BIODIVERSITY BASELINE SURVEY

75MW PHOTOVOLTAIC ELECTRICITY GENERATION FACILITY

on

PORTION 8 OF FARM 187 OLYVENKOLK, KENHARDT DISTRICT

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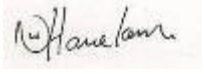
Author	Principle EAP	Nicolaas Hanekom		November 2012
Authorized By:	Director	Mark Duckitt		November 2012

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INTRODUCTION

This biodiversity survey is presented by Eco Impact Legal Consulting (Pty) Ltd ("Eco Impact").

1. Background & Competency

Eco Impact is a Cape Town based consultancy with environmental, health and safety legal expertise. We are suited to assist clients with National Environmental Management Act 107 of 1998 ("NEMA") section 24G applications, obtaining and managing waste license applications, environmental authorisations, biodiversity assessments and with ISO 14001 and OHSAS 18001 related issues.

Nicolaas Hanekom is a registered Professional Natural Scientist in the ecological science field with the South African Council for Natural Scientific Professions ("SACNASP") and a qualified Environmental Assessment Practitioner ("EAP") who holds a Masters Technologiae, Nature Conservation ("Vegetation Ecology and Biodiversity Assessment") degree from the Cape Peninsula University of Technology.

He further qualified in Environmental Management Systems ISO 14001:2004, at the Centre for Environmental Management, North-West University, as well as Environmental Management Systems ISO 14001:2004 Audit: Internal Auditors Course to ISO 19011:2003 level, from the Centre for Environmental Management, North-West University qualifying him to audit to ISO/SANS environmental compliance and EMS standards.

He has also completed the suite of Greener Governance courses with certificates in:

- An Overview of Environmental Management at the Local Government Level, Centre for Environmental Management, North-West University;
- Greener Governance for Local Authorities, Centre for Environmental Management, North-West University;
- Tools for Integrated Environmental Management and Governance, Centre for Environmental Management, North-West University.

Hanekom attended and obtained a certificate on Integrated Protected Area Planning at the Centre for Environmental Development, University of KwaZulu Natal and a certificate in Project Management (Theory and Practical), through CS Holdings. He has presented lectures in two subjects at the Cape Peninsula University of Technology. He has 14 years of environmental planning experience, working for Free State and Western Cape departments of environmental affairs, where he reviewed and commented on development (EIA) applications in the West Coast Region.

Hanekom has been responsible for many environmental impact assessments and several EIA applications, waste license and atmospheric emission license applications as well as being involved in the implementation of several environmental management systems.

This report has been prepared by Nicolaas Hanekom for Eco Impact Legal Consulting (Pty) Ltd ("Eco Impact").

2. Conditions Relating to this Report

The findings, results, observations, conclusions and recommendations given in this report are based on the author's best scientific and professional knowledge as well as available information. Eco Impact and its staff reserve the right to modify aspects of the report including the recommendations if and when new information may become available from on-going research or further work in this field, pertaining to this investigation.

This report may not be altered or added to without the prior written consent of the author. This restraint also refers to electronic copies of this report which are supplied as sub portion of other reports, including main reports. Similarly, any recommendations, statements, or conclusions drawn from or based on this report must specifically refer to this report. If such comments form part of a main report for this investigation, the Base Line report must be included in its entirety as an appendix or separate section to the main report.

3. General Preamble

3.1. Fundamental Objectives

EIA's and EMP's encompass two ultimate purposes:

- Maintenance of South Africa's biodiversity, and
- Enhancement of the quality of life of all South Africa's people.

These two objectives are frequently perceived to be in conflict, and are fundamentally aligned to legislation via the Constitution and National Environmental: Biodiversity Act.

They are, in fact, inseparably linked and fundamentally compatible. Research indicates that the availability of natural and wilderness areas are essential to the emotional, intellectual and physical well-being of urban residents, especially children (Miller 2005).

To preserve biodiversity, it is necessary to focus on both ***pattern and process***, that is, the full range of species and habitats (pattern), as well as the ecological and evolutionary processes that allow biodiversity to persist over time (Driver at al. 2003). Animals cannot survive in the absence of their habitat, and neither species nor habitat can survive in the absence of the ecological processes which sustain them.

For this reason, this report may devote as much or more attention, to habitat and ecological processes than to species.

3.2. Guiding Principle

In large-scale development projects (e.g., 10ha or more) it is necessary to apply the principle that *a development should not impact on habitats needed to meet conservation targets and where ecological processes could naturally occur*, especially if the site contains unaltered natural habitats.

This principle is based on the logical premise that unless biodiversity conservation is applied at the micro-scale of individual developments, biodiversity conservation at the macro-scale, that is, in the country as a whole, will not succeed.

Important implications of this principle are that:

- Large-scale developments may need to set aside portions of land specifically for conservation purposes, and
- Such portions need to be appropriately and effectively managed to preserve their ecological and biodiversity value.

3.3. Ascribing Value and Importance

There frequently is an assumption made that certain species, habitats and biotic communities have greater value and importance than others. The factors which affect value and importance, also in our view, are:

3.3.1. Ecological importance

The contributions of portions of a particular habitat to the overall ecology of an area are not all equal. Some habitat has greater importance because of the rarity factor or because of a specific role within the habitat. Wetland habitat, for example, are usually small components of a landscape in terms of area, but play a vital role in sustaining aquatic biota and in providing essential resources to terrestrial animals.

Any habitat which is needed to maintain ecological processes has added value.

3.3.2. Connectivity

A particular piece of habitat, which may have little importance itself, may acquire considerable, even critical importance and value, if it connects two other areas of ecological importance. Such “corridor” areas sustain the process and movement of biota between areas and thereby promote the long-term sustainability of ecosystems. Similarly, if an area is adjacent or connected to other areas of conservation importance, its value is increased because it functions as a part of a larger ecological system.

3.3.3. Sustainability

Sustainability is a central concept because conservation aims to preserve species, habitats and ecosystem processes in the long term. In fact, the ideal of conservation is to preserve natural systems at temporal and spatial scales that allow evolutionary processes to continue indefinitely. It is therefore essential that conservation planning take into account the factors that are likely to affect the long-term sustainability of systems. Preservation of isolated patches of habitat, no matter how pristine, will not succeed if the larger processes that sustain that patch are not also preserved.

In general, the smaller and more isolated a conserved area is, the more intensive the management of the area needs to be in order to maintain its character. Sustainability interacts with the allocation of value and importance. If a feature is deemed to have high value, but that value is unsustainable, its value tends to be down-graded. Conversely, a feature of lesser intrinsic value may have its value enhanced by a greater degree of sustainability.

3.3.4. Threatened status

If a species has been designated “Threatened”, its value is taken to be higher than that of a non-threatened species. Similarly, the higher the level of threat, the greater is the ascribed value. Levels of threat for species are usually objectively defined in Red Data books and the status of veld types is given in the National Spatial Biodiversity

Assessment (Rouget et al. 2005). Special attention is devoted to wetland and lowland habitats because, in general, they are more threatened than dry land and montaine habitats, respectively.

3.3.5. Intactness

The concept applies to habitats, ecosystems and communities. If a system is perceived to be relatively undamaged and functioning normally, it is considered to be "intact". This attribute does not imply long-term sustainability, but merely that, at the time, the habitat and its biotic community are present and functioning.

