditions and potentially expansive clays. There is very little presence of large water bodies on the site. Wetlands can be found associated with drainage lines as channeled valley bottom wetlands or man made impoundments. The Maloti Drakensberg tourist route to swartfontein which houses the vulture breeding colony is a major tourist route. Finally, people driving along the R58 may be affected by the shadow flicker caused by the rotating turbines. Although a good number of environmental issues would be affected and most impacts can be mitigated, the farm portion is considered ***highly sensitive*** in terms of avifauna and cannot accommodate the proposed development. The national importance of the vulture colony and the very real risks posed by the turbines have resulted in this conclusion. Expert opinion that was sought on this matter agrees with this assessment highlighting that wind farms should not be located within 40km of a breeding colony of Cape Vultures.

- **Remainder of portion 139**

Table 26: Remainder of farm portion 139

	Low	Medium	High
Environmental issue			
Biodiversity assessment (flora, fauna)			3
Biodiversity assessment (avifauna especially bats)			3
Socio Economic Issues		2	
Proximity to sensitive features (Heritage, wetlands and surface water features)			3
Visual		2	
Geology/geotechnical			3
Soils and Agricultural Potential	1		
Total	**17 (Not preferred)**		
Mitigation potential		2	

This farm portion is approximately 1 021Ha in size. Results show that the site is **not preferred** (Table 25). In terms of floral biodiversity, the site is not considered to be sensitive due to existing transformation. However, there are roosting surfaces present which indicate habitat for bats (with specific concern to Lesueur's wing gland bat which is a vulnerable species). In addition, the confirmed presence of the Cape Vultures and the proximity of the site to the breeding colony to the west of the study area has been identified as a fatal flaw on this site. The area has a steep topography and extensive hard excavations. Weathered basalt provides an adequate founding medium for wind turbines and shallow foundation options where prevalent. The weathering of this rock typically forms hard core stone boulders. The site may experience problematic areas associated with shallow groundwater conditions and potentially expansive clays. There is very little presence of large water bodies on the site. Wetlands can be found associated with drainage lines as channeled valley bottom wetlands or man made impoundments. The Maloti Drakensberg tourist route to swartfontein which houses the vulture breeding colony is a major tourist route. Finally, people driving along the R58 may be affected by the shadow flicker caused by the rotating turbines. Although a good number of environmental issues would be affected and most impacts can be mitigated, the farm portion is considered ***highly sensitive*** in terms of avifauna and cannot accommodate the proposed development. The national importance of the vulture colony and the very real risks posed by the turbines have resulted in this conclusion. Expert opinion that was sought on this matter agrees with this assessment highlighting that wind farms should not be located within 40km of a breeding colony of Cape Vultures.

