3.1.8 Mammals

Large game makes up less than 15% of the mammal species in South Africa and a much smaller percentage in numbers and biomass. In developed and farming areas, such as Cookhouse, this percentage is greatly reduced, with the vast majority of mammals present being small or medium-sized. Except where reintroduced into protected areas, lions, black wildebeest, red hartebeest, buffalo, black rhinoceros, elephant, hippopotamus and reedbuck are extinct. Cheetah and hunting dog are no longer found in the area and hyenas, leopard, ratel and vaal ribbok are almost extinct (Skead, 1974b).

The antelope that are abundant in the thick bush (thicket or bushclump savanna) are bushbuck, duiker, steenbok and kudu (the most abundant antelope of the valley thicket). Blesbok (Plate 3-13), bontebok and gemsbok have been reintroduced on some farms.

Of the cat species, the lynx (caracal) and black-footed cat are found. Jackal and bat-eared foxes are also found as is the aardwolf, but it is not abundant.

Vervet monkeys are common and baboons are found in appropriate sites in kloofs and valleys. Rock dassies are common, but tree dassies are only found inland in forests along larger rivers. Genet and mongoose species are also common. Aardvark also occur in the region (Plate 3-14) Twenty-three rodent species are found in the area and include rats and mice, the cane rat, springhare and porcupine. A number of species of bat also occur. Table 3-9 lists large and medium sized mammals on the IUCN Red Data List that occur in the Eastern Cape Province.

Plate 3-13: Blesbok (*Damaliscus pygarus phillipsi*), have been introduced into some of the farms in the Proposed Golden Valley Wind farm area

Plate 3-14: Typical excavations made by the Aardvark (*Orycteropus afer*), which, though rarely seen, occurs in the area

Table 3-9: Threatened large to medium-sized mammals in the Eastern Cape Province

Common name	Latin name	Conservation Status
Wild dog	*Lycaon pictus*	Endangered
Brown Hyaena	*Hyaena brunnea*	Rare
Aardwolf	*Proteles cristatus*	Rare
Balck-footed cat	*Felis nigripes*	Rare
Serval	*Felis serval*	Rare
Leopard	*Panthera pardus*	Rare
Blue Duiker	*Philantomba monticola*	Rare
Honey Badger	*Mellivora capensis*	Vulnerable
African Wild Cat	*Felis lybica*	Vulnerable
Aardvark	*Orcteropus afer*	Vulnerable
Cape Mountain Zebra	*Equus zebra*	Vulnerable
Black Rhinoceros	*Diceros bicornis*	Vulnerable
Oribi	*Ourebia ourebi*	Vulnerable
Pangolin	*Manis temminckii*	Vulnerable
Small-spotted cat	*Felis nigripes nigripes*	Rare

Source: Smithers (1986)

Of specific importance for wind farm developments are the presence of bats in the area; a confounding number of bat fatalities have been found at the bases of wind turbines throughout the world. Echolocating bats should be able to detect moving objects better than stationary ones, which begs the question, why are bats killed by wind turbines (Baerwald *et al*.). Table 4-11 lists the species of bats likely to occur in Cookhouse and surrounds, and thus will be affected by the proposed development.

Table 3-10: Bat species that occur in the Cookhouse area which are likely to be affected by the wind turbines.

Order: Chiroptera		
Common Name	Species Name	SSC
Straw-coloured fruit bat	*Eidolon helvum*	Near Threatened
Egyptian fruit bat	*Rousettus aegypticus*	
Geoffrey's horseshoe bat	*Rhinolophus clivosus*	Least Concern
Cape horseshoe bat	*Rhinolophus capensis*	Least Concern
Temminck's hairy bat	*Myotis tricolor*	Least Concern
Cape serotine bat	*Eptesicus capensis*	Least Concern
Common slit-faced bat	*Nycteris thebaica*	Least Concern
Giant yellow house bat	*Scotophilus nigrita*	Least Concern
Schreiber's long-fingered bat	*Miniopterus schreibersi*	Near Threatened
Tomb bat	*Taphozous mauritianus*	Least Concern
Angola free-tailed bat	*Tadarida condylura*	Least Concern
Wahlberg's epaulated bat	*Epomophorus wahlbergi*	Least concern
Banana bat	*Pipistrellus nanus*	Least Concern
Egyptian free-tailed bat	*Tadarida aegyptiaca*	Least Concern
Lesser woolly bat	*Kerivoula lanosa*	Least Concern

Bat fatalities at wind power facilities are highly variable throughout the year, but there are many more bat fatalities than bird fatalities at wind farms (Brinkman *et al*. 2006). Importantly, bat studies have been done in Europe and the United Sates of America, but none in South Africa. These studies have found that even a few deaths can be seriously detrimental to bat populations, and is thus cause for concern (Hotker *et al*. 2006). Most bats are struck during periods of migration or dispersal (Hotker *et al*. 2006, Johnson *et al* 2003).

Horn *et al*. (2008) conducted a study on the behavioural responses of bats to wind turbines and discovered the following:

- Bats actively forage near operating turbines
- Bats approach both rotating and non rotating blades
- Bats followed or were trapped in blade-tip vortices
- Bats investigated the various parts of the turbine with repeated fly-bys
- Bats were struck directly by rotating blades

These behavioural responses of bats to wind turbines explains why many of them are killed, however, there are additional explanations for this behaviour. There are several reasons proposed for the number of bat fatalities, one is that the turbines attract insects, and thus foraging insect-eating bats (Ahlen 2003, Kunz *et al*. 2007). Alternatively, bats may mistake turbines for trees when they are looking for a roost, or be acoustically attracted to the wind turbines (Kunz *et al*. 2007). The cause of death is not entirely explained by collision with turbine blades, but instead is caused by internal haemorrhaging. Most bats are killed by barotrauma, which is “caused by rapid air-pressure reduction near many turbine blades” (Baerwald *et al*.). Barotrauma “involves tissue damage to air-containing structures caused by rapid or excessive pressure change” (Baerwald *et al*.).

Possible mitigation measures

In a study conducted to determine the effects of turbine size on bat fatalities, Barclay *et al*. (2007) discovered that the diameter of the rotor had no effect on bat fatalities. Height of the turbines, however, though having no effect on bird fatalities, bat fatalities increased exponentially with an increase in turbine height (Barclay *et al*. 2007). There are, as a result, a few mitigation measures that have been suggested to reduce bat fatalities, these are:

- Ultrasound broadcast can deter bats from flying into wind turbines. (Szewczak and Arnett 2007)
- Minimizing turbine height will help to reduce bat fatalities (Barclay *et al*. 2007).
- Turbine sites on ridges should be avoided (Brinkman *et al*. 2006).
- Wind turbine operating times should be restricted during times when bat activity is high (Brinkman *et al*. 2006). Bats are at higher risk of fatality on nights with low wind speeds (Horn *et al*. 2008).

3.1.9 Terrestrial Invertebrates

Of nearly 650 butterfly species recorded within the borders of South Africa, 102 are considered of conservation concern and are listed in the South African Red Data Book (RDB) for Butterflies. Two have become extinct, whilst three rare butterflies are known from a number of scattered localities in the Coega region.