Intact systems are given greater value because they are generally more functional with regard to ecological- process, -complexity, -rarity and -sensitivity than damaged, disturbed or transformed habitats.

3.3.6. Aesthetic, recreational and educational value

These aspects of value are largely context dependent. That is, the social and economic context of any particular piece of habitat and its associated biotic community is what largely determines whether it has aesthetic, recreational or educational importance. In general, the more developed and densely populated an area, the more relevant these aspects become.

Such aspects need to be viewed as important to the maintenance of the quality of life, in both urban and suburban environments.

3.4. Importance of Management

The underlying assumption of development plans tend to be that certain natural features may be destroyed and other natural features must be preserved. This approach is far too simplistic to achieve the fundamental objectives of 4.1 above.

If biodiversity and the quality of life of human inhabitants are to be maintained, the environment has to be managed. This principle is readily accepted for the built environment where various environmental management services are routinely provided by landowners and local authorities (e.g., refuse removal, drainage, waste-water treatment, etc.), but the principle of management is frequently ignored when applied to the more extensive and natural environment.

While benign neglect may be a valid aspect of a management policy, it is never a complete solution.

3.5. Standard Caveats

Surveys such as herewith generally suffer from a number of defects that must be overtly acknowledged.

3.5.1. Limited time

A truly comprehensive survey requires systematic sampling of the entire habitat in all seasons, and at different times of day. Such thoroughness is seldom possible and therefore most records of occurrence are based on literature and reports obtained from local residents. Follow up verification of occurrence of important species is thus recommended in appropriate cases.

3.5.2. Taxonomic scope

A comprehensive survey should examine all biodiversity, not only plants, mammals, birds, reptiles and amphibians. It is probable that important and sensitive species of fish and invertebrate could have been overlooked in surveys limited to the above groups.

3.5.3. Limited expertise

It is not possible to be an expert on all groupings within biodiversity and all aspects of ecology.

We trust that this report will *sufficiently identify and address issues of likely importance*, acknowledging that the full appropriate response to some of these aspects may require the inputs of other particular specialists in appropriate instances.

4. Biodiversity Survey

Ecology is essentially a multi-disciplinary science concerned with the relationship between organisms themselves and between organisms and their environment, in which the emphasis may be on the organisms, populations, communities or ecosystems. It is also the scientific study of the interactions between man, living organisms and the abiotic environment (habitats) with one another and with the non-living environment of matter and energy. It concerns substantially the structure and function of nature. An ecologist is someone who has received appropriate comprehensive training and has experience in biological studies and the analysis of the responses of organisms to the environment and to each other, which then equips a person to be an ecologist.

Loss of natural habitat is the single biggest cause of biodiversity loss in South Africa and in much of the world. This means that it often makes sense to focus conservation action on preventing further habitat loss in priority ecosystems, in and out of protected areas, rather than on conserving individual species. Each plant community can therefore be considered as a different ecosystem (Bredenkamp *et al.* 2002).

It is on the above statement and principle that the National Spatial Biodiversity Assessment is based. This National Spatial Biodiversity Assessment is further based on the phytodiversity or vegetation types. The substrate, which in turn determine the flora component, is however seen as a baseline for all ecosystem functioning.

Faunal species rely on habitat and niches provided in most instances by vegetation types. It is therefore reasonable to make use of the National Spatial Biodiversity Assessment in making recommendations for this ecological and biodiversity study. Differences in environmental parameters result in differences in vegetation. Biodiversity conservation is linked to the preservation of critical habitat in priority ecosystems.

5. Purpose and Background to the Study

Green Continent Partners is proposing the establishment of commercial solar electricity generating facilities and associated infrastructure on Portion 8 of Farm 187 Olyvenkolk, Kenhardt, Northern Cape.

The solar facility intends to accommodate a photovoltaic component and associated infrastructure on the proposed site. The proposed site for the photovoltaic electricity

generation facility was identified through an extensive site selection process which took several conditions such as climatic conditions, topography and grid connection into consideration.

The National Environmental Management: Biodiversity Act (No. 10 of 2004) under Chapter 4 in particular relates to threatened and protected ecosystems and species and related threatening processes and restricted activities. This report has taken into consideration those indigenous species listed as threatened or protected species in terms of Section 56(1) of the Act.

6. Description of the Study Area

The facility will be constructed north of the Aries ESKOM Substation southwest of the town Kenhardt, Northern Cape (See Figure 1) on Portion 8 of Farm 187 Olyvenkolk. The property where the facility is proposed covers a total area of approximately 1419 ha, the extent of which is larger than the space required for the facility's developmental footprint. The site falls within the quarter degree grid 2920BD. GPS readings as per Google - 29° 26‘ 47“S and 20° 50‘ 11“E.

The study site is situated approximately 37km southwest of Kenhardt, north of the Aries Eskom substation. The study area is south of the gravel road from Kenhardt to Pofadder. The gravel road turns west off the R27 south of the town Kenhardt.