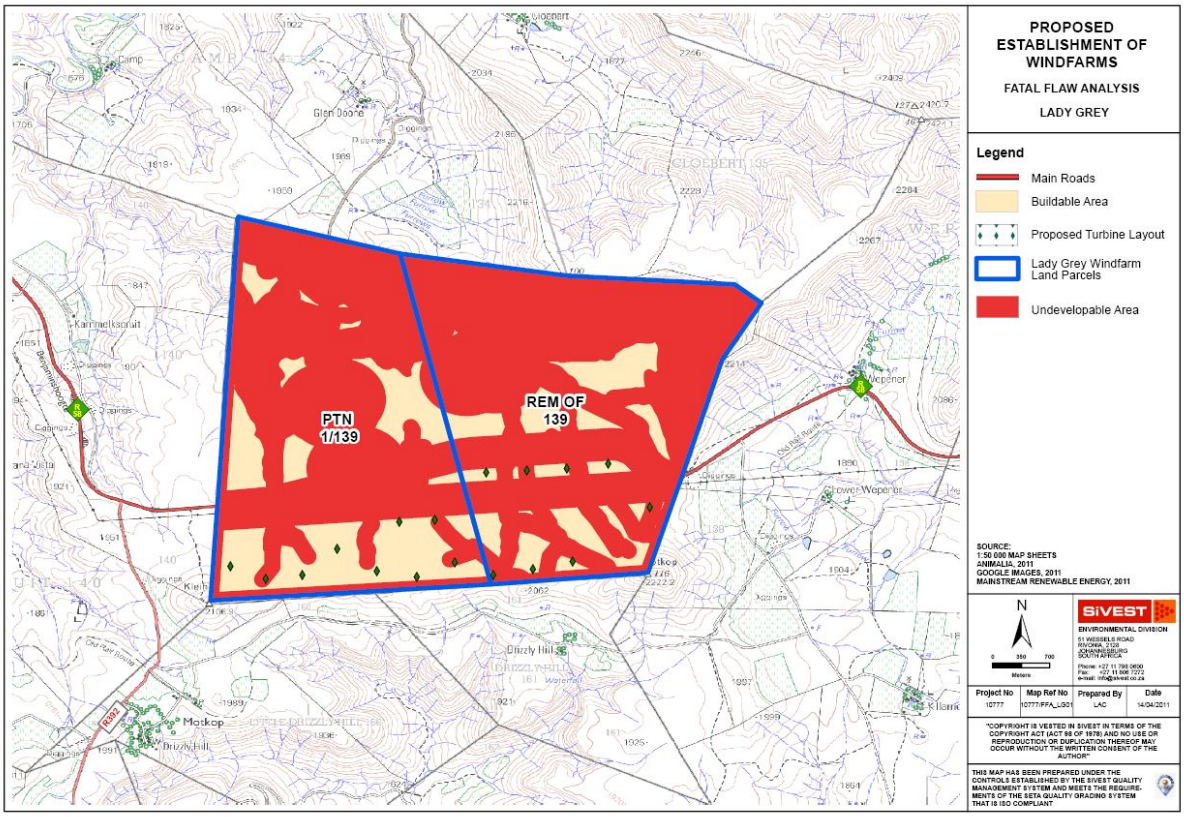

Figure 31: Site Preference Rating for Lady Grey Site

6 POTENTIAL MITIGATION FOR IDENTIFIED IMPACTS

Table 27: Table indication potential mitigations for certain impacts of the Wind Farms

THEME	FARM PORTIONS	IMPACT	POTENTIAL MITIGATION
Flora and Fauna	All Farm portions	Potential loss of vegetation (habitats) and hence faunal species.	▪ Ecological corridors must be preserved in order to maintain an ecologically suitable habitat for various species. ▪ No large scale clearing of vegetation.
Avifauna	All farm portions	Mortalities due to blade collisions during migration Destruction of habitat	▪ The correct placement of wind farms and of individual turbines ▪ Long term monitoring and implementation of mitigation measures to be prioritized
Bats	Loeriesfontein, Noupoort and lady Grey Sites	Mortalities due to blade collisions and barotrauma during foraging Mortalities due to blade collisions and barotrauma during migration Destruction of foraging habitat Destruction of roosts	▪ The correct placement of wind farms and of individual turbines ▪ Long term monitoring and implementation of mitigation measures to be prioritized ▪ Identify areas where bat foraging activity is high and treat them with more caution ▪ Keep all diggings and earth works at a minimum especially in outcrop areas to prevent destruction of roosts
Heritage and Tourism	All farm portions	Minimal visual impacts on major tourist routes and heritage sites.	▪ Avoid erecting the wind turbines on sensitive areas mitigation measures can be utilised such as vegetation screening which will help to obstruct the visual obtrusiveness of the housing units.

			▪ Ensure briefing of construction staff with regards to possible uncovering of heritage artefacts.
Visual	All farm portions	Visual exposure of the facility from protected areas or areas with scenic, cultural or historical significance; Visibility of the facility to people travelling along major routes that are regarded to have high tourism value as a result of scenic, cultural or historical significance; Visibility of the facility to tourism facilities and recreational activities that are largely dependent on the natural scenic or picturesque quality of an area; Visual exposure and close proximity of the facility to settlements and towns;	▪ Siting of turbines in shielded areas where possible. ▪ Decommissioning of the wind farm when the project life cycle comes to an end

		Visual impact during the construction phase of the wind energy facility; Modification of an areas visual character / sense of place; Visibility of operational and security lighting at night; Shadow flicker effect on residences and roads in close proximity to wind turbines.	
Agricultural potential	All farm portions	Clearing of vegetation around the footprint of the turbine with the only direct loss of agricultural land being directly underneath the turbines	▪ Preclude cultivated fields from the site layout
Geotechnical	All farm portions	Erection of Wind Turbines on unstable ground (expansive clays), and hard excavations	▪ Geotechnical engineering solutions will be needed to overcome these impacts.