According to the most recent IUCN red data list there are no members of the Athropoda (insects arachnids and crustaceans) Phylum in the area that can be defined as SSC. One of the most important insects of the study area is the dung beetle (Plate 3-15), there are over 780 species in Southern Africa.

Plate 3-15: Perhaps one of the most important invertebrates of the region is the family Scarabaeidea, which contains the dung beetles (Picker et al. 2002). This picture shows one of the species of the region (there are over 780 species in Southern Africa) (Scholtz & Holm 1996)

3.2 Socio-Economic Profile

The proposed Terra Wind Energy-Golden Valley Project is to be developed in the BCRM. It is likely that the development of the Terra Wind Energy-Golden Valley Project will have indirect socio-economic impacts on the municipal area and its population. Accordingly the discussion that follows provides a brief socio-economic profile of the municipal area.

The BCRM is situated in the Eastern Cape Province, the second largest province in South Africa, covering approximately 169 580 square kilometres, or 13.9% of South Africa's total land area. With more than six million people, the Eastern Cape has the third largest provincial population. The demographics of the BCRM according to StatsSA (Census, 2001) are outlined in Tables 3-11 to 3-13. These statistics show a predominantly black population, with low incomes, and high levels of unemployment.

Based on a household survey conducted by Cacadu District Municipality (the greater district municipality in which the BCRM falls) in 2005, the total population of the BCRM was estimated at 36 798 (constituting approximately 7.21% of the greater Cacadu District Municipality). The three major urban nodes of the BCRM are Cookhouse, Somerset East and Pearston.

The largest group of the population is the economically active group (between the ages of 15-64) constituting approximately 64.2% of the BCRM population. Employment and income levels are low within the municipality. However, according to the StatsSA (Census, 2001) data, 35.92% of the population of BCRM is economically inactive. This data also reflected that the majority of the population receive no income and the majority of those whom earn an income earn within the R400 – R800 per month bracket. This reflects the level of poverty within the municipality. The dominant economic activity or land use in the area is farming.

The economy of the Eastern Cape has grown faster than the national economy over the past few years. Economic growth has been led by the manufacturing sector, which accounts for over 16 percent of the total value of the province's production of goods and services, and 20 percent of employment (Eastern Cape Economy – CDC, 2004). According to the Eastern Cape Development Corporation (ECDC), the manufacturing sector grew by 21 percent in real terms from 1998 to 2001, compared to 9 percent for South Africa as a whole. The province's manufacturing sector is well integrated into the world economy. Table 3-14 indicates the sectoral production and employment in the Eastern Cape. These sectors have been identified as areas of opportunity by the ECDC. The other important areas of the Eastern Cape's economy are agriculture, textiles, clothing and leather, wool processing, timber and transport, and tourism. It is clear from Table 3-14, that the manufacturing sector is the largest contributor and employer in the Eastern Cape Province. This sector is also highly reliant on electricity and will therefore be affected by electricity availability.

Table 3-11: Representative population groups in the BCRM

Population Group	Number
Black African	20 868
Coloured	11 517
Indian or Asian	20
White	2 603

Source: Census (2001)

Table 3-12: Employment status in the BCRM

Employment Status	Percentage
Employed	34.28
Unemployed	29.80
Not Economically Active	35.92

Source: Census (2001)

Table 3-13: Income groups in the BCRM

Income group	Number
No income	21 445
R1 - R400	4 361
R401 – R800	5 903
R801 - R1 600	1 210
R1 601 - R3 200	974
R3 201 - R6 400	682
R6 401 - R12 800	273
R12 801 - R25 600	71
R25 601 - R51 200	33
R51 201 - R102 400	36
R102401-R204800	20
R204 801 or more	0

Source: Census (2001)

Table 3-14: Sectoral production and employment in the Eastern Cape economy

Production sector (source: StatsSA)	Value of output (Rm)	% of total EC output	No. of Employees	% of total
Agriculture, hunting, forestry, fishing	2 063	3.6	70 470	13.2
Mining & quarrying	57	0.1	7 154	1.4
Manufacturing	14 783	25.8	97 035	18.1
Electricity, gas & water supply	874	1.7	5 598	1.0
Construction	1 892	3.3	43,635	8.1
Wholesale, retail trade & accommodation	9 339	16.3	83 818	15.7
Transport, storage & communication	5,501	9.6	32 851	6.1
Financial, insurance, real estate & business services	7 048	12.3	35 181	6.6
Community, social & personal services	15 643	27.3	159 453	29.8
Total:	**57 300**	**100.0**	**535 195**	**100.0**

4 PUBLIC PARTICIPATION PROCESS

In terms of section 32 (2) of the EIA regulations (2006), *an environmental impact assessment report must include:-*

(e) Details of the public participation process conducted in terms of subregulation (1), including:

(i) Steps undertaken in accordance with the plan of study;
(ii) A list of persons, organisations and organs of state that were registered as interested and affected parties;
(ii) A summary of comments received from, and a summary of issues raised by registered interested and affected parties, the date of receipt of these comments and the response of the EAP to those comments; and
(iv) Copies of any representations, objections and comments received from registered interested and affected parties;

In line with the above-mentioned legislative requirement, this chapter of the EIR provides the details of the public participation process conducted for the proposed Terra Wind Energy-Golden Valley Project. There are four key steps within the overall public participation process. These include -

- Notifying I&APs of the Draft EIA report;
- Holding public meeting(s);
- Making provision for I&APs to review and comment on all reports before they are finalised and submitted to the competent authority;
- Making a record of responses to comments and concerns available to I&APs; and
- Informing the I&APs of the competent authority's decision on the EIR.

Each of the above-mentioned steps, which comprised the public participation process of the proposed development, are discussed in detail in Sections 4.1-4.4 following. All supporting documentation related to the public participation process for the proposed Terra Wind Energy-Golden Valley Project is contained in Appendix D of this report.

Please refer to Section 5 of **Volume 1: "*Final Scoping Report: Proposed Terra Wind Energy-Golden Valley Project, Blue Crane Route Local Municipality*" (CES, December 2009)** for the first phase of the public participation process conducted for the EIA for Terra Wind Energy-Golden Valley Project. Section 5 of this report outlines the following:

- Notifying interested and affected parties
  - Background information document
  - Written notices
  - Advertisements
  - Site notices
- Public Meetings
- Public review of the DSR
- Registration of I&APs and comments database

4.1 Notifying Interested and Affected parties of the Draft Environmental Impact Report

4.1.1 Written notices

Written notices, in the form of e-mails and registered letters, were sent to the landowners, adjacent landowners, registered IA&Ps, governmental departments etc. Copies of these letters are included in Appendix D-1.