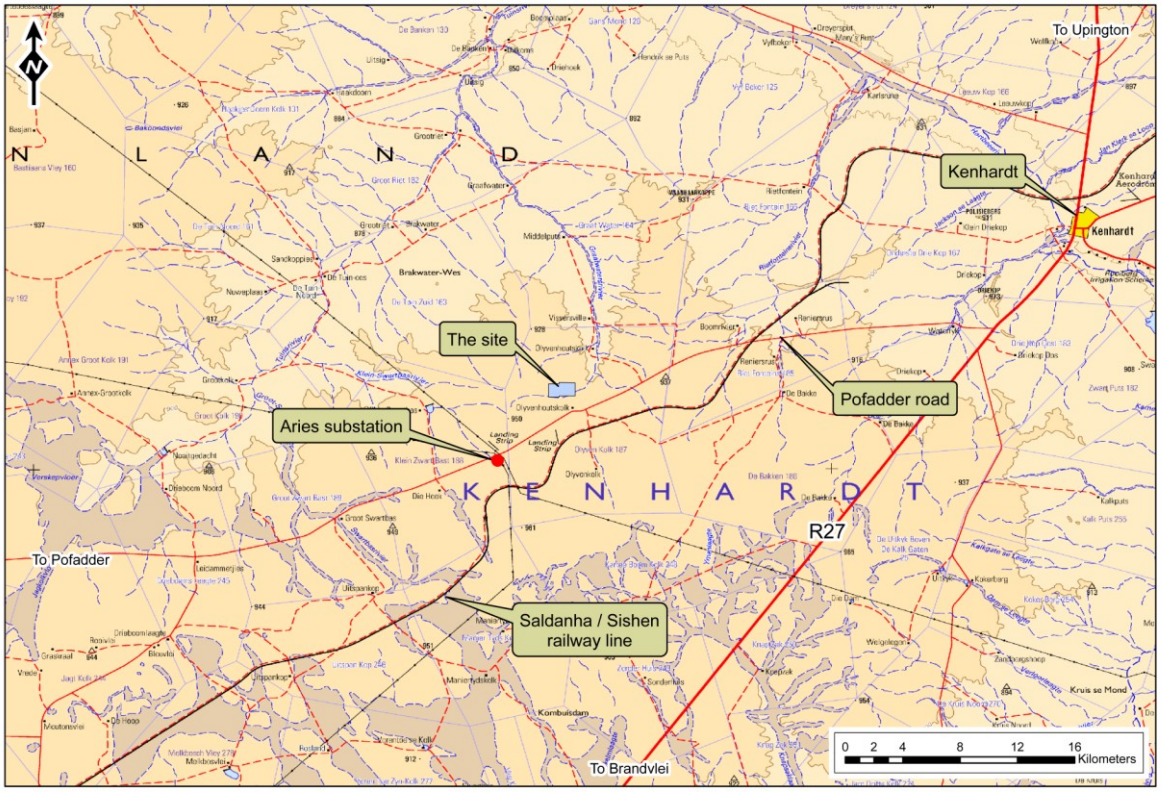


Figure 1: Locality Map

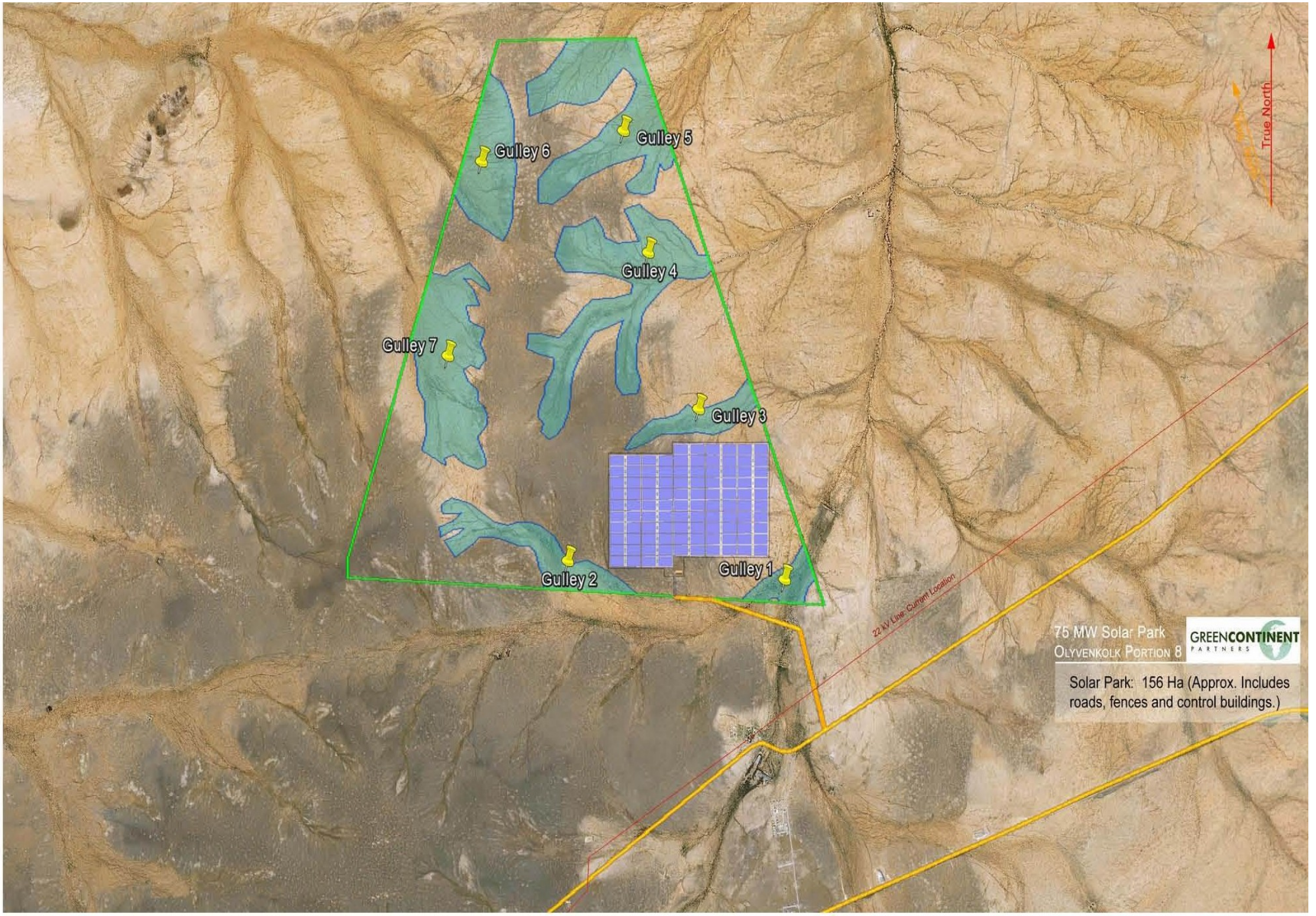


Figure 2: Site layout

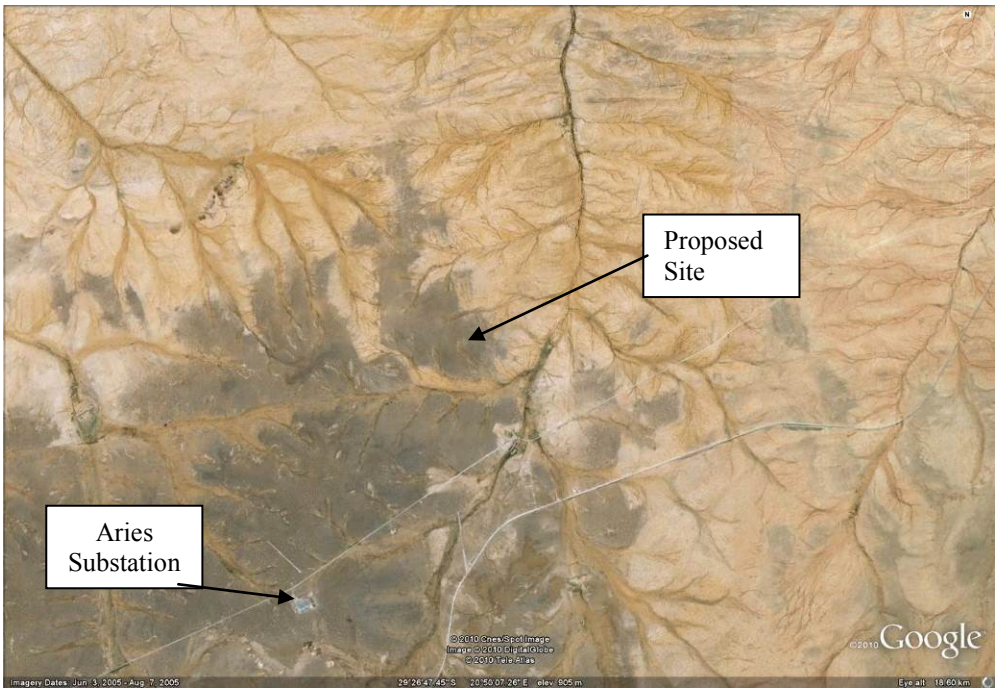


Figure 3: An aerial photograph and the locality of the property

6.1. Topography

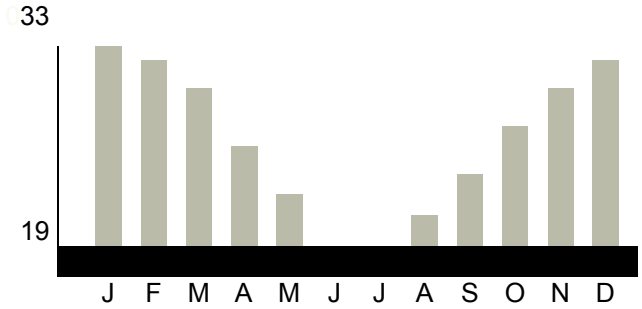
The study site is located mostly on flats plains which slope gently (20m drop in 2 km) towards the east. This landscape is typical of the broader region within which the study area is located and the pattern repeats itself up 30 km in any direction. The plains are situated at an elevation of 960 m. The highest point on the plains within the study site is at the western side of the site and it drains down to a flat area in the east. The site is situated in a very arid part of South Africa. Several drainage lines drain the water collected on the site towards the east, which eventually feed into the upper catchment of the Graafwatersrivier, a non-perennial river north of the study area.