Surface water	All farm portions	Destruction of habitats for aquatic species; Disruption of biogeochemical cycling processes; Impact on the hydrology of river\stream systems; Displacement of wetland fauna.	▪ Turbines and their associated infrastructure should not take place within wetlands, on the banks of rivers\streams or in the buffer zones attributed to these systems; ▪ Measures to ensure ecological connectivity as well as habitat continuity in the form of ecological links should be considered to reduce loss of aquatic habitat; ▪ Ensuring ecological connectivity between wetlands and rivers will discourage the displacement of wetland mammals. ▪ Create buffers to all surface water features
Socio-economic	All farm portions	Social impacts derived from establishment of the wind farms	▪ Use local labour and contractors where possible. ▪ Ensure ongoing communication with I&APs ▪ Maximise the use of local service providers (accommodation, maintenance, etc.). ▪ Ensure maximisation of local benefits - emphasise and support BEE development. ▪ Focus on support of Local economic development activities.
		Employment equity and occupational opportunities.	▪ Source skills from the local community as far as possible. ▪ Contractors should capacitate locals where

			practical. ▪ The project proponent could consider training to lessen the skills disparity. ▪ Communicate the skill requirements to the local community leaders and community based organizations. ▪ Ensure an equitable process whereby minorities and previously disadvantaged individuals (women) are taken into account.
		Impact on land use	▪ Environmentally considerate planning. ▪ Careful alignment of ancillary infrastructure. ▪ Environmentally responsible construction practices. ▪ Appoint environmental control officer (ECO). ▪ Monitoring of construction process. ▪ Effective environmental management during operation phase. ▪ Monitoring by ECO during the operation phase

7 RESULTS IN TERMS OF APPLICABLE GUIDELINES

The Department of Environmental Affairs (DEA) set out to establish an initial Strategic Environmental Framework (SEF) for the optimal location of wind farms in the coastal provinces of South Africa (Environomics and MetroGIS, 2011). The SEF supports decision-making in respect to the siting of wind farms in the short term, in an effort to streamline applications by providing a national context for decision-making that will be clear in respect to the spatial feasibility and likely negative impacts at suitable locations. This section evaluates the extent to which the results of the environmental constraints analysis currently comply with the SEF guidelines for each site.

7.1 Strategic Environmental Framework Methodology

The methodology for establishing a framework against which the applications can be evaluated is based on an index approach (Environomics & MetroGIS, 2011). At the highest level (primary), overall suitability is determined combining an environmental suitability index and a technical suitability index at a secondary level.

The environmental suitability index is made up of three indexes; namely an ecological suitability index, land use suitability index and visual sensitivity index.

- The ecological suitability index considers the suitability of wind farm sites against threatened ecosystems (mainly sensitive vegetation and habitat) and important bird areas (IBAs) and data.
- The land use suitability index, on the other hand, considers the suitability of wind farm sites in relation to a range of specified sensitive land uses (for example, agricultural areas) along with applicable buffer zones attributed to the sensitive land uses.
- Lastly, the visual suitability index consists of three evaluation criteria including nationally important landscape features identified by the DEA, steep slopes (steeper than 8°) and important visual catchments between national roads and landscape features.

The technical suitability index can be broken down into two sub-indices including wind farm connection potential and wind resource potential. The connection potential considers the proximity of a proposed wind farm to the national electricity grid and the system capacity (700MW wind farm capacity limit for the first integrated resource plan 1 – IRP1). Finally, the wind resource potential takes into consideration the extent of the wind potential for a wind farm site. Therefore, information pertaining to this is necessary in terms of the SEF.