Letters were also sent to:

- Blue Crane Development Agency (BCDA)
- Blue Crane Route Municipality (BCRM)
- Cacadu District Municipality
- Wildlife and Environment Society of Southern Africa (WESSA) Eastern Cape Branch
- Eastern Cape Department of Agriculture
- Eastern Cape Department of Economic Development and Environmental Affairs (DEDEA)
- National Department of Environmental Affairs (DEA)
- National Department of Energy
- Eskom Holdings Limited
- Eskom Land Development Manager Southern Region
- Civil Aviation Authority
- EP Herald - Assistant Editor

Copies of these letters are provided in Appendix D-1 and slips proving that these letters were sent are included in Appendix D-2.

4.1.2 Advertisements

An advertisement was placed in one Provincial and one Local newspaper namely, the Eastern Province (EP) Herald and the Somerset Budget on 30 July 2010 and 29 July 2010 respectively in order to:-

- Advise readers of the intention to undertake an EIA for the proposed Terra Wind Energy-Golden Valley Project;
- Informing the public of the availability of the draft EIR and its placement at the Cookhouse Library for convenient access;
- Inform the public of the date, time and venue for the public meeting (see section 4.2 below), and;
- Invite the public to register as I&APs.

A period of four weeks (2 August 2010 to 2 September 2010) was allowed for registration of any new I&APs, and for I&APs to submit comments after the advertisement(s) appeared. A copy of the advertisement(s) is included in Appendix D-3 and proof of newspaper advertisement placement is attached in Appendix D-4.

4.2 Public Meetings

A public meeting was held at the Golden Valley Country Inn just outside Cookhouse on 23 August 2010 at 13h00. Appendix D-5 provides the attendance registers from this public meeting.

4.3 Public Review of the Draft Environmental Impact Report

In line with the letters of notification and advertisements mentioned in section 4.1 above, a hard copy of the Draft EIR was placed at a strategic location that was easily accessible by the public. The Draft EIR was placed at the Cookhouse Library (6 Main Road, Cookhouse) for a period of four week from 2 August 2010 to 2 September 2010.

Appendix D-6 provides a signed delivery letter from Cookhouse Library confirming that a hard copy of the Draft Scoping Report was received at the establishment.

An electronic copy of the Draft Scoping Report was also displayed on the EAP's website - www.cesnet.co.za - via the Public Documents link.

No comments were received during the four week public review period. The outcomes from the public meeting held on 23 August 2010 were included in the Issues and Response Trail in Appendix D-7.

4.4 Registration of Interested and Affected Parties and Comments Database

A detailed record of all comments and observations made at the public meeting or via written correspondence during the EIR phase has been recorded in Issues and Response Trail (Appendix D-7). This document also provides a record of the response to each issue. Where issues were raised at the public meeting, the verbal response given at the time has been noted. The document also contains responses prepared by the EAP to issues or questions raised after review of the draft documents.

A register of I&APs has been compiled, including all available contact details of those who responded to the advertisement(s), registered as I&APs, or attended the public meeting (Appendix D-8).

5 NEED AND DESIRABILITY ASSESSMENT

In terms of section 32 (2) of the EIA regulations (2006), ***an environmental impact assessment report must include:-***
(f) A description of the need and desirability of the proposed activity…….

In accordance with the above-mentioned legislative requirement, this Chapter of the report identifies the need and desirability of the proposed Terra Wind Energy-Golden Valley Project

According to Terra Wind Energy-Golden Valley (Pty) Ltd, the proposed project will be beneficial for the following reasons:-

5.1 Climate change

Due to concerns such as climate change, and the ongoing exploitation of non-renewable resources, there is increasing international pressure on countries to increase their share of renewable energy generation. The South African Government has recognised the country's high level of renewable energy potential and has placed targets of 10 000 GWh of renewable energy by 2013. In order to kick start the renewable energy sector in South Africa, a Feed-in Tariff for various renewable energy technologies was established. This Feed-in tariff guarantees the price for electricity supply from the renewable energy installation.

In relation to the above, TWEGV also highlighted the following:-

- For every 1 MWh of "green" electricity used instead of traditional coal powered stations, one can:-
  - Save 1 290 litres of water
  - Avoid 8.22 kg of Sulphur Dioxide (SO_2)emissions
  - Avoid 1 000 kg of Carbon Dioxide (CO_2) emissions including transmission losses, and;
  - Avoid 142 kg of ash production

5.2 Social upliftment

The Eastern Cape, and particularly the Cookhouse area, has large tracts of land that are very dry and the farmers do their best to earn a living from the land. The towns are small and socio-economic development activities and potential is limited. The need to improve the quality of life for all, but especially the poor, is critical in South Africa. With the expected wind resources in the Cookhouse area, the proposed project will contribute directly to the upliftment of the individuals and the societies in which they live. Terra Wind Energy-Golden Valley (Pty) Ltd intends to identify community involvement, and projects will be implemented for the fundamental improvement in Cookhouse and the surrounding areas:

- A Special Purpose Vehicle (SPV) company - Terra Wind Energy-Golden Valley (Pty) Ltd - has been established for the development phase with TPS and General Electric (GE) as shareholders.
- This Company's shareholding will be reconfigured after full project development, but before construction and operation begins.
- The shareholders, who support the Government's Broad Based Black Economic Empowerment (BBBEE) initiative, will ensure that the company's shareholding will reflect this after reconfiguration.
- During all phases of the project the shareholders will ensure that the community is properly informed and have insight into all decision making.
- Local community enhancement projects will be identified and supported as far as is possible.
- Skills development and transfer is one of the top priorities of the shareholders.

Electricity supply

The establishment of the proposed Golden Valley Wind Energy Installation will contribute to strengthening the existing electricity grid for the area and will aid the government in achieving its goal of a 30% share of all new power generation being derived from Independent Power Producers (IPP). In addition to the above-mentioned benefits, the proposed project site was selected due to:-

- Global enthusiasm towards clean energy projects.
- Good wind resources suitable for the installation of a large wind energy facility.
- The proposed project site has localised wind intensified by a funnelling effect caused by surrounding topographical features.
- Proximity to connectivity opportunities such as the Poseidon substation (8km away) or the High Voltage (HV) overhead lines traversing the proposed development site.
- The site is easily accessible from the N10 road, which will assist in the transportation of wind turbines to the site.
- The surrounding area is not densely populated.
- There is potential and appetite within the Blue Crane Route Municipality (BCRM) to engage with new technologies and industries.

5.3 Reduction in CO2 emissions

The current project will contribute towards the growth of the South African renewable energy sector and, more specifically, the country's wind energy portfolio. Once a number of wind energy facilities are in operation around the country, it's is highly probable that at least some will be spinning at any given time. As such, collectively they will provide a reliable "green" input to the national grid (although less than their theoretical maximum combined generating capacity). Initial modelling has been performed and shows a likely 30% capacity base-load from installed wind capacity in SA, thanks to its geographically dispersed different wind regimes. As such, each MW generated from a wind farm will equate to a MW not being produced by a conventional source (coal), and thus avoiding the emission of approximately 1 ton of CO_2 into the atmosphere.