6.2. Climate

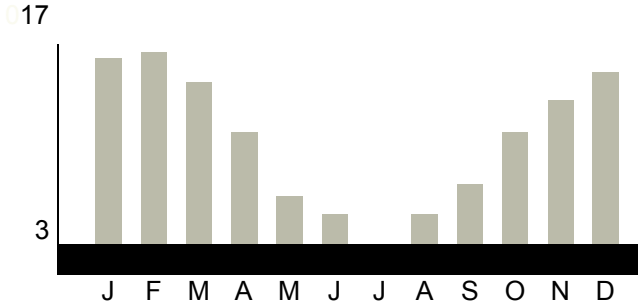
The study area is characterised by an arid climate. Kenhardt normally receives about 70mm of rain per year, with most rainfall occurring mainly during autumn. The chart below shows the average rainfall values for Kenhardt per month. It receives the lowest rainfall (0mm) in June and the highest (23mm) in March. The monthly distribution of average daily maximum temperatures shows that the average midday temperatures for Kenhardt range from 19°C in June to 33°C in January. The region is the coldest during July when the mercury drops to 2.6°C on average during the night. Consult the chart below for an indication of the monthly variation of average minimum daily temperatures.

Average rainfall (mm)

Average midday temperature (°C)



Average night-time temperature (°C)



6.3. Geology

The geology according to Almond (2011) is outlined on the 1: 250 000 geology map 2920 Kenhardt (Council for Geoscience, Pretoria; Fig. 3 herein). An explanation to the Kenhardt geological map has been published by Slabbert *et al.* (1999). Several of the relevant rock units are also treated in the explanations for the adjacent 1: 250 000 sheets such as the Britstown sheet to the southeast (Prinsloo 1989), the Pofadder sheet to the west (Agenbacht 2007) and the Sakrivier sheet to the south (Siebrits 1989).

According to the Kenhardt 1: 250 000 geology map (Fig. 3) the construction site of the proposed Green Continent Partners PV power station is underlain by the

Permocarboniferous **Dwyka Group** (Karoo Supergroup, **C-Pd**). Dwyka sediments underlie most of the western portion of farm Olyven Kolk 187, with Quaternary alluvium lining the major water courses. Both these rock units are present in the vicinity of the Olyvenhoutskolk farmstead (black circle in Fig. 3) where most of the proposed construction will take place. Small exposures of Mokolian (Mid Proterozoic) basement rocks of the **Namaqua-Natal Province** (De Bakken Granite, **Mdk**, and the Kokerberg Formation, **Mko**) occur in the northeastern portion of farm Olyven Kolk 187. These two billion year old granitoid intrusions and highly metamorphosed sediments (*cf* Cornell *et al.* 2006) are largely mantled by Quaternary wind-blown sands and associated fluvial sediments and pedocretes of the **Gordonia Formation** (Kalahari Group, **Q**). Since the Mokolian basement rocks are unfossiliferous and will not be directly affected by the proposed development, they will not be considered further here. Satellite images (Fig. 2) show that the landscape in the study area is extensively dissected by distal tributaries of the Orange River, notably the Graafwatersriver that flows northwards into the Hartbeesrivier and thence into the Orange.

Dwyka Group

Permocarboniferous glacially-related sediments of the **Dwyka Group** (**C-Pd** in Fig. 3) underlie the thin, superficial cover of Gordonia sands, calcrete and Late Caenozoic alluvium both north and south of the Orange River and crop out at surface within the study area southwest of Kenhardt. The geology of the Dwyka Group has been summarized by Visser (1989), Visser *et al.* (1990) and Johnson *et al.* (2006), among others. The geology of the Dwyka Group along the north-western margin of the Main Karoo Basin as far east as Prieska has been reviewed by Visser (1985). Other studies on the Dwyka in or near the Prieska Basin include those by Visser *et al.* (1977-78; summarized by Zawada 1992) and Visser (1982). Fairly detailed observations by Prinsloo (1989) on the Dwyka beds on the northern edge of the Britstown 1: 250 000 geology sheet are in part relevant to the more proximal (near-source) outcrops at Kenhardt. Massive tillites at the base of the Dwyka succession (**Elandsvlei Formation**) were deposited by dry-based ice sheets in deeper basement valleys. Later climatic amelioration led to melting, marine transgression and the retreat of the icesheets onto the continental highlands in the north. The valleys were then occupied by marine inlets within which drifting glaciers deposited dropstones onto the muddy sea bed ("boulder shales"). The upper Dwyka beds (**Mbizane Formation**) are typically heterolithic, with shales, siltstones and fine-grained sandstones of deltaic and / or turbiditic origin. These upper successions are typically upwards-coarsening and show extensive soft-sediment deformation (loading and slumping). Varved (rhythmically laminated) mudrocks with gritty to fine gravely drop stones indicate the onset of highly seasonal climates, with warmer intervals leading occasionally even to limestone precipitation.

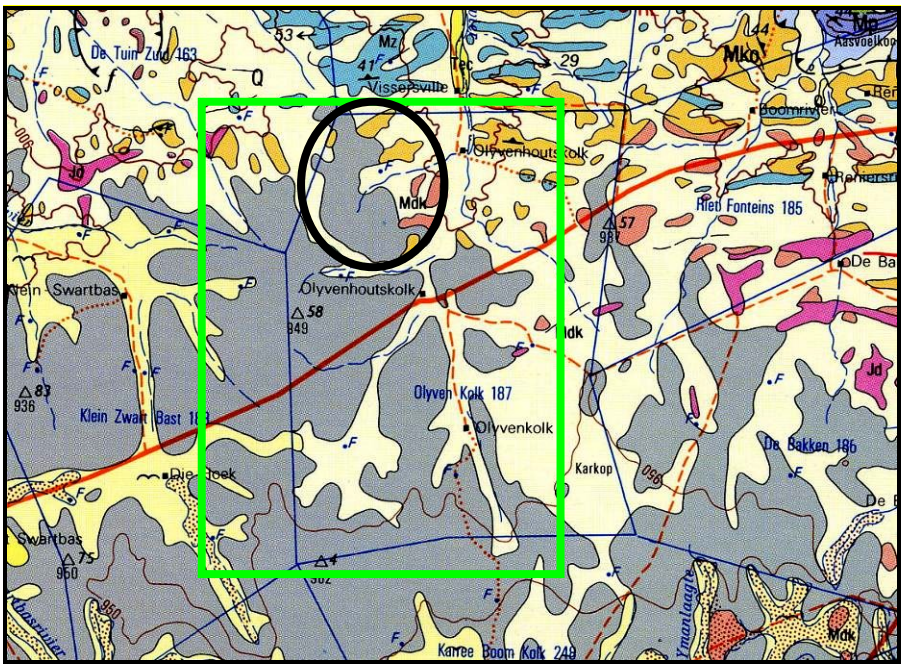


Figure 4: Extract from 1: 250 000 geological map 2920 Kenhardt (Council for Geoscience, Pretoria) showing the approximate location of proposed Green Continent Partners study area on the northern part of farm Olyven Kolk 187 (Green rectangle). Construction will largely take place in the vicinity of the Olyvenhoutskolk farmstead (small black ellipse), in an area that is underlain by Quaternary alluvium (pale yellow) and Dwyka glacial deposits at depth (grey).