Once all the requirements have been evaluated, the indices are combined and an overall suitability can be derived. For the purposes of this report, the degree to which each site satisfies the methodological requirements for the SEF is evaluated below. This will help to provide an indication of

the extent to which the information collected for each site and used in the constraints analysis currently satisfies the SEF.

7.1.1 Loeriesfontein

In terms of the degree to which the Loeriesfontein site meets the ecological suitability index, important bird areas as well as sensitive habitats have been taken into consideration. This has been evaluated at a high level and hence, a regional context is provided in the environmental constraints analysis. However, site specific information is provided and can be viewed as at a local scale. The information at local scale will however still need to be refined and this will take place in the forthcoming stages of the environmental assessment process for the potential wind farm site.

The land use suitability for the Loeriesfontein site has taken into consideration the range of sensitive environments as well as their applicable buffer zones. From a visual perspective, slope, national landscape features and visual catchments between national roads and landscape features have been taken into consideration. From the analysis undertaken in this report, it is evident that several of the wind turbines overlap with environmentally sensitive areas. However, groundtruthing will be required to determine whether these sites are in fact in sensitive zones. In general, the ecological suitability of the proposed wind farm site in Loeriesfontein, as per the SEF guidelines, has been evaluated.

From a technical suitability point of view, the wind resource potential is yet to be determined at this stage of the assessment. However, monitoring masts will be erected in order to accurately gauge the wind energy generation potential for the Loeriesfontein site. From this information, and taking into account other environmental factors, the generation capacity will be determined. The generation capacity information is therefore yet to be determined. However, a provisional capacity of 30MW is envisaged.

The connection potential is good for the Loeriesfontein site and a 66kV transmission line will be built into the nearby existing network. The technical suitability of the proposed Loeriesfontein wind farm site can be viewed as partially satisfying the SEF guidelines, remembering that the requisite information that is lacking will most likely be obtained later in the process and available to the authorities at the decision-making stage of the environmental authorisation process.

The proposed wind farm site at Loeriesfontein meets with the indices to a large extent and complies with the Overall Suitability in terms of the SEF guidelines,. Where information is not available at present, it is probable that it will be presented later in the environmental assessment process.

7.1.2 Prieska

Much like the Loeriesfontein site, the same ecological suitability criteria was used in analysing the potential for the Prieska site as a wind farm. Hence, in terms of meeting with the SEF guidelines, the Prieska site can similarly be viewed as satisfactorily complying in this respect. It should be noted that

several potential turbine locations do overlap with environmentally sensitive areas. As per the Loeriesfontein site, groundtruthing will be required to determine whether these sites are in fact in sensitive zones.

The technical suitability for the Prieska site as a potential wind farm will likewise initially be based on a 30MW capacity which may change as information becomes available. A 66kV line is to be constructed to connect to the national grid. However, this line will link into an existing line that crosses the site. The connection potential is therefore, good. With regards to wind resource potential, a mast is to be erected on site that will provide this information in the near future.

From the standpoint of Overall Suitability, with relation to the SEF guidelines, the Prieska site meets many of the methodological evaluation criteria. The Prieska site can therefore, generally be viewed as complying with the guidelines. Where information is not available at present, it is probable that it will be presented later in the environmental assessment process.

7.1.3 Noupoort

The same ecological suitability criteria was used in determining the suitability of the Noupoort site, for a proposed wind farm development, as the two previously evaluated sites (Loeriesfontein and Prieska). Hence, the Noupoort site, can be viewed as satisfactorily, complying with the SEF guidelines. The results in the constraints analysis however, reveals that several of the provisionally identified wind turbines sites are positioned on environmentally sensitive areas. Groundtruthing will be required to determine whether these sites are in fact in sensitive zones before design changes can be made.

It is anticipated that 30MW generation capacity is planned for the proposed Noupoort wind farm site. The connection may be based on either a 66kV or 132kV line that will follow an overhead line off site to the connection grid depending on the grid capacity potential. With respect to determining the wind resource potential for the Noupoort site, a mast is to be erected and the information will become available later in the environmental assessment process. In general, the technical suitability of the proposed Noupoort wind farm site can be viewed as partially satisfying the SEF guidelines, remembering that the requisite information that is lacking will most likely be obtained later in the process and available to the authorities at the decision-making stage of the environmental authorisation process.