6 ALTERNATIVES

In terms of section 32 (2) of the EIA regulations (2006), ***an environmental impact assessment report must include:-***

(f) ……identified potential alternatives to the proposed activity, including advantages and disadvantages that the proposed activity or alternatives may have on the environment and the community that may be affected by the activity.

(h) A description and comparative assessment of all alternatives identified during the environmental impact assessment process.

One of the objectives of an EIA is to investigate alternatives to the proposed project. There are two types of alternatives - Fundamental Alternatives and Incremental Alternatives. The EIA regulations define 'alternatives' as, "*different means of meeting the general purpose and requirements of the activity"* which includes alternatives to:

(a) The property on which or location where it is proposed to undertake the activity;
(b) The type of activity to be undertaken;
(c) The design or layout of the activity;
(d) The technology to be used in the activity; and
(e) The operational aspects of the activity.

6.1 Fundamental alternatives

Fundamental alternatives are developments that are totally different from the proposed project and usually involve a different type of development on the proposed site, or a different location for the proposed development.

6.1.1 A different type of development

Since the core business area of the project proponent, Terra Wind Energy-Golden Valley (Pty) Limited, is wind farming for electricity production, the Fundamental Alternative of a development other than to construct and operate a wind powered generation facility is therefore not viable in this case, and was not considered further in the EIA.

6.1.2 A different location

The main determinants in selecting the proposed location were:-

- Good wind resources suitable for the installation of a large wind energy facility.
- Proximity to connectivity opportunities such as the Poseidon substation or the High Voltage (HV) overhead lines traversing the proposed development site.
- The surrounding area is not densely populated.
- There is potential and appetite within the Blue Crane Route Municipality (BCRM) to engage with new technologies and industries.

Preliminary investigations have identified that the proposed project site meets these criteria and so different locations for the current project will not be considered. It must be reiterated, however, that the applicant is undertaking various feasibility studies for numerous potential sites countrywide. As such, various alternative locations for wind farm projects are by virtue of this being investigated and are in various phases of their respective EIA processes

The EIR examines the impact of doing nothing (i.e. the "No Go" option) as it relates to the specialist studies and the project as a whole. In essence, the No-Go option would imply a continued overall reliance on fossil fuel fired electricity generation plants, which will not aid in achieving the various renewable energy strategy targets determined by various government agencies.

6.2 Incremental alternatives

Incremental alternatives are modifications or variations to the design of a project that provide different options to reduce or minimise environmental impacts. There are several incremental alternatives that can be considered, including –

- The design or layout of the activity
- The technology to be used in the activity
- The operational aspects of the activity

6.2.1 Design/Layout Alternatives

The layout/design alternatives for the proposed Terra Wind Energy-Golden Valley Project have been discussed extensively in Section 2.1 in Chapter 2 above and will therefore not be repeated here.

6.2.2 Technology Alternatives

The nature of the proponent's business is to develop wind energy projects. As such, no alternative power-generating technologies were considered as part of this study. Contemporary wind turbines have over the last 20 years become significantly more technologically advanced in terms of their generating output capacity, and design interventions to reduce their noise impacts. As such, the only technology alternatives available would be utilising the different size and generating capacity turbines as is suited to an individual project basis.

6.2.3 Scheduling Alternatives

It is intended that construction will commence as soon as possible after all relevant approvals have been obtained. Alternative timeframes for development cannot be considered.

6.3 The 'No-Go' Alternative

According to the EIA Regulations, the option of doing nothing i.e. not proceeding with the proposed development (i.e. the No Go Option) must be assessed during the EIA. In addition to the No-Go Alternative, all the above-mentioned incremental alternatives (design/layout) with the exception of scheduling alternatives have been examined in the EIA.

7 APPROACH TO THE ENVIRONMENTAL IMPACT ASSESSMENT

In terms of section 32 (2) of the EIA regulations (2006), a*n environmental impact assessment report must include:-*

(g) A description of the methodology used in determining the significance of potential environmental impacts.

In line with the above-mentioned legislative requirement, this chapter of the EIR details the approach to the EIA phase of the proposed Golden Valley Wind Energy Project with a particular focus on the methodology that was used when determining the significance of potential environmental impacts.

7.1 Specialist Studies

Based largely on the issues raised during the Scoping phase (refer to Chapter 4 above) as well as legislation relevant/applicable to the proposed project (refer to Chapter 3 of **Volume 1: Final Scoping Report: Proposed Terra Wind Energy-Golden Valley Project, Blue Crane Route Local Municipality (CES, December 2009)**). A series of specialist studies were conducted during the EIA (see Table 1-3 in Chapter 1 above), the results of which are summarised in this EIR.

The team of specialists that conducted the specialist studies (see Table 1-3 in Chapter 1 above) was drawn from many sources, including universities and private consulting companies. Specialists were required to address the issues raised by I&APs (refer to Table 1-2 in Chapter 1) in their reports by gathering baseline information and identifying the possible impacts related to the proposed project. Mitigation measures for impacts were also provided.

The detailed specialist studies have been compiled into a separate Specialist Studies Volume (***Volume 2: Proposed Terra Wind Energy-Golden Valley Project: Specialist Reports*** **(CES, July 2010**)) for the proposed project. The details and expertise of each of the specialists as well as signed declarations of their independence are also included in the Specialist Studies Volume (refer to Appendices B-1 and B-3 respectively of Volume 2 and are therefore not repeated here.

The Terms of Reference (ToR) for each of the specialist studies were defined in the Final Scoping Report (**Volume 1: Final Scoping Report: Proposed Cookhouse Wind Energy Project, Blue Crane Route Local Municipality (CES, December 2009**) and the Plan of Study document for the EIR and approved by DEA (refer to Appendix C). Table 7-1 below details the ToR for each of the specialist studies undertaken in the detailed EIA Phase for the proposed Terra Wind Energy-Golden Valley Project.

Although the specialists were given free reign on how they conducted their research and obtained their information, they were required to provide the reports in a specific layout and structure, so that a uniform report could be produced. Consequently, the specialists were given details on how their reports should be laid out, and considerable time was spent ensuring that the reports are of the highest standard possible.

In addition to the above, in order to ensure that a direct comparison could be made between the various specialist studies, a set methodology was used by all the specialists when evaluating the significance of impacts. This methodology is discussed in detail in Section 7.2 that follows.