MAIN GEOLOGICAL UNITS:
Orange (Mdk) = De Bakken Granite (Mokolian Basement, De Kruis Fragment)
Dark yellow (Mko) = Kokerberg Formation (De Kruis Group, De Kruis Fragment of Mokolian Basement)
Grey (C-Pd) = Mbizane Formation (Permo-Carboniferous Dwyka Group, Karoo Supergroup)
Pale yellow (Q) = Quaternary to Recent sands and sandy soil of the Gordonia Formation (Kalahari Group).

According to maps in Visser *et al.* (1990) and Von Brunn and Visser (1999; Fig. 4 herein) the Dwyka rocks in the Kenhardt area close to the northern edge of the Main Karoo Basin belong to the **Mbizane Formation**. This is equivalent to the "Northern (valley and inlet) Facies" of Visser *et al*. (1990). The Mbizane Formation, up to 190m thick, is recognized across the entire northern margin of the Main Karoo Basin where it may variously form the whole or only the *upper* part of the Dwyka succession. It is characterized by its extremely heterolithic nature, with marked vertical and horizontal facies variation (Von Brunn & Visser 1999). The proportion of diamictite and mudrock is often low, the former often confined to basement depressions. Orange-tinted sandstones (often structureless or displaying extensive soft-sediment deformation, amalgamation and mass flow processes) may dominate the succession. The Mbizane-type heterolithic successions characterize the thicker Dwyka of the ancient palaeovalleys cutting back into the northern basement rocks. The key Reference Stratotype C section for the valley fill facies of the Mbizane Formation is located a few kilometres west of Douglas on the northern side of the Vaal

River (Von Brunn & Visser 1999). The composite section, which overlies glacially-striated Precambrian bedrock, is some 25-30m thick. The lower part of the section consists of massive diamictites with subordinate conglomerates and siltstones. The upper half is dominated by laminated mudrocks with thin diamictites, lonestones (dropstones) and calcareous concretions. The section is conformably overlain by mudrocks of the Prince Albert Formation (Ecca Group) which is not represented in the study area.

For details of the Dwyka Group rocks in the Kenhardt area the reader is referred to the accounts of Visser (1985) and Slabbert *et al.* (1999). The study area *c*. 35km southwest of Kenhardt lies close to the eastern edge of the Sout River palaeovalley identified by Visser (1985, fig. 12 therein). The Dwyka succession in this area comprises both massive, muddy diamictites ("boulder shales") as well as heterolithic intervals dominated by interbedded reddish-brown, pebbly sandstones, conglomerates, and diamictite (ibid., figs. 2, 4). Slabbert *et al.* (1999, p. 107) report that the uppermost Dwyka beds contain stromatolites, oolites and calcareous concretions.

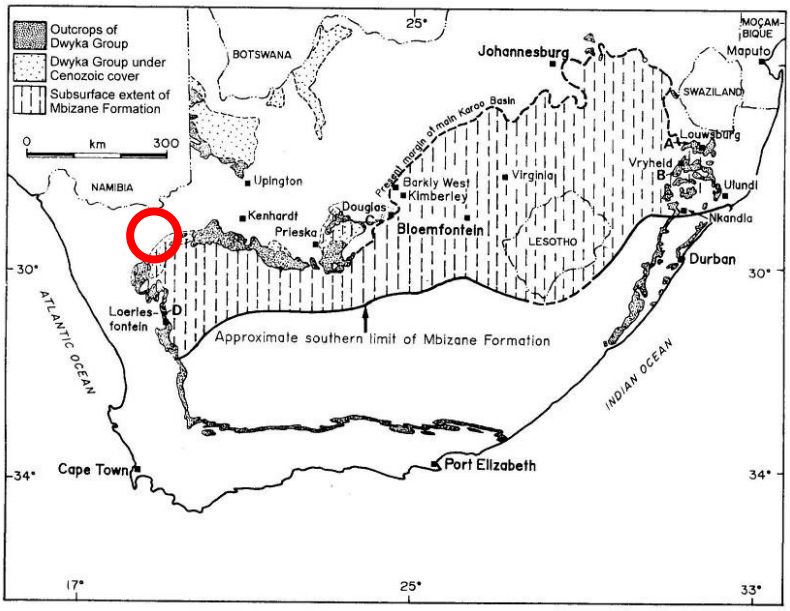


Figure 5: Outcrop map of the Dwyka Group within the Main Karoo Basin of South Africa. Exposures in the study area southwest of Kenhardt (red circle) are assigned to the outcrop area of the Mbizane Formation (From Von Brunn & Visser 1999).

Superficial deposits: Kalahari Group sands, calcretes, alluvial gravels
Unconsolidated, reddish-brown aeolian (*i.e.* wind-blown) sands of the Quaternary **Gordonia Formation** (**Kalahari Group**) (**Q** in Fig. 3) blanket large areas of the landscape in the Kenhardt area (Slabbert *et al.* 1999). The geology of the Late Cretaceous to Recent Kalahari Group is reviewed by Thomas (1981), Dingle *et al.* (1983), Thomas *et al.* (1988), Thomas & Shaw 1991, Haddon (2000) and Partridge *et al.* (2006). The Gordonia dune sands are considered to range in age from the Late Pliocene / Early Pleistocene to Recent, dated in part from enclosed Middle to Later Stone Age stone tools (Dingle *et al*., 1983, p. 291). Note that the recent extension of the Pliocene - Pleistocene boundary from 1.8Ma back to 2.588 Ma would place the Gordonia Formation almost entirely within the Pleistocene Epoch.

According to Slabbert *et al.* (1999, p. 109) Gordonia wind-blown sands in the Kenhardt area, far to the south of the main Kalahari Basin, are thin, rarely preserve longitudinal dune bedforms (these are seen along the Hartbeesrivier near Kenhardt but not further west), and are probably of Holocene age. In the study area the thin superficial blanket of sandy sediments is admixed with local weathering products of the Karoo and other bedrocks. According to these geological survey authors, the sands capping the plains west of the Hartbeesrivier might not in fact be correlated with the Gordonia Formation proper, although they are at least in part derived from the Kalahari Basin.

Late Caenozoic **alluvial deposits** of the Hartbeesrivier tributaries are not described or discussed in detail by Slabbert *et al.* (1999). In addition to finer-grained silts and sands, in the study area they probably include an admixture of coarser gravels derived from weathering of the Karoo rocks (*e.g.* polymict, bouldery erratics and pebbles from diamictites and conglomerates of the Dwyka Group). De Wit (1999) discusses the post-Gondwana evolution of the drainage systems in the Bushmanland region, including pans between Kenhardt and Brandvlei that fed floodwaters from the region *via* the Sakrivier and Hartbees Rivers into the Orange from at least the Plio-Pleistocene times (Ibid., fig. 13. See also De Wit *et al.* 2000).