Overall Suitability, with relation to the SEF guidelines, the Noupoort site meets with many of the methodological evaluation criteria. The Noupoort site can therefore, generally be viewed as complying with the guidelines. Where information is not available at present, it is probable that it will be presented later in the environmental assessment process.

7.1.4 Lady Grey

Applying the methodology of the SEF guidelines to the proposed Lady Grey wind farm site, from an ecological suitability point of view, the same criteria is evaluated in the constraints analysis that was applied to all previous potential wind farm sites (Loeriesfontein, Prieska and Noupoort). Currently, the information provided in this analysis can generally be viewed as satisfactorily complying with the SEF guidelines. Importantly, a highly important bird area (vulture breeding colony) is located in close proximity to the site. From an ecological suitability perspective, the site is not viewed as suitable and this has therefore been highlighted as a fatal flaw and will not require further assessment as the Lady grey site will not be considered for the proposed Wind Farm Development.

8 CONCLUSION RECOMMENDATIONS AND WAY FORWARD

The preferred sites for the wind Farms have been selected based on several key environmental issues at a desk top level as discussed above. Analyses and discussions have revealed that the following farm portions are acceptable and can be considered for the establishment of the proposed wind farm:

- Loeriesfontein: Farm portions; 2/226, RE/226, 2/213 and 1/213
- Noupoort: Farm portions; RE/168, 1/181, 21/182 and 3/178
- Prieska: Farm portions; 3/118, 1/118 and RE/102

The Loeriesfontein and Prieska study areas are the most ideal sites for the proposed development. Nourpoort is the least ideal as vast areas over the site have been identified as potential habitat for several bat species in requirement of conservation. Moreover, the terrain of this site is particularly mountainous and presents a further obstacle to development in terms of access.

The Lady Grey site is a no-go area specifically because of its proximity to a breeding colony of threatened Cape vultures and the sheer magnitude of the impacts will overwhelm the site. The Lady Grey site is therefore designated as a fatal flaw site that will not be able to accommodate the proposed development.

In general, it must be noted however, that each portion is affected to some degree by environmental features. Where extensive areas are identified as undevelopable, it is recommended that these findings be confirmed by more in-depth studies conducted at a ground level to determine the exact area that may be affected. Studies that are particularly important in this respect relate to avifauna studies, bat studies, geotechnical studies, heritage studies and surface water studies. The environmental constraints analysis therefore serves as a provisional indication of the developable potential of a site.

In terms of the level of detail required to satisfy the national SEF guidelines for wind farm development applications, the details at present are inadequate. More in-depth information is needed.

In conclusion, the Loeriesfontein, Noupoort and Prieska sites should therefore be further investigated during the EIA process for the proposed development.

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Appendix A

LIST OF RED DATA SPECIES FOR THE NORTHERN CAPE THAT MAY OCCUR IN THE LOERIESFONTEIN, PRIESKA, NOUPOORT AND LADY GREY STUDY AREAS

Plant Species

RED DATA SPECIES	STATUS
Conophytum achabense	Extinct & Threatened
Conophytum auriflorum	Extinct & Threatened
Conophytum burgeri	Extinct & Threatened
Conophytum herreanthus	Extinct & Threatened
Conophytum phoneciaum	Extinct & Threatened
Conophytum rooidae	Extinct & Threatened
Conophytum schlecteri	Extinct & Threatened
Conophytum semivestitum	Extinct & Threatened
Conophytum smorennskaduense	Extinct & Threatened
Conophytum achabense	Extinct & Threatened
Conophytum vanheerdei	Extinct & Threatened
Aloe buhrii	Extinct & Threatened
Aloe chlorantha	Extinct & Threatened
Aloe comosa	Extinct & Threatened
Aloe daberonisana	Extinct & Threatened
Aloe khamiensis	Extinct & Threatened
Aloe pearsonii	Extinct & Threatened
Aloe pillansii	Extinct & Threatened
Aloe ramosissima	Extinct & Threatened
Aloe striata	Extinct & Threatened
Amaryllis paradisicola	Extinct & Threatened
Brunsvigia herrei	Extinct & Threatened
Brunsvigia radula	Extinct & Threatened
Gethllis lata	Extinct & Threatened
Gethllis pectinata	Extinct & Threatened
Haemanthus graniticus	Extinct & Threatened
Haemanthus namaquensis	Extinct & Threatened