Table 7-1: Terms of Reference for the Specialist Studies undertaken in the detailed EIA Phase of the Proposed Terra Wind Energy-Golden Valley Project

Specialist Study	Terms of Reference
VISUAL	1. Conduct a site reconnaissance visit and photographic survey of the proposed project site. 2. Conduct a desk top mapping exercise to establish visual sensitivity:- • Describe and rate the scenic character and sense of place of the area and site. • Establish extent of visibility by mapping the view-sheds and zones of visual influence • Establish visual exposure to viewpoints • Establish the inherent visual sensitivity of the site by mapping slope grades, landforms, vegetation, special features and land use and overlaying all relevant above map layers to assimilate a visual sensitivity map. 3. Review relevant legislation, policies, guidelines and standards. 4. Preparation of a draft Visual Baseline/Sensitivity report • Assessing visual sensitivity criteria such as extent of visibility, the sites inherent sensitivity, visual sensitivity of the receptor's, visual absorption capacity of the area and visual intrusion on the character of the area • Prepare photomontages of the proposed development • Conduct shadow flickering modelling • Assess the proposed project against the visual impact criteria (visibility, visual exposure, sensitivity of site and receptor, visual absorption capacity and visual intrusion) for the site. • Assess impacts based on a synthesis of criteria for each site (criteria = nature of impact, extent, duration, intensity, probability and significance) • Establish mitigation measures/recommendations with regards to minimizing visual risk areas
ECOLOGICAL	The assessment will follow on from the initial study, which included a site visit conducted during the scoping phase, and will address any key issues raised by interested and affected parties. A considerable body of information on the flora and fauna of the Cookhouse area and its environs has been assembled in the reports on previous studies of the area in general. Accordingly the study will comprise a desktop study of all available relevant literature. However, a detailed survey of the site will be undertaken to determine the possibility of there being listed threatened or protected ecosystems and species on the proposed project site. If any of these are found, the Environmental Management Plan will include recommended measures to remove or otherwise protect plant species found on the site that are afforded protection under the National Environmental Management: Biodiversity Act during construction. This specialist study will therefore include but will not be limited to – • A detailed description of the ecological (fauna and flora) environment within and immediately surrounding the footprint of the proposed development and will consider terrestrial fauna and flora. Fauna include mammals, reptiles, amphibians, and insects but not avifauna as these will be the subject of a separate specialist study (refer to Section 8.1.1.5 below). This aspect of the report will specifically include the identification of -

	– Areas of high biodiversity; – The presence of species of special concern, including sensitive, endemic and protected species; – Habitat associations and conservation status of the identified fauna and flora; – The presence of areas sensitive to invasion by alien species; and – The presence of conservation areas and sensitive habitats where disturbance should be avoided or minimised. • Review relevant legislation, policies, guidelines and standards. • An assessment of the potential direct and indirect impacts resulting from the proposed development (including the wind turbines, associated infrastructure e.g. access road), both on the footprint and the immediate surrounding area during construction and operation; • A detailed description of appropriate mitigation measures that can be adopted to reduce negative impacts for each phase of the project, where required; and • Checklists of faunal groups identified in the region to date, highlighting sensitive species and their possible areas of distribution.
HERITAGE	The National Heritage Resources Act 25 of 1999 (NHR) requires that "*…any development or other activity which will change the character of a site exceeding 5 000m², or the rezoning or change of land use of a site exceeding 10 000 m², requires an archaeological impact assessment*" An archaeological impact assessment will therefore be conducted, the primary objective of which is to determine whether there are any indications that the proposed site is of archaeological significance. This will be a phase 1 assessment and will be largely desk-top although a site visit will be required to enable the specialist the opportunity to look for significant artefacts on the surface of the site. It is not expected that a more detailed Phase 2 assessment will be required but this remains to be confirmed. The terms of reference for the Phase 1 archaeological study will be to: • Determine the likelihood of archaeological remains of significance in the proposed site; • Identify and map (where applicable) the location of any significant archaeological remains; • Assess the sensitivity and significance of archaeological remains in the site; and • Identify mitigatory measures to protect and maintain any valuable archaeological sites and remains that may exist within the proposed site.
AVIFAUNA	An avifauna specialist study will be conducted. The assessment will include: • A desk-top review of existing literature The literature will seek: 1. Previous means of predicting bird mortality (and other impacts) of wind turbines affecting birds in groups similar to those in the study area. 2. Accounts of mortality at wind turbines 3. Information on the status, in the Grahamstown, Eastern Cape, South Africa and globally, of bird groups most likely to be affected

- A site visit to identify species of special concern and assess the likely impacts of the construction and operational phases on the avifauna of the site.

Surveys will be conducted on at least two days at sites at either end, and in the middle of the proposed turbine corridor and, as a control against the post construction situation, one-day surveys at two similar sites outside the turbine affected area. Survey sites will be selected to reflect variation in local habitat and terrain.

At each site, a camp will be established in the early afternoon. Two hours of observations will be undertaken before dusk and two during the first hours of darkness (when night-migrating birds are likely to be flying at lower altitude). Observations will begin again at first light and continue for 3-4 hours (depending on bird activity levels and especially the use of thermals by soaring birds).

During daylight in each survey hour

2 x 15 minutes for visual scans of birds crossing the proposed turbine corridor (with appraisal of flight height above the ground)

2 x 10 minutes circular point surveys

After dark in each hour scans by night vision binoculars

2 x 10 minutes focused on bird activity

- Conduct a review of international literature and experience relating to operational wind farms; including state of the art plants around the world
- Contextualize the literature and experience and relate it to the Eastern Cape scenario and local avifauna;
- Map sensitive areas in and around the proposed project site(s);
- Describe the affected environment and determine the status quo in terms of avifauna;
- Indicate how an avifaunal resource or community will be affected by the proposed project;
- Discuss gaps in the baseline data with respect to avifauna and relevant habitats;
- List and describe the expected impacts;
- Assess and evaluate the anticipated impacts, and;
- Make recommendations for relevant mitigation measures which will allow the reduction of negative impacts and the maximization of the benefits associated with any identified positive impacts.

Although the avifauna specialist will assess avian collision risk and provide detailed explanations and ratings of the likelihood of collisions of various species, ***detailed avian collision modelling*** i.e. quantitatively assessing the collision risk potential (i.e. birds directly colliding with rotor blades and turbine towers) of the proposed wind farm cannot be undertaken. This is because the extent to which this can formally be modelled and quantified to arrive at predicted numbers of collisions, would depend largely on the primary data collection related to flight frequencies and species, but it is unlikely that even the best possible data collection between now and mid 2010 would provide much confidence in such a model, as it would require more representative data collection across a range of conditions/seasons etc. In addition, very often the worst bird collision 'events' at wind farms around the world have been found to have occurred in extreme weather conditions, when flight behaviour etc is abnormal.