Figure 6: Approximately 4m deep quarry south of the study area

7. Site Visits and Methods Used

Eco Impact visited the sites (Portion 8 and Portion 12) on 20 June 2012 from mid-morning until late afternoon. This report takes recognition of guidelines as in Brownlie (2005), De Villiers et al. (2005) and IAIA (2005).

8. Observations and Findings Relative to the Terms of Reference highlighted below

8.1. Describe the broad ecological characteristics of the site and surrounds:

Observations and Findings:

The study area lies within the Orange River Broken Veld vegetation type of the Northern Cape. The site is not isolated as it forms part of an extended natural veld area used as extensive grazing for sheep and cattle farming.

The study area is not regionally important from a biodiversity point of view and the survey found that the impact of the proposed development will not have any significant effects on the biodiversity and connectivity of the specific site or region.

8.2. In terms of biodiversity pattern, identify or describe, at a community and ecosystem level-

8.2.1. The main vegetation type:

There are an estimated 5400 plant species in the Northern Cape Province. These plants occur in six large vegetation units known as biomes. Each biome is a broad ecological unit that represents major life zones of large natural areas, defined mainly by vegetation structure and climate. There are six biomes in the Northern Cape, namely the Savanna Biome, Nama Karoo Biome, Succulent Karoo Biome, Fynbos Biome, Grassland Biome & Desert. The proposed site falls within the Nama Karoo biome. Each biome is subdivided into vegetation types, which are groups of plant communities that share similar ecosystem processes, and have similar climatic and geological requirements. There are many vegetation types in the Northern Cape. The Orange River Nama Karoo is an example of one of these vegetation types, within the Nama Karoo Biome. It is found along most of the Orange River from its confluence with the Vaal River near Kimberley to the Richtersveld in the far northwestern corner of the Northern Cape. A common plant of this vegetation type is the Quiver Tree (Kokerboom) Aloe dichotoma that grows on the broken, rocky terrain.

Observations and Findings
The Surveyor General's 1: 50 000 topocadastral maps and google images indicates that the entire site consists of natural vegetation. This was confirmed during the site survey.

8.2.2. The types of plant communities that occur on, and in the vicinity of the site:

Individual plant localities were not plotted in detailed. The site was surveyed and plant communities were identified and species recorded. The habitat approach was preferred. Species collection was focused on the different plant communities present on site.

The study area has been impacted upon to some degree by livestock farming, although the vegetation is in relatively good condition and mostly natural. The vegetation of the study area is dominated by *Salsola tuberculata*, *Eriocephalus ericoides*, *Rhigozum trichotomum*, etc.

The Bushmanland Basin Shrubland (Not Threatened) on the site is in a good condition, although sparsely vegetated due to the low rainfall.

Some of the vegetation species identified on site during the survey included:

- *Prosopis sp*
- *Acacia karoo*
- *Agave rigida var. Sisalana*
- *Eriocepthalus ericoides (kappokbos)*
- *Chrysocoma ciliate*
- *Rhigozum trichotumum*
- *Pterthrix spinescens*
- *Aloe dichotoma (Quiver Tree)*
- *Phaeoptilum sponsum*
- *Zygophyllum gilfillanii*
- *Salsola tuberculata*
- *Limeum aethipicum*
- *Thesium lineatum*
- *Cenchurs ciliaris*
- *Schmidtia kalihariensis*
- *Stipagrostis ciliate var. capensis*
- *Stipagrostis obtuse*
- *Stipgrostis uniplumis var. Uniplumis*
- *Fingerhthia africana*
- *Eragrostis curvula (Increaser IIb)*
- *Pelargonium sp.*

Aloe dichotoma is the only rare and endangered species recorded on the property. Only two specimens of Aloe dichotoma were noted adjacent to the site - one adjacent to the road approaching the site and one on the skyline above the sight. No other rare and endangered species were observed on the proposed impacted site. However, no parts of these plants may be harvested, collected or disturbed without a valid permit from Northern Cape Nature Conservation. The proposed development infrastructure will not impact on this specie.

8.2.3. Threatened or vulnerable ecosystems:

The proposed development will not impact significantly on the biodiversity pattern at neither the community or at an ecosystem level.

The property lies in the general area that supports Bushmanland Basin Shrubland, according to the new vegetation map of South Africa (Mucina & Rutherford 2003). This vegetation type is listed as Not Threatened in the South African National Spatial Biodiversity Assessment (Rouget et al 2004).

8.2.4. The types of animal communities (fish, invertebrates, avifuana, mammals, reptiles):

Fish
No fish species are present on site.

Invertebrates
Insect species observed during the survey includes:

- *Lamarickiana sp.*
- *Bullacris intermedia*
- *Lacustana pardanlina*
- *Culex sp*
- *Pseudolynchia canariensis*
- *Messor capensis*
- *Camponotus fulvopilosus*
- *Grysllus simaculatus*
- *Epusa guttula*
- *Psammotermes allocerus*
- *Hodotermes mossambicus*
- *Trithemis aretoeriosa*
- *Arachnid solifugae*

The proposed development will not have significant impacts on invertebrate species. No known rare or special species were observed or are known to occur or breed on the site.

Birds (Avifauna)

Observation:
62 species are known to occur in the bigger area (Hockey et al 2006).

The following species were observed during the survey:

- *Alopochen aegyptiaca*
- *Bubo africanus*
- *Coluba guinea*
- *Neotis ludwigii*
- *Eupodotis vigorsii*
- *Pterolcles namqua*
- *Charadrius tricollaris*
- *Melicras canorus*
- *Polemaetus bellicousus*
- *Falco biarmicus*

- *Telophorus zeylonus*
- *Corvus albus*
- *Lanius collaris*
- *Hirundo fuligula*
- *Prinia maculosa*
- *Chersomanus albosfasciata var. garrula*
- *Chrthilauda sub coronate*
- *Erythoropygia coryphaeus*
- *Myrmecochchla formicrivora*
- *Philetarious socius*
- *Motacilla capensis*

Findings
The proposed development will not impact significantly on any listed bird species.

Bird species known to occur in the study site that will be impacted upon by the proposed development, would simply fly away and move out to the surrounding areas during construction and move back afterwards.

Generally speaking, the potential effect of Solar PV installations on avifauna is not considered an issue of relevance in a comparative assessment done of Solar PV installations around the world.

Mammals

Some 36 species are known to occur in the bigger area (Smithers 1983).

Observation and Findings:

The following mammal species were observed on the bigger site during the survey:
Proteles cristatus (Aardwolf spoor)
Ictonys strtiatus (Striped polecat)
Xerus inauris (Ground squirrel)
Hystrix africaeaustralis (Porcupine)
Otocyon megalotis (Bat Eared Fox)
Raphicerus campestris (Steenbok)

The following table lists the Red Data listed mammal species which are predicted, or confirmed to occur in the general area and possibly within the site study area: (Friedman & Daly, 2004).

Amphibians and Reptiles (Herpetofauna)
With respect to amphibians, Minter et al (2004) state that “habitat loss or modification as a result of agriculture and other forms of human activity remains the most important single threat to the survival of amphibian populations. The scale of such changes and their relative permanence are the major cause. At greatest risk are species that have limited distributions.”

As reported in Branch (1988) 26 reptile species are likely to inhabit the area.