Hassea pusilla	Extinct & Threatened
Hassea tenuipedicellata	Extinct & Threatened
Namaqua bruce-bayeri	Extinct & Threatened
Strumaria aestivalis	Extinct & Threatened
Strumaria perryae	Extinct & Threatened
Strumaria unguiculata	Extinct & Threatened
Ectadium virgatum	Extinct & Threatened
Athanasia spathulata	Extinct & Threatened
Europys virgratus	Extinct & Threatened
Felicia deserti	Extinct & Threatened
Felicia diffusa	Extinct & Threatened
Othonna rechingeri	Extinct & Threatened
Acanthosicyos horridus	Extinct & Threatened
Carex acocksii	Extinct & Threatened
Disperis purpurata	Extinct & Threatened
Conophytum armianum	Least Threatened
Conophytum auriflorum	Least Threatened
Conophytum blandum	Least Threatened
Conophytum carpianum	Least Threatened
Conophytum concavum	Least Threatened
Conophytum ernstii	Least Threatened
Conophytum frutescens	Least Threatened
Conophytum lithopsoides	Least Threatened
Conophytum loeschianum	Least Threatened
Conophytum praesectum	Least Threatened
Conophytum regale	Least Threatened
Conophytum velutinum	Least Threatened
Conophytum verrucosum	Least Threatened
Brunsvigia pulchra	Least Threatened
Cyrtanthus smithiae	Least Threatened
Haemanthus dasyphyllus	Least Threatened
Haemanthus pubescens	Least Threatened
Hessea incana	Least Threatened
Hessea pilosa	Least Threatened
Hessea pulcherrima	Least Threatened
Hessea stenosiphon	Least Threatened
Strumaria barbarae	Least Threatened
Strumaria bidentata	Least Threatened
Strumaria discifera	Least Threatened
Strumaria karooica	Least Threatened
Strumaria masionella	Least Threatened
Strumaria merxumuelleriana	Least Threatened

Strumaria picta	Least Threatened
Strumaria pubescens	Least Threatened
Strumaria villosa	Least Threatened
Strumaria watermeyeri	Least Threatened
Adenoglossa decurrens	Least Threatened
Europys marlothii	Least Threatened
Helichrysm micropoides	Least Threatened
Lasiopogon ponticulus	Least Threatened
Osteospermum attenuatum	Least Threatened
Othonna armiana	Least Threatened
Othonna retrorsa	Least Threatened
Tricogyne lerouxiae	Least Threatened
Wahlenbergia minuta	Least Threatened
Wahlenbergia namaquana	Least Threatened
Spiloxene sp	Least Threatened
Corycium ingeanum	Least Threatened
Cliffortia arborea	Least Threatened
Agatosma namaquensis	Least Threatened
Conophytum lithopsoides	Data deficient
Gethyllis britteiana	Data deficient
Ceropegia occidentalis	Data deficient
Helichrysm leptorhizum	Data deficient
Senecio erysimoides	Data deficient
Senecio trachylaenus	Data deficient
Wahlenbergia buseriana	Data deficient
Wahlenbergia floribunda	Data deficient
Wahlenbergia lasiocarpa	Data deficient
Wahlenbergia rara	Data deficient
Wahlenbergia roelliflra	Data deficient
Cyphia longiflora	Data deficient

Birds Species

RED DATA SPECIES	COMMON NAME	STATUS
Ephippiorhynchus senegalensis	Saddlebulled Stork	Endangered
Gyps coprotheres	Cape Vulture	Vulnerable
Gyps africanus	African Whitebacked Vulture	Vulnerable
Torgos traheliotos	Lappetfaced Vulture	Vulnerable
Trigonoceps occipitalis	Whitehead Vulture	
Aquila rapax	Tawny Eagle	Vulnerable