NOISE	1. Determine the land use zoning and identify all potential noise sensitive sites that could be impacted upon by activities relating to the construction and operation of the proposed wind energy facility. 2. Identify all noise sources relating to the activities of the facility during the construction and operation phases that could potentially result in a noise impact at the identified noise sensitive sites. 3. Determine the sound emission, operating cycle and nature of the sound emission from each of the identified noise sources. 4. Calculate the combined sound power level due to the sound emissions of the individual noise sources. 5. Calculate the expected rating level of sound at the identified noise sensitive sites from the combined sound power level emanating from identified noise sources. 6. Display the rating level of sound emitted by the noise sources in the form of noise contours superimposed on the map of the study area. 7. Determine the existing ambient levels of noise at identified noise sensitive sites by conducting representative sound measurements. 8. Determine the acceptable rating level for noise at the identified noise sensitive sites. 9. Calculate the noise impact at identified noise sensitive sites. 10. Assess the noise impact at identified noise sensitive sites in terms of:- • SANS 101 SANS 10103 for "The measurement and rating of environmental noise with respect to land use, health, annoyance and to speech communication". • Noise Control Regulations. • World Health Organsation - Guidelines for Community Noise. • World Bank - Environmental Guidelines. 11. Investigate alternative noise mitigation procedures, if required, in collaboration with the design engineers of the facility and estimate the impact of noise upon implementation of such procedures. 12. Prepare and submit a full environmental noise impact report containing detailed procedures and findings of the investigation including recommended noise mitigation procedures, if relevant.
PALAEONTOLOGICAL	The terms of reference for the Phase 1 palaeontological impact study are to: • Provide a summary of the relevant legislation; • Conduct a site inspection as required by national legislation; • Determine the likelihood of palaeontological remains of significance in the proposed site; • Identify and map (where applicable) the location of any significant palaeontological remains; • Assess the sensitivity and significance of palaeontological remains in the site; • Assess the significance of direct and cumulative impacts of the proposed development and viable alternatives on palaeontological resources; • Identify mitigatory measures to protect and maintain any valuable palaeontological sites and remains that may exist within the proposed site; • Prepare and submit any permit applications to relative authorities; • Preparation of a draft and final specialist report.

7.2 Methodology

7.2.1 Evaluating the significance of impacts

To ensure a direct comparison between various specialist studies, a standard rating scale has been defined and will be used to assess and quantify the identified impacts. This is necessary since impacts have a number of parameters that need to be assessed. Five factors need to be considered when assessing the significance of impacts, namely:

- Relationship of the impact to **temporal** scales - the temporal scale defines the significance of the impact at various time scales, as an indication of the duration of the impact.

- Relationship of the impact to **spatial** scales - the spatial scale defines the physical extent of the impact.

- The severity of the impact - the **severity/beneficial** scale is used in order to scientifically evaluate how severe negative impacts would be, or how beneficial positive impacts would be on a particular affected system (for ecological impacts) or a particular affected party.

  The severity of impacts can be evaluated with and without mitigation in order to demonstrate how serious the impact is when nothing is done about it. The word 'mitigation' means not just 'compensation', but also the ideas of containment and remedy. For beneficial impacts, optimization means anything that can enhance the benefits. However, mitigation or optimization must be practical, technically feasible and economically viable.

- The **likelihood** of the impact occurring - the likelihood of impacts taking place as a result of project actions differs between potential impacts. There is no doubt that some impacts would occur (e.g. loss of vegetation), but other impacts are not as likely to occur (e.g. vehicle accident), and may or may not result from the proposed development. Although some impacts may have a severe effect, the likelihood of them occurring may affect their overall significance.

Each criterion is ranked with scores assigned as presented in Table 7-2 to determine the overall **significance** of an activity. The criterion is then considered in two categories, viz. effect of the activity and the likelihood of the impact. The total scores recorded for the effect and likelihood are then read off the matrix presented in Table 7-3, to determine the overall significance of the impact. The overall significance is either negative or positive.

The significance scale is an attempt to evaluate the importance of a particular impact. This evaluation needs to be undertaken in the relevant context, as an impact can either be ecological or social, or both. The evaluation of the significance of an impact relies heavily on the values of the person making the judgment. For this reason, impacts of a social nature need to reflect the values of the affected society.

Cumulative Impacts
Cumulative Impacts affect the significance ranking of an impact because it considers the impact in terms of both on-site and off-site sources. For example, pollution making its way into a river from a development may be within acceptable national standards. Activities in the surrounding area may also create pollution which does not exceed these standards. However, if both on-site and off-site activities take place simultaneously, the total pollution level at may exceed the standards. For this reason it is important to consider impacts in terms of their cumulative nature.

Seasonality
Although seasonality is not considered in the ranking of the significance, if may influence the evaluation during various times of year. As seasonality will only influence certain impacts, it will only be considered for these, with management measures being imposed accordingly (i.e. dust suppression measures being implemented during the dry season).

Table 7-2: Ranking of Evaluation Criteria

EFFECT	**Temporal scale**			**Score**
	Short term	Less than 5 years		**1**
	Medium term	Between 5 and 20 years		**2**
	Long term	Between 20 and 40 years (a generation) and from a human perspective almost permanent.		**3**
	Permanent	Over 40 years and resulting in a permanent and lasting change that will always be there		**4**
	Spatial Scale			
	Localised	At localised scale and a few hectares in extent		**1**
	Study area	The proposed site and its immediate environs		**2**
	Regional	District and Provincial level		**3**
	National	Country		**3**
	International	Internationally		**4**
	Severity		**Benefit**	
	Slight / Slightly Beneficial	Slight impacts on the affected system(s) or party(ies)	Slightly beneficial to the affected system(s) or party(ies)	**1**
	Moderate / Moderately Beneficial	Moderate impacts on the affected system(s) or party(ies)	An impact of real benefit to the affected system(s) or party(ies)	**2**
	Severe / Beneficial	Severe impacts on the affected system(s) or party(ies)	A substantial benefit to the affected system(s) or party(ies)	**4**
	Very Severe / Very Beneficial	Very severe change to the affected system(s) or party(ies)	A very substantial benefit to the affected system(s) or party(ies)	**8**
LIKELIHOOD	**Likelihood**			
	Unlikely	The likelihood of these impacts occurring is slight		**1**
	May Occur	The likelihood of these impacts occurring is possible		**2**
	Probable	The likelihood of these impacts occurring is probable		**3**
	Definite	The likelihood is that this impact will definitely occur		**4**

** In certain cases it may not be possible to determine the severity of an impact thus it may be determined: Don't know/Can't know*

Table 7-3: Ranking matrix to provide an Environmental Significance

Environmental Significance		Positive	Negative
LOW	An acceptable impact for which mitigation is desirable but not essential. The impact by itself is insufficient even in combination with other low impacts to prevent development. These impacts will result in either positive or negative medium to short term effects on the social and/or natural environment	**4-7**	**4-7**
MODERATE	An important impact which requires mitigation. The impact is insufficient by itself to prevent the implementation of the project but which, in conjunction with other impacts may prevent its implementation. These impacts will usually result in either positive or negative medium to long term effect on the social and/or natural environment.	**8-11**	**8-11**
HIGH	A serious impact which, if not mitigated, may prevent the implementation of the project. These impacts would be considered by society as constituting a major and usually long term change to the natural and/or social environment and result in severe negative or beneficial effects.	**12-15**	**12-15**
VERY HIGH	A very serious impact which may be sufficient by itself to prevent the implementation of the project. The impact may result in permanent change. Very often these impacts are unmitigable and usually result in very severe effects or very beneficial effects.	**16-20**	**16-20**

7.2.2 Example of an environmental significance statement

Impact 1: Impact of noise on human health

Cause and Comment
The noise associated with Heavy Goods Vehicles (HGVs) has the potential to impact on human health. A recommendation for the movement of large vehicles at night may impact on the sleep patterns of local communities.