Observations
The following reptiles were observed on site during the survey:

- *Psammobates tenorius* (tent tortoise)
- *Agama hispida* (Spiny agama)
- *Chondrodactylus turneri*
- *Mabaya capensis* (Cape Skink)
- *Stigmachelys pardalis* (Leopard Tortoise)

No Red Listed amphibian or reptiles species are known to occur in the area of the development site.

Findings
The proposed development will not have a significant impact on reptiles or amphibians. The reptiles and amphibians may move outside the proposed development area during construction, but will be able to move back afterwards.

With regards to amphibians, Minter et al (2004) state that "habitat loss or modification as a result of agriculture and other forms of human activity remains the most important single threat to the survival of amphibian populations. The scale of these changes and their relative permanence are the major cause. At greatest risk are the species that have limited distributions."
As reported in Alexander *et al* (2007) 33 reptile species are likely to inhabit the area.

Seven amphibian species may inhabit the area, but viable populations are unlikely because there are no constant water bodies on or near the site.

8.3. In terms of biodiversity pattern, identify or describe, at species level-

8.3.1. The viability of, and estimated population size of the Threatened or Protected Species ("TOPS)" and Red Data Book ("RDB") species that are present.

(Show the degree of confidence in predictions based on the availability of information and specialist knowledge, i.e. High 70-100% confident, Medium 40-70% confident, low 0-40% confident. Assess the likelihood of RDB and TOPS species, or species of conservation concern, occurring in the vicinity. Reflect this in degree of confidence indicator).

What is a Rare or RDB species?
This is a species that is listed in one of the categories in the Red Data List of species. It is listed as such because it is under threat of extinction, often endemic to an area, and has a limited distribution.

There are various categories in the Red Data List that give us an indication of the conservation status of each species. The categories are "Extinct", "Endangered", "Vulnerable", "Rare", "Indeterminate" and "Insufficiently Known". Species classified as "Extinct" are those that are no longer known to exist in the wild. Those classified as "Endangered" are in danger of extinction if the factors causing their numbers to decline continue operating.

A number of factors can be responsible for a decline in the size of species populations. They may eventually cause the extinction of a species. Once this species is lost, it can never be replaced. The most common threat too many arid plants are overgrazing. Overgrazing leads to a decrease in the number of plant species, a change in the ecological balance, and the eventual loss of plant diversity. Species collectors that collect rare species for trade or other purposes can pose a serious threat to some species. Fauna and flora have been classified in terms of the ever-increasing threats of over exploitation, illegal trade or habitat transformation and habitat loss. They are rated in terms of their vulnerability to extinction in RDB, one for each group. Some rare and localized plant species are known to be present in the area. Other protected species are listed under the TOPS regulations. Any activity impacting on these species listed under the TOPS regulations requires a permit.

RDB Listed or species listed under TOPS (Vegetation)

Observations and Findings

Aloe dichotoma is the only rare and endangered species recorded on the property. Only two specimens of Aloe dichotoma were noted adjacent to the site - one adjacent to the road approaching the site and one on the skyline above the sight. No other rare and endangered species were observed on the proposed impacted site. However, no parts of these plants may be harvested, collected or disturbed without a valid permit from Northern Cape Nature Conservation. The proposed development infrastructure will not impact on this specie. Our confidence in predictions based on the availability of information and specialist knowledge is High=70-100%.

RDB or species listed under TOPS (Reptiles and Amphibians)

No Red Listed species of reptiles and amphibians are expected to occur in the proposed development area. No species of conservation value occurs in the area.

Observation and Findings

No rare and localized species were recorded at the time of the survey, and none are expected to be on site. The site is not the preferred habitat of the known rare and endangered species. Our confidence in predictions based on the availability of information and specialist knowledge is High=70-100%.

RDB or species listed under TOPS (Mammals)

The following table lists the Red Data listed mammal species which are predicted, or confirmed to occur in the general area and possibly within the site study area: (Friedman & Daly, 2004).

COMMON NAME	SCIENTIFIC NAME	RED DATA CATEGORY	PREDICTED OCCURENCE
Lesueur's Wing-gland Bat	*Cistugo lesueuri*	Near Threatened	Unlikely
Cape Serotine Bat	*Neoromicia capensis*	Least Concern	Possible

Egyptian Split Faced Bat	*Nycteris thebaica*	Near Threatened	Possible
Egyptian Free-tailed Bat	*Tadarida aegyptiaca*	Least Concern	Possible
Rock Hyrax	*Procavia capensis*	Least Concern	Unlikely
Black-backed Jackal	*Canis mesomelas*	Least Concern	Definitive
Caracal	*Caracal caracal*	Least Concern	Likely
Yellow Mongoose	*Cynictis penicillata*	Least Concern	Possible
Small Grey Mongoose	*Galerella pulverulenta*	Least Concern	Likely
Small-spotted Genet	*Genetta genetta*	Least Concern	Likely
Striped Polecat	*Ictonyx striatus*	Least Concern	Possible
Bat-eared Fox	*Otocyon megalotis*	Least Concern	Definitely
Leopard	*Panthera pardus*	Least Concern	Not Present
Aardwolf	*Proteles cristatus*	Least Concern	Present
Cape Fox	*Vulpes chama*	Least Concern	Unlikely
Springbok	*Antidorcas marsupialis*	Least Concern	Present to the north of the site
Reddish-grey Musk Shrew	*Crocidura cyanea*	Data Deficient	Unlikely
Cape Hare	*Lepus capensis*	Least Concern	Unlikely
Scrub Hare	*Lepus saxatilis*	Least Concern	Possible
Short-tailed Gerbil	*Desmodillus auricularis*	Least Concern	Possible
Hairy Footed Gerbil	*Gerbillurus paeba*	Least Concern	Possible
Spectacled Dormouse	*Graphiurus ocularis*	Least Concern	Possible
Porcupine	*Hystrix africaeaustralis*	Least Concern	Present on site
Aardvark	*Orycteropus afer*	Least Concern	Likely
Black Rhinoceros	*Diceros bicomis bicomis*	Critical Endangered	Not present
Gemsbok	*Oryx gazella*	Least concern	Not present
Steenbok	*Raphicerus campestris*	Least Concern	Present west of site
Common duiker	*Sylvicapra grimmia*	Least concern	Not present
African Wild Cat	*Felis silvestris*	Least concern	Likely
Honey Badger	*Mellivora capensis*	Least concern	Likely
Suricate	*Suricata suricatta*	Least Concern	Unlikely
Smith's Rock Elephant Shrew	*Elephantulus rupestris*	Least Concern	Unlikely
Round-eared Elephant – shrew	*Macroscelides proboscideus*	Least Concern	Unlikely
Namaqua Rock Mouse	*Aethomys namaquensis*	Least Concern	Likely
Brush-tailed Hairy-footed Gerbil	*Gerbillurus vallinus*	Least Concern	Unlikely
Large-eared Mouse	*Malacothrix typica*	Least concern	Unlikely
Multimammate Mouse	*Mastomys coucha*	Least concern	Unlikely
Karoo Bush Rat	*Otomys unisulcatus*	Least concern	Unlikely
Brants' Whistling Rat	*Parotomys brantsii*	Least concern	Unlikely

Littledale's Whistling Rat	*Parotomys littledalei*	Least concern	Unlikely
Springhare	*Pedetes capensis*	Least concern	Likely
Pygmy Rock Mouse	*Petromyscus collinus*	Least concern	Unlikely
Striped Mouse	*Rhabdomys pumilio*	Least concern	Likely
Bushveld Gerbil	*Tatera leucogaster*	Data Deficient	Unlikely
Cape Ground Squirrel	*Xerus inauris*	Least concern	Present.