Polemaetus bellicosus	Martial eagle	Vulnerable
Circu ranivorus	African marsh Harrier	Vulnerable
Falco naumanni	Lesser kestrel	Vulnerable
Anthropoides paradiseus	Blue crane	Vulnerable
Ardeotis kori	Kori Bustard	Vulnerable
Neotis ludwigii	Ludwigs Bustard	Vulnerable

Mammals

RED DATA SPECIES	COMMON NAME	STATUS
Alcelaphus buselaphus	Red Hartebeest	Lower risk least concern
Antidorcas marsupialis	Springbuck	Lower risk least concern
Ceratotherium simum	White Rhinoceros	Lower risk least concern
Connochaetes gnou	Swart Wildebeest	Lower risk least concern
Connochaetes taurinus taurinus	Blue Wildebeest	Lower risk least concern
Diceros bicornis bicornis	Black Rhinoceros (arid ecotype)	Critically endangered
Equus burchelli	Plain Zebra	Lower risk least concern
Equus zebra hartmannae	Hartmann's mountain Zebra	Endangered
Giraffa cameolopardalis	Giraffe	Lower risk least concern
Hippotragus equinus	Roan antelope	Vulnerable
Oryx gazella	Gemsbuck	Lower risk least concern
Paphicrus campestris	Steenbuck	Lower risk least concern
Redunca fulvorfula	Mountain reedbuck	Lower risk least concern
Sylvicarpa grimmia	Common duiker	Lower risk least concern
Syncerus caffer	Cape buffalo	Lower risk least concern
Tragelaphus strepsieros	Kudu	Lower risk least concern
Aonyx capensis	Cape Clawless Otter	Lower risk least concern
Atilax paludinosus	Water Mongoose	Lower risk least concern
Canis mesomelas	Black backed jackal	Lower risk least concern
Caracal caracal	Caracal	Lower risk least concern
Cynictus penicillata	Yellow mongoosee	Lower risk least concern
Felis nigripes	Black footed cat	Lower risk least concern
Felis silvestris	African Wild Cat	Lower risk least concern
Galerella pulverlenta	Small grey mongoose	Lower risk least concern
Galerella sanguinea	Slender mongoose	Lower risk least concern
Genetta genetta	Small-spotted Genet	Lower risk least concern
Hyaena brunnea	Brown Hyena	Lower risk near threatened
Ictonyx striatus	Striped Polecat	Lower risk least concern
Lutra maculicolis	Spotted -necked Otter	Lower risk near threatened

Mellivora capensis	Honey Badger	Lower risk near threatened
Otocyon megalotis	Bat-Eared Fox	Lower risk least concern
Panthera Leo	Lion	Vulnerable
Panthera pardus	Leopard	Lower risk least concern
Poecilogale albinucha	Arican Weasel	Data Deficient
Proteles cristatus	Aardwolf	Lower risk least concern
Suricata suricatta	Suricate/meerkat	Lower risk least concern
Vulpes chama	Cape Fox	Lower risk least concern
Cistugo lesuer	Lesuesr's Wing-gland Bat	Lower risk near threatened
Hipposideros caffer	Sundevall's Leaf-nosed Bat	Data Deficient
Miniopterus schreibersii	Schreibers' Long-Fingered Bat	Lower risk near threatened
Neoromica capensis	Cape Serotine Bat	Lower risk least concern
Nycteris thebaica	Egyptian Slit-faced bat	Lower risk least concern
Rhinolophus clivosus	Geofferey's Horseshoe Bat	Lower risk near threatened
Rhinolophus darlingi	Darlings' Horeseshoe Bat	Lower risk near threatened
Rhinolophus denti	Dents' Horeseshoe Bat	Lower risk near threatened
Tadarida aegyptiaca	Egyptian Free-tailed bat	Lower risk least concern
Crocidura cyanea	Reddish-grey Musk Shrew	Data Deficient
Crocidura hirta	Lesser Red Musk Shrew	Data Deficient
Myosorex varius	Forest Shrew	Data Deficient
Lepus capensis	Cape/desert hare	Lower risk least concern
Lepus saxatilis	Scrub/Savannah hare	Lower risk least concern
Pronolagus rupestris	Smith's Red Rock Rabbit	Lower risk least concern
Cercopithecus aethiops pygerythrus	Ververt Monkey	Lower risk least concern
Papio ursinus	Chacma Baboon	Lower risk least concern
Aethomys granti	Grant's Rock Mouse	Lower risk least concern
Aethomys namaquensis	Namaquoa Rock Mouse	Lower risk least concern
Cryptomys hottentotus	Common Mole Rat	Lower risk least concern
Desmondillus auricularis	Short-tailed Gerbil	Lower risk least concern
Gerbillurus paeba	Hairy-footed Gerbil	Lower risk least concern
Gerbillurus vallinus	Brush Tailed Hairy-footed Gerbil	Lower risk least concern
Graphiurus murinus	Woodland Dormous	Lower risk least concern
Graphiurus ocularis	Spectacled Dormous	Lower risk least concern
Hystrix africaeaustralis	Porcupine	Lower risk least concern
Malacothrix typica	Large-eared Mouse	Lower risk least concern