Mitigation and Management
There are standard mitigation measures to ensure that vehicle noise is kept within acceptable limits. Vehicles should be kept in good repair; they should use standard exhaust and silencing equipment. Drivers should stick to designated speed limits. Roads should be kept in good condition.

Significance Statement

RATING		Temporal Scale		Spatial Scale		Severity of Impact		Risk or Likelihood		Total
	Without Mitigation	Short term	1	Localised	1	Moderate	2	Definite	4	8
	With Mitigation	Short term	1	Localised	1	Slight	1	Unlikely	1	4
Overall Significance without mitigation										**MODERATE**
Overall Significance with mitigation										**LOW**

8 KEY FINDINGS OF THE SPECIALIST STUDIES

In terms of section 32 (2) of the EIA regulations (2006), a*n environmental impact assessment report must include:*

(i) ***A summary of the findings and recommendations of any specialist report or report on a specialised process;***

8.1 Avifauna Impact Assessment

The key findings of the Avifauna Impact Assessment are presented below. The study was informed by the following data sources and reports, which presented limitations and assumptions.

The following data sources and reports were used in varying levels of detail for this study:

- The South African Bird Atlas Project (SABAP) data (Harrison et al 1997) for the quarter degree square covering the sites
- The Important Bird Areas report (Barnes, 1998) was consulted for data on the area
- Conservation status of species occurring in the study areas was determined using Barnes (2000)
- The bird specialist report for the original Klipheuwel demonstration facility (van Rooyen 2001)
- The report to Eskom Peaking Generation on the monitoring of bird mortalities at the demonstration facility at Klipheuwel (Kuyler 2004 – obtained from Eskom Peaking Generation)
- International literature on avian interactions with wind energy facilities
- Co-ordinated Avifaunal Road (CAR) counts were used to supplement the SABAP data

Any inaccuracies in the above sources of information could limit this study. In particular, the Bird Atlas data is now thirteen years old (Harrison *et al* 1997), but no reliable more recent data on bird species presence and abundance in the study area exists.

8.1.1 Avifauna of proposed Terra Wind Energy-Golden Valley Project

The vegetation classification shows that the area is comprised mainly of shrubs and “grassland” and that few large trees are present. We would thus expect more terrestrial species in the area. The Atlas of Southern African Birds suggests that the following sensitive species that may be collision sensitive would be expected to be found in this area:

- Blue Crane
- Secretary bird
- Denhams Bustard
- White Stork

The vegetation data is also useful in predicting the likelihood of occurrence of certain species presented in the SABAP data below (Table 8-2). The vegetation characteristics help us to assess what the predominant habitat type is and, when correlated to each species preferred habitat, its likelihood of occurrence.

The study area is predominantly shrubland and low fynbos, as well as some thicket and bushland, forest and woodland, unimproved grassland and commercially irrigated cultivated land.

The commercially irrigated cultivated land is found on the western side of the site following the Fish River. Irrigated land is generally attractive to a wide variety of avifauna and this is one of the sensitive micro-habitats discussed further below.

Table 8-1 lists the Red Data bird species recorded in the quarter degree square covering the study area by the Southern African Bird Atlas Project (Harrison *et al,* 1997), i.e.3225DD. The total number of all species recorded and the number of cards (counts) submitted per square is also shown. In total 6 Red Data species were recorded across the square, comprising 2 Vulnerable and 3 Near-threatened species. In addition, the White Stork was included here as it is afforded protection internationally under the Bonn Convention on Migratory Species. Report rates are essentially percentages of the number of times a species was recorded in the square, divided by the number of times that square was counted. It is important to note that these species were recorded in the entire quarter degree square in each case, and may not actually have been recorded on the proposed site for this study.

Table 8-1- Sensitive bird species in the effected quarter degree square

Total Cards		35		
Total Species		156		
Total Breeding Species		19		
Name	**Conservation status**	**3225DD**	**Habitat**	**Likelihood of occurrence**
Blue Crane	VU	20	Midland and highland grassveld, edge of karoo, cultivated land, edges of vleis	Likely
Denham's (Stanley's) Bustard	VU	9	Montane and highland grassveld, savanna, karoo scrub	Likely
Black Stork	NT	3	Feeds in or around marshes, dams, rivers and estuaries; breeds in mountainous regions	Possible
Secretarybird	NT	14	Semidesert, grassland, savanna, open woodland, farmland, mountain slopes	Likely
Melodious (Latakoo) Lark	NT	6	Open climax grassland, especially Red Grass (Rooigras) *Themeda triandra* and species of *Eragrostis* and Russet Grass *Loudetia simplex* , sometimes with rocky outcrops, termite mounds or sparse bushes; also cultivated fields of Teff *Eragrostis tef* ; in KwaZulu-Natal at 550-1750 m elevation, rainfall 400-800 mm/year; moves into e Karoo after good rains.	Possible
White Stork	Bonn	20	Highveld grasslands, mountain meadows, cultivated lands, marshes, karoo	Likely

VU = Vulnerable

NT = Near-threatened

Bonn = Protected under the Bonn Convention on migratory species

Table 8-2- CAR data for the EG02 route, data is numbers of birds per 100km. (Young, D.J, et al, 2003)

	Summer	Winter
Blue Crane	7.63	15.97
Kori Bustard	-	0.7
Ludwigs Bustard	-	2.1
White Stork	18.03	-
Secretarybird	5.6	6.97
Black Korhaan	9.03	4.2
Whitebellied Korhaan	-	2.1
Spurwinged Goose	0.7	1.4
Blackheaded Heron	7	2.8
Total	48	36.23

As can be seen in the two tables above, large terrestrial birds are present in the study area. These larger species are the species of particular concern for us as they are known to be more collision sensitive with power lines (EWT central incident register) and as such we suspect that they will also be more collision sensitive with wind turbines. A lack of data on avifaunal interactions with wind turbines in South Africa is of concern and as such the precautionary principle has been applied to this assessment due to the lack of knowledge and experience on wind energy in South Africa.

As well as the above two datasets, surveys were conducted at 4 locations. At each site the following was done:

- Surveys were conducted on at least two days at sites at either end, and in the middle of the proposed turbine corridor and Survey sites will be selected to reflect variation in local habitat and terrain.
- During daylight in each survey 2 x 15 minutes of visual scans of birds crossing the proposed turbine corridor (with appraisal of flight height above the ground) as well as 2 x 10 minutes circular point surveys were conducted.
- Flight height was recorded as either: Below Turbine Height; Turbine Height; or Above Turbine Height.

The data that was collected can be seen below in the tables (Table 8-3 – 8-6).