Observations and Findings:

Bats are also classified as near threatened. The bats will be unaffected by development, as there are no roosting sites within the affected area that could be impacted upon by development.

The species listed above occurring on site will not be affected negatively. The impact of the proposed development on them will be of low significance. Their home ranges are much bigger than the proposed development.

Other red data species as listed which are likely to occur in the study area above were not observed during the site survey.

None of the red data listed should be specifically threatened, either in number or habitat by the proposed development, should such species occur on the development site they can simply move to extensive, nearby undisturbed habitat during construction and move back afterwards. The solar panels will not sterilise the ecology totally. Vegetation will still grow under and between the open corridors during the operational phase.

The proposed development should not have significant impact on the red data listed species likely or observed in the study area.

Our confidence in predictions based on the availability of information and specialist knowledge is High (70-100%).

RDB or species listed under (Avifauna)

Red Listed species of avifauna could include the following:
Polemaetus bellicosus
Neotis ludwigii
Falco biarmicus

Observations and Findings
None of the above species were observed during the survey and are more likely to occasionally visit the site and will not breed there.

Our confidence in predictions based on the availability of information and specialist knowledge is High=70-100%.

8.4. Other pattern issues-

Any significant landscape features or rare or important vegetation/faunal associations such as seasonal wetlands, alluvium, seeps, quartz patches or salt marshes in the vicinity:

None of the above features occur on the site.

8.5. The extent of alien plant cover on the site:

The following alien plants were recorded on site:

- *Prosopis sp*
- *Opuntia sp*
- *Agave rigida var. sisalana*

The *Prosopis sp* is mostly restricted to the drainage lines. The *Opuntia sp* and *Agave rigida var. sisalana* is restricted to the disturbed areas next to the farm yard.

8.5.1. Whether the infestation is the result of prior soil disturbance such as ploughing or quarrying (alien cover resulting from disturbance is generally more difficult to restore than infestation of undisturbed sites):

The alien infestation on site is the result of soil disturbance.

8.6. The condition of the sites in terms of current or previous land uses:

The ecosystem of the site is in a moderate to good condition.

8.7. In terms of biodiversity process, identify or describe:

8.7.1. ***The key ecological "drivers" of ecosystems on the site and in the vicinity, such as fire.***

The property lies in the general area that supports Bushmanland Basin Shrubland, according to the new vegetation map of South Africa (Mucina & Rutherford 2003). This vegetation type is listed as Not Threatened in the South African National Spatial Biodiversity Assessment (Rouget et al 2004).

Observations and Findings

The proposed development will not affect the ecological drivers on the site. The open space and drainage lines not impacted upon by the infrastructure will allow the ecological functioning of the site to continue. The vegetation type is not a fire driven system. The applicant can use the roads around the facility as a fire break, should it be required. Any accidental fire must however immediately be extinguished to prevent ecological damage. The whole site is not proposed as a conservation area or a corridor.

8.7.2.Environmental gradients (e.g. upland-lowland), biome boundaries, soil interfaces or sand movement corridors on the site or in its vicinity.

None of the above ecological features are present on the study site.

8.7.3. Any possible changes in key processes e.g. increased fire frequency or drainage/artificial recharge of aquatic systems.

No significant changes in key processes will occur on site due to the proposed development. The drainage lines, inclusive of the 32m buffer area between the development and the bank of the stream will allow the key ecological process to continue on site.

8.7.4. The condition and functioning of rivers and wetlands (if present) in terms of possible changes to the channel, flow regime and naturally-occurring riparian vegetation.

The proposed 32m buffer will protect the buffer areas. The vegetation between the solar panels may not be spread with herbicide and the vegetation growing in between the panels must be kept to stabilize the soils to prevent erosion and siltation of the drainage lines.

8.7.5. Would the conservation of the site lead to greater viability of the adjacent ecosystem by securing any of the functional factors listed?

No.

8.7.6. Does the site or neighbouring properties potentially contribute to meeting regional conservation targets for both biodiversity pattern and ecological processes?

No.

8.7.7. Is this a potential candidate site for conservation stewardship?

No.

8.8. Recommend actions that should be taken:

8.8.1. To prevent or, if prevention is not feasible, to mitigate impacts and restore disturbed vegetation or ecological processes.

Areas disturbed during construction should be rehabilitated. The 32m buffer area next to the drainage lines must be maintained. The development and operation of the facility may not impact or disturb the rare endangered species identified on site. The alien species identified in this report must be cleared and followed up.

8.8.2. Indicate how preventative and remedial actions will be scheduled to ensure long-term protection, management and restoration of affected ecosystems and biodiversity.

On-going clearing of annual invasive plants and perennial alien invasive trees.

8.9. ***Indicate limitations and assumptions, particularly in relation to seasonality:***

None

9. Concluding Remarks and Further Recommendations

The report finds that the proposed development should not impact negatively on any listed species. No significant breeding, roosting or habitat on the site will be impacted upon. Most animals will move out of the area when construction starts and back when construction is finished.

Eco Impact is of the opinion, and based on the survey and study done, that the development if designed according to the ecological sensitivity map will not impact significantly on the biodiversity or affect ecological functioning of the area.

No additional survey or further assessment is in our view recommended.

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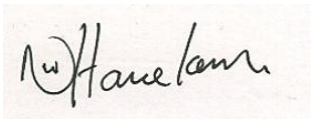
THE INDEPENDENT PERSON WHO COMPILED A SPECIALIST REPORT OR UNDERTOOK A SPECIALIST PROCESS

I **Nicolaas Willem Hanekom**, as the appointed independent specialist hereby declare that I:

- act/ed as the independent specialist in this application;
- regard the information contained in this report as it relates to my specialist input/study to be true and correct, and
- do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the NEMA, the Environmental Impact Assessment Regulations, 2010 and any specific environmental management Act;
- have and will not have no vested interest in the proposed activity proceeding;
- have disclosed, to the applicant, EAP and competent authority, any material information that have or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan or document required in terms of the NEMA, the Environmental Impact Assessment Regulations, 2010 and any specific environmental management Act;
- am fully aware of and meet the responsibilities in terms of NEMA, the Environmental Impact Assessment Regulations, 2010 (specifically in terms of regulation 17 of GN No. R. 543) and any specific environmental management Act, and that failure to comply with these requirements may constitute and result in disqualification;
- have ensured that information containing all relevant facts in respect of the specialist input/study was distributed or made available to interested and affected parties and the public and that participation by interested and affected parties was facilitated in such a manner that all interested and affected parties were provided with a reasonable opportunity to participate and to provide comments on the specialist input/study;
- have ensured that the comments of all interested and affected parties on the specialist input/study were considered, recorded and submitted to the competent authority in respect of the application;
- have ensured that the names of all interested and affected parties that participated in terms of the specialist input/study were recorded in the register of interested and affected parties who participated in the public participation process;
- have provided the competent authority with access to all information at my disposal regarding the application, whether such information is favourable to the applicant or not; and
- am aware that a false declaration is an offence in terms of regulation 71 of GN No. R. 543.

Note: The terms of reference must be attached.



Signature of the specialist:

Eco Impact Legal Consulting (Pty) Ltd

Name of company:

Date: 26 November 2012