Mastomys coucha	Multimammate Mouse	Lower risk least concern
Otomys angoniensis	Angoni lei Rat	Lower risk least concern
Otomys irroratus	Vlei Rat	Lower risk least concern
Otomys sloggetti	Sloggett's Rat	Data Deficient
Parotomys brantsii	Brants' Whistling Rat	Lower risk least concern
Parotomys littledalei	Littledales' Whistling Rat	Lower risk near threatened
Pedetes capensis	Springhare	Lower risk least concern
		Lower risk least concern
Petromyscus collinus	Pygmy Rock Mouse	
Rhabdomys pumilio	Stripped Mouse	Lower risk least concern
Saccostomus campestris	Pouched Mouse	Lower risk least concern
Steatomys krebsii	Krebs' Fat mouse	Lower risk least concern
Tater brantsii	Highveld Gerbil	Lower risk least concern
Tater leucogaster	Bushveld Gerbil	Data Deficient
Xerus inauris	Cape Ground Squirrel	Lower risk least concern
Elephantulus edwardii	Cape Rock Elephant shrew	Lower risk least concern
Elephantulus intufi	Bushveld Elephant shrew	Data Deficient
Elephantulus myurus	Rock Elephant shrew	Lower risk least concern
Elephantulus rupestris	Smit's Rock Elephant shrew	Lower risk least concern
Macroscelides proboscideus	Round-eared Elephant shrew	Lower risk least concern

Frogs of Northern Cape

Species Name (latest 2009)	Common Name	Red Data Status
Breviceps adspersus	Bushveld Rain Frog	
Breviceps macrops	Desert Rain Frog	Vulnerable
Breviceps namaquensis	Namaqua Rain Frog	
Amietophrynus garmani	Eastern Olive Toad	
Vandijkophrynus angusticeps	Cape Sand Toad	
Vandijkophrynus gariepensis	Karoo Toad	
Amietophrynus gutturalis	Guttural Toad	
Amietophrynus poweri	Western Olive Toad	
Amietophrynus rangeri	Raucous Toad	
Vandijkophrynus robinsoni	Paradise Toad	
Poyntonophrynus vertebralis	Southern Pygmy Toad	
Cacosternum boettgeri	Boettger's Caco	
Cacosternum karooicum	Karoo caco	Data Deficient

Cacosternum namaquense	Namaqua Caco	
Kassina senegalensis	Bubbling Kassina	
Phrynobatrachus natalensis	Snoring Puddle Frog	
Phrynomantis annectens	Marbled Rubber Frog	
Pyxicephalus adspersus	Giant Bullfrog	Near Threatened
Amietia angolensis	Common River Frog	
Amietia fuscigula	Cape River Frog	
Strongylopus grayii	Clicking Stream Frog	
Strongylopus springbokensis	Namaqua Stream Frog	Vulnerable
Tomopterna cryptotis	Tremelo Sand Frog	
Tomopterna delalandii	Cape Sand Frog	
Tomopterna tandyi	Tandy's Sand Frog	
Xenopus laevis	Common Platanna	

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