Table 8-3- First Bird survey conducted at 17:05 on the 8/2/2010

Species	Flight Height
Barn Swallow	Below Turbine Height
Red-faced Mousebird	Below Turbine Height
Southern Glossy Starling	Below Turbine Height
Southern clapper Lark	Below Turbine Height

Table 8-4- Second Bird survey conducted at 05:48 on the 9/2/2010

Species	Flight Height
Red-eyed Dove	Below Turbine Height
Barn Swallow	Below Turbine Height
Turtle Dove	Below Turbine Height
Deidricks Cuckoo	Below Turbine Height

Table 8-5- Third Bird Survey conducted at 16:18 on the 9/2/2010

Species	Flight Height
Pied Starling	Below Turbine Height
Deidricks Cuckoo	Below Turbine Height
Turtle Dove	Below Turbine Height
Southern Glossy Starling	Below Turbine Height
Southern Clapper Lark	Below Turbine Height
Barn Swallow	Turbine Height
White Storks	Below Turbine Height

Table 8-6- Fourth Bird Survey conducted at 05:35 on the 10/2/2010

Species	Flight Height
Egyptian Goose	Below Turbine Height
Barn Swallow	Below Turbine Height
Southern Glossy Starling	Below Turbine Height
Red-eyed Dove	Below Turbine Height
Fork-tailed Drongo	Below Turbine Height
Cape Sparrow	Below Turbine Height
Sacred Ibis	Below Turbine Height

As can be seen above the bird surveys did not really add much in terms of sensitive species but it was a worthwhile exercise to assess the height the birds are flying at, at various locations within the study area. As can be seen in the four tables above only one incident of birds flying at turbine height was recorded and these were Barn swallows. Having said this, however, the scope for first hand data collection within the current EIA process in South Africa is severely lacking. It would be far better to have 1 year's worth of data from many more localities within this site to have a real idea of bird flight paths and to be able to model this with any degree of accuracy. Unfortunately this is not feasible in the current EIA process and as such second hand sources are relied on far more heavily than the limited first hand observation data that was collected.

8.1.2 Recommendations

Overall, this specialist study found that the proposed Terra Wind Energy-Golden Valley Project should not pose any significant environmental threat to the surrounding avifaunal environment if all the mitigation measures and recommendations are undertaken. The impact of collision is expected to be the greatest and this can be mitigated by the correct placing of turbines, painting the turbine blades as specified in this report and the use of no or red strobe lights on the turbines. As mentioned in the report, there is a lack of experience and knowledge on wind energy in South Africa and as such, this report has been dealt with using our best scientific knowledge and experience from other fields and from international studies that are available. We have applied the precautionary principle throughout, and this may mean that some impacts have been rated higher and some areas have been identified as more sensitive than they really are.

It must be noted here that there is some concern regarding the cumulative impact of multiple wind energy facilities on avifauna. This facilities site is located just south of another proposed wind energy facility. This means that in this particular area, there is the possibility of approximately 700 wind turbines and the associated infrastructure. This will obviously have a much larger effect on avifauna and no study has been done on this cumulative impact. While both facilities have been subject to EIA studies, there has been little thought for the cumulative impact. This should not be seen as the fault of the developer but rather a gap in the environmental process that needs to be filled with a more strategic assessment of wind energy in South Africa.

A site specific avifaunal EMP is seen as a critical next step to refine the sensitivity map and to strengthen the mitigation measures in order to have the least impact possible on avifauna in the area.

8.2 Heritage Impact Assessment

The following limitations and assumptions were experienced during the Heritage Impact Assessment study. The physical survey of the study area proved difficult. Much time was spent finding landowners and negotiating access to property. Organised hunting had been scheduled on certain land portions which meant that less time was spent in certain areas than was desirable. The proposal is for some 214 wind turbines. While ideally each turbine site should have been inspected, this was not possible due to the considerable amount of time it took to reach many of the localities which were very remote (if one hour was dedicated to each locality, the study would require 3 weeks of survey time). Locked gates, jackal and kudu fences all contributed to the physical difficulty of the work.

The proposed locations of turbines provided by the proponent are preliminary and not field-tested. It is highly likely that turbine positions will change through the course of the proposed project.

The proposed turbine localities will each require an access road. Given the rugged topography of the study area, this will involve considerable road works to create gradient suitable for transportation of abnormal loads. No information with respect to proposed roads was provided by the proponent, which meant that a potential source of significant impact in heritage terms could not be fully assessed for the purposes of this EIA.

Given the low level of detail at this stage of the project, the ACO team focussed on carrying out a general survey of the study area focussing on determining the general density of heritage/archaeological occurrences and the relative sensitivity of the range of topography

8.2.1 Heritage aspects of the proposed Terra Wind Energy-Golden Valley Project

The heritage survey revealed that the heritage of the study area is characterised by archaeological sites spanning the Early, Middle and Late stone ages.

Early Stone Age (Site 1 in Figure 8-1) material was located at a single locality situated on the lower slopes of the hilltop referred to "Onder Smoorsdrift" on the farm Bygevoegt 164. The site which contains fine examples of Achaeulian bifaces, regular and irregular cores is (moderately) scattered over a wide but definable area on a gentle gradient above a river. The site is significant in that it is the only example of its kind found in the study area so far. Suggested heritage grading: Locally significant 3b.

Middle Stone Age (MSA) material was found thinly scattered throughout the study area, however definable archaeological sites could not be easily identified. The material may be described as "ancient litter" containing occasional flakes and blades. Like the Late Stone Age material it is more common on alluvial fans around dongas, sandy flat areas, and is even occasionally seen on remote hilltops and steep slopes. Relatively dense scatters were identified as an eroded scatter of MSA material, mostly informal flakes, blades and large cores made from hornfels on a valley bottom cut through by a deep donga (Site 2 in Figure 8-1); an eroded scatter of mostly MSA material found along the banks of a shallow stream bed (Site 3 in Figure 8-1); and MSA material thinly associated with a dammed donga on the farm Olivewoods (Site 4 in Figure 8-1)

Late Stone Age material was limited to two recorded occurrences:

1) A scatter of ceramics strewn over along the edges of an erosion gully which has cut into an alluvial fan (Farm Great Drift 173). The site is unusual as only ceramics in the style of Cape Coastal Pottery and a stone cairn were noted. Pottery of this kind is associated with the period after 2 000 years ago when pre-historic pastoralists entered the Cape bringing with them domestic stock and the knowledge of working clay into pottery. Suggested grade locally significant 3b (Site 5 in Figure 8-1)
2) A large assortment of informal artefacts scattered widely over a large alluvial fan area on the farm Bijgevoegd 164. The site, which lies on sandy land, is cut through by a very large erosion gulley. The presence of up to 20 upper and lower grinding stones is a possible indication that there may be prehistoric graves here, as such artefacts were used as grave markers or ornaments. No human remains were noted at the time of inspection. The raw material used was *Hornfels* and *Siltstone*. Suggested grade: moderately locally significant 3b (Site 6 in Figure 8-1).

A single occurrence of **historical archaeology** was recorded at Site 7 in Figure 8-1. There is a single disused set of farm buildings situated at Groot Rietfontein. The farm house was originally a rectangular cottage built from home-made bricks and mud mortar. Apart from one end-wall, it has collapsed completely. Indications are that the structure is of late 19th century origin judging by the proportions of the last remaining window opening. Other features of the site are a corrugated outbuilding, stone/ wire kraal as well as various enclosures. There is a wind pump and a corrugated iron out-building. No historical artefactual material greater than 100 years of age was noted.